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THE SPECIFIC FEATURES OF THE FACTOR OF UNDERSTANDING IN THE SCIENTIFIC COMMUNICATIONS

The article contains results of analysis of science communication (SC) that takes place between such actors as science, business, government and society. In particular, the communication gap between the above-mentioned actors is investigated. The relevance of this topic is proved by numerous publications of national and foreign researchers. It is known that the success of communication largely depends on the understanding and perception of the information message (IM) that is sent to the recipient. Their absence leads to communication gaps, which reduces the

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effectiveness of science communications up to complete misunderstanding. The aim of the study is to identify and structure such gaps, as well as to find ways to overcome them in order to increase the efficiency and successful design of scientific communications. The empirical basis of the study is the scientific works of leading domestic and foreign scientists. The research methods are the principle of ascent from the abstract to the concrete (Hegelian principle), as well as general scientific methods of cognition: analysis, synthesis, generalization, scientific deduction and induction. The conducted research demonstrates that the difference in mental models and thesauri of communicants leads to communicative gaps in understanding — representational gaps, which in foreign literature are termed as rGaps. Such gaps occur when the communicators give the information message a meaning that the recipients do not realize, thus creating a conflict in the meaning and value of the transmitted information. It is concluded that the design of a successful SC should take into account the understanding factor along with its accompanying fascination. Mechanisms and techniques that contribute to the elimination of representational gaps are proposed, which in some cases make it possible to find a solution to the problem of understanding in the SC.

Keywords: *noosphere, science communication, communication gaps, gaps in understanding, understanding of the information message, fascination, representative gap, perception gap.*

Introduction. The communications are the driving forces of science and its “living” social fabric. A special role belongs to scientific communications (SC) that take place between scientists within the scientific community as well as with the representatives of business, government and society — it is the communications Science — Science (Sc — Sc), Science — Business (Sc — B), Science — Government (Sc — G), Science — Society (Sc — S). All these are the examples of SC of different types. In all these cases, SC differ from each other, have their own distinctions; however, at the same time, the success of communication depends on the understanding and perception of the message communicated. It should be taken into consideration that these factors are strongly influenced by the information and communication technologies (ICT). A lack of understanding in the perception of information message (IM) results in various kinds of communication gaps (CG), which negates the results of communication and directly affects the social transformational shifts in society, being a basis for building the knowledge economy (KE) and knowledge society as well as noospheric transformation of the society. This requires an in-depth study and thorough analysis.

In particular, it relates to the issues of overcoming the gaps in understanding in case of different types of SC. Therefore, the paper attempts, based on the systematization and structuring of multiple types of SC that take place in social relationships, to identify CG in the factor of understanding by the addressee and suggest mechanisms for their effective overcoming.

Literature review. The major focus of the western researches in the field of SC is on the promotion of science [1—4]. This focus can be explained by the fact that communicating your developments to the general public is considered as the main thing in the scientific development, because this is thought

to enable changing the world with your ideas¹. At the same time, it is critical to embed an understanding into the problems of SC.

The paper [5] addresses the matter that often the addressers and addressees of SC have different knowledge bases. The authors argue that the gaps in understanding are often caused by differences in values, viewpoints and knowledge. Even though such communication is needed to address difficult social and technological challenges, involving a multitude of parties concerned; a diversity of knowledge among communicators might result in the occurrence of so called representational gaps rGaps. rGaps gaps occur when the addressers make the assumptions which are not made by the addressees, thereby causing a conflict over the meaning and value of the information communicated. This conflict, if it is controlled, can promote learning and innovations, because communicators harmonize their assumptions. However, most often, the conflict turns from discussion that informs into a dispute that divides. Conflict management in a way that does not worsen communication requires building relationships to mitigate the adverse effects of constant conflict, while maintaining the appropriate levels of cognitive differences between the parties concerned. In order to eliminate rGaps, a good communicator needs to try to understand the reason for the concern of people with opposite point of view in order to try to “allay” these concerns. Such actions intended to understand and respect the opposite point of view, most probably, can increase confidence in information shared by the communicator and emphasize that he/she takes into account the interests of the other party.

The term “rGaps” [5], introduced in the western literature, is specially intended to define not only CG, but also representational gap, gap in perception — that’s how we can translate this term, but, in fact, it is a gap in understanding. The main purpose of an introduction of the term “rGap” is that, if people believe that their own values are being criticized, then they to a much smaller degree are ready to learn and adopt something new. Overcoming the rGaps is not only replenishment of information deficit, but also change in the point of view, which is related to understanding and is more complicated process, in particular cognitive integration can take place — an extent to which the points of view in this communication can be broadcasted and, thereby understand the intended meaning of something that is communicated by others. Cognitive integration increases owing to the processes of enrichment (the communications Sc — S, Sc — B, Sc — G can be used as an example), extension (the communications Sc — Sc) and harmonization (the communications Sc — Sc, Sc — B) (Fig. 1).

