The Analysis of Reliability and Objectivity of Information That Can Be Found on the Internet

Vyacheslav VOLOSHYN [a,1]; Irina FEDOSOVA [a]; Viktoriya GONCHAR [a];
Oleksandr KALININ [a]; Dmytro MIRONENKO [a,1]; Kateryna POLUPANOVA [a]
[a] *SHEI "Pryazovskyi State Technical University", Mariupol (Ukraine)*

Abstract. The article deals with the analysis of reliability and objectivity of information that can be found on the internet and the objectivity and reliability of such information is compared to the system's behavior. The terms "useful" and "useless" information have been introduced. On the basis of Shannon's law of connection between information and entropy, as the measure of system's organization the notion of information chaos is analyzed, it illustrating growth of entropy in such system. The work comprises a graphical interpretation of various events with Lars Onsager's curves. Described is the parameter which has to discern authentic useful information available for analyzing and obtaining new knowledge from false and biased. A variant of the general scheme of the dynamic information system of the Internet, reflecting the appearance of inaccurate information, is given. The analysis of experts' evaluation of the internet users' reaction on appearance of false, biased or unreliable information showed that young users were oriented largely on emotional content, while the scientific society preferred reliability, objectiveness and authenticity of information.

Keywords. Internet, global information space, Shannon's law, false information, experts' evaluation, entropy, reliability, objectivity

1. Introduction

In recent years, the Internet has become one of the main sources of news and other information for many people (media channels, news portals, social networks, Youtube). They allow you to see the coverage of events taking place in the world from different points of view, quickly and conveniently receive any thematic information. Along with this, the global information space of the Internet is increasingly used to spread various rumors, fraudulent and other inaccurate information, as well as political propaganda. Information can be distorted both by an intruder pursuing his own selfish goals, and by ordinary users who inadvertently disseminate inaccurate information by posting data obtained from unverified sources on their pages. All this can have an impact on social, political, economic stability.

Reliability and objectivity of information that can be found both on the Internet and outside of it have always been paid much attention to in scientific and other publications [1-7], still, the data regarding the comparison of objectivity and reliability

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[1] Corresponding Author, E-mail: mironenko_ds@ukr.net.

of such information with the system's behavior, particularly, how the system's organization and its entropy, as a measure of its regulating and disordering can be compared to it are quite scarce.

The same can be applied to false, untruthful and biased information the contemporary Internet is deluged with. According to the research by IDC nearly 95% of information found on the Internet is not source information. In essence, it is not original reposted information, really inessential, i.e. it's useless for the society, as it can be termed as misinformation because it is biased or false. Only 35% of information, available on the Internet can be processed analytically, though just 1% of information has been analytically processed.

We must not forget that the aggregate information volume of the Internet can now exceed 40 terabytes [8]. We may assert, paraphrasing the words of David Sarnov, the honorary doctor on New York, Columbia and other world universities that "Knowledge in its essence is neither good, nor bad, its value could be measured how it is applied". It can be just for information found on the Internet, when it is applied.

Consequently, in the current situation, when the number of intentional and unintentional threats to violate the reliability of information increases, and at the same time, there are no built-in assessment mechanisms available to an ordinary user in the Internet services, it becomes necessary to create a system for monitoring the objectivity and reliability of information.

2. The main material

2.1. Literature review

In article [9], it is proposed to evaluate information posted on the Internet by calculating the sum of points according to four criteria: the degree of identification of the site owner, motivation to provide reliable information, relevance of information and the quality of the output data. This method is easy to use, but it is not universal and is more suitable for evaluating scientific information.

Work [10] is devoted to training the organization of the process of searching for information on the Internet. The author proposes to determine the reliability of information, taking into account its completeness, integrity and truthfulness. The most difficult task is to determine the truth of the information, and as a solution, the article proposes to evaluate the reliability of the source as a whole. A source can be considered credible if it belongs to a scientific, educational, or government organization. Otherwise, the analysis of links to the used data sources can be used as a method for assessing the truth of information. However, often sites do not contain links to the sources used, and in this case it is necessary to assess how reliable the information presented on the site on a topic known to the user is. Based on this, the user can later draw conclusions about thematically related information, the reliability of which he needs to evaluate. To solve this problem, it is proposed to use the Mamdani controller of the fuzzy logic apparatus. The disadvantage of this approach is that the user may not always have enough information to assess how true any information on the desired topic is, and, therefore, in this case, he will not be able to judge the reliability of the information in the source as a whole.

