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ART-TECHNOLOGIES FOR CREATING AN ARTISTIC IMAGE: ISSUES OF IMITATION AND THE TRANSITIVITY OF THE CREATIVE PROCESS

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Abstract. The article reveals certain aesthetic patterns in the creation of augmented reality content, namely the importance of modelling the real environment, transitivity, and simulation of traditional practices of creating sculptural forms. These issues are analyzed on the author's projects examples organized through the augmented reality use (applications *REMS Companion App* and *MININ Art*). An aesthetic patterns interdisciplinary research of augmented reality content perception allows us to draw significant conclusions about the artistic uniqueness of virtual images. The article reveals certain regularities in the creation of augmented reality content, including the peculiarities of imitation of traditional sculptural techniques and materials texture. It has been established that in order to create a realistic embodiment of virtual models in a real environment and to make these objects three-dimensional, it is important to take into account the peculiarities of chiaroscuro. Technologically, this can be done by installing a light source in the virtual scene that will illuminate objects at a certain angle. Consideration of the results of technological experience of content generation suggests that augmented reality allows the artist to create a transitional creative environment by imitating real space. When virtual content is detached from its marker (the image of real space), the specific author's context is lost. As a result, we can safely talk about the content uniqueness created with the help of augmented reality technology. Having all the signs of artistic creativity, these models can be called augmented reality sculptures – a form of synthetic digital and visual art.

Keywords: artistic image, augmented reality, augmented reality sculpture, creativity, culture, digital technology, imitation.

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1. Introduction

The arts have taken a dramatic turn thanks to advanced information technology, digitalization, and finally, social media, and finally business skills. Performing arts in particular have undergone radical changes in the digital age, where ephemeral performance can now be experienced, reproduced and repeated (Dunne-Howrie, 2020). Global changes in the direction of intensifying digital transformation are affecting most activities (Szostak & Sułkowski, 2024). Participation in art requires sensations. However, the digitization of art is limited by the ability of technology to transfer the experience of analog sensations to the virtual dimension (Mao & Jiang, 2021). Therefore, it is justified that digital participation in art should be called "digital mediation"; this concept places the role of digital technologies in a precise position, *i.e.* "between" the work of art and the recipient (Jarrier & Bourgeon-Renault, 2019).

It is obvious that the comparative experience of analog (traditional) and digital realization of an artist's creative intent is an important issue for further research, as it relates to the problem of transitivity and syncretism of artistic practices. After all, in the new digital

circumstances, artists and art lovers stimulate inclusion and active participation in art (Huang, 2015).

In the postmodern era, there was a need to design not only the real environment, but also the virtual one. Virtualization products have become tangible thanks to computer technology, and in parallel with the process of materializing the virtual, there was a demand for its aestheticization and humanization. In the context of this study, we consider virtual reality as an interactive information simulation technology created by high-performance computers that affects users through visual, auditory, and other methods of information transmission and receives experience from them (Zhang & Wang, 2021).

Despite such possibilities of modern creative industries, humanity, as it should be according to the laws of cultural development, does not abandon the accumulated experience, including traditional practices of creating artistic works, but, on the contrary, tries to combine the traditional with the innovative, the ordinary with the creative.

This experience is particularly evident in the cultural practices of augmented reality technology, which involves the creation of creative virtual content based on images of real objects. The analysis of the technological particularity of augmented reality organisation focuses on their significant impact on cultural practices (Zhang & Wang, 2021).

Augmented reality is an active cultural and educational tool for interacting and informing user audiences (Goepel & Crolla, 2021), as a technology for integrating virtual reality information into real space (Chen et al., 2019; Mota et al., 2018), technology for distracting the viewer from the real (object) art object, fulfilling educational and entertaining functions, rather than real learning (Aitamurto et al., 2018). Augmented reality is an ideal display that provides the opportunity to explore ideas that are not realised in the physical world (Sutherland, 1965). It allows not only adding any elements of the virtual to the real, but also removing elements of the real (Azuma, 1997). According to Azuma (1997), a developing prospect for this technology will be the emergence of a device by which a computer can control the existence of matter. With the increasing number of augmented reality applications, there is a need to analyze user experience (Dey et al., 2016; Schrepp et al., 2017; Davidavičienė et al., 2019) and stimulate user creativity, both developed by the technology and related to user loyalty (di Serio et al., 2013).