¹ Stanford University, Office of Technology Licensing, Annual Report 2006–2007. URL: <https://otl.stanford.edu/sites/g/files/sbiybj16766/files/media/file/otlar07.pdf> (last accessed: 24.09.2022).

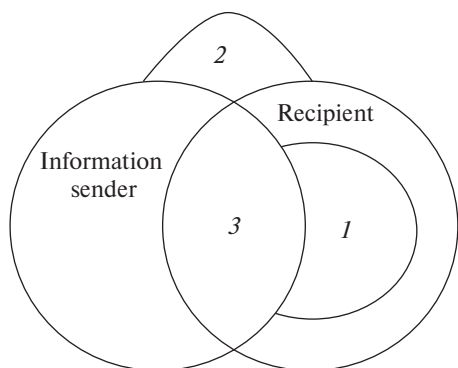


Fig. 1. Communication processes to generate knowledge: 1 — enrichment; 2 — extension; 3 — harmonization
 Source: developed by [5].

Imagine that the addresser and addressee have knowledge bases, represented by circles in the Figure. Sometimes, something that is known to one person is unknown to the other one (area 1 in the Fig.1). This process can

be typical for the communications Sc — S, Sc — B, Sc — G. In some cases, none of these people has the knowledge needed to connect their views, which requires a research to seek knowledge — extension (area 2 in Fig. 1). The communication Sc — Sc can be used as an example of this process. Sometimes, both parties have knowledge on the subject, but it leads to conflicting assumptions that require harmonization (area 3 in Fig. 1), which can be observed in case of the communications Sc —S and Sc — B. Each process represents its own way, using which the addressers and addressees can generate the knowledge that will bridge rGaps.

In order to overcome CG, the research ² provides some of the best strategies, which may be used by data scientists to present the scientific information they have in a business-friendly form, aiming to communicate with it, namely by using charts, graphs and visualizations, finding a common language, simplifying the presentation of data and turning it into information, i.e., providing only major findings and doing it clearly and laconically, using visually attractive presentations.

The paper ³ discusses the importance of communication between scientists and society. A study by the Royal Society showed that scientifically well-informed citizens are more likely to take better decisions in their personal life. However, a huge amount of research and invention is not generally known to public; therefore, their advantages are not used to the fullest extent. Globally, public policy depends on national opinion. If people are better informed about scientific progress and start to understand scientific achievements, they can not only make the best decisions in their personal life, but also influence the decisions that affect their cities and countries.

The paper [6] addresses the issue that social media are experiencing an obvious demand for science and scientifically based information. Indeed,

² Bridging the gap between data science and business. URL: <https://ied.eu/blog/bridging-the-gap-between-data-science-and-business/> (last accessed: 24.11.2022).

³ Why should scientists communicate clearly with the public? URL: <https://www.britishecouncil.org/voices-magazine/why-should-scientists-communicate-clearly-public> (last accessed: 12.09.2022).

Facebook pages dedicated to science attract millions of subscribers, and the best 30 pages include the well-known scientific communicators and organizations³. Although, some of the best 30 pages can offer “dubious” or even “pseudoscientific” advices or information. At the same time, the last decade has seen an increase in the spread of disinformation and anti-scientific information, which shows no sign of slowing down. Notwithstanding the fact that social media provide scientists with unprecedented opportunities to combat disinformation and reach a broad audience, proportionally small online presence of scientists and scientifically based information is a missed opportunity.

In order to address this problem, it is necessary to value and encourage the efforts of scientific communities as well as public participation in discussing the scientific news, including social media. A lack of time and absence of incentives are major barriers to the participation by scientists in Science Communication⁴ activities (for example, social media, explanatory work, education).

A study of the problem of communication between participants of scientific and business groups was carried out by T.H. Bergmann & J.L. Grahn⁵. The authors draw attention to the fact that one of the obstacles to the development and dissemination of knowledge is a communication gap in scientific circles and business world. Communication between practitioners and scientists is usually limited to seminars, practical conferences and publications. In such case, the information tends to be general, minimal and, above all, one-sided. Creating an interactive center can be a solution that will close this gap. In the authors' opinion, a creation of such center will enable scientists to more effectively carry out researches and publish the findings related to business and its interests as well as to provide advising services and organize internship in business organizations for themselves and their students. Marketing Science Institute (MSI) serves as an example of such center.

M. Luna & J.L. Velasco [7] analyzed the relationship between science and business. It is found that the gap in such kind of communication occur due to different cognitive orientations, codes and interests. Based on the interview with the representatives of these groups, it was concluded that there is a need for “broadcasters”, who, in the authors' opinion, should facilitate the communication. The attention was drawn to the fact that systematic examining of functions and characteristics of such “broadcasters” is scarce. The authors identified personal and professional characteristics, which enable certain people to serve as “bridges” between the academic

⁴ Science Communication corresponds to the communication type Science — Society.

