Metaphor in Terminology: Finding Tools for Efficient Professional Communication

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Abstract Professional communication between an expert and a non-expert, the so-called transdiscursive communication, presupposes special knowledge transfer and acquisition. Asymmetry in communicants' knowledge causes ambiguity and conceptual misrepresentation. Precise knowledge transfer in the context of transdiscursive communication can be achieved by means of knowledge mediation. In this context metaphor accomplishes the function of a transdiscursive knowledge mediation tool. This cognitive mechanism encourages conceptual mapping of specialized knowledge from a routine area to some knowledge domain. The study of metaphoricity of terms provides ground for finding language tools for cognition management.
For discourse analyses we have focused on specialized texts from scientific journals and popular magazines obtained from the Corpus of Contemporary American English as a result of the key word in context search. We aim at proving the evidence for special knowledge mediation necessity and efficiency in the context of transdiscursive communication.

Keywords Professional communication, transdiscursive knowledge communication, computer security discourse, deliberate metaphor, knowledge mediation, terminology, ontology, context model, situation model, three-dimensional metaphorical modelling

1 Introduction

The results of professional activity depend heavily on the efficiency of communication between its players, who usually make up a complicated network of participants, from scientists to common users. This means that people with different background knowledge, diverse professional competence, and various qualifications come together to accomplish their collaborative task or achieve a shared purpose. Despite communicants' aspiration for proper knowledge transfer and acquisition, the performance of this process may vary.

This situation can be described in terms of Cognitive-Discursive Linguistics. In this framework it is believed, that knowledge communication occurs in discourse, which is defined as verbally mediated professional communication (cf. Alekseeva/Mishlanova 2002). This refers to the activity, carried out in some professional sphere, and represented both in cognition of its participants in the form of mental models (context and situation models), and in language in the form of words. Such kind of interactions make up the institutional discourse. It is entitled institutional because that refers to special knowledge domains, e. g. Medicine, War, Computer Security, connected with "work-related institutions" (Freed 2015: 1). The diversity of discourse participants is explained through their belonging to different functional types of one

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institutional discourse. Functional types correspond to genres of professional communication, i. e. scientific, popular, and lay (Alekseeva/Mishlanova 2002, Utkina 2006, Utkina/Mishlanova 2008, Mishlanova 2008). Despite similarity in context models provided by the consistency of the institutional discourse the individual mental models differ due to the distinction in the functional types.

2 The problem of ambiguity in transdiscursive knowledge communication

Within a certain institutional discourse, communication between experts with different professional competence and non-experts with various background knowledge turns out to be transdiscursive, meaning special knowledge is transferred from one functional discourse to another.

The higher the asymmetry in communicants' individual mental models, the more evident is the ambiguity and conceptual mismatch between the same special knowledge transferred and acquired. This means that transdiscursive professional communication presupposes knowledge conversion. Without adequate measures taken this conversion can be done with losses and cause conceptual misrepresentation. Meanwhile, in the current information epoch, when information stored in the form of knowledge is of great value, the problem of special knowledge distortion is particularly evident.

Linguistics is the branch of science which is directly related to all other fields of knowledge, as it studies language in various forms of its existence and areas of implementation. Because of this, it is relevant to study language of professional communication from the perspective of cognitive - discursive linguistics as a tool for receiving, processing, and storing special knowledge. At the same time, the role of interdisciplinary (transdiscursive) communication becomes more important, which highlights the problem of scientific information misrepresentation.

This problem covers various fields of knowledge. The most vulnerable are the spheres with a many layered system of participants. Computer Security is a bright illustration of such many layered spheres.

3 The evolution of the research question

The effectiveness of professional communication is not a new research issue. The first attempts to study terminology as the basic tool for professional communication, date back to the 16th–18th centuries; the researchers focused on the terminology record of Anatomy (Versalius, the Royal Society), Chemistry (AL Lavuoze, Berthollet KL), Economy (J. Beckman), Biology, and Zoology.

In the 19th century the work on standardization of terminology begins, terminology theory and practice (e. g.: lexicography languages for special purposes) appear.

In the 20th century, the study of languages for special purposes becomes a branch of applied linguistics, a major contribution to the development of which was done by E. Wüster, D. Lotte, A. Reformatskiy, and others. Attention to language processes, communication, language and thinking becomes the impetus for the development of cognitive science. The most important contribution to its development is made by such famous scientists as G. Harman, U. Cheyf (identifying the principles of cognitive science), Ch. Fillmore (the theory of frame semantics), G. Lakoff and M. Johnson (the conceptual metaphor theory), R. Langacker (the cognitive grammar), E. Roche (the prototype theory). In Russia understanding of cognitive linguistics as a new direction of research began with the appearance of "Concise Dictionary of cognitive terms", which was published in Moscow in 1996. On the basis of cognitive linguistics cognitive (epistemological) term study was formed, in which a significant role was played by such Russian scientists as L.M. Alekseeva, B.N. Golovin, E.S. Kubryakova, V.M. Leichik and others.

Linguistics of the 21st century is based on the theoretical foundations of the previous paradigms developing in the direction of cognitive studies and delving into the conceptual meaning of the term. Today, such Russian linguists as L.M. Alekseeva (2009), N.N. Boldyrev (2007), V.Z. Demyankov (2016), E.I. Golovanova (2013), L.A. Manerko (2009), S.L. Mishlanova (2011), V.F. Novodranova (2011), V.F. Tabanakova (2014), and others work in the framework of this approach. There appears to be the idea that terminology of any field of knowledge is the means of storing, processing, transmitting, and developing conceptual paradigms in science; for the central problem of cognitive term studies is the relation between terms and underlying special knowledge (Golovanova 2013: 13).

Cognitive-discursive approaches to term study offers a comprehensive research into the terminology and allows us to consider terminological units on the linguistic, conceptual, and pragmatic levels. Such an approach to the description of terminology coincides with modern trends of the leading European and American linguistic schools represented by the works of L. Barsalou (2008), G. Budin (2016), J. Engberg (2010), P. Faber (2012), R. Gibbs (2003), G. Steen (2007), T. van Dijk (2012), etc.

