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Ph.D. Thesis Summary

Security risks due to the new digital communication paradigm

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INTRODUCTION

The chosen research topic is of major relevance due to its implications in all aspects of life and society. The transformations caused by digitization and computerization have brought about a series of changes in communication protocols and especially in the dissemination of mass information. At the same time, technological advancements have increased the size of the audience with access to information and the speed of information propagation significantly.

The models of information transmission have undergone fundamental changes, and the decision to make certain data available to the public is now automatically taken by a software program with decision-making limits. It should not be overlooked that this program is developed by commercial companies whose primary goal is to profit, with ensuring confidentiality or accuracy of information being secondary or even tertiary objectives. The fact that the algorithm determining the reach of information to a larger or smaller audience remains secret further complicates the issue.

Society had several hundred years to adapt to the new information communication models after the advent of the printing press. Adapting to the telegraph took a few decades, and the time of adaptation decreased even further with the appearance of radio and television. Currently, digitization has reduced humanity's reaction time to new communication models drastically, demanding a rapid adaptation.

Legislative and practical solutions at present need to be modified to respond to the technical transformations, provide necessary security, and address emerging risks. The internet emerged as an unregulated zone and experienced unprecedented growth due to this characteristic. However, the comfortable anonymity provided by the internet has begun to fade due to the lack of regulation. It is challenging to specify the boundary between private and public spaces. Equally difficult is determining the demarcation between freedom of expression and the fight against fake news. Any government regulation concerning the internet can easily slide into censorship. Beyond politics, Western states have condemned and diplomatically reacted when non-democratic states regulated or over-regulated access to information via the internet. Yet, after some time, these same states began to debate regulatory systems or even restricted access to certain information themselves.

Sometimes, any month spent without regulations can mean a huge risk of life disruption. At the same time, the absence of a decision by governmental entities allows corporations to make

decisions, and this is one of the most important debates. As concluded by Bakshy et al. (2015)¹, some companies that own digital platforms have started to gain a monopoly on information dissemination in certain countries, and this has significant implications in electoral processes because the vast majority of voters get their information from social networks. The relationship between digital platforms and the public is best depicted by Brose (2020), showing the interdependence between the goal any algorithm of any digital platform seeks to achieve: "Consumers of media want content. Media producers need the attention of consumers. Moreover, media consumers want to bypass all irrelevant materials and find the good things, whether it's entertainment, education, or news. And media producers must bring their content in front of the right audience."²

The main debate at this moment is related to the entity that can regulate the domain. Government, civil society, or corporations are being considered for such a challenging task, and legislation differs from one state to another. There are tendencies, especially in totalitarian regimes, to apply various restrictions on access to information. However, technical innovations enable circumventing them. This information shows us that beyond changing legislation, digitization can be a difficult-to-regulate domain due to its perpetual changes and shifts in approach from providers or users.

At the same time, the issue of private entities reenters the discussion, as they are often more powerful than some states and manage communication issues based on their own rules designed to ensure control. Moreover, these entities are challenging to regulate by smaller states, leading to an approach that must be different from that taken by governments during the advent of television or radio. Back then, regulation was more feasible because transmission frequencies were managed by the government, the transmitter's location was identifiable, and the number of receiver manufacturers was somewhat limited and could be controlled and regulated.

The pandemic period has revealed a series of risks related to the spread of false news and undoubtedly demonstrated how these news stories have caused serious disruptions. The anti-vaccination campaign significantly slowed down the vaccination process, with severe effects on social activity. On the other hand, banning information that is critical of vaccination can

¹ Bakshy, Eytan; Messing, Solomon; Adamic, Lada A.; Exposure to ideologically diverse news and opinion on Facebook; Science, no. 348, pg. 1130-1132(2015); DOI:10.1126/science.aaa1160

² Brose, Christian; The Kill Chain; Hachette Book; New York; 2020; ISBN – 9780316533539; pg. 13

undoubtedly be labeled as censorship. Subsequently, it was observed that certain information initially categorized as false news turned out to be at least worthy of analysis, while other news that seemed unequivocally true turned out to be fragments of truth at best. Thus, it can be seen that the role of the entity managing the "truth" is as important as it is difficult. Wooley et al. (2019)³ gave the example of the crisis in Ukraine, which was the target of informational attacks in the mid-2010s. The state had a minimal reaction, unlike the private sector, which created several truth verification tools such as Youscan.io, ContextMedia, Noksfishes, Semantic Force, or InfoStream. Utopian models have been proposed, including the introduction of special courts to judge this information before distribution, especially in cases where mass disinformation via social media led to coordinated reputation destruction.⁴ However, this approach still does not determine how these "instances" would be composed. Nevertheless, it would at least let us know who the "censors" of information distribution are, unlike the current model where we have no idea about the way news stories are censored.

By identifying potential risks, solutions or directions can be determined to minimize these risks. People's dependence on communication has been considered to generate a risk of their accidental or intentional misinformation, as shown by Sperber et al. (2010)⁵. The research addresses major public interest subjects with implications in almost all social, economic, political, and security aspects. From the influence of mass communication on politics to the success or failure in business following paradigm shifts in mass communication, every aspect of this topic is sprinkled with risks that need to be minimized. The risk of reducing people's interaction, precisely at a time when information dissemination has reached unimaginable speeds, should not be overlooked. This risk, known in the specialized literature as the risk of societal polarization, was best described by Sunstein (2007) at a time when the polarization of digital platform users was at a much lower level compared to today's situation.⁶

³ Woolley, Samuel; Howard, Philip; *Computational Propaganda*; Oxford University Press, 2019; ISBN 978 – 0 – 19 – 093141 – 4; pg. 243

⁴ Dershowitz, Alan; *Cancel Culture - The latest attack on free speech and due process*; 2020; Hot Books and Skyhorse Publishing, ISBN 978-1-5107-6490-2, pg. 55

⁵ Sperber, D., Clément, F., Heintz, C., Mascaro, O., Mercier, H., Origg, G. and Wilson, D. (2010), *Epistemic Vigilance*. *Mind & Language*, 25: 359-393. <https://doi.org/10.1111/j.1468-0017.2010.01394.x>

⁶ Sunstein, Cass R.; *Republic.com 2.0*; Princeton University Press; 2007; pi.lib.uchicago.edu/1001/cat/bib/6491932

In recent history, there have been major political changes that raised suspicions of being caused by the exploitation of security risks arising from the transformations in communication due to digitization (e.g., the 2016 US elections, Brexit, etc.). Investments related to search engine optimization have become an important and indispensable part of large companies' budgets, while governments struggle to manage the taxation issue for these large companies that practically control the entire global information dissemination flow. Although not the subject of this research, the rush for profit has made the entities managing and economically exploiting digital platforms quasi-anonymous from a tax perspective. This has two effects. First, it results in unfair competition with traditional media outlets. A traditional publication pays taxes in its country of origin and will inevitably have higher prices than a digital company operating under tax havens. The second effect concerns accountability for the information being disseminated. A traditional publication is identifiable and can be held accountable in court. On the other hand, a digital platform, being a transnational giant, is difficult to bring to justice due to the complexity of companies established in tax havens that hold parts of the intellectual property rights but cannot be easily identified as responsible in the current international legislative context.

