

Media effects and the impact of fake and anti-fake news on youth audiences: The use of eye-tracking technologies

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Abstract

This paper analyzes media effects of fake and anti-fake journalistic materials and their impact on youth audiences. The paper deals with fake news as a relevant problem of the modern information society and defines the term “anti-fake” as a way to combat Internet fakes. A sample of fake and anti-fake news was formed from 100 informational political materials. The selected media texts were marked as “fake” and “anti-fake”. The research was based on the main provisions of the cognitive approach in the investigation of media effects within the framework of interrelated models: agenda-setting and framing (analysis of the content and form of presenting information). The main results of the research identified the key patterns of the respondents’ attention and areas of interest (“image”, “text”), as well as their attitude to the proposed stimuli. The research was based on eye-tracking and a survey. The results showed that anti-fake and fake news attract the respondents’ attention; however, anti-fake materials have the maximum impact on the respondents in terms of the number of fixations on the stimulus, the level of memorability, and the level of credibility. “Fake” and “anti-fake” warning labels affect significantly the perception process.

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Keywords

Media effects, framing, agenda-setting, fake, anti-fake, youth audiences.

Introduction

The development of the Internet, information and communication technologies has enabled people to quickly receive and spread news messages (Jamil et al, 2022). The number of media channels and the amount of disseminated information and misinformation on the Internet has increased dramatically (Simons, & Manoilo, 2021). The main field of misinformation activities is information and psychological operations, which are becoming more aggressive and targeted through the use of fakes, and youth audiences are among the main targets of impact.

The future of society depends on how this category is socialized and how it perceives information. Among various groups of young people (scientific and creative intelligentsia, school students, etc.), a significant part is made up of students. Student youth (Mikhaylovskaya, 2014) is not only the most active and dynamic part of any society, objectively it is its future, since it will soon have to determine the fate of the country in a decisive way. The student youth is of interest as a generation that, due to its significant educational level, active working age, dynamic social behavior, will take the place of the main intellectual and productive social force in the near future. At the same time, the information impact aimed at deforming the consciousness of young people to blur their values and moral and ethical standards has recently intensified.

Fake news unintentionally and intentionally spread by various political actors have become part of the daily “news menu” (Albright, 2016; Allcott, & Gentzkow, 2017) of Internet users. The social, political, and economic consequences of the mass distribution of fakes (Sternin, & Shesterina, 2020) are devastating to society; they sow confusion, contribute to the incorrect political orientation and mobilization of citizens, and form a sense of anxiety and uncertainty. The situation is aggravated, on the one hand, by the speed of spreading fakes on the Internet and, on the other hand, by the fact that youth audiences, unable to distinguish between reliable and fake information, spread themselves misinformation.

Fake news is a multifaceted area of research, in which scholars focus on various aspects: essence, typology (Wang, 2020; Allcott, & Gentzkow, 2017; Tandoc, Lim, & Ling, 2018, etc.) and the functional role of fake news (Chatterjee, Chaudhuri, & Vrontis, 2022); psychology of fake news (Pennycook, 2021; Greifeneder, & Newman, 2020, etc.); politics and fake news (Ognyanova, Lazer,

Robertson, & Wilson, 2020, etc.); journalism and manipulative techniques in fake news (Ilchenko, 2015; Sternin, & Shesterina, 2020; Manoilo, 2019; Perez-Escoda, 2022, etc.), morphological analysis of fake news (Kapusta, Hajek, & Munk, 2020, etc.). However, today we face a problem of fragmentation and inconsistent knowledge about media effects and the impact of information (fake and anti-fake messages) and the responses of youth audiences to them. Methods quantifying the perception of misinformation by young people and their responses have almost not been studied. The effectiveness of the insight into the impact and responses of young people to fake and anti-fake news can be upgraded using neuromarketing technologies (Lobodenko et al, 2022). Real-time neuromarketing studies record individual unconscious physiological reactions (pupil movement, changes in the activity of various brain regions, etc.) to various media stimuli, as well as assess potential memorization, cognitive load, and involvement in viewing, identifying features of text perception and attention patterns. This generally determines the relevance of adequate measuring the audience behavior.

Besides, despite the growing number of studies on combating fake news (Tandoc, Ling, & Westlund, 2018), there is no adequate review of the impact of fake news on the society and various audience groups. Giglietto et al. (2019), Grundmann (2020) and Dentith (2018) talk about a research approach based on considering the producer. Giglietto et al. (2019) proposed to go beyond the initial stage (producer of misinformation) using an interdisciplinary approach. The purpose of this work is to identify and compare the effects of fake and anti-fake political messages on youth audiences using eye-tracking and sociological research methods (survey).

In this paper, the scientific focus is shifted from the dominant area of studying the information and misinformation producer to a new area of unconscious and conscious consumer responses (cognitive, affective) to fake and anti-fake messages, which makes this interdisciplinary research relevant.

Based on the stated relevance and for the future development of the issue of the impact of fake and anti-fake news, we outlined the hypotheses tested during the research:

- The respondents react to both fake and anti-fake news due to the emotional presentation of information;
- “Fake” and “anti-fake” warning labels fall into the zone of the audience’s attention and set out the direction of perceiving messages;
- The respondents pay more attention to the text (headline, body text) in fake and anti-fake news than to the image.

