Preserving human mental health through control of pathogenic text in mass media by means of indexing and marking

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Abstract. Subject of this research paper is problem of pathogenic text as method for manipulating human consciousness and its dissemination through mass media, which due to their specific, make such manipulation most effective. Mass media have mastered metaphoric language, which can flawlessly influence readers' imagination.

We need to separately highlight our interest in text-based mass media (printed or blogs) versus audio-visual mass media (broadcast and digital), where flow of negative information seems to be magnitudes larger. In particular, paper touches specifics of written information perception.

Paper describes different negative consequences of pathogenic information consumption for human mental health, such as: lack of creative activity, depression, ambivalence, development of adrenaline addiction, etc.

In this paper, we analyze existing solutions of the problem of negative impact of pathogenic information, implemented in various countries and communities, substantiating their deficiencies in today's realities, especially considering opposition to censorship and governmental limitations.

We see resolution for the pathogenic text influence on human consciousness in person herself, in her self-awareness and ability to independently assess situation and make decisions. One of approaches to protecting society from pathogenic text without censorship, could be marking of pathogenic level of each specific article or publication. We also suggest not to limit markings to "pathogenic" or "non-pathogenic" labeling, but show percentage of text pathogenicity. By informing consumer of level of negative impact by particular text, we give him/her opportunity to decide about necessity or desire to read this text.

We propose automatic classification method based on Bayesian filters (Himmelblau, 1970), (Yerazunis, 2003).

Keywords: mental health, informational warfare, mass media, information, consciousness, influence, protection, text classification.

1.   Introduction

Radical changes that occur in political, economic and social areas of life not only of Ukraine, but of the whole world, increased activity of political life, global change of consciousness stereotypes, brought to the surface previously undetected or neglected patterns of society development, which show differently interdependence of many social phenomena.

Special place among factors that significantly influence mass consciousness, is occupied by processes of mass communication, which is one of most important institutes of modern society. They perform different functions: inform, advertise, entertain and manipulate. Obviously, they play important role in forming, functioning and evolution of social consciousness overall. Moreover, perception and interpretation by mass consciousness of most important phenomena and events happening in the country or world, is performed through and with assistance of mass media.

Growing impact of mass media in modern society aggravates problem of their negative influence. In recent years, this become a topic for wide discussions within scientific community. Impact of negative information on humans is discussed by specialists from various scientific disciplines: psychologists, sociologists, philologists, political scientists, philosophers and even mathematicians. Concept of free press, born within American culture and adopted as foundation for Ukrainian journalism, raises discussions and criticism. Necessity and expediency of putting information flows under control are debated. Many potential solutions are suggested: creating public oversight boards, control through licensing process, media product assessments. Simply put, solution is seen in putting extra regulatory barriers for publisher/broadcaster. Nevertheless, picking one of proposed solutions is deemed impossible, since all of them exhibit insufficient level of objectiveness and independence or

have other technical implementation flows.

2. Related Work

Influence of information on human consciousness was analyzed during decades following researchers: S. Maksymenko, I. Bila, L. Levchenko, Olexander Gliskov, Mykhaylo Dymshyts, D. Briant, V.A. Abramov, M.D. Venedictov, Y.N. Krapivina, T.M. Dubinina. Especially a lot of research is dedicated to influence of mass media: S.W. Kuzina, M.L. Kniazieva, Adam D. I. Kramer, Jamie E. Guillory, Jeffrey T. Hancock, Y.N. Volkov, V.V. Sarytchev, Yu.V. Borsukovskyy, V.Yu. Borsukovska. Researchers like Vidar Shtreme, B. Potyatynyk, M. Lozynskyy, G.S. O'Keeffe, K. Clarke-Pearson, S. Kryvorutchko wrote about problem of pathogenic text and danger of using such techniques in information warfare. Works of D. Himmelblau, William S. Yerazunis are dedicated to methods and machine algorithms used for text analysis.

In this paper, we are bridging research from different areas of scientific knowledge to identify optimal and acceptable for most communities approach to solving problem of pathogenic text influence on human mental health.