Despite considerable interest in augmented reality technology, authors often consider only the experience of creating computer games and virtual content, ignoring other creative practices. Whereas this study focuses on artistic images creation, which can arguably be considered a form of art.

Let us assume that augmented reality technology can be used to develop creative content that can be called a work of art, an immersive form of creative activity.

To prove this hypothesis, we should consider the results of technological experience in creating art installations to which the author is directly related (author and developer of the necessary virtual content and software application). The author intentionally refers to the previously published materials of his experimental research (Sovhyra, 2020, 2021) in order to elaborate on the researched issues and to avoid republishing the research results. In particular, the previously published works ("Implementation of Augmented Reality Technologies in Artwork Creating Process" (Sovhyra, 2020), "Augmented Reality Technology in the Cultural

Industry" (Sovhyra, 2021)) discuss the technological content, while the issues of aesthetic significance and creativity of the created content, imitation and transitivity of creative process are not considered.

Achieving this goal implies solving the following interrelated tasks:

- to define the functional component of augmented reality technology in relation to the possibility of its use in the development of creative practices;
- to trace and reveal the artistic significance of virtual content in the process of creating a work of art using the presented author's developments. To explore the issues of creativity and uniqueness of augmented reality models, the study uses a comparative research method;
- to identify ways to imitate traditional sculpture in the virtual dimension;
- to investigate the issues of imitation of traditional texture and form created in a traditional way.

2. The conceptual field of virtual and object sculpture in the context of imitation and transitivity analysis

According to *The Encyclopædia Britannica: A Dictionary of Arts*, *Sciences*, *Literature and General Information* (Konody, 1911), sculpture has traditionally been a general term for the plastic art of carving, especially in stone and marble, but also in materials such as wood, ivory, metal, and precious stones. A sculpture in the traditional sense is something that can be carved, engraved, chiselled (in stone, brass, wood, and other materials), moulded, created or produced by carving, engraving, *etc.* (Lewis & Short, 1879).

Due to the availability of new ways and means of creating three-dimensional figures (including digital technologies), sculpture can be made in a non-traditional way. In turn, augmented reality is a technology that allows you to interconnect the virtual (artificially created) and real (natural) worlds. An artist who creates artworks using augmented reality, like a sculptor, needs professional skills to create a sculptural work. The sense of realism experienced by the human body is actually formed by the transmission of various sensory impulses to the brain through the nerves (Zhao et al., 2023).

Despite the fact that physically and financially, the process of creating a virtual sculpture is hundreds of times easier and cheaper than working in material, but in terms of intellectual costs, the work of creating three-dimensional objects is no less. Perhaps in some ways this process is even more difficult, because you cannot feel what you are doing with your hands.

Virtual reality is one of the most important technological tools for visual modelling, where the artist can test models for imitation of natural or manufactured forms, which helps to develop a new vision and access the best solutions in the process of creating plastic forms. Thus, virtual sculpture is a graphic three-dimensional analogue of the corresponding embodied original. The sculptor resorts to the practice of using virtual reality to create virtual models instead of real material ones, as well as to reduce the implementation cost and, in cases where it is necessary to evaluate an art work, to approve the artist's idea with further work in traditional techniques.

The principles of virtual sculpture are similar to their traditional analogues. Steven M. LaValle (2020) notes that human brain neurons react to virtual elements in the same way

as to elements of the real world. Therefore, a person perceives the virtual environment and reacts to events in the virtual world in the same way as to those in reality. Thus, it can be concluded that virtual objects can influence the viewer in the same way as embodied invariants (LaValle, 2020, p. 13).

