Abstract: We can observe terminologies changing across time, languages, cultures, subject fields, users and usage. It is not only terminology per se that is changing, but so is its structure. In the present paper we want to postulate the following: since knowledge is closely connected with conceptual continuum which is structured with the help of system of notions represented by terminological system, then the cultural-linguistic divergences (and changes occurring here) affect the knowledge organization through terminology structure. The tool for controlling this process is Comparative Terminology Science.

1. Introduction
In the broad scope of the problems concerning terminology organization and change, four most important issues will be highlighted:

- Terminology management as a basis for knowledge organization and knowledge engineering
- Levels and immediate reasons of terminological changes
- Synchronous and diachronous dynamics of terminology
- Deep reasons for terminological fluctuations and tools for managing them.

It is our intention to aware the reader of the ways terminology and knowledge organization are determined by changes in subject fields, cultures, languages, and usage. By change we understand both major and minor terminology changes, be it dramatic change in terminology structure due to technological revolutions and complete change of paradigm, or just dynamic variation in terminology usage, due either to divergences in scientific schools approach, or to translation, or to different language structures and cultural traditions. Analysis of terminology organization and change is based on Russian, Ukrainian, and English terminologies of Mathematics, Logics, Computer Science, Linguistics, and Applied Semiotics.

2. Terminology Management and Change
As different from Terminology Science proper and terminology teaching, terminology management is a practical activity of any purposeful manipulation of terminological information (Budin, 1995, 41). Terminology management is most essential with respect to:

- Computer-assisted terminology processing with the help of specially designed systems for translators and technical writers who actually "manage" multilingual terminology (i.e., database operations of data entry, retrieval, etc., in Translators' Workbenches and similar systems)
- Basic work on contents of terminological information used for a broader variety of purposes, like industrial and information management, the work involving term selection, concepts description, checking and updating multilingual definitions, source information additions, etc.

To hold the edge, terminology management for any of the aforementioned purposes should identify the kind and degree of changes/divergences occurring in this or that subject field. For instance, in multilingual dictionaries on subjects other than natural sciences, the socially and culturally determined knowledge structures may differ greatly (Picht, 1995, 24); the terminology manager
must add language-pair-related information to such a dictionary, in order to make clear the kind
and degree of the divergences revealed. So, we agree with Picht (1995, 29) that any TBD worthy
the name must of necessity contain extensive semantic information, i.e., explanation/definition,
non-verbal means, plus information about subject field, through the position of the concept in a
system of concepts; the latter permits the concept to be viewed in the context of the system of
concepts, allowing the TBD user to make a proper decision. This is easier said than done, for the
simple reason that most terminology managers do not have enough background logico-linguistic
information to do the job; so, more special research is necessary.

Recent investigations rightly point out the increasing fusion of Terminology and Knowledge
Engineering, because all central areas of knowledge engineering are heavily based on terminology
work of the following kinds:

- Terminology work relevant for special subject fields
- Content analysis of documents
- Extraction of knowledge from multiple sources, etc.

These are the common areas of interest of Terminology and Knowledge Organiza-
tion/Engineering. Most importantly, terminological system is just the instrument that turns a
conceptual continuum into a system of concepts—by making it structured, fixed—and,
consequently, preparing a basis for knowledge organization. Ordering of terminology is, in a way,
ordering of knowledge. The system of notions/concepts is subject to changing in time, as our
knowledge about the world develops; it also varies from language to language—and so does the
system of knowledge. Thus, it is clear that knowledge organization leans heavily on terminology
organization, though neither of them is a part of another.

It is almost a truism in linguistics that human beings cannot exercise any significant influence
upon language as such in terms of change, for language is an entity independent of us, not created
by man. This is the area where we can never be in perfect control, we are rather observers than
managers. Still, we do speak of terminology management, and we know very well by now that
terminology and knowledge can be organized, at least certain things can be done to our best
benefit. How to considerably improve our level of terminology management under conditions of
constant change of this open system (and terminological system, as any other language system, is
open by definition)—that is the question. To adequately answer it, we should know more about
the nature of terminological changes, of how these changes occur, and when, and where, and why.
It is impossible to cover this broad range of questions in the frames of the present article, so, of
necessity, we only outline the research to be carried out in this direction, and present some of our
own results.

3. Levels of Terminological Change

Let us consider changes in terminology (and knowledge) organization, along with immediate
reasons underlying them. The changes take place on the following levels:

- **Individual level.** Changes are inevitable here as specialists of one and the same subject field
do not necessarily think in the same way. Individual perception, individual vision, individual
thinking are highly characteristic to scientific world. Thus, Linguistics is a centuries-old subject,
still the term Perfect tenses remains controversial for years. In Sciences, especially in
Mathematics, where definitions of basic terms are strictly given at the beginning, individual level
changes/variations are rare; in Humanities, on the contrary, they are almost legitimate, and should
therefore be given special attention.

