

Evaluation of Art Museums' Web Sites Worldwide

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Abstract:

Nowadays, it is widely observed a constantly growing number of online museums. At the same time, many studies argued that evaluation is the major tool in the effort of designing informative, effective and qualitative web sites. This paper introduces MUSEF (Museum's Sites Evaluation Framework), a framework for evaluating museums' sites from the users' point of view, and applies it to evaluate 210 art museums' web sites worldwide. MUSEF is composed from six fundamental evaluation dimensions: Content, Presentation, Usability, Interactivity & Feedback, e-Services, and Technical. Each evaluation dimension contains several important criteria. The evaluation results revealed that most sites needed improvement with respect to Interactivity & Feedback, and E-Services. There were also large variations among the sites with respect to Presentation, Usability, and E-Services. Finally, suggestions for improvements are made.

Keywords: Art Museums; Digital Culture; E-Culture; E-Services; Evaluation; Interactivity; Museums; Usability;

1. Introduction

We are at the beginning of the Information Revolution and the World Wide Web is being widely used by a constantly growing number and variety of people. At the same time, there are many developments regarding digital culture and there are constant efforts to preserve heritage and make it available in a digital way. Therefore, most museums have established some presence on the (World Wide) Web by creating their web sites. In a sample of 290 UK museums, 38% of them had a web site, while 20% were planning to develop one in the near future [7]. National museums were then leading the way, with 86% of them already having a web site.

Nowadays almost every museum has created its own official web site. Museums contain rich sources of material in their collections and there is particular interest in making this material available to a wide audience [10]. This information must be accessible and usable by the public [8]. Digitalisation of museums reflects library developments of shifting traditional library card catalogues to online catalogues, digital libraries and finally transferring to

digital collections. Museum collection information which are originally stored in paper format is now stored in electronic museum catalogues, digital collections and in the World Wide Web [1]. A wide number of users, from preschoolers to art historians and researchers, may visit digital museums. Thus, the museums' sites face the desires and expectations for culture and knowledge of a large variety of people (various ages, professions, levels of education, languages spoken, etc.). They would do their best to satisfy all these different needs.

On the other hand, online museums are using some tools in order not to be seen exclusively as guardians of information, but as part of a wider exchange. In particular, these Internet tools, such as online seminars, online tours, chat forums, e-shops, surveys/polls, e-talks, extend the function of the museum web site so that it is not regarded as a catalog of knowledge.

2. Statement of the problem

The main problem at this state is that improvements could be made regarding the design and development of the museums' web sites. Web developments are often undertaken with limited resources in terms of time, knowledge and money and consequently many museums' sites lack useful features.

It is widely argued that the development of compelling and informative web sites needs money and time. Regrettably, most cultural institutions such as museums often have neither money nor time in order to accomplish this kind of project. Large national museums have often some funds for employing professionals to design their online museum in an effective way. However, small museums have many difficulties in developing and maintaining their official web site and as a consequence this project is usually accomplished by volunteers who are not skilled in web designing. Furthermore, it is widely observed that the small local museums are not receiving the necessary financial support by the national government.

Another factor that acts against the development of the small local museums' web sites is the lack of understanding of technology by the public. This problem is even more evident in less developed countries where many categories of possible museum visitors such as the elderly, the teachers and even young people do not have real access to the Internet and therefore they do not feel easy with technology [11].

A museum's web site has to be a dynamic entity in order to keep up with the evolution of technology and to attract a constant growing number of users. By understanding the link between motivation and meaning-making, museum professionals will be able to provide more effective and more enriching on-line experiences for their visitors [13].

The designers of these web sites should take into serious consideration the wide variety of the people who visit the sites in order to satisfy their expectations. As a result, it is quite obvious that the evaluation of a museum's site should be the major tool not only during its design but also during its lifetime maintenance as it is essential for determining whether it meets the needs of its virtual visitors. Last but not least, these sites should also be effective enough in order to fulfil the communication goals of the museums with the public.

