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## Digitalization of the Historical and Cultural Heritage of Kazakhstan

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### Abstract

*Creating a database of digital cultural and historical objects will make historiographical material on Northern Kazakhstan available to a wide range of interested parties, as well as to secondary and high school students. The project will improve the effectiveness of scientific developments and ensure integration into the global scientific space. Thanks to WEB technologies, everyone will be able to access the cultural and historical sites of Northern Kazakhstan. As part of the "Digital Kazakhstan" program, it is necessary to introduce new digital technologies into all spheres of life. For the correct formation of patriotism in the younger generation, cultural and historical objects that are accessible for study are needed, which will allow researchers to obtain information that objectively reflects the main milestones in the development of the country and people. The article presents the results of the integration of technical and humanitarian knowledge. Virtual reconstruction becomes especially relevant when a cultural heritage site is lost completely or partially. Work on rendering and creating digitized cultural and historical objects is carried out in various three-dimensional programs, and in modern practice of historical research technologies for 3D reconstruction and augmented reality are used.*

**Keywords:** Digitalization, Historical and Cultural Heritage, Archiving of Three-Dimensional Models, Historical Heritage, Historical Computer Science.

### Introduction

Kazakhstan is home to various ethnic groups, including Kazakhs, Russians, Uzbeks and Ukrainians, who have contributed to the country's diverse cultural identity. However, like many other countries, Kazakhstan faces the challenge of preserving its cultural heritage in the digital age. "In the era of rapid globalization... While remaining part of the global community, we must be sensitive to our roots. It is impossible to break away from our distinctive culture and unique traditions that make up our national identity. Only by protecting and strengthening it, we will be able to preserve ourselves in the civilizational chaos" (Tokaev K.-Zh.K. "Independence above all") [1]).

Heritage means something inherited and often refers to tangible or intangible objects that have historical, cultural, symbolic, social and/or aesthetic value. A distinction is often made between tangible heritage, which represents tangible elements such as historic cities, collections, archives, natural landscapes and technological achievements, as opposed to intangible heritage, which includes intangible aspects such as knowledge, skills, traditions, craftsmanship, beliefs, social practices and values.

Only 15 percent of the world's cultural heritage is currently available in digital format. No matter how well they

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have been protected and preserved, the vast majority of ancient artifacts and objects are naturally susceptible to corrosion due to age. In addition, there are frequent cases of unexpected natural and man-made disasters.

Thanks to the transformative socio-economic events that occurred in the late 20th and early 21st centuries, the need to protect cultural heritage arose, leading to the creation of the United Nations Educational Organization, Scientific and Cultural Organization (UNESCO) World Heritage List, which currently numbers over a thousand sites that are considered important for conservation for their “outstanding universal value” [2].

The digitization of cultural heritage truly provides a unique opportunity to preserve a virtual copy of a material object in standard quality over time, which will allow its cultural value to continue to be used and appreciated for future generations.

Relevance: the article is due to the need to preserve the historical memory of generations as a key factor in the unity of society in the conditions of information wars of the 21st century. “Historical memory and historical consciousness are the basis of the unity of the nation, its stability, its national security, this is the unity of generations [3]. Today, innovative methods of documenting cultural heritage artifacts are becoming increasingly important. But it is impossible to preserve these artifacts without the use of innovative three-dimensional technologies.

## **Literature Review and Problem Statement**

For historical analysis and scientific research, there is already a large number of digitized documents that are in the public domain or have already been published in strictly scientific publications.

4. The experience of digitalization of historical and cultural heritage has not existed for long, but in Kazakhstan there is practically none.

At the international scientific conference (Perm, October 20-22, 2021), dedicated to the use of information technologies in the preservation, study and representation of historical and cultural heritage, exchange of experience and identification of the needs for the development of the digital environment of cultural heritage for society, science and storage institutions, there was Many interesting proposals have been made [10].

