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КОМП'ЮТЕРНІ НАУКИ ТА ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ

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THE SEMANTICS OF «CYBERNETIC SAFETY» TERM. WHAT WE CANNOT AGREE WITH

The state of knowledge related to the scientific field of «cybernetics safety» definitely needs clarification. As every computer system represents a system of human-machine type, in which two components: a human and a computer are inseparably linked, the field of knowledge mentioned above must also comprise knowledge regarding safety of the man, being a component of this system. The present-day state of things seems to be related only to protection of computer software from external influence, ensuring correct functioning of computers and creating the conditions opposing external attacks on this system, thus setting up the objective of preserving its integrity and functioning. All such tasks are vital and are aimed at securing one part of the «human-machine» system. Scientific knowledge comprising the base of «cybernetic safety» are in no way related the second inseparable component of this system-human's safety, an operator, a user, an ordinary inhabitant. The problems of safety of man in such system, with due regard to an avalanche-like character of the process of computerization of our society, development of internet, computer networks and fields of human activity, in which computers find application, has been setting and is setting urgent problems of co-existence of man and computer, both from the positions health and physiology and the positions of sociality of man in the present-day society. The society can equally place an order for existence of knowledge in the field of protection of man-the user of such systems from outer biological, psychological and asocial meddling and protection of actual knowledge, ensuring worthy human life in the contemporary world.
Keywords: *cybernetic safety, semantics, human safety, human-machine systems, sociality.*

Волошин В.С. Семантика терміну «кібернетична безпека». З чим не можна погодитися. *Стан знань, що відносяться до наукового напрямку «кібернетична безпека» в науковій галузі «кібернетика» потребує уточнення. Оскільки будь-яка комп'ютерна система являє собою человекомашінну систему, в якій нерозривно співіснують дві складові – людина і комп'ютер, зазначена вище галузь знань повинна включати і знання про безпеку людини, що є складовою частиною цієї системи. Сучасний стан питання відноситься тільки до захисту програмного продукту комп'ютерної системи від зовнішнього впливу, забезпечення належного функціонування комп'ютера, створення умов, що протидіють зовнішнім атакам на цю систему, і має на меті збереження її цілісності і працездатності. Всі ці завдання є актуальними і спрямовані на забезпечення безпеки однієї частини системи «людина-машина». Наукові знання, що становлять основу «кібернетичної безпеки» практично ніяк не співвідносяться з безпекою другої нерозривної складової цієї системи – безпекою людини, оператора, користувача, обивателя. Проблеми безпеки людини в таких системах, враховуючи лавиноподібний процес комп'ютеризації суспільства, розвиток інтернету, комп'ютерних мереж і галузей людської діяльності, в яких знаходять застосування комп'ютери, давно ставило і ставить актуальні проблеми співіснування людини і комп'ютера, як з позицій фізіології і здоров'я,*

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так і з позицій соціальності людини в сучасному суспільстві. В рівній мірі суспільство може робити замовлення на існування знань в області захисту людини – користувача цих систем від зовнішнього біологічного, психологічного, асоціального втручання, як знань актуальних, що забезпечують гідну життєдіяльність людини в сучасному світі.
Ключові слова: *кібернетична безпека, семантика, безпека людини, система «людина-машина», соціальність.*