3. Relevant literature on museum's web site evaluation

Although there are several previous studies on web sites' evaluation, there is not a comprehensive mechanism for systematically assessing all components of a museum's web site. QEM (Quality Evaluation Method) was used to evaluate and compare quality characteristics of a museum's web site [15]. In this method, the core models and procedures for artifact evaluation are supported by the Logic Scoring of Preference (LSP) model and continuous preference logic mathematical background. The following web site's quality features were considered: usability, functionality, reliability efficiency, portability and maintainability. In another [9], several museums' web sites were evaluated with respect to the usability, presentation and facilities that are being offered. Four evaluation methods have been suggested [4] to be used by non- professionals in order to evaluate the usability of museums' web sites. These methods are: direct observation, log analysis, online questionnaires and inspection. MILE (Milano-Lugano Evaluation Method) was used to assess the quality and usability of museums' web sites [2]. An accessibility and usability survey was performed on 25 UK and international art galleries and museums' web sites [14]. The Cast Bobby Validator and the Jaws screen reader were used in order to investigate the sites' technical accessibility and usability. It was found that in many cases the web designers of the surveyed web sites have not taken into consideration even the basic techniques for accessibility. It was suggested that the web designers should deliver accessible, usable, logical and sensible information for as many people as possible. Similarly, a museum web site evaluation survey was performed [3] in order to raise awareness of the issues concerning online access by disabled people.

The presence and the quality of 100 randomly selected history repositories in United States were examined in [12]. The content quality and effectiveness of 73 repositories (including many museums, archives and libraries) in the Internet were evaluated. The usefulness of online resources of museum libraries and research centres in meeting the scholars' needs were investigated in [16]. The following web sites' features were examined: navigability, coverage, relevance and images. The FQT4Web (Fuzzy Quality Tree for Web Inspection) methodology for evaluating a museum's web site contains the following criteria: functionality, usability, accessibility, efficiency, maintainability and compliance [5].

4. Aim of this work

The majority of the previously mentioned studies used a small number of either qualitative or quantitative criteria in order to evaluate the quality of the museums' web sites. Specifically, most of these studies considered the Usability [2, 4, 5, 9, 12, 14, 15 and 16] and Accessibility [3, 5 and 14] of the web sites. Also, some studies considered Content [12 and 16], Presentation [9 and 16], and Technical [5 and 15] characteristics. Consequently, although these studies produced useful results, they have not proposed a comprehensive evaluation framework for museums' web sites.

The first aim of this paper is to present an evaluation framework that uses a combination of both quantitative and qualitative criteria from the virtual visitor's point of view. The proposed evaluation framework, called MUSEF, is easy-to-use and can provide useful results for museums' administrators and web sites' designers and developers. It consists of six evaluation dimensions containing many criteria (Tables 1 and 2). Many of these criteria are proposed for first time.

In addition, using MUSEF, this paper evaluates 210 web sites of art museums from all over the world in an effort to illustrate the current state of art museums' web sites. A comparison of art museums web sites from three different regions (North America, Europe, Rest of World) of the world is presented in order to discover whether there are any significant differences among these regions. So, it is the first time that such a massive evaluation of art museums' web sites is performed using a large number of evaluation criteria. Differences of art museums' web sites are identified and suggestions for improvements are made.

5. Methodology

Based on the previous studies on museums' sites evaluation, our research on e-commerce and e-learning sites evaluation, discussions with many colleagues and our personal experience and knowledge on using and developing Web applications, we have developed MUSEF, a framework for evaluating museums' web sites. It consists of six (6) evaluation dimensions of criteria: Content, Presentation, Usability, Interactivity & Feedback, e-Services, and Technical (Table 1). Each dimension contains a number of specific criteria. We analyze and these evaluation dimensions and their criteria along with the results in the next section 6.