⁵ Interactive Centers: Bridging the Marketing Gap between Business. URL: <https://www.proquest.com/openview/3be4ea78cc86ebba3d24c9486effbdb8/1?pq-origsite=gscholar&cbl=48428> (last accessed: 05.10.2022).

circles and business. They gave an example of positive and negative aspects of integrating this position.

The paper ⁶ states that, in order to overcome a gap between scientists and non-scientists, Scientific Communication should become a formal part of academic training at all levels, and it should take place both inside and outside the classroom. Moreover, in an ever-changing communication landscape, scientists and institutes should encourage public involvement and use social media. Prioritizing SC can bring broad benefits, such as improving the individual career outcomes, facilitating the scientific progress, promoting the confidence in science and medicine and conducting more scientifically based policies. The society will also be better prepared to take more rational decisions, which can result in improving public health.

In addition, it should be noted that, in order to overcome representational gaps as well as to improve global SC [8–13], suggest using the noospheric concept, on the basis of which it is possible to create new methodological approaches. A number of scientists note that the processes bearing noospheric component, always have creative nature and high creative potential, which is critical for achieving the key goals and objectives of SC, and they also imply providing people with new vision, environmental thinking, development and introduction of innovative science-intensive technologies. An introduction of noospheric approach aiming to narrow and bridge communication and representational gaps to enable effective SC and ensure noospheric trajectory of the development of society is a very important challenge, addressing which will enhance scientific understanding between different population groups (representatives of science, business, society, and government bodies) and will make it possible to prevent negative effects of the global crises and pandemics.

Moreover, SC at any level facilitates the innovative development of society and nation in general (e. g., development and introduction of cognitive methods and technologies) that also overlaps with the key areas of focus of noospheric approach.

It is also essential to highlight the papers of some scientists, dedicated to CG, rGaps and gaps in understanding. For example, P. Hunter [14] states that explanatory work with the public becomes more and more important and necessary for science, because it can counteract to a vast amount of scientific disinformation; get rid of various dangerous misconceptions; and also first-hand learn about the research conducted by various research and development institutes. The European Union has “Science with and for

⁶ Bridging the gap between science and society with research communication competitions. URL: <https://www.purdue.edu/gradschool/news-events/2021/05/Bridging-the-gap-between-science-and-society-with-research-communication-competitions.html> (last accessed: 12.08.2022).

Society” program⁷, under which the confidence in science is strengthening in the society, and it is also clarified how to assess the reliability of information more critically that, ultimately, will enable to ensure effective SC. Different ways and solutions to overcoming CG while carrying out awareness-raising and educational activities (in fact, this is SC) in various fields of science and technology are presented in [15]. The need for more intense communication between scientists and representatives of government, business and society aiming to increase confidence in their reports, supported by scientific arguments, is discussed in [16]. The authors come to the conclusion that in order to conduct SC with the public, scientists should more actively use the advantages provided by interactive mass media (e. g., social media) and online platforms as well as develop the strategies to reach out different population groups. The public’s striving for obtaining professional and competent information, which can be provided by experts and scientists, is also justified, which demonstrates people’s pursuit for scientific communication.

Novelty of problem statement and results obtained. The above analysis demonstrated that building successful SC depends to a large degree on overcoming CG, some of which are associated with external conditions, and some of which involves the internal factor, which was mentioned above as the representational gap rGaps and it is inherent in all considered types of SC. In many aspects, these gaps are related to the factor of understanding, which, is poorly studied on the above-stated SC and have practically never been studied before.

The goal of the paper, research method and empirical base. This paper is aimed to systematize and structure rGaps within SC structure as well as to identify mechanisms for their overcoming to enhance effectiveness of SC and design of successful SC. The sources of information for this purpose are scientific papers by the leading Ukrainian and foreign scientists as well as the results of empirical researches. Hehel’s principle of ascending from the abstract to the concrete and general scientific methods of cognition (analysis, synthesis, generalization, scientific deduction and induction) became research methods.

Presentation of the basic research material and results obtained. The success of the state directly depends on the success of economy, and the success of the latter depends on its embeddedness in the world civilization processes, the ultimate goal of which is, though not fully conscious, a noospheric organization of society.

One of the stages on this way of social transformations is a stage of building KE, a new economy focused on knowledge and the processes of its ge-

⁷ Towards clearer and more accessible science communication. URL: https://rea.ec.europa.eu/news/towards-clearer-and-more-accessible-science-communication-2022-01-12-0_en (last accessed: 12.08.2022).