Contemporary Internet users do not value knowledge, as information giving "food for the mind" they seem to prefer information that creates some mood, some

impression, relations or desire, i.e. information with simplified social content, which is not rendered through texts, but preferably through images, pictures, video rows, in which the written contact form can be lost. Here, the ways of deliberate sense distortion of the original information can be applied as one of the objective tools, in order to adjust it to the mood or other simplified user's needs, quite often it could be distorted information, fakes, misinformation, information lies. It all is in great regular demand and finds the corresponding response in the Internet.

Quite arbitrary separation of information into useful and useless can, for example be determined by the probability formula by M. Bongard [8], still it has to be expressed in Shannon's law on connection between information and entropy, it being a measure of the system's organization, in investigations of other authors, like [11,12]. Claude Shannon showed that information growth was lost uncertainty, while regulated information was antipode of entropy growth [13]. He introduced one more notion of entropy-events entropy, having shown that entropy could be sufficient information measure, thus differing it from differential entropy, related to changing information values. At that event's entropy is measured by information that could be obtained as a result of the occurrence of this event, it can be measured in bytes and is equal to it. Information on the Internet is always of eventual character. So, we may depend upon the fact that events entropy is directly related to the object of our investigation.

We will show, that in some consecutive event s row (α_i), the information flow is, on the whole, nothing but expression of a sequence of some independent events. Then, in accordance with the well-known law, information is determined as:

$$I(\alpha_n) = -k \cdot \sum_{i=1}^{n} p(\alpha_i) \log_2 p(\alpha_i), \text{ bit} \qquad (1)$$

where $p(\alpha_i)$ – is the probability of α_i information event among n-multitude of other ones, connected with this system; k – is a coefficient, expressing relations between entropy units and information in the formula.

At that, according to Shannon, average entropy of $H(\alpha_n)$ event is equal to the information that leads to this event only (it follows from the law)

$$H(\alpha_n) = I(\alpha_n). \qquad (2)$$

The system with well-arranged information may be considered as organized, having some minimal entropy for the case. Vice versa, it's logical to think that distorted and not arranged information is to certain extent connected with growth of entropy. There is even quite an objective notion of information chaos, expressing, according to Shannon, growth of entropy in such system.

2.2. The objective of the investigation

The objective is to propose one of the possible ways of separating information within the Internet space, according to its quality with subsequent information objectification of analytical character.

To achieve this goal, the following tasks were solved during the research:

1. Divide the general information flow into useful and useless information; give a verbal definition of these terms, which in the future will make it possible to systematize information flows in the global information space of the Internet.

2. Based on Shannon's law on the connection of information with entropy, as a measure of the organization of a system, consider the concept of information disorder, reflecting the growth of entropy in such a system.

3. Introduce the concept of a weighting factor that should distinguish information available for analysis and for obtaining new knowledge from inaccessible for this.

4. Consider a variant of the general scheme of a dynamic information system of the Internet, reflecting the appearance of inaccurate information.

5. Conduct an analysis of the expert assessment of the reaction of certain groups of Internet users to the appearance of distorted or inaccurate information; the groups should include average users, young people from among students, scientists.

2.3. Presentation of the main material

We are interested in this work in distorted or false information and its influence upon organization of the information space. It is also information, though it is of low quality and not adapted to usual analytical application.

