THE ROLE OF *SENTIMENT ANALYSIS* AND *DATA MINING* SOLUTIONS IN THE STUDY OF *FAKE NEWS* AND COUNTERING DISINFORMATION

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The proposed article highlights the importance of studying the phenomenon of fake news spreading based on sentiment analysis solutions (use of natural language processing techniques) and data mining (obtaining relevant information from the study of data), given the diversification and travel speed of these types of news, as well as the need to implement mechanisms to assist us, in a first stage, in gaining a thorough understanding of them and, subsequently, in taking the necessary steps to limit the spread of the phenomenon.

The method of qualitative analysis of specialised studies was used for this article.

Keywords: mass-media; trolling; fake news; sentiment analysis; public opinion;

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Motto:
"There is no communication without emotions and without communication there is no social life"
Jacques Cosnier
(Introduction to Emotions and Feelings Psychology)

INTRODUCTION

To understand the phenomenon of fake news, it is first necessary to place it in the context of the human society. Thus, even if the appearance of fake news in its current form is still debatable, it is unanimously accepted that false stories, rumours about aspects of community life have always existed in human groups, the favourite way for their transmission being, for many decades, via *"word of mouth"* (Burkhart, p. 5).

The advent of writing and, later, of printing led to a first form of theorising the news stories, as well as to a first set of deontological requirements, namely that the news should be objective, correct, and reflect, above all, the truth (Schudson with Edson C. Tandoc, Zheng Wei Lim & Richard Ling, p. 140). However, Lippmann separates the truth from the news in his work *"Public Opinion"* (Lippman, p. 363) and notes that while the purpose of the news is to signal the occurrence of an event, the truth comes to unveil the hidden facts behind the respective event.

With the access of humankind to the third stage of its development, a stage characterised by the evolution of technology as a trigger for the development of interpersonal communication to the detriment of the printed one (McLuhan), information sources have widely diversified. Thus, one can notice not only a development of media (radio, TV, print media), but also the emergence of a new phenomenon, important in the equation of fake news, namely the diversification of the news program, which starts to become more flexible and to *"attack"* the rigor

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of classic news journals. At this moment, a new form of entertainment appears in the US media, which starts from the real news and is then satirised through exaggerations, changes of the context, sometimes even by adding untrue facts (Edson C. Tandoc et al., p. 139).

In this context characterised by media diversification, the Internet comes into play and the news begin to be analysed more scrupulously, to have multiple approaches, nuances, to be sometimes more detailed, sometimes briefer, depending on the technical possibilities and the interest of the media, as well as its ability to adapt to the new *"virtual"* context. This is the birth of the *"new media"* (Dobrescu, Bârgăoanu, p. 83), defined, at the time of its appearance, as *"the result of the convergence between traditional media and computerised systems"*. Blogs and forums are now present, and journalists are starting to have a larger space to add more contextual elements to the information sent for publication to their media organisations. Also, journalists become moderators of these forums and encourage the reader's participation in debates, sometimes even directing the discussion to certain areas of editorial interest (Schifirneț, p. 102). The media landscape is expanding, freelancer journalists (who no longer belong to a certain media institution) are emerging and more and more people are starting to comment on the news posted on the editorial websites, debate or even post their own version of what happened (either as a direct witness or by consulting other sources of information). With some exceptions quite easy to identify [e.g. news from entirely false sites – hoax sites (Burkhart, p. 7)], the main visibility remains, at this stage, with the *"original"* news, those that are presented by the established media outlets, including in their online version.

However, the appearance of social networks shortly after will almost completely change the media landscape, several elements contributing to this fact almost simultaneously. First, the constant access to news, now in a digital format and very accessible by masses of users, resulted in a more diverse and an exponential increase of the volume of news available to those interested. Secondly, non-journalist users who in the previous stage were very active on discussion forums provided

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by the online versions of media institutions, have now at their disposal free online platforms and their own constantly expanding audience. This outlines the concept of participatory journalism, enshrined by Melissa Wall (2012) in *"Citizen journalism: valuable, useless or dangerous"*, a concept according to which any user of the Internet (and, implicitly, of a social platform), having an opinion and an interest in informing, can produce any kind of content (which can become news) globally and whose veracity is the almost exclusive contribution of the author.

