MEGALITHIC MONUMENTS IN THE DIGITAL ENVIRONMENT – OPPORTUNITIES AND CHALLENGES

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Abstract. Digitalization of heritage is one of the current issues regarding the preservation and development of culture. The technologies provide many opportunities for in-depth study of artifacts, as well as for creating a virtual environment that can be reused for presentation and promotion. Megalithic monuments are a special kind of heritage – a unique combination of natural forms, tangible and intangible heritage. These characteristics predetermine their positioning in the digital environment. The use of technology here reveals both many opportunities and challenges for professionals – both those dealing with heritage and technicians. In order to effectively implement innovations, a multifaceted scientific and applied expertise is needed, which works together in the field of heritage, informatics and management.

Keywords: digital technologies, megalithic monuments, cultural heritage, opportunities, challenges, risk

The topic of digitalization of heritage is one of the current issues regarding the preservation and development of culture. Digitalization is taking shape as a center of national and international cultural policy – a means of preserving and developing heritage. The process is turning cultural resources into an important pillar of the digital economy, improving public access to different forms of culture, as well as the heritage-public interaction. Advances in digital technology allow for better presentation and promotion and the opportunity for detailed research and acquisition of information about artifacts by science, as well as popular culture for the purposes of the tourism and creative industries.

In this context, museum collections, immovable property, and intangible cultural heritage, with the advancement of technology, require a new "reading" in an expanded historical, geographical, scientific, and now technological aspect. This imposes the need for multifaceted scientific and applied expertise, which works simultaneously in the field of museology, informatics and management, in order to develop and integrate innovative technologies for

management, preservation, exhibition and promotion of heritage. Storytelling, which is the most important aspect of all computer-generated worlds, requires both well-trained screenwriters – museum curators, and innovative technologies to offer easy work with the digital data archive, as well as understanding the semantics of sites to meet consumer expectations.

The digitalization of heritage and the interactivity of modern reality in an improved and virtual environment are a synthesis between technological innovation and consumer sensitivity. This synthesis allows overcoming the traditional perception of the real environment and thus increasing the knowledge of heritage. Visual and spatial technologies are increasingly enriching archeology and helping to understand the past in relation to the modern world. Through digital objects and landscapes, geophysics, geographic imaging systems and the creation of virtual worlds, new technologies offer an alternative perspective and a new understanding of the past and present (Unver, Taylor, 2012).

The tourism industry actively uses virtual environments to attract visitors. Cultural institutions are increasingly focusing on digitalization as a virtualization of heritage (Kostadinova, 2020), instead of the process as documentation of artifacts. Widely applicable worldwide, incl. and in Bulgaria, are technologies such as virtual and augmented reality, 3D reconstructions and modeling, virtual walks, even gamification. The analysis of the potential of new technologies in terms of heritage is already underway, although still fragmented in separate scientific articles and case studies. The review of publications from different regions of the world shows a tendency to virtualize the heritage mainly in its material varieties – from single representations of individual movable artifacts to the reconstruction of archaeological and architectural sites. Against this background, there are relatively few documented examples of the application of technology to intangible culture, and research has begun in the last 3-4 years. Of course, this summary does not include the recording of audio, video or photo documentation of cultural units and their distribution on the Internet and social networks or other types of software applications. This includes the integration of innovative technologies such as 3D, augmented,

virtual and mixed reality, enhanced virtuality, artificial intelligence and others (Kostadinova, 2020). In this context, the question of the positioning of megalithic monuments in the digital environment is interesting – new opportunities and problematic areas in connection with the application of innovative so-called "immersive" technologies.

The megalithic monuments represent stone / rock structures – cult places related to the performance of certain ritual / religious practices. They are found in picturesque areas, often located on mountain peaks or hills. In essence, megaliths are a unique synthesis of natural forms, tangible and intangible cultural heritage. As Vasil Markov (Markov, 2007) writes, ancient linguistic holy places, such as megalithic monuments, are eternal cult centers that have been the basis of public consciousness for thousands of years, despite the numerous changes of peoples and cultures. Markov, as well as the college of researchers of megalithic complexes, prove convincingly that they testify not only to individual cultural and historical layers, but also continuity and intercultural contacts in time and space. These characteristics of heritage largely predetermine the opportunities, but also the challenges regarding the application of technologies for digitization of megalithic cultural monuments in their entirety, namely – natural code, tangible and intangible nature.