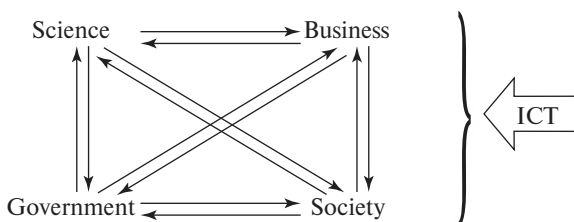


Fig. 2. Interaction of science, business, government and society, including the influence of ICT
 Source: developed by the authors.

neration. The social and digital transformation, required for this purpose, includes interaction of science, business, government and society as one of the key factors of this transformation, which also experiences a powerful influence of information and communication technologies (ICT) [17] (Fig. 2).

SC between the above-stated entities is a key component of this interaction. In the most general case, by SC is meant the process of the movement of scientific ideas and results, both from scientists to scientists and “from scientists through scientific community into the mass consciousness. It is a multi-faceted sphere, including different entities, different levels of their interaction and different forms and methods of promoting the ideas” [18, p. 279]. However, in our case, a definition of SC requires considerable clarification as, in the modern sense, communication is not so much broadcasting, but to a large extent it represents the process of interaction, depending on various circumstances.

Taking into consideration an analysis of multiple definitions of SC [19—26] and an interaction of the subjects of the transformation, shown in Fig. 1, the more precise definition of SC is suggested below.

By SC we mean a well-focused dialogue between its participants, where an addresser is a representative of scientific community, and an addressee — a representative of business or government, or society; and, in this well-focused dialogue, the addressee gains knowledge by the way of interpreting the addressor’s information messages of scientific nature, which affects the addressee’s mental model, including the change of his / her thesaurus. It is clear that, in this case, the addressee comprehends the meaning of the information message communicated. This definition of SC allows generalizing many of the definitions previously provided in these papers, also including the definition suggested by the authors earlier [27].

It is this point of view that gives us hints at the fact that the effective communications should be established between the key participants of SC — science, business, government and society, based on the more precise model of SC, taking into consideration the basic determinants of this interaction and the influence of information and communication infrastructure, which will have a significant, perhaps even decisive, impact on the formation of KE.

Moving from graphical presentation (Fig.1) to the tabular one enables to explicitly specify all the possible pairs of interaction of the above-listed subjects of transformation, totally making 16 (Table 1).

Only the pairs in the first row of Table 1 are of interest to us, because these are the pairs that the most relevant to the above-mentioned definition of SC.

In our opinion, the basis for a more in-depth study of SC is a logical structural model of SC suggested in [27], which allows taking into consideration multiple factors of interaction, affecting SC, and which is, in fact, transitional bridge between essentially humanitarian science that is SC and natural sciences, such as mathematics, logics, structural analysis, etc. This model is represented by the formula (1) and scheme in Fig. 3.

$$SC = \langle C_1, \text{SignS}^{ICT}, C_2, X, T_1, T_2, M_1, M_2, G, CS \rangle \quad (1)$$

where C_1 — communicator 1; C_2 — communicator 2; SignS^{ICT} (Sign system) — using which, scientific information is presented, including the use of ICT; X — characteristics of information message; T_1 — thesaurus C_1 ; T_2 — thesaurus C_2 ; M_1 — mental model C_1 ; M_2 — mental model C_2 ; G — goal (hierarchy of goals from some sets of goals); CS — communication space.

A critical feature of SC is that the scientific text, i.e., written transmission channel for information, is the preferred and most significant way of information transmission in SC, and it includes monographs, textbooks, papers, reviews, abstracts, essays, theses, reports, supplementary notes, etc.

At the same time, the choice of style, compositional form of the text, etc., and its characteristics determine the strategy of the addresser's behavior in SC, who always has several goals: to communicate information about the object, to convince the addressee of the reliability of this information, to have an impact on the addressee, to demonstrate his/her role in obtaining this information, etc. Since a scientific text is, by and large, a description of the result of scientific research with its inherent characteristics, and verification and testing of the informative consistency of such texts are strictly regulated procedure, the main thing for designing successful communications $Sc - Sc$,

Table 1. Interaction between the subjects of transformation

Subject	Science	Business	Government	Society	ICT
Science	Sc — Sc	Sc — B	Sc — G	Sc — S	
Business	B — Sc	B — B	B — G	B — S	
Government	G — Sc	G — B	G — G	G — S	
Society	S — Sc	S — B	S — G	S — S	

Source: developed by the authors.

