

Analysis of the Process of Information Transfer from the Source-to-User in Terms of Information Impact

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Abstract

The process of transferring information from an official source or from the “scene” to the final consumer is quite complex and lengthy. During its promotion, information circulates in the information space and is influenced by various groups of influence that pursue their interests. Thus, very often the end-user receives biased, biased information, the purpose of which is to exert a certain influence on his behavior. The situation is complicated by the limited sources of information, their subjectivity, and bias, which are the essence of information conflict when the opposing parties try to put any information pressure on the sources of information and the whole process of its dissemination. To ensure the proper functioning, making adequate decisions, the task of the end-user is to obtain objective and timely information, for which the issues of assessing its reliability come to the fore.

Keywords

Cybersecurity, information space, resources, information, cyber war, reliability, information confrontation, media space, social networks.

1. Introduction

The concept of “information space” was formed in the geopolitical dimension, which contains properties and allows to consider it as independent spaces with their resources, structure, boundaries and features of activity, interaction of subjects that include information support. The information space is not static, so it can quickly adapt to the challenges of modern society, protecting the interests of the state or, conversely, influencing it. The information space is an environment in which the content of such processes as competition changes (due to changes in the content and nature of competition between the actors operating in it) and interaction in the process of joint activities.

In the information space there are significant changes like geopolitical competition, through the struggle to achieve information superiority, for possession of a better information resource, which can open greater prospects for control over the information resource of the enemy [1].

Today, there are many scientific approaches to explaining the information space. In the informational aspect, the interpretation of this term is based on the definition of the information sphere. The term “information space” is used to express a system of external and internal information flows, which, in turn, may have different characteristics in terms of content, methods, transmission and intensity of information exchange. Information space is also used to denote a certain area of society covered by a certain system of information flows [2]. “The set of information, information infrastructure, entities that collect, form, disseminate and use information, as well as the system of regulation of certain social relations, is defined as the information sphere” [3]. A common approach to understanding the information sphere as a set of relationships that arise in the formation and use of information resources based on the creation, collection, processing, accumulation, storage, retrieval, dissemination and provision of information, organization and use of information technology and its means. Information space is a dynamic environment where physical objects usually have well-defined physical boundaries that can gain informational advantages over time, and space is structured. “Information fields and information flows are the main structural components of

CPITS-II-2021: Cybersecurity Providing in Information and Telecommunication Systems, October 26, 2021, Kyiv, Ukraine
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CEUR Workshop Proceedings (CEUR-WS.org)

the information space. The movement of information in the information field is performed through a physical connection between the recipient and the source of information that materializes in the information flow.

The complex of information that moves in the information space through communication channels, scientists consider as an information flow. Information flows can spread both within individual infospheres and between them, depending on the availability of communication channels [3]. Society's information infrastructure is an environment that provides the ability to collect, transmit, store, process and disseminate information. As a component, it belongs to the technological and organizational components of the information space. "The information infrastructure of society arises from a complex of:

- Information and telecommunication systems and communication networks of the industry of means of informatization, telecommunication and communication.
- Systems of formation and maintenance of information resources.
- Systems for providing access to information and telecommunication systems, communication networks and information resources.
- Information industry and information services market; training systems, conducting research.
- Algorithms and software that ensure the functioning of software and hardware platforms, etc." [3].

The information space of society is distinguished by subjects and communities. Due to the lack of boundaries and its virtuality, the information space is an integration mechanism of organizational structures. The main functions that currently perform the information space are as follows:

- Integrating—the association in the spatial-communicative and socio-cultural environment of different activities (economic, social, political and cultural).
- Communicative—creation of a special environment of cross-border, interactive and mobile communication of different subjects, within which they exchange information.
- Actualizing determines the objectification of the interests of various actors in the information space through the implementation of their information policy.
- Geopolitical—the formation of personal resources and change the significance of traditional resources, creating a new environment of geopolitical relations and competition [3].

The information sphere is the engine of development of post-industrial society and actively influences the state of political, economic, defense and other components of national security.

Since the information space of the state today has become an environment of information counteraction, then, accordingly, all information resources can also be classified according to their belonging to certain aspects of such counteraction. This can be most vividly illustrated by the example of the media space, which is part of the information space of the state (Fig. 1).



Figure 1: The structure of the media space of the state as an environment of information counteraction

2. Functions of Information Space

Today, the *Information Space* (IS) is increasingly seen as an area of information conflict [4, 5]. Actions in the information space unfold in [4, 5]:

- Technical sphere.
- Psychological sphere.