Волошин В.С. Семантика термина «кибернетическая безопасность». С чем нельзя согласиться. *Состояние знаний, относящихся к научному направлению «кибернетическая безопасность» в научной области «кибернетика» нуждается в уточнении. Поскольку любая компьютерная система представляет собой человекомашинную систему, в которой неразрывно сосуществуют две составляющие – человек и компьютер, указанная выше область знаний должна включать и знания о безопасности человека, являющегося составной частью этой системы. Современное состояние вопроса относится только к защите программного продукта компьютерной системы от внешнего воздействия, обеспечение правильной работы компьютера, создание условий, противодействующих внешним атакам на эту систему, и ставит целью сохранения ее целостности и работоспособности. Все эти задачи являются актуальными и направлены на обеспечение безопасности одной части системы «человек-машина». Научные знания, составляющие основу «кибернетической безопасности» практически никак не соотносятся с безопасностью второй неразрывной составляющей этой системы – безопасностью человека, оператора, пользователя, обывателя. Проблемы безопасности человека в таких системах, учитывая лавинообразный процесс компьютеризации общества, развития интернета, компьютерных сетей и областей человеческой деятельности, в которых находят применение компьютеры, давно ставило и ставит актуальные проблемы сосуществования человека и компьютера, как с позиций физиологии и здоровья, так и с позиций социальности человека в современном обществе. В равной степени общество может делать заказ на существование знаний в области защиты человека – пользователя этих систем от внешнего биологического, психологического, асоциального вмешательства, как знаний актуальных, обеспечивающих достойную жизнедеятельность человека в современном мире.*
Ключевые слова: *кибернетическая безопасность, семантика, безопасность человека, система «человек-машина», социальность.*

Description of the problem. Three paradigms, ensuring human's existence as an individual, lie at the heart of man's biological essence, just like other representatives of the living world. These are conditions of keeping up energy balance (nutrition, rest and energy losses, spent on food procuring), reproduction of progeny and ensuring personal safety or protection of personal life. The third paradigm has eventually acquired some social status, ensuring the required safety level, not only for life, but also for protection from illnesses and mental disturbances, protection and preservation of economic well-being and social prosperity. Safety, within the framework of the global information safety, is but the same paradigm, that can't be neglected in the contemporary society. But correlation of the notion of safety with regard to its cybernetic component needs clarification.

Analysis of recent research and publications. The term «safety» has existed for a long time and has always played a major part in all life processes, both personal and social. It is worthwhile mentioning that its meaning has always been related to the man, the object of safety. To ensure safety meant preservation of life and later man's health. Safety at war means protection of soldier's body from affection by corresponding means of impact (an arrow, a sable, a bullet, shells and then like). Means of human protection were quite appropriate. The period of Great sea discoveries was linked with mass navigation and ships' quality. Their navigation parameters were especially important as they were to ensure not only the final outcome but also human lives. At peaceful times man's safety was ensured mostly in the process of labour, which occupied the bulk of his time. Safety of human labour appeared then. When computing machines and other sources of ultra-high frequency generators

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sprang up, greater attention started to be paid to electromagnetic safety of man from various lamps, electron-beam tubes, monitors and the like [1-3]. When it became clear that time frequency of computer micro schemes and chips was the key chain for ensuring fast operation of personal computers this actual danger was successfully ignored and ultra-high frequency devices, potentially dangerous for almost all biological systems obtained an advantage over human health and safety [4]. In this case human safety gave in to electron-beam monitors and microchips of first personal computers.

If for cybernetics (from Greek κυβερνητιχη), as an art of management, man is a subject of activity, for cybernetic safety man is but an object of influencing. In [5] it was admitted that cyber-safety alongside with protection from attacks of viruses had to provide protection from manipulating with public consciousness. So, the author took consideration of a human factor in the system of cybernetic safety. In [6] the problems of cyber-safety were connected with protection from various menaces for management systems and at the same time from threats for public human values. In [7] another definition of «safety» term is given, it is defined as «…the science, which studies natural, man caused, social, economic and other processes of formation, development and interaction of environmental objects and subjects and their combinations with the objective of discovering sources of danger, determining their characteristics and developing laws and other legal acts, specifying notions, requirements and methods, fulfillment of which is to guarantee protections of interests of a separate individual and the entire society from all revealed sources of danger».

However, it follows from it that the notion of «cybernetic safety» can be described as prevention of damage, which could be done by one person to another by means of unlawful intrusion of certain harmful software product into basic software. Such software product is nothing but a tool, by which the result is obtained. The logic can prompt us that the notion of safety, including cybernetic safety, in a wider sense, is determined by man's confidence that nothing threatens him, his biological safety, his psychological state and equally nothing can threaten his social well-being or economic prosperity.

Purpose of the article. The work is aimed at obtaining more precise definition and enlarging the thematic content of the field of knowledge, entitled «cybernetic safety».