LaValle's (2020) hypothesis forms the basis of this study and dictates the further course of analysis for aesthetic products created by synthesising virtual and real objects.

Therefore, in this article, the concept of virtual is used to refer to artificially created digital content, while augmented reality is considered as a technological way of combining digital (virtual) models and real space to create a single creative composition.

3. The problem of interaction between virtual and real space in the context of the review of author's technological developments

The author Tetiana Sovhyra has developed an augmented reality by application *REMS Companion App* using *Unity* cross-platform development environment (*Unity Technologies*, United States). This platform is designed for the development of game applications, visualization of mathematical models. However, it allows you to create virtual and augmented reality content by uploading images of real objects. To recognize these images, marker technology is used. Thus, the research integrated the required illustrative material of the real space on the basis of which the creation of virtual content was planned (Sovhyra, 2020, pp. 113–115). A promotional brochure of an educational institution (Kyiv National University of Culture and Arts, Ukraine, Department of Variety Art and Show Direction, DVASD) was chosen as a marker. To visualise the information material of the brochure, the author developed several graphic three-dimensional models.

Figure 1. Augmented reality *perpetuum mobile* composition, application *REMS Companion App* (source: created by author)

Figure 2. Augmented reality composition, *REMS Is Cosmos*, application *REMS Companion App* (source: created by author)

Figure 1 shows a graphic model of the planet with *REMS Companion App* logo, which turns around and moves along a certain trajectory, thus symbolizing – *perpetuum mobilee* – the constantly moving process of learning and development for creative potential of the students of the DVASD.

The model of the planet is virtual – it can only be seen on the gadget screen. It appears when the camera captures the first page of the booklet. In this case, the graphic element serves not only as a decorative element, but also as a distinctive artistic image that carries a certain semantic meaning. At the same time, users note that due to the augmented reality this slide of the booklet becomes more informative and meaningful, as a result, it leaves a more vivid emotional imprint on the user (Sovhyra, 2021).

The space theme is also inherent in the following compositions, creating a common style for the entire series of virtual models. Figure 2 shows a more complex composition consisting of several virtual objects – planets.

The augmented reality models are three-dimensional and mobile. They appear as soon as the gadget screen captures the programmed page. If the marker location changes, the three-dimensional model moves accordingly. In addition, the application is programmed with the necessary soundtrack (music, text recitation) to explain the rules of use to the reader, draw attention to key words and create the necessary solemn atmosphere.

4. Chiaroscuro as a way to simulate the illuminability of three-dimensional objects in virtual space

A prerequisite for realistic representation is the correct perspective, *i.e.* deep construction of depicted bodies form. Both the artist and sculptor need to see and understand the regularities of light and shadow distribution on the surface of the form and be able to use them in

order to get the fullest idea of the relief form variety. The practice of chiaroscuro relies on the organization of light (conscious) and shadow (subconscious) to bring out the smooth void of fragmented time and thereby unlock its ability to invoke the subconscious and re-occupy the inherited landscape as a dimension of life (Goché, 2016).

Computer graphics programs provide the ability to set a specific position of the sun in order to understand how it might affect the design. In this way, it is possible to change the amount and the type of light source to simulate the distribution of light and shadow in space. The augmented reality model in the digital platform is subjected to a detailed calculation, whereby all the visual components of the art form are observed.

The degree of the body surface illumination, or luminosity, is directly proportional to the intensity of the light source and inversely proportional to the square of the distance between the light source and the illuminated body. In addition, the degree of surface illumination changes as the light spectrum increases and the distance between objects increases.

Consequently, if this distance is small, the change in magnitude will be very noticeable: thus, if the distance is doubled, the luminous intensity will be four times weaker. However, these simulations often only approximate the real lighting effects.