The context becomes even more complex when considering that digitization has had major implications in the educational sphere, and the capacity to access information has increased alongside changes in how information is accessed. In the last century, books were the only means of transmitting education. Now, increasingly, information is transmitted for educational purposes through films and other digital media.

From a theoretical perspective, research is keeping pace with technology, and new implications emerge as digital platforms evolve. The use of secretive algorithms poses a greater challenge, and researchers strive to understand the logic behind these algorithms based on theoretical knowledge and empirical experiments to see how society is transformed in this context, as evidenced by studies conducted by Pennycook et al. (2019)⁷ and Flynn et al. (2017)⁸.

Access to theoretical sources related to the topic is relatively extensive, as the field has garnered significant academic interest in recent times. After 2016, numerous scientific studies have

⁷ Pennycook G, Rand DG. Lazy, not biased: Susceptibility to partisan fake news is better explained by lack of reasoning than by motivated reasoning. *Cognition*. 2019 Jul; 188:39-50. doi: 10.1016/j.cognition.2018.06.011. Epub 2018 Jun 20. PMID: 29935897

⁸ Flynn, D. J., Nyhan, B., & Reifler, J. (2017). The nature and origins of misperceptions: Understanding false and unsupported beliefs about politics. *Political Psychology*, 38, 127-150. <https://doi.org/10.1111/pops.12394>

emphasized the propagation of information, particularly due to the global scandal surrounding the influence of digital platforms on the US elections. Relevant conclusions highlight that individuals who possess accurate facts may not necessarily share the same opinions about those facts⁹. This aspect further complicates the issue, as even if the presentation of facts were regulated, it would not necessarily resolve the perception problem. However, this particular aspect was not the focus of the present research.

The majority of studies in this area focus on the Twitter platform due to researchers' ease of studying information propagation on this platform. Nevertheless, there are few studies that delve into the precise functioning of algorithms. Google publishes a set of best practices that researchers can use to empirically determine certain parameters based on which the algorithm classifies and presents information to the public. Recently, there have been increasing references in academia to the use of artificial intelligence by digital platforms to decide what information users should read. Zarkadakis (2020) compares artificial intelligence to the steam engine or the invention of electricity, as it can trigger an irreversible process leading to the development of derivative technologies.¹⁰

Through theoretical study and observing the evolution of theories over time, future development directions can be established. A decade ago, most research focused on studying two or three parameters based on which a computer made decisions on disseminating information. Today, academic discussions revolve around the fact that a particular source of information can modify its ranking based on user behavior, which is carefully tracked by digital platform servers.

The theory in the field evolves as certain researchers choose to study specific cases of manipulation or cyberattacks aimed at technically influencing the algorithms used by digital platforms, each case having a different final objective. The most classic example is manifested during the 2016 US elections, the campaign for the UK's exit from the European Union, or the 2016 Ukrainian elections¹¹. In all these cases, risks were exploited to change the public's perception in a certain direction. However, there are also motives related to financial aspects or hidden military objectives. The study of these classic cases reveals increasing security risks.

⁹ Gaines, B. J., Kuklinski, J. H., Quirk, P. J., Peyton, B., & Verkuilen, J. (2007). Same facts, different interpretations: Partisan motivation and opinion on Iraq. *The Journal of Politics*, 69(4), 957-974.

¹⁰ Zarkadakis, George; *Cyber Republic: Reinventing Democracy in the Age of Intelligent Machines*, The MIT Press; Illustrated edition (September 22, 2020), ISBN: 978-0262044318, pg. 12

¹¹ Allcott, H.; Gentskow, M. (2017). Social media and fake news in the 2016 election. *Journal of economic perspectives*, 31(2), 211-36 <https://doi.org/10.1257/jep.31.2.211>.

Examining the changes in theory in this field definitely indicates the directions of development, although the domain itself remains unpredictable in the long term. Certain elements remain unchanged; propaganda remains as it was defined in the past. Ellul's definition (1965) is relevant: 'Propaganda is a set of methods used by an organized group that aims to bring about the active or passive participation of a mass of individuals, psychologically unified through psychological manipulation and incorporated into an organization.'¹² Although the methods of conducting propaganda are increasingly diverse and difficult to identify and control, the essence of the action remains the same.

We have attempted to capture the current moment with as much accuracy as possible. In the field, there is a growing concern for modifying legislative regulations. At the same time, technological advances are outpacing the legislative response. This situation leads to a delay in regulatory changes compared to technological advancements.

Analyzing the evolution of information transmission systems reveals a continuous acceleration in evolution, closely linked to relevant technological advancements in information transmission. To predict future changes and the system's reaction to technological progress, we briefly examined society's responses during relevant paradigm shifts in the past. Each significant step in the evolution of mass information transmission has been followed by a period of societal adaptation, generating reactions at all levels of society. This was due to the fact that each progress brought along a new set of problems that needed regulation at that time.

One distinct aspect that has been analyzed is how the information selection process has been modified as technological advances have changed the speed and mode of data transmission. The relevance stems from the fact that information selection also involves control over it. On the one hand, we examined the key figures responsible for the selection, and on the other hand, we traced how the information selection process has evolved and how it has been influenced by the new communication paradigm. To get a comprehensive picture, we analyzed the differences in the same selection made by human operators in the early days of traditional media compared to the end of the period when newspapers, television, or radio dominated mass communication.

We attempted to analyze the indirect influence that technical parameters, involved in digital communication, have on human operators, and we wanted to see how the direct distribution of information is affected by the new model of mass communication through digital platforms.