Presentation of the main material. Since appearance of the term «cyber safety», the root of the word containing «safety» and a great branch of science, linked with protection of software from abnormal breaks-in, we have seen that this term has in no way been connected with protection of health of the user in accordance with the signs, mentioned above. This domain of knowledge, in accordance with the right of its appearance started to deal with safety of machines functioning in the same «human-machine» system, in which computer, its software and now computer networks, internet and new communication technologies act as a machine. They pushed away the man, i.e. the second part of the system, from safety in favour of other social benefits, convenience of up-to-date mini devices with wide spectrum of capabilities, access to valuable and varied information, a new form of wide communication etc.

It seemed that the ways of «safety» and «cyber safety» had drifted apart forever. Still, with the development of information science and appearance of new technologies and communication networks, that got a social reflection in the society, when human grew, there appeared new aspects of danger, linked with «cyber attacks» and possibilities of integration of such «machines» into criminal media and also with changes of communication in the networks. All these represent quite a new object of investigation – a return to human's safety in the information space. Here «information» is understood as a media in which damage can be done to a man. Safety, too, is connected, primarily, with the use, i.e. to man. Human mentality, when he/she is treating information or is making a decision can be represented in the first and simplest approximation, as a system consisting of two units: consciousness and sub-consciousness. Admission of information and adoption of a decision are carried out by consciousness while information treatment by consciousness and sub-consciousness in complex [8] It appears that cybernetic systems can't function without human participation, at least, within the limits of the up-to-date system of artificial intellect. So, the ultimate object of safety in the «human-machine» system happens to remain the same-it the user, i.e. the man. The system becomes more and more similar to a functionally one in two system, with which one has always to deal in any process of labour activity. Where labour and danger coexist and can't appear separately there is no danger without labour and there can't be labour without absolute danger.

In literature there is a description of one of the actual cyber-attacks on one uniform digital data-

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control system of electric power substations resulting in re-arrangement of digital units or deletion of system and applied software, it leading to a damage of costly primary equipment and potential exposure of personnel to the action of electric current [9]. This is a direct menace to human lives, its cause being a cyber-attack on the software. There are plenty of such examples now.

Cyber safety, a new field of knowledge has to pass a very difficult methodological way to determining terminology of its own, to its own notions and comparison of its tasks and aims with similar knowledge in other fields of human safety. Cybernetic safety largely tends with its tasks aimed at preservation of integrity of the machine and its software, to ensure the safety level of certain aspects of human existence. Now, let us consider some key notions of the science, bearing the title of cybernetic safety.

1. Confidentiality of information expresses such state of information at which the right of access to it is in the hands of these, who are the subjects of such rights.

2. Availability of information is the right for free access to information from the side of its owner. This peculiarity lies in the basis of the so-called confidence protocols in block-chain technologies.

3. Information integrity is preservation of information from illegal alternations, as a result of external intervention.

All these violations: infringement of the rights of the owner and information disclosure, infringement of information integrity, limitation of access to open information – all these is bringing damage to the user, i.e. to the man.

Table 1. Summarizes the notions definitions for the bulk of knowledge in the domain of safety. We pay attention to the fact that a human is present in the absolute majority of the fields of knowledge regarding safety, the man, or conditions of his existence, are present in the bulk of safety types.

This can be explained, because originally both the subject and the object of investigation belonged to computer, equipment or machine, that functioned not independently, but within the «human-machine» system. Computers, the Internet and social network, so far, don't have means of independent existence. The man is an integral component of such system. When the tasks of protecting from outer actions were urgent the situation was suitable for all. And the fact that stable functioning of a computer helped save the working time and protected users' mentality and the software free from viruses gave the correct anticipated result expect was considered to be something additional or unimportant. The developers of this science quite reasonably thought protection from hackers and cybernetic crimes was the main task of cybernetic safety. And it used to justify itself at some time span, though not always.