Thus, the term “virtual museology” is actively discussed, implying the introduction of virtual reality technologies into museum practice. This connection reflects the desire of museums to evolve in harmony with technological evolution and the use of innovative technological tools to engage visitors in more interactive, multi-sensory and experiential museum exhibitions. Virtual reality applications allow museum visitors to be completely immersed in an artificial environment that transports them in space and time and offers the opportunity to learn in a fun and interactive way (materials from Greek scientists)[10;19]

1. -Digital cultural heritage collections in libraries, archives and museums are increasingly being used for digital humanities research. (materials - Belgium)[10;23]
2. -Virtual 3D reconstruction to restore the historical appearance of industrial, architectural, sculptural monuments (Gasnov A.A. Moscow State University - materials)[10;110].

Abdullina, an employee of the Tobolsk Historical and Architectural Museum-Reserve, shared her interesting experience - online excursions and virtual tours with augmented reality technologies [10;117].

Bulgarian historian Rakhovsky considers attractive the possibility of creating virtual cultural spaces that provide an interactive context for information about an artifact and easy access to information about historically related objects and events. One of the main tasks is the automatic aggregation of relevant multimedia content based on information about available artifacts and specific user requirements.

Maintaining different options for providing information resources to the user - in different formats and suitable for different mobile devices - is another important factor in improving the user experience [11].

Serbian historian Stanojevic notes that “institutions such as libraries, museums, archives play a primary role in the translation of historical sources into digital format, being the direct custodians of cultural and historical heritage. The material stored in them is provided for global visual access in digitized form, which is a valuable resource for all levels of the educational process in terms of quality, quantity and attractive accessibility” [12; 359].

Cultural critic Ekaterina Lapina-Kratasyuk focuses on digital history in general. “Today we are dealing with a completely new form of documentary filmmaking. But this documentary is quite difficult to understand: few people are able to process the volume of documentary evidence that forms an idea of the historical events taking place before our eyes. And this is where digital history comes to digital history. Digital history is a new form of historical knowledge, not a linear narrative, but a website, map or database that allows not only to present historical sources as fully and accurately as possible, but also to find a non-hierarchical visual form representations of different points of view, private and public, documents and memories”[13].

Today the world is losing cultural and historical monuments faster than they can be digitized [5]. As mentioned above, it will be possible to improve the quality of life for visually impaired or blind people, who will be able to explore cultural and historical objects made on 3D printers by touch. The printout can be realistic or scaled, but without loss of accuracy. The combination of digital information obtained using drones, then 3D modeling and 3D printing of historical objects to scale has not yet been used in Kazakhstan.

The prerequisites for the implementation of the program are the “Historical Information Systems” system on the DigitalHistory.ru portal, developed at the Center for Digital Humanities at Perm State National Research University. Research work devoted to creating the basis for combining information resources of digital cultural heritage and the process of building digital cultural heritage infrastructures is of significant importance. Renowned expert Antonello Fres emphasizes the particular relevance of the introduction of three-dimensional technologies for European digital historical and cultural heritage. Approaches to 3D digitization of cultural and historical objects are outlined in the works of Nikolai Stoimenov, Petr Panev, Miglena Panev, Dimitar Karastoyanov [6]. Much credit goes to the laboratory of the Institute of Information and Communication Technologies of the Bulgarian Academy of Sciences.

Today there are virtual historical reconstructions abroad, there are not many of them, the largest of them are:

1. In Portugal - virtual reconstructions of the Cistercian monastery of Santa Maria of the 16th century;
2. In Spain, the city of Ripoll - reconstruction of the monastery of Santa Maria of the 12th century;
3. In France - reconstruction of the monastery of Saint-Avi Senier of the 12th century;
4. In Hungary - reconstruction of the Cistercian monastery of the 12th century;
5. In Turkey - reconstruction of the 11th century monastery of Christ Pantepoptos.

Research using three-dimensional technologies in the field of historical reconstruction is known in the humanities faculties of US universities (Brown, Harvard, Columbia, Stanford), the University of California UCLA, the Institute of Advanced Technologies in the Humanities of the University of Virginia, in universities in the UK (University of Birmingham, King's College London), as well as France, Italy, Spain, Austria and other countries [6].

