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Towards open museums: The interconnection of digital and physical spaces in open environments

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Abstract

This paper studies the recent evolutions in digital cultural mediation for museums. It aims to show the convergence of recent socio-technological trends and their social appropriation by museums towards the building of an "open museum" based on the paradigm of collaboration and open access to culture. In the last fifteen years, museums developed policies to make digital cultural resources available. To facilitate the dissemination and circulation of cultural contents, they adopted the media habits of their audience by relying on electronic artefacts and digital data. They began with local indoor installations, then extended them to websites and social networks and finally went digitally mobile with specific apps. This innovative digital communicational policy blurs boundaries between in-situ physical museums and their digital resources. Museum contents are displayed on external platforms developed by industrial stakeholders whose core business was not initially the cultural field. This new configuration allows individual access to cultural content inside and outside the museum by combining the discovery of physical locations and digital resources. In this perspective, we investigated cultural Linked Open Data, in particular the opportunities offered by the social construction of an inter-museum cultural space leading to free circulation of knowledge. We showed that the notion of museum is being extended to include digital social networks, digital mobility and cultural Linked Open Data. This conception of a museum extending beyond its physical space to digital spaces is what could be called an "open museum." Our approach is based on three studies: a) a qualitative analysis of a corpus of professional publications by American and European museums during years 2012-2014; b) five case studies based on interviews with professionals from five American museums; c) one specific example, "Musée de l'Histoire de Marseille" in France, in which one of the authors was involved.

Keywords: digital cultural mediation, cultural Linked Open Data, global museums

1. Introduction

This paper studies the recent evolutions in digital cultural mediation in the museum field. It aims to show the convergence of recent sociotechnological developments and their social appropriation by museums towards the building of an "open museum" based on the paradigm of collaboration and open access to culture. In the last fifteen years, museums have developed extensive policies to make cultural resources available involving the widespread use of digital media. In order to facilitate the dissemination and circulation of cultural content, they have adopted the media and communicational habits of their public by relying on electronic artefacts and digital data.

Grounded in empirical studies, our theoretical research calls for a redefinition of the notion of cultural mediation in this new open museum space. Architectural design, scenography of exhibitions, digital collections, and social communication are no longer severable and must be jointly designed as an 'open museum.' This unprecedented situation of integration of real and virtual data opens up a broad field of innovations. All these mutations call for an investigation into the evolution of the responsibilities, competencies, and tasks of the professionals in charge in the museum field. This study is the result of a joint reflection between academic researchers and professionals involved in cultural fields.

2. Symbolic power of institutions, authorship, and intermediation

Since the second half of the twentieth century, museums in many countries have extensively developed and diversified their activities. Since the 1980s, cultural mediation in the French context (Caillet & Lehallé, 1995) has included educational, professional, and political issues. 'Interpretation,' the equivalent American term, encompasses the notion of a dynamic process of communication between a museum and its audience as well as modes of disseminating contents. It focuses on the central role of education as outlined in the standards and professional principles of American museums (EdCom, 2005, 11). In this paper, mediation and interpretation are tackled in their ideological project of cultural democratisation, comprising institutional and political dimensions. From this point of view, the institutional policies of museums include an underlying conception of culture, science, audience, devices, and legitimate practices. Since the beginning of the 1990s, the central role of mediation and services to the public has become one of the major changes in the organisation of museums' activities. In Europe and the United States (McArthur, 2002), a major evolution has been the need for museums to listen to their public and take into account their needs and engagement.

Cultural institutions are analysed here as 'potential places of action' (Fleury, 2002, 36). The actions of institutions are a 'relevant level of observation' to understand cultural practices in the digital age (Donnat, 2009) and the democratisation of museums (Eidelman & Jonchery, 2011). In this perspective, a museum is studied as a 'complex organization' that has to face economic and industrial issues (Ballé, 2003), as well as an 'organization engaged in public service' using digital media to communicate. In doing so, museums institutionalise a conception of audience, cultural mediation, and a relationship to culture that gives them symbolic power. Authorship is studied through the authority and legitimacy relationships (Bourdieu, 1982) that museums have with their publications and with the public. By changing the conditions of access to cultural contents, digital technologies have destabilized the socioeconomic equilibrium of museums and the way they manage the publication of information and knowledge. Stakeholders in communication industries and the Internet now play an increasing role within cultural industries.