Theoretical framework

Modern civilization is characterized by the development of the Internet and the globalization of the communication space. The Internet embodies the entire diversity of human life, from “facilitating interpersonal relationships” (Ledbetter, Mazer, & DeGroot, 2011), “influencing personal well-being” (Kim, & Lee, 2011), “facilitating social coordination” (Ling, & Lai, 2016) to the formation of “news consumption” habits (Lee, & Ma, 2012).

The Internet provides users with freedom of opinion and information, as well as huge flows of news information. However, the negative aspect of this phenomenon is the appearance of trolls, bots and the fact that the news flow in the digital media space is “accompanied by the spread of misinformation” (Tandoc, Lim, & Ling, 2019) fairly characterized by scholars as a challenge of the digital media space (Simonova, 2022). Quoting the words of the Spanish journalist I aki Gabilondo, one can say that “during the flood, drinking water is most scarce” (Perez, 2019).

In the recent past, news was generated and spread through traditional media (newspapers, magazines, television, radio) acting as an authoritative source of information. The rapid spread of news and messages on the Internet has changed news industry practices (Westlund, 2013). In the age of the Internet, many new media channels have emerged to deliver news (online news media, news aggregation sites, content farms, and social networks). Fake news or “camouflage content” disguised as news floods the Internet with fakes, propaganda, hoax news, which mislead with their content, false, and manipulative information (Perez, 2019).

The concept of fake has become widespread today. However, despite the high interest of scholars from different scientific fields, the scope of this phenomenon remains disputable. A wide range of heterogeneous phenomena are considered fakes. Wang (2020) notes that several terms are used interchangeably to define fake information, for example, fake information and false information; the terms misinformation and mal-information are close in meaning to these concepts. In the variety of terms somehow related to fake information, the scholar also identifies news satire, ‘yellow’ journalism, junk news, pseudo-news, hoax news, propaganda news, advertorial, alternative fact, misinformation, and fake news.

Scholars showed that the scientific literature has various definitions of this term based on two levels: facticity and deception (Tandoc, Lim, Ling, 2018). Considering the features of these levels, Kornev (2018) points out that fake errors are unintentional, passive (typos, inaccuracies, inattention), while fake deceptions are deliberate, active fakes (characterized by bias, prejudgment,

dependence, and engagement of the author; they contain conscious manipulative structures). In the second case, there is an ulterior motive for manipulating the audience.

In turn, Rini (2017), clarifying the scope of the term “fake”, suggests that fake news should not be identified with false news, i.e., not only false information, but also content intends to deceive and falsify the journalism industry. More recently, the term began to refer to false or misleading information fabricated to look like a fact-based story (Nelson, & Taneja, 2018).

The analysis of scientific works shows that the term “fake” is often defined as “the intentional presentation of false or misleading statements to manipulate the cognitive processes of the audience” (Bilos, 2019). The Merriam-Webster Dictionary (2020) emphasizes that the definition of the word “fake” leads us to forgery, fraud, imitation, replica, or pretense”. Allcott and Gentzkow (2017) also define fake news as news deliberately created to mislead readers.

In the conditions of aggravated information confrontation, “fake news coverage” is almost officially legalized in media activities. A fake “as a specific format for working with information and its sources in this way turns from a purely entertaining, postmodern fun or game of Internet fans into an unexpected and effective tool for political struggle” (Ilchenko, 2015). As modern researchers note, “fake is understood as a deliberate distortion or framing of reality, and fake news is news items based on a deliberate distortion of facts, created to derive certain benefits (for example, increase traffic or citation)”, as well as for the political benefit of global political players (Voronova, 2022).

In order to respond to the destructive effects of fake information in the media space, there appears a new “anti-fake” format. The technologies for creating this format are actively used in the modern Internet space. However, there is still no scientific interpretation of this phenomenon. We propose to define the term “anti-fake” as a message created and spread in the media space in response to a fake message, including the results of validating published information and the exposure of false, misleading statements, as well as the description of the real (actual) state of affairs. The main function of anti-fakes is to counteract the processes of manipulating the minds of the audience and the negative information-psychological impact.

The practice of marking fakes and anti-fakes with warning labels is quite actively developing on the Internet. R.H. Grady et al. (Grady, Ditto, Loftus, 2021) note that “if people were warned that information is unreliable before receiving it, they processed it differently and, over time, persistently did not believe it.” This is consistent with other studies on correcting misinformation, since

warnings about upcoming misinformation are more effective than correcting the information after, though these warnings do not offer complete protection (Ecker, Lewandowsky, & Tang, 2010; Loftus, 2005).

The study of fake news becomes particularly relevant in the context of constantly changing communication technologies. It is essential to determine media effects and the impact of fake and anti-fake news on the audience, as well as how users react to fake news and its refutation they face with (Tandoc, Lim, & Ling, 2019). At the same time, the information and psychological impact of fake information can be directed both to an individual and a group of people, or to public consciousness in general. It is aimed at changing such mental areas as need-motivational, intellectual-cognitive, emotional-volitional, and communicative-behavioral areas (Manoilo, 2003). The mechanisms most subject to changes and transformation are beliefs, stereotypes, and attitudes (Shmelkova, 2018).