All known digital historical monuments were created in various programs, and not all and not always it is possible to use these reconstructions for research, their cost is considerable because A lot of work and expense has been invested. The first publications on the use of three-dimensional modeling technologies in historical research date back to 2010 (Yu. M. Baranov, E. A. Kurlaev). The activities of the Russian Association “History and Computer” (AIC) had a significant impact on the spread of the introduction of three-dimensional modeling

technologies into the field of historical research. Since 2016, works on virtual reconstruction have appeared by historians of Tambov State University (R.B. Konchakov, D. I. Zherebyatyev), the Faculty of Arts of St. Petersburg State University in collaboration with the Institute of the History of Material Culture of the Russian Academy of Sciences (E. V. Logdacheva, S. V. Schwemberger and others), Siberian Federal University (M. V. Rummyantsev, A. A. Smolin, I. N. Rudov, N. O. Pikov), Ural Pedagogical University (A. V. Fishchev) [7].

As for Kazakhstan, as part of the “Sacred Kazakhstan” project, in 2018 the LANIT-Integration group digitized 13 historical objects with photorealistic quality, including the majestic Mausoleum of Khoja Ahmed Yasawi, recognized as a UNESCO World Heritage Site. Recreated digitally, objects are transferred to virtual space, but the created models cannot be run for three-dimensional printing because digitalization was not carried out with the necessary parameters.

## **Purpose and Objectives of the Study**

The goal of the project is to increase the level of knowledge and preserve the cultural and historical heritage of Northern Kazakhstan through the use of digital three-dimensional technologies.

### **Project objectives**

In accordance with the goal, it is necessary to solve the following tasks:

1. compiling a catalog of historical objects that are in unsatisfactory condition and require priority digitization for their preservation;
2. three-dimensional laser scanning of large cultural and historical monuments using a quadcopter;
3. - rendering of the resulting 3D models, i.e. their refinement and creation of high-quality and reliable three-dimensional digital cultural and historical objects in the “3Ds Max” KOMPAS 3D program and saving the resulting models in a format accessible to a wide range of OBJ users;
4. - scaling and three-dimensional printing of the resulting prototypes.

Detailed computer reconstruction occurs through close collaboration between historians and architects. The sources for creating computer reconstructions are architectural measurements, plans, sections, maps, descriptions, images and photographs of the reconstructed monument. Based on a comparison of these sources and modern space, a 3D model of the lost building is created within its historical boundaries.

Expected result: reconstruction of cultural and historical monuments and development of recommendations for government agencies at all levels involved in the preservation of historical monuments. It is important that a Base will be created for the national museum of the Republic of Kazakhstan of digitized cultural and historical objects of Northern Kazakhstan.

## **Materials and Methods**

Collection of information about large-scale historical objects will be carried out using a drone. Further refinement of the data obtained by the 3D scanner, and after rendering, the analysis and systematization of the cultural and historical heritage will take place.

In recent years, drone technology has had a significant impact on the preservation and protection of historical and cultural sites. Drones provide an effective and cost-effective alternative to traditional methods of surveying and monitoring large objects, offering a bird's-eye view of the area.

Overall, the use of drones to monitor and map historical and cultural sites is becoming increasingly important as it provides a much higher level of detail and accuracy than traditional methods. This

technology helps researchers and historians better understand these sites and can help ensure their preservation for future generations.

One of the most important applications of drone technology is archaeological research and mapping. Drones can quickly and accurately cover large areas, allowing archaeologists to create detailed maps of sites and identify areas of potential interest. In addition, drones can be used to obtain detailed aerial photographs of sites, providing archaeologists with invaluable information about the layout and design of a site.

Overall, the use of drones to map and analyze historical and cultural sites will revolutionize the way archaeologists and historians can study and understand the past. With their ability to obtain detailed images and data from different heights and distances, drones provide archaeologists with a powerful tool for obtaining information about the past [8].

Digital reconstruction is an interesting step towards truly restoring the appearance of lost cultural and spiritual monuments.

A number of examples confirm the relevance and effectiveness of the use of digital technologies in the study and revival of heritage. A striking example is the reconstruction of the Moscow Chrysostom Monastery with a six-century history using the augmented reality method. In the 1930s it was destroyed, and in its place a residential complex for NKVD employees was built. Today, the territory of the monastery is included in the register of cultural heritage sites with the protection status of "Landmark", but only the cell building, the corner tower and fragments of the monastery fence have been preserved from the buildings. Due to the absence of many structures, a digital reconstruction of the monument was carried out in virtual reality and a form was created in which history, archeology, architecture are combined with digital technologies. Tourists can enter a photorealistic virtual space using a VR headset and see the monastery come to life in a modern cityscape, view historical photographs from the point at which they were captured by the photographer, climb the bell tower and explore the monastery grounds. bird's eye view of the monastery [8].