¹² Ellul, Jacques; Propaganda: The Formation of Men's Attitudes, New York, Vintage Books (1965), p. 61

Mostly, algorithms created and owned by companies operating digital platforms are the ones automatically deciding the mode of information dispersal. This is because the majority of the audience no longer belongs to a media institution. Digital platforms are what newspapers and television were to the public 100 years ago, and these media institutions have become, for digital platforms, what editors and reporters were for them in the past.

In the classic form, someone who wanted to spread information had to convince a journalist to turn that information into news. The next step was for the editor to approve the dissemination of the news, and ultimately, the impact of the information was limited to the readership or viewership of that specific newspaper or television channel. In practice, the maximum reach hoped for by the person seeking to propagate certain information was limited to the number of readers or viewers of the newspaper or television channel where the information was broadcast. To expand the coverage, the person trying to spread the news had to access and convince more journalists from multiple newspapers, who, in turn, had to convince editors.

Essentially, between the primary information and the public, there were at least two human filters that could identify a staged situation, false information, or an attempt to manipulate the truth. At present, for a massive dissemination of information, the only entity that needs to be convinced is the algorithm of a digital platform.

METHODOLOGY OF THE RESEARCH

To have a clear picture of the new context of communication and mass information distribution, we considered it necessary to analyze the historical evolution of information dispersal in order to observe how society was influenced by technological advances that brought about major changes. This also allowed us to anticipate future trends and their impact on the communication ecosystem.

We employed the method of analyzing the evolution of communication means to identify key moments of change and observe society's reactions to these shifts. In the initial stage of the research, we analyzed historical data to identify patterns of societal behavior during key moments of communication paradigm shifts. Concurrently, we conducted a literature review, which is one of the most important aspects of scientific research, as it helps gain a deep understanding of the field and assess previous contributions.

Given the research's scope and objectives, we also conducted an analysis of developments in the specialized literature, which evolved rapidly alongside trends in communication and mass information dissemination. The literature review facilitated the development of a critical perspective on the research topic. We took into account the timing of previous research and analyzed their conclusions in the context of their respective eras.

Theoretical changes revealed through the literature review are highly important as they indicate how the scientific community, and society at large, reacted to and treated certain changes that were the subject of the research. Furthermore, the literature review was instrumental in avoiding duplication of previous efforts. It allowed us to focus on areas that were underexplored or minimally explored in the past and used previous findings as a basis to test certain theories in the field of information communication to the public.

The literature review and analysis of changes in the scientific community's opinions on relevant issues were crucial in the early stages of this research, but were not sufficient to make a meaningful contribution. Therefore, we had to apply the case study research method, incorporating both quantitative and qualitative analyses that were relevant to the research's purpose.

Knowledge is defined flexibly by Ristea et al. (2013) as follows: "The existence of human beings is fundamentally linked to the knowledge of the universe in which they operate. Individually or collectively, humans use the knowledge they have acquired previously, transmitted spontaneously through natural language from one generation to another."¹³ In our case, the universe also includes the virtual universe, which has gained increasing importance in recent times. However, the difficulty lies in the fact that information about this virtual part of the "universe" has not been transmitted from generation to generation because it emerged within a single generation. Throughout the research, we observed that the acceleration of changes has increased during evolution. Consequently, the common knowledge described by Septimiu Chelcea (2001)¹⁴ has real limits due to the lack of a tradition passed down from past generations regarding the knowledge of the virtual universe.

¹³ Ristea, Ana-Luia; Franc, Valeriu Ioan; *Metodică în cercetarea științifică*; Editura Expert; 2013; ISBN 978-973-618-200-6 ; pg. 22

¹⁴ Chelcea, Septimiu; *Metodologia cercetării sociologice. Metode cantitative și calitative*; Editura Economică; 2001; ISBN – 973 – 590 – 451 – 9; pg. 17

The purpose of the research is to identify security risks that have arisen after the paradigm shift in communication due to digitization. For this, the historical evolution of mass communication tools must be presented to identify trends in the field. The research requires the use of quantitative methods to gather data about the subject of the study (e.g., average time spent by a reader on a web page, statistical data on web traffic, etc.). Quantitative methods are also necessary to better understand the historical evolution of the phenomenon. Data will be collected from existing statistics at the level of public or private organizations and analyzed comparatively. Additionally, to better understand the researched subject, an analysis of norms and regulations and how laws have been modified is necessary (e.g., modification of the civil code regarding the protection of privacy at the expense of freedom of expression, the ECHR's decision on the "right to be forgotten" obliging Google to delete search results, etc.). An important aspect should be devoted to judicial practice concerning the justified public interest vs. the interest in the public. Beyond technical matters, the control exerted over mass media remains significant, a matter that contradicts the fundamental right of freedom of expression and the right to be informed.

These two aspects and their demarcation boundary represent an important facet of the communication paradigm issue. The research aims to analyze the modification of information propagation throughout history, with a particular focus on the new models of information dissemination and the risks they entail. The dependence of traditional media on digital platforms and the inclusion of an algorithm in the news selection process are key points that have been extensively analyzed, with an emphasis on the risks arising from this change. The relationship between states and transnational corporations indirectly managing the way citizens are informed is also an important element of the new communication paradigm.

In practice, each information consumer receives personalized content precisely tailored by artificial intelligence, secretly programmed by a corporation. The algorithms used by digital platforms are trade secrets. Essentially, these algorithms are not made public precisely because their disclosure would continuously lead to attempts to influence the results. At the same time, consumers, governments, and competitors have to take a corporation's word for how relevance is determined. The importance of influencing these results has become so significant that changes in Google's search ranking can lead to a substantial decrease in revenue.

Algorithms operate based on data concerning interests, online behavior, location, nationality, gender, operating systems used, etc. All this data is stored by digital platform managers

and used for operational or commercial purposes. The management of this data can lead to major dysfunctions, and the regulation in this area is far from covering the risks. For this reason, the research also includes aspects related to the modification of regulations over time and how different states have acted in response to the changing communication paradigm. More and more countries are raising issues regarding laws governing the virtual world. Timid legislative changes are happening worldwide, attempting to protect the delicate line between regulation and censorship. The domain is one where everything moves at an extremely rapid pace. The speed is driven by technological innovations and how they change the public's perception. Thus, the degree of understanding of the phenomenon is also continuously evolving.