A.S. Alpeev in his work [10] expressed quite a well-reasoned position. We will refer to these investigations here, because they represent, probably, the first attempt to unite the object and the subjects of investigation of an entire branch of science –cybernetic safety. The author quite reasonably insists on the fact that «…the term «cyber safety» is a derivative of the generic term «safety», thus, «cyber safety» is a part of «safety», to which some specific peculiarities are added, which are to comprise the second part of the term's definition of the term «cyber safety» which follows the generic word». It is obvious that terms with the same root should have the same sense content.

Now, let us analyze the semantics of the subject of our investigations, i.e. the term «cybernetic safety», or shortly «cyber safety» in the series of related compound already existing terms (see table 1). All such terms consist of two words one of which is the subject, expressing the basic thematic significance of the term, namely, «safety» and possess an independent sense meaning. The second is a secondary member, showing belonging of the subject to one or another field of knowledge: military, labour etc.The second word is governed by the first word in sense. In other words the essence of such terms, consisting of two words is in the noun-«safety». The additional element is an adjective – cybernetic, chemistry, ecology, radiation etc.

The sense of safety is in a word combination «without danger» The key word danger denotes a threat to life, health or existence. Such notions characterize the object only as living substance, which is afraid of losing an ability to exist – to live and carry out its activities.

Safety in the «human-machine system», as related to the notion of «machine» is determined by other words: fitness, reliability, safe operation, integrity of the system, preservation of functionality, meantime-between failures, indestructibility, preservation of the principles of the system's functioning, easiness of repairs, long service life etc.

In 2013 the Cabinet of Ministers of Ukraine issued a decree No 62 «On establishing a technical schedule of machines safety», according to which «requirement to machines are established, regarding

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protection of man's life or health» (the author italicized the word herein deliberately). In 2017 «Requirements to safety and health protection at application of industrial equipment by workers» were adopted in Ukraine (НПАОП 0.00-7.14-17), according to which the priority of man as a factor at working with any machines is established. Generally, the machine safety is understood in technical documentation as ability to perform the required function in the state in which impermissible risk to human is absent.

Table 1

Definitions of the notion of safety for some fields of knowledge

No	Safety type	Notion in customary terms
1	Military safety	It's a state, when **man's** organism is protected from external destruction with military means of armed enemy
2	Labour safety	It's a state, when **workers are protected,** ensured by a complex of measures that exclude any actions of harmful and/or dangerous production factors upon **the workers** in the process of labour (taken from Wikipedia)
3	Safety of vital functions	It's a state, when **a man is protected** from dangerous and negative actions of natural and man-caused actions and reaching comfortable conditions of vital functioning labour (taken from Wikipedia)
4	Fire safety	It's a state, when **a person,** property, society, or state **are protected** from fire labour (taken from Wikipedia
5	Chemical safety	It's a state, at which conditions for chemical contaminations or affection of **people** are excluded labour (taken from Wikipedia)
6	Environmental safety	It's admissible level of negative impact of natural and man-caused factors of environmental danger upon **the**
7	Electromagnetic safety	It's the field of knowledge, regarding harm caused to **men** by electromagnetic radiation
8	Cybernetic safety	1. The process of application of safety measures for ensuring **confidentiality, integrity and availability** of data and measures, aimed at protection of systems, networks and software supplements from digital attacks (Cisco). 2. Embodiment of all measures of protection of networks, supplements and devices from menaces, preservation of **correct functioning of organizations** (Linkas). 3.The segment of information safety, within the framework of which the processes of formation, functioning and evolution of cybernetic objects are investigated, for disclosure of the sources of cyber-danger, that originate at it, determination of their characteristics, as well as their classification and preparation of normative documents, the fulfillment of which is to guarantee protection of cyber-objects from all revealed and investigated sources of cyber-danger (labour (taken from Wikipedia).

The same is related to the global information space just like to the system «human-machine». Here, safety is a requirement set before hardware, software and the information character, not causing user's health problems and problems with his/her sociality.

Now, let us analyze the content of two parts of the compound term «cybernetic Safety».

