AR-sculptures: Issues of Technological Creation,

Their Artistic Significance and Uniqueness

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Abstract

The threat of the Covid-19 epidemic quickly influenced the development of remote working tools using modern IT technologies. This has led to the emergence of a significant number of cultural practices for remote (virtual) use. Among them are experimental attempts to create volumetric virtual models that could be considered sculptures. At the same time, these developments have served the emergence of culturological problems: solving questions of uniqueness, artistic significance of works of this kind. In this regard, this article provides the results of a scientific study of the specifics of creating virtual sculptures, authorship issues and artistic significance of virtual content, identified as a result of an examination of the authoring developments of the AR-application "REMS," as well as works presented at the exhibition "More than a sculpture." In the example of the author's development of content for AR (augmented reality) installations, it turns out that virtual content can significantly change the content and ideological significance of art work. The artistic component of these objects determines their designation as art works, objects of fine art. In this way, the uniqueness and artistic significance of virtual sculptures as three-dimensional graphic objects created using augmented reality technology is confirmed.

Keywords: *Culture, Augmented Reality, Sculpture, Technology, AR-models, Art, AR-application, REMS AR*

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Received 1/21/22 – Revised 11/8/22 – Accepted 12/14/22

Introduction

Contemporary artists are increasingly using digital technology to realize their ideas and creative ambitions. Moreover, having abandoned traditional techniques for creating their sculptural creations – by means of sculpting from soft material and cutting (carving out) excess fragments from hard material – they increasingly use exclusively digital technologies and mathematical data analysis to create artworks (Roman Minin, Claire Bardeen and Adrian Mondo). At the same time, the created models are completely virtual – they have no subject analogs in real space (Anton Bakker, KAWS).

On the other hand, thanks to this feature of virtual reality technology, it becomes possible to create virtual analogs of volumetric artifacts (models), in particular, sculptures. Digital technology allows to create a three-dimensional image that can be viewed from different angles. In a pandemic, the issue of "visiting" virtual museums, art exhibitions, installations, libraries and archives has become critically relevant and important. Virtual sculpture has become an important and relevant art form of artist-creator's expressing the ideas.

During the pandemic, the practice of creating virtual artwork using digital tools has become popular. After all, it's the only way artists can survive the ongoing and seemingly endless pandemic blockages. In addition, special instructions for creating three-dimensional forms and virtual spaces are also in growing demand from young artists (Binson, 2021). Due to the relevance of the problem, augmented reality content developments that are used in cultural practices are attracting particular attention. Of particular interest are the projects "More than a sculpture," "REMS AR," in which it is possible to create three-dimensional and moving models. Nevertheless, virtual sculpture in most cases is a graphical volumetric analogue of the corresponding reified original. Therefore, the authorship issues and uniqueness of the created digital models are very relevant in the scientific literature.
To avoid tautology in the text, the abbreviation AR is used hereafter to denote augmented reality.

Related Work

3D models creation using virtual and augmented reality technologies was first considered by Louis Rosenberg at the US Air Force Research Laboratory (AFRL), resulting in the pioneering Virtual Fixtures platform (Rosenberg, 1993). Following Steuer (1992) and Rosenberg (1993), a critical review of research was conducted that categorized realities to identify weaknesses, inconsistencies or contradictions in content creation practices using VR and AR technology.

This methodology highlights problems or discrepancies in existing knowledge about the VR and AR specifics. Researchers Q. Hongyan, W. Changbo and L. Junjun (2008), Y. Chen, Q. Wang, H. Chen, X. Song, H. Tang, M. Tian (2019), L. Rau, R. Horst, Y. Liu and R. Dorner (2021), J. Bitter, U. Soierling and R. Dorner (2022) explain the features of AR content creation and the relationship between virtual and real objects. A comparative analysis of VR and AR specifics is carried out in the studies of D. Krevelen and R. Pelman (2015), A. Joseph (2015), C. Flavian, S. Ibanez-Sanchez, C.

Orus (2019). Augmented reality is considered as a technology for combining virtual and real worlds (Chen and Wang, 2019) and active cultural and educational tool for interacting with and informing a user audience about otherwise complex art-historical content (Crolla and Goepel, 2022). At the same time, there is research that proves that AR technology distracts the viewer from the real (subject) art object, fulfilling the function of teaching rather than actual learning (Aitamurto, Boin, Chen and Shridhar, 2018).

