

Visualization of Culture Using Computer Technologies

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Abstract—The modern world includes many technologies, without which it is already quite challenging to imagine our life. Every day we receive information through the visual perception of reality; images of objects are built through various images in our head. After that, a whole system of concepts, knowledge, and ideas about the world is formed. The constantly changing environment of our time, endlessly replaced by images that are prepared in the form of images by our consciousness, is a multimedia sphere consisting of useful information, various video sequences, animated computer graphics and the Internet. In their research, the authors set the task to study the phenomenon and directions of visualization of culture using computer technology. For this, the authors analyzed the theoretical and methodological basis, which allowed them to put forward 3 hypotheses. Further, the authors conducted several studies from 04.2019-10.2020. As a result of which 2 hypotheses were confirmed, one was refuted, showing the importance and necessity of visualizing culture through computer technologies.

Keywords—computer technologies, culture, cultural services online, visualization

1 Introduction

Today, the rapid development of technological, geopolitical, socio-economic, mental processes significantly transforms the main directions of cultural development and contributes to the emergence of new phenomena that require theoretical understanding. Modern information exchange is carried out mainly within the digital information environment (Internet environment), which determines a unique format of communicative practices, given the increased oversaturation of information, its fluidity and compression of messages. In recent decades, there has been a growing awareness of the intrinsic links between the state of culture, social, economic and political phenomena, and culture and cognition [1; 2]. Understanding the dynamics of culture and the existence of traditional cultures in innovation processes through a new categorical apparatus allows us to comprehend their uniqueness and preserve the basis of civilization's ecogenic methods to stimulate interdisciplinary research.

The brilliant thesis of the Canadian thinker about the meaningfulness of the means of communication was not entirely (with rare exceptions) applied to the analysis of the phenomenon of "new entertainment", which became the core of the emerging global culture. At one time, insightful analysis of the hidden worldview potential of the first samples of video technology led Marshall McLuhan to the realization that the natural magic of the Obscura camera anticipated Hollywood in turning the spectacle of the surrounding world "into a consumer product packed in a frame" when "detached visibility awakens the magic of tribal hordes" [3]. However, in the future, the swiftness of the expansion of information and entertainment technologies, as a rule, outstripped attempts to comprehend them adequately. The appearance of modern culture and the nature of its functioning are steadily, unstopably changing before our eyes: the new European literary centrism of the individualistic and rationalistic "Gutenberg galaxy" of the printed Word is being supplanted by the electronic civilization of the Image, which is multidimensionally connected with the industrialization of human vision, the formation of a global market of visual images and, consequently, with new opportunities indirect global control [4; 5].

COVID-19 has taken digitalization to a new level: the introduction of quarantines in many countries, restrictions on movement and home isolation have led to a significant increase in the demand for online services, incl. cultural character [6; 7; 8]. Such as watching movies and entertainment content on the Internet, many theatre companies began to show performances online, and museums joined them to visualize their exhibits. This shift in the vector of culture determines the relevance of research and deeper subject analysis.

The purpose of the article is to study the phenomenon of visualization of culture and the transformation of the directions of its development using computer technology under the influence of the global pandemic COVID-19.

The research is supposed to be carried out according to the following structure:

1. study of the theoretical and methodological basis of visualization of culture;
2. putting hypotheses based on the analysis;
3. conducting an empirical experiment to confirm or refute hypotheses;
4. analysis and conclusions from the study.

2 Theoretical basis

In Western social science, over the past decade, the question of the need for a comprehensive study of visual culture as a particular subject has been repeatedly raised. Elaine Hooper-Greenhill concretizes the topic of upcoming research: "Visual culture deals with the theory of vision (visuality), focusing on the problem of what becomes visible, who sees it, how it is seen, understood and correlated with power relationships. She explores the act of seeing as a product of intense interaction between external images or objects and internal thought processes" [9]. Problems of the interdisciplinary discourse of visuality, according to W.J. T. Mitchell, are even broader: "What is the relationship between visual culture and visible nature? Are all images visual? How does

the image function in consciousness, memory, fantasy and perception? What is the relationship between visible images and visuals in general? What is a visual mediator? How are the differences between images established? How do images fit into the processes of communication and designation? What is the role of the image in art? What is the relationship between art and visual culture in general? What impact do technological innovations have on the reproduction of visual culture?" [10; 11].