As with all other cultural values with material dimensions, and with regard to the rock cult centers related to one or another epoch, the innovative tools are a way to study the objects in detail – such as would not be possible without the available technologies (laser scanner, digital photogrammetry, panoramic photos, etc.). Moreover, these tools help not only to collect data on the environment and artifacts, but also to manage them as multidimensional digital environments in which different types of information (metric, geometric, diagnostic and documentary) can be linked (De Fino et al. al., 2019a, 2019b). The methodological approach in this sense is the creation of a virtual environment for research and, as Russo and Manferdini (2015) write, for the re-offer of information as virtual types of reality. This approach, applied to the study and documentation of megalithic monuments and their specifics of natural forms, makes it possible to study the site in its entirety, as well as to study the relationship of the same with the

environment. And the landscape, according to a number of experts in the field, is an important part of the functioning of places of worship, loaded with symbolic and astronomical significance. The technologies allow capturing the high-resolution subject from a different angle, with different perspectives and sizes, in height, even scanning in depth. This predetermines the collection of a set of data, the analysis of which makes it possible to compile new research hypotheses about the chronology, structure and functioning of the site. Moreover, all this information becomes more accessible for the purposes of tourist interpretation. An eloquent experience in this direction is the project "The Hidden Landscapes of Stonehenge". Gaffney et al. (2012) describe in detail how the object is mapped, visualized, and three-dimensional data are interpreted on a landscape scale. The millions of collected images are presented in 2D and 3D reconstructions, including the restoration of time-lost fragments and even landscapes. This in combination with audio guides and appropriate sounding of the archaeological history allows the so-called. "Immersive" experience for non-professionals (tourists), which in turn affects the perceptions and knowledge acquired about the heritage.

In the Bulgarian version, such a large-scale project has not yet been developed for any of the numerous registered megalithic monuments, but there is no lack of experience in this direction, although the examples do not include site research, but are limited to visualization and presentation based on real physical space. in particular, rock structures. It is about the project of an interactive national map Iwalk.bg, which started from Belogradchik in 2013. The initiators – IT specialists. The goals are a tourist interpretation of the cultural heritage of Bulgaria by integrating innovative technologies of a new generation. The project is actually developing a mobile application and website whose interface visualizes an animated graphics map of the country. The first object positioned on the map is a 3D visualization of the Belogradchik rocks, made by a designer using computer graphics based on numerous photographs of the object. The presentation also includes a multilingual audio guide of a local legend, which, however, represents the Roman period of the fortress at the foot of the monument. In the current 2020 The project in Belogradchik has been upgraded with the installation of

a large touch screen at the entrance of the fortress – again a 3D representation of the site, which orients visitors to the upcoming trip.

In 2017, the sanctuary Begliktash (Burgas region, near the town of Primorsko) appeared on the same map. And at that time, as in 2013, photogrammetry technology is still not well represented in Bulgaria, which is why the 3D visualization of the megalithic monument was again made through graphic design. Again we have added an audio guide – this time the focus is summarized information about the rock sanctuary, provided by the museum operating in the region. The interesting thing here is the integration of augmented reality technology. Using a marker – a poster card, which is activated when scanning with a smart device after pre-installed for this mobile application, the object is displayed in 3D. Software options allow the history of the monument to be heard in different languages, and the user can view the sanctuary from all sides with just the movement of a finger on the display of his device.

Another example from Bulgaria regarding the integration of digital technologies for research and presentation of megalithic monuments is the creation of an interactive multimedia map of the rock structures of Sarnena Sredna Gora. I would define this project as legacy documentation, not so much as virtualization, which term is more related to computer-generated images positioned in a virtual or superimposed on the real environment, as in the previous examples. The objects of research from Valeriya Fol and Oleg Konstantinov area are positioned as points on the map, and for each of them there is information and a large set of photographs (Fol, Konstantinov, 2019).

The Bulgarian experience, compared to the Stonehenge project, is much smaller in scale and investment. The examples also differ in operational objectives. In the Bulgarian case we have the integration of technologies with a focus on tourist representation. In the example from Great Britain, it is impressive that the project is primarily for research purposes, and the collected data are also used in the subsequent tourist interpretation. In my opinion, the different goals and approaches in the two countries are based on the differences in the main initiator of the individual projects. In the Bulgarian case – the initiators are specialists in the field of technology, with an affinity for heritage, while in the UK

we see the opposite – researchers of heritage, with an interest in technology. The Stonehenge project visualizes the teamwork of different experts from different research fields, who are looking for innovation opportunities for more in-depth research and therefore better communication with the public. In the projects from Belogradchik and Begligtash we see the opposite – IT experts are looking for museum curators to apply the technologies. Moreover, in the Bulgarian case there is a clear tendency for museum specialists to reject innovations. The statement is based on a monitoring of the attendance of the described sites after and before the integration of the innovations. It turns out that there is no difference in the tourist flow. Moreover, there is a lack of supply and marketing positioning of technical innovations or there is a lack of maintenance of the acquired hardware and software. The reason – employees in memory institutions do not know how to handle technology and/or are not motivated enough to learn. Therefore, in general, and in particular to megalithic monuments, which are often far from large urban centers, attempts at technological innovation and their successful integration to manage and promote heritage, as well as its study and preservation, remain a good wish, despite widespread opportunities they provide.