One of the cognitive discursive methods of studying and organizing concepts existing in some field of knowledge is the frame-based terminology (a term coined by P. Faber 2012). It is based on the assumption that the structure of a language reflects its conceptual framework, and that it is possible to understand human thinking by studying its reflections in the language (cf. Langacker 1987). One of the key units of the frame-based terminology is an event, which comprises the term's conceptual frame, the context of its situational and potential usage and its relations to other terms in the field of knowledge.

The role of metaphor in professional communication has been discussed many times by both Russian linguists (cf. L. Alekseeva, A. Chudinov, L. Manerko, S. Mishlanova, V. Novodranovoy) and foreign researchers (cf. A. Denies, Z. Keveches, T. Krennmayr, G. Lakoff, J. Littlemore, E. Semino). Metaphor is regarded as a "cognitive mechanism in which one conceptual area is partially mapped onto another conceptual area, which is in turn understood through the prism of the former one" (Isaeva/Mishlanova 2014: 8). In the language for special purposes conceptual metaphors occur in the form of metaphorical terms. Cognitive potential of metaphor in terminology lies in its ability to model the content and structure of new scientific concepts by analogy with familiar concepts from other knowledge domains or everyday life.

4 Our solution

Precise knowledge transfer in the context of transdiscursive communication can be achieved by means of knowledge mediation and adjustment in accordance with the level of communicants' professional competence. We understand knowledge mediation as an interim stage between knowledge transfer and acquisition. At this stage conceptual structures, which represent special knowledge, are transferred into a verbal form and again rendered into conceptual structures. To objectivize this process, let us compare it with a process of signal transfer, described in the Information theory, originally proposed by Claude E. Shannon in *A Mathematical Theory of Communication* (1948).

Structurally knowledge communication can be seen as a typical system for storing and transmitting information. Let us represent this communication in the form of a flow chart, similar to C. Shannon's connection system (Shannon 1948), but adjusted to our research purposes (cf. Figure 1).

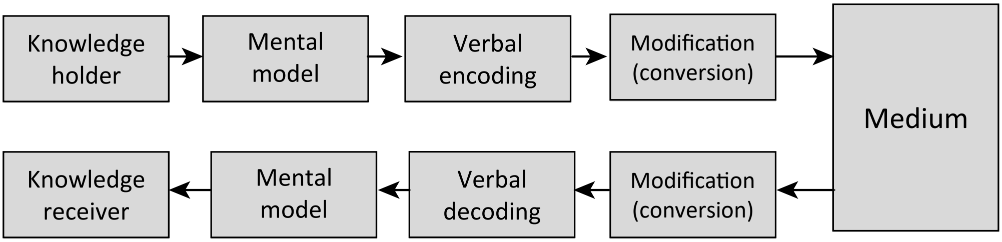

Figure 1: Knowledge communication flowchart

In this flowchart knowledge holder is the person (in our case an expert) who is going to share his or her special knowledge with another person (in our study a nonexpert), labelled as a "Knowledge receiver". The process of knowledge transfer and acquisition comprises a number of steps. First the expert's knowledge being a part of his or her ontology is extracted from this ontology in a form of a mental model. This means that not the whole ontology will be transmitted to the knowledge receiver, but only the part of it that is necessary for adequate knowledge acquisition. This important step, which facilitates redundancy elimination, is labelled "Mental model extraction". In cognitive linguistics a mental model is understood as the way an event is represented in thought and "stored in the episodic memory" (van Dijk 2012: 589). The model comprises a set of elements associated with the event, such as time, place, participants, objects, etc. Mental models "contribute to the construction of the common ground" (van Dijk 2012: 589) and enable human beings "to 'read the mind' of others through plausible and often reliable reconstructions of the mental models of others" (van Dijk 2012: 589). The form of a mental model is an efficient way for preserving knowledge due to the fact that missing elements, lost or distorted in the process of knowledge transmission or storing are easily restored or drawn upon from the event frame.

The step entitled "Verbal encoding" is intended for mental model transformation into a verbalized form of a message. Here minimal idea units (propositions) are encoded by means of the languages of general and special communication to form a message. This message is to be converted in the following "Modification" step into an oral or written text.

The medium where the knowledge is stored or transmitted causes random noise or distortions, which make knowledge reception more perplex. Here by the word medium we understand the discourse where the knowledge is being communicated, i. e. transferred and acquired, comprising the event of communication, its participants, settings. All of these influence the completeness of the initial knowledge at the moment it is being acquired.

Blocks located on the receiving side perform reverse operations and provide the receiver with information in a convenient for perception form.

The loss of a part of specialized knowledge in this complicated process is difficult to avoid not only due to the complexity of the "route" but mostly due to the mismatch between the ontology, the knowledge to be transferred is being part of (the output ontology), and the ontology the knowledge being transferred is received by (the input ontology).

Ontology as a set of concepts hierarchically related to one another to form a knowledge field is part of human conceptual system inherent in human perception. To study its complex organization, we apply the method of ontological modelling. For this reason, we go in for an applied understanding of ontology accepted in computer and information sciences as knowledge bases of a specialized type which are feasible for "reading" and understanding, alienating from their developer, and physical sharing by the users (cf. Gavrilova/Khoroshevskii 2001). According to Gruber (2009: 59 f.)

> ontology defines a set of representational primitives with which to model a domain of knowledge or discourse. The representational primitives are typically classes (or sets), attributes (or properties), and relationships (or relations among class members). The definitions of the representational primitives include information about their meaning and constraints on their logically consistent application.

T. Gruber points out the following features of the ontology. First, he notes, that "an ontology defines (specifies) the concepts, relationships, and other distinctions that are relevant for modeling a domain", and adds, that "the specification takes the form of the definitions of representational vocabulary (classes, relations, and so forth), which provide meanings for the vocabulary and formal constraints on its coherent use" (Gruber 2009). To differentiate the ontology from semantic word nets we introduce another distinctive feature, namely, hierarchy.