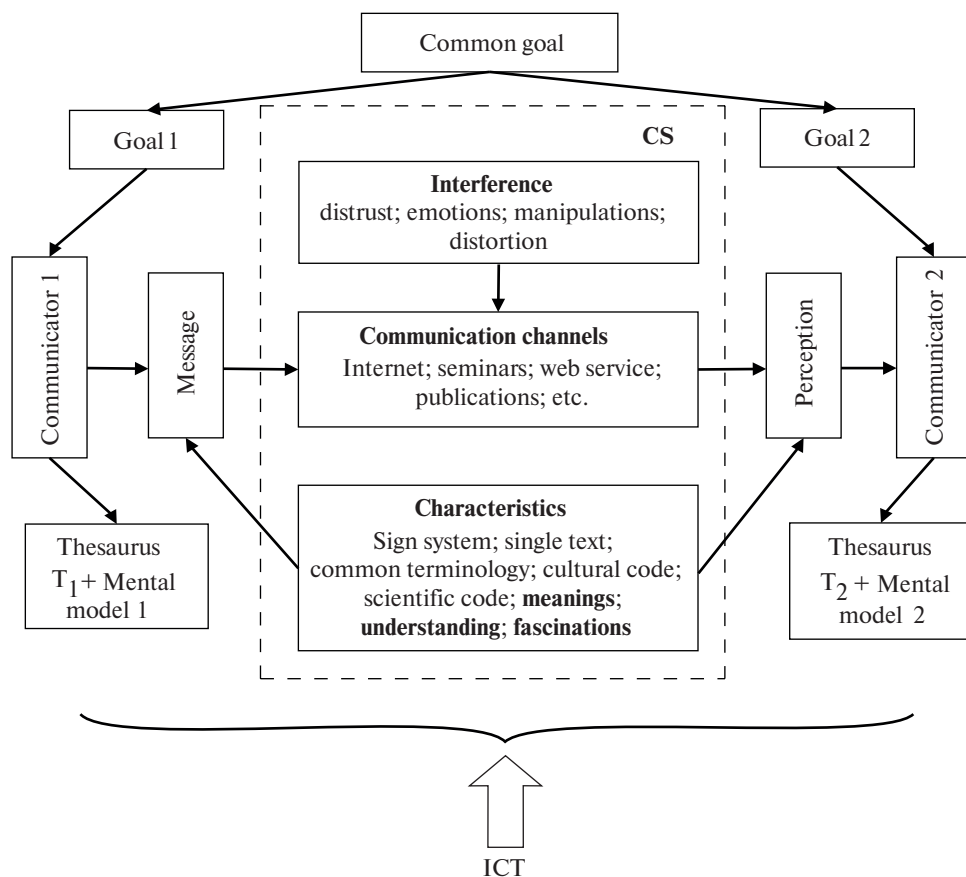


Fig. 3. Structural scheme of SC (CS — communication space)

Source: developed by the authors.

Sc — B, Sc — G, Sc — S is to convey and perceive the meaning, comprehend IM contained in this text and in a certain format.

The model of SC under consideration includes the concepts of understanding, which directly influences the effectiveness of SC, and also fascinations [28], which accompany and enhance this factor. A lack of understanding can be considered a major obstacle in communications; it has been designated above as rGaps. Let us note that well-known communication models [29—40] haven't any of the above-mentioned aspects at all. And their analysis, in terms of designing successful communication, has not been conducted, despite their undoubted importance to SC⁸.

⁸ This phenomenon is of particular interest in terms of the use of web services, where the understanding by the addressee of the meaning of the features encrypted in the web service interface is the determinative factor in his interactions with this web service in terms of its effectiveness. This was pointed out by D.A. Pospelov in [41].

Therefore, it should be said that, in general, a major obstacle to designing effective and successful SC is CG, which occur almost in all forms of SC between its participants for two main reasons. The first one is related to “external contour” of SC: its factors such as intra-group closeness, excessive administration, inability to “translate” from scientific language to the commercial one, etc. The detailed consideration of CG of this type and mechanisms for their overcoming was given in [42].

The second reason, being deeper in its nature and that was mentioned earlier, is most often based on a certain lack of understanding⁹ among the parties to a communication. And, in this case, the factor of understanding is of predominant importance. It is for this reason that we introduced an understanding as characteristics of IM perception by the addressee into the logical structural mode under consideration as a part of the so called CS (Fig. 2). Fascination factor enhances an understanding and it is an absolutely required component for SC [43].

In many aspects, CG don't let modern society take full advantage of scientific knowledge and move to a new, more advanced level of development, especially in view of the widespread application of ICT. The researches carried out on CG, related to an understanding of information message (IM) in the full range of types and forms of SC, are entirely insufficient, even though overcoming them among various participants of SC is a major challenge, both in terms of the methodology of scientific cognition and in the context of building a successful economy and changing the world.

It is critical in SC to separate the knowledge communicated from the process of its understanding by a specific addressee. In SC, knowledge can be communicated by the addresser to the addressee only provided that it is represented in objective material form, with natural or formal language used conventionally for this purpose. Thereby, knowledge is separated from the process of its understanding by specific human being and acquires the status of formalized explicit knowledge or information [44].

The information is communicated from the addresser to the addressee using IM, being the ordered collections of language characters, i.e., a distinction should be made between the information and information message as they are different concepts.