The technical field is an area of information space in which information is created, processed and stored. In addition, it is an area in which management, intelligence and communications systems operate. Later, in the list of main documents, the development and refinement of the concept of the technical sphere of information space led to the creation of the conceptual apparatus of cyberspace.

Psychological sphere is an area of information space that combines the thinking of competitors and society.

This is an area in which competitors' plans, doctrines, tactics and methods of confrontation, the concept of cohesion, level of training, morality, experience, understanding of the situation and public opinion are formed [4, 5].

Many US Armed Forces experts consider it appropriate to exclude the participation of physical means of defeat in information actions (such as infrastructure destruction, failure of control points, etc.), because these actions take place in physical space, which is a common area of war and combines traditional spheres of confrontation—land, sea, air and outer space. That is, the space in which the systems of military equipment, weapons and communication systems operate [4].

One of the main concepts used by specialists in the field of information confrontation in the United States is the “information environment,” which in terms of content is consonant with the “information space.”

Information environment is a set of individuals, organizations and systems that collect, process, prove information or act on its basis [6].

Elements of the information environment is managers, decision makers, individuals, organizations and systems [6].

Resources of the information environment is material means and systems used to collect, analyze, apply or refute information [6].

Including the concept of resource and elements, we can provide the following definition of the information environment: this is the area in which individuals and automated systems operate—conduct observations, navigate, make decisions and act on information. From this point of view, the information environment is the “main decision-making environment” in the information space.

According to US experts, the information environment consists of three dimensions: physical, informational and cognitive (Fig. 3) [6].

The physical dimension is a familiar area of war. This area combines traditional areas of confrontation—land, sea, air and outer space. This is the area in which the physical armament platforms and technical control and communication systems operate. Therefore, the elements of this area are the easiest to identify. Combat power in this area is traditionally measured by the effects of physical defeat [4, 6].

Information dimension - the area in which information is created, processed and stored. In addition, this is an area in which there is a logic of the operation of control, communication and intelligence systems. In the competition for information superiority, this area is most sensitive to information influences, because this dimension connects the real physical world with the logic of technical systems of collecting, transmitting and processing information, and through them—with human consciousness, which functions in the cognitive dimension.

The cognitive dimension is the area of thinking of the combatant and the civilian population. This is the area in which the purpose of commanders, doctrines, tactics, methods of confrontation are formed. Intangible assets of leadership, cohesion of units, level of training, experience, morale, understanding of the situation and public opinion—these are all elements of this area. The cognitive dimension exists in the mind of the individual who makes the decision. This is the area where a person processes the received information by his inherent set of norms, morals, beliefs, culture and values. The latter act as a basis in the perception of the individual, in filtering information and determining the consciousness of significance and relationship. Information is evaluated and analyzed to form conclusions that are transmitted through the information dimension to the realm of the physical world [6].

