Content analysis of visual elements in scientific journalism (on the example of the Website Postnauka)

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ABSTRACT

The article is devoted to the science journalism content analysis. This dynamic branch of modern media can be called topical since it helps readers to get the notion of unique scientific knowledge and to form a scientific worldview. That is especially up-to-date at advancement of technology, when various significant discoveries are constantly coming up. Present article brings a question what visualization methods are the most frequently used by various scientific disciplines. The answer to the question raised is resolved through the content analysis of the PostNauka website content.

CCS CONCEPTS

• **Human-centered computing** → **Visualization**; Empirical studies in visualization

KEYWORDS

Media, content analysis, scientific journalism, visualization.

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1 INTRODUCTION

In today's context, one needs to tap effectively into the knowledge of the environment one lives in. It is a continuous process. Various significant discoveries are constantly coming up. Therefore throughout whole life one will have to constantly adapt new information about the real world. Science journalism meets this need as it is aimed at dissemination and popularization of science. The task of science journalism is not only to inform, but also to analyze the information, to represent a prime cause and principle as well as the consequences of various phenomena. Most importantly it explains difficult things to the public. That is a burning topic of the day for scientific journalism: how to lay complex ideas and concepts so, that it is exciting for the reader? One of the possible solutions to this problem is to visualize the content. Since advancement of technology made it possible to use several methods of visualization, even within one product, especially for online media, it was decided to analyze one of the largest Russian popular science website, which is PostNauka. Its most frequently applied visual elements, used for science content creation in various scientific fields, are under consideration. An effective method of resolving this problem can be the content analysis of the website content within a certain time period, since the main focus is on quantitative indexes.

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2 THEORETICAL-METHODOLOGICAL BASE

2.1 Science journalism

Scientific events have always been an attractive item for public. However, in recent years, Russian science journalism has become even more popular. The interest has provoked a new research on the phenomenon. The researches suggest wide range of terminology and classification for the area [1–3]. Practical recommendations are offered for journalists working in this field, [4–5] as well as ways of content presentations, studied on the example of science media and programs. According to the scientific roundtable memorandum, organized by the editorial staff of the website STRF.RU, science journalism is pronounced necessary for many structures: for science itself, the state, business and society [6].

On the one hand, such interest occurs due to the spirit of the times. Advancement of technology allows us to make more and more large-scale discoveries and to receive answers to important questions, both in natural, social and human sciences. Person has to constantly update their knowledge and scientific base as well as understanding of the world will not become obsolete. In addition, the main educational institutions (such as school, college, university, etc.) are not always able to adapt and introduce updated knowledge and latest scientific discoveries into education quickly. That is how many myths and misconceptions are still imposed on students. Science media become the most operative and accessible interactor between science and public. On the other hand, some media experts (for example, Roman Abramov) associate the increased interest in science journalism with blogs boom and online media devoted to the

subject. That has become possible thanks to the Internet [1]. Firstly, the Internet allows the audience to find scientific expositor, communicating with the audience in an understandable manner. That is how stereotypes that science is boring and tedious are vanished. Secondly, an important component of the success of online scientific media is a possibility to use different formats and methods of visualization. Now journalists have got a lot of opportunities for visual and original presentations of complex information with the help of audiovisual and visual elements, as well as interactive formats, including games. The evidence of the visualization importance in today's journalism and scientific content can be found in the studies of the researchers [7–8]. Under conditions when a journalist is obliged to work with non-exclusive, secondary information, the task is not only to provide timely coverage, analysis and facts comprehension, but also their attractive presentation to the public. It's worth mentioning that visualization elements have been used in science journalism earlier. The high-quality photos in the magazine Vokrug Sveta may serve as an example. Svetlana Simakova has also mentioned the case in her studies [9] as well as TV-programs on the Russian channel Science 2.0. But they all are traditional mass media. In contrast, online media combine both usual ways of visualization, and completely new ones, that exist only in the digital space, quite successfully.

2.2 Visualization of information

Conventionally, media content can be divided into verbal and visual. And, despite the fact that it is verbal content that is traditionally considered the main medium, an important task is not only to write a text, but also to find the most appropriate method for information visualizing in each particular case in modern convergent multimedia journalism.