Besides formalized knowledge, there is also the knowledge, inherent in a specific human being, that cannot be expressed abstractly using any characters — it is called “non-formalized” or “implicit” knowledge. By the way, it leads to the conclusion that any information is knowledge, but not any knowledge is information. And one more conclusion that an explicit and for-

⁹ In general, we believe it is important to distinguish between a lack of understanding and rejection based on completely different communication principles, most often the conflict ones. We will provide more details about it below.

malized knowledge can be discovered through communication. In general, knowledge should be distinguished from data and information.

A lack of understanding is related to the meaning and information put into IM. What is going on in this case? What is a lack of understanding for the addressee and what are the possibilities of overcoming it? Finding out the factor of understanding can be an answer, which will immediately provide guidance to overcome the representational gaps rGaps. At the same time, we believe that the addresser has “encrypted” in IM, quite precisely and clearly for himself, all knowledge required for the addressee, being the information intended for the addressee. So now we need to help the addressee to comprehend and figure out the information contained in IM, i.e., gain knowledge communicated by the addresser. It means that the addressee should interpret the language characters contained in IM and comprehend the semantic meaning it conveys. This way of gaining knowledge is referred to in [44] as interpretational or semantic. In fact, it is the only way in SC to gain knowledge.

In any case, it should be kept in mind that human communication activities, above all, create communication space, which has persistent relationship between all elements of communication system [45]. In its turn, communication space combines such spaces as technosphere, infosphere, semiosphere, socioinfosphere, sensorosphere and noosphere. They encourage the creation of innovations to transform the external and internal relationships between the subjects of communication activities. However, due to the fact that the issues related to the structure, content, specific features of the functioning of communication space and its components as well as the creation of innovation are still being developed [46], the communication gaps and rGaps, when communicating different IM, are inevitable. Nevertheless, the global trends in the development of SC have already been introduced and are under development, which is the first step to overcome the existing gaps.

The following core processes occur in any types of the communications Sc — Sc, Sc — B, Sc — G, Sc — S:

Creation of IM is the process of formalizing a certain object, and the more complex is the object, the more difficult is the process of formalizing it. There are many examples — try to write a paper or advertising document. It is easier for SC, because, in a number of cases, this process is associated with the use of various kinds of templates and other standard forms.

Transmission of IM through the communication channels, implying its preliminary encryption and further decryption.

Interpretation by the addressee of the IM, received from the addressee — this is the last in sequence, but the most significant process in SC. Actually, this is the process of gaining knowledge, because, as it was mentioned above, we gain knowledge when we interpret language characters, i.e., comprehend

their semantic meaning. The primary goal of SC is an understanding by the addressee of the information communicated to him/her.

At the same time, the communication, as it follows from the logical structural model, takes place in a certain CS, which combines various additional characteristics of communication process, such as, for example, a single text, common terminology, single paradigm, the same or similar data and knowledge, understanding, fascination, etc.

Therefore, SC consists in gaining knowledge by the addressee by the way of interpreting the information messages from the addresser, their understanding and, thereby, expanding his/her thesaurus. This, we might say, a decryption of everything that exists in SC.

It should be noted that SC is a semantic communication, and, in order to design successful SC, it is important to understand what the meaning in the content of IM is and how this meaning is understood by the addressee.

In SC, the addressers, as a rule, have three goals, which should be included into IM, as follows:

- cognitive — the addressers disseminate new knowledge and skills, and the addressees gain them;
- encouraging — the addressers encourage the participants of SC to any actions or obtaining proper incentives;
- expressive — the addressers seek to trigger certain emotions in other participants of SC.

To achieve *cognitive goal*, the relevant IM should include the addresser's knowledge and skills. To achieve *encouraging goal*, the relevant IM from the addresser should include the incentives that encourage to activities. To achieve *expressive goal*, the relevant IM from the addresser should include emotions.

We believe that, in all above-listed cases, IM should include fascinations which “enhance” the information contained in IM and make its understanding easier.

These spiritual products of human activities are generally called meanings [47].

Obviously, the above stated goals are not equal for different cases of SC:

- for the communication Sc — Sc cognitive goal is of utmost importance,
- for the communication Sc — B and Sc — G encouraging goal is of utmost importance,
- for the communication Sc — S the expressive goal is of utmost importance.

These specific features of SC for different kinds should be taken into consideration when designing SC themselves. In order to start SC, the addresser has to put his / her meaning into the content of IM and communicate it to the addressee.

In order to complete this cycle of SC, the addressee should embed the meaning of IM, i.e., the addresser's mental model, in his/her mental model,

which means to properly (from the point of view of the addressee) interpret IM (to understand it and incorporate the meanings understood into his/her individual memory).

The effectiveness and success of SC to a large extent depend on the addressee and on the way how he/she understood the message communicated to him/her. And the only way to attain the meaning communicated to him/her is to understand it.

A message is understood at different levels: terminological, conceptual, the level of hidden cognitive and motivational prerequisites [48]. Like in any communication process, the meaning of the message attached by its author might be misunderstood and, this inadequate meaning might be broadcasted further by the addressee at any of the above-mentioned levels. This is evidenced by J.A. Schrejder and others [43]. It is possible to single out the basic levels of understanding the information — an understanding is considered as a multilevel process: the first level — terminological understanding, the second level — conceptual understanding, an understanding of context, etc.