In conclusion, today's media landscape, for the most part unregulated and characterised by the coexistence of traditional media institutions and Social/New/Citizen media, brings a huge volume of news (real, partially real, complete false, etc.) in the same place, the most important challenge being a clearer distinction of them.

DEFINITIONS AND TYPES OF FAKE NEWS

From the linguistic point of view, the term of fake news implies that the event described in the news is not true, did not exist or the report about it is completely incorrect. However, given that most current news falling in the category of fake news have a true component (which can be presented, as such, in the beginning or within the body of the news), the notion of "false news" could be debatable. For this reason, the notion of *"fake"* is more appropriate, and the most appropriate equivalent in the Romanian language is *"counterfeit"*, *"tricked"* or *"fabricated".* It is also the reason why the notion of fake news will be used to designate, in most of the cases, such news.

A study on fake news, in general, and on the identification of methods to counter them will have to consider definitions and classifications of these types of news in the first place, so that the effort to combating them is focused on the relevant ones. Such a distinction, which can be a starting point in identifying other subtypes of fake news, divides this type of news into two broad categories: economically and ideologically motivated (Alcott, Gentzkov, p. 217). But for a better understanding of how these types of news are spread, even more detailed classifications are required.

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In this regard, the results of a study coordinated by Edson C. Tandoc et.al. in 2017 on several scientific papers in the field identified a typology of fake news that included: satire, parody, completely invented news, photo manipulation, masked advertising, and propaganda (Edson C. Tandoc Et al., p. 141). The strengths of this classification are given by the identification of several common elements of fake news, such as preference for how they are spread in the virtual space or the use of emotions to make them more attractive.

On the other hand, the crisis in Ukraine in 2014, the US elections in 2016 and BREXIT (2017-2020) were events that not only accentuated and made more visible the fake news, but also witnessed the intensified spreading of those ideologically motivated news, created with the purpose to diminish the trust in authorities or in political or politico-military organisations. Moreover, a large study conducted by the NATO Center of Excellence in Strategic Communication[1] called *"Internet trolling as a tool of hybrid warfare: The case of Latvia"*, also identified a new vehicle for transmitting false news, namely the trolling. These two elements, fake news and its transmission vehicle, placed in a certain geopolitical (Ukraine crisis, BREXIT), political (US elections in 2016) or health-related context (COVID pandemic of 2020 and 2021) outline a phenomenon that is met more and more frequent and continues to produce harmful effects: the phenomenon of disinformation.

This phenomenon is also maintained by a set of factors such as the confusion created by the insufficient explanation of the differences between sources of information. Moreover, the thin line between the presentation of facts versus opinions results in an effervescence of dialogue, which is beneficial for the good information of the community. However, this effervescence becomes a hotbed for the alteration of the initial information and the generation of news whose degree

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[1] NATO StratCom Center of Excellence (www.stratcomhcoe.org) is a NATO center of excellence in Strategic Communication located in Riga, Latvia established in 2014 as a result of the North Atlantic Alliance's need to deepen the StratCom field and support allies by providing expertise in this field.

of veracity can be profoundly affected. In addition, the automatic extraction of news from the virtual space by the traditional press and insufficient time for documentation or incomplete documentation may result in major discrepancies between the information transmitted by the broadcaster correctly, completely, timely, and the final piece of news that reaches the audience.

The problem of fake news spread intensifies in crisis situations when the emotional state of the public and, implicitly, the impact this news can have are more significant. Moreover, the effects can be felt in the medium and long term, given that the spread of these type of news and the disinformation they generate can lead to the erosion of traditional communication systems, which are based on mutual trust between sender and receiver.