Evidently, news has value, and the reasons why people read news affect what they will go in for to authenticate a story. People rely on their own judgment about a source and a message, and when it does not give an adequate answer, they turn to external resources to verify news. These verification strategies may involve intentional information search in their social sphere or other institutional sources. Alternatively, verification may be random. Verification can simply arise from the process of interacting with friends or consuming media (Tandoc, Ling, & Westlund, 2018).

Tsfati and Cappella (2005) summarized the motives for consuming news to include social integrative (to be part of a conversation), observational (gathering information that will help in everyday life), mood management (stimulation when you are bored), and cognitive needs (understanding the world, political life, pros and cons of the topics discussed). In order to achieve goals, fake news creators take into account these social needs, as well as the conditions for verification and spread of news by the audience in the digital media space. Majority of fake news is targeted to a specific sample of the population with the aim of promoting a certain ideology by stimulating strong beliefs and polarizing society (Chen, & Sharma, 2013).

At the same time, the specifics of information and communication in the digital environment – its clipping and streaming nature, appeal to emotions – hinder the development of analytical thinking and make youth audiences that grew up in this environment receptive to this kind of information, which requires a detailed study of media effects on youth audiences.

Studying the impact and media effects of information and misinformation is of particular relevance when fake information deliberately distorts the real course of events and is massively spread. At the same time, while the investigation of the media impact in the science of communications occupies a leading place (McQuail, 2010), media effects of fakes and anti-fakes have not been fully studied yet.

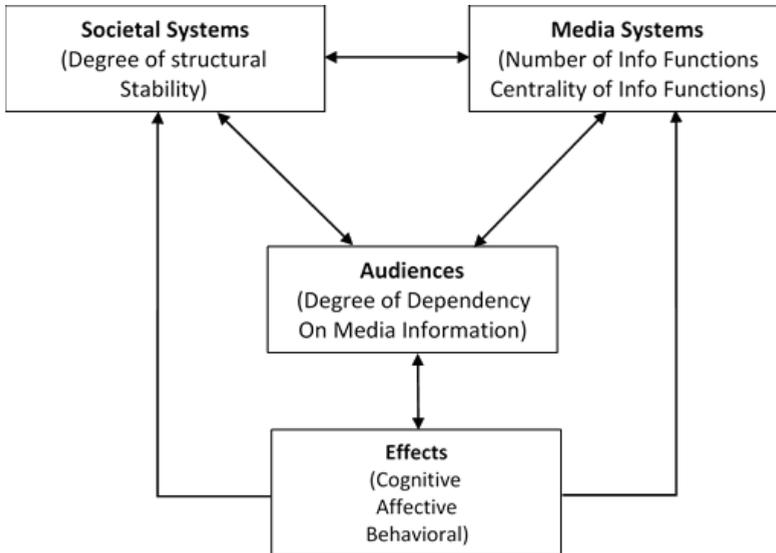
Research aimed at studying the media impact on the individual and society has become one of the most developed areas in the science of communications. The study of media effects is represented by a fairly extensive publication database (McQuail, 2010). Researchers analyze the media impact on changes in cognition and beliefs, as well as emotional and behavioral effects. The authors emphasize that the impact of a media message on the representatives of the audience depends on many factors (demographic data, psychological characteristics, etc.). Media effects can be positive or negative, short-term or long-term, direct or indirect.

The term “media effects” has been widely interpreted in the scientific literature. In the paper, we define media effects as “conscious and unconscious short-term and long-term intrapersonal changes in cognitions, emotions, attitudes, beliefs, physiology, and behavior resulting from using the media (Valkenburg, Peter, & Walther, 2016).

In the communication process, the perception of messages is expressed in the effects on human consciousness. Thus, the subject of the “Society, Media and Audience: Reciprocal Relationships” conceptual model proposed by well-known specialists Ball-Rokeach and DeFleur (1976) is the structural conditions of society realizing mass media effects (see *Figure 1*). The main idea of the concept is that people become maximally dependent on the media in a situation of changes, conflicts and instability in society. Within the framework of the model, the authors focus on the following set of media effects: cognitive (formation of attitudes, definition of “agenda items”); affective (appearance or formation of emotions); behavioral (activation of old or new activities). The probability that views and images broadcast by the media penetrate into the consciousness of the target audience is the highest in the conditions of uncertainty (Semenova, & Korsunskaya, 2010).

Figure 1

Society, media, and audience: Reciprocal relationships



Source: Ball-Rokeach, & DeFleur, 1976

As society becomes more complex and the quality of media technologies improves, the media constantly assume more and more unique informational functions. The potential of media messages to achieve a wide range of cognitive, affective, and behavioral effects will keep on growing as media systems exercise many unique and centralized informational functions.

According to the theory of Ball-Rokeach and DeFleur, a high level of dependency on media information is a key interactive condition in understanding when and why media messages alter the audience beliefs, feelings, and behavior. Dependency is defined as a relationship in which the satisfaction of the needs or goals of one party depends on the resources of the other party. This state can be encountered when the user verified the received information. Media messages affect human needs, psychological and social characteristics.

