

# The Metaphor Cycle in a Term-Formation Process

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## ABSTRACT

Many models of term-formation and term-acquisition processes have been published over the years, representing them from different perspectives. This article outlines an investigation of the metaphorical term-formation process (MTFP), starting from an analysis of special knowledge modelling. We describe our theoretical framework and propose a four-staged procedure which is conceived to integrate different perspectives of concept-building and term-production into one integrated model which includes three levels. The first level is associated with the cycle of conceptualization developed by Lev Vygotsky, who suggests that each step in knowledge development is correlated with a certain mental structure. The second level correlates with Ikujirō Nonaka's spiral model of knowledge development. The third level has been founded on the results of two experiments with terminology learners. Theoretical debate is accompanied by the discussion of the mode of peculiarities of metaphorical terms comprehension and usage. It is demonstrated how professional knowledge gets into mind, and how it is developed.

**KEYWORDS:** term-formation process, metaphorical terms, the metaphor cycle model, conceptualization, knowledge transfer

## ANOTACIJA

Per daugelį metų buvo paskelbta daug terminų darybos modelių ir terminų atpažinimo procesų, nagrinėjančių juos iš skirtinų perspektyvų. Šiame straipsnyje aptariamas metaforinis terminų darybos procesas, prasidedantis specialiųjų žinių

modeliavimo analize. Pateikiamas teorinis pagrindimas ir siūlomas keturių etapų procesas, sujungiantis skirtinges savykų kūrimo ir terminų darybos perspektyvas į vieną trijų lygmenų modelį. Pirmasis lygmuo siejamas su Levo Vygotskio pa- siūlytu konceptualizacijos ciklu, pagal kurį kiekvienas žinių kūrimo žingsnis ko- reliuoja su tam tikra mentaline struktūra. Antrasis lygmuo atitinka Ikujiro No- nakos spiralinį žinių kūrimo modelį. Trečiasis lygmuo sukurtas dviejų eksperi- mentų su besimokančiais terminologijos rezultatų pagrindu. Teorinę diskusi- ją papildo metaforinių terminų suvokimo ir vartojo ypatybų aptarimas. Paro- doma, kaip profesinės žinios patenka į protą ir kaip jos yra kuriamos.

**ESMINIAI ŽODŽIAI:** terminų darybos procesas, metaforiniai terminai, metaforos ciklo mode- lis, konceptualizacija, žinių perkėlimas

## 1. INTRODUCTION

Our research focuses on the issues of special knowledge modelling. The main question we are going to discuss is – What is a term-formation process modelling? This can best be understood in terms of several sug- gestions. It is known that any model is constructed by the efforts of many researches.

First, the progress in Terminology has been dependent on the efficiency of term-formation modelling, viewed as a methodological driver for dis- covering the term's nature (Björk 2007; Campo, Cormier 2005; Faber 2003; Faber 2009; Myking 2001). Modelling of the terminological knowledge has existed for a long time (Toft 2011). Terminology theory seems to be evolv- ing from a prescriptive to a descriptive perspective with a growing focus on the study of specialized language units from a social and cognitive view (MA; Picht 2005; Temmerman 1997). Thus, the study of specialized lan- guage is undergoing a cognitive shift, which is conducive to a greater em- phasis on meaning as well as conceptual structures (Faber 2009).

What is less researched in Terminology is the nature of the termino- logical process from a cognitive point of view. Modern terminologists very often leap over the basic stages of terminological activity and take for granted the suggestion that professional knowledge is acquired as an “off- the-shelf” knowledge. However, we cannot study a professional language without having knowledge about ways and mechanisms of its creation and development. For this purpose we have to model a terminological process, revealing the linguistic and cognitive mechanisms of professional activity. Before the late 1960s, the term ‘model’ was rarely used in researches. The dominant terms were ‘sequences’, ‘stages’, ‘framework’, ‘paradigm’, or ‘con-

ceptualization' (Godin 2015). The term 'model' started to be used only in the 1970s (Rogers et al. 1977).

Now it is common knowledge that models allow people to understand, predict, and facilitate to solve scientific problems.

Second, in comparison to many other terminological processes, the development of metaphorical terms modelling is especially challenging. Researchers have created numerous models to understand and improve the process of term-building considering its particular characteristics. (Alekseeva, Mishlanova 2019; Gibbs & M. Tendahl 2006; Lakoff 1993; Mishlanova 2002; Steen 2007; Temmerman 2002). It arose from the need to facilitate specialized knowledge transfer. Modern view on metaphor is that scientists need the metaphor as a bridge between old and new knowledge and by this metaphor obtains a hypothetical nature. The scientific picture of the world is created by means of "seeing" the world as a certain image. In such a way, metaphor is the foundation of scientific theories and concepts.

Third, the idea of "knowledge conversion" may be traced in L. Vygotsky's researches (Vygotsky 1934; Vygotsky 1980) regarded as the first systematic attempts to study the development of scientific concepts. He studied the individual's knowledge as the formation of person's *cognitive structure*. From L. Vygotsky's theory we have taken two suggestions: 1) the idea that language represents the major mediator of human cognition, and 2) the theory of psychological processes founded on the assumption that "complex psychological processes" are associated with "inner speech" and with its further exteriorization.

Fourth, according to the conceptual view of knowledge creating processes as outlined in *A Dynamic Theory of Knowledge Creation* (Nonaka 1994), the society we live in has been turned into a "knowledge society". However, relatively little attention has been paid to how knowledge is created and how the knowledge creation process can be managed (Nonaka 1994: 16). Taking this into consideration, I. Nonaka created the "spiral" model for the process of knowledge conversion. By conversion he means that existing knowledge can be "converted" into new knowledge. We believe that this idea is very fruitful for modelling mental processes with a special accent on a dynamic interaction between the different modes of knowledge conversion.