We formulate the hypothesis that the upheavals caused by information and communication technology lead to a global digital inter-museum organization. Consequently, museums must tackle two challenges: authorship and institutional identity. In order to study the validity of this hypothesis, we conducted three studies:

- First, a qualitative analysis of a corpus of professional publications by American and European museums during the years from 2012 to 2014;

- Second, five case studies based on interviews with thirteen professionals from five American museums selected for their innovative policies: the Art Institute of Chicago (AIC), Denver Art Museum (DAM), Getty Museum (GM), Museum of Modern Art (MoMA), and San Francisco Museum of Modern Art (SFMOMA);
- Third, one specific example, "Musée d'Histoire de Marseille" in France, in which one of the authors was involved, is thoroughly described.

3. Digital-based mediation policies at the crossroads of places, media, and technologies

For professionals, digital communication is a means used to implement communication and public policies. Professional surveys report digital news, but they do not discuss the slow sedimentation process built by fifteen years of a policy of digital communication in cultural organizations. The analysis of editorial supply and interviews shows that the museums selected rely in their communication and publication on what we have termed a "digital information ecosystem." This ecosystem is built up by the progressive and ongoing integration of contents in connection with different generations of technology and electronic and computing tools (Juanals, 2015). The ecosystem is composed of the arrangement of sociotechnical devices and representations of works of art in various forms with their associated discourses.

For the museums studied, all these elements coexist in digital and physical places. The latter combine the use of devices installed in the galleries (computers, tablets, interactive walls, etc.) with mobile devices brought by visitors (DAM, GM, MoMA) or available on request (AIC, GM, SFMOMA). According to the professionals interviewed, there is no impermeable boundary between online collections and galleries of exhibitions in which digital devices set up by museums or brought by visitors are present. Contents, practices, and devices constitute a continuum. They also pointed out the importance of the extension of the communication space of museums beyond its physical walls and the evolution of the mode of engagement towards the public. This expression "beyond the museum's walls" was used by Nancy Proctor, formerly in charge of mobile strategy at the Smithsonian Institution (Gross, 2012). In this perspective, apps, mobile sites, blogs, tweets, Facebook pages, and Pinterest walls compose digital spaces conjointly invested by museums and the public to interact and exchange.

The use of a museum's website for marketing purposes fosters the emergence of new online services inspired by preexisting practices. In several American museums (Brooklyn Museum of Art, Dallas Museum of Art, Metropolitan Museum of Art, Whitney Museum of American Art), new models based on digital access "digital-centric membership models" are offered in order to propose services to a broad audience not primarily interested in visiting the museum in situ. For example, since 2013 the MoMA has been experimenting with a "Digital Member Lounge" (Burnette, 2013), which personalizes digital access, proposes programs online, and provides increased access to contents.

4. Digital mobility within and outside museum space

The social use of mobile electronic devices by the general public has led to unprecedented changes in terms of access to resources. Museums have adapted to the equipment of their visitors consisting of Apple-branded phones and tablets (GM, MoMA) or of various other

brands (AIC, DAM). The availability of these devices has led to the emergence of new publishing formats, software, and technologies adapted to situations of mobility in the museum space. Mobile applications, which first appeared in 2009 as downloadable multimedia software for guided tours of permanent or temporary exhibitions, have been widely disseminated (Economou & Meintani, 2011).

As cultural content is combined with software, the online stores of the U.S. firms Apple and Google have emerged as new intermediaries for downloading applications and digital catalogues for exhibitions. However, museums have kept control of the distribution of audio or video podcasts that they offer as MP3 files for streaming inside the museum (MoMA) and that can be downloaded from the museum website or listened to online. The distribution policy of scientific publications combines free access to books or scientific resources (AIC, GM), to valorize research and to enhance the visibility of institutional sites, and paid access through online libraries.

Within museums' walls, the introduction of contactless technology (NFC, RFID, QR code) provides access to online contents through visitors' electronic terminals. New industrial actors such as telecommunications operators and digital product manufacturers have taken sectorial initiatives to promote their technological innovations in museums. The museums studied here remain divided in their attitudes to the adoption of these technologies.

Outside the museum's walls, equipped mobility is also used. In this direction, the Museum of History of Marseilles launched a major multimedia program for its renovation and expansion in 2013, as part of the European event "Marseilles-Provence European Capital of Culture" (Dupuy, 2014).

