Chapter 11
Interactive and Social Technology: Challenges and Opportunities for Museums and Heritage Institutions in Latin America

Letícia Verona, Adriana S Vivacqua and Maria Luiza M Campos

Abstract Cultural institutions, such as museums and heritage sites, face particular challenges when dealing with technology and innovation adoption in developing countries. Social and economic instability, low priority attribution, usually leads to lack of funding and insufficient investment in technological infrastructure to appropriately support innovative projects and interactive visitor participation. These difficulties often mean institutions fall back to traditional, static, one-size-fits-all displays, which frequently fail to meet the interest of modern audiences. Additionally, content generation is slow, usually not adapted to digital media, and teams are limited in what they can do, compromising technology adoption and content evolution. In parallel, in many of these societies, there has been a visible increase in mobile technology dissemination and social media interaction. We believe that this creates an opportunity to engage museum visitors and to approach challenges with novel strategies without requiring a large technological investment on the part of the institution. In this chapter, we explore the challenges faced by cultural institutions in Brazil, based on interviews with local museum directors and curators. We also point out the opportunities to tackle these challenges that arise from the widespread adoption of personal and mobile technology in Brazilian society. Real-life examples from Brazilian museums, art schools, and heritage sites are used to illustrate typical situations.

11.1 Introduction

Technology has a big potential to bring the public closer to museums and heritage institutions and to enrich audience experiences. Besides enabling a wide dissemination of their cultural program and providing pre-visit information for those who intend to visit the institution, websites, mobile apps, and social media can enrich the

L. Verona (✉) · A. S. Vivacqua · M. L. M. Campos
PPGI, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil
e-mail: leticiaverona@ufrj.br

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depth and understanding of these visits. As informal learning environments, these institutions can facilitate access to information in different ways and enable an adaptive approach, focused on each visitor's previous background that is currently not possible in schools or universities, given the strict curricula and current teaching practices (Hawkey 2009).

Digital content presentation has the power to show permanent exhibitions through a new perspective, enabling curators and museum interpretation teams to rearrange the objects and display pieces that usually would not be seen together because of time, space, or accessibility limitations. Online educational resources allow teachers and school groups to plan their visits and perform preliminary classroom activities, making the group more prepared for what they are about to see. Interest in artwork and science can be previously awakened making room for more in-depth investigations, reflections, and research during a visit, by presenting educational and provocative materials to the public before the visit. Virtual visiting tools and interactive activities invert the traditional perspective and bring the museum to the classroom, turning it into a school ally in educating children and young people, regardless of distance, time, and access limitations.

Brazil is a big and heterogeneous country and virtual visits to inaccessible museums are indeed a strong democratization tool. Moreover, the Internet can be the ideal vehicle for dissemination and conservation of material produced by museums in symposia, workshops, roundtable discussions, researches, and debates.

Such potentialities, however, face difficulties that emerge from the Brazilian reality, from both schools and museums perspectives. The technology has potential to bring huge benefits for both the visitors and the institution: an enormous research material available online; content exchange between schools and museums all over the world; students and citizens in different countries that could discuss without any intermediaries how their lives are affected by their history, economy, or geography; and visits to foreign libraries and museums. However, the problems are also big: there are few or poor equipment and infrastructure available in Brazilian museums; museums have reduced human resources and/or budget allocated to technology projects; students and employees have language constraints; and museum staff and teachers have very often little knowledge to guide the students in the use of technology.

In Brazil, the majority of cultural and patrimonial institutions are managed and funded by the government. This strong characteristic has benefits: the institutions are not guided by the art market and therefore have the power to present new and/or unknown artists and run experimental curatorial projects without profit-oriented constraints. However, they face the fluctuations of political changes, bureaucracy, and budget limitations. Museum directors are appointed positions and may be dismissed at any time according to authorities' political negotiations. It is not unusual for a previous management initiative to be interrupted, even if its costs are not a problem. Besides, most human resources are civil servants, and hiring a new employee is a long-term process. All these factors create a heavy administration context, where personnel staff is very conservative and bureaucracy prevents the institution to allocate funds for experimental and innovative projects with all the

inherent risks, creating a gap between a highly connected public and low-tech adopting museums.