In a broad sense, visualization is understood as a) Representation of something physical – a process, phenomenon, etc. – in a form convenient for observation; b) Method of directed image invocation [5; 11]. Thus, in the first case, the phenomenon of visualization is understood as the final result of some (i.e., the effect) of procedurally presented with the help of visual codes. In this case, visualization makes it possible to reflect the development of an action, which is difficult or impossible to observe under normal conditions. In the second case, visualization is understood as a procedure during which a specialized apparatus (cinema, camera, laser, etc.) and a set of techniques (composition, editing) are used. The motive for choosing one method or another for representing an image is due to the technical equipment that exists in a specific historical time and the author's ideological plan. The particular content of the definition of "visualization" occurs within the framework of particular scientific discourse.

We are primarily interested in the status of the phenomenon of visualization concerning reality, the basis of which is human activity, i.e. culture. Here we turn to the discourse of cultural anthropology, which describes a person as a subject and object of cultural creation. A specific discipline feature also causes interest in cultural anthropology – a person appears as a dynamic and variable system. Returning to the beginning of our reflections, the visualization should represent the dual nature of man; in other words, a person is an objectification of cultural processes and an active subject of cultural creation. Analysis of visualization resulting from cultural processes refers the researcher to artefacts that bear the imprint of these processes. Thus, visualization is an explication of the processes in the logic of which a specific socio-cultural system develops: ethnic, historical, civilizational. The role of visualization is to confirm or refute this logic of development on real, in this case, visually perceived, facts. However, we associate several serious concerns with this research position. Thus, the researcher runs the risk of becoming a "victim" of his bias when choosing visual objects [12]. To the detriment of his ideal vision of a specific socio-cultural system, for example, historical culture, the researcher will ignore other, in his opinion, discriminatory facts. The researcher can also manipulate exotic evidence of a particular national culture.

A promising direction in studying the phenomenon of visualization can be the so-called "visual modes". This phrase denotes the conventional way of broadcasting visual information. In other words, the visual mode should be considered a consequence of the normative and regulatory mechanisms that affect the transfer of visual information from the addresser to the addressee in a closed socio-cultural system. Currently, there are two types of visual modes based on the degree of specialization of the translation process – particular and total (Figure 1).

Perhaps the most significant function of this mode is adaptive. This function consists of an individual's attempt to gain a foothold in the cultural space of a specific socio-cultural system. For example, when a migrant finds himself in a new socio-cultural

reality, he/she creates and fills the individual world in the same way as it was in "native" conditions.

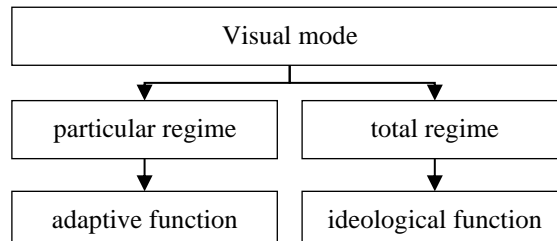


Fig. 1. Features of the types of visual mode

Many particular regimes are possible within the framework of one socio-cultural system, for example, a modern metropolis. The particular regime is based on the translation of the visualization of a person's private intentions. In the emancipated space of the "world city," they can synchronize, intersect occasionally, or exist autonomously and independently of each other.

The total (not to be confused with "totalitarian") *visual regime* is formed by normative and regulatory mechanisms that have a supra-individual nature. This position does not negate individual creativity, but it is a consequence of the social conformism of a person (i.e., "I create so that the environment accepts me"). As a result of the functioning of this mode, an ideological visual text is created.

The visualization phenomenon, considered a result of cultural processes, allows us to study its architectonics (i.e., the compatibility of elements that make up a socio-cultural system; harmonious connection of parts). This aspect of the study is predetermined by several questions, the first of which concerns the structure of the socio-cultural system. In culturological theory, it distinguishes three types of cultural features - universal (since they are present throughout the entire time of a person's existence and regardless of his living environment), general (arising from cultural contacts) and specific (varying in different cultures). In this case, the visualization of these traits includes a person in a dialogue – universal and intercultural [13; 14].