This is due, first of all, to the needs of the audience, which is submerged by information and has less and less time to look it through. After all, the perception of visual information often does not require a serious and deep studying. It is understandable to a reader and is quickly memorized.

Another reason for the popularity of visual information delivery methods lies in the main trends of modern media. That is working with large data sets, publishing material on several platforms at once, targeting different types of receiver devices (from personal computers to mobile phones), and interactive communication with the audience. Information visualization partially helps to achieve these tasks.

According to Viktoria Shevchenko [10], the term visualization can be interpreted as a way of conveying information in a graphic way, non-verbally. Although one of the main media theorists Marshall McLuhan [11] noted that the written culture, that we are accustomed to, in contrast to the visual one, is non-verbal, since a written word is perceived not by hearing, but visually. If to accept this point of view, we can conclude that each graphic character (letter, sign) is an element of visual communication.

At the moment there are many ways to visualize data. They are photos, illustrations, infographics, timelines, videos and so on. And each of them is studied in sufficient detail and classified by media researchers. Therefore, it is possible to identify the most appropriate areas for their application. It should be noted that Swiss researchers R. Lendler and M. Epler have even proposed a periodic system of visualization methods, [12] in which 100 visualization methods are grouped into six clusters: Data Visualization, Information visualization, Concept visualization, Strategy visualization, Metaphor visualization, Compound visualization. Understanding the basic features of these forms of visualization allows identifying the method, most closely suited to any task and purpose of a content item. Therefore, depending on a case, journalists apply both the simplest forms (drawings, photographs,) and more complex (dynamic infographics, timelines) for their materials. The main advantage of visualization is that it helps public to get the information better and quicker, not simplifying the content. That is how a visual content functions as good in the quality and depth of disclosure of the stated topic as purely textual format. A successful combination of different information transfer methods allows selecting for every piece of information the most optimal public presentation method.

2.3 Content analysis

For the first time, the content analysis was theoretically developed and described by sociologists Harold Lasswell and Bernard Berelson and was applied in the 1930s in the USA. Initially, it was used in the social sciences: literary criticism and journalism, as well as in political studies. Later, during the Second World War, the method was applied in publicity effectiveness analysis. In 1952 Berelson described the content analysis in the study "Content Analysis in Communication Research" [13]. The research represents the main provisions of content analysis. It contains the method definition, its varieties systematization, cited criteria and units of quantitative research. Subsequent to the study, a lot of scientific researches appeared, in which the content analysis was successfully applied.

Content analysis is based on the statistical counting of the selected units of a text. The method provides high methodological potential due to the fact that almost any component of the material can act as a unit of the counting. It can be done both verbal (word or phrase) and visual (image, audio and video). Data reliability and accuracy of media is rather high due to thorough content units selection and strict mathematical calculation. At the moment, two main approaches to the content analysis are distinguished: qualitative (search for meanings, their interpretation, formulation of the analyzed source context) and quantitative (random selection, units frequency). That is, qualitative content analysis, which we do not address in this study, as opposed to quantitative, focuses not on the units frequency, but on certain topics, symbols and other things that have caused scientific interest.

Since we have applied quantitative content analysis as the main method for the research, it is necessary to mention a few more basic concepts, necessary for further discussion. Category of analysis is a research problem, ideas or topics. The category of analysis of the present article is the occurrence of separate visual elements in science media. The unit of analysis is the part of the content that belongs to a particular category. In our case these are visual elements of a publication. It is important not only to find the units, but also to count them. To do this, we need a unit of count. It is a number of content parts of interest occurrences measure. In this study, the unit is visualization of different kinds (image, video, and so on). After counting the selected units, we turn to the analysis and interpretation of the data.

3 RESULTS AND DISCUSSION

3.1 Content analysis of visual elements

For the analysis, we selected the content of one of the largest and most popular Russian science website PostNauka. It's worth mentioning that the website mission is to report the public nowadays fundamental science, shifting the emphasis from the applied to the fundamental one, as well as to cover present-day theories, ideas, concepts, laws and notions. The website exists since 2012. During this time (according to the website data), more than 3,500 materials are published, and more than 800 scientists from different research fields, including Nobel laureates, take part in the project. The daily audience of the portal is more than twenty thousand people. All authors on the website, are scientific experts.