Digital 3D reconstruction for the preservation of cultural heritage can be carried out using several methods: using digital photogrammetry or direct measurement methods and CAD, orthophotography of the surface. Highly detailed 3D reconstruction using a laser scanner and the integration of image-based modeling with photogrammetry are well known in world practice, for example: The Church of Santo Domingo (Portugal) [9].

3D laser scanning creates highly accurate 3D models of historical buildings and cultural sites. The 3D model consists of a large number of points that accurately define the geometry of the object. In addition, to obtain a realistic appearance of the model, texture maps obtained from a high-resolution digital camera are required.

Field work to collect primary (initial) information includes scanning of each object and full photographic coverage for photogrammetry and phototexturing tasks. The optimal combination of techniques will depend on various parameters: overall dimensions, shape, texture, condition of the object, etc.

## **Results**

Digitalization refers to the process of converting analog information into digital form. In the context of Kazakhstan's cultural heritage, digitalization involves the use of technologies to create digital copies of cultural artifacts and objects. These digital copies can then be used for a variety of purposes, including research, education, conservation, and tourism.

Digitalization offers many benefits, including increased accessibility and preservation of cultural heritage. Digitization is the process of converting physical objects or information into a digital format for preservation and access. In the case of cultural heritage, digitalization provides access to historical artifacts, works of art, documents and other important cultural works that may otherwise be lost over

time or destroyed. Digitalization also makes it possible to share cultural heritage and promote it among a wider audience, including those who cannot visit it in person.

By digitizing artifacts and landmarks, it is possible to make cultural heritage accessible to people who are physically unable to visit them. In addition, digital copies can be used for research and education without damaging the original artifact or site. Finally, digital copies can be stored and backed up to ensure their long-term preservation.

However, digitalization has its drawbacks. One of the most significant compromises of digitalization is the potential loss of authenticity. Digital copies may not reflect the nuances and subtleties of the original artifact or place, which reduces their value for researchers and historians. In addition, digital copies can be easily manipulated or altered, which can create misleading information.

New knowledge will be obtained that will enrich existing museum collections in the Northern region of Kazakhstan. The introduction of a geoinformation database of monuments will enable regional authorized bodies to optimize and increase the efficiency of measures to preserve monuments. Everyone will have the opportunity to print a three-dimensional reduced model of digitized objects from the resulting database.

Economic effect: it is possible to use digitized three-dimensional models for the production of souvenirs or educational products. Also, the created database of digital visualized cultural and historical objects of Northern Kazakhstan can become an export item for museums around the world. The connection between the process of development of the national economy and the revival of material and traditional culture is obvious. Economic successes have enabled the state to pay attention to cultural needs. In turn, the revival of the rich culture and best traditions of the ethnic group has a beneficial effect on the further sustainable growth of the national economy. Studying and preserving the heritage of our ancestors will provide an opportunity to unlock the potential of the Northern region as an additional factor in the country's economic growth. The knowledge and skills of ancestors, the support of cultural bearers and creative associations will stimulate the development of a competitive cultural environment, the growth of human capital and the development of tourism [10].

Social effect: The new data obtained will allow preserving knowledge and skills related to cultural and historical heritage. The past fills the future. The data obtained from the results of the research will become the basis for the formation of Kazakhstani patriotism, the development and preservation of the cultural code of the nation.

It also becomes possible to obtain accurate scaled copies of famous geographical historical objects, which in turn makes it possible to provide the content of cultural and historical objects to visually impaired or blind people. This will allow them to get to know, study and explore historical monuments and sites, which will improve their quality of life. The effect will be the transfer of unique centuries-old knowledge and skills about the culture of the Republic of Kazakhstan to the general public.

Target consumers of the results obtained: Organizations of culture and art, education and science, government agencies and authorized bodies related to the preservation of cultural and historical objects, the media, representatives of small and medium-sized businesses.