Neuman and Guggenheim (2011) analyzed almost all publications on the theory of media effects over fifty years and identified six historically consistent clusters in the theory of media effects. The fifth stage, which includes related traditions of the theory of agenda-setting and framing, is relevant for our research. The authors do not only prove the significant impact of media, but also

explore how the impact can affect the perception, interpretation, and cognitive organization of information and opinions to which people are exposed:

- agenda-setting (Lippmann, 1927; McCombs, & Shaw, 1972) – the impact of the media on society and the individual *through the structuring of the information field* and “assigning” the degree of significance to various topics and plots;
- framing (Goffman, 1974; Gitlin, 1980; Entman, 1993) – the impact of the media on society and the individual *through the form of presenting information* framing the *meanings* and relationships between the publicized objects in such a way as to frame a certain model of perception/interpretation of this information.

Notably, the key problem in the study of media effects is the concealment of the true feelings of the audience through psychological screens, including the screen of consciousness, the screen of tolerance, the screen of courtesy, the screen of conformity, etc. To this end, the use of neuromarketing technologies becomes relevant for studying media effects.

Neuromarketing is an innovative line of research, the subject of which is human unconscious cognitive and emotional reactions to certain stimuli. Neuromarketing technologies allow tracking and “measuring” indirect reactions to a stimulus (individual physiological reactions: pulse and respiration rate, pupil movement), i.e., measuring interest and attention patterns.

In psychology, attention is defined as the process and state of setting a subject to perceive priority information and complete tasks (Tsfati, & Cappella, 2005). The orientation and concentration of mental activity during attention provides a more effective perception of information. In general terms, there are two main types of attention: involuntary and voluntary (selective). The level of distribution and switching of attention is considered as a psychological characteristic and an integral indicator of performance under cognitive loads. In our work, we used eye-tracking (or oculography) to capture gaze motion, patterns of visual attention, and areas of interest.

One of the leading and most studied functions of attention is the selection of relevant information. The applicable experimental data and theories allow that relevant information can be selected on different bases depending on the task to be completed. Thus, information can be searched for and selected highlighting individual essential features, which can be conditionally designated as areas of interest.

In general, the media can affect the feelings and thoughts of the audience, form attitudes and stereotypes, and influence the behavior of various subjects.

Media effects, which are “perhaps insignificant within a single communicative event, can provoke significant social shifts due to their cumulative nature” (Aslanov, 2021). In these conditions, the study of media effects and the impact of media messages on the audience’s opinions seems relevant.

Methodology

The reliability of this research is ensured by the extensive empirical material and the system of its study, as well as the use of an interdisciplinary approach. The work is based on a set of methods, namely comparative analysis, document analysis with elements of content analysis, as well as visual neuromarketing – eye-tracking and survey.

Special attention was paid to eye-tracking technologies which use video recording to register eye movement, gaze direction, the duration of visual fixation on an object and to determine the degree of focus and the sequence of viewing information. Visualization methods used in eye tracking clearly and accessibly represent dynamic processes through quantitative indicators, thus improving the comprehension of the available data. They include fixation sequence maps and heat maps. The main eye-tracking indicators used in the research are the number of fixations and the average duration of fixations. Fixations are used to calculate the time spent on viewing a particular spot, which reflects the attentional involvement and time needed to process the stimulus at that spot. The average duration of fixations is related to the speed at which the brain processes information.

Heat maps demonstrate the statistical and dynamic integration of all points of the respondent’s gaze by overlaying a color gradient on the presented image. They show which elements of the stimulus attracted maximum attention: “warm” red areas correspond to more gaze points (maximum interest), cooler yellow and then green areas correspond to fewer gaze points (lower interest).

An important element of the eye-tracking research procedure is the areas of interest of the stimulus material, which are a tool for selecting areas of focus on the presented image. The calculation of such indicators as the number of fixations and the average duration of fixations is determined by areas of interest.

The Gazepoint GP3 HD eye-tracker with a sampling frequency of 150Hz and the Gazepoint Analysis software were used to prepare, conduct, and analyze the results of the experiment. In the experiment, the respondents were shown stimulus materials separated by neutral images on a 24-inch monitor. The experiment lasted for 20 seconds. As a result, we obtained metrics of views,

fixations, returns to the area of interest, time to the first fixation, etc. and built heat maps. The eye-tracking study was followed by a survey.

The experiment was based on the analysis of social media content (Telegram). At the initial stage in selecting the stimulus material we analyzed the content of “WarFakes”² telegram channel (according to the official website of the Ministry of Education of the Russian Federation, it is an authoritative channel specializing in the exposure of fakes on acute facts) for the period 28.02.2022 – 01.05.2022.

The starting point for the beginning of the study (28.02.2022) and the collection of fake and anti-fake information was the statement of the Permanent Representative of the Russian Federation to the UN Vasily Nebenzya during a meeting of the UN Security Council that an information war has been unleashed in social networks³.

The stimulus material was selected by five experts and agreed upon at a collegiate discussion by the team of authors. Media texts were selected based on the homomorphism principle (unity of form) and included image and text (headline, body text). More than 100 messages about current political processes were studied and 12 messages were selected for the research (six fake and six anti-fake messages). Fake and anti-fake messages were selected on the subjects mostly discussed in the media space. All selected the materials were marked with “fake” and “anti-fake” warning labels.

