

Physical and Digital Accessibility of Museums in Bulgaria: Problems and Innovative Technologies

Vesela Georgieva¹, Galina Bogdanova¹ [0000-0002-5463-4274]

and Mirena Todorova-Ekmekci² [0000-0002-9532-0677]

¹ Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences,
Acad. Georgi Bonchev Str., Block 8, Sofia city, Bulgaria

² Institute of Ethnology and Folklore Studies with Ethnographic Museum at the Bulgarian
Academy of Sciences, 6A Moskovska Str., Sofia city, Bulgaria
vessy95georgieva@gmail.com, galibogdan1@gmail.com,
mirena.todorova@iefem.bas.bg

Abstract. The present article relates to the topic of physical and digital accessibility in the context of museums in Bulgaria, as well as the presentation of innovative digital technologies for accessibility to cultural heritage sites and the creation of a conceptual model of a digital passport for access and accessibility of museums in Bulgaria in terms of people with special needs. The paper shows research and certification of the accessibility of museums in Bulgaria for people with disabilities and impaired vision. The text covers the following: the Bulgarian museum context; the application of innovative technologies in museums and different examples; problems and possible solutions to the physical and digital accessibility of museums in Bulgaria; innovations for physical and digital accessibility of museums in Bulgaria, review of good practices for accessibility certification, development of a conceptual passport model for museum accessibility, using a comprised, adapted methodology.

Keywords: Physical and digital accessibility, Passportization, Cultural heritage, Museums, Innovative digital technologies, Disabilities, Blind

1 Introduction

According to Eurostat data on the European Council site of the EU, 87 million people in EU live with a disability in 2022, which is 1 of every 4 adults. Protecting their rights and improving the environment of everyday life of people with disabilities is a priority for the EU and that includes access to services, knowledge and culture. The Cultural Heritage Act of the Republic of Bulgaria requires equal access to museum spaces for people with special needs. Innovative technologies and following certain accessibility guidelines and criteria can be useful for overcoming accessibility problems and barriers. This scientific article examines some of the existing barriers and challenges related to the physical and digital accessibility of museums in Bulgaria, as well as the socialization and adaptation of innovative technologies for people with

special needs. There are problems in different functional areas: management, communication, marketing, and advertising, while at the same time, they all function in a specific way in museum work. Gradual socialization and digitalization depend on traditions, financial, personnel and management capabilities. Modern information and communication technologies (ICT) and digitization contribute to the development of museum work in the context of the preservation, protection and promotion of cultural heritage and the creation of new opportunities for presentation and accessibility. The presentation of the report includes: innovative technologies, problems, and possible solutions of the physical and digital accessibility of museums in Bulgaria; innovations for physical and digital accessibility of museums in Bulgaria, as well as the development of a conceptual passport model for museum accessibility. The research focus for digital accessibility of cultural heritage sites is on visually impaired and blind people.

2 Usage of Innovative Technologies in Museums

An important part of the modern development and modernization of museums is the use of innovative technologies and providing access to the cultural heritage of various target groups. Book [1] examines current topics and issues related to modern technologies and their application in museums, as well as the gap between formal education and training and real work. Over time, museum users are no longer just consumers of cultural products but become active subjects of cultural content. On the other hand, digital innovations help build the infrastructure that increases opportunities for exchange, accessibility and participation, and museums gradually begin to adapt to the new dynamic changes.

In the modern world, museums are expected to present and socialize cultural heritage, both onsite and online, internally, and externally, locally, and internationally, including collections and various content, objects, and artifacts. Digital technologies are a very useful tool to achieve the aims of museums in the different functional areas of the work of museums and their personnel. For example, augmented reality and the inclusion of various interactive educational games can have a revolutionary role. Designing and offering immersive environments and applied games, in the context of museums is important as “gaming encourages active participation, user interaction and loyalty, before and after the visit [1]. By using various databases, museums can present their cultural content in an innovative way that is often more effective, more informative, easy to perceive, find, research, preserve and disseminate. By using 3D scanning it is now possible to access various high-level digital archives, which in turn allow quick and easy access to a vast range of information from museum collections. This is useful for all interested parties – the general population, organizers of exhibitions, related institutions, scientific researchers, associations, tourism-related parties, and others. Digital culture contributes to the modernization, socialization, dissemination, and promotion of museum cultural heritage, identified as one of the key highlights of the future. Sharing cultural heritage online also creates opportunities for development and growth, an indirect marketing tool, useful for audience expansion.