The knowledge of specialized literature and the integration of this knowledge into the evaluation of scientific theory represent an epistemological endeavor that lies on the somewhat unclear border between philosophy and science, where the researcher must reflect on their own knowledge and its limitations.¹⁵

We conducted the analysis of content on several datasets extracted from open sources and employed a combination of quantitative and qualitative analysis based on the relevant data available to answer the research questions. The response to the question regarding the correlation of technical performance parameters indicated both technical aspects related to information dissemination regardless of its content and certain risks arising from process automation.

The quantitative analysis was directly interpreted by observing trends and patterns of modification in certain analyzed technical parameters. Moreover, we complemented the quantitative analysis with qualitative analysis by categorizing specific types of content to identify typologies of message expression within the given context.

The data managed for quantitative analysis, such as the number of users, were extracted from open sources and represent official data that is publicly available and freely accessible. These data consist of audience studies and traffic data specific to online publications, which are sometimes openly presented for advertising agencies' access and occasionally accidentally disclosed in reports from certain entities. The data related to specific technical parameters recorded by analyzed websites were manually collected for each link to ensure there were no discrepancies

¹⁵ Niculescu, Maria; Vasile, Nicolae. (2011). Epistemologie. Perspectiva interdisciplinară Maria Niculescu, Nicolae Vasile, Editura Bibliotheca, Târgoviște, 2011, 978-973-712-651-3; pg. 22

or errors caused by automated processes. We primarily focused on the number of backlinks to a page or domain and the number of domains linked to a specific page. These parameters are automatically retrieved by specialized programs that offer services for the internet industry.

We structured the obtained data in such a way that their visual analysis allowed us to identify archetypes of expression or atypical aspects based on which we could compare the research's conclusions with those previously obtained by the scientific community. In this manner, we could draw more straightforward and relevant conclusions for the research. The correlation of technical parameters with performance data is relevant because it reveals the model that digital platforms apply in classifying information.¹⁶ Considering that the online performance of publications is linked to how they are optimized to perform on digital platforms, we deemed it important to understand the parameters that determine this optimization. At times, it was necessary to extract new datasets to compare and validate or invalidate certain intermediate conclusions and to identify trends in the field. This enabled us to identify a paradigm shift in the distribution of certain information on digital platforms during the course of the research and adjust the conclusions accordingly.

Initially, in 2021, we analyzed the audience data of 12 online publications in Romania, from which we extracted two technical parameters for each. Subsequently, we had to correlate each technical parameter with each audience-related data to identify any potential connection between them. We selected technical parameters that we presumed, based on the analysis of specialized works, were important for digital platforms and compared them with audience performance. Although we primarily focused on the analysis of search engines in general and Google in particular, we also needed to analyze performance data from the social media platform Facebook in parallel.

After two years, we repeated the analysis to validate the conclusions. We compared the audience rankings of all publications included in the study to formulate a coherent opinion and identify exceptions and general rules. Additionally, we made comparisons for each parameter and each audience-related data to indicate the trends in the field.

¹⁶ Simon, Julian L.; Basic research methods in social sciences. The Art of Empirical Investigation; Random House; 1969; 9781351305648; pg. 126

SYNTHESIS OF THE DOCTORAL THESIS

The evolution of information transmission systems

At the beginning of the research, we wanted to analyze in detail the evolution of information communication throughout history to observe the societal response patterns to most of the changes that occurred in the past.

Until 1455, when Johannes Gutenberg completed the printing of the Bible using small and reusable matrices for each letter, the circulation of information involved enormous costs, making it economically restricted. Poor people couldn't afford books due to the high costs. As a result, an idea spread very slowly, and it took a long time for information to reach large masses of people, even within geographically close communities. The path that information took from one corner of Europe to another was extremely winding, and this was not solely due to transportation means.

From the invention of the printing press until the time when society felt the need for newspapers, a considerable amount of time passed. It was only after over a century and a half that the world's first newspaper was printed and distributed. The credit for this goes to the weekly newspaper printed by Johann Carolus in Strasbourg, which was then located in Germany.¹⁷

However, the availability of the printing press to the masses did not solve the dispersion of information. The speed of information penetration was limited. Newspapers or books could only be accessed by small communities, and their transportation to other geographical areas was limited by the speed of transportation means. The editors of the first newspaper in the United States had to wait about two months to receive news from England.¹⁸

It took almost four centuries for the paradigm of information to change again. By the late 18th century, the first theories on fast methods of transmitting information over long distances were emerging. However, it was not until the mid-19th century that the telegraph appeared, providing humanity with the ability to transmit information over vast distances at very high speeds.

In 1832, Pavel Schilling created a prototype of an electromagnetic telegraph that was able to transmit a series of characters.¹⁹ A year later, Johann Friedrich Gauss and Wilhelm Eduard

¹⁷ Schapals, A. K. (2019). Newspaper Journalism. *The International Encyclopedia of Journalism Studies*, 1–9. doi:10.1002/9781118841570.iejs019

¹⁸ Fang, Irving; *A History of Mass Communication Six Information Revolutions*; Focal Press; 1997; ISBN 9780240802541; pg. 65

¹⁹ Liffen, J. (2013). TELEGRAPHY AND TELEPHONES. *Industrial Archaeology Review*, 35(1), pg. 23. doi:10.1179/0309072813z.00000000014

Weber installed a long-distance communication device between the University of Göttingen (Germany) and the astronomical observatory in the town.²⁰ At that time, various researchers were testing different systems that could transmit information over long distances. Some of the research was identical, while others had similar approaches. However, humanity was almost ready to take a big step forward in terms of information dissemination.

In 1901, Guglielmo Marconi achieved the first transatlantic radio communication. In 1896, he had patented an experimental device capable of wirelessly transmitting information over long distances.²¹ Just like with the telegraph, there were several researchers who were close to achieving a functional wireless transmission device. When Marconi received the Nobel Prize, the president of the Swedish Academy mentioned Faraday, Maxwell, and Hertz in his speech, as they had made significant scientific contributions to the invention of radio communications through their research and experiments.²²

Other researchers believe that Nikola Tesla and Alexander Popov also have an equal contribution to Marconi's in the invention of radio communications.²³

The major advantage was that radio transmissions could be made without an extremely large infrastructure. The costs related to infrastructure development were reduced. In the United States, amateur radio enthusiasts appeared, conducting experimental transmissions for a decade and a half. In 1917, due to World War I, the government banned such activities because they could mask espionage actions.²⁴

It took only two decades for humanity to start using radio reception devices on a large scale. World War I prompted the United States government to order emission and reception devices necessary for military operations.