Hoping to find out why in some cases of professional communication output knowledge is not completely embedded into an input ontology, we decided to study premises for its inclusion.

We assume that knowledge is transferred from one person to another in patches, a number of concepts, linked together to recreate a particular event of a real or imaginary life, physical, biological, or chemical process. In the mind these recreations occur in the form of so-called context and situation mental models (cf. van Dijk/Kintsch 1983, van Dijk 2006). Situation mental models are individual representations of an event with reference to the time, participants, objects, relations, and operations. An event framed in the form of a mental model is rendered as data or "sense data" as it is put in B. Russel's philosophy, where

> sense data are taken to be mind-dependent objects whose existence and properties are known directly to us in perception. These objects are unanalyzed experiences inside the mind, which appear to subsequent more advanced mental operations exactly as they are (CRAM101 Text book Reviews 2016: 77).

Sense data occur as mental reflections of real events refracted through the prism of individual's cognition. Therefore, they are distinct from the real-life events and subjective.

On the other hand, a situation model is not only dependent on the personality of its bearer, but also on the external factors as it comprises a personal vision of an event through the frame of a context model.

Context models are dynamic pragmatic models of typical communicative situations. Context models determine collective mental representations of communication or interaction between (among) discourse participants by people, belonging to the same epistemic group. Context models frame an ongoing event and relate it to a proper sociocultural context. In particular, they determine communicants' roles (speaker, listener, author, etc.), social roles (professor, journalist, doctor, etc.), category (gender, age, etc.), personal relations (friend, enemy, helper, etc.), aims, and intentions. One of the important functions of context models is knowledge management, because they take part in knowledge adaptation. They provide context for event acquisition. In other words, on the basis of these models discourse participants perceive real life situations and react correspondingly.

Context models in turn are restricted by discourse, which can be regarded as the media, the mechanism, as well as the result of special knowledge transmission. In particular, according to Karasik (2002: 192), discourse is "an intermediate phenomenon occurring between speech, verbal communication, and linguistic behavior, on one side and a recorded text on the other"[1]. So, it includes both, "text as a static object, occurring in the process of special communication, and dynamic unfolding processes of its production and understanding"[2] (Kibrik 2003: 4). Speech linguists share the opinion, that discourse stands for live verbalized communication, characterized by a variety of deviations from the standards of the written text. Thus, from this perspective, special attention is payed to its spontaneity, completeness, thematic coherence, and perspicuity (cf. Karasik 2002: 193). For sociolinguists discourse is communication in or between some social groups and it is studied with reference to some specific speech behavioural event (cf. Karasik 2002: 194).

As disciples of Cognitive-Discursive Linguistics (cf. Alekseeva et al. 2014), which suggests the complex study of complementary knowledge representation in language, in thought, and in communication, we stick to the theory that discourse as a verbally mediated professional (special) activity (cf. Alekseeva/Mishlanova 2002) is serviced by a language for special purposes. Because of this, discourse is terminologically rich. Terms accumulate segments of special and background knowledge in a compressed way and comprise elements of context model shared by members of epistemic community. That is why the study of transdiscursive knowledge communication inevitably leads to research into metaphoricity of terms.

5 Metaphor as a tool for knowledge communication

Recent developments in the study of metaphorical nature of terms (cf. Alekseeva et al. 2014, Bogatikova at al. 2014, Isaeva/Mishlanova 2014) have shown the potential of employing the method of Three-Dimensional Metaphorical Modelling, which allows us to examine terminology from lexicological, cognitive and pragmatic perspectives. In this respect terms are considered as part of language, thought and communication.

For our research we have chosen Computer Security discourse, since it is relatively new (about 70 years) and rapidly developing. It involves participants with various professional competences, that is why special knowledge about Computer Security is transferred from specialists both to experts and non-experts. Furthermore, lexical units belonging to language for special purposes elicit diverse conceptual content based on recipient's background knowledge and experience. This provokes disagreement in conceptual content of output and input knowledge and causes conceptual ambiguity in the process of transdiscursive special knowledge sharing. This is the rationale for our research, carried out on texts specialized for an IT

1 Our translation.

2 Our translation.

expert readership (scientific genre) and texts targeting an unsophisticated readership (popular genre), extracted from the Corpus of Contemporary American English (COCA).

6 Methods and data analysis

To analyze the data we have employed the method of Three-Dimensional (3D) Metaphor Modelling meant to constrain pragmatic, semantic, and conceptual aspects of metaphor (Isaeva/Mishlanova 2014). The method comprises a number of strategies: corpus analysis, thesaurus modelling (cf. Baranov/Karaulov 1991, Utkina/Mishlanova 2008), MIPVU (cf. Pragglejaz Group 2007, Steen 2010), the Five-Step Method (cf. Steen 2007, 2011), Frame semantics (cf. Fillmore 2006). The procedure is executed in succession: communicative-pragmatic analysis, semantic analysis and conceptual analysis.

Communicative-pragmatic analysis includes three steps: key word in context (KWIC) search; discourse type distinction; discourse subtype (genre) distinction. The KWIC search has been limited to the contexts of the lemma *virus* in COCA. The search has resulted in approximately 10000 contexts. To divide the contexts into discourse types we have applied the definitional analysis of a lexeme *virus*. As a result, three knowledge domains have been distinguished with reference to the meanings of the lexeme:

1) *Medicine/Virology:* "a) Any of the various submicroscopic agents that infect living organisms, often causing disease, and that consist of a single or double strand of RNA or DNA surrounded by a protein coat. Unable to replicate without a host cell, viruses are typically not considered living organisms. b) A disease caused by a virus" (American Heritage Dictionary).
2) *IT/Computer Virology:* "A computer program or series of commands that can replicate itself and that spreads by inserting copies of itself into other files or programs which users later transfer to other computers. Viruses usually have a harmful effect, as in erasing all the data on a disk" (American Heritage Dictionary).
3) *Sociology/Social Relations:* "A harmful or destructive influence" (American Heritage Dictionary).