If we exclude the probabilistic approaches, introduced, for instance, by M. Bongard, A. Kharkevich, Y. Hintikk and their followers, then, in the notional sense we may assert that information possess qualitative character only in case it is suitable for analysis and further application with the aim of obtaining some new knowledge for learning and analyzing, so, when human brain can generate new knowledge, useful for the mankind from the existing information. It is difficult to overestimate the analytical character of information, contained in the Internet, despite the fact that it is contradictory to gradual loss of interest in the web to significant, sense content in favor of sensual perception of information. An opposite opinion can be met in literature, which can be quoted in this form:" knowledge is but an instrument for emotions and sensuality", trying to bring the contemporary Internet to into the number of its allies. Knowledge and analytical information becomes at that secondary, as it depends on the user's mood. This position has the right to exist only until the society acquires a new order for further development. It is bound to require new knowledge, appearance of new laws, development of the natural science and society to the degree, which man may deserve, with the level of his outlook and degree of his claims to the biotope.

Let us try to represent in a quite simple form the original information in the form of some useful substance for man, presenting opportunities for own analytical comprehension and interpretation in human brain. Such comprehension is bound to lead to appearance of new information. Let us call it useful information, unlike information, which, as a rule, does not give any "food for thought" and does not allow to get any new knowledge when it is analyzed by human brain. Let us call it useless information, as it is not necessary because it somehow differs from the useful information and it distorts man's perception of the world, complicates his communicative processes, hampers rationalism and to some extent the constructive sociality in the society. We can maintain that this information, useless for brain does not promote organization of the information system. It seems that this useless information, in the form of a simplified assumption regarding equiprobable outcomes for the system's entropy can be linked with its vector changes, particularly, with the

system missequencing. If the absence of the growth of entropy from the initial state H_0 to some subsequent H_1, state, as a result of appearance of information I_1, can be compared to $-I_1' = H_1' - H_0 > 0$ expression, then the opposite logics, regarding appearance of distorted information (misinformation and false information, useless for the system) I_1' can have the right to exist, as there happens to be some entropy growth $-I_1' = H_1' - H_0 > 0$.

The theory of information entropy characterizes uncertainty, due to the absence of information on the system state. Unreliable information increases this uncertainty in strict correspondence with Shannon's logics, so it leads to growth of the system's entropy.

C. Shannon, for example, shows that entropy's measure is one of the factors of uncertainty about the reliability of information $\Delta H \sim -(I_{rel} - I_0) > 0$ [13]. It is connected with the difference between two information types regarding the event (I_0) and its part (I_{rel}), which arises no doubts (i.e. is precisely well-known and is reliable enough). So growth of the system's entropy is linked with unreliable information, requiring additional rechecking.

In the volume of the "digital universe" it is suggested to consider as quality only the information which is capable of giving opportunities of its application for analytical treatment appearance of new knowledge, promoting some growth of the organized character of the system. Low grade information, in its turn, is the information incapable of giving opportunities of getting new objective knowledge, not promoting the organized character of the system, the level of the system's organization being determined by alternations in its entropy.

Not plunging into the semantics of expressions, as there are enough works, devoted to it, we will limit our claims and reduce to the sign of correspondence between quality and usefulness of information. We will stress here that division of information into useful and useless can be conventional only, even in the interpretation given here. Any information can be an object of the corresponding analytical comprehension in human brain for certain conclusions, even if they contain a negative result.

Such division, applied for the material under consideration will allow systematizing of the information flows in the global information space, providing for the user some opportunities, either positive or negative. In a more general case, when we have to deal with information events of different probability, which are consecutive and supplement each other the equation (1) acquires the well-known view:

$$I(P) = -P(\alpha)\log_2 P(\alpha) - [1 - P(\alpha)] \cdot \log_2 [1 - P(\alpha)]. \tag{3}$$

This dependence, in graphical interpretation (Fig.1) is quite comparable to phenomenological curves of Lars Onsager, marked with dotted lines in Fig.1 for the system arranged within the area of week thermodynamic no equilibrium and described with general equation $\Delta[H] = \sum_{\alpha=2} J_\alpha I_\alpha$, in which thermodynamic flows J_α and forces I_α are generalized in such a way that

$$J_1 = J_{11}I_1 + J_{12}I_2 = 0 , \qquad (4)$$

$$J_2 = J_{21}I_1 + J_{22}I_2 \neq 0 . \qquad (5)$$

Now, let us introduce the notion of weigh coefficient, related to false, incorrect and distorted information in the form of relation $\mu = \dfrac{P(\alpha)_-}{P(\alpha)_0}$, and its relation to reliable and true information in the form of $1 - \mu = \dfrac{[P(\alpha)_0 - P(\alpha)_-]}{P(\alpha)_0}$.