On the other hand, digital media enables the "viral" dissemination of events such as debates and openings, reaching a number of people formerly unthinkable by Brazilian museums. As an example, a Facebook post inviting to the opening of the exhibition "Orixás" at Casa França Brasil[1] was shared by thousands of people, resulting in an audience ten times bigger than the average for the institution. The promotion event on Facebook became a digital place for discussion about Afro-Brazilian culture, involving spontaneous manifestations that happily overwhelmed the museum educators and directors. Unexpected situations like this show that the road is still to be paved and many opportunities can naturally arise from the audience. This theme is also explored in Chap. 6 ("Crowd mining applied to preservation of digital cultural heritage") of this book. To point out what the main challenges and potentialities for the use of interactive, innovative experimental projects involving technology resources by museums, heritage sites, and other cultural institutions are, we have collected opinions and thoughts from four experienced managers and directors of museums, art school, and heritage sites in a qualitative study. The remaining of this chapter is organized as follows: Sect. 11.2 discusses the main challenges faced by museums and other cultural institutions in Brazil, based on a set of interviews we conducted and regarding technology adoption. Section 11.3 presents some guidelines for overcoming these barriers. Section 11.4 includes our final considerations, summarizing risks and benefits of technology support for on-site visitor experiences.

11.2 Interviews with Museum Professionals

11.2.1 Method

To elaborate further on this study, we have interviewed museums, heritage sites, and art schools professionals to find out what they see as the major challenges and opportunities when implementing technology projects in Brazilian museums. We looked for respondents who fulfill all the following criteria: (a) director or management positions in museums with relevance in the Brazilian context; (b) previous experience implementing innovation and technology projects in cultural institutions; and (c) experience with institutions funded by the government. We successfully interviewed four people with high-level positions in museums, heritage sites, and art schools located in Rio de Janeiro and São Paulo. In their career, they have been working at every public level (municipality, state government, and federal government). This is important because each of these levels has its own

[1]Casa França Brasil is a museum located in Rio de Janeiro. The exhibition "Orixás," about Afro-Brazilian religions and culture, was showed in September 2016.

aspects and challenges: a manager with only a "municipality experience" can be very biased and with a limited vision on the state of innovation in Brazilian museums. We were also careful to avoid respondents that are connected to political fluctuations: because the directors of these institutions are frequently appointed positions, it is not rare to find a manager that gets positions when a specific party is in power. Our respondents were selected because of their consistent, technical, independent career.

- Respondent 1: Director of the education division of Moreira Salles Institute in Rio de Janeiro (private museum), former director of Lasar Segall Museum in São Paulo (federal government managed museum), and educational curator of the 27th São Paulo Biennial (the biggest art fair in Latin America);
- Respondent 2: Former director of Escola de Artes Visuais do Parque Lage (School of Visual Arts, managed by Rio de Janeiro State government), former curator of Museum of Contemporary Art from Niterói (managed by the municipality), and current director of Paço Imperial (federal government managed museum), in Rio de Janeiro;
- Respondent 3: Coordinator of Casa França Brasil (Rio de Janeiro state government managed museum) and former coordinator of the education division at Escola de Artes Visuais do Parque Lage (School of Visual Arts); and
- Respondent 4: Manager of the research department in Museu da Casa Brasileira (São Paulo State government managed museum) in São Paulo.

The interviews were semi-structured and conducted in two phases: first, a questionnaire with preliminary questions about their experience with technology was sent to them by e-mail after which a personal interview followed. The questions asked via e-mail were as follows: (a) "What are the challenges faced when implementing innovative technology projects in museums?"; (b) "What management and project strategies do you think would cope with these challenges?"; and (c) "On the other hand, what are the major potentialities to enrich user experience using technology?." Their answers were used as a guide for the personal interviews, performed in a semi-structured way: the respondents were asked to illustrate each challenge they highlighted with previous experiences and testimonies with technology projects.

11.2.2 Results

The e-mail answers are summarized in Table 11.1.

From these results and the testimonies, we could identify three major challenges in the Brazilian museum and heritage institution scenery: the constant demand for maintenance and for content generation and also the resistance from museum managers and personnel to innovate.