The participants of the experiment were 78 students (bachelors and masters) of humanities and technical specialties of the South Ural State University aged between 18 and 22 years old, who agreed in writing to participate in the study and were informed about the content and progress of its conduct. In the course of the study, respondents were asked to familiarize themselves with the incentive material on the topic using tracking technologies that analyze the unconscious reactions of participants, and then all respondents took a survey aimed at analyzing the conscious perception of the information presented. Respondents individually participated in the study in the period from 01.06.2022 to 30.09.2022. Viewing the incentive material and passing the survey by the participants took no more than 20 minutes. This pilot research was aimed at determining the effectiveness of the impact of fakes and anti-fakes, agenda-setting for the audience, as well as framing by analyzing attention patterns and responses of the youth audience by areas of interest.

² <https://tgstat.ru/channel/@warfakes>

³ <https://iz.ru/1297914/2022-02-28/nebenzia-zaiavil-o-razviazyvanii-protiv-rf-informatcionnoi-voiny>

Results

Eye-tracking research results

The purpose of our research was to analyze the media effects of fake and anti-fake materials and their impact on youth audiences. The study was conducted in three stages: 1) studying the current media space, selecting stimulus material and categorizing it into fakes and anti-fakes; 2) conducting an eye-tracking research and an online survey; and 3) processing the obtained results.

The first stage of the research included sampling of 12 messages (six fake news items and six anti-fake news items refuting the selected fake news items) out of 100 news items on political topics according to their frequency on Telegram-channel. They were devoted to the following topics: *Tragedy in Bucha*, *Strike on Kramatorsk*, *Maternity hospital in Mariupol*, *Ghost of Kiev*, *Chemical weapons in Mariupol* and others. Each stimulus was assigned a code (see *Table 1*) of the letter 'S' and a two-digit number (for example, S01). While forming the sample and thematic sections, five experts analyzed the stimuli to meet the following criteria: content (relevance of the political topic); active public discussion on the Internet. The stimulus material was preliminarily categorized into areas of interest: a headline, a text, an image. All the selected materials were marked with warning labels, i.e. 'fake', and 'anti-fake'.

The second stage of the experiment involved the use of eye-tracking technologies, and the participants were shown selected stimuli randomly for 20 seconds each. After the eye-tracking research, all respondents participated in a survey aimed at revealing their conscious perception of the presented information. The survey was aimed to determine the efficiency of the materials' impact and identify the agency-setting for the audience; and to identify the attention and reaction patterns of the youth audience by areas of interest (frames).

Table 1

Topics and stimuli codes (anti-fakes, fakes)

Stimulus code	Warning label	Headline	Date	Average number of fixations, units
S1	Anti-fake	The massacre in Bucha is a fake, and here's why	03.04.2022	59.200
S2	Fake	An eyewitness of the massacre in Bucha	29.04.2022	65.867
S3	Anti-fake	Strike on Kramatorsk: ridiculous accusations and a reason to ask for more weapons	08.04.2022	63.714
S4	Fake	Tragedy in Kramatorsk	10.04.2022	63.400
S5	Anti-fake	A girl-blogger from Mariupol maternity hospital told how she was involved in a fake story	03.04.2022	63.857
S6	Fake	A pregnant woman died in Mariupol after a maternity hospital was bombed	14.03.2022	59.533
S7	Anti-fake	Looting or not?	22.04.2022	66.929
S8	Fake	A new wave of looting in Mariupol	19.04.2022	63.267
S9	Anti-fake	Ukrainian Air Force Command recognized the 'ghost of Kyiv' as a fake	01.05.2022	64.786
S10	Fake	The 'Ghost of Kiev' has already destroyed 15 enemy aircraft	28.02.2022	60.933
S11	Anti-fake	'Sarin' in Mariupol. Is 'Russian use of chemical weapons' a fake?	13.04.2022	55.067
S12	Fake	Russia used chemical weapons in Mariupol: victims in relatively good state of health	13.04.2022	67.067

The eye-tracking research on the media effects of fake and anti-fake online media materials involved the indicator of the average number of fixations' (units) of respondents' views on the stimulus and its areas of interest, which shows the attention and interest of the audience. The use of the obtained results revealed the leading topics in the information agenda, the most interesting for the target audience (Table 1).

Thus, the leaders of the information agenda according to the total number of fixations of gaze (from 65.867 units to 67.067 units) are stimulus S12 (fake) with 67.067 units of fixations. The second place is held by stimulus S7 (anti-fake) with 66.929 units of fixations, and the third place belongs to stimuli S2 (fake) with 65.867 units of fixations and S9 (anti-fake) with 64.786 units (see Figures 2-4).

Figure 2

S12 (fake)



Figure 3

S7 (anti-fake)



Figure 4

S9 (anti-fake)



Thus, the analysis of the impact of fake and anti-fake materials of online media showed that the fakes about the use of chemical weapons, the tragedy in Bucha and anti-fake materials refuting the looting in Mariupol, as well as the existence of the military pilot ‘Ghost of Kiev’ attracted the greatest interest of the respondents. According to the areas of interest, the attention of the respondents was distributed by text and image areas (see *Table 2*).