Recent developments in the field of AR technology are applied in several industries. In particular, in the commercial industry (Krevelen and Poelman, 2015; Bonetti and Warnaby and Quinn, 2018; Kerrebroeck, Brengman and Willems, 2017), tourism (Griffin, 2017), education (Merchant, Goetz, Cifuentes, Keeney-Kennicutt and Davis, 2014; Joseph, 2015), health (Freeman, 2017), entertainment (Lin, Wu and Tao, 2017) and scientific research (Fan and Liang, 2012; Flavian, Ibanez-Sanchez and Orus, 2019).

At the same time, the issues of technology implementation in the cultural sphere remain under-researched. In the scientific literature, several publications were found that partially reveal the specifics of AR using for artistic purposes.

Director of the Kiev Lavra Gallery, T. Mironova's (2020) analyses of the state of technology development and some art installations where AR is used experimentally. I. Gardabkhadze (2019) explores the impact of augmented reality technologies on the shaping of the fashion industry. According to the researchers, new digital trends have emerged in contemporary art thanks to innovative technologies. For example, thanks to digital tools, virtual sculpture has emerged as an object of digital art. M. Jenkins notes that the case of virtual sculptures refers to objects that "can only be seen with mobile phones and other mobile devices equipped with cameras and not with the naked eye." (Jenkins, 2021).

The literature review shows the lack of a fundamental study of the specifics of the use of augmented reality technology in cultural and artistic practice, analysis of the main characteristics of creating virtual sculptures using digital tools.

Research Methodology

Analytical equation modelling has made it possible to analyze the current practice of creating volumetric models using digital tools. Based on REMS AR authoring it was possible to investigate the technological stages of digital content creation. The theoretical-conceptual method allows one to define the artistic significance and conceptualization of the created models with the help of augmented reality technology.

The results of the comparative-typological method of research, namely the comparative analysis of the principles of creation of plastic and virtual sculpture, AR and VR technologies, the analysis of projects aimed at studying the interaction between AI technology and art, allowed to justify the possibility of creating AR-sculptures.

Principles of Creating AR-models Based on the Image of Real (Subject) Art Object

Augmented reality changes the current perception of the real world environment, while virtual reality completely replaces the user's real environment (Steuer, 1993). This distinction between technologies defines the main functions of their use and points to the importance of compatibility between real-world imagery and virtual content in the use of augmented reality.

The principle of AR using in art is that the artist can use digital graphics to give static works of visual art dynamism and volume, as well as to synthesize a real image with a virtual one. In practice, only a few virtual elements are used, which are synthesized with an image of the real world.

The viewer aims his gadget at a painting, sculpture or a specific point in space and sees through the device screen images of art object and graphic drawings. The gadget's camera recognizes objects as special programmed marks in the frame and adds a graphic image. At the same time, the virtual part is not static, it is linked to the image of the outside world, which the computer constantly monitors on the signal of the video camera (Mamontov, 2009). Digital virtual images are combined with physical reality, art work from a static form turns into a dynamic, mobile, volumetric one.

The technical means use multimedia, 3D modeling, real-time tracking and recording, intelligent interaction, and sensing. Its principle is the application of computer virtual information such as text, images, 3D models, music, video (Chen and Wang, 2019). The screen of the gadget (phone, tablet) shows AR graphics and images, and is captured by the built-in camera. Thus, augmented reality and the environment can be synthesized on the same plane. The synthesis of images is carried out instantly on the screen, without additional manipulations. The viewer becomes a part of this story.

AR graphic model is created on the basis of the image label of the object world. In specialized computer programs and editors, certain coordinates are set and the image is analyzed, on the basis of which a three-dimensional model is created. Therefore, the image of augmented reality serves as an auxiliary means for creating an artistic composition.

Authoring 3D-content and Software Applications for AR-installations

The author of the article proposes to consider the process of creating and presenting AR content using the example of our own graphic and software developments created for the presentation of an advertising booklet of the Department of Directing and Mass Holidays of the Kiev National University of Culture and Arts. The goal of the experiment is to visualize and give artistic form to the text of the document.