3. Results and Discussion

It is implied that there is direct dependency between demonstration of shows with negative content and anomalies in audience behavior. Scenes of violence trigger fights or murder, erotic scenes should cause sexual activity of audience, commercials – urge to felony, etc. Usually extreme forms of social deviations – crimes, are being highlighted as results of negative impact of information on humans (Hliskov & Dymshyts, 2010).

According to the theory of psychic mechanisms (reflection – projection – objectification), described in this paper, humans can create, design, build, view objects and phenomena from known and realized elements (Maksymenko, 2008; Maksymenko, 2008). Since one of characteristic feature of human psychology is transference, analogy, building of associative series, one of the questions analyzed in the paper is: what actions would be performed by the person, what she will be capable of creating or designing, imagining and realizing, if, with everyday information flow, her consciousness will be "consuming" descriptions of awful outcomes of catastrophes, detailed descriptions (photos) of bloodied corpses, details of sexual crimes, corruption cases of governmental officials, deliberations about total decay of its country. Such technologies are used today in psychological operations (PSYOPS) carried as part of informational wars. Work (first of all intellectual), as meaningful activity (including arts), requires that its results should first be visualized in form of vision, thought or feeling (Bila, 2014). This allows to compare it with subject of work, its transformation and result of work. This way vision, which drives person activity, is realized in object form.

There are other threats in consumption of pathogenic text: e.g. informational addiction. Once experiencing emotional reaction, e.g. interest, fear, shock, stress, after consuming information (text describing scandal, tragedy or sensation), person will seek to repeat experience (Briant, 2014). According to researchers, besides strong addiction to such informational drug and inability to exist without it, people exhibit:
•   readiness to consume any, even very "dirty" informational drug;
•   the need to increase the dose of consumption, as well as the use of stronger drugs. In the case of informational addiction, this is expressed, for example, in increasing the time spent

watching TV or the attraction to texts of a pathological nature;
•   narrowing of consciousness and vital interests;
•   increased insight, loss of will, responsibility and informational independence;
•   the state of chronic exhaustion in the form of a syndrome of chronic fatigue.

Socially, information addiction is expressed in increased external control of people. Any addiction, including informational, is usually cause by temptation to get something with minimal efforts (Abramov, Venedictov, & Krapivina, 2001).
We need to separately highlight our interest in text-based mass media (printed or blogs) versus audio-visual mass media (broadcast and digital), where flow of negative information seems to be magnitudes larger. In particular, paper touches specifics of written information perception. Contrary to the TV, where information is served fragmented, creating illusion of real-time and diversity, in press and other text-based mass media information is structured, with well though composition, which makes it more memorizable. Information is imprinted in readers memory, creating so called "anchor", which is commonly used in neuro-linguistic programming practices (Levchenko, 2001).

This topic becomes especially acute and relevant in the context of the formation of the younger generation. Interest in newspapers and magazines (increasingly electronic) usually occurs in adolescence. This makes quality and quantity of information placed on the pages of periodicals very important, taking into account the needs of forming personality, helping to form universal values, ethic and basic components of culture (Dubinina, 2008). Today, there are a large number of youth magazines that are in great demand among teenagers among print and internet publications. The teenager, comprehending his/her "Self," prefers to read about his peers. This is foundation of popularity of many teenager magazines and publications. The content of these magazines, in general, is not diverse and educative; major topics are: music, fashion, celebrities, sex, horoscope, tests, anecdotes. Obviously, such publications do not aim at expanding the horizons, raising the level of education and erudition among adolescents. Given that reading in human life in recent years has decreased not only quantitatively but also qualitatively, decrease in intensity and quality of youth reading presents large social loss (Kuzina & (RAGS), 2007).
One can even argue not only about the social loss of reducing the number of people read during life, but also about the social danger when it comes to the quality of information. Man does not associate his depressive mood, moral decay, apathy with the newspaper read in the morning coffee. Today we live in a negative informational field. We are haunted by bad news. And it's not just in the socio-political situation, but in the very principles of working with facts, events, their selection and presentation on the pages of print and on the television screen (Knyzeva, 2001, p. 5).

In 2013, a group of researchers conducted an experiment: within 7 days, part of Facebook users started receiving more often posts with negative information in their feed. Most of the posts had news with very emotional context. 689 003 Facebook users were subject to this experiment. Result: news affected the behavior of users, prompting them to show more often negative emotions and publish similar information. People perceived bad news as if they were happening in their own lives and became part of their own experiences. Within the scope of the experiment, the reverse theory was also validated: by filling their lives with positive news, people feel happier and more often show kindness, love and compassion (Kramer, Guillory, & Hancock, 2014, p. 5).

