Internet Addiction in the Aspect of Information Technology

Sergey Fadyushin*[1], Elena Vereshchagina[1], Galina Tsyganova[2], Galina Tikhonovsky[3], Anastasiia Khvatova[4], Roman Moiseenko[5],

[1]Associate Professor Far Eastern Federal University, Vladivostok, Russky Island, Russia

[2]senior lecturer Far Eastern Federal University, Vladivostok, Russky Island, Russia.

[3]senior Lecturer Far Eastern Federal University, Vladivostok, Russky Island, Russia.

[4]senior student Far Eastern Federal University, Vladivostok, Russky Island, Russia.

[5]senior student Far Eastern Federal University, Vladivostok, Russky Island, Russia.

Corresponding Author: Sergey Fadyushin, Associate Professor Far Eastern Federal University, Vladivostok, Russky Island, Russia, **Tel:** +7423245-76-87**; Email:** fadyushin.sg@dvfu.ru

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ABSTRACT

The progress of information technology is undoubtedly useful, but it brings a number of threats to man and society. One of them, called Internet dependence or Internet addiction, is intensively discussed in the field of information technology and in psychological sciences. Internet addiction is not yet a universally recognized factor of human addictive behavior. But almost all researchers note the increasing power of the negative impact of this phenomenon on the mental state of Internet users. The purpose of the study, the results of which are described in this paper, is to theoretically substantiate the diagnostic criterion of Internet-dependent human behavior in the aspect of information technology. The main research tool is the method of estimating the meaningfulness of search queries in the Internet, developed on the basis of probability theory and mathematical statistics. The study was conducted on the example of a group of senior university students. The content of this paper relates to the field of interdisciplinary scientific research, which lies at the intersection of information theory and psychology of the Internet (cyber-psychology). The paper is of a scholarly and researching nature and represents a topic for a broad discussion on the Internet addiction. The main result of the study is a diagnostic criterion for assessing Internet addiction in the aspect of information technology, enabling to identify the patient's "general" personality disorder based on statistical analysis of the meaningfulness of search queries on the Internet. The results obtained can be of theoretical and practical value for specialists in Internet psychology, psychiatrists, artificial intelligence developers, Internet-dependent people and anyone who cares about their fate.

KEYWORDS

Internet Addiction; Information; Entropy; Addiction; the Internet.

INTRODUCTION

The founder of the psychological study of the phenomena of dependence on the Internet is a clinical psychologist K. Young [1]. From her point of view, Internet addiction should be considered as a real clinical phenomenon, one of the types of mental disorders and diseases.

However, a considerable number of scientists still doubt this.

Therefore, the term "Internet addiction" is not accepted in official medical reference books, such as ICD-10 and DSM-5 and is treated as a condition that requires further study. But at present, the problems of the psychology of the Internet have become so widespread that many psychiatrists tend to consider addiction to the Internet as a real diagnosis.

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So according to a survey conducted by the independent sociological service Foundation "Public Opinion", the question: "Are there among your friends / acquaintances those who cannot do without the Internet for a long time and experience dependence on it? And if there are, are such people many or few?" was answered positively by almost half of the respondents (40%) under the age of 30 [2].

In this paper, "the Internet is understood not as a specific network of interconnected computers and mobile devices, and not even a network of networks along with channels and communication devices between components with the corresponding software and protocols, but along with such networks, also social services built on their basis, attracting people and / or providing for their activities" [3]. From such an interpretation of the Internet, follows the concept "psychology of the Internet" or "cyber- psychology" [3].

To designate the phenomenon of a person's dependence on the Internet, the specialists coined a number of terms: Internet addiction, Internet dependency, Internet abuse, compulsive Internet use, pathological Internet use or problematic and disturbed Internet use. Behind the differences in the terminology, there are fundamental disagreements: should the Internet Abuse be viewed as a clinical disease, is the addiction development model suitable for it? In our paper, we use a widespread term "Internet addiction". In doing so, we do not assert that this phenomenon necessarily represents a psychological dependence.

However, it would be interesting to know the opinion of the authors and readers of the Mathews Journal of Psychiatry and Mental Health both on the terminology of Internet addiction and on the basic fundamental issue.

One of the problems of assessing Internet addiction is the establishment of diagnostic criteria. Of the proposed measurement scales, none is universal. But the standardization of the criteria and the consideration of both psychological and the information aspects would contribute to solving the problem of psychodiagnostics of Internet-dependent human behavior.