Table 11.1 Summarized results

Challenge (respondent's number)	Aspects highlighted (respondent's number)
Maintenance/upkeep of existing systems (4)	Lack of permanent funding (4)
	Lack of interest from museum personnel (2)
	Forced interruption from government (2)
	Technology has relatively high costs (2)
	Resources' need of constant updates (1)
Content generation (3)	Lack of knowledge/resources to generate digital
	Content from museum personnel (3)
	Lack of personnel resources (2)
	High costs to convert from paper/analog to digital (3)
	Changes in digital formats (files, images, etc.) (3)
	Permanent needs for content (2)
Conceptual resistance to use technology (3)	The public should see the artwork with no filters or digital interference (1)
	Resistance from museum personnel to learn and use new technology (2)

11.2.2.1 Maintenance/Upkeep of Existing Systems

Cultural institutions' practices are deeply rooted in the analogic era and are typically project-based. When assembling an exhibition or publishing a book, the institution frequently makes a concentrated effort, allocates staff and resources, and demobilizes them as soon as the project ends. This is reinforced by typical characteristics of institutions funding in Brazil: it is easier to raise funds through sponsors and grants than obtaining a constant and permanent budgetary endowment. But unlike a book or an exhibition, which, once finished, will not generate further costs and needs, technology projects require constant maintenance. "The challenge is to pre-allocate resources for future equipment maintenance that will indeed be necessary.[2] In most cases, to obtain results with a good quality, the cost is much too high. There is a need for permanent maintenance, which many museums cannot afford."[3] In fact, this concern was mentioned by all managers we interviewed, showing us how the constant allocation of funds is a major issue. As a concrete example, we can mention Portfolio magazine, a digital publication of the Escola de Artes Visuais do Parque Lage (EAV). The magazine was created in 2013 as an iOS and Android app and used many multimedia and interactive resources, with content created specifically for digital publishing. Three editions were published. "The digital magazine contributed to the innovation of language, offered research resources, promoted exhibitions that take place in Rio and other cities, as well as disseminated the EAV artistic and intellectual production. Portfolio was a

[2]Testimony given to the authors, January 2017.

[3]Testimony given to the authors, January 2017.

dialogue platform with the city and the national and international art circuit."[4] Unfortunately, despite having been well received by the public, when the governing authorities of Rio de Janeiro changed, the EAV School board also changed and the project was interrupted. Previously published issues are no longer available online due to technological outdating, since the device operating systems updates made them incompatible with the published version of the magazine. With no further interest and budget from the cultural institution for technological updating, the editorial effort vanished. Another kind of obsolescence can be found in São Paulo, at Museu da Casa Brasileira with The Ernani Silva Bruno Archive.[5] The archive holds more than 20,000 cataloged records and objects of Brazilian daily life. It is a rich source for research on Brazilian daily life, with excerpts of texts from chroniclers and travelers, inventories and family wills, and official archive reports from the fifteenth to the nineteenth centuries. There, the maintenance is kept in its simplest form, to avoid discontinuity. Despite the museum remarkable effort in keeping the system online, it was conceived more than 10 years ago and is therefore no longer compatible with smartphones and other mobile devices and does not take advantage of current browsing resources. In this case, the public loses interest because the graphic and functional language has become old and tablets or smartphones cannot be used. This problem is not exclusive to Brazil: the challenge of "Maintaining Progress in Technology, Workflows, and Infrastructure" was considered a "Wicked Challenge" by The New Media Consortium in their 2015 Horizon Report (Johnson et al. 2015), especially regarding long-term maintenance. An important mission for a museum is to protect its collections for future generations. This includes metadata, its relation to physical collection items or digitized material, exhibition catalogs, and digital records, all subject to risks stemming from technology obsolescence. In museums where the collections themselves are made of multimedia records (e.g., sound and video), this issue is particularly serious. When technology is involved, "to protect" means to keep the data, the hardware and software to manipulate these data, as well as trained people who can operate the system. Funding and infrastructure seem to be recurring problems in other Latin American countries (Arjona et al. 1982). In Pitarque and Guardia (1982), for example, the authors also describe how museums in Ecuador and Venezuela are affected by these shortcomings and what steps might be taken to deal with the issue.