Apart from the already mentioned cases of application of innovations in the field of megalithic heritage, which cases refer more to the study or presentation of monuments as a natural phenomenon – a single object and part of the surrounding landscape with the relevant interrelationships determining cultural values, technology is a good opportunity. and in terms of research and presentation of the monument as a tangible cultural heritage. There are many examples from the practice of virtualization of archaeological and architectural sites, which researchers describe in separate articles – from 3D reconstructions and reconstruction of the interior and exterior of temples, residential and public buildings, to the restoration of entire settlements, including destroyed such. With the help of new technologies, they can be presented anywhere and at any time, as well as on site. Of particular interest in recent years is the option of augmented reality or superimposition of a virtually generated image on a real environment, as well as the possibility of fully digital reconstruction of artifacts. The

study of the scientific literature at this stage has not identified such examples from practice with a focus on megalithic monuments (of course, this does not preclude such to exist in the world), although virtual and added environments are a good means of representing the cultural significance of rock structures. In order to visualize the hypothetical integration of the so-called "Immersive" technologies, I will use specific examples with the Belogradchik rocks. The choice of site is dictated by the fact that at present it seems the most realistic option in view of the available hardware installed on site and the stated support and openness to technological innovations by local authorities (the examples described above are indicative in this regard).

Field research (Markov, 2007) of a natural phenomenon registered numerous round excavations, gutters and a ladder in the western part of the rock on the penultimate site. In the highest part of the rock on two cult sites are also localized burials of different shapes, including a large human step. The eroded rock at the moment prevents the non-professional eye from noticing the artificial character of the rock forms, which according to Markov form a typical ancient Thracian sanctuary, developing in height. Technologically mediated methods could reproduce through augmented reality the condition and shape of the monument at the time of its felling, superimposing the computer-generated image on the physical environment. Moreover, the technology allows the addition of an audio guide to the image, which explains instead of the museum employee the functions of the carved rock forms, as well as possible references to other similar sanctuaries. Augmented reality is also an option for the reconstruction of the pottery found at the foot of the monument and its virtual positioning within the sanctuary. All this would benefit visitors to understand the history, and thus increase their knowledge of the heritage. Researchers who can better compare and analyze the digital database can also have positives. Of course, such a reconstruction, although based on mathematical and physical calculations (at best), would always contain to a greater or lesser extent hypotheses either by megalith researchers or by technicians.

Each rock group from the Belogradchik rocks has its own name – "The Monks", "The Horseman", "The Madonna", "The Dervish",

"The Convent", "Haydut Velko", "The Cuckoo" and others. Although they have received preliminary explanations, tourists find it difficult to navigate among the natural forms. In this regard, technology can again be useful. Each rock group could serve as a marker, which, after scanning with a smart device, submits information in the form of text or voice message. The information, of course, can be not only the appropriate name, but also that of cultural values. The choice is entirely in the hands of the curator of the story. In this sense, however, there is a risk that someone's hypothesis will become the only one in time, not because of its scientific endurance, but because of the preferences of one or another author and the means of technology to influence consumers.

An opportunity, but at the same time a great challenge, is the use of innovative technologies for the presentation of the intangible cultural heritage. The difficulty of the task is further enhanced when there are no registered live practices to be documented and virtualized on site. Continuing the example with the Belogradchik rocks and the identified legends about some of the rock formations, the first difficulty comes from the choice of a specific variant of the intangible heritage. The Stone Wedding, for example, is found in several stories (Markov, 2007). In one version we see a young horseman in love with a nun, in another – a brother in love with his sister. The motives of the legends are similar and as Markov notes – reminiscent of the images from the votive tablets of the Thracian Heros. Researchers (Markov, 2006, 2007, Stefanov, 2006) also point out the connections between the Thracian heritage and the Christianization from the end of the 4th century AD, thanks to which ancient motifs continue their life in the folk beliefs.

There are various options for this cultural heritage to continue its life in a digital environment. The first – a text or audio presentation of the legend and the relevant cultural relationships, although supported by photographs of rock structures. This, of course, is rather a form of inheritance documentation that does not differ much from the book version of the inheritance (I mean the descriptions in the books, be it electronic or on paper). The second option is the virtualization of heritage, which I have already mentioned several times. This opportunity is much more labor-intensive and requires significant financial resources. However, the challenges are of a different nature.