Table 2

Text and image areas of interest

Code	Warning label	Area of interest	Average time of viewing (sec.)	A share of total duration of viewing stimulus material (%)	Average number of fixations, units
S1	Anti-fake	Text	11.111	55.556	39.714
		Image	1.166	5.829	7.000
		Headline	0.732	3.658	4.083
		Monument	0.162	0.810	1.375
S2	Fake	Text	10.409	52.047	36.533
		Image	3.038	15.189	14.733
		Headline	1.640	8.198	9.600
		people1	0.066	0.329	1.500
		people2	0.207	1.035	1.714
		people3	0.141	0.704	2.400
S3	Anti-fake	Text	8.574	42.868	29.643
		Image	3.323	16.615	15.429
		Headline	1.268	6.340	7.462
		Weapon	1.038	5.189	5.071
S4	Fake	Text	7.595	37.973	26.800
		Image	3.300	16.502	14.533
		Headline	2.220	11.100	13.929
		People	1.049	5.244	5.133
S5	Anti-fake	Text	6.090	30.449	24.462
		Image	6.685	33.425	27.143
		Headline	1.313	6.566	7.000
		People	4.082	20.411	16.357
S6	Fake	Text	8.092	40.459	30.667
		Image	3.945	19.725	16.143
		Headline	1.579	7.894	8.308
		People	1.684	8.419	7.231
S7	Anti-fake	Text	6.149	30.744	45.566
		Headline	0.956	4.780	4.769
		Image	1.521	7.607	7.538

**Media effects and the impact of fake and anti-fake news
on youth audiences: The use of eye-tracking technologies**

S8	Fake	Text	3.562	17.808	13.214
		Image	5.957	29.785	22.867
		Headline	2.677	13.386	14.733
		Buildings	2.600	13.001	10.333
S9	Anti-fake	Text	8.247	41.234	36.804
		Image	2.821	14.103	19.514
		Headline	1.208	6.042	8.071
		People	1.586	7.929	7.929
S10	Fake	Text	9.298	46.489	32.000
		Image	4.003	20.013	16.357
		Headline	1.451	7.253	8.769
		People	2.262	11.312	9.500
S11	Anti-fake	Text	7.987	39.937	26.286
		image	2.583	12.913	12.071
		headline	1.256	6.278	8.308
		buildings	1.331	6.653	6.357
S12	Fake	Text	2.450	12.252	26.286
		Image	4.190	20.950	15.667
		Headline	3.671	18.356	21.214
		people	1.238	6.188	4.308

At the next stage of the research the study of frames (attention patterns) was carried out in the framework of the analysis of creolized media texts by selected areas of interest. Creolized media texts are understood as such texts, “the texture of which consists of two inhomogeneous parts: verbal and nonverbal, belonging to other sign systems than natural language” (Sorokin, & Tarasov, 1990). All media texts (fakes and anti-fakes) were grouped into the following areas: 1) verbal – text (title, main text); 2) non-verbal – image.

The data in *Table 2* shows the average viewing time (sec.), the share of the total duration of viewing the stimulus material (%) and the data of heat maps of the average number of fixations, thus identifying the respondents’ attention fixation areas. The results by areas of interest show that the area of text comes first in terms of attracting attention. The analysis of the headlines and the body text shows that it is the fake headlines that attract the attention of the audience, however, more respondents concentrate on reading the body text of the anti-fake headlines. The leaders in the headline area of interest are stimulus S12 (fake, 21, 214 fixation units), followed by S8 (fake, 14, 733 fixation units) and the third place in this area of interest is occupied by stimulus S4 (fake, 13, 929 fixation units).

The analysis of the average number of fixations and the time of viewing (%) of the body text shows that the leaders are the anti-fakes. Stimulus S7 comes first (anti-fake, 47.572 fixations), stimulus S1 comes second (anti-fake, 39.714 fixations) and stimulus S9 comes third (anti-fake, 36.840 fixations on the text) (see *Figure 5-7*).

Figure 5

S7 (anti-fake)



Figure 6

S1 (anti-fake)



Figure 7

S9 (anti-fake)



The data of heat maps and content analysis of the text area revealed that the following lexical units fall into the audience's area of interest:

- nouns – truth, data, photos, videos, tragedy, girl-blogger, maternity hospital, residents, attacks, strike, nationalists, command, servicemen, shield, ghost, Ukrainians, Russians, Google map, planes, epicenter, etc.;
- nouns/toponyms – Mariupol, Bucha, Kramatorsk, etc.;
- verbs – tracked, shot down, withdrawn, confirmed, reported, etc.;
- adjectives – armed, Ukrainian, peaceful, alive, Russian, etc.;
- word combinations – civilians, mass departure, epic failure, fake, nationalists, fake factory, in fact, 'ghost of Kiev', legend superhero, refuted the information, etc.

Among the leaders in terms of attention to the image area there were S5 (anti-fake, 27.143 fixation units) in first place (see *Figure 8*); S8 (fake, 22.867 fixation units) in second place (see *Figure 9*), and S9 (anti-fake, 19.514 fixation units) in third place (see *Figure 7*).