In Figure 1 there are these dependences in general view, that differ in their integral are by the value of

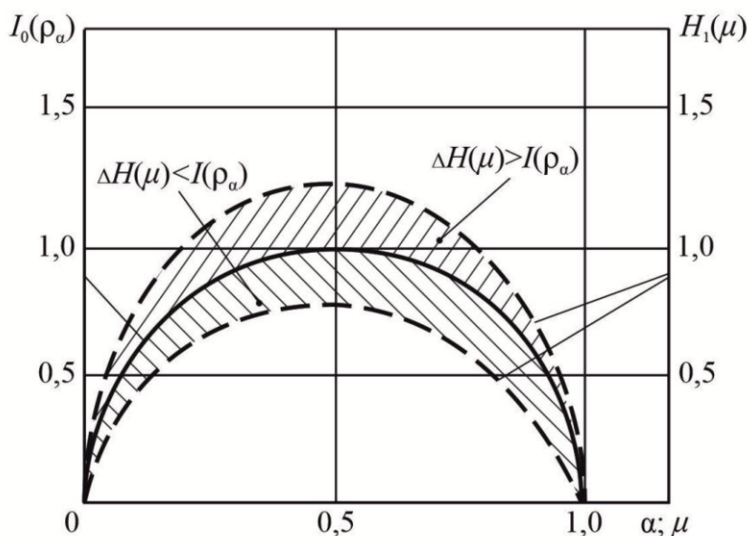$$\Delta = \pm(I_0 - H_1) = \pm[\alpha \cdot I(P_\alpha) - (1 - \mu) \cdot H_0] . \qquad (6)$$

Figure 1. Graphical interpretation of entropy of an event and entropy of thermodynamic system in the area of week no equilibrium.

Index "0" is here related to the entire information volume, while "-" index – to information of distorted view; $I_0 = H_0$ is related to the general state of information and the corresponding entropy of the events in the system.

The parameter μ from equation (6), in its essence should differ information, available for analysis and obtaining new knowledge from information unfit for it and, thus, it helps to tell useful information from useless and distorted.

To confirm the what we have mentioned above we'll show that if $\Delta > 0$, then, entropy of the system, containing in its volume some distorted information, less than the general information volume in the system $(H_1 < I_0)$, and on the contrary, if $\Delta < 0$,

then the entropy of the system with distorted information exceeds the entire mass of the data contained in this system $(H_1 > I_0)$. In the first case the system is stable to deformations; in the second case it is not stable. In other words, unreliable and distorted information hampers the growth of the system organization and reduction of the events' entropy.