This multimedia program was of course intended first for the inside of the museum, to accompany visitors during their visit by means of interactive screens, video walls, multi-touch tables, and specific installations. But the twenty-six centuries of history of the city of Marseilles have left many remains outside the museum, too, especially along the historic path that extends from the museum to the MuCEM (National Museum of European and Mediterranean Civilisations), the latest French national museum. This historic path was already used in the Greek era to reach the center of the antique city, through the fortified gate whose remains are still visible from the museum. This path became the main route of the city (Decumanus) in Roman times, after the siege of the city by Julius Caesar in 49 B.C. The path persisted throughout the Middle Ages, becoming today a modern street (Grand Rue) with pedestrians and cars. Unsurprisingly, when walking along this street one goes past almost two dozen classified historic monuments and a large variety of remains and vestiges of the past twenty-six centuries.

Mobile digital technologies made it possible to extend the "territory" of the Museum of History of Marseilles far beyond its walls and to include the whole heritage of this historic path. Using the mobile application "Digital Extension of the Museum of History of Marseilles," visitors can go out of the museum without ever really leaving it: they pursue their walk freely outside, while remaining connected to the spirit of the museum and interactively guided by its team of experts, archaeologists, and historians. This application relies technically on permanent connectivity, visitor geolocation, compasses, and gyroscopes, and on top of this, on three-dimensional (3D) modeling of the city at various key periods: the ancient Greek period, Roman times, and the Middle Ages. Another 3D model symbolically depicts the modern city to allow visitors to find their way at any time, and to know where the

points of interest are along their route. But at this stage, what really matters is not technology, databases, and mobile software. When developing a mobile digital application for a museum, the concern is no different from developing exhibitions inside the museum, namely to ensure the authenticity and accuracy of the content and to foster emotion as a vector for better understanding.

As many as forty-five specialists were involved to ensure the greatest possible accuracy of the 3D models of different periods and of the interpretations delivered to the public. Thanks to continuous exchanges, the archaeologists gradually observed with increasing interest the progress of the 3D models that were closely based on their own studies, some conducted over several decades, that raised numerous questions and answers, particularly about the elevations: while plans drawn by any archaeologist accurately map the discovered remains, 3D models must also take a stand on the heights and shapes of the digitally reconstructed (and interpreted) buildings and monuments. In fact, the digital application, before even being operational and delivered to the public, quickly became a new tool available to specialists, leading to many iterative interactions with them. To allow for emotion, the digital application had to avoid being only a digital application. This is where art comes in. While 3D modeling is obviously a highly technical operation, especially when intended for visitors' terminals (iOS and Androids), the responsibility for rendering was entrusted to painters, a watercolor specialist for ancient periods, and a specialist in more saturated colors for the Middle Ages.

Ultimately, as visitors walk on the historical path, they also walk within the symbolic 3D model of the same path, which shows them their position in real time and reminds them where the nearby points of interests are. Here, visitors enter a public square lined with olive trees and surrounded by restaurants, which was a place covered in part by the sea during the ancient Greek era, became a shipyard a few centuries later in the Roman period when the coastline had receded, and subsequently became an important terrestrial and naval archaeological research site only twenty years ago. The Digital Extension of the museum allows one to enter the 3D model of this archaeological site to see beneath one's feet the genuine wrecks that were found there (now on display at the museum) in their exact position, together with impassioned comments by the specialists who discovered and analyzed them. Further on, visitors encounter a small church, the Eglise des Accoules, whose bell tower dates from the Middle Ages, and the 3D model of this period shows them the unexpected importance of this church at the time and the influence it once had on the populous medieval quarter around. Elsewhere, the historical content of the Digital Extension concerns World War II. Visitors find themselves in a neighborhood that has clearly been reconstructed, and the 3D model of the period reminds them of the extent of destruction of the area in 1943, and the impressive reconstruction efforts that the city had to deploy. After their walk through the historical path with the Digital Extension of the museum, nothing is perceived by visitors quite as before.

In these concrete examples, mobile digital developments have undoubtedly provided a feasible answer to the natural desire of the curator's team to enhance visitors' understanding of the twenty-six centuries of the city's historical heritage. But once investments have been made, new horizons open, further enhancing the affordances of digital technology: the application is also available to teachers, who can select the points of interest of their class's visit and add their own interpretative contribution to the mobile application from the museum website specifically for their students. The exhibits in the museum can also be linked to the Digital Extension to match the places of their use, manufacture, or discovery in the 3D models, or be part of a treasure hunt for younger audiences. The 3D models of different periods are also remotely accessible from the website of the museum (though without being

able to move around as when on the spot), as well as all the comments by the scientists who share their emotions with the public.

Integration is so complete that the boundary between the physical and the digital spaces of the museum is barely perceivable. The museum becomes a whole: it is now an 'open museum' that exists both as an architectural reality and in the digital world. A further step forward will be to connect the museum and its digital extension to other museums, primarily of the same type, historical and archaeological. It will then no longer be only a global museum: it will become one of many cells linked within a larger global space composed of a multitude of museums.