The most remarkable thing is the ability to print a 3D object on a 3D scanner. Large cultural and historical monuments can be printed on a reduced scale. Such prototypes should be distributed as teaching aids for schools and as mock-ups for the visually impaired. Thus, the digitalization of historical monuments becomes a social factor [11].

On the former territory of the Turkic Khaganates of the 6th-8th centuries there are many statues. Many stone sculptures have been found on the territory of Kazakhstan, but the most interesting monument is Kos-batyr - these are stone sculptures of Balbal. Balbal is a type of stone sculpture that represents a

portrait image of a deceased Aruaha ancestor.

Most often they depicted men with mustaches, who had a vessel in one hand and a dagger in the other. The tradition of installing balbals on burial grounds is associated with the cult of ancestors among the Turks. After the death of a person, the ancient nomads made a figure of the deceased; relatives believed that the deceased moved into the balbal. The cup in the hand was intended for drinking; often food was left in front of the balbal, thereby showing respect and caring for the ancestor.

Balbals are most often located in the steppe, along rivers or gumbes in a prominent place. The statues are installed facing east. Eastern vertical stone balbals symbolize the revival of leaders in the future and are associated with the Sunrise in the East and Life. The flat horizontal layouts of “rings” on the western side of the mounds are intended for farewells and commemorations of the dead, and are semantically associated with Sunset in the West and Death [12].

The territory of Kazakhstan is vast and there is a lot of history in the vast steppe. The monument to the Kumai complex is located in the Akmola region, Erementau district, within the Buiratau National Park at the foot of the mountain of the same name, south of the village of Karagaily and 4 kilometers west of the left bank of the Kumai River.

They were discovered thanks to exploration research in 2009. The complex consists of several groups of monuments from different periods. The Turkic cult monument Kos Batyr is a structure for rituals, it consists of two rectangular fences oriented from south to north. The walls of the fences were built from flat stone slabs placed on edge. The dimensions of the fence are 1.25m x 2.25m x 2.35m x 2.05m. The height of the walls is from 0.6m to 0.73m.

On the eastern outer side of the slab in the upper left corner there are two signs of tamga, a moon and a circle nearby. On the outer eastern side in front of the slab there is a stone male statue measuring 1.8m x 0.4m x 0.15m, made of red granite. The facial features of the figure are clearly conveyed, the nostrils are weakly expressed. There is a mustache with tips curved upward, the mouth is outlined with oval lines (picture 1).. There is a drop-shaped earring in the left earlobe. There are 2 hands; the vessel on the right is depicted, the hand is bent at chest level. In the left hand there is a bladed weapon with a straight crosshair. The contour of a straight, elongated blade is depicted below the handle and continues on the left and side parts of the stone sculpture.

**Picture 1:** One of the Balbals of the Kos Batyr Monument.



On the southern side there is fence 2, this is the second part of the Kos Batyr complex. The fence size is

2.2 m x 1.75 m x 2.05 m x 2.08 m. The height of the southern walls is 0.55 m, northern – 0.55 m, eastern – 0.68 m, western – 0.45 m. On the eastern side of the wall there is a second statue, also male, carved from dark gray granite, its height is 1.9 m, width 0.32 m x 0.2 m. The sculptures are made in the style of rounded sculptures. The head is clearly separated from the body by a line through the neck. The man is depicted in the Turkic style. The face of the statue is round, the eyes are oval, the tonsils of the eyes are convex, the nostrils are wide, there is also a mustache with tips curved upward and the lines of the mouth are clearly detailed. On the forehead of the statue there is a rounded tamga of about 3 cm. The right hand is raised up to chest level, in the hand is a goblet-shaped vessel. In the left hand there is a short dagger. The crosshair of the dagger handle is above the palm, encircling the blade of the weapon. In front of the statue lies a stone that is the lower part of the statue, rectangular in shape with a cone-shaped tip.

It is extremely important that even a Muslim historian of the 17th century. Abul Ghazi, speaking about the ancient pagan Turks, pointed out: “When someone’s loved one died, be it a son, or a daughter, or a brother, then they made a statue similar to him. They placed it in their house, showed their love for him: they placed the first part of the dish in front of him, kissed him, rubbed ointments on his face and eyes and bowed.” [13].