Another 20 years were needed for humanity to reach another level. In 1941, the National Television Systems Committee in the United States approved the technical standard for analog

²⁰ Martin-Rodriguez, F., Garcia, G. B., & Lires, M. A. (2010). Technological archaeology: Technical description of the Gauss-Weber telegraph. 2010 Second Region 8 IEEE Conference on the History of Communications. doi:10.1109/histelcon.2010.5735309

doi:10.1109/histelcon.2010.5735309

²¹ Barlow, H. M. (1974). Guglielmo Marconi, 1874–1937. *Radio and Electronic Engineer*, 44(4), 185.

doi:10.1049/ree.1974.0051

²² Grandin, K. (2010). Marconi's Nobel Prize. *IEEE Antennas and Propagation Magazine*, 52(2), 198–200.

doi:10.1109/map.2010.5525630

²³ Kuzle, I., Pandzic, H., & Bosnjak, D. (2008). The true inventor of the radio communications. 2008 IEEE History of Telecommunications Conference. doi:10.1109/histelcon.2008.4668707

²⁴ Simaan, M. A. (1999). Looking back: KDKA [radio station]. *IEEE Potentials*, 18(4), pg. 41, doi:10.1109/45.796101

television broadcasting. On July 1, 1941, the Federal Communications Commission (FCC) in the US approved the beginnings of commercial television. After the war, in May 1944, there were 39 applications for commercial television licenses.²⁵

In the United Kingdom, where experimental transmissions had been conducted by the government since 1932, the development of television was interrupted by the war.²⁶ In other European countries, experiments were carried out regarding the transmission of images over long distances using electromagnetic waves.²⁷

Both in North America and Europe, the state maintained control over entities that could broadcast radio and TV programs. In Europe, television stations were largely government-owned, regardless of which side of the Iron Curtain we analyze. In the United States or Canada, there were corporations that owned radio or television stations, but they were licensed based on government regulations.

Analyzing the control held by the state or corporations over information dissemination was an essential aspect to establish, and we analyzed how different models of regulatory exercise were applied over time to see how society responded to various challenges in this regard.

Data processing had been a concern for humanity for some time. Governments had been involved in collecting and organizing information long before the internet's appearance, as Zarkadakis (2020)²⁸ explains that the relationship between computers and government goes far back in history, and the ideological roots of computers are found in public administration. The mechanization of government began towards the end of the 18th century when the British public administration invested in collecting and processing information from around the globe. Essentially, the new step was the interconnection of data collected over many years and the transition to a data collection system that could not even be imagined at that time.

Stanford, the University of California, Los Angeles (UCLA), UC Santa Barbara, and the University of Utah were the four educational institutions that were networked through computers

²⁵ Fink, D. G. (1945). Television broadcasting practice in America—1927 to 1944. *Journal of the Institution of Electrical Engineers - Part I: General*, 92(60), 457–458. doi:10.1049/ji-1.1945.0129

²⁶ Radio and television broadcasting in great britain. (1961). *Journal of the British Institution of Radio Engineers*, 21(5), 379–384. doi:10.1049/jbire.1961.0050

²⁷ Burns, R. W, Series: History of technology series 22, Publisher: Institution of Electrical Engineers, Year: 1998, ISBN: 0-85296-914-7,978-0-85296-914-4

²⁸ Zarkadakis, George; *Cyber Republic Reinventing Democracy in the Age of Intelligent Machines*; 2020; The MIT Press, ISBN 978-0262044318, DOI: <https://doi.org/10.7551/mitpress/11853.001.0001>, pg. 39

in 1969. Over 15 years, until 1984, the network of these four universities reached 1,000 computers. Just three more years, and by 1987, the same network counted 10,000 computers. Another two years, and it already reached 100,000 computers.²⁹

In March 1989, at the European Organization for Nuclear Research (CERN) in Switzerland, the decision was made to create a computer network for researchers. After five years of developing the infrastructure, the Europeans at CERN and the Massachusetts Institute of Technology (MIT) signed the World Wide Web Consortium to standardize communication protocols between computers.

By October 1994, a total of 3.8 million computers were connected to the internet. In July 1995, this number had reached 6.6 million. A year later, the number of computers doubled. In the year 2000, just six years after the beginning of mass internet usage, over 300 million computers were connected worldwide.³⁰

We observe that the acceleration of information dissemination speed has been increasing during the analyzed period. While it took nearly four centuries between Gutenberg's printing press and Samuel Morse's telegraph, the standards adopted in the United States for television are separated from the first data transfers by only 25 years.

The accelerating pace of transforming the mass communication paradigm is a characteristic of this phenomenon itself. Transformations have been occurring faster and faster, and society has had less time to adapt and react to changes in the field of information communication.

The telegraph, telephone, and later the internet served as bridges between information propagators and the public. Each time, the technical infrastructure mattered. In the past, there was a relationship between the newspaper owner and the printing press owner. Between the television owner and the cable owner who brought the transmission into people's homes. With the advent of the internet, this relationship was refined and completely changed the way information propagates.

Evolution of mass information selection systems

I analyzed the evolution of optics regarding the selection of information to be transformed into news. Most researchers have studied publications within certain periods of time and classified

²⁹ Michael A. Banks, *On the way to the Web: the secret history of the Internet and its founders*, Apress, 2008, ISBN 1430208708, p. 31

³⁰ Ryan, Johnny; *A history of the Internet and the digital future*; Rektion Books, 2010, 978 1 86189 777 0; p. 115

the news to observe which characteristics were encountered more frequently. These studies essentially indicate the type of news published. Often, the choice of information or the decision to turn information into news is made by journalists or editors without considering specific criteria, based on their instincts or past audience reactions to similar situations.

Hardcup and O'neal (2001)³¹ presented the results of a study in which they attempted to update the characteristics of news by identifying celebrity, notoriety, entertainment, surprise, good news, bad news, impact, and relevance. The authors aimed to see how the communication paradigm has changed since the publication of Galtung and Ruge's study.³²

The frequency of an event that is about to become news must be similar to that of the news itself. In other words, a social event will have fewer chances of being selected compared to a sudden event (accident, crime, arrest, etc).