A non-exhaustive classification of fake news, subject to the need for constant update given the dynamics of the current media landscape, identifies, among others, some important categories that, through content and addressability, will have to be treated and analysed thoroughly:

a) **Ideological** – *types of news that aim to change the perception of general concepts and approaches, such as public attitude toward membership in international organizations or the support at national level for international approaches;*

b) **The news-pamphlet** – *types of news intentionally created as such, which may include elements of sarcasm or irony and whose emphasis falls not on the veracity of the news, but on the humour that characterises this news;*

c) **Commercial news** – *news whose purpose is exclusively to have the reader reach a landing page, access specific sites and expose the viewer to advertisements on those pages;*

d) **Erroneous news** – *unintentional false news obtained through insufficient documentation or reliance on unofficial sources and published without verification the information from various sources.*

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THE ROLE OF EMOTIONS MEASUREMENT IN COMBATING FAKE NEWS

As described in the previous chapter, information is practically available anywhere and anytime, and it is often proactively sent to the reader, thus exposing the public to an unprecedented flow of information. And if we look at the *"new information ecosystem dominated by technology"* (Bărgăoanu, p. 33) as the right place for the development of the fake news phenomenon, we will have a clearer picture of the impact on the individual and society, impact that can be reached at with little resources through the extensive use of today's interpersonal communication networks.

A key point in the effort to outline a strategy to combat fake news and disinformation must be to identify, as objectively as possible, the potential emotional impact that fake news has on people, both at individual and at collective level. The intent in obtaining an emotional impact can be easily noticed by the presence of words describing feelings of fear, using capitalisation and the excess of exclamation marks, by inserting suggestive photos or videos (illustrations that also begin to be altered, both partially and in full). However, the key elements that may lead to the emotional impact will have to be accurately measured so that it can answer the question *"but what harm did the news produced (or distributed) by me do?"*

That is why the measurement of the emotional impact fake news, both at individual and societal level, can lay the grounds for the creation of strategies to counter the disinformation phenomenon. Such measurement performed with the help of data mining techniques as part of sentiment analysis systems will bring relevant information about the emotional impact that fake news has on their audiences. However, it is important to mention that the measurement of the individual or collective reaction to such news will have to be corroborated with other elements, such as the predilection for information consumption, the general emotional state of the individual, age, level of education, and so on.

Currently, there are numerous fake news detection solutions on

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the market, the current challenge being the complete automation of this process in the coming years, as the algorithmic processing capacity of fact-checkers continues to advance. Approaches in this direction fall into two categories: the first focuses on linguistic aspects (which follow patterns in the use of certain words and expressions), and the second focuses on identifying *"information connections"* that seek to identify where information is transmitted, network reaction speed etc. (Burkhart, p. 16). Joanna M. Burkhart identifies in her 2017 paper *"Combating Fake news in the digital age"*, four directions for researching linguistic aspects to detect misleading information in a given text.

The first of these called the *"Bag of Words"* measures the use of words in a news story in order to identify patterns that may be associated with the presentation of unreal information. Studies on automatic word processing have shown that fake news can be identified and separated from real by this method, in the case of fake news prevailing the use of words that express real, concrete things (Certainty), compared to the factual news that leaves more place of words that express feelings, faith, thinking (Insight) (Mihalcea and Strapparava, p. 312). A similar study (Ott et al, apud Feng et al, p. 171) reveals the predominant use of first-person verbs and personal pronouns in misleading statements, while truthful information uses more nouns, adjectives or prepositions.

Another direction of research in the study of linguistic approaches is presented under the generic name *"Deep Syntax"* (Burkhart, p. 16) which analyses words out of context and compares them with the syntax specific to misleading expressions. This study improves the effectiveness of detecting misleading claims to an estimated level of 91.2%, with an error probability of 14% (Feng et al, p. 173).

The third approach of the study is *"Semantic Analysis"* (Burkhart, p. 16), where the emphasis falls on the comparison between written information from several sources describing the same event and the statistical measurement of inconsistencies can highlight misleading information.

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A final approach in this study, called the *"Rhetorical Structure"* (Ibid.), identifies the relationship of various linguistic elements in an analysed text that can be later presented graphically, using spatial vector models, thus bringing these linguistic combinations closer or further away from the truth.