We have selected PostNauka content under the period from January to May 2018. The total number is 171 items. Since there is a convenient system of headings on various scientific disciplines on the website, it is easy to divide the whole content into two main categories: social plus human sciences (history, psychology, sociology, philology, culturology, economics and philosophy) and natural sciences (astronomy, biology, physics, mathematics, medicine and chemistry). In the first category, respectively, there are 98 materials; in the second there are 73.

Also it is worth mentioning the text design. A single-colored pale beige substrate is used as a background. The black text suits it perfectly. The main font used in all publications is Helvetica. It is one of the most popular sans-serif fonts. The body-size for the main text is 13.5, for the headlines is 25.5. Italics are applied to highlight the lead and important semantic elements in the text. Alignment of text is set to the left, there is a small interval between paragraphs. Also, in each material, hyperlinks and footnotes are necessarily available. All together it provides the most comfortable conditions for reading lengthy written submissions, which occur very frequently met on the website. But most likely, even these positive features could not keep readers if the whole content consisted of plain text. Therefore, we turn to the analysis of content visual elements.

Website visualization means with their specified features are following.

• Illustration is a picture, photo or any other image, explaining the text. It is used as a cover of an article or addition to its various parts. On PostNauka there are two formats for making illustrations: small images that do not go beyond the boundaries of the text, and large images, stretched over the entire width of the screen.

• Video is an animated video sequence or a slide show with the ability to overlay text or audio tracks. Usually it has a short duration, which is about 5 minutes. Videos give the basic concepts or features of the phenomenon described. Sometimes film trailers are posted on the website to the selections and tops.

• Video lecture is a lecture by a specialist, recorded from one angle without imposing additional effects. The viewer watches a medium shot or a close-up of a lecturer, as a rule, sitting against a white wall, clearly explaining the stated topic. The average length of the video is from 10 up to 20 minutes.

• Reference represents some additional information of the key points of a publication. It appears to the left corner of the main text. It includes one or several elements at once (text, illustration, hyperlink). Most often it gives the general idea about significant characters, terms, phenomena and dates, connected with the topic of an article. It also gives extra information about what is mentioned briefly in the main text or offers additional sources on the topic.

• Division into sub-headings is a breakdown of the material into several semantic parts, having its own title. The number of subheadings in one article is from two to eight.

• Schema is a model or infographics that depicts a device or a connection between parts of something. It is presented as a static simple illustration and does not require a focus.

• Animated image is a looped short moving image in GIF format. It is used exclusively as a cover of a material, mainly for large special projects to attract the attention of the public.

• Test is an interaction with the audience, offering readers online quizzes. For each quiz, one selects own thematic background. Each question provides an illustration and a text. For example, "How is the brain arranged?" quiz holds a computer image of neural networks of the brain as a background bottom layer.

• Gallery includes several images (from two to five). Readers are able to switch the illustrations on their own by means of arrows, located on the right and left in the image.

• Thesaurus is a small dictionary of special terminology, selected according to the stated subject. Each individual term is designed in the same way as the subtitle. It is followed by a short scientific concept description.

• Quotation represents a graphical highlighting of an important text element. It is formed in the same font as the subtitles, with an indent from the text. A short conclusion from the preceding text or an important fact from the life of the person described is highlighted this way.

All of the above-mentioned elements are used only in combination with a text. We have not found materials that consist only of visual elements.

After calculating the means of visualization, presented on the website, we provide totals in Table 1. The number in each line indicates the visualization means usage frequency in analyzed content. The number in brackets next to it indicates the amount of materials in which the visualization means is applied.