Finally, the question about the metaphor cycle model is answered by contrasting with the prescriptive models of terms. Taking into consider-

ation the dynamic character of terminologization and the concept of knowledge cycle, we reveal the analogous system of steps in the MTFP. The metaphor cycle model has been created to address many different issues in the MTFP. The research suggests that most cases of MTFP could be described with the help of this model. The worked out model provides insight on different levels of thinking and conceptualization.

The novel contribution of this paper is the application of the MTFP model to terminological projects. Our developments in cognitive terminological theory suggest that it is highly determined by the creation of knowledge at various levels.

In our research we support the idea, suggested by a group of terminologists that “a coherent theory of terminology did not emerge in the first decades of the terminology movement; terminological activities were pragmatically oriented and marked by either a strong linguistic orientation (especially in language planning), or by a predominantly professional, non-linguistic approach” (Antia et al. 2005).

Experimental data of the term acquisition process semantics have appeared mostly in analyses of non-metaphoric terms. In what follows, we offer new results of studying this process by means of new experiments on terminological inference and describe changes in the conceptual structures gained at all the stages of professional personality’s activity, i.e. the process of metaphorical terminologization. For this purpose we have designed and developed two important experiments with medical students, who acquire new professional knowledge. We were motivated by, and aimed to address, certain characteristics of professional knowledge acquisition with specific reference to term-formation competence. Paragraph 4 outlines how the cyclic model of term-formation can highlight the definite stages of concept development.

We argue that the development of knowledge correlates with the development of the concept. Thus, we examine the transfer of the professional knowledge supported by the process of concept development.

By modelling the process of metaphorical term-formation as a cycle, we gain fundamental insights into the challenges of coming close to human mental activity. Taking into consideration the suggestion that concepts are developing, it is possible to conclude that the main essence of their development lies primarily in the transition from one structure of generalization to another.

The main tenet of our research is that terms, being specialized units of cognition and verbalized in language, are adapted for the process of getting knowledge and its further processing in knowledge transfer. This view of terms provides mediation of their comprehension across knowledge communication.

Research questions are the following:

- (1) How do terms interact with cognitive capacities and abilities in expressing one's thoughts (concepts)?
- (2) How does the metaphor cycle reflect the process of term-production?

In our study we (1) compare previous efforts to explain the term-formation process of a metaphorical term, (2) draw on evidence from theoretical and empirical studies, and (3) outline four stages of the “metaphor cycle” of a metaphorical term-formation process.

## 2. SOME THEORETICAL APPROACHES TO MODELLING

It is known that the first cyclic models were used in philosophy and sociology. Well-known French philosopher Edgar Morin, the founder of the systems theory, developed a project of complex sociology in the centre of which are the principles of uncertainty, self-organization and dialogue. He advanced the idea that cognitive movements regarded within the frames of complexity are always circular and non-linear (Morin 1977).

The starting point for modelling is the suggestion that a person's understanding and explanation of the reality is done by means of linguistic expressions. Any understanding is based on the use of certain concepts that explain what is observed in the world. Therefore, the development of knowledge appears to us as concepts development.

We mark that several cyclical models appear in the methodology of linguistics at the beginning of the XXI century. P. Carlile regards the development of knowledge as a cyclical model, or the knowledge transformation cycle (Carlile 2003). This model is based on three concepts – *transformation*, *storage* and *retrieval*. The knowledge transformation cycle begins with the accumulation sector. In our opinion, this model correlates with the general concept of knowledge development and requires some effort and refinement when used in relation to specific processes.

The foundations that our approach builds on are the following:

- (1) I. Nonaka's model of knowledge development,
- (2) L. Vygotsky's theory about concept development,
- (3) the results of our own experiments.

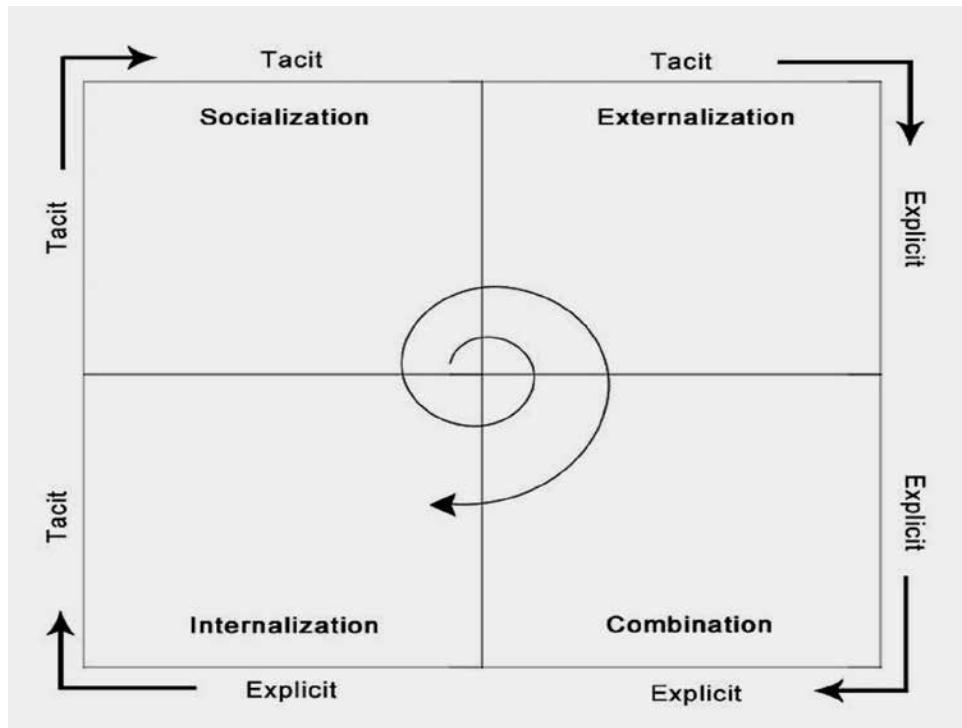
These foundations are challenging for several reasons:

- (1) they touch the role of language in higher psychological processes (i.e., language in the role of the major mediator of human cognition),
- (2) the study of language representations of the concept-building process provides mental modelling and systems thinking research,
- (3) observing these foundations, it is possible to come close to the inner speech by means of studying its complex character.