So, the easiest approach is to forbid everything that can lead to destructive behavior of the populationч, but it would be all too easy.

For example, the creation of public review boards, such as the German Central State Agency for Media Protection of Young Persons, covering video, audio and printed products. The Agency operates on the basis of the Law on the distribution of literature that is dangerous for young people. Serving on the Federal Review Board for Publications Harmful to Young Persons are one chairperson appointed by the Federal Ministry for Family, Senior Citizens, Women and Youth, one official appointed by each of the State governments as well as additional officials appointed by the above Federal Ministry. At least one deputy shall be appointed to the chairperson and to each of the officials.
Officials appointed by the above Federal Ministry shall represent the following facets of society:
1.   Creative and performing arts
2.   Literature
3.   Book trade and publishing
4.   Suppliers of data media and telemedia
5.   Non-government bodies of youth welfare
6.   Bodies of public youth welfare
7.   School teaching
8.   Christian churches as well as Jewish and other religious communities holding the status of a public-law corporation.

The result of the board review work may be the rating of material as undesirable for youth (there is also an age gradation). This means that a rated movie, book, magazine or computer game cannot be distributed in youth camps (in kiosks, on the street, on the Internet, in libraries, etc.), they cannot be placed on shop display, selling of such materials is allowed in "adult only" sections. Violation of this provision may result in a prosecution by law (BMFSFJ, 2002).

This is a great example of an independent expertise, but it has a number of conditions that are not suitable for Ukraine. First, a large number of employees are required to support such activities. In Germany, this responsibility rests with about 900 workers throughout the country, and the rest of citizens or organizations should contact them to initiate the procedure. Secondly, the effectiveness of German laws is supported by the functioning of documents that have no legal but moral force, such as the Code of the Press, currently lacking in our society. The attitude to freedom of the press in Germany greatly differs from American one. It is not considered untouchable, but, on the contrary, is used as an instrument of social conflict therapy (Volkov & Sarytchev, 2000). Although there is no censorship in Germany, the approaches to information security here are aimed at protecting the moral and ethical standards adopted in society (fines up to 500 000 marks!), Ensuring protection of the psyche of youth, honor and dignity of citizens. And thirdly, the described scheme is aimed only at protecting children and young people from the pathophysiology. Criteria for evaluating harmfulness or neutrality of the text for an adult are absent.

Recently, our European neighbors put emphasis on "information and psychological security", which means, first of all, the protection of the national information space in view of the morally-psychological state of the population (Borsukovsky & Borsukovska, 2017). There is a licensing system for television and radio broadcasts, in which the type of media, language,

distribution area, periodicity, maximum volume and time for television and radio broadcasting are clearly regulated. From January 1, 2009, the program concept, within which the topics should be declared, their short content description and the percentage ratio to the volume of broadcasting became an integral part of the license (Hliskov & Dymshyts, 2010). However, all this, in our opinion, is a formal issue. The actual influence of the television or radio company, and especially of print media, on the audience cannot be foreseen. Under the existing licensing system, the negative or positive impact of information is practically not evaluated. No one in the program concept will declare such topics as "propaganda of violence or pornography".

There are other ways to protect against pathogenic text. According to Norwegian laws, all newspapers, organizations whose activities involve mass media should have a responsible editor who is fully and individually responsible for the content of the publication. The role of the editor in Norway has been formed over a long period, and independence, which is an integral part of this post, is today considered one of the foundations of true freedom of expression in Norway (Shtreme). This protection and strengthening of freedom of expression consists both in protection from interference by the state and from the owner, which secures publication from corrupt, ordered low-grade materials and pursuing ratings in order to enrich the owner. But let's note: the role of the editor was formed over a long period. Under our current conditions it will be impossible to get rid of the subjectivity, dependence or authoritarianism of one person. Europe at the end of the 20th century for several decades sought means of combating American "pseudo-culture" as the embodiment of pathogenic information. For example, France, according to some experts, deliberately initiated the SECAM television system (later in Europe, it became PAL-SECAM standard), incompatible with American NTSC (Potyatynnyk & Lozynskyy, 1996, p. 193).