11.2.2.2 Content Generation

Technology applications often involve the creation of new content or some degree of adaptation of preexistent content to the new media. Although institutions hold information in many formats about the collection items, in most cases, some treatment is still necessary (e.g., scanning photographs or texts from older books).

[4]Testimony given to the authors, January 2017.

[5]Online Database. http://ernani.mcb.org.br/ernMain.asp. Accessed 10 Jan 2017.

The use of social media requires the constant generation of new content in a very specific manner. All these demand qualified personnel, which is frequently not available. Many projects are held in the content generation phase for many months, simply because the institution cannot allocate people to execute the task. This was already a problem for digital technology projects in museums in the '90s. But after the arrival and huge acceptance of the Internet and, furthermore, social networks, the problem gained dramatic contours.

Not only the constant generation of new content is necessary, but its format and language are also immersed in a changing environment. "The production of content and its presentation to the public demand a discerning look for new (and always changing) technologies and permanent research about the proper language of such technologies."[6]

11.2.2.3 Resistance to Innovation and Change

As discussed in the previous section, the constant demand for new formats and content is a major barrier in the Brazilian context. And this constant need must be fulfilled by the institution staff because the funds raised for the project usually cannot be used for long-term maintenance. This brings the issue of human resources. The museum staff is often a permanent group of civil servants, and the admission of new, young people is a long and bureaucratic process, which does not occur very often. "The major issue is the engagement of the staff of public museums with new platforms and technologies that can publicize the content held by the institution. Any novelty finds cultural resistance about technology usage."[7] But there is also a conceptual issue addressed by our respondents: if the technology is applied during the visitor's experience with the collection objects, it may bring cognitive noise, bias, and overload. This special moment, when the visitor should have the focus on object interpretation and sensing, is to be considered with attention. There must be a joint effort between curators and technology engineers to promote an experience that will leverage and not diminish the impact of this moment on visitors.

"We have diagnosed cases where the rush to insert technological gadgets was not based on actual needs, but on market trends thus not resulting in real benefits for the museum."[8] Managers also mentioned that technology engineers are also very fond of novelty, and sometimes this novelty does not last. As an example, two of them have experienced projects where the programming language used for software development became obsolete just after the project ending, and the effort and costs to maintain the software running turned to be prohibitive. "Museum projects must

[6]Testimony given to the authors, January 2017.

[7]Testimony given to the authors, January 2017.

[8]Testimony given to the authors, January 2017.

last decades, but the IT guys always want to use the newest and trending tool, before the market stabilizes to guarantee this tool will survive."[9]

11.3 Discussion: From Challenges to Opportunities

A part of these problems is intrinsic to the Brazilian government structure and quite difficult to address, like the allocation of resources for technology or of proper training to museum staff. However, some attempts can be done to address the challenges in a creative way. In this section, we present some ideas that can guide future research and project development.

Visitor interaction in museum spaces is normally standardized, through information panels presenting static text and images, which present themselves the same way for every visitor, every time in a very traditional communication scheme. Traditional (or mass) means of communication base their structure on the classic paradigm of sender-channel-receiver, granting considerable power to the sender and the channel owner. The Internet structure, based on a network of associations and interactivity, instead allows the receiver to shape the context of the information, and therefore its meaning. The individual obtains what they want, when they want it, and how they want it. The former "receiver" has gained power and control over the communication.

The museum public is no longer formed by passive spectators. As all other knowledge spaces, museums are also routinely visited by a heterogeneous public: museums, galleries, historic places, zoos, and parks usually have a very diverse range of visitors, like school groups, families, artists, curators, and so on. "Visitor diversity may lead to different interpretations of the same content, or to seeing things with distinct perspectives, depending on personal experiences. These differences also mean that diverse visitors may desire to obtain more information on different aspects of what they are seeing. In particular, young people are used to publishing their text, videos, photos at astonishing speed. They really want to interact!"[10]

Interactive experiences can create a two-way street between visitors and organizations, not only providing more information upon request but also enabling visitors to add their impressions or associate new information to the information displayed. Interaction with information becomes tailored to the individual and has the potential to improve the learning experience.