The choice of variant is also not the main difficulty, because it is possible to clarify variability, although such clarification, in my opinion, in time loses "audibility" at the expense of the imposed image, which is undoubtedly imprinted in the mind to a greater extent than the story told. In fact, for me the biggest challenge is the construction of the image, the visual presentation of the intangible cultural heritage. And if there is no problem for the technicians involved in such an activity, then it inevitably appears from a scientific, even aesthetic point of view.

Let's say we focus on the version of the legend of the Stone Wedding at the Belogradchik Rocks, which tells the story of the horseman and the nun. For the needs of virtualization we have the landscape – the Belogradchik region. But in the plot the main place is occupied by the characters and the architectural units (monasteries), which are symbolically loaded. The story does not have a specific periodization and description of the same. This requires a hypothetical construction of the images, namely – the choice of clothing, as well as the architectural typology of the monasteries. In order to be a bearer of cultural values, the virtualized legend must take into account every detail, relating it to a certain period, although the same may be presumed. This requires in-depth research in various scientific fields – ethnology, ethnography, archeology and others. Only in this way can virtualized heritage claim educational value, in different areas. Otherwise, there is a risk that the legend will become a digitalized fiction. And although the main motives and plots will stand the test of time, the details will be replaced, and the overall image will become a mix of different chronological elements.

Speaking of living cultural heritage, such as ritual practices associated with certain holidays, or ritual activities for health, fertility, etc., a good alternative for the presentation of heritage are technologies such as augmented and mixed reality and enhanced virtuality (Kostadinova, 2020). The latter two are still extremely poorly applicable in practice due to the technical specifics, namely – the transmission of real scenes in a virtually simulated environment. These technologies work with special hardware, namely – VR glasses, which provide users with a completely "immersive" experience. What would the innovation look like in a specific example with the localized megalithic sanctuary

in Kribul and the localized living ritual practices for the treatment of female infertility, mental illness, etc. (the choice of the site is illustrative, and the technology is applicable to any monument and certified ritual or ritual practices). The ritual practiced to this day, described in detail by Markov (2007, 2009), may be digitally processed – for example, video recording of the entire set of actions performed by each participant in the ritual. This same record can be "superimposed" on the real environment, and even in the absence of the dedicated woman leading the rite, it can be repeated to achieve the expected results. In a sense, such a combination of technology and living cult practices would be an example of cross-cultural continuity in the modern version. Of course, there is also a risk of profanation and loss of authenticity and a sense of mysticism. Moreover, while I strongly support the integration of technology in the field of heritage, I believe that everything must be within reason, because overexposure of everything leads to its irretrievable loss.

The statement in this report confirms the thesis that computer-generated worlds need innovative technologies, but also well-trained screenwriters – museum curators to offer an understanding of the semantics of objects and meet consumer expectations, thus helping the spread of knowledge. In fact, it is a matter of creating a new category of heritage – virtual, where the leading motive should not be the tourist attraction, but the preservation and dissemination of certain cultural values – the only ones with the potential to become a sustainable resource for development. Moreover, they are the only ones who could preserve culture in a globalizing world, translating the idea of unity into diversity.

However, in order for the application of technologies to be effective, it is necessary to know and understand their capabilities. The cited examples from Bulgaria for the integration of innovations identify a lack of perception of technology as an operational tool by those dealing with heritage. The reasons for this fact are found not only in the lack of sufficient financial resources, they can also be psychological – fear of the new, reluctance or low motivation to learn. The influencing factors are multifaceted and different and can be the subject of independent research. On the other hand, consumers themselves and the degree of

satisfaction of their expectations predetermine the degree of efficiency. That is why the way in which information is translated as a synthesis of scientific, cultural, aesthetic and visual suggestions is important when using technology.

Innovative technologies provide a wide range of opportunities for research and promotion, but also a number of challenges in terms of cultural heritage protection. Therefore, their integration should be the result of multilateral scientific and applied expertise. Otherwise, instead of a positive impact, the digital environment may be risky for the heritage, either in terms of megalithic cultural monuments or, in the general case of heritage, in its tangible and intangible varieties. However, the benefits and risks of applying technologies in the field of cultural heritage remain undeniable, and opportunities and challenges are changing dynamically.

In these conditions and in the rapidly developing environment, with the ever higher expectations of the users of the heritage, the only option for the virtual representation of it to withstand the test of time is the teamwork of different specialists with one goal – preservation and development of the cultural heritage. This is also the possibility for the artifacts and mythological symbols, telling today the history of the separate cultural-historical layers and the continuity between the separate cultures and peoples to be preserved and comprehended by the generations.

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