The urbanization, globalization and dynamics of our modern world also affect museum cultural heritage usage. Modern users expect better tools for fast and easy digital, distanced presentation and accessibility. Examples of that are digital platforms and collections, applications, software, virtual tours, virtual reality and smart AI research and recreation tools, education tools, modern innovations and ICT.

Digital Repositories. Digital technologies are used for accumulating, organizing, and providing fast and easy access to vast amounts of cultural information to local, national, international audiences and concerned parties. They are important for the digital transformation of museums and memory institutions and for providing access and accessibility of larger audiences to cultural heritage, including an increasing percentage of people with special needs and disabilities. Digital technologies, tools and accessibility standards are important for safeguarding, socializing, and promoting cultural heritage and the development of museums. Not just museums, but also local, national, and international digital platforms have started to gather and present in one place vast amounts of cultural heritage data and collections of cultural objects and elements. Often it is important for local museums to be mentioned or to show some part of their collections on such collective digital platforms like Europeana in order to attract more visitors and attention. Online presentation and promotion have become an important part of the socialization of tangible and intangible cultural heritage of countries, as people use search tools online in order to find what they are looking for.

Digital Transformation and Virtual Museums. In the past, there was speculation and discussions in the museum community that physical museums might be diminished by virtual ones with a decrease in the on-the-sight real visits and experience of people in museums. But even though the number of virtual museums and exhibits has vastly increased around the world, in fact, the data from various research, like [2], [3] shows that virtual museums, collections and exhibitions do not reduce museum attendance. Virtual museums and exhibitions contribute to increased awareness of physical museums, reaching a wider audience, increased attendance, and enhanced museum experience and engagement [4], [3], [5]. Digitization of museum collections, virtual exhibits, and electronic resources is discussed and presented in detail in the book [2], which explores a wide variety of museums and musicological approaches worldwide. Whether virtual museums should be included in the definition of a museum is a controversial question posed by museum professionals and musicologists. In the same book, virtual museums, the hypothesis is that this type of museum [2], [3]. Virtual museums provide opportunities to access information and make an important contribution to society. It is also significant that the museums are perceived by their users as meaningful to them and provide opportunities for interaction with actual objects.

3 Problems and Solutions for Physical and Digital Accessibility

3.1 Some Problems and Research of the Accessibility of Bulgarian Museums

The Cultural Heritage Act of the Republic of Bulgaria requires equal access to cultural heritage for all. To realize accessibility for people with disabilities, architectural, technological, and software solutions are needed, which depend on the type of disability (wheelchairs, elevators, ramps, marked paths, sound and light signaling, Braille inscriptions, screen readers, audio guides, magnifiers, glasses, etc.).

In 2015 - 2016, a team from the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences, together with volunteers from 3 groups of people with special needs: visual, physical, and cognitive difficulties, conducted field surveys of part of the 100 national sites list in Bulgaria (over 100 sites). The research results showed physical inaccessibility for the majority of the national sites. One of the goals of the research was related to the perception of museums in an accessible way, working in favor of people with special needs and with the aim of evaluating museum accessibility and the use of modern assistive devices and technologies for accessibility of people with disabilities. Collected data from the field surveys of physical accessibility of the sights was analyzed and evaluated, in order to draw conclusions and recommendations for solutions towards better socialization and accessibility. A large part of the researched museum objects turned out to be completely inaccessible to people with mobility problems. Tactile accessibility for people with visual impairments was also researched and results showed a lack of such accessibility almost everywhere.

Subsequently, in 2022, regional museums from the mentioned sites were tested for digital accessibility (sites, software applications, documents, etc.) for people with impaired or lost vision in several ways - by means of automated software (WAVE), by volunteers with visual problems, and the conclusion was that over 75% of the sites were largely inaccessible to people with visual disabilities. Most regional museum websites did not sufficiently meet the criteria for web accessibility [6], [7].