It is the museum's responsibility to explore this interactivity promoting more immersive presentations in the context of artworks. By migrating the visitor from the position of a passive observer to an active agent (that makes choices, writes, asks, creates), the museum establishes a dialogue channel, creating therefore a new

[9]Testimony given to the authors, January 2017.

[10]Testimony given to the authors, January 2017.

model of relationships with the society, in which collaboration and participation are highlighted.

As a knowledge place, a museum is a huge repository of information. This information takes form in books, photographs, handwritten notes, collection databases with metadata, printed programs from previous exhibitions, sound and video records, and so on. We want to take advantage of this repository in technology applications without overloading the museum staff, using the public as our workforce. Already used to interact and publish in social media, the visitors may enrich and adapt this content to fit the technology application, if tasks are properly organized. The use of crowdsourced voluntary resources to help with translation, photomasking, and interpretation of handwritten documents is already a reality in some museum environments, and the British Museum, with its Micropasts Projects, is a shiny example[11] (Bonacchi et al. 2014). The British National Library[12] and the National Library of Israel[13] continuously ask the public to perform tasks (e.g., translating from dialects to English, catalog handwritten notes). Even smaller institutions are also taking advantage of the public's workforce (Hallinan 2014).

The integration and organization of such open repositories of museum knowledge have, however, major challenges (Henry and Brown 2012): information management, especially as related to its organization, correlation, and editing; human–computer interaction, particularly tailoring the experience to the user and the settings, enabling easy access to the museum body of knowledge.

The first issue is information management and, more specifically, information integration. Structures that organize information must be clearly defined and known, so that new information can be incorporated in and properly linked to existing information. When multiple organizations are involved, they might each have its own underlying structures, and the same concepts might appear more than once. Finding points of connection to interlink these structures is one challenge. Navigating both of them together is another one.

One technology that has potential to help in this solution space is Linked Open Data (Berners-Lee et al. 2001). There has been growing adoption of Linked Open Data strategies in libraries, archives, and museums (LODLAM[14]), as evidenced by a number of existent workshops and conferences (for instance, see the MW2016 conference[15] and LODLAM-based tutorials). The British Museum is one institution that has released its collection using semantic technologies (Oomen and Aroyo 2011). Semantic tags, descriptors, and ontologies could help interlink information

[11]Micropasts Project Website, UK. http://micropasts.org.

[12]National Library Crowdsourcing Website, UK. https://www.libcrowds.com/. Accessed 15 Jan 2017.

[13]Israelian National Library Crowdsourcing Website, IL. http://nlics.org/. Accessed 15 Jan 2017.

[14]Linked Open Data in Libraries, Archives, and Museums Website. http://lodlam.net/ Accessed 15 Jan 2017.

[15]Museums and the Web 2016 conference website. http://mw2016.museumsandtheweb.com/ Accessed 15 Jan 2017.

from the museum collection to information found "in the wild," or between institutions.

On the other end of the spectrum, users could be encouraged to contribute with photos, videos, or comments based on their daily experience. This turns them into more active participants in the construction of a museum body of knowledge. When the visitors leave a museum, feelings and memories of the visit are still present. While walking out in the street, something (an object or an event) reminds them of something they saw during the visit. Through an interface, the visitors could send the museum a photo, video, or textual description of the element that reminded them of an exhibit, and link it with the appropriate museum elements. In this situation, visitors are the ones making the connections between information elements, and sending them back to the heritage institutions. Naturally, this also means curators' jobs would change: from handling museum content, they would now have to look through visitor-generated content to decide what should and should not be incorporated in the exhibits. Crowdsourcing is explored in more detail in Chaps. 7, 8, and 9 of this book.

Were a user to visit two different sites, where both had their collections semantically enhanced, it would be easy to create links between them using linked data technology. Thus, when visiting a heritage site (e.g., a castle), objects from the museum (e.g., tapestries) could be inserted (virtually) into the experience, providing additional information and contextualizing the objects in their original space. Some initiatives on outdoor activities are already being undertaken (Wecker et al. 2015), and we believe these have the potential to add to the museum experience. Chapter 14 adds more to this subject as well.