These knowledge domains correspond to similarly named institutional discourse types: Medicine (Virology), IT (Computer Security), and Sociology (Social Relations).

For our purposes we have selected those contexts which are associated with definition 2, i. e. belong to a Computer Security institutional type of the discourse.

To subdivide the texts into functional discourse subtypes (genres) we have sorted them according to a potential professional competence of their target audience. The first group included the contexts taken from specialized computer journals (*Compute!, PC World, Communications of the ACM (CACM), Computer World*), while the second group encompassed the contexts extracted from popular magazines (*Science News, Popular Science (PopSci), Omni, The futurist*). The received concordances represent two functional subtypes of the Computer Security discourse: scientific and popular. Thus, the result of the communicative-pragmatic analysis is *virus* tokens divided into institutional discourse types, namely IT/Computer Virology, Medicine/Virology (discarded from further analysis), and Sociology/Social Relations (discarded from further analysis), and functional subtypes, namely scientific and popular.

The linguistic dimension of the 3D Metaphorical Model represents Metaphor Related Words (MRW) (cf. Pragglejaz Group 2007). The identification procedure involves MIPVU, which stands for Metaphor Identification Procedure, developed by the linguists of Vrije University Amsterdam. The procedure is based on comparison of contextual and basic meanings of words composing selected contexts. Those words which have contrasting contextual and basic meanings, while the former can be understood in comparison with the latter, have been tagged MRW. An example of this can be the word *virus* in *Virus attacks the computer*. The contextual meaning is "A computer program or series of commands that can replicate itself and that spreads by inserting copies of itself into other files or programs which users later transfer to other computers. Viruses usually have a harmful effect, as in erasing all the data on a disk" (American Heritage Dictionary). The basic meaning is "Any of the various submicroscopic agents that infect living organisms, often causing disease" (American Heritage Dictionary). The contextual and the basic meanings refer to different fields of knowledge, namely IT Security (the former meaning) and Microbiology or Medicine (the latter one), however the IT Security meaning can be elicited from the Microbiological or Medical one.

The conceptual dimension refers to situation and context mental models. A situation model, i. e. an individual mental representation of an event, fixes event distinctive features: space-time characteristics, participants, their relations, roles, specific actions, goals etc. This knowledge is grounded in human mind in the form of propositions, "minimal idea units consisting of small numbers of concepts" (Steen 1999a) and is elicited by words' semantics.

In this paper we are interested in a metaphorical constituent of mental models, therefore we have focused our attention on the features, which carry allusions to the source domains of metaphorical mappings. These features are examined on the basis of MRWs in their contexts with the usage of the Five-Step Method (cf. Steen 2011). The method allows recreating metaphorical mappings through the analysis of indirect comparisons and the reconstruction of indirect analogies at the text base level. Consider a specific example of the method (see example 1):

(1) *It (AntiVirusPlus) scans and removes the virus code from the infected files as it reconstructs the original data* (Oligschlaeger, Richter 1991).

According to Steen (2007) the first step is to identify the focus of metaphor. This refers to an expression activating a "concept which cannot be literally applied to the referents in the world evoked by the text" (Steen 1999b: 61). For this purpose, we have applied Metaphor Identification Procedure (cf. Pragglejaz Group 2007) and have obtained the following focuses of metaphor:

scan	
Contextual meaning	Basic meaning
"if a machine or computer program scans something, it examines it in order to look for a particular thing" (Macmillan Dictionary)	1) "to look at something very carefully, because you hope or expect to see a particular person or thing" (Macmillan Dictionary) 2) "to read something very quickly, in order to get a general idea of its meaning or to find particular information" (Macmillan Dictionary)

remove	
Contextual meaning	Basic meaning
"uninstall (a feature in Microsoft Windows that lets users uninstall and manage the software installed on their computer)" (Computer Hope)	"to take something or someone away from a place" (Macmillan Dictionary)

code	
Contextual meaning	Basic meaning
"a set of instructions that a computer can understand" (Macmillan Dictionary)	1) "a system of words, numbers, or signs used for sending secret messages" (Macmillan Dictionary) 2) "a complicated system of rules, relationships, or instructions (the genetic code)" (Macmillan Dictionary)

infected	
Contextual meaning	Basic meaning
"if a computer or disk is infected, the information in or on it has been changed or destroyed by a computer virus" (Longman Dictionary)	1) "someone who is infected has a disease that can be spread from one person to another" (Macmillan Dictionary) 2) containing bacteria or other substances that cause disease (Macmillan Dictionary)

file	
Contextual meaning	Basic meaning
"a collection of data or program records stored as a unit with a single name" (American Heritage Dictionary)	1) "a set of papers, documents, or records that you keep because they contain information" (Macmillan Dictionary) 2) "line, row, chain, string, column, queue, procession" (The Free Dictionary by Farlex)

reconstruct	
Contextual meaning	Basic meaning
"to make a copy of something that existed in the past" (Macmillan Dictionary)	1) "to build something again" (Macmillan Dictionary) 2) "(Linguistics) to deduce the form and properties of (a protolanguage or an unattested word) based on evidence from attested languages, such as cognate words" (American Heritage Dictionary)

The second step is devoted to the examination of conceptual structures elicited by the foci of metaphor. To accomplish this, we present all the concepts and their relations in the form of propositions, structurally recorded minimal idea units (cf. Steen 1999a). Each proposition consists of a predicate and one or two arguments.

P1: (SCANt/s ANTIVIRUSPLUSt CODEt/s)
P2: (REMOVEs ANTIVIRUSPLUSt CODEt)
P3: (MOD CODEt/s VIRUSt)
P4: (FROM P2 P5)
P5: (MOD FILEt/s INFECTEDt/s)
P6: (RECONSTRUCTs ANTIVIRUSPLUSt DATAt)
P7: (MOD DATAt ORIGINALt)

Here P1–P7 stand for propositions, t – target domain, s – source domain, MOD – adverbial or adjectival modifier.