As noted in [47], an understanding is present in two mental processes: cognition and communication. In SC, it is more often about an understanding of the cause and effect relationship of the process, a composition of the system, a structure of the machine, the motives of human behavior, the specifics of the given situation, and then cognitive understanding occurs. If it is about an understanding of the message itself, then communicative understanding is meant.

The communicative understanding can have three forms as well as criteria for identifying:

- the addressee gains knowledge which is new for him; communicative understanding merges with the cognitive one and *communicative cognition* occurs;

- the addressee, who received a message, does not comprehend its deep meaning, limiting himself / herself to *communicative perception* (for example, the text of the fable is understood, but the moral has not been grasped);

- the addressee remembers, repeats, copies individual words or phrases, without understanding even the superficial meaning of the message; then it is about *pseudocommunication*, as there are no “movement of meanings, but only a movement of the material shell of signs”.

- Different criteria for identifying the level of understanding — addressee's behavior, affirmative statements by the addressee in respect of the content of information message, etc.

For the purposes of our research, it is critical to highlight several circumstances related to understanding, as follows:

1. An understanding in SC deals with text — these are papers, documents, books, brochures and other products, but it is not the spiritual world

of a man — the author of these materials, which is much wider than any author's text. In our case, texts to a large extent are quite well-structured material. As far as an understanding of information is considered as multilevel process, so it should be treated accordingly: depending on the complexity of the text and its semantic component, this text can and should be referred to step by step and repeatedly, aiming to understand all its nuances, including the hidden meaning contained in it. At the same time, depending on the type of SC, an understanding takes on additional color. An understanding in the communication Sc — Sc means cognitive understanding, and this is enrichment, i.e., gaining knowledge and skills. An understanding in the communications Sc — B, Sc — G means encouraging understanding, i.e., relevant texts should contain incentive's, encouraging the activities. An understanding in the communication Sc — Sc means expressive understanding, i.e., texts should trigger certain emotions in other participants. At the same time, taking into consideration the results of the analysis carried out in [28], in all types of communication, the addresser should provide for the use of fascination in the IM intended for the addressee.

2. If the addresser is willing to find out whether the addressee understood him, he tries to clarify whether the addressee knows the position occupied by the subject of discussion in one or another process, structure, machine or product. That is, in our case of Sc, a definition of “understanding” as “knowing the position of an element in the system” will work [49].

3. To understand means to simplify. This bright idea found by the Struatsky brothers [50] may be supplemented, as follows — in order to clarify the meaning of your IM, there should be given a number of examples, corresponding to the level of understanding of the given addressee, and this means to simplify, and, therefore, to understand.

4. To embed the meaning of the communicated IM into the mental model of the addressee [51].

It should also be kept in mind that an understanding paves the way for the influence of the addresser on the addressee¹⁰, and it leads to the following essential and, in fact, final stage of communication, being, more often, its goal is an interaction between the participants of communication.

The abovementioned circumstances play a major role only if there is a lack of so human-specific thing as relationship, arising from exchanging the information; otherwise, a connection between communication and relationship appears on the scene, which might impose its restrictions on the

¹⁰ As noted in a number of papers, communicative influence is possible only provided that the communicator (a person who communicates the information) and the recipient (a person who receives the information) have a single or similar system of encryption and decryption. The above-mentioned circumstances, actually, create such single or similar system of encryption and decryption for communicants.

above-stated circumstances, for example, the relationship that turns into full or partial rejection of the interlocutor.

Indeed, SC can be considered through the networks of personal contacts, which might be of different nature, and through the interaction of scientists, businessmen and other participants of communication; while the relationship within these networks can be of different nature, including the conflict one, i.e., the structure of this intellectual space implies “an ongoing struggle between networks, educated scientists and other participants of communications, each of which accumulates emotional energy and cultural capital, for the right to stay in a limited number of the points of focus” [52, p. 21].

Therefore, the concept of V.A. Lefebvre about two fundamental ethical systems [53] appears to be very important. Summarizing this concept, the famous scientist Y.P. Adler writes: “In the first ethical system, morality does not compromise good and evil. This affirmation leads to high evaluation of compromise with people who threaten it. In the second ethical system, morality allows compromising good and evil. The representative of this system is focused on the aggressive self-defense and confrontation with any opponent — his/her slogan “goodness has to be with fists” [54, p. 91]. It turned out that the first ethical system dominates in the US culture, the second one — in CIS countries. Hence, the conclusion is drawn that the second ethical system dominates in the scientific community of our country (this also refers to CIS countries), which means that it's hard for the advocates of this system to compromise with the academic, and not only academic staff, who are the followers of another representation system. It is absolutely clear that this important scientific fact should be taken into consideration when designing successful SC.