In some of the cases, solutions for physical accessibility and at the same time preservation of the uniqueness of the traditional museum and site look with old infrastructure cannot be found (Tsarevets - Veliko Tarnovo, Bulgaria, Regional Open Air Ethnographic Museum - ETARA - Gabrovo, Bulgaria, architectural and historical reserve "Bozhentsi" - Gabrovo region, Bulgaria, tombs from the Valley of the Thracian Kings in Kazanlashko, etc.). In these cases, alternative solutions were offered and sought depending on the disability (audio guides, photos, video films, 3D models, etc.). Almost all tested sites had no online audio guides to provide accessibility for people with physical and visual disabilities, but many of them had virtual tours. Concerning the issues related to digital accessibility from the perspective of museums and other memory institutions, it is important for them to consider the opportunities that digital new technologies, websites and software provide for better access and accessibility at all levels and for all users, including disabled people.

Problems we found related to the topic are: lack of a methodological guide/s for digital accessibility for museum specialists; knowing in depth the essence of the problem and workers' capacity building for improvement; digital access and usability for

various groups of users of the museums in Bulgaria. There are both physical access issues in museums and issues concerning using digital new tools and technologies.

Our observation and research results showed that the museums in Bulgaria have focused more on projects for developing physical facilities and helping tools for people with disabilities visiting the museums on sight. Less has been done for improving the digital accessibility of their cultural and historical heritage and many of the sites of museums that are being renewed and developed in recent years do not take as a priority in providing digital accessibility and functionality on the websites for people with different disabilities. Evaluating the digital accessibility of sites, as mentioned above, is difficult to do, mostly due to the need of using qualified specialists on the topic at the location as well as on the sites. Specialized testing software for accessibility can also be used, but mostly for basic digital accessibility, not in-depth testing, and analysis. It can be discussed if the museums currently have the necessary resources provided for the presentation of cultural heritage for people with special needs and disabilities, including the blind, deaf and mute, and those with physical disabilities and mobility difficulties. For each of the mentioned categories of disabilities, different and specific approaches for better accessibility are required.

Due to the above-mentioned reasons and as a consequence of the public importance and functions of museums, it is necessary to ensure accessibility (physical and digital) to cultural artifacts and data for all types of museum audiences. Possible solutions include braille inscriptions, annotations, sound and tactile techniques to individual exhibits (for the blind); specialized visual and digital tools (for people with impaired or missing hearing); auxiliary ramps (for people with reduced mobility), etc.

3.2 Some Solutions for Physical and Digital Accessibility

Digital Audio Guide System with Accessibility. In 2022 to 2023, a digital audio guide system with braille signs and QR codes was created as a joint project of our accessibility research team from the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences and the Regional Ethnographic Museum in the city of Plovdiv, Bulgaria. The project and the resulting digital-audio system with accessibility (digital and audio guide in the museum with additional cultural heritage information), was an example solution to some of the above-mentioned accessibility problems for museums. The digital website <https://ethnograph.info/en/audio-guide/> also safeguards and presents information on local traditions and related to them historical objects and cultural artifacts via informative stories. The methodology of work can be used for other museums and memory institutions on a national and international scale and is included on a website ecosystem platform with methods, guidelines and good examples for digital accessibility: <http://www.math.bas.bg/vt/ab/index-en.php>.

Digitalization, Socialization and Accessibility of Intangible Cultural Heritage. Museums in Bulgaria often have much more artifacts and information of tangible and intangible cultural heritage than they can exhibit in reality in the physical exhibition halls of the museums. Digital presentations and platforms like the above-mentioned

audio guide with traditional stories with multimedia and sound help for socializing and showing more cultural heritage to a wider audience on a national and international scale, including people with disabilities. Moreover, museums of the past often focus more on showing physical artifacts in static form behind glass displays, while digital technologies give better opportunities for preserving, presenting, understanding and enhancing the experience of local cultural traditions, rituals, context and way of life in an attractive and engaging way via vast categorized repositories with text, photo multimedia audio and video, digital screens, 3D models, virtual tours, augmented and virtual reality, smart games, etc.