The third step is aimed at an indirect comparison identification. This is done by means of splitting propositions, which contain references to both target and source domains, into two parallel lines, representing either concepts of the target or source domains. Each concept has a variable referent in the parallel domain line. These referents are signified with variables F, x, y and G, a, b substituting predicates and two arguments in the target or source domain respectively.

P1: (SCANs ANTIVIRUSPLUSt CODEt)
SIM{[]F, []a, []b

[	F	ANTIVIRUSPLUS	CODE	]t
[	SCAN	a	b	]s

P2: (REMOVEs ANTIVIRUSPLUSt CODEt)
SIM{[]F, []a, []b

[	F	ANTIVIRUSPLUS	CODE	]t
[	REMOVE	a	B	]s

P3: (MOD CODEt VIRUSt)
SIM{[]x, []b

[	MOD	CODE	VIRUS	]t
[	MOD	a	b	]s

P5: (MOD FILEt/s INFECTEDt/s)
SIM{[]x, []b

[	MOD	FILE	INFECTE	]t
[	MOD	a	b	]s

P6: (RECONSTRUCTs ANTIVIRUSPLUSt DATAt)
SIM{[]F, []a, []b

[	F	ANTIVIRUSPLUSt	DATA	]t
[	RECONSTRUCT	A	b	]s

The fourth step is devoted to the reconstruction of indirect analogies. This is done by means of filling in the empty slots, designated with variables in the third step. The concepts to be inserted instead of the variables are determined by the dictionary entries, which define correlating meanings in corresponding knowledge domains.

The pattern under analysis belongs to the scientific discourse subtype, therefore we fill in the missing slots by reference to the communicators' professional knowledge. Thus, taking into account Computer Virology's succession to conceptual frames and metaphors of Virology in medicine (cf. Mislanova/Mishlanov 2012, Bogatikova et al. 2014), we assume that the usage of the MRWs *scan, remove, code, infected, file,* and *reconstruct* might evoke mappings from a referential medical knowledge domain. We believe that this happens only at a scientific level of professional communication (cf. Hoffmann 1985, 1988) as it invokes fundamental knowledge of Computer Virology origins. In this case we obtain the following results:

SIM{
[SCAN ANTIVIRUSPLUS CODE]t
[ANALYZE DOCTOR DNA/RNA]s

SIM{
[DEINSTALL ANTIVIRUSPLUS CODE]t
[REMOVE DOCTOR DNA/RNA]s

SIM{
[MOD CODE VIRUS]t
[MOD DNA/RNA VIRUS]s

SIM{
[MOD FILE INFECTED]t
[MOD CHAIN INFECTED]s

SIM{
[MAKE-COPY ANTIVIRUSPLUS DATA]t
[RECONSTRUCT DOCTOR GENETIC-MATERIAL]s

Or, if communicators are not equipped with the knowledge on Computer Virology history and general scientific knowledge, the metaphorical constituent of the situation model might have a different a frame, e. g.:

SIM{
[SCAN ANTIVIRUSPLUS CODE]t
[READ PROOFREADER SET-OF-LETTERS]s

SIM{
[DEINSTALL ANTIVIRUSPLUS CODE]t
[REMOVE PROOFREADER SET-OF-LETTERS]s

SIM{
[MOD CODE VIRUS]t
[MOD SET-OF-LETTERS ERROR]s

SIM{
[MOD FILE INFECTED]t
[MOD SET-OF-PAPERS ERRORFUL]s

SIM{
[MAKE-COPY ANTIVIRUSPLUS DATA]t
[RECONSTRUCT PROOFREADER TEXT]s

In the fifth step we take down all the correlating concepts in the target and source domains received in the fourth step. Table 1 contains correlations representing indirect mappings in the exemplary extract as it might be interpreted by the communicants who possess fundamental knowledge on Virology both in Microbiology/Medicine and Computer Security (see "Fundamental knowledge" in Table 1) and by the communicants who possess only applied knowledge in Computer Security (see "Applied knowledge" in Table 1). The results obtained from pattern (1) analysis are consistent with the full selected corpus described in (cf. Isaeva/Mishlanova 2014).

Table 1: Indirect mappings evoked in pattern (1)

Fundamental knowledge		**Applied knowledge**	
TARGET DOMAIN	SOURCE DOMAIN	TARGET DOMAIN	SOURCE DOMAIN
VIRUS	VIRUS	VIRUS	ERROR
CODE	DNA	CODE	SET-OF-LETTERS
INFECTED	INFECTED	INFECTED	ERRORFUL
FILE	CHAIN	FILE	SET-OF-PAPERS
ANTIVIRUSPLUS	DOCTOR (GENETIC-ENGINEER)	ANTIVIRUSPLUS	PROOFREADER
MAKE-COPY	RECONSTRUCT	MAKE-COPY	DEDUCE-FORM
DATA	GENETIC-MATERIAL	DATA	TEXT

From the mappings represented in Table 1 we extrapolate, that in scientific communication the metaphorical constituent of the situation model of the exemplary extract draws upon a correlating situation model in the source (Genetic engineering) domain. The latter introduces a virus as a pathogen, which embeds into the DNA chain. A genetic engineer aims at reconstructing damaged genetic material.

In professional communication in order to conceive the way Antivirusplus operates on a virus, interlocutors appeal to a Linguistics domain where a proof-reader corrects errors in texts.

The article deals with the scientific versus the popular discourse subtypes, that is why communication at levels lower than scientific is not taken into account.

When the metaphorical constituent of the situation model is simulated, we examine the metaphorical component of a context mental model. For this purpose, we arrange all the MRW in taxonomy with fields, denoting source domains at various explication levels. A completed taxonomy represents an integration of socially shared models of similar events. Context models have three main functions: they determine the way events are imprinted in the episodic memory of discourse participants, define the way an event is perceived by the members of an epistemic community, i. e. "a community of shared knowledge" (Haas 1989: 377), and provide successful knowledge communication.