During Fall 2006, we gave a task to undergraduate students in an e-commerce course. Every student had to find 5 art museums' web sites from a specific country or a state in the U.S.A. Then he/she had to perform some other tasks. The students used search engines as well available international lists of museums' web sites, associations, organizations and other useful links. More than 110 students completed their task. The museums were classified into 3 regions: i) North America (U.S.A. and Canada), ii) Europe and iii) Rest World. The impact of the U.S.A. on the world is very strong. Many states of the U.S.A. are comparable to many countries with respect to economy, culture, technology. Therefore, we considered a state as a country. Correspondingly, the impact of Europe on the world is also strong. For each region, we compiled a list with the corresponding museums' web sites. Each list contained more than 150 museums' sites. Then, we randomly selected 70 sites from each list. The only restriction was that the site should have an English version. The first author evaluated all these 210 sites using MUSEF. For every museum's web site, he assigned a score to each criterion according to the following scale: 0:= non-existent; 1:= very poor; 2:= poor; 3:= mediocre; 4:= good; 5:= very good. The score for each evaluation dimension is the average score of its criteria.

Tables 1 and 2

Finally, we calculated the average (and the variance) of all museums' web sites in each region (North America, Europe, Rest World) for every evaluation dimension.

6. MUSEF analysis and application

In this section, we explain MUSEF, and apply it to evaluate 210 art museums' sites from a virtual visitor's point of view. MUSEF consists of six (6) evaluation dimensions: 1) Content, 2) Presentation, 3) Usability, 4) Interactivity & Feedback, 5) E-Services, and 6) Technical (Table 1). Each evaluation dimension consists of several evaluation criteria. Next, we describe these evaluation dimensions and criteria along with the evaluation results.

6.1. Content

The content of a museum's site is a fundamental dimension. An art museum does not only aim to collect artwork, rather its objective is to exhibit and communicate art to many people. Content includes all information about its exhibits and artists. For example, the history, reviews and comparisons about a painting would add value to its picture itself. Information about the museum itself is included in the Informational Services (Section 6.5). The comprehensiveness and usefulness of the content is important for a virtual visitor. Also, unique content that could not be found elsewhere increases its value. Relevant references and links to other related material and web sites contribute to its quality. Of course, the content should be accurate, current and updated. The existence of personalization features (e.g. "first time visitor", "my favorite artworks", kid- profile, student- profile, art researcher- profile, support of multiple languages) enhances its usefulness.

Figure 1

North American and European art museums' web sites provided a satisfactory content (Figure 1). However, some sites from the Rest World needed improvements in content. Many sites from the Rest World had incomplete content and as result they failed to provide the visitors with all the information that they might need. In particular, some of them showed only a limited portion of their art collections that are exhibited at the real museum. Moreover, they did not provide a lot of information about the artifacts. Also, only some of them had translated their content in different languages. As a consequence, they could not be explored by people speaking other languages. However, it has to be mentioned that there were also some North American and European sites that also lacked a variety of languages. The Metropolitan Museum of Art of New York (www.metmuseum.org/) had a web site with the most complete and useful content (score= 5.00). This site offered a unique application (My Met Museum) to the visitor so that he had the opportunity to develop his own collection (My Met collection) and his own calendar (My Met calendar). Also, the 'Rapid checkout' application offered

personalization. The site could remember a registered user who had previously bought something.

6.2. Presentation

The presentation of a museum's site is another important evaluation dimension. Especially a site of an art museum must show an attractive appearance with various multimedia and colors. The right quantity, mix and position as well fidelity of the multimedia contribute to its value. The appropriate and consistent use of format, styles, fonts etc. are essential. Of course, right spelling, grammar, syntax etc. are required.