In conclusion, the study of how emotions at the individual level are influenced by news will provide insights as to how such news is thought, structured and created, as well as their clear purpose.

Given that the response to disinformation cannot be a partial or complete block of the communication activity of government institutions, public or private organisations, a detailed analysis of these types of news is needed, so that the response is accurate, consistent, and adapted to this type of threat posed by their spread. Thus, it becomes increasingly necessary to identify, catalogue and measure the impact on public opinion of fake news using information technology, by adapting and operating search engines based on well-defined algorithms, and by using big data solutions (data volumes too large to be analysed separately) and data mining (extracting information from large volumes of data). Sentiment analysis solutions can be added to these efforts so that algorithms for measuring the frequency of keywords and the feeling induced by a well-defined set of news, posts, blogs, articles can be catalogued according to the period and context of their appearance in the public space (pandemic, post-pandemic, regional security crisis, period of election campaign and elections, etc.).

In his book *"Introduction to the psychology of emotions and feelings"*, Jacques Cosnier identified an axis of the emotions (Cosnier, p. 46). According to this figure, emotions can be categorised on two main axes: pleasant/unpleasant and attention/rejection, each including feelings such as joy, happiness (corresponding to the axis of pleasure) and anger or fear, which describe feelings diametrically opposed to pleasure. Similarly, capturing attention is achieved by triggering feelings such as surprise or suffer, while rejection is achieved through feelings of disgust or contempt.

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Cosnier also brings together a set of basic emotions defined as such by most specialists in the field, the French author specialised in the study of affections, emotions and feelings proposing 12 basic emotions to be studied: joy, surprise, fear, anger, sadness, disgust, contempt, despair, interest, guilt, shame, love (Cosnier, p. 30) like presented in *Table no. 1*.

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	Joy	Surprise	Fear	Anger	Sadness	Disgust	Contempt	Despair	Interest	Guilt	Shame	Love
Woodworth and Scholsberg (1964)	+	+	+	+	+		+	+				
Ekman and Friensen (1975)	+	+	+	+	+		+	+				
Izard	+	+	+	+	+		+	+	+	+	+	+
Schwartz and Schaver (1987)	+	+	+	+	+							

Table no 1: *The basic emotions table* (Cosnier, p. 30)

The American psychologist Robert Plutchik proposes, in his study called *"The Nature of Emotions"* (2001), one of the best-known classifications of emotions, also called *"the wheel of emotions"* (Plutchik, p. 349), which includes a number of eight basic emotions (joy, confidence, fear, surprise, sadness, aversion, anger and anticipation), as well as their combinations, called compound or secondary emotions *(Figure no. 1)*. According to the author, these emotions have developed over time in individuals as a form of adaptation to the external environment and argues that each of them has a well-established role in terms of survival and adaptation (Plutchik, p. 345).

This synthesis of emotions, starting from the basic ones and ending with the compound ones, has the advantage of allowing the grouping of the few hundred words (from English) that express emotions in these eight main types, which facilitates the development of research methods and study in the field of clinical psychology (Plutchik, p. 350).