Our objective at this stage is to simulate epistemically shared metaphorical models of the concept 'virus' in the scientific and the popular subtypes of Computer Security discourse.

The taxonomy we use includes two domains, subdivided into four basic taxons. The latter split into specific taxons:

Domain: MAN

Basic taxon:	MAN AS A LIVING BEING
	ANATOMY
	PHYSIOLOGY
Basic taxon:	MAN AS A SOCIAL BEING
Specific taxon:	PROFESSIONAL ACTIVITY
	POLICY AND WAR
	MACHINERY
	HOUSEHOLD
	CULTURE

Domain: NATURE

Basic taxon:	INANIMATE NATURE
Specific taxon:	LANDSCAPE
	NATURAL PHENOMENON
Basic taxon:	ANIMATE NATURE
Specific taxon:	PLANT
	ANIMAL

In the same way every taxon can be broken into subtaxons. We fill this taxonomy with the MRWs in compliance with the source domains of denoted concepts, activated in indirect mappings.

As a result two metaphorical models of the concept 'virus' in the scientific and the popular Computer Security discourse have been reconstructed. By means of statistic analysis we have revealed common and specific features in the models.

Thus, the taxon MAN AS A SOCIAL BEING predominates in both models (64.1 % in the scientific discourse and 57.4 % in the popular discourse). It means that both experts and non-experts conceptualize the computer virus as part of their social life. It is either a member of society, having a particular social status or role, or an object of social manipulation. It is followed by the taxon MAN AS A LIVING BEING (25.3 % in the scientific discourse and 39.3 % in the popular discourse). The least representative taxons are ANIMATE NATURE (8.6 % in the scientific discourse and 1.5 % in the popular discourse) and INANIMATE NATURE (2.5 % in the scientific discourse and 1.8 % in the popular discourse).

A slight disagreement of the models is apparent at the level of specific taxons and subtaxons. Figure 2 illustrates representativeness of specific taxons in two models.

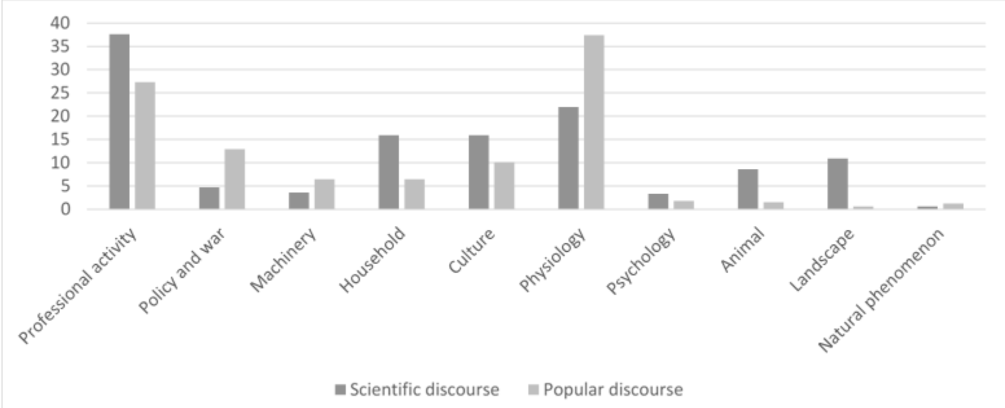

Figure 2: Representativeness of specific taxons in scientific and popular Computer Security discourse

As it is shown in the diagram high-representative taxons in both types of the discourse are PHYSIOLOGY (22.0 % in the scientific discourse, 37.4 % in the popular discourse), and PROFESSIONAL ACTIVITY (37.6 % in the scientific discourse, 27.3 % in the popular discourse). Medium-representative taxons in the scientific discourse are ANIMAL (8.6 %), HOUSEHOLD (15.9 %), and CULTURE (10.1 %), while in the popular discourse they are POLICY AND WAR (12.9 %), MACHINERY (6.4 %), HOUSEHOLD (6.4 %), and CULTURE (10.1 %). Low-representative taxons in the scientific discourse are LANDSCAPE (1.9 %), NATURAL PHENOMENON (0.6 %), PSYCHOLOGY (3.3 %), POLICY AND WAR (4.7 %), and MACHINERY (3.6 %), while in the popular discourse they are LANDSCAPE (0.6 %), NATURAL PHENOMENON (1.2 %), ANIMAL (1.5 %), and PSYCHOLOGY (1.8 %).

Specificity of the models becomes more obvious through semantic roles differentiation (cf. Fillmore 2006). We have examined semantic relations in the frames modelled in the last step of the Five-Step Analysis. As a result, all the nominative elements have been assigned with semantic roles: Agent, Counteragent, Patient, Object, Instrument, Location, and Result.

In the professional Computer Security discourse, we have encountered the following semantic roles: Agent (DOCTOR, POLICEMAN, DEFENDER, TAMER, WRITER/ARTIST), Patient (BIOLOGICAL VIRUS, CRIMINAL, ENEMY, WILD ANIMAL), Object (DEVICE, MACHINERY, ARTICLE), Instrument (TOOLS), Location (NATURE), Result (WORK OF ART, LITERARY WORK).

Thus, in the scientific discourse computer virus is conceptualized as an object of professional, home, and cultural activity, verbalized by MRWs included into the taxons LAW, MEDICINE, HOUSEHOLD, ANIMAL, and CULTURE. The taxon LAW contains MRW verbalizing the conceptual metaphors “a computer virus is a criminal”, “an IT specialist is a policeman” (see example 2):

(2) *More than 42,000 distinct variants of the new malware spread over a 2-day period, according to security company Commtouch. The attackers intended for the onslaught to evade traditional signature-based virus detection, which must know about a specific piece of malware before it can catch it* (Naraine 2007).

detection	
Contextual meaning	Basic meaning
"the process of detecting someone or something" (Macmillan Dictionary)	"the work of trying to discover information about a crime so that the criminal can be caught" (Macmillan Dictionary).