Figure 2

The North American sites exhibited an aesthetic design with an excellent mix of media and multimedia and a right quantity of gif images producing a vivid result (Figure 2). Although European and Rest World sites were surpassed by the North American sites, they were not poorly designed. However, some sites from the Rest World did not show adequate amount of multimedia. In particular, they did not have video or other animation. This shortcoming made them static and unexciting. The high variances (North America=0.72, Europe= 0.86, Rest World= 1.21) reveal that there were large differences among the sites in each region regarding their presentation quality. For example, the Italian and French sites exhibited much better presentation than the majority of the other sites in Europe. These differences were even larger among sites in the Rest World. So, the art collections in Japanese and Australian museums were much better presented than in other museums in the Rest World. The Fine arts of Boston (www.mfa.org) had the site with the most attractive presentation (score= 5.00). It presented a beautiful home page with a gif application which also showed some of the upcoming events of the museum.

6.3. Usability

Usability refers to the site's easiness of use by a visitor. It is essential that any visitor can easily learn, use and remember the site. The design of its user interface (e.g. menus, toolbars, buttons, icons, frames) should facilitate the visitor in his exploration. Easy and simple navigation with shortcuts, no page errors, link prediction, return-to-home and Help buttons enhance its usability. Also, accurate orientation with site map, indexes and useful directories are essential. Moreover, the structure of the site must be simple and well-organized. Of course, an advanced search engine that returns accurate and relevant results is important. Finally, accessibility for special needs persons should be provided.

Figure 3

North American sites achieved the best usability score, while the Rest World sites achieved the lowest score although at a satisfactory level (Figure 3). Some sites from the Rest World were not well organized and a visitor

could be messed. The navigation though them was rather complicated. Additionally, many of these sites did not provide reliable orientation to the visitor. So, he could easily lose his way. In addition, there were differences among the sites in the same region (variances: North America=0.69, Europe=0.88, Rest World= 0.98). The Fine Arts of Boston (www.mfa.org) had the easiest to use site (score = 5.00). Although it was a quite large site it had a simple and not confusing structure. Moreover, it offered high quality navigation with many buttons, alternative paths, no broken links and consistent orientation which helped the visitor to know anytime where he was located.

6.4. Interactivity & Feedback

A visitor would welcome the ability to interact with a museum's site. This can be accomplished using either asynchronous (e.g. e-mail, sms, alerts, newsletter) or synchronous (e.g. chat, telephony, videoconferencing) communication. Visitors would like to have the ability not only to interact with the site but also to communicate with the museum's staff as well as other visitors and museum's friends. They would exchange information, news, opinions, and suggestions. They would also participate in surveys and polls. The support of forums and e-communities (e.g. friends of the museum, members, volunteers or sponsors) enhances its quality.

Figure 4

Although North America's sites offered the best interactivity to their visitors, there was a lot of space for improvements (Figure 4). On the other hand, the rest sites and especially the European sites needed to do a lot of work in order to reach desirable levels of interactivity and feedback. Most European and the Rest World sites did not support e-communities and forums and as a consequence they fallen short to create museum-related communities and supporters. In addition, there was a shortage of interactive multimedia applications in these sites. The National Gallery of Victoria in Australia (www.ngv.vic.gov.au/) could be considered as the best case regarding interactivity & feedback (score= 4.75). It offered to the visitor the ability to sign up for e-news and to contact the museum's staff by either phone, or fax, or e-mail. The visitor could become a member of the museum online. There was a special e-mail address which could be used only by members in order to solve any problems that might occur. In addition, by becoming a member the visitor could receive special information and news regarding not only the museum but also his membership. Furthermore, it offered podcast, an online audio application. A podcast is a multimedia file that can be downloaded via the Internet and be played on mobile devices and personal computers. The visitor can subscribe to podcasts via an RSS (Really Simple Syndication) feed, which is the underlying technology used by podcasts. This museum offered podcasts that contained audio information such as artists' interviews.