Taking into account that Internet exists as a receiving and transmitting information system (Figure 2), having its original (let us designate it as I_x) information and its received information (I_y), as well as the corresponding passing channels, we will apply the theory of entropy analysis of digital data [14] for determining the role of distorted information in this global information system.
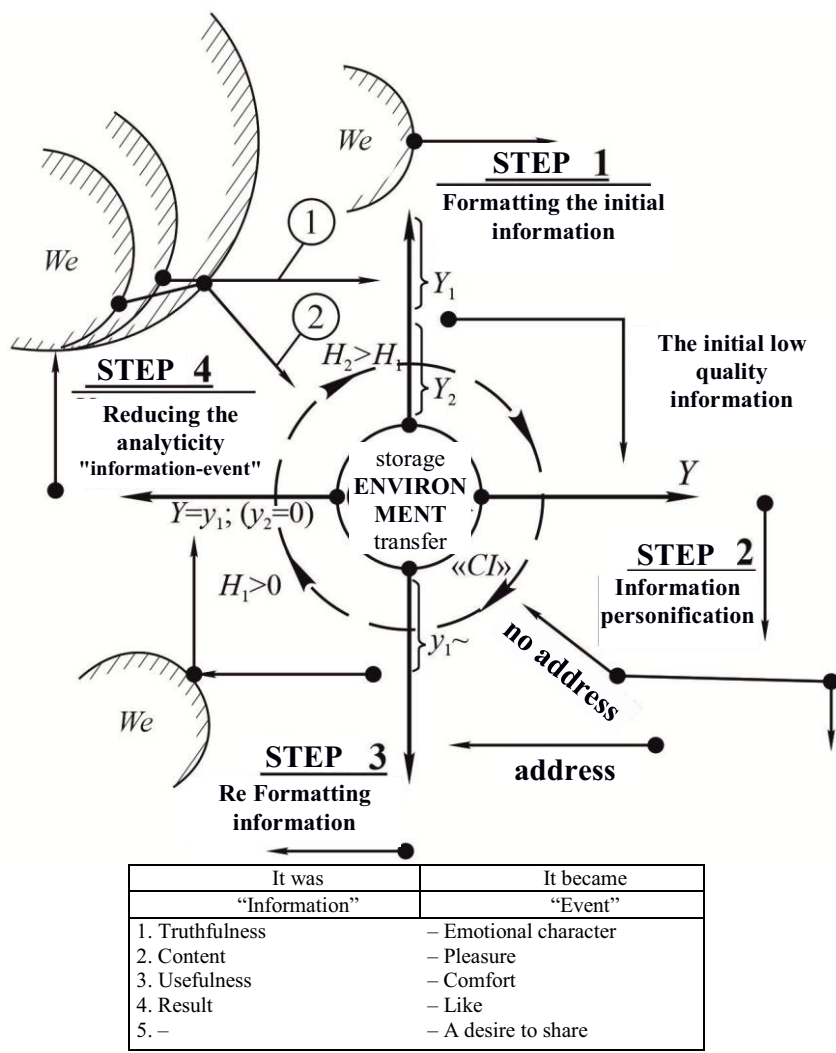

It was	It became
"Information"	"Event"
1. Truthfulness	– Emotional character
2. Content	– Pleasure
3. Usefulness	– Comfort
4. Result	– Like
5. –	– A desire to share

Figure 2. A variant of the general scheme of dynamic internet information system, showing appearance of false information (We – the users area(source of information); "CI" – the complete cycle of low quality information circulation; 1 – Emotional reaction for the event; 2 –Propagation in the net)

By introducing an auxiliary variable (z) for evaluation of standard distribution of random value for *n* events with zero average value and singular dispersion $z(n) = N(0,1)$ we will receive

$$I_x(n) = k[\alpha z(n) + (1-\alpha)N(0,1)] = \alpha k z(n), \tag{7}$$

$$I_y(n) = k[\alpha z(n') + (1-\alpha)N'(0,1)] = \alpha k z(n'). \tag{8}$$

The existence of the auxiliary variable shows a tense connection between variable multitudes of events *n* and *n'* in the form of received and transmitted information.

The original data in the form of I_x и I_y variables depending upon the coefficient of connectivity (α), compiled on the basis of selection of the events, connected with false information (the information that was not confirmed or was denied afterwards), contained in Internet regarding COVID 19 epidemic, available for users within the specified time span are represented in Fig.3. The time interval of information selection is 10 months of the year of 2020 (March-December). The overall number of information events for entropy analysis was 205, from that number there were 172 events connected with false of distorted information, fakes or errors.
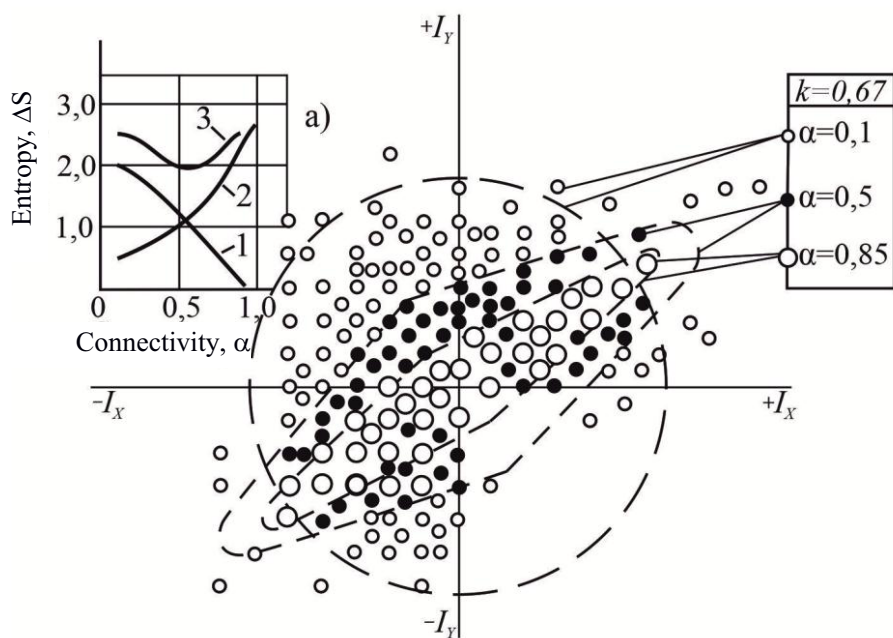