The author has developed a software application based on the Unity digital development platform, which allows to view augmented reality compositions based on images from the pages of the booklet.

The application launches the necessary audio sequence (music, reading the text), which allows to explain the reader the rules of booklet use, pay attention to the main keywords and create the necessary solemn atmosphere. In this case, the user sees on the screen the image that the gadget's camera takes. When the lens of the gadget fixes the pre-programmed booklet page, the necessary graphic model appears on the screen of the gadget.

The page is the commit marker. At the moment, five markers have been created – five volumetric graphic compositions (figure 1).

Figure 1. REMS, software developer T. Sovhyra, KNUKiM, 2021.

Authoring 3D-content and Software Applications for AR-installations

The booklet examines the disciplines that are taught at the department. The author has created virtual graphic models of students, which are programmed to demonstrate the skills and abilities acquired in practical classes. Thus, there is a visualization of the educational process.

The figures are three-dimensional and movable. They appear as soon as the gadget screen corrects the programmed page. The position of the marker changes – the 3D model moves accordingly. If the user changes the viewing angle, the model will expand too. If he turns or closes the page, the 3D model will disappear.
In this case, virtual content interacts with real (subjective) content, as a result of which a connection between the two forms of material presentation is created. Three-dimensional graphic models are moving virtual models that carry a semantic load with the help of means of expressiveness of fine art and the digital technologies use.

Another example: on the sixth page of the booklet, dedicated to the specifics of students' work on the stage, the author has created a graphic text model "REMS is the Cosmos" and placed several planets in a visual perspective. The idea of creating this composition is to show the viewer in an artistic allegorical form the endless possibilities of the department to provide students with practical experience on stage.

Thus, a completely new meaning of the created composition is created. Therefore, the question arises of the uniqueness and artistic significance of virtual content in the process of creating models of augmented reality.

"More Than a Sculpture:" A Project that Synthesizes Virtual & Plastic Sculptures

According to "Encyclopedia Britannica" traditionally sculpture is general term for the plastic art of carving, especially in stone and marble, but also in such materials as wood, ivory, metal and gems (Chisholm, 1911).

The presence of new ways and means of creating three-dimensional figures (including digital technologies), the sculpture can be made not in the traditional way. "Down with reality!" – manifested the artist Roman Minin, climbing on a painted metal barrel with a banner in his hands. So he presented his work "Friend / Foe" at the exhibition "More than Sculpture," which took place on March 7 – April 7, 2021 at the Art Ukraine Gallery in Kyiv and combined traditional art with augmented reality technologies. The exhibition includes sculptures made of granite, marble, bronze, plaster, and even works made using a 3D printer.

Figure 2. The exhibition "More than Sculpture," S. Udovik, 2021.

But at the same time, these sculptures are organized using augmented reality – a technology that brings virtual information into reality. "Augmented reality solves

the problem of transporting sculptures: fragile works can be shown in augmented reality instead of being transported around the world. At the exhibition itself, in augmented reality, you can see the sculptures from all sides, and the technology also conveys the structure of materials," says co-founder of the SIMO AR startup Marichka Velichko.

The new sculptural project is guided by the principle of "do everything and a little more." The exhibition is based on the study of the interaction of augmented reality, as a simulation, which has become an integral part of the space of modern life in the XXI century, with sculpture, as an art form with a thousand-year history. More than 30 artists took part – both already venerable and recognized authors, and representatives of the younger generation of Ukrainian art. Among them are Vladislav Volosenko, Alexander Dyachenko, Alexander Sukholit, Victor Sidorenko, Pyotr Gronsky, Yulia Belyaeva, Alexey Zolotarev, Roman Minin, Yegor Zigura, Konstantin Zorkin and others. That is why the exhibition brought together classical sculpture – from statues to masks – and futuristic works of young, talented artists. Ukrainian startup SIMO AR helped to combine traditional forms of plastic art with new technologies.

"The alternative reality development is psychologically necessary for society, because it is able to help a person hide from their problems for a while," explains the artist Roman Minin.