In the United States, the question of the fight against pathotext originated from the socio-medical side. Here, pediatricians work with community groups and schools on implementing special educational programs, which should help children understand and interpret advertising messages, other information consumed, "immunizing" youth against the harmful effects of the mass media. Programs teaching parents how to restrict mass media consumption by children have generally proved to be highly effective in USA (O'Keeffe, Clarke-Pearson, & Counsil on Communications and Media, 2011), (Council of Communications and Media, 2011).

4.Limitations of the study

As we see, the solution to the problem of the negative impact of information just by means of legislation or regulations is hardly possible. It should be remembered that the introduction of linguistic expertise is a potential threat to the principles of democracy and the freedom of choice. Any control body or system will provide a subjective assessment of the danger that comes from particular information. The question arises of the line between concepts of "control over negative information" and "censorship", which theoreticians of the concept of free press consider as an obstacle to freedom and progress. In addition, legal mechanisms allow only formalizing particular activity. Their implementation should be preceded by a diagnosis of the situation, which involves understanding not only what one wants to do, but also clarifying the goals and objectives of these efforts. Such diagnosis should be carried out with the involvement of psychological science.
It is possible, of course, to address pathotext by raising the moral and ethical standards among journalists (which in our opinion is a necessary foundation of journalist education and professional activity), but experience shows that, primary requirement from journalists,

starting from their graduation and though entire professional life, is volume of "product sales". Of course, we use here terms "product" and "sale" figuratively, referring to the publications and media ratings. At one time, the researcher of the psychology of information society and culture, M.L. Kniazeva, noted: "By the very nature of its work, a journalist must sharpen and dramatize event to attract attention. This is a feature of professional work with the fact. But today he often cannot confine himself to mere exacerbation - in accordance with the conditions and settings of the media in recent years, it requires a certain degree of escalation of the negativity of what is happening " (Knyzeva, 2001, p. 23).

So, it would not be just to put sole responsibility for adhering to such ephemeral concepts as "ethics" and "morality" on modern journalist, who needs to survive in the market conditions of the modern economy. We say - ephemeral, because morality is hard to define unambiguously. On one hand, there are some restrictions on the activities of the media, such as the need to protect the individual's reputation from slander and image in the press, unwarranted interference with his private life. But, on the other hand, the theory of free press argues that an individual, as a public figure, must be open to criticism (Kryvoruchko). And here it is difficult to draw a clear line between "reasonable" and "unreasonable" interference with his private life.

Article 3 of Ukrainian "Law on printed mass media" (Law of Ukraine "On printed mass media (press) in Ukraine", 1993) declares that "printed mass media in Ukraine cannot be used for promoting ideas of … forceful change… of territorial integrity of Ukraine". But, as we can see from actual practice, some media quoted "democratic principles of country development" as to right to cover ideas and desire of "nation" towards splitting country into autonomies or, even, merging with neighboring country.

Law creates barrier for dissemination of indecent materials, as mean to protect social moral. But in many cases, it is very hard to define what constitutes indecency. For example, term pornography in Ukraine is defined so broadly, that relevant articles of Criminal Code simply do not work. Good attorney can call in expert, which will place line between pornography and erotic "as needed". Formal criteria for court ruling in such cases do not exist in Ukraine.

Strengths of the study:

We see solution to problem of pathotext influence on human consciousness in human itself, in self-awareness and ability to independently evaluate situation and make decisions. One of ways to protect society from pathogenic text without introduction of censorship, could become introduction of pathogenic rating of each and every post, article, composition or publication, similarly to German approach, but applied regardless of consumer age. We also suggest using percentage of pathogenic, instead of simple "pathogenic" or "non-pathogenic" labels. By informing consumer about levels of negative information, we are providing way to independently make decision about need and desire to read it.

System we suggest is somewhat similar to nutrition facts labeling of food products. Nobody should dictate people, what they should eat, but one can educate them on implications from consuming excessive amounts of fat or cholesterol and provide information on which product contains what amount of such ingredients. Decision on consumption is made by person independently, depending on health and appetite.