In the *REMS Companion App* virtual scene, the light source is mounted at the top right of the virtual scene, so all objects have a reflection at a certain point. As the planets rotate, this glare does not change its position, resulting in the coordinate of the illuminator being marked (right up), with all models being merged into a single space using the chiaroscuro. Various lighting or shadow casting techniques can be used to improve the overall depth assessment. For example, a common lighting technique is to simply place the light source overhead at the 12 o'clock position to create shadows on the virtual objects. In the case of the *REMS Is Cosmos* slide, the light source is shifted to create depth and three-dimensionality.

Users can simply read the promotional brochure or download an augmented reality app to see the visual content of the information on offer in a different way. The difference in meaning between virtual and real content raises the question of the artistic significance and uniqueness of content created with augmented reality technology.

5. Artistic significance of virtual images in augmented reality composition

As for the issues of creativity and uniqueness of virtual objects, here (as in the previous scene) the conceptual meaning for the virtual composition dramatically changes the information content of this booklet page. Indeed, in the original version of the slide introduces students' directing work, instead the virtual content develops with a completely different semantic load: *REMS* is the logo and abbreviation in Ukrainian for the department of *Regissura Estrada ta Masovih svyat*, which means the DVASD. On this stage, *REMS* is a space that provides students with unlimited opportunities to realise their creative ambitions. As a result, we can again speak boldly about the uniqueness of the content that is created using augmented reality technology.

Moreover, we are talking about creating a unique artistic image using digital technology. As we know, the artistic image is a form of the world interpretation and exploration from the

perspective of a certain ideal, by creating aesthetically impactful objects (Young, 2020). In this case, the augmented reality content synthesis based on the image of real natural forms and original artistic symbols. With the help of augmented reality, the author can show real facts through the prism of his own perception. With the help of certain allegories, metaphors, lighting effects, proportionality and scaling it is possible to create graphic content, which serves as a supporting component for the perception of the text in the booklet.

After all, the created images can be placed anywhere – even on real architectural monuments. But it all depends on the creative idea and author imagination. If the idea is interesting, the combination of real and virtual content creates a new art form with unique content. Otherwise, this combination forms a distorted reality, which has the characteristics of vandalism. The value of using augmented reality technology in the process of creating an artistic image can be seen in another example of organising a virtual composition that has been integrated into an open space. We are talking about an virtual reality sculpture presented above the State Industry House – Derzhprom – in Kharkiv, Ukraine.

The sculpture concept is a typographic composition *LOVE*, consisting of just four letters, a replica of a sculpture by the American artist Robert Indiana. Particular attention should be paid to the ideological content of the composition. The convex elements of the composition visualise the high relief images, which in turn form a single artistic image, reflected in the inscription *LOVE* (Figure 3). In order to admire the *LOVE* sculpture above the famous monument of constructivism (the Derzhprom building), one only needs to download the *MININ Art* app to one of the devices with *iOS 11* installed.

While in the case of the *REMS Companion App* the sculpture concept is a typographic composition *LOVE*, consisting of just four letters, a replica of a sculpture by the Indiana. The virtual content is integrated using marker technology, in the case of the *LOVE* composition using *REMS Companion App*, a global positioning system (GPS) coordinate is used that must be in the centre of the frame. To see the artwork, one has to hold the phone horizontally before launching the camera, then flip it upside down and point the device at the facade of the building. In this way, due to digital mark-up technology, it becomes possible to place sculptures all over the world: against the background of historical sites in European cities,

Figure 3. Augmented reality composition *LOVE* in the case of Kharkiv, Ukraine, application *MININ Art* (source: created by author)

modern metropolises, in virtual interiors and landscapes, the virtual content is integrated using marker technology, in the case of the composition *LOVE* using *REMS Companion App*, a GPS coordinate is used which is supposed to be in the centre of the frame.

> "Augmented reality is something between the world we see every day with our eyes and the virtual reality that is relevant today […]. It is not another granite or concrete monument, it is a unique future that can be seen in Kharkiv",

notes Andrei Shapovalov (Slipchenko, 2018), one of the application's developers. His statement points to the innovative way of creating the installation, however, also in the case of *MININ Art* the imitation features of sculpture created in the traditional way can be observed. The design of the installation is based on the facades of the buildings captured by the camera. Upon closer inspection, the characteristic texture of granite material can be seen. It seems as if the sculpture is a high relief created from granite in the traditional way (creating a sculpture by cutting it out of stone). Accordingly, virtual reality-sculpture as a synthetic form of digital fine art imitates the features of a work created in the traditional way.