6.5. E- services

Another important evaluation dimension is related to the variety and quality of the offered e-services. It is useful to offer informational services such as calendar, upcoming events, temporary exhibitions, recent acquisitions, highlights, most popular items, and statistics (e.g. number of visitors per day). Also, it helps to show information about the museum's location, opening hours, transportation, facilities, maps and other operational information. Job openings and internships in the museum would also be advertised on its site. The site's visitors would like to have the ability to buy tickets or souvenirs from the museum's shop online. Also, group guides would welcome to reserve their tours online. Another essential service is online learning. Museums would aim at developing visitors' culture and education. So, they would offer e-lectures, documentaries, e-shows, masterpieces on video, e-classes, e-books, and databases with information about artists, artifacts, art and culture. Finally, the provided technical services (e.g. printing & downloading) support and help the visitor.

Figure 5

Regrettably, European and the Rest World sites did not pay much attention to their offered e-services (Figure 5). Most of them provided only informational services about the museum's exhibition calendar and opening hours. Some sites offered limited learning services about the museum's works of art and artists. Few sites provided virtual tours, e-classes, e-books, e-talks or other online educational services. Moreover, many sites lacked FAQs (Frequently Asked Questions) pages. On the other hand, the North American sites provided a satisfactory number of e-services. However, the high scores' variances (North America =0.74, Europe= 1.08, Rest World= 0.94) underline the fact that there were large differences in the e-services quality in all regions. The Art and Exhibition Hall of the Federal Republic of Germany (www.kah-bonn.de/index_e.htm) achieved the highest score (score = 4.83) for its e-services. It offered the best e-services both in quantity and quality. The visitors could get information about the opening hours, the admission and how to arrive at the real museum. They could book guided tours online, buy museum's products and send e-cards. Finally, it provided virtual tours which help the visitors to look at some rooms of the museum. For example, the 360 degree Ipix technology offered to the visitor unique views of the Forum of the Art and Exhibition Hall. However, it failed to achieve the perfect score (5.00) due to its limited online learning and educational material.

6.6. Technical

Evaluating a web site across the technical dimension, we consider four criteria: 1) availability & maintainability, 2) performance, 3) compatibility and 4) security & privacy.

Maintainability refers to the level that the site is maintained and upgraded. The site's administrator would inform the visitors about actions taken to upgrade it. Developing striking and informative museums' sites is taking place in a fast growing, competitive and changing environment. New Internet applications and technologies are continuously becoming available. The users are voracious for such advanced applications and technologies. So, the web

site should be continuously upgraded and available 24X7. All museums' sites achieved a very high score regarding availability/maintainability. Most administrators used state-of-the-art technologies to operate their sites.

Performance refers to the processing and output speed of the site. The speed of the server(s) and the communication channels should support all possible visitors and applications. We have used webxact (webxact.watchfire.com) to measure this speed. All museums' sites achieved very good performance.

Compatibility refers to the ability of the site to function properly using any browser (Internet Explorer, Firefox, Netscape Navigator) on any computer. Also, it helps the no need for specialized software in order to use the site. In case that extra software is needed, the site should provide it or link to it (e.g. Acrobat Reader, Macromedia Flash). Almost all museums' sites were compatible with all browsers. Most European and the Rest World sites offered a few services and consequently they did not require any special software. Many sites - especially in Europe and North America- gave to the visitors the opportunity to download the required software in order to use some of their services.

Security & Privacy is a constant concern in Internet. A site should ensure its visitors about their safety and their non-unauthorized use of their personal information. It would provide security licenses and inform its visitors about security measures taken. Furthermore, many visitors prefer not to be monitored (e.g. cookies). Almost all sites provided a satisfactory security level. The sites' administrators informed the visitors about their security mechanisms and confidentiality precautions.

Figure 6

After scoring each one of these 4 criteria for every site we take the average score for the technical dimension (Figure 6). All sites scored above 4.00. Furthermore, the fact that the scores' variances are quite small (North America= 0.14, Europe= 0.22, Rest World= 0.14) shows that all site achieved almost the same technical level. Many sites achieved the highest score 5.00.

7. Discussion of the results

The web sites of art museums worldwide were at a satisfactory level. The North American sites were leading the way but they did not have significant and substantial differences from the rest sites worldwide (Figure 7).