The SIMO AR team met with the sculptors as they were preparing for the exhibition. Having learned about the augmented reality technology, many authors decided to "revive" their work. Some sculptors already had 3D models of their work. It took three weeks to adapt them to the SIMO AR app. The startup's app recognizes the image and adds virtual content to it. Using an ordinary smartphone in the gallery, you can rotate the paintings 360 degrees, see how the sculpture "disintegrates" and revives again, and also learn more about the authors of the works. To do this, you need to download the application and point your smartphone at the name of the artist or his work.

As virtual installation author Anton Bakker notes, "The internal structure of the database is similar to the three-dimensional grid he uses to create sculptures." "I feel at home in the space of a cubic lattice." (Jenkins, 2021)

The Issues of the Uniqueness and Artistic Significance of Content in the Course of Creating an Artwork

The example of the author's AR installation (REMS AR) shows that the virtual model is conceptually different from the real one depicted on the brochure page. This means that with the help of augmented reality it is possible to change the meaning of reality and to give it the necessary directorial implication.

These results from the author's practical research led to the need to consider other implemented examples of the use of technologies in cultural projects in

order to study these issues of uniqueness and specifics of the interaction of the augmented reality model with the image of reality (marker). The same applies to virtual content based on works of sculpture. If sculptural works made in solid material are three-dimensional sculptures and are rightfully considered self-sufficient artworks, then with the addition of augmented reality technology, a virtual sculpture (virtual installation) is created. "Curves, loops, and knots seem more dramatic and just more interesting when they appear to be anchored to a specific location – and thus are in dialogue with stone and metal monuments rather than pixels." (Jenkins, 2021).

The project "More than Sculpture" reveals the essence of things in the modern world, exposing the "reference point" through plastic, and at the same time calls it into question, expanding the content with virtual elements.

Another example of a cultural practice where the uniqueness and artistic significance of virtual models created with the help of technology is observed: an art collection by artists Claire Bardin and Adrien Mondo. The viewer sees a pebble on white paper – nothing else. By pointing his phone or tablet at the exhibit, he can follow a graphic moving object on his gadget screen: on the person silhouette jumping on a pebble. The viewer involuntarily observes the actions of the "moving virtual face." He can change angles, edit the image scale, moving at the exhibit. The viewer can walk around the stone – the image of the face on the screen is three-dimensional and is viewed from all sides. In this case, the motion sensor is the user's gadget. The virtual sculpture, like a skilled actor, moves and performs certain manipulations. It is programmed to create a certain graphic pattern and to be in the required coordinates (in this case, on the stone). Thus, the exhibit turns into a visual-spatial installation organized using augmented reality technology. All virtual sculptures in this collection are thematically and stylistically related, representing certain episodes of the general concept of the project.

The issue of authorship in the creative process using augmented reality technology is problematic. Digital engineers, architects, planners and designers are involved in the organization of artistic activities, the creative process often resembles factory production. Given the complex nature of collaboration in the creative process, the independent author is replaced by the collective author.

Conclusion

On the example of the author's development of content for AR installations, it turns out that augmented reality technology provides significant advantages in viewing the necessary context: visibility, image volume, interactive use of the necessary material. But the main feature is the creation of unique content, which can be a self-sufficient art form – a virtual sculpture.

Using digital graphics in an AR application, it is possible to give dynamic and three-dimensional images to static works of fine art, to synthesize a real image with a virtual one.

It has been established that virtual content can significantly change the content and ideological content of art work. Based on the image of the marker, a new artistic context is created, organized into an AR installation.

Thanks to the three-dimensional effect and the ability of augmented reality technology to view from all sides, the created graphic models can rightly be considered three-dimensional figures. The artistic component of these objects determines their designation as works of art, objects of fine art. In this way, the uniqueness and artistic significance of virtual sculptures as three-dimensional graphic objects created using augmented reality technology is confirmed. It was found that in the artistic process AR can serve as a digital means of expressing the director's thoughts.

As a result of the analysis of scientific works, existing practices and the author's own developments in creating augmented reality content, it was found that this technology can be used in the process of creating works of art to give the image artistic imagery, volume and dynamics.

Based on the foregoing, it becomes clear that virtual content, created in relation to the author's intention, is an artistic overtone of this experiment, carries a content component that is different from the original source, artistic significance.

An analysis of the current state of development of AR technologies indicates significant prospects for the development of technologies and the need for further analysis of the best practices for using augmented reality in cultural and artistic practice.

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