Figure 3. The diagram of the distribution of I_x and I_y variables for different values of α (designations in the text)

With the increase in connectivity between the variables in distorted events information areas of linearization $I_y(I_x)$, become obvious, especially at $\alpha \to 1$. The

dependence of entropy of information upon the connectivity of the variables of input and output of the information system gives us distinct difference in the form of curves (1) and (2) in Fig.3 and, accordingly, those, connected with distorted information.

If with the growth in connectivity of true information its entropy is decreased, then, for false information this dependence has to be simply the opposite. There exists the area for each the aggregate information placed on the Internet per a certain time interval is minimal (see Fig 3, a), but its quite bigger than entropy of unambiguously reliable information, compared to it. It proves that any distorted information for an Internet user is a reason of destruction of organization of the information system in which such user is.

Thus, the quality of information, its error (unreliable, distorted or false) part is an essential obstacle for application of such information with constructive purposes. This peculiarity of the information field in the Internet is likewise evaluated by its users, representing more typical groups, it being confirmed by the results of experimental researches.

Now let us evaluate the results of the poll, investigating response reactions of separate groups of Internet users on appearance of false or unreliable information. Classification of types, reasons and ways of revealing disbelief in Internet systems in accordance to some selected data [15,16,17,18,19,20], and the so-called factors of disbelief to information in arbitrary view is summarized in Table1. The poll experts were:

- 111 average statistical users of Internet and social networks, including persons, trained professionally;
- 122 young studying persons of 10th and 11th school forms and university students, whose age does not exceed 25 years;

(these two expert groups have, according to their data have little need in analytical treatment of information they are interested in Internet)

- 67 among research workers, whose age is over 25 and who have a need in analytical processing of information with the objective of generating new information on the basis of the original information, i.e. in obtaining new knowledge.

Each expert had the right to evaluate the value of any three factors, taken from the list of suggested, the maximal rating was 60 points. The experts' marks underwent analytical processing, as specified [21]. The results (see Table 1) are represented in the form of specified values of mathematical anticipation and its average quadratic inclination and are illustrated in Figure 4 graphically.

The experts' evaluation Y defines indirectly the volume of distorted information, roughly calculated by the experts which the Internet users may face. It is quite a subjective index and conventionally can be divided into two parts $Y = Y_1 + Y_2$, where Y_1 – is the volume of distorted information confirmed afterwards, Y_2 – is the volume of potentially distorted information that eventually proved to be correct (see Figure 2).

The analysis of experts' research showed that young users, who are inclined towards sensual emotional content practically do not perceive the factors group 1÷6, as menacing to its interests in Internet, while representatives of the science circles were not worried by the 8÷10 factors, that are in their turn vital for young persons. It can be explained by different interest vectors among these users groups. The science circles of

the Internet are interested in reliability, authenticity and transparency of information, contained in the sources and authors' competences.