The taxon MEDICINE contains MRWs verbalizing the conceptual metaphors "a computer virus is a biological virus/infectious disease", "an IT specialist is a doctor" (see example 3):

(3) *Virus Immunization Program available for an additional $ 395.00 per year* (Oligschlaeger, Richter 1991).

immunization	
Contextual meaning	Basic meaning
the attempt to prevent a computer from getting a virus by "automatically spreading across networks and patching the known exploit, weeks before the real virus hit" (http://www.google.com/patents/US7512809)	"the attempt to prevent someone from getting a particular illness by putting a substance into their body, especially using a needle" (Macmillan Dictionary)

The taxon HOUSEHOLD contains MRWs verbalizing the conceptual metaphor "computer virus is an object", e. g. *load, block, float*. The taxon CULTURE contains MRWs verbalizing the conceptual metaphors "a computer virus is a work of art/literary work", "an IT specialist is an artist", e. g. *write, create, author*.

The taxon ANIMAL contains MRWs verbalizing the conceptual metaphors "computer virus is an animal", "an IT specialist is an animal tamer" (see example 4):

(4) *NAV detected 100 percent of the wild viruses, and it found more zoo viruses than any other package (over 99 percent)* (Miastkowski 1999).

wild	
Contextual meaning	Basic meaning
situated outside the single computer or lab where it was created[3]	"a wild animal or plant lives or grows on its own in natural conditions and is not raised by humans" (Macmillan Dictionary)

In the popular Computer Security discourse, the most active semantic roles are Agent (BIOLOGICAL VIRUS, CRIMINAL, ENEMY, DOMESTIC ANIMAL, NATURAL DISASTER, WRITER/ARTIST), Patient (VICTIM), Object (INANIMATE OBJECT), Instrument (TOOLS), Location (HUMAN ENVIRONMENT), Result (WORK OF ART, LITERARY WORK).

In the popular Computer Security discourse, a computer virus is conceptualized as a problem. Thus, the most representative specific taxon Physiology contains MRWs verbalizing the conceptual metaphors "computer virus is a biological virus/infectious disease", "computer is a diseased organism" (see example 5):

3 Our definition.

(5) *Never give out a password, and always use a virus checker to be sure that a file downloaded from the Internet isn't contagious* (Bruning 1995).

contagious	
Contextual meaning	Basic meaning
able to transmit malware code to another device[4]	"a contagious disease spreads from one person to another through touch or through the air" (Macmillan Dictionary)

Computer virus as a problem is represented in the popular Computer Security discourse by MRWs included into the taxons LAW and POLICY AND WAR, verbalizing conceptual metaphors "a computer virus is a criminal/invader", "a computer is a victim/territory" (see example 6):

(6) Could *computers themselves be used as weapons? Yes, say experts, thanks to that category of malicious computer programs known as viruses, which can alter, damage, or destroy files and computer memory and can attack and spread without their victims' knowledge.* (Gunther et al. 1994)

attack	
Contextual meaning	Basic meaning
penetrate into a computer system[4]	"to use weapons to try to defeat an enemy" (Macmillan Dictionary)

MRWs included into the taxon CULTURE verbalizing the conceptual metaphors "a computer virus is a work of art/literary work", "an IT specialist is an artist" indicate how sophisticated a computer virus is (see example 7):

(7) *The student, Onel A. de Guzman, who had been missing for several days, appeared at a news conference in dark glasses. # He did not directly say whether he had written the "ILOVEYOU" virus* (Beveridge 2000).

write	
Contextual meaning	Basic meaning
"to create a computer program" (Macmillan Dictionary)	"to create something such as a story or song by putting words together" (Macmillan Dictionary)

7 Results

While comparing semantic frames typical of the metaphorical components of context models in the scientific and the popular types of Computer Security discourse we have revealed that the former includes *a computer virus* in the role of Object and *IT specialist* in the role of Agent, whereas the latter contains *a computer virus* in the role of Agent and *a computer* in the roles of Object or Location (cf. Table 2). This rearrangement of semantic roles occurs due to the difference in real life experience of discourse participants. As far as scientific IT commu-

[4] Our definition.

nication includes experts who intend to stop virus influence, the metaphorical model of the concept 'virus' in the scientific Computer Virology discourse implies the idea of "suppression of aggression". Meanwhile non-professional communication includes users who suffer from virus malicious activity thereby in the popular Computer Security discourse the idea of "succumbing to aggression" is implied.

Table 2: Rearrangement of semantic roles in scientific and popular types of Computer Security discourse

Scientific Discourse	Popular Discourse
Agent (DOCTOR, POLICEMAN, SOLDIER, TAMER)	Counteragent (VIRUS, OFFENDER, ENEMY, WILD ANIMAL)
Instrument (EQUIPMENT, MECHANISM, TOOL)	Agent (VIRUS, OFFENDER, ENEMY, WILD ANIMAL, NATURAL DISASTER)
Counteragent (VICTIM, DISEASED ORGANISMS)	Instrument (WEAPONS)

8 Discussion

This rearrangement of semantic roles occurs due to the difference in real life experience of discourse participants. As far as scientific IT communication includes experts who intend to stop virus influence, the metaphorical model of the concept 'virus' in the scientific Computer Virology discourse implies the idea of "suppression of aggression". Meanwhile non-professional communication includes users who suffer from virus malicious activity, therefore in the popular Computer Security discourse the idea of "succumbing to aggression" is implied.

Based upon the results obtained we come to the conclusion, that even though the analyzed data belongs to the same discourse type (i. e. Computer Virology) and it represents relatively analogous sets of metaphorical models, we have revealed rearrangement of semantic roles in metaphor frames. This proves that the way a scientific entity is conceptualized, depends on a person's real-life experience, and an attempt to transfer original scientific data to non-experts might fail and/or lead to conceptual misrepresentation.