Any fundamental compound term must have its own sense components, expressing objects and their belonging, particularly *the object of impact, the subject of impact and an aim of impact.* For mono-semantic compound terms such semantic elements must coincide, so that it will be possible to exclude dubious interpretation of such terms. This issue has never been argued in science by anybody.

Now let us analyze these elements.

The subject of impact – it's a person or an object that exert certain impact with a specified ob-

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jective. *The object of impact* is a person or an object upon which an impact is exerted. *An aim of impact* is an element is best described on legal documents and denotes the function with which an impact is exerted in the system.

As is shown in table 2, all semantically one-rooted terms consider man as an object of any dangerous external impact. The subject of impact in the system is connected primarily in its functional designation with destruction of man's health or with death of man, as an object of impact. It is right for all terms, but everything but the term «cybernetic safety». We deliberately denoted that term with indices I and II, the former containing as an object of impact and, hence, protection from it the elements of cyber-space-computer software, computer integrity, integrity of gadgets or network Protection in cybernetic safety is aimed at them. In the latter case the user, i.e. the man is indicated as an object of impact. All disturbances of technical character in that system exert in some or other way influence on the user's state, his participation in the system of «human-machine» type being substantially deformed, including his health, an ability to continue working, leading to financial and social losses etc. Ignoring safety on the part of «machine», in its turn is what «cyber safety» is doing now is not permissible, as any induction or intrusion into operation of the components of the cyber-space is often a criminal element and requires not only correction of the system but also hacker's punishment.

Table 2

Safety as a function of exerting impact on human life and health

No	Safety type	The subject of impact	The object of impact	The aim of impact
1	Military safety	Armed unit of enemy	*A fighter, a* participant in a warfare	To destroy integrity of organism by wounding or killing
2	Labour safety	Technical system Техническая система (TS) or technological process (TP)	*A worker*, ensuring the functioning of TS or TP	To destroy health, or lead to death of professional disease
3	Vitality safety	Surrounding man-caused environment including extreme parameters	*Man* в in the environmental system	To violate comfortable or safe conditions of life and working
4	Fire safety	Fire and the temperature inside the combustion area	*Man* and his material values	To destroy material values and lead life losses
5	Chemical safety	Chemically active compounds	*Man* in the area of impact of chemical compounds	Chemical impact, poisoning, chemical burning etc.
6	Environmental safety	Natural environment	*Man* in the area of negative man-0caused factors	To destroy man's health and lead to diseases or death
7	Electromagnetic safety	Electromagnetic radiations	*Man* in the area of electromagnetic radiations	To destroy man's health and integrity of his organism
8	Cybernetic safety I	Alien inducer in the software	Software, elements of cyber-space (CP)	To destroy the software integrity and elements of CP
9	Cybernetic safety II	1. Alien inducer in the software. 2.the multitude of data	*The software user*	To deform user's participation in the system and destroy his health or well-being

All, without exception safety types of «human-machine» systems are somehow linked with a simple algorithm and violation of normal functioning of the machine due to both technical; or organizational reasons lead to breakage. It leading in its turn not only to problems with the functioning of the machine, but may lead to losses in integrity of human organism, health loss or worker's death, depending upon the degree of such breakage.

All these are also related to cybernetic systems, having two basic elements: cyber space and user, in various interpretations. So, stressing the urgency of tremendous work in the domain of cybernetic safety, aimed at protecting cyber space from external interventions, some attention should be paid to the second element of the system, i.e. to the user, his physical and mental state, as, in general, efficient functioning of the system is impossible without it. It is desirable that it should became a substantial argument in favour of sense extention of the notion of «cybernetic safety», as we understand that such an approach could only enrich science, opening up opportunities for appearance of new results.

Conclusions

Cybernetic safety as a domain of knowledge equally belongs to engineering filling of cyber space and users of such services of this «space». And possesses the equal rights to investigate the problems of protection of software products from intervention or destruction, as well as the conditions of complex safety, required for users of this «specific» machine. Under damage from any negative cybernetic impact we must understand not only deformation or destruction of the software product but all consequences of the user and other participants in the system, including the moral damage incurred and impact on mentality, physiology and sociality of big groups of participants.

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