Balbal tasy are very unique sculptures; the Kos Batyr monument carries a history dating back to the 6th-7th centuries. Basically, Balbaltas are located one at a time, but here there are two of them next to here and the name Kos batyr, which translated from Kazakh means two batyrs. In the sources, the most important text for our topic is the text of the Chinese chronicle Suishu (finished in 636), which reads (translated by N. Ya. Bichurin): “In a building built at the grave, they place a drawn image of the deceased and a description of the battles in which he was in continuation of life. Usually, if he killed one person, then they put one stone. For others, the number of such stones extends to a hundred or even a thousand” [14].

Consequently, the Kos Batyr monument, the burial ground of noble warriors who died in battle, since if this corresponded to the Chinese chronicle Suishu, one could argue that this was a warrior who killed another and in honor of this battle there are two Balbals. But these are two burial grounds located nearby and judging by the location, those who died in the same battle therefore were either 2 noble brothers or two friends who fought shoulder to shoulder and died together on the battlefield. Figure 2 shows an object that has become a discovery in recent years.

**Figure 2:** Kumai Complex [Compiled by The Author].



The ancestors of the Turks are depicted with all the attributes symbolizing the oath of allegiance to the fatherland, the desire to protect and preserve their native land for their descendants, and ensure its well-being. Traces of images of weapons are visible, sometimes vessels in the hands of stone sculptures. Ancient masters depicted their ancestors as beautiful and courageous: wide eyebrows, large eyes, straight noses, curved mustaches, earrings in their ears. Specifically, two figures, like many others, are located in the open



air and exposed to the environment. Now work is already underway on rendering this object to save it [13]. This became possible only thanks to three-dimensional scanning of the remains of the historical site. Restoring the original sculpture is carried out in modern programs, specifically for Kumai Blender is used.

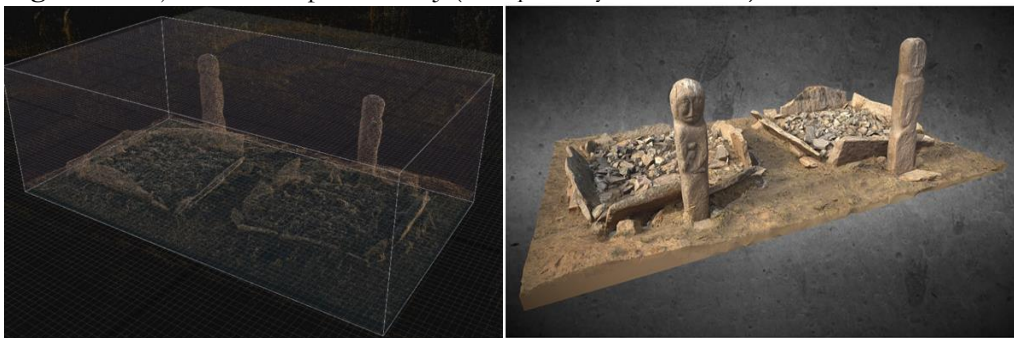
To digitize the Kosbatyr monument, three-dimensional scanning and photogrammetry were used. The object was photographed from various angles. There were 218 photographs in total. Shooting was done with aperture priority f/22 (fully closed aperture). In such conditions, photographs are as sharp as possible, with both the subject itself and the background behind it in focus. Since the aperture is closed, the shutter speed also increases. Therefore, the shooting is carried out from a tripod. Each object of interest should be photographed from all sides. It is convenient to walk in a circle so as not to get confused. The large circle promotes general stitching, the small circle contributes to the detailing of the object. Figure 2 shows the location of each photo and the direction of the lens.

**Figure 3:** Photographing the Object (Compiled by The Author).



Initially, raw FARO laser scanner data was imported into FARO Scene software, colored, and exported. Next, they imported into Trimble RealWorks, where they completed the final stitching and exported to PTX format. Data merging takes place in RealityCapture software. Alignment (merging) occurred automatically (Fig. 4).

**Figure 4:** Object After Export to OBJ (Compiled by The Author).



## Discussion of Results

Since the end of the 20th century, interdisciplinary teams from around the world began to carry out projects for virtual reconstructions of monuments of historical and cultural heritage. Experience has been accumulated in the use of innovative technologies in humanitarian research in the fields of history, archeology, and museology. The use of virtual reality allows you to see lost architectural monuments in the historical landscape [17].