Our model of a metaphorical term-formation is founded on three layers.

The *bottom layer* of the constructed model is the so-called I. Nonaka's spiral model discussed in I. Nonaka "A Dynamic Theory of Organizational Knowledge Creation" (1994) (see: Fig.1).

Fig. 1. I. Nonaka's spiral model



As we see, Fig. 1 illustrates the creation of a new knowledge in terms of a continuous dialogue between tacit and explicit knowledge (Nonaka 1994: 15). I. Nonaka describes tacit knowledge as being highly personal, hard to formalise and difficult to communicate. It is deeply rooted in action and in an individual's commitment to a specific context. Tacit knowledge (see: Polanyi 1966) consists partly of technical skill and knowhow which has been developed over years of practice. The cognitive dimension of tacit knowledge lies in its composition of mental models, beliefs, and perspectives, which are difficult to explain because the holders of this knowledge take it for granted.

I. Nonaka's assumption about knowledge creation allows him to distinguish four "modes" of knowledge conversion: (1) from tacit knowledge to tacit knowledge, (2) from explicit knowledge to explicit knowledge, (3) from tacit knowledge to explicit knowledge, and (4) from explicit knowledge to tacit knowledge.

The *middle layer* is associated with L. Vygotsky's theory about concept development (see: Fig. 2). As early as the first half of the 20<sup>th</sup> century L. Vygotsky was introducing ideas related to the forms of mind. He studied the process of knowledge development. The major theme of L. Vygotsky's theoretical framework is that social interaction plays a fundamental role in the development of cognition. L. Vygotsky believes that everything is learned on two levels: "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals" (Vygotsky 1987: 57). Thus, he studied the development of knowledge basing on the development of concept.

In his view, concept is not a simple summation of associative relations, but a complex process of thinking, during which one's thought rises in its internal development to a higher level creating the possibility for a concept to be born in mind.

An intrinsic factor in the systemic organization of complex psychological processes is the engagement of certain conceptual forms (*syncretic, complex, pre-concept* and *concept*). According to his main suggestions, the

role of these conceptual forms is in establishing mediation of knowledge, universal for all types of knowledge (Vygotsky 1934: 239).

As L. Vygotsky puts it, concepts at any level of their development are, from the psychological perspective, *acts of generation*. Taking into consideration the suggestion that concepts are developing, it is possible to conclude that the main essence of their development lies primarily in the *transition* from one structure of generalization to another (Vygotsky 1934: 164–165).

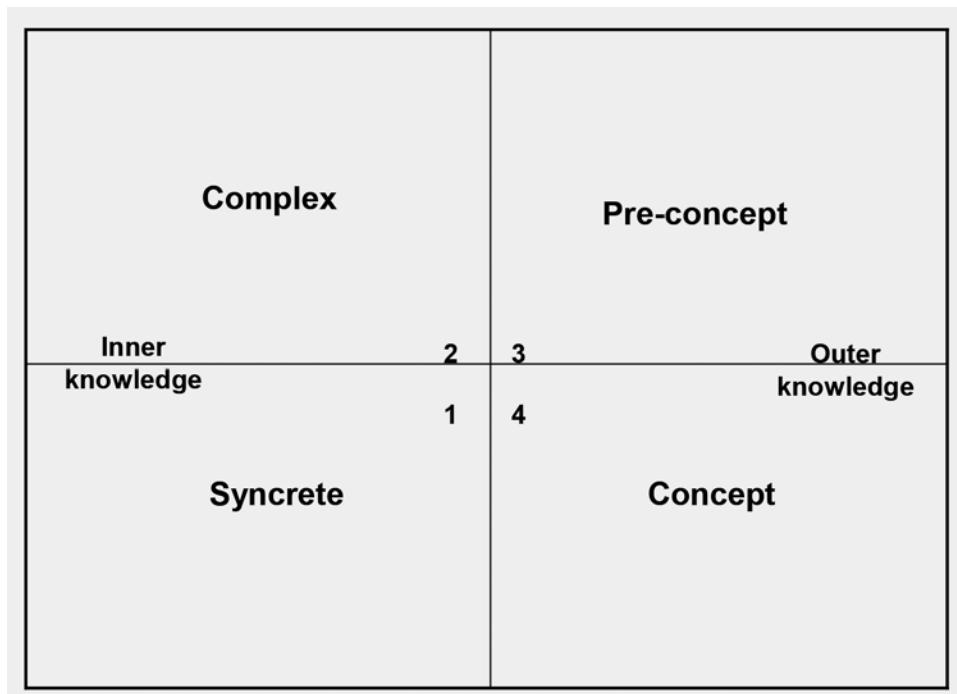
According to L. Vygotsky, the birth of the scientific concept begins not with an immediate encounter with things but with a mediated relationship to the object (Vygotsky 1934: 218). The first stage in the concept development process is characterized by the construction of syncretic images, or *syncretes*, which are the first forms of thought reflecting the most general and dissociated kind of person's meeting with new objects. They are associated with concrete objects arising in memory as results of previous perception or information about life.