This inter-museum digital cultural space unfolds as a continuum on external platforms as well as through Linked Open Data.

5. Open museums: Towards an inter-museum and international digital cultural space

Museums have widely disseminated their contents on external platforms while keeping editorial control of the content. For example, in 2013 MoMA launched the first MOOC (Massive Open Online Course) to experiment with this new pedagogical format. As part of its pedagogical mission, the museum proposes two MOOCs for middle- and high-school teachers on the Coursera Platform with the overt aim of testing this innovative environment. This editorial choice is part of the 'museum beyond the walls' strategy characterized by the investment in external platforms fostering exchange and interaction. Providing a broader public with access to training and multidisciplinary collaboration is promoted.

Other categories of stakeholders are mentioned in surveys and in interviews with professionals: social networks, Google Art Project, and Wikipedia. These new stakeholders are engaged in the production and the dissemination of contents directly related to museum resources, but museums have no editorial control over the contents of these external platforms. Their presence raises the question of both the social legitimacy of producers and institutions (Bourdieu, 1982) and their industrial strategies.

Since social networks attract the general public, the communication strategy of museums is to be actively present in these popular digital spaces. Exchanges on social networks are a means to capture the needs, questions, and practices of the public. Although not explicitly mentioned, marketing concerns are present, since the image of an institution is affected by its ability to ensure visibility on media which are known to be innovative in their strategies for attracting the public and sharing cultural resources. Nevertheless, the publication of cultural information on external sites exposes museums to the possibility of ideological censorship. For example, in 2013 Facebook closed the account of the French museum Jeu de Paume for 24 hours, and a lawsuit involving Facebook and a French professor about the same work of art (*Origine du Monde* by Courbet) is presently pending in France. Asked about this event, professionals (AIC, DAM, MoMA) recommended a strategy of systematic pluri-information and diversification of the museum's digital presence in the media in order to preserve their editorial independence. In the end, for all the museums studied, general and specialized social networks (especially Facebook, Twitter, and YouTube) are used to disseminate cultural news and practical information. The public is redirected to institutional websites that centralize the cultural and scientific resources.

We should also briefly mention the arrival of Twitter in the cultural field. At the end of February 2014, a European event called MuseumWeek (with the generic hashtag #MuseumWeek) was designed and planned to take place during one week in March 2014. More than six-hundred European museums participated in this event, and more than twenty-thousand users sent one or more tweets (Courtin et al., 2014). In February 2015, Twitter and the French Ministry of Communication launched MuseumWeek 2015 on a worldwide level.

In a similar perspective, the museums studied have agreed to moderate exposure on the virtual museum Google Art Project or on the Indianapolis Museum of Art's Art Babble. The reason given is Google's ability to attract the public thanks to its status as the most well-known and powerful search engine. As a result, museums are interested in displaying a limited number of digitized art works in order to enhance their visibility on Internet, boost their image as institutions eager to share cultural resources, and redirect visitors to their websites.

Museums are divided, however, about the use of the knowledge base Wikipedia. The professionals interviewed did not know the identity of contributors to the specialized domain of their institution or whether curators of their museum were contributors. The application of the Musei Capitolini (Rome), which presents both access to the museum's resources and hyperlinks to Wikipedia, and the decision of the Brooklyn Museum to be strongly present on Wikipedia are frequently mentioned. The anonymity of authors, the presence of errors, and the possibility of contradictory information justify the refusal (GM) to cooperate with Wikipedia. Nevertheless, the contribution of this source of information can be positively assessed on principle (SFMOMA) or for a targeted public. In this case, it contributes to the scientific need for contemporary works of art and artists and authors' biographies to be updated (AIC, SFMOMA, DAM), a task that museums struggle to accomplish. However, some professionals from GM (curators, researchers, editors) point out their disagreement and mention a crisis of conscience at Getty. Others insist on the need to develop a model that is more open to interconnections and external contributions, whereas others defend a classical model in order to preserve editorial independence, echoing cultural censorship (McArthur, 2002, 2026203). In 2009, the conflict between the National Portrait Gallery and Wikimedia Commons about the reuse, finally acquired, of 3,300 images displayed on the museum website illustrates this issue. Since 2009, the editorial policy of Wikipedia has evolved toward the negotiation of institutional cooperation in the framework of the GLAM-Wiki (Galleries, Libraries, Archives, Museums with Wikipedia) project. The British Museum, Museu Picasso, Smithsonian Archives of American Art, and Centre Pompidou are among the most well-known museums participating.