All visual content can be divided into three subgroups according to some common characteristics inherent in each object separately (Figure 2).

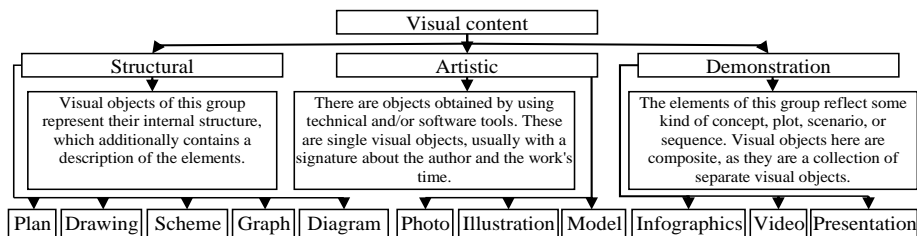


Fig. 2. Subgroups of visual content, its types and subspecies

The given visual objects have different types and can also be expressed in various forms: be static or dynamic, be in the same plane, or be deployed in three-dimensional space. We classify all visual objects into two other display categories.

1. Classification by the time of display of visual content:
 - Static* – for still images, as you know, the time strip does not exist; therefore, such objects are called static since they do not change their display form over time.
 - Dynamic* – dynamic objects tend to change in a certain period. The display time of such things depends on their type; for example, a dynamic photo can last a few seconds, and an infographic in video format can last from three minutes or more.
2. Classification by the type of display of visual content:
 - 2D* – an object that has two components: height and width; objects are considered two-dimensional.
 - 3D* – a rendered visible object in three planes is three-dimensional.

Having studied the above visual objects and their characteristics, we will determine the fundamental principles by which visible content formation occurs (Table 1).

Table 1. Principles of visual content formation

Principle	Description
Conformity	Finding the right render type
Credibility	The result should not distort information
Quality	Good or excellent quality of the objects used
Completeness	Presence of data comparison or clarifying material. Sufficiency for the formation of an adequate image of the object.
Regularity	Compliance with the logic of the presentation of the material.
Availability	Ease of information perception.
Optimality	Avoiding information overload.

The components of visual objects during formation can be different depending on the type of object and the group to which it belongs; however, they all obey the general principles of creating visual content:

1. Compliance. Regardless of how attractive a particular visual object may be, it is necessary to correlate the type of object with the theme of the educational material being created. It is important to remember that not all objects may be suitable to demonstrate the interesting aspect clearly.
2. Credibility. The resulting visual object from any author or created independently should not distort the events and objects of the real world. Information that visually shows and explains the chosen topic must be verified and have reliable sources, which you can subsequently refer to for clarification.
3. Quality. When forming a visual object, it is necessary to pay attention to the quality of the selected graphic and video materials. These should be images that contain, if possible, clear boundaries of the drawing. A high-quality object must have good scalability so that its placement in any composite object occurs without loss of essential details and a blurry image does not appear.

4. **Completeness.** Not always the entire amount of information can be displayed in text form, and not always an image or video can fully reflect the aspects of the selected topic. Therefore, visual content should be composed so that the information contained in it introduces the material to the maximum extent possible.
5. **Regularity.** In presenting any information, the logic of the narrative is contained, which can be traced both in the text and in additional elements. Adding individual objects to the subsequent material should not lead to placement in different parts of the finished work. The information sequence must be clearly defined in advance to obtain a holistic, structured result.
6. **Availability.** For the prepared educational material to be visual and to be remembered for a long time, it is necessary to make a demonstration taking into account the psychological characteristics of a particular category of students.
7. **Optimality.** Each element individually should carry a moderate amount of information without overloading either the graphic object or its space. It is advisable to place visual objects evenly throughout the created material without load or void in some separate fragments.

Thus, it is possible to form principles for selecting electronic visual content (Table 2).