The second stage is an advanced step in concept development and is characterized by the construction of more complex mental units called *complexes*. The stage of complexes signals that a person gathers, or unites syncretic images constructed at the previous stage into a group in accordance with their common qualities and characteristics. A *complex* is the first structured mental image based on the empirical similarity of isolated objects. Qualities of these objects are generalized and represented into a united image. Thus, *complexes* are more abstract and general than *syncretes*.

*Pre-concepts* and *concepts* are based on various kinds of logical connections or relationship between objects. The *concept* is based on uniform connections. In the *concept*, each object is included within the generalization on the same basis as are all the other objects. Each of the elements is connected to the whole, and through this whole to each of the other elements. Transition from *pre-concepts* to *concepts* is realized by means of still more general types of abstraction compared to the previous stages of concept development. Thus, it becomes clear that the development of knowledge correlates with that of the concept.

As we can notice in this model, cycles of concept development are associated with the stages of mental activity – syncrete, complex, pre-concept and concept, which represent the process of abstraction.

**Fig. 2. L. Vygotsky's model of concept development**



This process regarded as the *cycle of conceptualization* was called by L. Vygotsky “living knowledge”, results in localization of a concept within a certain system of relations (Vygotsky 1934: 166). Advancing this term, the author means that concepts do not arise by themselves, but are produced as a result of a great tension and activity of human thought. In such a way, he suggests that “thinking moves through the gates of scientific concepts” (Vygotsky 1934: 193–194). This movement may be interpreted as a kind of transfer of knowledge.

We observe from Fig. 2 that the first two stages are associated with *internal development* in the emergence of scientific concepts. L. Vygotsky distinguished between “inner speech” (internalized social speech), including “egocentric (private) speech” (or speech to ourselves), and “external (social) speech” (or speech used in social interactions).

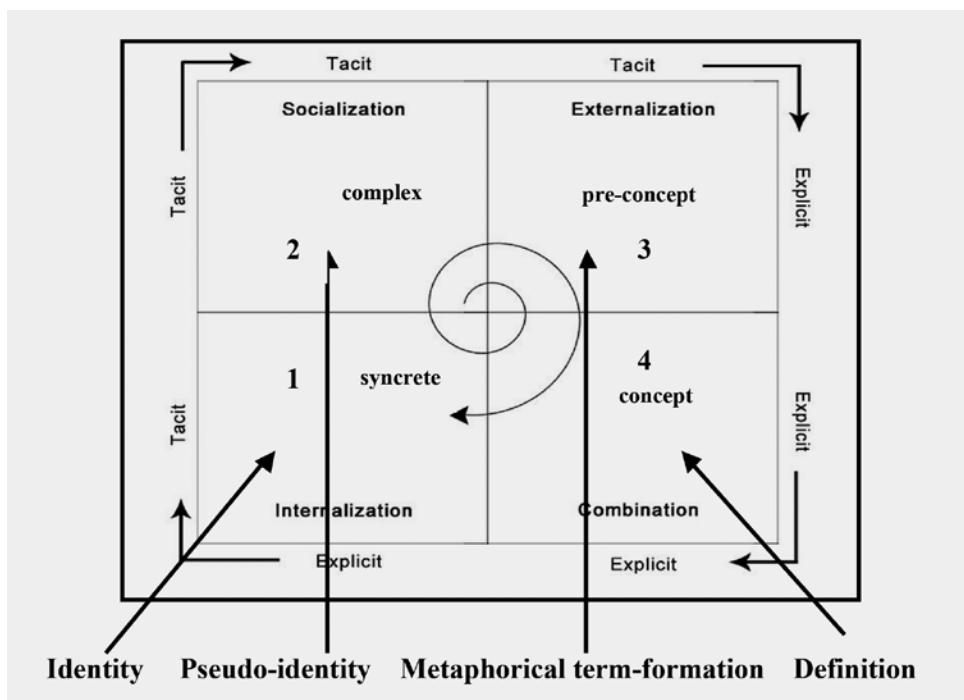
It is important to note that there is a process of “internalization” in which the first (external or social speech) is transformed into the second (egocentric or private speech), and finally into the third (inner speech).

As a matter of fact, private speech represents a kind of halfway station between “external” and “inner” speech, but with very distinctive properties. Therefore, L. Vygotsky’s egocentric (private) speech is the link between social (external) speech and organized inner speech. Furthermore, social speech represents the overt, external speech addressed to others (words, sentences) for the purpose of social interaction and communication; whereas inner speech is sub-vocalized speech directed and adapted to oneself.

Thus, we see that the idea of inner and outer transfer is not new, but it is only in recent years that it has come to acquire great importance.

The most important foundation for modelling is our own experience. Basing on the results of experiments we would show how real-life knowledge transfer works. We provide new experiments on terminological inference. We describe changes in the conceptual structures at all the stages of a personality’s professional activity, i.e. the process of terminologization. We have shown that the development of knowledge correlates with the development of the concept (see: Fig. 3).