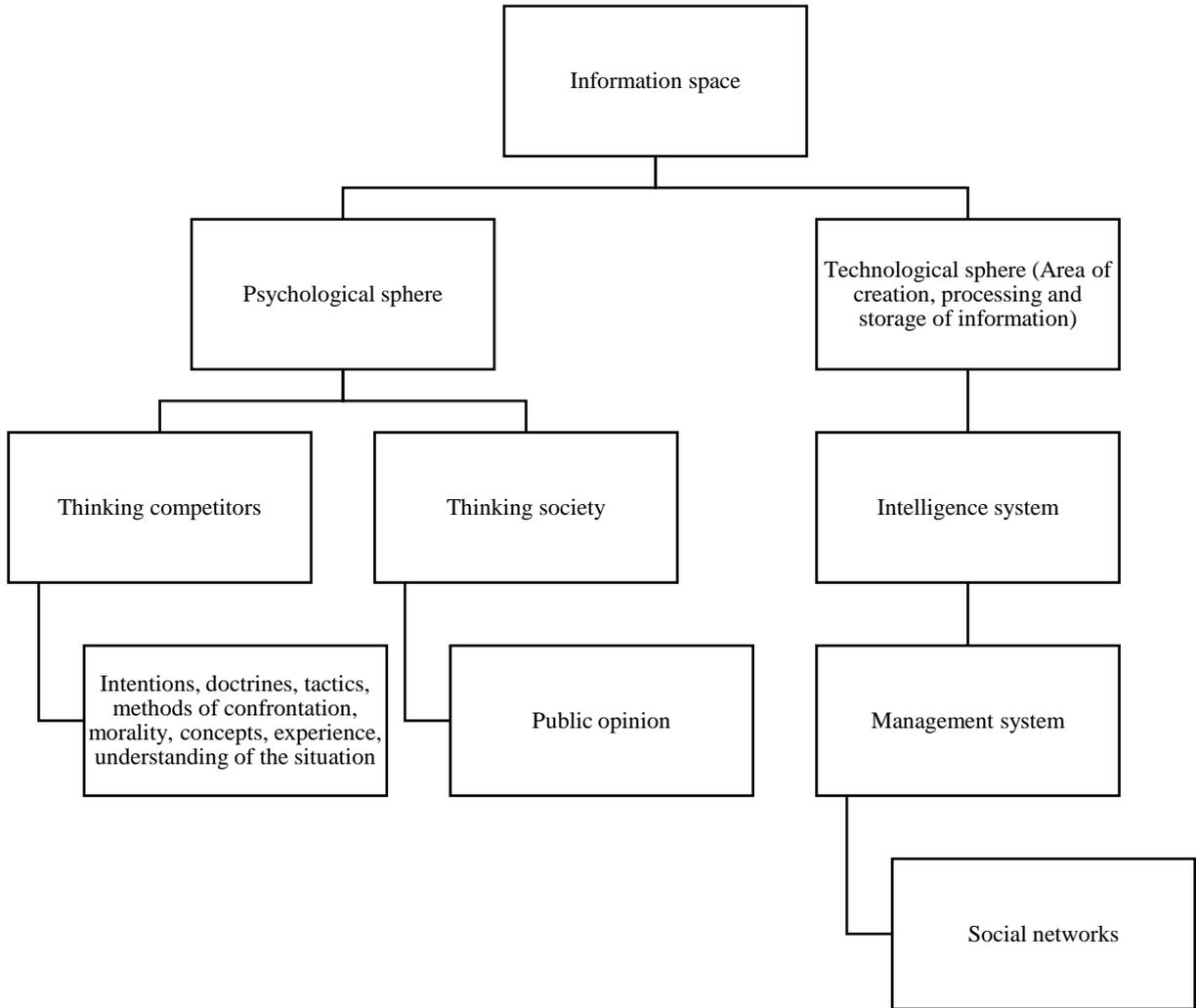


Figure 2: Decomposition of information space [4, 5]

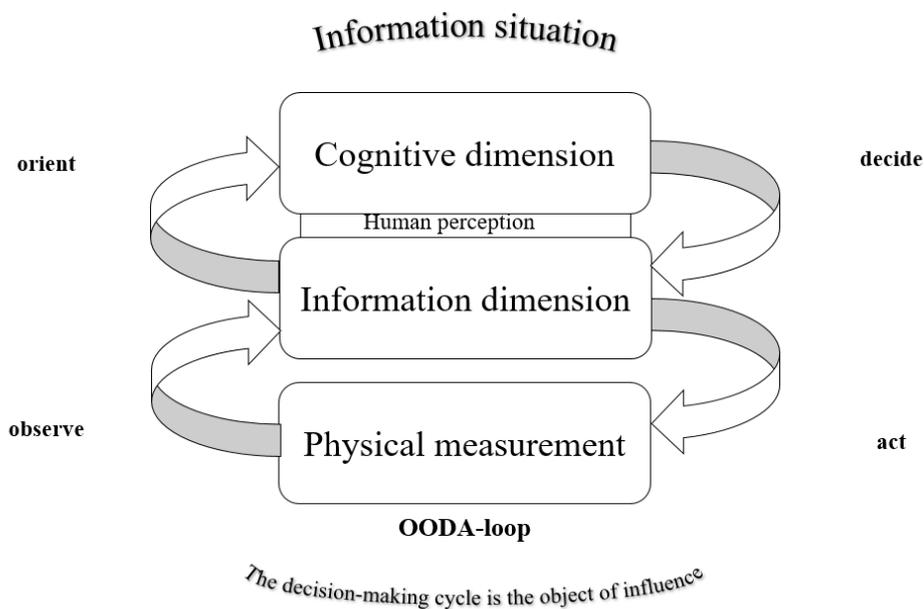


Figure 3: Areas of information environment [6]

Each of the components of the information environment can be exposed to a certain influence and be an object that under certain circumstances can affect the outcome of the operation (war), taking into account their conceptual relationship in the decision cycle.