In short, Linked Open Data (LOD) is about using the Web to connect related data by using standard languages (RDF, OWL, SPARQL, etc.) and protocols designed by the W3C (<http://www.w3.org>). Cataloguing data and images describing a museum's collections will be easily accessible thanks to a standardized query language (SPARQL). For museums, their commitment to LOD implies considering interoperability and open data in a common cultural space; that is, the institution must give up a local point of view focused on its own collections, thesauri, and organisation, and enter a digital open space shared by other cultural institutions that possess collections and knowledge on shared domains. These evolutions open up the possibility of interconnecting and reusing heritage and cultural resources from other private or public organizations, sometimes on a very large scale. Seen from this angle, LOD fosters the idea of a wide-open museum in which different museums could store and connect their collections.

We have identified two different institutional strategies from emblematic experiences. The policy concerning vocabularies (using RDF properties) and the alignment of Uniform Resource Identifiers (URIs) characterise these strategies.

The Smithsonian American Art Museum (SAAM) in Washington (Szekely et al., 2013), British Museum (Oldman et al., 2013), and Amsterdam Museum (De Boer et al., 2012) published their data as LOD. In 2013, a major stakeholder, the Getty Research Institute (GRI), launched the "Getty Vocabularies Program" (Harpring, 2013).

By using automatic tools such as Karma (Szekely et al., 2013), SAAM decided to align its URI with two other institutions considered to be trustworthy, Wikipedia and the *New York Times*. The decision to offer this kind of connection, which delegates authorship and legitimates organisations that are not museums, implies a desire to share and delegate resources that could promote networks of cultural clusters supervised by scientific or cultural organizations with substantial technological and financial resources. A good example of this kind of approach is the project "American Art Collaborative" (<http://americanartcollaborative.org/>), "a consortium of 14 museums in the United States committed to establishing a critical mass of Linked Open Data on the subject of American Art."

By 2015, the Getty Vocabularies Program will offer free access to four thesauri (Art and Architecture Thesaurus and Getty Thesaurus of Geographic Names in 2014, Union List of Artist Names and Cultural Objects Name Authority in 2015). It will be possible to download ontologies (or thesauri) in RDF and OWL formats or to dynamically query a SparqlEndPoint to obtain data about descriptors. Any museum can use Getty's URI to index its own data or align its descriptors with those of the Getty. It should be pointed out that the Getty Research Institute retains full editorial control over its thesauri and will not align their URI with other institutions (Harpring, 2014). This policy fosters the construction of cultural hubs, which raises the question of the potential influence of a sociocultural and political stance (soft power) in the knowledge domain. This conception can be qualified as centripetal: knowledge is shared unilaterally.

Those two examples illustrate the emergence of two organisational models in cultural LOD: one model with a few repository hubs and another with a large number of tightly connected clusters. In other words, will LOD promote a shared knowledge space, or on the contrary will it be a factor of concentration, fostering the predominance of one kind of cultural categorization in a single language?

In this international context, we wish to point out the importance of ISO standards and W3C recommendations. These "standards" are used by major stakeholders (Juanals et al., 2013) to homogenize practices by proposing their own conceptual models (or ontologies), such as CIDOC-CRM (supported by ICOM) in the museographical field, FRBR (promoted by the International Federation of Library Associations and Institutions) in the bibliographic field, or Schema.org (supported by providers of search engines like Google, Bing, and Yahoo). In January 2015, OCLC and the Library of Congress released a white paper to compare and contrast the compatible linked data initiatives at both institutions and "investigate the promise of Schema.org as a common ground between the language of the information-seeking public and professional stewards of bibliographic description" (Godby et al., 2015).

6. Conclusions

The use of electronic artefacts and digital technologies began with local installations inside museums (video), then extended to websites and social networks. This evolution was combined with the boom of digital mobility by developing specific apps on smartphones and tablets. Museums also disseminated their collections and knowledge on external publishing platforms and linked those contents with other internet stakeholders (Google with Google Art Project, Coursera, Wikipedia) or cultural ones (Art Babble). The use of mobile communication tools, the development of software, and the design of multi-platform interfaces (based on responsive design) have given rise to a conception of cultural mediation that fosters multimedia, personalized, and multisensory experience inside and outside museums by combining the discovery of physical locations (a building, city, territory, etc.) with digital resources. The progressive deployment of policies and technologies of the Linked Open Data vector of potential semantic interconnections opens new possibilities for the social construction of a digital cultural space between museums that could foster the free circulation of heritage artefacts.

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