**Fig. 3. Three-layer model of knowledge mediation**



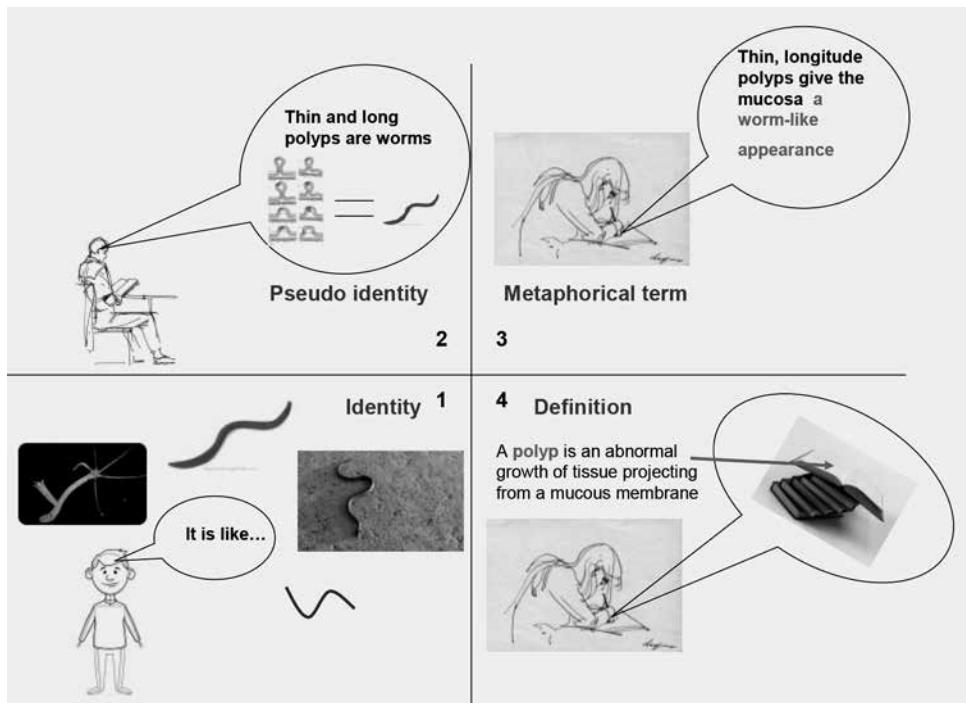
The *upper layer* of the model is associated with four sectors associated with four concepts: *identity*, *pseudo-identity*, *metaphorical term-formation* and *definition*. The stage of *identity* is rather individual. Each knowledge worker passes it in his own way. At this stage the knowledge worker gets information from various sources and mostly reflects and imitates them. The stage of *pseudo-identity* is characterised by means of a free associative experiment. The aim of the experiment is to come in touch with the deep level of conceptualization of individual knowledge.

In this experiment, we investigate structures of the associative fields of the term IMMUNITY in different types of medical discourse (naïve, practical, professional and scientific). We define the associative field as an ordered set of reactions to the stimulus. The stimulus was the term IMMUNITY. As we can notice, the hierarchy of concepts in the cognitive structure correlates with the dynamics of concept formation within the history of immunology. The stage of *metaphorical term-formation* is linked with the process of externalization of tacit knowledge. At this stage explicit knowledge is created by articulating of tacit knowledge. It is the process of transition from the maximum compressed inner speech (speech for oneself) to the folded verbalized speech. This process is monitored by means of a directed experiment. In this experiment, we asked the respondents to use the term IMMUNITY in sentences of their own. The stage of *definition* deals with the second part of the directed experiment, when the respondents were asked to give definitions of the term IMMUNITY. We did the conceptual analysis of their definitions.

In order to have a clear view of how our model works, we highlight it by an illustrated scheme (see: Fig. 4).

We realize that the described foundations are not the only ones. We also observe several more names, such as Peter Kastberg and his work “Knowledge Communication Formative Ideas and Research Impetus”, 2009 where he distinguishes three perspectives – *construction*, *representation*, and *communication* of knowledge, and advances the idea that they seem to be able to encompass a sort of *prototypical lifecycle of knowledge*. As well as, Rita Temmerman, who suggests that humans do not just perceive the objective world but have the faculty to create categories in the mind (Temmerman 2000).

Fig. 4. Illustrated scheme of metaphor term-formation cycle



### 3. MENTAL MODELLING METHODOLOGY

The goal of this part is to provide a methodological foundation for mental modelling. In this part we shall describe the stages of terminologization by which terminology would acquire identity in knowledge mediation and constitute its knowledge base.

Terminological activities include term-formation, sharing, comprehension and application. Terminologisation is composed of basic mental units, which we shall refer to as *concepts*. That is why we have worked out a model, representing, on the one hand, the process of terminologisation and, on the other hand, the process of professional knowledge development. To have a clear idea about these processes, we need a successful reconstruction of their insights.

However, it is not so simple to determine the life cycle of a concept, since the life cycle of a concept is determined by societal changes, not necessarily by scientific cognition and research. We should answer when the life cycle starts and when it finishes (Picht 2013: 37–47).

In our research, we try modelling the professional knowledge development, i.e. to get evidence how it is acquired, used, and represented. On the other hand, the aim of modelling is highlighting the process of term-formation.

We would stress one important suggestion. The term *life cycle* does not signify the time of term existence, or a period of time, during which any term is considered to be valid and correct, but rather its model of formation. Therefore, *life cycle* is the name of a model of term-formation. It expresses the relations of mediation between four phases of term development. To highlight the concept of a life cycle we have distinguished between linear and cyclic models (see: Table 1).

**Table 1. Differentiation between linear and cyclic models**

The path-dependent (linear) nature of term-formation	Term-formation as a cycle
Dependence on language	Dependence on thought
Establishes knowledge boundaries across domains	Boundaries free domains
The amount and/or type of specialization or difference between sources of knowledge	All types of knowledge (naïve, practical, professional and scientific) are taken into consideration
The “discovery-push” model	The “demand (need)-pull” model
Term formation model	Knowledge creation model

We propose and evaluate a four-phased knowledge mediation procedure which is conceived to integrate different perspectives of concept-building and term-production into one consensual model.

#### 4. STAGES AND RESULTS OF RESEARCH

Complexity and polyparadigmatic methodological principle of the analysis involves many preparatory tasks. We have started with the choice of a proper metaphorical term for further consideration and selected IMMUNITY, the basic term of immunology, an intensively developing science.