Moreover, the famous replica of Indiana is transformed into a new artistic image symbolizing the heart of Kharkiv. Identification of the author's research results becomes the basis for the conclusions about the creation of a new artistic product with the help of augmented reality.

Can we talk about a more important semantic load of virtual content than real (speech) content?

In the case of *MININ Art*, I suppose so. After all, the augmented reality *LOVE* composition is conceptually important wherever it appears (based on which building layout it would be programmed). In the case of *REMS Companion App* authoring, the virtual models (although unique) are not independent in their use. By detaching them from the image of the speech (real) booklet, the virtual images become ordinary graphic content without a specific authoring context.

Therefore, it is essential to understand the important feature for synthesis of virtual and object environment images, real and virtual models. Accordingly, it is important to consider the transitivity of creative content creation practices through augmented reality.

6. Transitivity and imitation features in the creative process

The author's augmented reality content developments demonstrate the transitive features of the artistic creation organization. Digital technologies of virtual content development inherit traditional techniques of sculptural and graphic work creation. Due to innovative technology the author can show real facts through the prism of his own perception. For the artist digital tools give a completely different degree of freedom. After all, created images can be placed anywhere, even on real monuments. But everything depends on the creative idea and the author's imagination. If there is an interesting idea of combining real and virtual content, new art forms with unique content can be created. Otherwise this combination forms a distorted reality with the characteristics of vandalism.

Identification of the author's study results becomes the basis for the conclusion that through augmented reality it is not only possible to develop new content, but also to create a new art work.

Graphic models designed for implementation in real space are created according to all the laws of artistic expression, dimensionality and proportionality. An augmented reality model lends itself to detailed parameter calculation, which is much more difficult to do using traditional techniques.

By combining the theoretical foundations of sculpture with knowledge in three-dimensional design, it is possible to create virtual sculptures of different shapes, sizes and proportions. With all the characteristics of artistic uniqueness and creativity, these models can be called augmented reality-sculptures – forms of synthetic – digital and visual – art.

Virtual reality artist, like a sculptor, needs professional skills to build a sculptural work. While physically and financially the process of creating virtual sculpture is hundreds of times easier and cheaper than working "in the material", the intellectual cost of creating three-dimensional objects is no less. Perhaps in some ways the process is even more difficult, because the material cannot be felt with the hands.

Digital technologies for developing virtual content follow the traditional methods of creating sculptural and graphic works. Therefore, the modern understanding of sculptural and architectural forms is based on the understanding of canonical established norms and theories and technological interaction between the recipient and the work of art, which results in the creation of interactive models. The virtual content created in accordance with the author's idea is the artistic content of this experiment, and carries a different content component and artistic significance from the original source. This means that augmented reality technology creates a new artistic form – an virtual reality sculpture. The visual and expressive medium is digital volumetric graphics.

Due to the increase in the computing power of devices, the improvement of more sensitive hardware sensors and cameras in gadgets, augmented and virtual reality technologies are being introduced into new areas of human activity. Among other things, technologies are actively used to create creative content.

Therefore, to summarise the above, it is worth noting that the importance of virtual reality lies in the fact that it is an effective means of simulating reality, regardless of its circumstances and difficulties, with the help of which it is possible to create various environments that simulate reality that cannot be accessed or coexist with.

Due to virtual reality technology, the process of creating sculpture has become more exciting and economical (it takes less time), as it is now possible to create art works and virtual exhibitions of sculptural works with the participation of artists at a distance. In this case, the subject can be a "mediator" in art, which has unlimited potential in creative abilities, using all the possibilities of form, space and sound (through their imitation). Since virtual reality eliminates physical laws, its art allows users to live in dreams and in the world of imagination.