For practical implementation of pathogenic text evaluation, an objective method of text classification should be developed. It should be based on psychological and sociological research and allow classification of further texts without direct human intervention. It is obvious that manual classification of all texts in all printed media, not mentioning Internet, is impossible. Besides of enormous amount of work, human intervention would introduce

subjectivism in text evaluation. In addition, it could result in certain form of censorship, when motives of some individual could influence availability or acceptance of certain text in society. That is why, we are suggesting automatic method of text classification.

Automatic text classification based on certain principles is not new. Many methods and classification approaches have been researched and implemented in many areas. We consider closest and most relevant following areas: automatic determination of text authorship, based on comparative analysis with predefined library of known authors; and filtering of unsolicited email messages (spam). Spam filtering can be considered a special (partial) case of classification and filtration of pathogenic text, since people use spam filters to avoid negative emotions from excessive amount of unsolicited and irrelevant messages in their mailbox.

Spam classification approached evolved throughout entire existence of commercial Internet. First attempts were quite primitive and were based on keyword search based on predefined blacklist of words or phrases. Such approach required creation and maintenance of blacklist, which means significant human efforts in analysis of unwanted (pathogenic) messages. There was significant probability of wrong classification due to appearance of blacklisted words in neutral text. Considering versality of human language, accuracy of such approach is very low. Last generation of spam filters are using much more sophisticated methods, which is based on statistical analysis of texts. Such filters are often called Bayesian, since they are based on Bayes theorem, named after reverent Thomas Bayes (Wikipedia), one of leading researchers in area of binomial distribution (Himmelblau, 1970)

Bayes theorem is formulated as following:

$$P(H_0|E) = \frac{P(E|H_0) \cdot P(H_0)}{P(E)}$$
, where

H_0 – hypothesis, that can be made based on previous observation and before occurrence of event E

$P(H_0)$ – marginal probability H_0 (probability that hypothesis is true);

$P(H_0|E)$ – conditional probability of event E occurrence if H_0 - true;

$P(E)$ – marginal probability of event E occurrence, probability of event E occurs without any additional information

$P(E|H_0)$ – posterior (after fact) probability of hypothesis, if event E – occurred (Himmelblau, 1970, p. 54).

In case of text classification, theorem can be formulated in the following way:

Probability that text is pathogenic, if it contains certain words, *equals* probability of such words occurrence in pathogenic text *multiplied* by probability that ANY text is pathogenic *divided* by probability of these words occurrence in ANY text.

Statistical classification of pathogenic text is based on fact, that certain words and phrases have different probability of occurrence in texts with low and high pathogenic influence. For example, word "bloody" often occurs in descriptions of tragedies or crimes, as opposed to, e.g., word "refraction". Given example is, of course, an oversimplification, since pathogenic text would contain a lot of generic words, which are often present in neutral texts as well. For correct classification, algorithms need to undergo training, when lists of words and phrases are formed through frequency analysis of pre-classified texts. To classify pathogenic texts, two bodies of texts should be compiled: one – with high level of pathogenic influence, second – with low. During training, classifier is first fed with texts of high pathogenic influence only and performs statistical analysis of words in such texts. Same process is repeated for low

pathogenic text. This way two bases: one containing words (or phrases) found in high pathogenic texts, another – words from low pathogenic texts. In order to determine probability of text belonging to one of groups, following steps are performed:

1) Calculation of local probability that word (or phrase) characterizes text as highly pathogenic, using following formula:

$$P = \frac{N_{path}}{N_{path} + N_{nonpath}}$$

where:

N_{path} – frequency of occurrence of word from pathogenic base in pathogenic texts;

$N_{nonpath}$ – frequency of occurrence of word from nonpathogenic base in pathogenic texts;

To improve accuracy with low frequencies, we can use modified formula, where result is shifted towards nondeterministic value:

$$P = \frac{N_{path} - N_{nonpath}}{C_1 \cdot (N_{path} + N_{nonpath} + C_2)}$$

where C_1 and C_2 – experimentally selected coefficients, e.g. $C_1=10$, $C_2=1$.