The analysis of the extensive literature and dictionaries (Drössler 1988; DRW 1856; DST 1953; NLU 1948; Wasserman 1910; WM 1956) allowed us to study features of the formation and evolution of one of the key terms of immunology. By the time this term was formed, it had already

undergone a number of changes, which, in our opinion, caused the originality of the term's formation.

It took us much time to learn the history of immunology development. As a result, periodization of science was compiled and substantiated, concepts formed at certain periods of the history of immunology were revealed. We were able to discover that the first pre-scientific ideas about immunity referred to the notion of health / life protection during epidemics in ancient Greek in V–IV BC. The beginning of the first scientific stage in the development of immunology started with the development of the first scientifically grounded theory of immunity, according to which immunity was defined as insensitivity to infectious diseases. The founder of this theory was French scientist L. Pasteur (1881).

Before the experiments, we drew on the cognitive structure of the concept IMMUNITY. As we observed, the initial etymological meaning of this concept comes from a derived Latin word «IM-MUNIS» from the collocation “in + munia”, where “IM” is negation, “MUNIA” is “duties, official affairs, occupations”: “*IMMUNITY (from Lat. immunis, not subject to a munus or public service), a general term for exemption from liability, principally used in the legal sense discussed below, but also in recent times in pathology (for which see Bacteriology)*” (EB 339). Thus, “IM-MUNIS meant “free from duties and occupations, a privilege” (ChED 458; see also: DRW 428).

A further development of the term IMMUNITY took place during feudalism when it got the meaning “free from state taxes, feudal immunity”. The next stage of the development of the term IMMUNITY was due to the accumulation of natural science knowledge. Such a process caused the biological meaning of the word IMMUNITY, which was for the first time registered in the French Encyclopedia Dictionary: “*IMMUNITE n.f. (1866) Biol. Etat d'un organisme qui resiste, sans manifestations pathologiques, à une infection à laquelle un autre organisme, réagit par une évolution morbide*” (DLFr<sup>1</sup> 936). The next important event was connected with the discovery of the way to protect from pox by British doctor Edward Anthony Jenner in 1896. A further process of terminologisation of the concept IMMUNITY was connected with specialization of its meanings due to the publication of a famous article by Louis Pasteur published in *The British Medical Journal* in 1881. In this article the term IMMUNITY got the meaning of *resistant to infectious diseases*. This meaning gave rise to a new term: “*IMMUNITE. 1. Droit fixe accordé à tout un corps, à tout*

une ville, et qui les affranchit d'impôts, de charges, de devoirs, etc. <...> 2. <...> Terme de féodalité. Privilège en vertu ducuel aucun juge royal ne pouvait entrer dans les domaines ecclésiastiques, pour y faire acte, quelconque d'autorité. 3. Terme de médecine. Préservation, exemption de maladie. La vaccine procure, dans la plupant des cas, l'immunité contre la variole" (DLFr<sup>2</sup> 24).

As the result, we built a hierarchy of concepts reflecting the history of the development of the term IMMUNITY.

The history of IMMUNOLOGY distinguishes 3 periods and 3 basic metaphors: 1) IMMUNOLOGY was understood as insensitivity of a body to infectious diseases and the metaphor – "War against the microbes" (Louis Pasteur), 2) active participation of macro-organisms in creating immunity (Ilja Mechnikov), IMMUNITY was considered a way to protect the body from everything genetically alien, it was not only in the war against microbes, but also *recognition* and *destruction* of "*traitor cells*", i.e. cells in which a mutation of at least one gene has occurred, 3) IMMUNITY was understood as the regulation of interaction of "friends" and "aliens" macromolecules or antigens, therefore, a metaphor of *a well-worked collective, collaboration*.

Following the revealed hierarchy of the cognitive conceptual structure, we have found out the main characteristics of the concept IMMUNITY:

- **Health,**
- **Disease,**
- **Vaccination,**
- Property of an organism,
- Factors of immunity,
- Protection,
- Interaction.

We should point out that in different periods of immunology development the concepts associated with IMMUNITY were constructed with various meanings. The first three concepts refer to *pre-scientific period* of the development of immunology. The last four concepts were constructed during the development of the science of immunology.

This paper reports on an empirical study concerning the students' acquisition of the term-formation competence. In particular, it seeks to explore how students perceive this competence. It aims at identifying the problems they may face as terminology users during the learning process.

The main task of our experiment is to inquire into the process of metaphor terminologization by monitoring the stages of terminological competence formation within all types of discourse by means of the analysis of responses on the stimulus IMMUNITY.

The observed stages of a metaphorical term-formation cycle are clearly seen in the course of a psycholinguistic experiment (a free associative experiment) (see: Table 2). For this purpose we formed several groups of informants whose professional competence corresponded to the scientific, professional, and practical and naïve (control group) kinds of medical knowledge. The first group was represented by the VI year students of Perm Medical Academy (50 students), by the V year students (39 students), by the III–IV years (36 students), by the II year students (43 students) and by the 1 year students (52 students). The second group was represented by doctors (23 persons) and by nurses (53 persons). The third group was formed by school teachers and patients of medical clinics (130 persons). The last group was formed by the I–II years students of Perm Polytechnic University (44 students). Thus, the total number of respondents of the associative free experiment was 534 people. The experiment was conducted by the method of analyzing the associative fields (AF) of the term IMMUNITY on various levels of knowledge – scientific, professional practical and naïve.