The amplitude or impact of an event can be seen from the perspective of the number of people directly affected by the event (deaths in an accident, injuries in an explosion, employees laid off by a company) as well as the number of people who will be affected by a decision (taxpayers, retirees, social assistance recipients, etc).

Clarity refers to the simplicity with which an event can be described. It also involves the availability of data about an event. The more information there is and the easier it is to explain, the more likely that event will become news. The best example is the difference between an announcement from a director stating that they will lay off 1000 employees and a statement from a union leader claiming that a proposed amendment by the Budget Finance Committee in Parliament could impact the budget and cause mass layoffs.

The meaning is translated through adapting information to a specific audience. A news item about a church will be selected by a conservative newspaper, while one about the stock market will prevail in a publication with an audience of active individuals. In other words, if a Swede has stolen something in Germany, the news will be meaningful to the Swedish audience but will have absolutely no significance for those in Romania.

³¹ Harcup, T., & O'Neill, D. (2001). What Is News? Galtung and Ruge revisited. *Journalism Studies*, 2(2), 261–280. doi:10.1080/14616700118449

³² Galtung, J., and Ruge, M. (1965). 'The structure of foreign news: The presentation of the Congo, Cuba and Cyprus crises in four Norwegian newspapers'. *Journal of Peace Research* 2(1): 64– 90; doi.org/10.1177/002234336500200104

Consonance is seen by the authors as the link between the image the public has and the image the information presents. If journalists expect the audience to learn about a football club, a concert, or the results of local elections, they will prioritize selecting and presenting that information in the press.

Rarity is one of the most well-known characteristics of news. It is taught in journalism schools using the symbol of a man biting a dog, which is the opposite of the common event of a dog biting a man. The rarer an event is, the more likely it is to become news.

Continuity is seen as that characteristic of information that leads journalists to select an event that has already become important news and to continue covering it in the following days. In other words, an event that has already made headlines in newspapers, radio, and television will continue to be covered by journalists for a certain period of time.

Composition or content of news is a characteristic related to how certain information fits or does not fit with the editorial policy of a particular publication. Thus, information that would not have been selected to be turned into news will still be chosen if it relates to aspects that the publication frequently addresses. For example, a publication that writes frequently about corruption will publish information about seemingly insignificant anti-corruption legislative initiatives.

The notoriety of individuals, countries, or institutions involved in certain information is an important characteristic in a journalist's decision to turn that information into news. The greater the notoriety of the factors involved in an event, the more likely that event is to be turned into news.

Personification is the characteristic of news that gives priority to an event carried out by a named person over collective events.

The simple negative property of information can turn it into news. It is observed, in particular, that negative news is more appreciated in terms of audience, which increases the chances of being selected by journalists and covered by newspapers, radio, or television.

Digitalization has brought an innovation that has already revolutionized traditional news values. In the past, journalists and editors had limited possibilities to analyze audience reactions after reading the news, but now things have changed. Journalists gain the ability to see not only the number of readers but also the time they spend reading a news item, their gender, age,

geographic location, or other data that, some years ago, they could only dream of. Welbers (2015)³³ has analyzed these changes starting from the idea that newspaper websites offer journalists the unexpected opportunity to see real-time interest from readers in a particular news item. Researchers analyzed five national newspapers in the Netherlands and concluded that editors are increasingly influenced in choosing news items based on the performance of previous subjects. The same conclusion is emphasized by Chakraborty et al. (2019)³⁴, who, like Loosen (2012), believes that not all aspects of the change can be encompassed yet.

More and more people read news on social media, as shown in a study conducted by the Pew Research Center in the United States in 2018.³⁵ The researchers concluded that two-thirds of American adults read news on social networks.

The increase in internet users has led journalists and editors to focus their attention on this new market. Social media has also become a source of information for journalists, as indicated by Heravi (2016)³⁶. At the same time, digital platforms represent a way to increase the audience. "Professional journalists must understand the audience of these channels and develop new strategies to maximize the audience's attention to the news they provide," says Orellana-Rodriguez (2017)³⁷. Researchers have analyzed the posts on the digital platform Twitter from 200 accounts in an attempt to develop a set of recommendations for journalists who want to increase their audience through social media networks.

Practically, the beginning of the 20s brought two certainties: between the event and the public, alongside the press institution and the journalist, there was also the technological company that owned the digital platform, and the algorithm of this company decided who learns what. This reality makes us think exactly who has the greatest power in the process of selecting the news that people read. A third aspect is not a certainty, but it is extremely important to take into account: the

³³ Welbers, K., van Atteveldt, W., Kleinnijenhuis, J., Ruigrok, N., & Schaper, J. (2016). News selection criteria in the digital age: Professional norms versus online audience metrics. *Journalism: Theory, Practice & Criticism*, 17(8), 1037–1053. doi:10.1177/1464884915595474

³⁴ Chakraborty, A., Ghosh, S., Ganguly, N., & Gummadi, K. P. (2019). Editorial Versus Audience Gatekeeping: Analyzing News Selection and Consumption Dynamics in Online News Media. *IEEE Transactions on Computational Social Systems*, 1–12. doi:10.1109/tcss.2019.2920000

³⁵ Pew Research Center, September, 2018, "News Use Across Social Media Platforms 2018", <https://www.journalism.org/2018/09/10/news-use-across-social-media-platforms-2018/>

³⁶ Heravi, B. R., & Harrower, N. (2016). Twitter journalism in Ireland: sourcing and trust in the age of social media*. *Information, Communication & Society*, 19(9), 1194–1213. doi:10.1080/1369118x.2016.1187649

³⁷ Orellana-Rodriguez, C., Greene, D., & Keane, M. T. (2016). Spreading the news. *Proceedings of the 8th ACM Conference on Web Science - WebSci '16*. doi:10.1145/2908131.2908154

whole process of selecting the distribution of information can be influenced by external factors of the company that owns and operates the digital platform or even by the company itself. Extrapolating, a state finds itself unable to control the dissipation of information, which is beneficial in a democracy. However, a supranational structure or another state can develop control over information without the target state being able to react in such a case.

The fine line between freedom of expression and protecting the population from informational attacks will pose a challenge in the future when the relationship between the user, content creator, and digital platform needs to be more strictly regulated. In broad terms, it must be clearly established who has control, how control is exercised, and in what way control is exerted.