3. Information Process of Communication

Encoding transmitter (encoder). In short, the process of information transfer that is affected can be described by the Shannon-Weaver Communication Model, which was described in 1948 in the article “Mathematical Theory of Communication.” The main purpose of this model was to improve technological communication, mainly telephone, but later Weaver applied it to all types of communication. This model focuses on the act of communication between the communicator and the recipient and consists of five main elements:

1. Information resource (sender) that produces the message.
2. Transmitter (encoder), which encodes messages with special signals, which are compressed for transmission via cables or satellites.
3. The channel to which the encoded signal is adapted to transmit information.
4. Receive a signal and convert it into a message. Reverse encoding process that provides effective communication between the communicator and the recipient.
5. Recipient (recipient). The final destination of the message. Based on the information received, the recipient gives feedback to the sender.

The main feature of the Shannon-Weaver model is the allocation of feedback (reaction) of the recipient of the media message, which can serve as an indicator of the correct receipt of the message. And also the added component of the communication process - noise. Noise is considered a dysfunctional factor that can affect the message when it moves through the media channel, as a result of which the recipient may receive an erroneous message.

As such noise, in our case, the information influence on messages which will lead to their distortion can be considered. This, in turn, makes it necessary to assess the accuracy of the information received by the user.

Influence on information can occur at any stage of its existence and promotion from source to user.

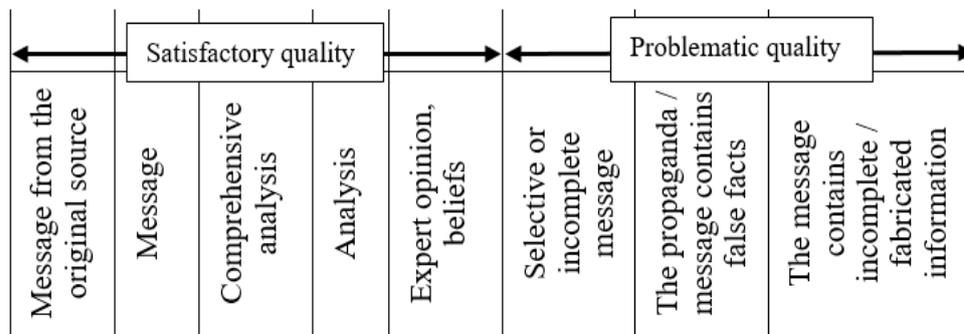


Figure 4: Stages of influence on information

Thus, the information space of society is the result of its evolution and is formed as a set of information, information infrastructure, and entities that collect, form, disseminate and use information. Today, it is increasingly seen as a field of information warfare in the technical and psychological domains. The information space is the environment for the implementation of the communication process, which includes the information resource, transmitter, communication channel, signal reception procedures, and the recipient (recipient). Any of these elements may be influenced by stakeholders in the information confrontation.

4. Features of the Information Transmission Medium

Consider the features (properties) of the information space, in which there is a need to ensure the reliability of the transmitted information:

1. “The human factor.” Based on the concept of building an information space, it should be considered as a socio-technical system - a set of information-technical and social infrastructures. Due to this, the basic

concept of building an individual entrepreneur is expanding: individuals, as well as their information connections, belong to the system as elements of the structure. The basis of the productive functioning of the information space is not only high productivity, reliability, and security of its hardware and software and personnel, but also the quality of information (primarily, reliability), transmitted and received by individuals. The processes of interaction of individuals due to erroneous information can lead to dysfunctional behavior of the entire information space [7]. Management of the social environment, professional skills, and qualifications of individuals, as well as a general understanding of the tasks, become important components of the information space, which have an impact on information processes, which determines the approach to ensuring the reliability of the information processed.

2. "Conflict environment." Relationships of individuals can be like conflict [8]. Functioning in a conflict environment means that there are two dynamic processes of confrontation in the information space:

- The process of purposefully reducing the reliability of information to translate the information space into a functionally volatile state. The main reason for its emergence is the interests of criminals, whose purpose: to distort, replace, make inaccessible information resources for "legitimate" users. Method of implementation - information attacks. The ability to successfully implement them is based on weak links in the technical and social subsystems.
- The process of improving the reliability of the information, which consists in choosing "reliable" sources to counter attacks by attackers, restore damaged information resources, ensure the reliable functioning of technical and social subsystems.