**Table 2. Experiment data**

TYPES OF KNOWLEDGE	RESPONDENTS	FAE	DE
<b>Scientific</b>	VI year V year III–IV years II year I year	50 39 36 43 52	
Medical students			
<b>Professional</b>		23 53	
Doctors Nurses			
<b>Practical</b>		194	
Patients			
<b>Naïve</b>		44	
Students of Polytechnic University			
<b>Total</b>		534	344

They were suggested to give their responses to the main term of immunology – IMMUNITY (free associative experiment, FAE). We define the associative field as an ordered set of reactions to the stimulus. The stimulus was the term IMMUNITY. That was the task associated with *pseudo-identity* stage. The aim of the experiment is to come in touch with the deep level of conceptualization of individual knowledge. As a result of FAE, a certain Matrix was worked out. In this experiment, we have investigated structures of the associative fields of the term IMMUNITY in different types of medical discourse (naïve, practical, professional and scientific).

The results of the FAE depict the greatest distribution of the concepts of the scientific period of immunology development in scientific discourse: *protection, factors of immunity* and *organism*. And the highest distribution of the concepts of the pre-scientific immunology development in the naïve discourse: *health* and *disease*.

The second experiment (directed experiment, DE) was associated with the third stage of our model – the process of metaphorical *term-formation*. In the second experiment, we asked the respondents to use the term IMMUNITY in sentences of their own. We studied the dynamics of conceptual structures.

This experiment dealt with externalisation (articulating) of tacit knowledge. It is the process of transition from the maximum compressed inner speech (speech for oneself) to the folded verbalized speech.

As we have found out, only 5 concepts (out of 7) are activated – *interaction* from the scientific period and *vaccination* from the pre-scientific period are omitted.

Three concepts of the scientific period are represented (*protection, factors of immunity* and *organism*) and only 2 concepts of the pre-scientific period are activated (*disease* and *health*). Most reactions are linked with the concept *organism* (55%). The dominance of the concept *organism* may be explained by the tendency of a respondent to associate his knowledge with his private experience and by an accent on himself. Thus, we see that the majority of reactions are linked with the concepts of the scientific period. We may conclude that the terminological competence of the students is formed and evaluated at a good level.

The task for the students at the fourth stage was linked with the second part of the directed experiment, when the respondents were asked to give definitions of the term IMMUNITY (see: Table 3). We did the conceptual analyses of their definitions. We come from the suggestion that a definition

comprises of three components: an integrating generic component, a differentiating species component and a facultative concretizing element.

Consider: "Immunity is the ability of an organism *to defend itself / from alien agents / by means of producing anti-bodies*". It is vivid that the integrating component explicates the concept DEFENSE.

The highest level of the terminological competence model is oriented to the reflexive activity, revealing knowledge of the main laws of professional and transfessional activity, and the ability to work consciously and autonomously. We have found out that the conceptual structure of the term IMMUNITY is mostly comprehended by the respondents within the scientific sphere of knowledge. They view the term IMMUNITY as protection (40.3%), as the necessity of vaccination 36%) and as the function of the organism (21.3%). This understanding of the term IMMUNITY corresponds to the purely scientific interpretations of this concept within the logic of its historical development.

**Table 3. Formation of definitions (DE)**

TYPE OF KNOWLEDGE	PRO-TEC-TION	FACTORS OF IM-MUNITY	ORGAN-ISM	VACCI-NATION	DISEASE	HEALTH
Scientific	<b>40.3</b>	<b>17.2</b>	<b>21.3</b>	<b>36</b>	<b>9.1</b>	<b>8.1</b>
VI year	44	20	18	0	8	10
V year	41.0	20.5	20.5	10.2	5.5	2.6
III–IV years	41.7	22.2	25.0	0	8.3	2.8
II year	44.2	18.6	14.0	4.7	7.0	11.62
I year	32.1	9.4	28.3	3.8	13.2	11.3
<b>Professional</b>	<b>26.7</b>	<b>12.0</b>	<b>37.3</b>	<b>3</b>	<b>10.7</b>	<b>12.0</b>
Doctors	30.4	21.7	30.4	4.3	8.6	4.3
Nurses	25.0	7.7	40.4	0	11.5	154
<b>Practical</b>	<b>16.0</b>	<b>1.6</b>	<b>36.6</b>	<b>3.2</b>	<b>6.4</b>	<b>12.9</b>
Teachers	28.1	1.6	42.2	3.2	6.4	14.1
Patients	10.0	1.5	33.8	3.1	13.8	12.3
<b>Naïve</b>	<b>15.9</b>	<b>2.3</b>	<b>18.2</b>	<b>11.4</b>	<b>18.2</b>	<b>25.6</b>
Students of PSPU	15.9	2.3	18.2	11.4	18.2	25.6

It is known that the concept *Protection* is the latest from the point of view of the history of the development of the term IMMUNITY. We have found out that responses representing this concept are most typical and comprise 27.5%. This concept is represented in all types of discourse. The maximum number of responses associated with this concept is in the scientific discourse, and the smallest number – in the naïve discourse (40.3% and 15.9% accordingly). The most frequent responses associated with the concept *Protection* are the following: *protection, organism protection, protective system of the body*. The concept *Organism* is also one of the most frequent ones in all types of discourse (28.8%). Its activity can be explained by the fact that it directly reveals the meaning of the term IMMUNITY almost in all the lexicographical sources. Similarly, this fact serves as an explanation of the activity of the concept *Organism* in practical (36.6%) and professional (37.3%) types of discourse, and the lowest degree of activity in the naïve discourse (18.2%). The most typical responses representing this concept are the following: *organism, non-perceptiveness, specific, powerful, weak*.

We have found out that only 3 concepts are used in students' definitions. All of them are from the scientific period of *immunology* development. Most reactions are linked with the concept *Protection* (73%). The results of this part of the experiment provide to observing the character of a more or less stereotyped situations.