Table 1. Frequency of visual elements usage in website PostNauka content

Visualization means	Social and human sciences	Natural science
Content (publications number)	98	73
Illustration	97 (34)	63 (28)
Video	31 (22)	14 (11)
Video lecture	47 (47)	29 (29)
Division into sub-headings	24	19
Reference	24 (4)	30 (5)
Scheme	3 (2)	18 (10)
Animated image	4 (4)	6 (6)
Test	6	4
Quote	–	6 (3)
Gallery	1	2 (2)
Thesaurus	1	1

3.2 The received data interpretation

From the data obtained, the following conclusions can be drawn:

1) The most popular means of visualization on the website are video lectures, which are presented in 44.4% of publications. Moreover, this trend does not depend on the scope of scientific knowledge. The lectures recorded on video are found both in the social and human sciences, and in natural sciences. In our opinion, this trend is related to the popularization of video content caused by the blogging boom. It is more convenient to watch a video (this process can be combined with other activities) and is easier than reading a text. In addition, the creators of the portal stated that one of their main tasks is the transfer of scientific knowledge from the first mouth, on behalf of the experts themselves. A video format in this case is a success. However, readers can choose a way of information consumption, convenient for them, since each video lecture is accompanied by a detailed textual summary on the website.

2) The most common means of visualization is a traditional illustration, the total number of which is 160 units. However, only 36% of the content include illustrations. That allows speculating that, as a rule, the means of visualization is integrated into an article several times. The illustrations analyzed, provide two main functions: to attract attention of a reader and to supplement or visualize the text content. And in the humanities and social sciences, illustrations often perform the first function, while in the natural, respectively, the second.

3) Videos on the website occur less than video lectures and are present only in 19.3% of the content. Perhaps, this is due to numerous pre-production steps: video range and audio elements, writing a script or rendering an animated video. However, in our opinion, such materials are more preferable to the public, since the phenomena described are more comprehensible and more interesting.

4) The meaningful part of the content selection by sub-headings is used quite seldom. Only in a quarter of the content (25.1%), despite the large volume of almost all analyzed materials. For example, in video lecture notes this method does not occur at all. The sub-headings help reading, complex materials and systematizing information.

5) Reference, like the illustrations, is applied several times within a framework of one article. Despite the impressive number of 54 units, a similar means of visualization is registered only in 9 materials (5.2% of the total number of content).

6) Schemes and quotations are more often used in the content relating to the natural sciences, especially for materials on biology and astronomy. This can be related to the peculiarities of the industries.

7) The animated images serve as an alternative to illustrations, but are applied much less. There is only 5.8% of the analyzed content. Most likely the main reason for this lies in the fact that suitable GIF-images are more difficult to select or make independently than conventional pictures and photographs.

8) Tests on the website occur with the same frequency as the animated images. But, perhaps, due to the format peculiarities, it should not be applied too frequently. After all, as means of information visualizing and gamification can lose the audience quickly. Therefore, the frequency of using the quiz format is satisfactory.

9) The gallery and the thesaurus are found only in few content items. The formats do not require much production effort, and help in the information assimilation.

10) In these materials we are unable to find examples of some modern means of visualization inherent in the digital space: dynamic infographics, timelines and mini-games. Similar formats have been used earlier as parts of big special projects, but because of their date of access to our collection for analysis, they are not included. As on e can see, journalists are familiar with these means and tools, and recognize their value, but, perhaps, due to a lack of resources (editorial personnel or finance), they cannot afford to use it more often.

4 CONCLUSIONS

The obtained data allow us to draw a conclusion about the need for visualization in the sphere of science journalism. Out of 171 materials analyzed, there is none of visual elements, which would not be applied. Due to the received data, we make conclusions about the frequency of use or lack

of application of visualization methods in the content of one of the most successful Russian science journalism websites. The described field of scientific interest (social and humanitarian or natural) in most cases does not affect the choice of the visualization method. It depends on a case, purpose and the format of a material. Only a few individual methods of visualization (quotations and diagrams) relate mainly to one of the spheres.

The visualization methods help in mastering the material and promotion of science journalism are under further exploration. Plain text, text with infographics or/and illustrations and video provide a triple approach of delivering information in each piece of content. In the course of the discussion it will be established whether it is convenient to receive information in one form or another, whether the audience percept the broadcast material, whether it is interesting for the public to get acquainted with it. Next step, that is going to be undertaken, is a test (provided twice: after 10 and 30 days), which shows the long-term knowledge. It is to figure out the most interesting and effective ways of presenting information in science journalism. The data, presented in the framework of this article, is supposed to have commercial value.

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