Accessibility Passportization Model with Related International Researches and Examples. A possible solution for assessing and overcoming the problems related to access and accessibility to museum objects and cultural historical knowledge in Bulgaria is the usage of a conceptual passport model for accessibility. The methods and good practices used in other countries to modernize cultural institutions and the need to ensure and assess their accessibility for people with special needs are explored. Several international research papers, publications and developments on the topic of accessibility for people with special needs are considered in the following research for developing a passport model for accessibility for Bulgarian museums [6], [8].

Other valuable local and international research results, related to understanding and improving accessibility for people with special needs can also be found in the following papers [9], [10], [11], [12], [13]. The valuable experience of project ARCHES [14] helps European museums to become barrier-free with 3D art replicas, mobile phone apps, games and sign language video avatars.

The Institute for Vocational Rehabilitation and Training of Personnel has also researched the accessibility of blind people [15] and afterward developed an accessibility passport for the visually impaired [16]. Passportization of social infrastructure and services in Russia is included in the state program for an accessible environment for 2011-2020 (Order of the Ministry of Culture of Russia dated November 16, 2015 No. 2800). In 2012, the UN Convention on the Rights of Persons with Disabilities was ratified. The passport shows to what extent the institution and its services are accessible to people with disabilities. There is a methodological guide for ensuring accessibility to objects and services for people with disabilities: prepared by the author's team of the Interregional Resource Center "Accessible World" with the aim of spreading ideas, principles, and means for creating an accessible environment; describing the legal, organizational and methodological aspects of the certification of objects and services for assessing their accessibility and developing management solutions aimed at increasing accessibility indicators, both at the territorial level and at the level of institutions and organizations.

Accessibility Passportization Model for Bulgarian Museums. Based on the above-mentioned studies, results, guidelines and examples, we analyzed all and gathered the useful criteria and points for developing an adapted, appropriate methodology for certifying the accessibility of museums for people with disabilities in Bulgaria, suitable

ble to the local context. We also prepared a questionnaire for the needs of the passport nation of museums, including the main criteria for digitalization and accessibility. A preliminary conceptual model of a digital accessibility passport of museums in Bulgaria (Regional Ethnographic Museum - Plovdiv) for people with special needs is presented. It consists of five main sections: (1) General information about the object (name, address, year of construction of the building, form of ownership, territorial affiliation, etc.); (2) Characteristics of the activity of the cultural institution (types of services, the form of service, age categories of visitors, planned capacity, etc.); (3) The state of accessibility at the site for people with disabilities and other persons with reduced mobility (route to the site, distance from public transport stops, presence of a pedestrian path, functionality when accessed, etc.); (4) Management decision - proposals for adapting the main structural elements of the site (recommendations for adapting the entrances of the buildings; adjacent territory; physical accessibility for people with disabilities); (5) Digital accessibility for people with disabilities.

The next stages of our research include: testing and implementation of an accessibility passport in five sections; ensuring accessibility in a virtual environment; establishing good practices; obtaining information about the accessibility of museum objects; opportunities for improvement; passportization of museum accessibility for different types of disabilities at the national level.

4 Conclusion

The article analyzes some of the challenges and existing barriers to the accessibility of museums in Bulgaria), as well as presents the application of modern technologies to improve the physical and digital accessibility of museums and their cultural heritage. The focus of the research is on digital accessibility for visually impaired and blind people. The text of the paper covers the Bulgarian museum context; the application of innovative technologies in museums; problems and possible solutions to the physical and digital accessibility of museums in Bulgaria; innovations for physical and digital accessibility of museums in Bulgaria, as well as the development of a conceptual passport model for museum accessibility. Documents related to practices used in museums for accessibility certification for different types of disabilities in different countries were reviewed. The article also proposes some possible solutions for accessibility and better presentation of cultural traditional heritage, such as digital audio guide system in museums with QR codes and braille signs, suitable for people with visual impairments and a conceptual model of a passport for the accessibility of museums in Bulgaria for people with special needs. A methodology for passportization of the accessibility of the museums in Bulgaria is offered, based on the researched methods.