One of the main features of Internet addiction is that people spend too much time on the Internet. Indeed, among people who seek psychological help because of problems related to the use of the Internet, 61% do so because of excessive use of the Internet [4]. However, the number of hours spent by a person on the Internet increases exponentially. Therefore, quantitative data on the "norm" are not at all indicative of Internet users from different eras.

Recently, in studies on psychology of the Internet, there has been a tendency to search for links between Internet addiction and flow experience [3, 5]. Such phenomena as Internet dependence and the experience of the flow are outwardly similar. both being associated with behavioral repetition of the action. Therefore, some authors believe that getting the experience of flow on the Internet can cause a tendency to dependence [6].

Currently, poll methods are used to measure the dependence on the Internet. The most common method is CIAS [7]. An important feature of this technique is the availability of the time management scale. An increasing number of studies on the Internet addiction is carried out in China.

Thus, a review of the literature on the Internet addiction and the author's own research on this topic made it possible to formulate the main hypothesis of the study. When searching the Internet, an Internet dependent person, obviously, will most often refer to a particular specified search topic. From that, it follows that the level of meaningfulness of a set of words and phrases of search queries on this topic ("user's" text) will be different from the set of words and phrases of search queries, compiled according to the rating of topics of a search engine ("machine's" text). In this case, the "machine's" text will represent the "norm", and the "user's" text will be the "anomaly". Comparing the meaningfulness of these texts, one can quantify the deviation in the use of the Internet from the norm. If the discrepancy between the "anomaly" and the "norm" increases with an unlimited increase in the number of hours spent on the Internet, then obviously the experience of the flow is transformed into an Internet addiction. This is a signal to start using psychodiagnostic methods to finally establish the dependence of a person on the Internet.

In most dictionaries, "sense" is often defined as a synonym for the word "meaning". But the Russian notions "meaning" and "sense" denote different etymologies that do not coincide in different languages. Russian "sense" means "with thought." From the authors' point of view, sense is a thought coded by certain linguistic signs, reflecting the purposeful activity of a person.

As the basic premises for the substantiation of this hypothesis, the following postulates were used:

1. Sense carries information about its denotation and has a probabilistic nature. Meaningfulness of the text is the level (the amount of meaning) in it.

2. The experience of the flow associated with the use of the Internet can gradually be transformed into Internet addiction.

3. One of the main factors in the development of Internet addiction is the time spent by a person on the Internet.

In this paper the authors used the results of research on the influence of information on people [8-12] and other materials, a bibliographic list of which is presented in the References section.

MATERIALS AND METHODS

The words that make up the search queries symbolize random events when the user searches for information on the Internet. However, a single word does not in itself make sense. The word is the expresser, the instrument for describing, the denotation, but not the sense [13, 14]. In order to reveal the sense, it is necessary to establish semantic connections between words and build a "chain of semantic links" [15]. In addition, both categories ("meaning" and "sense") must be homogeneous, in the language of mathematics, to have the same unit of measurement, i.e. the semantic connection between words must have the property of homogeneity. The common thing that unites both these categories is information that, according to K. Shannon, is measured through entropy [16].

In establishing the semantic links for each word and phrase of "machine's" and "user's" texts, the Shannon entropy (H) was calculated. Then the difference in entropy between two adjacent words or phrases (ΔH) was found. This action isolates the denotation contained in both adjacent words and phrases, and what finally remains is meaning. Because the selection of search words and phrases by a person is a random process, then the difference in entropy will be a random variable that plays a major role in the probabilistic evaluation of meaning.

The entropy difference ΔH as a random variable has an exponential distribution law, the parameters of which can be used to estimate the value of the sense. For evaluation it is convenient to use such a parameter as the differential entropy $H(\Delta H)$. Earlier in [12], when comparing two types of texts (source and probabilistic), it was found that the level of meaningfulness depends on the ordering (Shannon entropy) of the text by ΔH. With respect to the parameter $H(\Delta H)$, this means that the greater the differential entropy of the exponential distribution of the random variable ΔH, the greater the sense and vice versa. This pattern gives grounds to use the differential entropy of the semantic connection of search words and phrases for quantifying the meaning of a text as a psychometric characteristics (diagnostic criterion) M:

$$M = H(\Delta H).$$

When evaluating the Internet dependence, values of M_i and Mm of "user's" and "machine's" texts are compared and analyzed, respectively:

if $M_i \geq M_m$, then, most probably, there is no Internet dependence;

if $M_i < M_m$, then, most probably, there is an ongoing Internet dependence.