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Laros and Steenkamp propose a diagram of feelings in terms of the effect produced on the individual, namely positive or negative. Thus, in the case of positive effects, joy, happiness, love, and pride are retained, while negative emotions are triggered by feelings of anger, fear, sadness and shame, each including emotional subdivisions that lead to a hierarchy of emotions and affections.
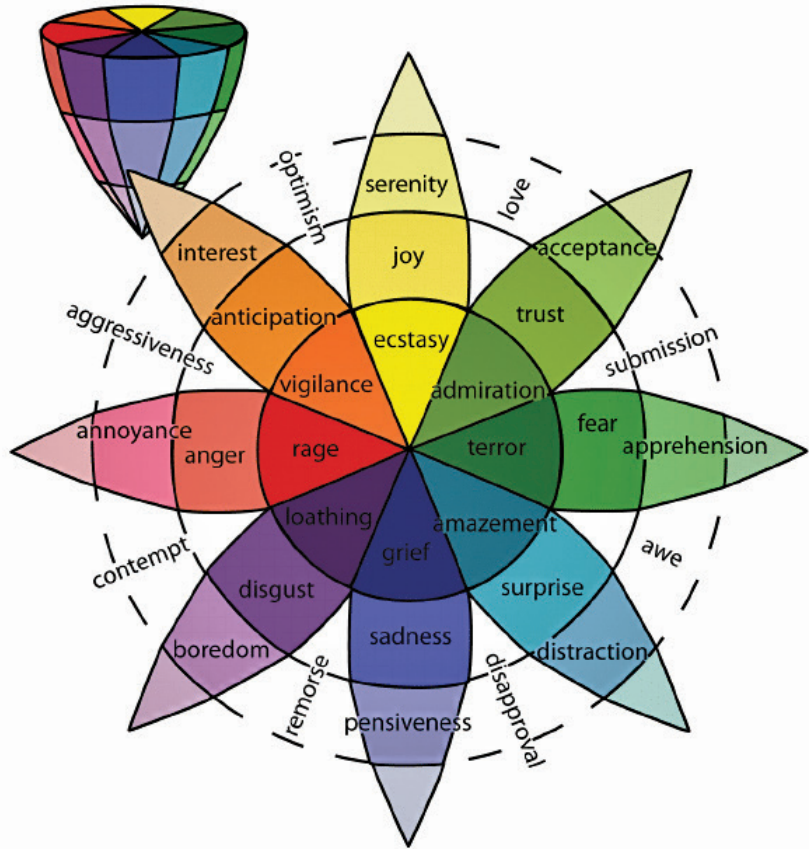
Figure no. 1: Wheel of emotions (Plutchnik, p. 349)

A more appropriate view for the purpose of this study on the impact of fake news on emotions and feelings is found in the work of Fleur J.M. Laros and Jan-Benedict E.M. Steenkamp, *"Emotions in Consumer Behaviour: A Hierarchical Approach"*. The two authors propose a diagram of feelings in terms of the effect produced on the individual, namely positive or negative. Thus, in the case of positive effects, joy, happiness, love, and pride are retained, while negative emotions are triggered by feelings of anger, fear, sadness and shame (Laros, Steenkamp, p. 1441), each including emotional subdivisions that lead to a hierarchy of emotions and affections, according to the model in *Figure no: 2*.
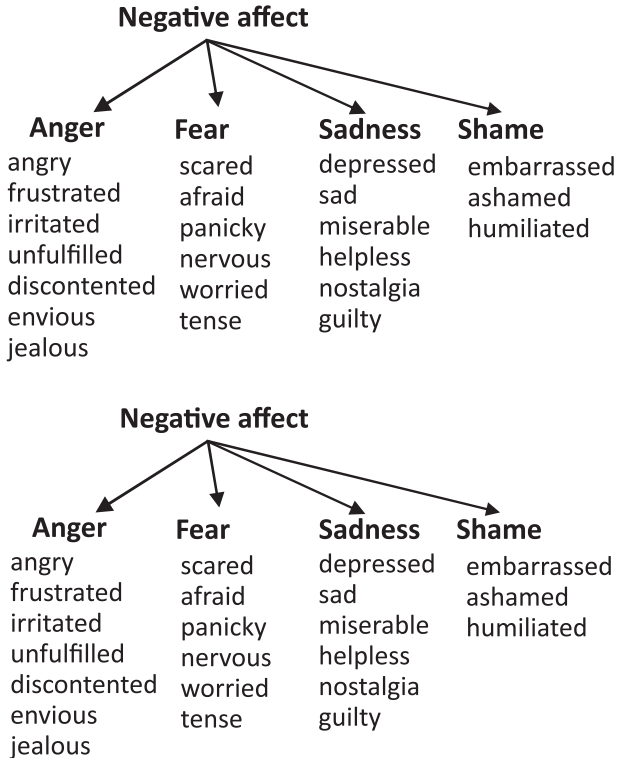
Negative affect