3. "Multiscale." The information space is formed from multi-scale systems [9], which contain many individuals and can be integrated into a global system of information interaction. Information spaces can be interpenetrating. Processes in information space are implemented based on distributed applications, can take place at different speeds, and have an impact on each other. Also, information resources can be added and disappear in the process of functioning the information space. Ensuring the reliability of information resources is achieved in a difficult control environment and requires the use of self-adaptive management tools.

4. "Multi-connection." Information space are usually multiconnected. This is the difference between their elements, which are interconnected (individual—information, hardware-software—physically) and can have both direct and feedback. The nature of information connections in the information space [10] strongly depends on the psychophysiological, intellectual, and other states of individuals. The overall structural reliability of the system and its components does not mean the stability of the information space, on the contrary, in case of dissemination of false information, the purpose of the systems may be changed, and new information processes will be considered as "dysfunction," system instability.

5. "Self-organization." Information space can be self-organizing, ie prone to independent autonomous (not controlled from the outside) appearance and behavior. This means that the information space has the ability, on the one hand, to become a "carrier of misinformation," on the other—to take measures to self-preservation and counteract external influences [11]. Clusters of nodes with changed targeting, which have partially or completely lost the authorized control as a result of the attacking influence and seized resources, can have a significant impact on ensuring the reliability of the information in a particular individual entrepreneur.

Summarizing the selected properties of the environment, we note the following features of the management of the process of ensuring the reliability of the information in the information space:

- The process of ensuring the reliability of information is a poorly formalized object of management because it is in conditions of significant uncertainty, the source of which is the technical and social components of the information space. Uncertainty is associated with the large-scale and fragile structure of individual entrepreneurs, which occur with high complexity in the system of information processes, their inaccuracy, and lack of study. It is also important to mention the repeated impossibility of quantitative measurement of the values of input and output parameters of subsystems, their high mutual influence, which leads to a synergistic effect [12], and the emergence of the properties of emergence [13]. This causes difficulties (and sometimes impossibility) in building formal (analytical) models of individual procedures for managing the process of ensuring the reliability of the information that takes into account the specifics of the information space.
- The presence of the "human factor" leads to the fact that most of the characteristics of the reliability of information resources lose their strict certainty: the links between social and technical subsystems are described vaguely, remains open the question of the amount and composition of input data, as it is unknown what may affect the behavior of the individual as an element of the system, etc. The effect of control effects on humans is difficult to predict. Since the purpose of the system is

formulated by the decision-maker, or determined by a higher-level system qualitatively (i.e., vaguely), it leads to blurring, the emergence of “range of admissibility” in achieving the goal in managing the process of information reliability.

- If the classical methods of statistics apply to the removal of "uncertainty" in the study of the technical subsystem, then they are not suitable for the social subsystem, because the uncertainty, in this case, is subjective.

In contrast to the objective probability, which reflects the relative frequency of an event in the total volume of observations, subjective probability means the degree of confidence of a person or group of people (experts) that the event will take place.

Thus, the management of the process of ensuring the reliability of the information in the information space should be considered as a complex intellectual problem-solving process, which can not be reduced solely to rational choice. To support this process, it is advisable to use a cognitive approach to modeling and management, as it aims to develop formal models and methods that support the intellectual process of solving management problems, taking into account these models and methods of human cognitive abilities [14–17].

5. Conclusion

The information space of society is the result of its evolution and is formed as a set of information, information infrastructure, and entities that collect, form, disseminate and use information. Today, it is increasingly seen as a field of information warfare in the technical and psychological domains. The information space is the environment for the implementation of the communication process, which includes the information resource, transmitter, communication channel, signal reception procedures, and the recipient (recipient). Any of these elements may be influenced by stakeholders in the information confrontation.

Features of the information space that affect the processes of information transfer in it are information confrontation, which includes: the influence of the human factor, the presence of conflicts, multidimensionality, multiconnection, and self-organization. One of the determinants is the influence of information weapons on information, which includes a wide range of methods and means of information influence - from misinformation and propaganda to means of electronic warfare. Information weapons are sold through technical means (viruses and other malicious software, ART attacks, and physical impact on information systems) and means of information and psychological influence: printed materials, media, Internet resources, cognitive weapons. The possibility of influencing information is realized at any stage of its existence - from the origin (observation, description, recording of facts) to the moment of delivery to the final consumer.

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