Figure 7

In particular, the North American sites led the way. Most of them had adequate and appropriate content including a satisfying amount of informational services with interactive maps (e.g. Knoxville Museum of Art: www.knoxart.org/) and very large museum libraries (e.g. Philadelphia Museum of Art: www.philamuseum.org/). They offered to the visitors the opportunity to book guided tours and tickets, to become museum's members or to buy souvenirs (e.g. replicas, t-shirts, posters, books, DVDs) online. Most

of them showed an aesthetic and pleasant presentation using suitable colors, fonts, titles and multimedia (e.g. Arkansas Arts Centre: www.arkarts.com/; Fine Arts of Boston: www.mfa.org). Furthermore, they provided easy, simple and accurate navigation with alternative paths and advance search engines. In addition, they provided sufficient asynchronous and synchronous interactivity. What is more, these sites were really consistent about security as they showed certificates in order to ensure the visitors about their safety. Some North American sites offered advanced e-services such as podcasts (e.g. Philadelphia Museum of Art: www.philamuseum.org/, Museum of Contemporary Art: www.mcachicago.org/), e-cards (e.g. Minneapolis Institute of Arts: www.artsmia.org/), interactive games and quizzes (e.g. Museum of Contemporary Art: www.mcachicago.org/; National Museum of Wildlife Art: www.wildlifeart.org/Frame_HomePage.cfm) and audio tours (e.g. Minneapolis Institute of Arts: www.artsmia.org/). However, it is fair to mention that the Canadian sites provided a little lower quality of e- services than the U.S.A. sites did.

In contrast, the European and the Rest World sites should take further steps towards improving their features. First of all, most of them have to improve the quality and the quantity of their online services. Most of them offered only some informational services about the opening hours, the admission fee and directions to the address of the real museum. However, online purchase and payments are important services not only from the visitors' point of view but also from the museums' point of view (e.g. extra revenues' channel). Also, educational and learning services would be part of the museums' aims. It is a pity that there were sites that did not inform the visitors about the museum's artifacts and exhibitions.

Also, the interactivity & feedback of the European and the Rest World sites needs to be improved. They would support e-communities, forums and survey polls in order to become dynamic entities. Furthermore, members in these e-communities often talk about the quality level of the site. Their suggestions may help the administrators to resolve the inefficiencies of the site and keep it always updated.

Moreover, the site developers should consider the personalization of the site to any visitor. Many sites did not support enough or any language preferences, such as the majority of the sites in France and Latin America. This becomes a great hindrance for visitors who do not speak these languages. In addition, many sites did not help people with special needs. Especially for museums that promote culture and civilization, this is a serious drawback. A museum's web site should be accessible by all people. However, it is worth mentioning that there were some sites (e.g. in Japan, France, Australia, Germany) which were almost as advanced as the North American sites.

After evaluating all these 210 sites, we concluded to three sites that would be considered as best practices for designing a museum's web site. These top art museums' web sites were: 1) The Fine Arts of Boston (www.mfa.org) (total score= 4.40), 2) Galleria Civica d'Arte Moderna e Contemporanea Torino (www.gamtorino.it/main.php) (total score= 4.43), and 3) The High Museum of Art Atlanta (www.high.org/) (total score= 4.32). These three sites achieved a high score at all 6 dimensions of our evaluation. Next, we describe some of their special features.

The Fine arts of Boston (www.mfa.org) - This site had an aesthetic presentation with a gif application and a proper use of colours and formats. It offered advanced personalisation ('my mfa' application) to the visitors. It also took into consideration the visitors with special needs by giving them the opportunity to enlarge the fonts of some pages. Moreover, it offered interactive virtual tours and educational material about the museum's artworks. It supported excellent navigation, orientation and usability. Finally, it provided RSS (Really Simple Syndication) feed.

Gallery of modern and contemporary art Torino (www.gamtorino.it/main.php) - This site offered a nicely designed multimedia menu that interacted with the visitor's navigation preferences offering outstanding usability. It provided superior catalogues about the museum's collection supported by search engines. It also offered a kind of virtual tour that informed the visitors about the exhibits at every floor and room of the museum.