5 Acknowledgements

The research is financed under the project "Digital Accessibility for People with Special Needs: Methodology, Conceptual Models and Innovative Ecosystems", grant contract No. KP-06-H42/4, dated 08.12.2020, by the National Science Fund of Bul-

garia and the National program of the Ministry of education and culture "Young scientists and post-doctoral students 2" (206/07.04.2022).

References

1. Museum of the Future Insights and reflections from 10 international museums. Book of Mu.SA Consortium, <http://www.project-musa.eu/>, last accessed: 05/05/2023.
2. Latham, K. F.: Foundations of museum studies: evolving systems of knowledge (2014).
3. S.Styliani, Fotis, L., Kostas, K., Petros, P.: Virtual museums, a survey and some issues for consideration. *Journal of Cultural Heritage*, 10, pp. 520-528 (2009).
4. Caspan, S. S.: Virtual museums as digital storytellers for dissemination of built environment: possible narratives and outlooks for appealing and rich encounters with the past. *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLII-2/W5, pp.113–119 (2017).
5. Borisova. V.: Cultural heritage digitization and related intellectual property issues. *Journal of Cultural Heritage*, vol.34, pp.145-150 (2018).
6. Todorov, T., Bogdanova, G., Todorova-Ekmekci, M.: Accessibility of Bulgarian Regional Museums Websites. *International Journal of Advanced Computer Science and Applications*, vol. 13(3) (2022).
7. Todorova-Ekmekci, M., Todorov, T., Sotirova-Valkova, K.: Usage of Innovative Technologies and Online Media Tools for Digital Presentation of Cultural Heritage in Bulgaria. *Digital Presentation and Preservation of Cultural and Scientific Heritage*. Vol. 11, Sofia, Bulgaria: Institute of Mathematics and Informatics – BAS, pp. 303-308 (2021).
8. Bogdanova, G., Sabev, N., Tomov, Z., Ekmekci, M.: Physical and Digital Accessibility in Museums in the New Reality. 5th International Symposium on Multidisciplinary Studies and Innovative Technologies, Ankara, Turkey, pp. 404–408 (2021).
9. Baule, S. M.: Evaluating the Accessibility of Special Education Cooperative Websites for Individuals with Disabilities. *TechTrends*, vol. 64, pp. 50–56 (2020).
10. Díaz-Rodríguez, N., Pisoni, G.: Accessible Cultural Heritage through Explainable Artificial Intelligence. *Adjunct Publication of the 28th ACM Conference on User Modeling, Adaptation and Personalization*, pp. 317- 324 (2020).
11. Pisoni, G., Díaz-Rodríguez, N., Gijlers, H., Tonoll, L.: Human-Centered Artif. Intelligence for Designing Accessible Cult. Heritage. *Applied Sciences*, vol. 11, no. 2, p. 870 (2021).
12. Deffner, A., Psatha, E., Bogiantzidis, N., Mantas, N., Vlachaki, E., Polyxeni N.: Accessibility to Culture and Heritage: Designing for all (2015).
13. Hayhoe, S., Carrisoza, H. G., Rix, J., Sheehy, K., Seale, J.: A survey of networked and Wi-Fi enabled practices to support disabled learners in museums. 2019 International Conf. on Wireless and Mobile Comput., Networking and Comm. (WiMob), pp. 197-202 (2019).
14. Project ARCHES Homepage, <http://www.arches-project.eu/>, last accessed 05/05/2023.
15. Collection of social networks and their opportunities for the visually impaired (materials of the XIX scientific-practical conference, 13/11/ 2019, Under the general editorship of prof. S.N. Vanshina/, Institute of Vocational Rehabilitation and Personnel Training, VOS "Rea-comp", pp. 64 (2020), <http://rehacomp.ru>.
16. Passport of accessibility developed in the Institute of Professional Rehabilitation and Staff Training, <http://rehacomp.ru/wp-content/uploads/2020/02/Passport-dostupnosti.pdf>, last accessed 18/08/2022.