Table 2. Principles for the selection of electronic visual content (compiled based on data [15; 16; 17])

Principle	Description
Scientificness	Compliance of an object with a specific topic.
Quality	Acceptable image resolution for demonstration.
Completeness	General information about the object.
Optimality	The optimal size of the object file for the demonstration.
Ergonomic	Effective use of the facility.

Therefore, we can conclude that any information transmitted through the visual content should be formed so that the user, without making additional efforts, can easily find, analyze and build the image of the object in the exact sequence in which it is necessary. The definition of these principles of creation and formation of visual content summarizes, concretizes and logically builds up actions in selecting material to highlight various aspects of culture.

3 Experimenting

As noted, the COVID-19 pandemic has significantly changed the way of life for many people, incl. their cultural recreation. Scientists believe that the pandemic has only accelerated the worldwide digitalization that was already evident. Thus, it is necessary to investigate which means of visualization of culture are the most effective. For this, from 04.2019-10.2020, several social surveys were conducted to identify the general trend and develop recommendations.

Results of a representative survey:

1. always probabilistic;
2. always have a sampling error;
3. the maximum error is declared.

100% accuracy only in continuous surveys (everyone is interviewed, no sample)

Statistical sampling error with a probability of 0.95 and a design effect of 1.5 does not exceed: 3.3% for indicators close to 50%

2.8% for indicators close to 25% and 75%

2.0% for indicators close to 10% and 90%

1.4% for indicators close to 5% and 95%

0.7% for indicators close to 1% and 99%

Polls were conducted both face-to-face (polls) and online (filling out a questionnaire in Google forms). In total, 7092 people took part in the sociological survey, among whom 62% are women and 38% are men, divided by age: from 12 to 18 – 19,6%, from 19-29 – 21,2%, 30-50 – 28,5%, 51 and older – 33,4%.

The surveys were conducted to confirm/refute the hypotheses put forward by the authors:

- Hypothesis 1. Isolation will promote the growth of creativity (verified).
- Hypothesis 2. Attendance at cultural events will decrease (not verified).
- Hypothesis 3. The use of online cultural services will increase, but not significantly (verified).

4 Results and discussion

Hypothesis 1. The first study – to identify cultural involvement – was conducted in 2 stages (10.04.2019-20.01.2019 and 08.04.2020-12.04.2020). It contained three questions (1 primary, 2 clarifying): *do you sometimes do art or amateur art – maybe draw, play a musical instrument, write poetry or prose, sing in a choir or yourself, do pottery, embroidery, woodcarving or other folk crafts, computer design or any other creative and artistic activity?* (Table 3).

Table 3. Survey results for Hypothesis 1

Cultural involvement	2019	2020	2019	2020
Yes, I practice regularly	8,2	16,5	23,4	58,7
Yes, I do, but rarely	15,2	42,2		
No, I don't do it, but I used to do it	14,3	13,6	14,3	13,6
No, I've never done that, but I would like to	10,4	4,6	49,1	25,9
No, I've never done that, and I'm not interested	48,7	21,3		
Hard to say	3,2	1,8	3,2	1,8
Total, %	100	100	100	100
Total, individuals	1845	1910	1845	1910

Thus, isolation led to a significant increase in creativity in one form or another – by 35.3%. It should be noted that the growth of users was observed:

- YouTube tutorials;
- Ready-made kits/starter kits of any kind of creativity;
- Online classes with a teacher.

Hypothesis 2. The second study – attending cultural events – was conducted in 2 stages (25.05.2019-03.06.2019 and 20.04.2020-30.04.2020). It contained 2 main questions: *During the last year, which cultural events did you attend? Please list from this list all the events you have followed.* (Table 4).