Another issue is how to tailor this experience to different users. The interests and visit dynamics may be different depending on the visitor's age, interests, or previous knowledge. User profiling and modeling techniques can be applied to elicit preferences and interests of a user. Beyond that, any integration with the world outside the museum walls would need to understand not only the location but also the context in which the information is to be presented. Just as there are many opportunities for presenting information, there is also the risk of doing so at an inappropriate moment. Chapters 15 and 16 also deal with personalization and tailoring of information.

A visitor might be struck with a question, be reminded of something or make a mental correlation while visiting an exhibit. He/she should be able to attach this question or comment to the display. He/she should also be able to interactively search for answers, either through the installations or through his/her own devices, and attach these answers to the exhibit at hand. Examples of these interactive applications are mostly extracted from North American and European institution. The application of such solutions in Brazil only lacks a small impulse: technology scientists working together with cultural institutions, two separate worlds, each one with its own vocabulary and problems, especially funding for joint projects. On the good news side, we can count on visitors: Brazil is always placed among the top when it comes to social network usage and mobile adoption. The crowd is ready to collaborate.

11.4 Final Considerations

Several proposals have been made in this chapter to create new forms of engagement with heritage institutions and museums. Previously defined strategies for research (Wecker 2014) provide guidelines for future engagement. However, we feel there are many possibilities still open, even considering the restrictions faced by developing countries like Brazil.

Thus, we would like to explore how museums could become more integrated into their public day-to-day reality and become more of an educational experience than an "archival" space. This involves defining useful technological platforms (cell phone usage is very high in the country, so it would be interesting to take advantage of that), finding new forms of interaction with the audience, leading them to question their knowledge and assumptions, and inspiring them to contribute.

Issues of context and information filtering become very important in this case: how could information overload be avoided when providing museum information? Moreover, how could personal and non-mediated art experience be protected? One of the respondents was very emphatic about this concern: "I am against the excessive use of technology in the museum, because the quality of the experience when you face a technology gadget is not different from what you have in daily life." The respondent meant that the museum should be a place where the contact with the art pieces should not be flattened to what we experience everyday with all the images we see. And continues: "I think the museum is the place to oppose the information overload we experience. It is the place to see without filters, without a screen as intermediary, because the principle of the museum experience is the contact with the primary source, the object that assumes multiple meanings depending on the context it is immersed in."[16]

On the other hand, engaging visitors is not always an easy task. Modern audiences seem to have a short attention span: younger visitors are easily distracted by calls from life outside the museum walls delivered by smartphones and other modern gadgets. Thus, it is important not only to provide the information virtually but also to connect it to its physical embodiment, which is experienced in a visit to the site. Thus, a partial visit to a site would allow the user to collect some information, but not all. Its correlation to the external world would, hopefully, entice the user to come back for another visit. "The use of technology is always welcome because it amplifies the institution's reach, in the scope of education, dissemination of the museum program and events and knowledge management. The audience is more present, is closer and responds positively to museum content."[17]

This chapter presented challenges and opportunities for technology adoption in the cultural scenery in Brazil with a dialectical approach: without listening to the individuals who deal with these limitations and strategies in the real world,

[16]Testimony given to the authors, January 2017.

[17]Testimony given to the authors, January 2017.

technology researchers tend to simplify the existing barriers to any proposed solution. Our main contributions can be summarized as follows:

(a) We have contextualized problems already presented more generally elsewhere to the particularities of a developing country like Brazil;
(b) We have discussed these with some managers and directors of Brazilian institutions, collecting their testimonies and comparing some findings in the literature with real situations;
(c) We have explored in more detail some of the challenges observed and some possibilities brought about by the adoption of new technologies; and
(d) We have proposed some actions that may contribute to reach a larger audience and to captivate the public, taking advantage of participation and interaction through the large use of social networks and other mechanisms available in virtual environments and new communication applications and equipment.

We believe that an interdisciplinary dialogue is necessary and that it can leverage the benefits of technology adoption. Besides, there is no doubt that museums should face the technology challenge to reach their contemporary public, but with a continuous effort to increase interest and participation. Researchers have noted there are special requirements in information systems development in developing countries (Mursu et al. 2000). This also translates to museums: being aware of and catering to these challenges allow designers to create better, self-sustaining solutions that will be applicable to a larger range of situations.