Besides the fact that the basic modern literature on immunology is mainly devoted to the factors of immunity, this concept is not completely represented in dictionaries, especially in thesauruses. However, the content of the represented responses linked with the concept is 13.9%. It is the third concept from the point of view of its validness. The maximum representativeness of the concept *Organism* is in the scientific discourse (17.2%). It is also rather active in professional discourse (12%). The lowest representativeness of the concept *Factors of immunity* is observed in practical (1.6%) and naïve (2.3%) types of discourse. The most typical responses associated with this concept are the following: *cell, lymphocytes, macrophage, immunoglobulin, antibodies, and blood*.

Characterizing the concepts of the pre-scientific stage of development, we point out the maximum activity of these three pre-scientific concepts in the naïve discourse; the most active among them is the ancient concept *Health* (25.6%), followed by the concept *Disease* (18.2%) and *Vaccination*

(11.4%). Among all the pre-scientific concepts the concepts *Health* and *Disease* (10.9% and 10.2%, accordingly) are dominant, whereas least active is the concept *Vaccination* (4.2%). We have observed that the concept *Disease* is more active in scientific discourse, and the concept *Health* is more active within professional and naïve types of discourse. The most typical responses representing the concept *Health* are the following: *health*, *healthy* and *recovery*.

The most typical responses representing the concept *Disease* are the following: *disease*, *AIDS*, *flu*, *weakness* and *deficit*. The greatest variety of representation variants of this concept is noticed within practical discourse, within which, besides the already marked responses, we notice the following: *disease*, *pain*, *infection*, *from a tick bite*, *allergy and allergy to antibiotics*, *medicine and pills*. We have also found out that in all types of discourse, which actualize the concept *Disease*, except for professional, there is the response *AIDS*. The naïve discourse contains various variants of this pathological state: *AIDS*, *HIV and acquired immunodeficiency*.

The concept *Vaccination* is registered in all types of discourse. However, among the III-IV and VI year medical students and among nurses there are no responses on the stimulus associated with the term IMMUNITY.

## 5. CONCLUSION

By modelling the terminological living cycle, we have focused on cognitive processes aiming at how professional knowledge gets into mind, and how it is developed. Our goal was to study external representations of conceptualization that provide insight into internal constructs and processes. Experimental analysis indicates that external representations can provide useful information on how students are conceptualizing the term IMMUNITY.

We hope that we have proved the efficiency of L. Vygotsky's theory to be applied to the study of term-production process. By applying this theory, it is possible to describe each phase of "living knowledge" model and reveal peculiarities of human conceptualization. Besides, it is of importance to study transitions of knowledge within this terminologization cycle.

We provide new experiments on terminological inference, including directed experiment. We describe changes in the conceptual structures at all the stages of a personality's professional activity, i.e. the process of terminologization. We have shown that the development of knowledge correlates with the development of concept.

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## METAFOROS CIKLAS TERMINŲ DARYBOS PROCESE

### Santrauka

Per daugelių metų buvo paskelbta daug terminų darybos modelių ir terminų atpažinimo procesų, nagrinėjančių juos iš skirtinų perspektyvų. Atsižvelgiant į pastarųjų metų kognityvinės terminologijos pažangą, galima sukurti metaforinio terminų darybos proceso modelį. Šio straipsnio tikslas – ištirti, kaip būtų galima sukurti šį modelį. Atsižvelgiant į teiginį, kad savokos yra kuriamos, svarbu konstatuoti, kad jų kūrimo proceso esmė pirmiausiai sudaro perėjimas iš vienos apibendrinimo struktūros į kitą.

Pirmame straipsnio skyriuje suformuluojami pagrindiniai tyrimo klausimai: (1) kaip terminai sąveikauja su kognityviniais pajégumais ir gebėjimais išreiškiant savo mintis (savokas)?; (2) kaip metaforos ciklas atspindi terminų kūrimo procesą?

Antrame skyriuje siūlomos modeliui sukurti reikalingos teorijos: (1) Ikujiro Nonakos žinių kūrimo modelis; (2) Levo Vygotskio savokų kūrimo teorija; (3) mūsų eksperimentų rezultatai.

Trečiame skyriuje pristatomas keturių etapų procesas, sujungiantis skirtinges savokų kūrimo ir terminų darybos perspektyvas į vieną integruotą trijų lygmenų modelį. Tai-gi, viena vertus, mūsų modelis atskleidžia terminologizacijos procesą ir, kita vertus, profesinių žinių kūrimo procesą.

Pirmasis mūsų modelio lygmuo siejamas su L. Vygotskio pasiūlytu konceptualizacijos ciklu, pagal kurį kiekvienas žinių kūrimo žingsnis koreliuoja su tam tikra mentaline struktūra. Antrasis lygmuo atitinka I. Nonakos spiralinį žinių kūrimo modelį. Trečiasis lygmuo sukurtas dviejų eksperimentų su besimokančiais terminologijos rezultatų pagrindu.

Teorinę diskusiją papildo metaforinių terminų suvokimo ir vartojimo ypatybių aptarimas. Parodoma, kaip profesinės žinios patenka į protą ir kaip jos yra kuriamos.

Ketvirtas skyrius yra skirtas mūsų eksperimentų etapams ir rezultatams aprašyti.

Darome išvadą, kad modeliuodami terminologinio proceso ciklą, daugiausiai dėmesio skyrėme kognityviniams procesams, siekdamis paaškinti, kaip profesinės žinios patenka į protą ir kaip jos yra kuriamos. Straipsnyje teigiamo, kad terminai, kaip specialieji kalboje verbalizuojami kognityviniai vienetai, yra pritaikomi žinių gavimo procesui.

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