Table 4. Survey results for Hypothesis 2

Cultural events	2019	2020
Movie in the cinema	22,8	18,7
Music concert	18,9	25,4
Theatrical performance (play, opera, ballet)	16,4	28,7
Exhibition of paintings, sculptures or other works of art	5,2	2,4
Museum exposition	9,7	14,2
Excursion to places of historical heritage	14,2	0
Bookfair	1,2	0
Humorous concert	8,7	0
Ethnofestival	0,9	0
Public lecture	1,1	5,8
Literary/poetic evening	0,4	0
Other	2,5	9,5
It's hard to remember	2,8	8,9
I have not attended any cultural event in the last year	28,1	18,3
Total, %	132,9*	131,9*
Total, individuals	978	954

*the total number is more than 100% since people attended 2 or more cultural events

The study results were somewhat unexpected for the authors since we assumed a reduction in attendance at cultural events. However, many cultural events were transferred online; it is especially worth highlighting theatrical performances: it turned out that it was very difficult for actors without spectators, without arrangements, and many found a way to popularize their work and attract, possibly, more viewers in the future, because online performances were free or in the form of donations. Also, world stars gave concerts online (paid), some museums digitized their expositions and conducted online tours. It is worth noting that initially, when the choice was limited, people “visited” almost everything indiscriminately, i.e. who was the first to visualize his work using computer technology, he attracted the largest number of viewers.

Hypothesis 3. The third study – the use of cultural services online – was conducted in 2 stages (01.11.2020-12.11.2020 and 30.08.2021-10.09.2021). Contains 2 main questions: *1. Do you use the Internet?* If there was a question – no, this person was not

interviewed anymore, and its results were not included in the sample. 2. Which of the following sites have you viewed online in the last six months? (Table 5).

Table 5. Survey results for Hypothesis 3

Cultural services online	2020	2021
Video online: entertaining or informative films, programs	41,7	43,5
Music online	38,9	41,5
A site where you can read books for free or listen to audiobooks (or download them from the site to read/listen to later)	18,4	19,8
Articles, blogs about culture online	1,8	2,3
I haven't seen anything like this online for the last six months	3,2	1,7
Other	2,5	8,4
It's hard to remember	1,9	1,4
Total, %	108,4*	118,6*
Total, individuals	680	725

*the total number is more than 100% since people attended 2 or more cultural services online

As might be expected, the pandemic has not led to a significant increase in the use of cultural services online for one main reason: the majority of the population already uses these services.

Summing up the research results, we can clearly show the results of 3 studies conducted (Figure 3).

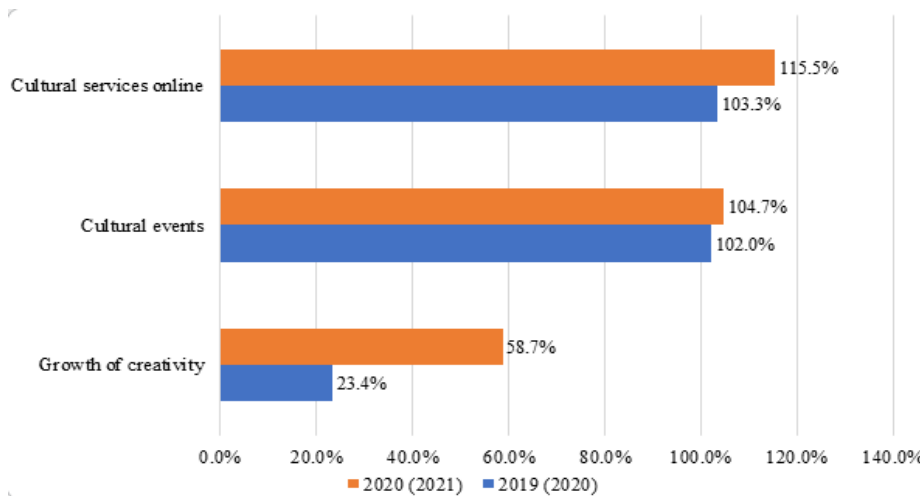


Fig. 3. The final result of the study of visualization of culture using computer technologies

5 Conclusion

The modern development of technologies and the emergence of new technical means make it possible to visualize objects, phenomena and processes of the microworld and

space, which were shrouded in mystery in the recent past. Science has stepped so far forward that we can visualize in detail the internal structures and organs of a person on a magnetic resonance imaging scanner, see the transition of an electron from one energy level to another, lower one, on an oscilloscope, and see the surface of distant planets with the help of satellite video cameras.

The research has shown that a culture visualization is a powerful tool for its popularization; visual culture itself is gradually becoming the predominant form of culture. In the information society, visualization of culture is essential.

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