2) Determine overall probability of text being pathogenic, using modified Bayes chain rule:

$$P_{fin\_path} = \frac{P_i \cdot P_{prev\_path,i}}{\sum_{j=0}^{i-1} P_j \cdot P_{prev_{path},j}}$$

where: P_i, P_j – marginal probability that i^{th} and j^{th} words classify text as pathogenic, $P_{prev\_path,j}$ – result of the formula on j^{th} word.

Training of classifiers, based on statistical analysis, is done on "learning on mistakes" principle. This means that after classifier has been trained on one high pathogenic text sample and one - low pathogenic text, next stage of training starts. During second stage, program is run in classification mode and only in case of wrong classification result this text is used as next training sample. There are theoretical and empirical proofs that such approach leads to higher classification accuracy. After probability bases have been formed, classifier program can produce actual result, calculating probability that given text belongs to one of two groups, which can be treated as level of pathogenic influence (Himmelblau, 1970, p. 559).

We should note that since proposed algorithms do not have any notion of pathogenic influence internally, classification accuracy solely depends on selection of samples used for training. If for some reason, classifier produces incorrect result, e.g. classified text uses completely different vocabulary or language (all training samples contained crime descriptions and new text is pornographic), algorithm can easily be tuned, by repeating learning process with new text.

Applying such approach in practice requires extremely high demand to quality of samples. We cannot accept any subjectivism here, even by group of experts. In order to eliminate subjectivism, we can select samples using sociological research based on sample population, e.g. for city of Lviv it would be 600 people with error tolerance of ±4%.

Further research on effectiveness of statistical classifiers has shown that to increase accuracy, one has to analyze not just single words, which can be pretty neutral, but phrases. Let us consider sample sentence "The rain has stopped falling". Classical Bayesian classifier will split it into 5 elements: "the", "rain", "has", "stopped", "falling" and will perform frequency analysis of these words. Classifier based on sparse binary polynomial hashing will distinguish sixteen equal elements:

- "The"
- "The rain"
- "The" <skip word> "has"
- "The rain has"

- "The" <skip word><skip word> "stopped"
- "The" <skip word> "has stopped", etc.

<skip word> - means that algorithm will consider two phrases equal, where all words match but one in given position.

Markov classifier, which we will use for best result, will distinguish also 16 elements in this sentence, but will consider match of longer sequence of elements more relevant (William S. Yerazunis, Sparse Binary Polynomial Hashing and the CRM114 Discriminator, 2003). For that each sequence receives a weight, depending on number of words:

Table 1

Phrase	Weight
"The"	1
"The rain"	4
"The" <skip word> "has"	4
"The rain has"	16
"The" <skip word><skip word> "stopped"	4
…	
"The rain has stopped"	64
…	
"The rain has stopped falling"	256

With such weighting, a match of sequence of N words has higher relevance than matching of all shorter sequences of N-3, N-2 and N-1 words. There are experimental proofs that Markov classifier gives twice the accuracy than classical Bayesian one (William S. Yerazunis, The Spam-Filtering Accuracy Plateau at 99.9% Accuracy and How to Get Past It., 2003).

Calculation of local probability for word or word combination in Markov classifier is done according to following formula:

$$P = \frac{(N_{path} - N_{nonpath}) \cdot W}{C_1 \cdot (N_{path} + N_{nonpath} + C_2) \cdot W_{max}}$$

where W – weigh for given word (see Table 1 выше) and W_{max} – maximum weight (see last row in Table 1 выше).

5. Conclusions (and Future Work)

Paper also demonstrates that for practical implementation of pathogenic text detection, there is need for an objective method of text classification and describes method developed by the author after series of psychological and sociological researches, which allows to apply criteria for detecting pathogenic text without human intervention.

In this paper, we used CRM114 software developed by William S. Yerazunis (William S. Yerazunis, CRM114 - the Controllable Regex Mutilator, 2004). CRM114 implements multiple classifier algorithms, defaulting to Markov. As result of running this software, we receive probability of text being pathogenic, which can be used as rating published on the beginning of every printed material. Using such classifier every socially responsible journalist can mark his/her material, preventing possible harm to people, who are treating their psychological, mental and as a result physical health in responsible manner. Similar approach

can be used by electronic online media and social network providers. Modern information society does not prohibit or control consumption of harmful information by citizens, but professionals should provide warnings about potential hazards of his "goods", just like it is done nowadays for tobacco and alcohol products.

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