Thus, the decrease in the level of differential entropy of the search queries of an individual (M_i) in comparison with the level of differential entropy of search queries by the search engine rating (M_m), with unmotivated unlimited time increase on the Internet (T_i) will indicate the development of Internet addiction:

$$M_i < M_m, T_i \rightarrow \infty,$$

where symbol ∞ is used in psychological context.

RESULTS AND DISCUSSION

On the subject of the survey, 50 university students were interviewed. The results of the survey are presented in Table 1.

Table 1: Rating of the Internet Search Topics

s/n	Internet Search Topics	
	Rating Made by Students	Rating Made by Search Engine
1	Studies	Porno
2	Music	Video
3	Video	Games
4	News	Music
5	Movies	News
6	Social Networks	Movies
7	Work+Business	Automobiles
8	Computer+Software	Computer+Software
9	Health	Work+Business
10	Games	Social Networks
11	Porno	Studies

From Table 1 it can be seen that students gave the basic preference to the topic *Study*, while according to the data of the search engine this topic occupies the last place. Obviously, the experience of the flow is affected here, i.e. students are involved in the learning process. According to the statistical data of the survey, the average time spent on the Internet was 8.2 hours, which corresponds to the norm for a modern Internet user.

According to Table 1, two types of texts were compiled:

- "machine's" - text consisting of words and phrases of search queries on all topics of the search engine rating [17];

- "user's" - text consisting of words and phrases of search queries on the topic *Study* of the students' rating [17].

As an example, see fragments from both types of texts, including 300 search queries.

"Machine" text: "business planning coursework, home video, how to install software on a computer, computer software for free, movies, porn categories, study, study tip, world news, video, watch movies, games ...".

"User" text on the topic Study: "study, workbook, years of study, study at a university, about studies, place of study, payment for studies, workbook for universities, study abroad, download textbook on information technology ...".

When processing both types of texts using the described method, the following results were obtained:

- "machine's" - text – M_m = 0.325659;

- "user's" - text – M_i = 0.053486.

The functions of probability densities on ΔH are shown in (Figure 1).
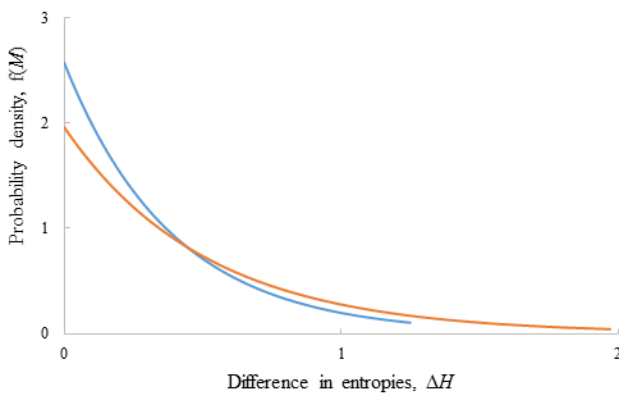
Figure 1: Functions of probability densities of "user's" text and "machine's" texts.

The obtained result in the form of a diagnostic criterion of the Internet dependence can be represented in the following form:

$$M_i < M_m, \; T_i = \text{norm.}$$

Thus, the students interviewed are in a state of flow of empathy with the learning process and they do not have a tendency to develop Internet addiction. However, increasing the time spent on the Internet can lead to the emergence of Internet-dependent behavior.

The obtained result is confirmed by the graphs in (Figure 1). The probability of "short" semantic connections among users in comparison with the probability of "machine" semantic connections is greater than "long" and vice versa. This can mean that the user uses standard recurring words and phrases when compiling searches, which reduce the overall level of informativeness and meaningfulness of search queries.

The results obtained should be considered as an example of the application of the diagnostic criterion of Internet addiction proposed in this paper. The use of this criterion will reveal the patient's "general" personality disorder, and then characterize it with specific signs. At the present time, psychiatrists often immediately diagnose a particular personality disorder, which is not consistent with the basic approach in the DSM-5.

CONCLUSIONS

Thus, in the context of information technology, it is proposed to use as a diagnostic criterion the differential entropy of the sense-related connectivity of keywords and phrases of search queries on the Internet to evaluate the Internet-dependent behavior of a person. Reducing the level of differential entropy of an individual compared to the level of a search engine with an unmotivated unlimited increase in the time spent on the Internet will indicate the development of the Internet addiction. For the final diagnosis of a person's Internet addiction, it is necessary to use appropriate psychodiagnostic methods, for example, CIAS.

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