The influence of digital platforms on the mode of information dispersal discussed in the previous chapter has radically changed the way a state entity, a company, or an individual can propagate certain information in a specific environment. In the classic form, someone who wanted to spread information had to convince a journalist to turn that information into news. The next step was for the editor to approve the dissemination of the news, and in the end, the impact of the information was limited to the audience of the respective newspaper or television. In practice, the maximum reach hoped for by the person who wanted to spread certain information was limited to the number of readers or viewers of the newspaper or television where the information was broadcast. To increase the coverage area, the one who wanted the news to be propagated had to manage to access and convince more journalists from multiple newspapers, which, in turn, had to convince the editors.

Practically, between the primary information and the public, there were at least two human filters that could identify a staged situation, false information, or an attempt to manipulate the truth. At present, for a massive propagation of information, the only one that needs to be convinced is the algorithm of a digital platform. This undergoes modifications made non-transparently by the corporation, as discovered by Barret and Kreiss (2019)³⁸. The explanation given by Van Dijck (2013) is much more plastic, stating that "Social media has automated systems that manage and manipulate connections. To recognize what people want and what they like, Facebook and other platforms record desires and encode relationships between people, things, and ideas in an

³⁸ Barrett, B. & Kreiss, D. (2019). Platform transience: changes in Facebook's policies, procedures, and affordances in global electoral politics. *Internet Policy Review*, 8(4). DOI: 10.14763/2019.4.1446

algorithm."³⁹ This suite of procedures, commonly known as an algorithm, is opaque and is constantly changing, as also revealed by DeVito (2016)⁴⁰, who maintains that "business confidentiality aspects and frequent changes make a scientific examination of algorithms almost impossible."

Regulations regarding the dissemination of information

To understand the phenomenon, we attempted to analyze current regulations and how they have evolved, striving to establish future directions. We focused on changes in legislation concerning the right to be informed, provisions related to the right to privacy, and those concerning free access to information. Additionally, we reviewed various interpretations of these norms, as made by judges.

To identify security risks arising due to technological advancements outpacing legislative changes, we analyzed publicly accessible data from open sources and how they might lead, in the absence of regulations, to security loopholes that could affect society.

Open source data and the risks of lack of regulation

We have identified laws in Romania that limit the protection of personal data and allow the display of personal data in various open or semi-open databases. As a result, we have reviewed the databases accessible in Romania due to legislation that interferes with data protection norms.

To illustrate security risks, we chose as a case study the identification of personal data of randomly selected elected officials and conducted verifications in an attempt to identify this data. In half of the cases, we succeeded in identifying the personal identification number (CNP). Even more concerning is that in all cases (100%), we managed to identify the address from the identity card. This exposes, especially public figures, to a particular risk regarding physical safety.

We have also identified other information that, given the context, can help discover other personal data or be directly used for other purposes. In some cases, we identified the names of

³⁹ Van Dijck, J. (2013). *The culture of connectivity: A critical history of social media*. Oxford and New York, NY: Oxford University Press, p.79, ISBN 9780199970780

⁴⁰ DeVito, M. A. (2016). From Editors to Algorithms. *Digital Journalism*, 5(6), 753–773. doi:10.1080/21670811.2016.1178592

spouses even if they were not mentioned in the wealth declaration or if the individual in question had gone through a divorce process.

The rapid circulation of information can influence other aspects of life as well. We chose to study the "post-event" scenario, such as how the press is influenced by a particular event or how an event is affected by news that appears in the press.

Case study on the correlation between news occurrence and stock trading

We chose to analyze all the news published by the Mediafax news agency on topics related to Roșia Montană. We selected this subject because behind it, we could analyze high-volume stock market transactions. Moreover, we had almost 20 years of important events and relevant news published in its history.

In general, especially during the research period, Mediafax news agency was the only private news agency in Romania. Due to the fact that most newspapers had officially or unofficially adopted a certain policy regarding this subject, choosing Mediafax as the basis of analysis was all the more straightforward.

The choice of Roșia Montană Gold Corporation for this study was because it generated the most press coverage over a long period of time, allowing us to extract data relevant for establishing correlations between the number of press materials and stock market events. Furthermore, the company's listing on a foreign stock exchange outside Romania provided the non-specialized public with greater access to investments, making them more susceptible to the information circulating around the company.

The analysis conducted considered both quantitative aspects (the number of news articles published around important events) and a qualitative analysis of the materials.

Study on the online audience of publications and the influence of digital platforms

To identify the technical factors that transfer decision-making power from humans to computers regarding the dissemination of information, we chose to analyze the relationship between the number of backlinks and the traffic generated by the main publications in Romania in order to identify a correlation between them.

Backlinks are references from other pages to a particular page and, naturally, they appear when an author wants to cite specific information from a certain newspaper to emphasize an opinion they support. Naturally, the number of backlinks is also related to the age of a particular

site. We expect that in the case of a publication that has been in the market for a long time, there will be more instances where, following the publication of exclusive news, it has been cited by other publications to identify the source of information. Another parameter we took into account is the number of domains that generate these linking links. A site can refer to one or more other sites. For this reason, the number of backlinks and the number of domains generating them may differ.

The rule that emerged seems to be: a large number of domains generating links to a site and a large number of links to that site represent a larger audience, whether it is unique customers, visits, or impressions. The latter depend heavily on how the publication manages to keep the user engaged there, considering design and content.

We repeated the analysis after two years and highlighted the resulting changes. We also conducted a study on publications in the United Kingdom where we identified correlations between technical factors and audience. We also analyzed artifacts of algorithm manipulation. We highlighted, in certain materials, a series of backlinks that seem to be artificially created to make that specific information more interesting from the perspective of the algorithms that decide its dissemination.

Analysis of the availability of information on digital platforms

To see how simple or complex it is to influence the results calculated by algorithms that decide the dissemination of information, we collected several data points. We used the google.ro platform in incognito mode to avoid influencing the search results based on preferences recorded on the computer from which we conducted the searches. We performed searches for ten terms and took into account the first five results from each of these searches.

The search terms were composed of the names of prominent politicians. To avoid influencing the results, we chose politicians who had a high degree of notoriety in Romania but are no longer at the forefront of the political scene, although they are not entirely retired from activity. We selected politicians who have held the highest office in the state, that of president, or who have been prime ministers of Romania, even for a short period.