Figure 8

S5 (anti-fake)

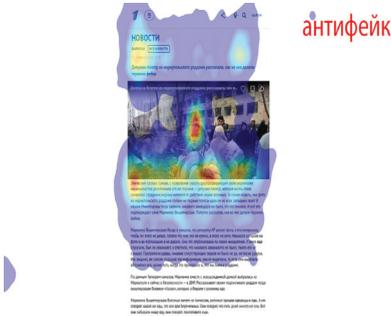
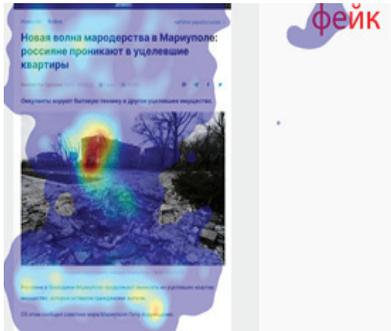


Figure 9

S8 (fake)



In the image area, the respondents' attention is drawn to people and their faces, buildings, and destroyed weapons. The warning labels "fake" and "anti-fake" were of great importance in the stimulus demonstration in this research. The analysis of the eye-tracking research in this area (see *Table 3*) showed that the "anti-fake" labels were rated higher in terms of the number of fixations and ranged from 2.169 units to 4.317 units; the "fake" labels were rated from 1.282 to 3.854 units.

Table 3

Results of eye-tracking research by “fake” and “anti-fake” warning labels

Stimulus code	Warning label	Average viewing time (s)	Average viewing time (%)	Average number of fixations, units	Number of fixations, units
S1	Anti-fake	3.367	0.569	2.846	4.109
S2	Fake	4.100	0.221	1.106	1.282
S3	Anti-fake	1.925	0.476	2.378	2.667
S4	Fake	1.836	0.271	1.356	2.311
S5	Anti-fake	3.544	0.241	1.206	2.169
S6	Fake	0.790	0.349	1.747	2.086
S7	Anti-fake	7.219	0.676	3.382	4.317
S8	Fake	3.505	0.657	3.286	3.854
S9	Anti-fake	5.326	0.399	1.994	3.485
S10	Fake	7.947	0.430	2.151	2.409
S11	Anti-fake	2.359	0.522	2.611	3.534
S12	Fake	4.154	0.176	0.879	1.714

In the current eye-tracking research, the average viewing time by stimulus area of interest ranges from 15.072 seconds to 17.511 seconds, with a fixed stimulus viewing time of 20 seconds. Another important aspect of the research was the survey of respondents at the end of stimulus viewing. Unlike the eye-tracking technique, providing data on the unconscious reactions of the audience, the main objective of the survey was to reveal opinions and conscious attitudes towards the viewed material.

Survey results

In order to assess the news communicative impact, the respondents were asked to complete a survey with an online questionnaire. The purpose of the questionnaire was to examine respondents’ attitudes toward the news items presented. For each fake news item, an anti-fake rebuttal news item was provided. The news items were intentionally assigned these statuses; the

respondents saw them in the survey. Attitudes toward fakes and anti-fakes were measured identically. The questionnaire included three questions to examine the cognitive and emotional effects of the respondents. Percentages were distributed separately for each question according to the number of respondents. Each news item was evaluated according to different criteria: reliability of the item, the level of its emotional impact, and the communicative purpose of the text (comprehension and memorability of the item).

The responses to the first question *Do you trust the presented materials?* (Table 4) revealed that the respondents (79.0%–95.6%) demonstrate a low level of trust in the fakes presented in S2, S4, S6, S8, S10, S12 stimuli. The respondents trust more the anti-fake news (S5, S11 and S3), providing the most detailed refutation of false information.

Table 4

The level of trust in the presented information, % of the respondents

Stimulus code	Warning label	Level of trust, % of the respondents
S1	Anti-fake	yes – 56.8 no – 43.2
S2	Fake	yes – 8.4 no – 91.6
S3	Anti-fake	yes – 61.7 no – 38.2
S4	Fake	yes – 13.7 no – 86.3
S5	Anti-fake	yes – 80.4 no – 19.5
S6	Fake	yes – 6.5 no – 93.5
S7	Anti-fake	yes – 54.4 no – 45.6
S8	Fake	yes – 4.4 no – 95.6
S9	Anti-fake	yes – 54.3 no – 46.6
S10	Fake	no – 79.0 yes – 21.0
S11	Anti-fake	Yes – 72.3 no – 27.7
S12	Fake	yes – 22.7 no – 87.3

The second question inquired about the emotional impact of the news on a scale of 1 to 5, where 1 is low impact and 5 is high impact (see *Table 5*). The score of 2.5 was considered the average value in the research.

Table 5

Evaluation of the emotional impact of the messages by the respondents

Stimulus code	Warning label	Average score, point
S1	Anti-fake	2.5
S2	Fake	2.4
S3	Anti-fake	2.4
S4	Fake	2.4
S5	Anti-fake	2.8
S6	Fake	2.4
S7	Anti-fake	1.6
S8	Fake	2.1
S9	Anti-fake	1.75
S10	Fake	2.0
S11	Anti-fake	2.6
S12	Fake	2.4

The obtained data (*Table 5*) demonstrate that more than 50% of the anti-fake messages disclosing the tragedies in the hospital in Mariupol and Bucha, as well as denying the use of chemical weapons in Mariupol had the highest emotional impact (S5 – 2.8 points, S11 – 2.6 points and S1 – 2.5 points).