The High Museum of Art Atlanta (www.high.org/) - This site offered quality content about its many collections (even a collection tailored to kids, called 'kid's corner'). It provided an event calendar in order to inform the museum's visitors about the upcoming art exhibitions and e-news to the subscribers. Moreover, it supported e-shop, e-cards, FAQs (Frequently Asked Questions), newsroom and online membership.

8. Conclusions and Future Research

The Internet is being increasingly used by a wide variety of people. At the same time, the applications that a web site can provide are growing at a very rapid pace too. As a consequence, many organizations are creating their official web sites. In the same way, museums are adopting Internet technology at a high level. However, there is still space for improvements. The online museums are visited by an increasing number of people beyond geographical, social, or educational borders. In order to keep pace with the technological advances and the growing users' demands and expectations, museums' web sites should be continually evaluated and upgraded. Through evaluation, the museums' administrators and the sites' managers and developers would identify the strengths, shortages and inefficiencies of their sites and take the appropriate actions.

We developed MUSEF, an evaluation framework for evaluating museums' web sites from the virtual visitor's point of view. We used quantitative criteria for evaluating features that could be objectively measured, and qualitative criteria for the rest ones. MUSEF consists of six evaluation dimensions and 28 criteria thus enabling a comprehensive evaluation of a museum's web site. Then, we evaluated 210 randomly selected web sites of art museums (and galleries) from North America, Europe and Rest World.

The evaluation results showed that the web sites of art museums are at a good level. However, their managers should plan continuous improvements to keep up with the continuous technology advances and growing users' demands and expectations. In addition, the results illustrated that the North American sites are leading the way without having really significant

differences from the rest sites worldwide. Next, some suggestions are provided so that the sites' designers and developers, as well as the museums' administrators should take into consideration in order to create effective sites.

First of all, they should take into serious consideration the fact that these sites are going to be visited by a large variety of people with varying background, needs, preferences and abilities. Consequently, the sites would support a large variety of services. For example, interactive educational applications for the kids would be welcome. People with special needs should be supported. For instance, a zoom application would be very helpful for a person with vision problems. Furthermore, the personalisation ability of the sites would be enhances. A visitor would tailor the site to his preferences or the site would be adapted to the visitor's needs. The Content, Presentation, Usability tools, Interactivity tools, E-Services and Technical characteristics would be adapted to the particular visitor. Correspondingly, various visitor-profiles (e.g. kid, student, teacher, first-timer, researcher, museum's friend) would be available. Each visitor-profile would correspond to specific site's characteristics.

In addition, the sites would employ avatars and virtual agents that would guide the visitor through virtual tours and recommend him exhibitions based on his profile. They would also announce upcoming events, suggest other interesting museums and sites, match visitors with similar interests, etc. Furthermore, mobile services would support the mobile visitors. For example, the site would send messages to the mobile phones of registered users about upcoming events. Finally, many museums would create a consortium in order to create a network of art museums' sites. They would share their content and e-services. Using standards and common specifications, they would achieve interoperability and compatibility. This will enable a visitor to access simultaneously all the sites in the network via a single portal. For example, via a single search, he would be able to look at all Picasso's paintings located at any museum in the network. A final recommendation to the sites' managers would be to perform online surveys regularly. They would measure the visitors' satisfaction in using the site. They would also collect the visitors' views, desires, dreams and proposals about an ideal art museum's site. This would help them in upgrading the site.

Future work would employ many people to evaluate museums' sites. However, the evaluators should comprehend the evaluation dimensions and criteria of MUSEF. However, they would use a simplified version of MUSEF or a particular evaluation dimension of it. Other types of museums would be also considered. Furthermore, the sites would be evaluated from the point of view of specific visitors (e.g. special needs persons, kids, students). As evaluation should be a continuous process, this study would be repeated after some time to identify the progress of the art museums' sites.

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