Table 1. Classification of the factors of disbelief X to the Internet information in expert evaluations of Y-users

| #	Disbelief factors, X		Experts' evaluations, Y points		
			Average users	Young persons	Researchers
1	Literary errors, distorting the sense of the text		22,55±3,41	5,1±2,21	34,3±5,83
2	Sense distortions in the main text, substandard text, loss of informational sense		22,5±4,01	4,9±1,29	37,9±9,11
3	Information without reference to sources; unverifiable information		21,4±2,16	7,2±2,54	40,2±3,45
4	Transparency of submitted information		26,1±4,87	12,6±4,34	39,8±6,44
5	Reliability of basic information sources		20,9±1,64	7,9±1,19	39,3±5,12
6	The depth of assimilation of information by its author		28,9±5,42	11,2±2,33	42,1±6,11
7	Consistency of questionable information		25,8±7,77	12,4±3,14	27,9±5,27
8	Flood manifestations, wipes, non-thematic information		35,1±4,63	26,9±4,74	12,5±3,41
9	Click bait		36,4±1,88	29,9±3,84	13,2±2,55
10	Direct information deception, false information, fakes		41,9±5,75	48,9±5,17	7,5±1,14
11	Opportunities to protect against misinformation on the Internet,%	Yes	6	12	31
		No	89	77	58
	Return to censorship,%	Yes	4	–	45
		No	88	95	51
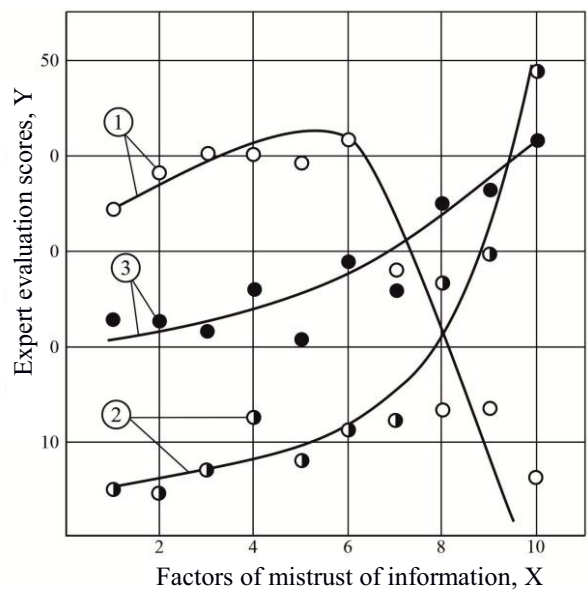
Figure 4. The results of an expert assessment of the factors of mistrust in information resources on the Internet. 1 – group of scientists, 2 – group of young users, 3 – group of average users.

The analysis of experts' research showed that young users, who are inclined towards sensual emotional content practically do not perceive the factors group 1÷6, as menacing to its interests in Internet, while representatives of the science circles were not worried by the 8÷10 factors, that are in their turn vital for young persons. It can be explained by different interest vectors among these users groups. The science circles of the Internet are interested in reliability, authenticity and transparency of information, contained in the sources and authors' competences.

An average internet user is less anxious about those groups of factors, because of his lack of professionalism and emotional perception, evaluating those hazards nearly equally. The group of factors 7-9 is most equally evaluated by the group of experts. False information, fakes, floods less worry the world of scientists than ordinary Internet users because there are fewer examples of such negative phenomena there, in comparison with social information space.

89% of experts of the first group, 77% - of the second group and 58% - of the third group do not see real opportunities of protecting Internet space from appearance of distorted information. While 45% of users of the third group see the way out in restoration of censorship, at least in scientific and public publications, it was being unacceptable variant for the bulk (88-95%) of the alternative internet users.

3. Conclusion

On the whole, it may be concluded that false information on the internet in its numerous forms comprises a great part of information and even nowadays is becoming an obstacle for further development of the information space, if it's reasonable enough to consider it to be one of the most important sources of organization and development of the contemporary society. It can be testified by the objective entropy processes, connected with information flows of different quality, that are present in the internet, as well as the results of sociologic polls, conducted among representatives of different groups of users.

Controlling the reliability of information on the global Internet is currently a very urgent task, since more and more people are becoming active users, and at the same time the number of threats is constantly growing.

The society has not invented the ways of ensuring reliability for the global information space yet; however, it has to be found, sooner or later, including, with the help of the criteria of organization of information systems.

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