In the process of projecting prefabricated virtual objects onto the real environment (set markers), it is difficult to ensure perfect seamless integration with the real environment, especially in the case of two-dimensional objects. A variety of material properties and depth

maps are used to give weight and dimension to the virtual objects and to emphasise their presence in the real world. In particular, Figure 2 shows that it is important to think about chiaroscuro to make virtual models more realistic in the virtual world. The importance of this technological technique should be discussed in more detail.

In the author's technological developments of augmented reality technology, the imitation peculiarities for traditional techniques of sculptural forms creation are observed. These issues are explored in detail through examples of author's technological experience in producing creative content of augmented reality for the artistic idea realization.

It is the elegance of the finish, the meticulousness of the details, the beauty of the form that testify not only to the talent, deep inner content, but also to the artist's skill that becomes the language that virtual sculpture speaks and that a new audience wants to hear.

Digital technologies make it possible to create a three-dimensional image that can be viewed from different angles. Accordingly, this feature makes it possible to create virtual analogues of three-dimensional artefacts, including sculptures.

Hence the need to identify the problem of the relationship between virtual reality and the art of sculpture and its applicability. The study problem is to show the philosophical dimension of virtual reality technology and its impact on the intellectual and creative vision of the sculptor in the age of technology.

Scientific developments and technologies of various virtual reality types provide an opportunity to create a new understanding of sculptural forms and to experiment, explore and apply new possibilities (movement, light) in sculptural work.

In particular, the artificial intelligence use challenges traditional methods of creating sculptural forms. As a result, the problem of transitivity and imitation of traditional techniques and form texture in the context of technological transformation of the cultural process becomes extremely relevant and necessary for further study in the field of art.

7. Conclusions

With the introduction of augmented reality technology into the creative process, it is possible to merge the real and virtual worlds, interact in real time and display the necessary objects in three-dimensional space. However, it is important to understand the interdependence of virtual and speech images in the creation of an artistic image. In *REMS Companion App* development, for example, the virtual models are not independent in their use. By detaching them from the layout, the virtual images lose their specific authorial context. The examples of the author's technological developments show that the conceptual meaning of the virtual composition radically changes the information content of the image of the real space. As a result, we can safely talk about the uniqueness of content that is created with the help of augmented reality technology.

It has been found that in order to create a realistic embodiment of virtual models in the real environment, it is important to consider chiaroscuro. Technologically, this can be done by installing a light source in the virtual scene that will illuminate objects at a certain angle. In this way, with chiaroscuro, the virtual objects will look more three-dimensional and imitate real three-dimensional objects.

In this way, the author can show real facts through the prism of his own perception. By combining real and virtual content, a new art form with unique content is created.

Consideration of the results of technological development suggests that augmented reality allows the artist to create a transitive creative environment and objects by imitating real space and objects. In this case, the feature of imitation and simulation of reality is important in the creative process, which gives the illusion of reality and dimensionality to the cultural practices organized with the help of augmented reality. It is revealed that by integrating the virtual model *LOVE* into the open space, a unique practice of urban culture is created. Moreover, the famous Indiana's replica is transformed into the new artistic image symbolizing the heart of Kharkiv.

It has been identified that by synthesising the theoretical foundations of sculpture and knowledge in the field of three-dimensional design, it is possible to create digital models. Having all the characteristics of artistic uniqueness and creativity, these models can be called VR-sculptures – a form of synthetic – digital and visual art. An artist creating an augmented reality work needs professional skills in creating a sculptural work. The study recommends that artists and sculptors make the most of modern digital technologies and integrate them into their work in accordance with the spirit of the times. The process of educating artists should be aimed at unlocking their artistic potential, emphasising the important role of infusing virtual objects into the conceptual content of the art form.

The research results emphasize the augmented reality adaptability in inclusion promoting and improving user experience. Continuous augmented reality progress is leading to greater innovation and expanding creative possibilities.

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