Anger	**Fear**	**Sadness**	**Shame**
angry	scared	depressed	embarrassed
frustrated	afraid	sad	ashamed
irritated	panicky	miserable	humiliated
unfulfilled	nervous	helpless	
discontented	worried	nostalgia	
envious	tense	guilty	
jealous			

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Figure no. 2: Hierarchy of emotions from the perspective of consumers
(reproduction according to Figure no. 1,
Hierarchy of consumer emotions (Laros, Steenkamp, p. 1441).

The final integration of these measurement and analysis solutions in a unitary system can take the form of an application for mobile devices and a complete version in a software solution, which can be then used by communication professionals to streamline the media analysis process. The software could, in principle, have three major components:

- the component formed by *sets of keywords* (including their semantic combinations, derived forms, compounds and synonyms) *and their combinations that define certain feelings*, sets that can be adapted according to the feelings to be analysed and created with the support of linguists;

- the component formed by the *corpus of fake news* in a certain field, in a certain period of time or in a certain context (pandemic, post-pandemic, regional security crisis, electoral campaign period and elections, etc.);
- the *basic software component*, made in a similar way to a search engine, which will perform *an extensive search of the words that define the feelings targeted on the news corpus* preloaded in the program.

The result of this search will take the form of graphs that will show the percentages of words describing a certain feeling in a news set, thus providing conclusive, objective, measurable and verifiable information about the feelings targeted by the initiators of this news. Identifying these feelings will reveal fake news that aim to induce a feeling of fear, apprehension, imminent danger, news to which the reaction will have to be immediate and include, for example, messages to reassure the population. Another type of news, which aims to induce feelings of mistrust in the ability of the authorities to deal with social phenomena, humanitarian, or security crises, will require, in response, information campaigns that explain, in detail and using multiple means and channels of communication, the role of institutions in the relationship with its citizens.

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CONCLUSIONS

In conclusion, we believe that the debate in the public space on the impact of fake news on public opinion can move to another stage, from raising awareness to that of drawing clear response strategies, to protect the media space from the negative influence of this phenomenon. For the drawing up of such strategies, it is necessary to have an extra knowledge of this phenomenon, so that the reaction to fake news is channelled toward the decrease of their effect on audiences. In-depth knowledge of the mechanisms in the field of psychology of emotions and feelings used in the development and dissemination of fake news can be capitalised at the level of news aggregators or other online platforms specialised in fact-checking or distribution of news.

Given the large volume of news that should be verified in a particular social context (e.g. political, health or national security crisis), the proposed instruments may highlight the preponderance of words and phrases in certain news which, beyond certain pre-established thresholds, can be marked accordingly, separated from the other news, and subsequently limited or even blocked in terms of their distribution/redistribution.

Regarding the conclusions of such a study, as well as the concrete proposals for capitalising on the results of research in the public, private, academic, or non-governmental organisations they could take the form of strategies aimed at responding to fake news and disinformation, implemented in programs, such as:

- *media education:* programs designed to explain how the media works and exposure to the phenomenon of fake news and disinformation, completed with measures to protect against their spread;
- *public information campaigns:* consistent communication effort that brings together a wide variety of information and communication tools on a certain field identified as insufficiently explained or exposed to disinformation;
- *rapid reaction to the appearance of false news:* official statements to clarify the issues mentioned in the news, reports of inaccuracy of information, exposing the news itself as false;
- *drawing up of deontological codes* associated with the professional fields of journalism and public relations regarding the way in which news should be verified, written, and posted, so that the phenomenon of fake news and disinformation is reduced.

Therefore, the setting up of rules and procedures as part of appropriate response mechanisms, including in terms of legislation, needs a more accurate and objective measurement of the impact that this fake news can have on the emotional level, especially in the context of social, security or medical crisis, while the sentiment analysis of fake news can provide the information needed for a more accurate analysis of their impact, so that the reaction is as effective as possible.

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