The responses to the third question *What do you remember most in this message?* (*Table 6*) revealed that the most memorable were the headlines of fake and anti-fake messages (S1 and S2, respectively, 86.0% and 68.3%), because these titles have a strong emotional connotation. The anti-fake messages (S5 and S3, respectively, 72.3% and 65.9%), with a photo of a girl blogger and a destroyed weapon, were the leaders in terms of images.

Table 6

**The level of remembering the stimulus material in the areas
of interest (headline, image) by the respondents**

Stimulus code	Warning label	Score, % of respondents
S1	Anti-fake	headline – 68.3 image – 31.7
S2	Fake	headline – 86.0 image – 14.0
S3	Anti-fake	headline – 34.0 image – 65.9
S4	Fake	headline – 53.2 image – 46.8
S5	Anti-fake	headline – 27.6 image – 72.3
S6	Fake	headline – 38.7 image – 61.2
S7	Anti-fake	headline – 56.8 image – 42.2
S8	Fake	headline – 66.6 image – 33.3
S9	Anti-fake	headline – 46.3 image – 53.6
S10	Fake	headline – 50 image – 50
S11	Anti-fake	headline – 63.6 image – 36.3
S12	Fake	headline – 42.2 image – 57.7

The results of both the eye-tracking research and the survey showed that anti-fake and fake news attract the attention of respondents. However, anti-fake materials have the greatest impact on respondents by the number of fixations on the stimulus, by the level of remembering and by the level of trust. Warning labels strongly influence this process of perception.

Conclusion

The *first hypothesis* was confirmed by the high level of attention of respondents to the stimulus material in the eye-tracking research. The respondents spent almost all the available time (from 15.072 sec to 17.511 sec) for a given time of viewing the stimuli for 20 seconds. The results of the survey revealed that

over 50% of the anti-fake materials evoked quite strong emotional reactions, exceeding the average level of emotional impact of 2.5 points (S5 – 2.8 points, S11 – 2.6 points, S1 – 2.5 points). These are the materials disclosing the tragedies in the maternity hospital in Mariupol, in Bucha and also messages refuting the use of chemical weapon in Mariupol. The survey revealed that the respondents mostly remembered the headlines of fake and anti-fake materials that have a strong emotional connotation (S1 and S2, respectively 86.0% and 68.3%). Also, the obtained data (Table 5) show that more than 50% of the anti-fake materials caused the strongest emotional reaction.

The *second hypothesis* was supported by the fact that the respondents focus on the labels when viewing all the stimulus materials (Table 3). The average number of fixations on the “fake” warning labels is lower than on the “anti-fake” labels, which correlates with the survey data proving that respondents trusted the “anti-fake” labels the most. The respondents (79.0%–95.6%) show a low level of trust in fakes (S2, S4, S6, S8, S10, S12) (Table 4). Meanwhile, the respondents trust more in the anti-fakes (S5, S11, S3) with a detailed refutation of the false information.

The *third hypothesis* was confirmed by the results of the eye-tracking research and the survey. The survey revealed that the text area in the anti-fake (S1, S7, S9) materials attracted the most attention of the respondents compared to the image area.

Based on the data in Table 2, constructed taking into account the indicators “average viewing time” (sec.), “average number of gaze fixations” (units) and heat maps data, the areas of fixation of respondents’ attention on the main parts of creolized media texts were identified. This was necessary to determine the main areas of focus of the respondents’ gaze. According to the results of data analysis, it was revealed that:

- The average viewing time (sec.): text (including title) varies from 6,121 (S12) to 12,049 (S2); images - from 1,166 (S1) to 6,685 (S5);
- The average number of gaze fixations (units): text (including the title) varies from 27,947 (S8) to 50,335 (S7); images from 7,000 (S1) to 27,143 (S5).

According to the results of the survey, images attracted less attention. In particular, respondents reacted to the images of people and destroyed objects in anti-fake messages (S5, S3). The results of the eye-tracking research showed that anti-fake stimuli (S5, S9) attracted the attention to the image area.

The research revealed that anti-fake is quite effective in terms of opposing fake information, as it always relies on the results of checking the reliability of

published information, discloses false and confusing statements, and offers a description of the real situation. This is confirmed by the increased interest of respondents in the text area, it indicates the desire of respondents to understand the issue, emphasizes the relevance of this format and highlights the need for journalists to acquire the skills to create anti-fakes.

In their turn, fake messages tend to form certain perception and interpretation of information and draw attention to themselves through very emotional images and headlines (mostly related to the problem of human life and health safety, and other basic values). However, fakes do not evoke trust when information is delivered precisely in the 'fake-anti-fake' block, and the objective of fake information is not achieved. The respondents focus more on 'anti-fakes', as they evoke the greatest emotional response and trust in them.

Thus, the impact of fake and anti-fake information on the audience is highly relevant and multidimensional. The use of neuromarketing technologies enables getting the most objective data, as unconscious audience reactions obtained through eye-tracking research are supplemented by survey data, which offers wide research perspectives to the scientific team.

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