Therefore, when building a dialog during SC, it is necessary not only to build it logically, but also to make it creative, systematically organized and also aimed to reach understanding and preserve the integrity of the communication system itself (Sc — Sc, Sc — B, Sc — S, Sc — G).

So, understanding, as an important part of CS, serves as the main category of SC — it is the meaning of SC. Therefore, both, the whole arsenal of modern ICT, even though the role of this arsenal is not the key one, but its capabilities enable to reinforce and “revive” the above stated circumstances¹¹ to a large extent, and facilitate embedding the addresser's mental model in the addressee's mental model, which is, in practical terms, the primary goal of SC, and the whole arsenal of the addresser's intellectual capabilities should be employed to support the meanings.

Conclusions and prospects for future research. Taking into consideration the problem of eliminating CG, the analysis of the above-stated material allows us to draw a number of conclusions.

¹¹ Actually, it is influence by means of signs and sign systems.

1. A major obstacle to designing effective and successful SC is CG that occur almost in all types of SC between its participants for two main reasons. The first one is related to the “external contour” of SC and CS. The second reason, being deeper in its nature. Is related to the factor of understanding, which needs to be taken into consideration, together with the accompanying fascination, to design successful SC.

2. In order to overcome the representational gaps rGaps, which are inherent in all types of SC under consideration, the priority in all the above-mentioned types of SC should be given to the factor of understanding as the key one when eliminating the representational gaps rGaps.

3. Apart from this factor, a major role is played by fascination, which enhances the factor of understanding.

4. An understanding of information is a multilevel process, which, depending on the type of SC, takes on additional color. An understanding in the communication Sc — Sc means cognitive understanding, in the communications Sc — B, Sc — G it means encouraging understanding, in the communication Sc — S it means expressive understanding. This aspect of understanding should be taken into consideration when creating the respective IM. Moreover, in all types of communication, the addresser should provide for the use of fascination in IM intended for the addressee.

5. The definition of “understanding” as “knowing the position of an element in the system” will work, and, therefore, will be effective, for the considered types of SC.

6. An understanding through simplification can be supplemented, as follows — there should be provided a number of examples, corresponding, by the level of understanding, to the given addressee, which means to simplify IM and, consequently, increase the chances of understanding it.

7. An understanding by embedding the meaning of IM in the addressee's mental model using ICT — web services, presentations, pictures, audio- and video materials, charts and other means to convert data into the form comprehensible by the addressee, in other words, converting data in information and thereby facilitating the embedment of the meaning in the addressee's mental model.

In the future, it is expected to study the applied aspects of the use of the above-mentioned requirements to ensure an understanding of IM by the addressee, including various methodological techniques associated with the achievement of understanding and development of the relevant criteria to identify reaching an understanding.

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ОСОБЛИВОСТІ ФАКТОРА РОЗУМІННЯ В НАУКОВИХ КОМУНІКАЦІЯХ

Стаття містить результати аналізу наукових комунікацій (НК), які відбуваються між такими суб'єктами, як наука, бізнес, влада та суспільство. Зокрема, досліджується комунікаційний розрив між цими суб'єктами. Про актуальність теми свідчать численні публікації вітчизняних і зарубіжних учених. Відомо, що успіх комунікації значною мірою залежить від розуміння та сприйняття інформаційного повідомлення (ІП), яке надсилається адресату. Відсутність ІП призводить до комунікаційних розривів, що знижує ефективність наукових комунікацій аж до повного непорозуміння. Метою дослідження є ідентифікація та структурування такого роду розривів, а також пошук шляхів їх подолання задля підвищення ефективності та успішного проектування наукових комунікацій. Емпіричною основою дослідження є наукові праці провідних вітчизняних і зарубіжних учених. Методи дослідження — принцип сходження від абстрактного до конкретного (принцип Гегеля), а також загальнонаукові методи пізнання: аналіз, синтез, узагальнення, наукова дедукція та індукція. Проведене дослідження демонструє, що відмінність у ментальних моделях і тезаурусах комунікантів призводить до комунікативних розривів у розумінні — репрезентативних розривів, які в іноземній літературі позначаються терміном *gaps*. Такого роду розриви виникають, коли відправники надають інформаційним повідомленням смисл, який не бачать одержувачі, створюючи в такий спосіб конфлікт у смислах і цінності інформації, що передається. Зроблено висновок, що для проектування успішної НК слід враховувати фактор розуміння разом із супутньою йому фасцинацією. Запропоновано механізми і техніки, які сприяють усуненню репрезентативних розривів, що в окремих випадках дає змогу знайти вирішення проблеми розуміння в НК.

Ключові слова: *ноосфера, наукові комунікації, комунікаційні розриви, розриви в розумінні, розуміння інформаційного повідомлення, фасцинація, репрезентативний розрив, розрив у сприйнятті.*