Therefore, the ten search terms were "Adrian Nastase," "Calin Popescu Tariceanu," "Emil Constantinescu," "Victor Ciorbea," "Mihai Razvan Ungureanu," "Nicolae Vacaroiu," "Petre Roman," "Theodor Stolojan," "Traian Basescu," and "Ion Iliescu." Analyzing the results, we

observe that in 43 out of the 50 cases, the ranking of the first five results in the Google platform was based on the number of domains that generate links to the web pages offered as results. In practice, in 86% of cases, the theory that a page with backlinks from multiple internet domains will be ranked higher by Google is supported.

One aspect worth noting is that out of the 50 analyzed results, 18 come from the Wikipedia domain, 13 are government pages (Chamber of Deputies, Government, European Parliament), 9 are from social media platforms (Facebook, Twitter, LinkedIn), 2 are personal pages of the individuals searched for, and 5 are pages of news publications.

To validate the results, we repeated the analysis with search terms representing the names of lesser-known politicians and also conducted an analysis of politicians in the United Kingdom. In this case as well, over half of the results (54%) are represented by those offered by Wikipedia and government pages. Considering that the results in Romania were influenced by the fact that Romanian politicians have relevant biographical versions in English, while British politicians do not have such versions in Romanian, we can say that the results converge to the same conclusion.

Research conclusions

By correlating the obtained results, we can conclude that technical parameters, among which the number of backlinks from other web pages stands out, influence the performance of a web page and, consequently, the way this page gains an audience through digital platforms. As seen from the specialized literature study, the weight of digital platforms (Facebook, Twitter, Google, TikTok, LinkedIn, etc.) as sources of information tends to increase, while traditional media is being surpassed.

In this context, technical parameters and their interpretation by each algorithm of each digital platform become determining factors in how mass information is distributed in our times. The number of keywords, the number of backlinks, the number of domains generating these backlinks, site speed, character size, or other unknown technical parameters have become more important than the content itself of a news item when it comes to mass communication.

We identified a direct connection between the number of backlinks, the number of domains generating them, and the overall audience performance of the analyzed publications in Romania. The data analysis extracted in 2021 indicated a closer relationship between the number of backlinks and audience performance. The data analysis from 2023 indicated a closer link between the number

of domains generating backlinks and audience performance. Both datasets show a clear correlation between one of these parameters and the number of visitors, unique clients, or impressions of a publication.

Furthermore, we noticed that a significant number of backlinks that were observed and taken into account by search engines in 2021 are no longer observable in 2023. This may indicate a change in how these parameters are recorded by the algorithms of digital platforms. It is possible that this change is due to the exclusion of artificially created backlinks designed to increase or decrease the performance of a website. Similarly, the differences may be caused by certain links generated too long ago no longer being considered. Regardless, the number of backlinks and the number of domains generating them continue to be closely related to the audience performance of a publication, whether it is from Romania or anywhere else in the world.

The analysis focused on how the algorithm classifies news on the Google search platform, which currently holds the largest market share worldwide. We can reasonably assume that the news section of the same digital giant operates similarly, hence the audience figures recorded and analyzed in the study. Equally reasonable is the assumption that other search engines and digital platforms interpret the same parameters to encourage users to spend more time online.

This is the declared purpose behind designing algorithms that make decisions about disseminating one piece of information over another or deciding what information each user should receive. There is no public data about how these algorithms work. They are the property of corporations that own the digital platforms and are protected by copyright law. In essence, the control over how information is distributed en masse globally belongs entirely to these transnational companies, and the manner in which this control is exercised is completely non-transparent.

A first problem that arises is the impossibility of deciphering an algorithm. In the hypothetical situation where companies are forced to make the parameters considered in the information dissemination process public, each online publication would over-optimize those parameters, making it impossible for computers to classify the results. They would be forced into a vicious cycle where they have to consider other parameters that they can no longer make public. Another derived problem would be related to the fact that in the business field, classification would no longer be possible. Commercial offers would be without competition, and a few privileged ones would have their offers ranked at the top of search engines, while the rest would go bankrupt due

to a lack of customers. In the mass communication field, the deciphering of algorithms would imply the impossibility of new publications emerging because old publications would already have over-optimized parameters that are known to be considered by search engines, thus capturing the entire audience.

The existence of a link between the mode of information dissemination and the technical parameters that can be influenced from the outside poses an increased security risk. Parameters like the number of backlinks or the number of domains generating these backlinks can be influenced both by a publication seeking to increase its audience and by third-party entities, whether private or state-owned, with legitimate or illegitimate interests in positioning a particular press article at the top of the audience.

Whether it's a politician who wants a positive article to reach as many voters as possible or a rival who wants a negative article to be seen by opponents, this risk exists and can take the form of hybrid warfare. A state with technical and financial resources can assist in boosting positive information about a politician or completely change the first page of a search engine so that only negative articles appear when searching for an inconvenient politician's name. This can also be done by organized crime groups against overly ambitious investigators or by legitimate interest groups seeking to influence public opinion.

Digitalization has greatly influenced the process of obtaining information, and as we discovered during the research, governments have been slower to respond to technological progress and lagged behind in enacting the necessary legislative changes to regulate new challenges. In a constantly changing environment, governments have had to balance between protecting the right to information and the right to privacy. With technological advancements, the harm that can be caused to personal image by false news has increased due to the larger audience and the fact that information is no longer controlled by identifiable individuals. In the past, news was selected by well-known journalists employed by identifiable commercial entities. This made them accountable and careful in selecting the data.

In this context, the future challenge lies in who will exercise control over mass media. Self-regulation within the industry is no longer feasible. In the past, non-governmental organizations, professional associations, or journalists' unions self-regulated certain aspects of news dissemination. In contemporary times, this is no longer possible because everyone has become a distributor of information with the help of tech giants. Without technical limitations (anyone with

a phone is a cameraperson) and without distribution limits (anyone with at least one social media account), every person can disseminate news that, if meeting certain technical parameters, can reach billions of people within seconds.

State control over the dissemination of information can be just as harmful as the lack of any control. Throughout history, governments have shown that they can transform into dictatorships within a few years. Therefore, giving control over mass information distribution to governments may seem like a flawed idea. On the other hand, control assumed by unidentified corporations is also an unfortunate option because their goal is to make a profit, and ensuring respect for fundamental rights or human values cannot be guaranteed.

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