Historical reconstructions using the latest information technologies contribute to solving the problems of studying, preserving and restoring cultural heritage sites, popularizing history and architecture. The use of augmented reality helps to see the past, attract public attention to the need to preserve monuments, and also opens a window to the future.

The introduction of computer technologies makes it possible to acquire new knowledge and increase creative potential through the creation and use of electronic educational resources, information portals, and three-dimensional modeling of cultural heritage objects [18].

The practical significance of the use of digital technologies in historical research, as well as in the reconstruction and recreation of monuments, is to unite the efforts of computer technology specialists, historians, archaeologists, museologists, architects, restorers, builders, as well as history buffs in preserving cultural heritage [19].

## **Conclusions**

The use of three-dimensional technologies in a science such as history is simply a vital necessity. Kazakhstan has the same needs for the preservation of cultural and historical heritage. Northern Kazakhstan, whose territory is larger than Italy or France, should have digitized architectural and historical monuments. As a result, the method of three-dimensional scanning and photogrammetry has already been used and not only a three-dimensional model of the Kosbatyr monument has been obtained (<https://sketchfab.com/3d-models/1651af5e283441ceafd01820a68527db>), but there is also a three-dimensional printed model made on a scale of 1:30 (Fig. 4).

**Figure 5:** Printed Model of The Kosbatyr Monument [Compiled by The Author].



The three-dimensional model is used by the KSU Center for the Preservation of Cultural and Historical Heritage of the Akmola Region for the educational process, as a digital exhibit.

For all the affordances of 3D modeling to preserve cultural heritage, there is still much to be addressed in this growing field, from best practices to guiding principles. Establishing standards will be necessary as institutions increasingly become responsible for the long-term preservation of 3D models, which are becoming integral parts of the cultural record [<https://blogs.loc.gov/thesignal/2017/01/using-three-dimensional-modeling-to-preserve-cultural-heritage/>].

## **Acknowledgments**

The time in which we live has three main characteristics that define its essence – the existence of an information society, the rapid development of information and communication technologies and the globalization of all spheres of public life. Never before has information played such a decisive role in the development of human civilization as it does today. The technological revolution and the emergence of a networked society create a new economic, social and cultural environment

Digital technologies are becoming a standard tool for collecting, preserving and distributing art and cultural heritage around the world. From the 3D configuration of ancient artifacts to the application of artificial intelligence to shed new light on how we perceive the lineage of the humanities, cultural heritage is moving towards a digital future.

Digitization technologies make it possible to transform traditional forms of information storage, such as paper and photographs, into binary code (ones and zeros) of computer storage. Subset is the process of converting analog signals to digital. But much more than translating any type of media into bits and bytes is the digital transformation of economic transactions and human interactions.

Expressing data in the form of ones and zeros facilitates their generation, replication, compression and distribution, their analysis and organization. It also encourages the replacement or addition of a physical - virtual or online-presence.

Digitalization of various materials and their installation on the Internet, which in the future can be used all over the world with the help of modern technological devices, open up opportunities for its operation on an unprecedented scale. One of the most important is the use of digitalization of cultural and historical heritage for the purpose of additional education of modern society.

The balance between the need for access to cultural heritage and the need for its preservation is another compromise related to digitalization. Digital access can increase the recognition and popularity of cultural heritage, but it can also increase the risk of theft, vandalism or destruction. For example, digital images of artifacts can be used to create fake versions of the original.

Finally, when making decisions about digitalization, the impact of digitalization on cultural heritage should be taken into account. Digitalization can change how cultural heritage is valued, perceived and understood. Public interest in digital images can overshadow the importance of original artifacts, which will lead to the ignoring or destruction of the original material.

In conclusion, the digitization of Kazakhstan's cultural heritage is fraught with many problems and compromises. Balancing the need for access and the need for preservation, ensuring accuracy and reliability, and taking into account the impact of digitalization are all important factors to consider. Despite these problems, digitalization makes it possible to preserve and popularize the rich cultural heritage of Kazakhstan for future generations.

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