The way to avoid this is mediation of special knowledge in the process of its transdiscursive communication. We believe that mediated special knowledge preserves its validity, as far as it contains "veridical data received as a result of scientific research but released from system-related context" (Chernyavskaya 2004: 5). The process is streamlined when knowledge transfer (sending) on one side and perception (receiving) on the other side are initiated as a conscious deliberate act of knowledge communication, which should include the additional step of special knowledge transformation both on conceptual and language levels (cf. Figure 3).

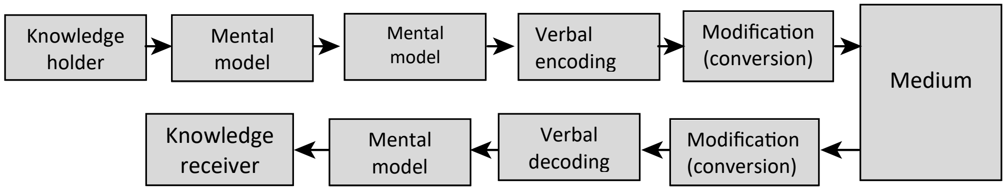

Figure 3: The flowchart of knowledge communication with internal mediation

In case the knowledge sender is aware of the metaphors, which the knowledge to be transferred is conceptualized with by the receiver (this means the expert employs the results of a preliminarily carried out cognitive discursive research in the corresponding discourse), mediation will be achieved with only one additional step of the initial mental model transformation. The following step of verbal encoding will be drawn from the obtained mental model. The rest of the steps will be preserved without any change.

Meanwhile in most cases of real professional communication the sender is an expert in his knowledge area but is not able to underpin his or her special knowledge transfer with any cognitive linguistic data. Due to this it is reasonable to introduce the third participant into the process of knowledge communication. The mediator (a linguist-cognitivist) decodes verbal data back into conceptual structures using the Five-Step Method. Then he or she transforms the situation model into the one, which correlates with the context model obtained with the Three-Dimensional Modelling. After that the conceptual data is encoded back into a verbal form (cf. Figure 4).

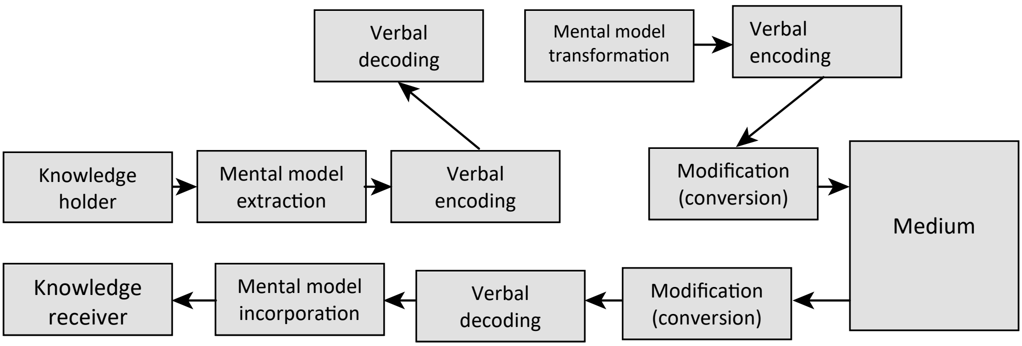

Figure 4: The flowchart of knowledge communication with external mediation

In such way conceptual metaphors and semantic frames can be preprogrammed to ensure adequate knowledge acquisition.

A mediator can provide specialized knowledge translation by intentional usage of certain language units for conceptual reframing. In professional communication deliberate (targeted) usage of terms helps to adjust expert knowledge to a nonexpert experience, and to dispose the receiver to unbiased perception of transferable knowledge (cf. Bogatikova et al. 2014). One form of deliberate specialized language usage is direct metaphor (see the example below). Together with intentional "semantic roles distribution" (Fillmore 1968) it regulates framing.

> *Computer viruses got their name from what White calls "an obvious but deep biological analogy". **Like biological viruses, the computer versions replicate by attaching themselves to a host** (a computer program **rather than a human cell) and then co-opting the host's resources to make copies of themselves. Infection can lead to death.*** [...] *Both research groups caution that **in nature, no defence system remains perfect forever. Just as white blood cells and viruses engage in a delicate dance, each evolving to outwit the other, so will computer viruses and antivirus technology**, White says* (Christensen 1999).

The situation starts with *virus* and *malware* in the Agent role as a voluntary initiator of the actions expressed by the predicates *replicate*, *attach*, *co-opt* and *make copies*. Similarly, *program* and *crash failure* perform the Goal role, that is the location or entity the Agent moves to. Such role distribution fits a nonexpert "succumbing to aggression" frame which provides expert knowledge adjustment. Direct metaphors as an efficient tool of specialized knowledge mediation provide targeted framing and results in optimized knowledge communication (cf. Table 3).

Table 3: Semantic roles distribution in direct metaphor

Role	**Target**	**Source**
Agent	*computer virus*	*biological virus*
Goal	*make copies*	*replicate*
Goal	*program*	*cell*
Agent	*malware*	*infection*
Goal	*crash failure*	*death*
Location	*computer environment*	*nature*
Agent	*antivirus software*	*defence system*
Agent	*antivirus technology*	*white blood cells*

9 Conclusion

In this article, we have addressed the problem of special knowledge misrepresentation in the process of its transfer. We have shown that this issue should be considered from different angles and the solution is complex, multistage, and can be achieved cooperatively by experts from various areas. Our approach is based on Cognitive-Discursive Linguistics. To investigate the problem and prove its topicality we have applied our method of Three-Dimensional Metaphorical Modelling. To explain the errors occurring in the process of professional communication, we have reprised the concepts of ontology and mental models. To objectivize the steps of special knowledge communication, we have referred to the Mathematical Theory of Communication.

As a result, we have come to the conclusion that special knowledge mediation solves the problem of conceptual ambiguity. The implementation of high quality mediation requires cooperative efforts of knowledge domain experts and linguists/cognitivists.

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