"Technology allows us to be in connection with the contemporary world and to keep up with its transitory aspects—this plural world that moves and organizes itself in fluxes, flows of information and images, where there is no truth anymore. The eye, used to lights, to numbers, to superficiality of data does not stop, does not linger. The pertinent use of technology can bring the visitor to the observation place. With the interest awaken in this way, the visitor becomes a spectator. And I am referring here to the spectator that physically enters the exhibition space. On the other hand, technology allows access to remote places, textual productions, virtual visits, simulations of diverse nature. A new *place* is created—that one inside a computer, a public display, a wall projection. Distance and time are reconfigured there. And this is certainly very good!"[18]

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[18]Testimony given to the authors, January 2017.

References

Arjona M, Brinkley FK, Camargo Moro F, Ebaks RC, Espinoza M, Lacouture F, Lumbreras LG, Magalhaes A, Mostny G (1982) Museum development and cultural policy: aims, prospects and challenges. Museum 34(2):72–81 (UNESCO, Paris)

Berners-Lee T, Hendler J, Lassila, O (2001) The semantic web. Scientific American (May)

Bonacchi C, Bevan A, Pett D, Keinan-Schoonbaert A, Sparks R, Wexler J, Wilkin N (2014) Crowd-sourced archaeological research: the MicroPasts project. Archaeol Int, 17:61–68

Hallinan ME (2014) Illuminating masterpieces: the Martin museum of art collections crowdsourcing project, Baylor University https://baylor-ir.tdl.org/baylor-ir/handle/2104/9069. Accessed 15 Jan 2017

Hawkey R (2009) Learning with digital technologies in museums, science centers and galleries. J Distance Educ 3:14

Henry D, Brown E (2012) Using an RDF data pipeline to implement cross-collection search. Museums and the web 2012, San Diego, CA

Johnson L, Adams Becker S, Estrada V, Freeman A (2015) NMC horizon report: 2015 museum edition. The New Media Consortium, Austin

Mursu A, Soriyan HA, Olufokuninbi K, Korpela M (2000) Information systems development in a developing country: theoretical analysis of special requirements in Nigeria and Africa. In: Proceedings of the 33rd Hawaii international conference on system sciences (HICSS), IEEE

Oomen J, Aroyo L (2011) Crowdsourcing in the cultural heritage domain: opportunities and challenges. In: Proceedings of the 5th international conference on communities and technologies, Brisbane, Australia, June 2011. ACM, pp 138–149

Pitarque SD, Guardia BR (1982) Museum financing: taking up the challenge. Museum 34(2) (UNESCO, Paris)

Wecker AJ (2014) Personalized cultural heritage experience outside the museum: connecting the museum experience to the outside world. In: International conference on user modeling, adaptation, and personalization, pp 496–501

Wecker AJ, Kuflik T, Stock O (2015) AMuse–an initial plan to associate museum visits to outdoor cultural heritage activities. In: Proceedings of the 8th international conference on personalized access to cultural heritage, vol 1352. CEUR-WS, pp 14–18

Author Biographies

Leticia Verona is a Master's degree student in Information Systems at PPGI-UFRJ and an entrepreneur. Her company is well known for developing technology solutions for Brazilian museums, individual artists and cultural institutions for almost two decades. Her research interests includes how pervasive technology impact user experience during museum visits and afterwards and how museum visitor's attention can be positively focused.

Adriana S. Vivacqua is a professor at the Computer Science Department at the Federal University of Rio de Janeiro. Her main area of interest is context-sensitive technology, and she has supervised students at the graduate and undergraduate levels and written extensively on the subject. She currently holds a Young Researcher Award from FAPERJ and a Productivity Award from CNPq.

Maria Luiza M. Campos is a professor at the Computer Science Department at the Federal University of Rio de Janeiro, with more than 30 years of experience in data and information management. Her main research interests are conceptual modeling and information integration, specially focusing on ontologies and metadata based strategies applied to the semantic web and the

e-government and e-Science domains. She has previously worked as a data administrator at the Brazilian Statistical Agency (IBGE) and has, for many years, been engaged in open data initiatives in Brazil.