- **Scientific school level.** Changes/differences here are determined by the approach adopted
within the same scientific school or group, and concern both lexical and semantic levels of term
coining and term usage. Different approaches often give rise to new ideas generation and development, which eventually leads to progress in science, but "on the way" to this progress, terminological conflicts and differences present a stumbling stone for terminologists and knowledge engineers. Thus, striking semantic changes could be seen in definition of the economic term *surplus value* when we consider the definitions made in Economics in the former Soviet Union and in the West. Viewing the term through the prism of communist ideology made a difference, adding a sema of *instrument of class exploitation* to the definition of otherwise equivalent terms *привоачная стоимость* (Russ.) and *додаткова вартість* (Ukr.).

A less dramatic example can be drawn from Applied Semiotics. Russian and American scientists came in touch in 1995 on Semiotic/Situation Control issues, and, since for many years the national schools worked in isolation from each other, often under security clearances, both parties immediately faced misunderstanding their basic terminology. Thus, even the terms *Semiotics, Semiotic Control*, representing the notions central for emerging Applied Semiotics, are interpreted differently.

- **Subject field level.** It is interdisciplinary interaction that triggers this kind of change. In other words, subject fields often borrow the terms from one another, modifying their meanings according to their own purposes.

This is what happened to *predicate*, originally a linguistic term, when it was used by Aristotle in Logics where it acquired a new meaning. In Mathematical Logics *predicate* was further developed to acquire a meaning "function defined on a set of objects, and taking values of truth or false", or, more exactly, "a predicate or sentential function is a formula which contains some variables and describes a property or a relation. The predicate \( x > 0 \) describes the property of being a positive number. The predicate \( x=y \) describes the identity relations" (Davis and Weyuker, 1983, p. 4). This case can also provide us an example with *predicate* as a linguistic term landing in different terminological systems in different languages, thus, in Russian/Ukrainian we have two terms, a primordial and a borrowed one, to denote what is represented by sole *predicate* in English. In Russian/Ukrainian normative grammars, it is a primordial term *сказуемое* (standing for *predicate*), while in Russian/Ukrainian Structural Linguistics, Mathematical Logics, and Logics we mostly find *предикат*, a borrowed term, though in certain cases a primordial term is used as its absolute synonym. As a result, we can find expressions like *предикат и ли логическое сказуемое/предикат або логічний присудок*, a phrase completely untranslatable into English because of appearing tautology "predicate or logical predicate".

- **Language level.** Due to divergences in the accepted terminological norms or semaseological structures of different languages, establishing direct correspondences of terms and adequate translation often present a problem.

A typical example of different terminological norms is the one where in one language we have only a general term, while in the other—two terms for derivative notions only. Thus, for Computer Science and Applied Semiotics Russian and Ukrainian have only one term: *скатие* (Russ.) and *уцільнення* (Ukr.); in English, on the other hand, there is no general term like that; instead, there are two derivatives: *compression of information* (the one without information losses) and *aggregation of information* (the one with losses). This phenomenon accounts for divergences in the terminological systems and calls forth different visions of reality, which results in misunderstanding between scientists.

Semantic divergences on language level are often there when we deal with the terms coined independently. Semantic divergence may concern not the structure, as in the previous example, but imaging, or motivation of terms; thus, this is the case with the Computer Science term *разъем* (Russ.), and its English equivalent *connector*. The matter is that *разъем*, a primordial
term. verbally means "disjunctor", "disconnector", so the Russian phrase "соединить с помощью разъема" — "to connect with the help of disconnector" sounds controversial—but it is still perfectly Computer-Science correct.

Some cases of this kind can be improved by harmonization; the important point here is that what we should tackle is not harmonization of isolated pairs of terms in the languages concerned, but the harmonization of terminological SYSTEMS as wholes).

• Cultural level. Cultural differences may sometimes bring about divergences in terminology. The appropriate example here will be methodology методология, as it is understood in Russia, in a more general sense, implying adherence to Marxist-Leninist ideology and presupposing materialistic thinking Marxist-style; as a result, for scientists the term bears a negative implication of showing one's political orientation. A phrase methodologically correct — методологически верно — meant only one thing: that of implementing Marxist materialistic principles in one's investigation. Coming now to the West, Russians cannot immediately accept this term in a different, very simple meaning, that of a particular procedure or set of procedures, or the analysis of the principles or procedures of inquiry.

Another typical example is Sciences, and different, totally culturally-determined interpretations this term has in English-American and Russian-Ukrainian environments. While in Russian and Ukrainian the term Sciences generally stands for anything that can be studied or learned as systematized knowledge (i.e., covering Natural Sciences and Humanities), in the West it is usually used with reference to exact or natural sciences, the ones that use "exact methods" of investigation, as opposed to Humanities. Hence, in Russian/Ukrainian there is the general term NAUKI and its derivatives: естественные науки (Russ.), природничі науки (Ukr.) and гуманитарные науки (Russ.), гуманітарні науки (Ukr.), meaning Natural Sciences and Humanities; in English, however, we have no general term like this at all. This is nothing else but a difference in terminology structure due to cultural traditions.

4. Types of Terminology Dynamics

On each of the aforementioned levels, there is a certain dynamics. We will refer to the lexico-semantic dynamics, which may be interpreted both in the aspect of synchronous variance across specific communicative situations within a ten to thirty years span of time, as well as in the aspect of diachronous change across stages of subject fields development that takes place over many years. Thus, synchronous variance and diachronous change can be regarded as two types of terminology dynamics.

Things are relatively simple with the diachronous changes of terminology, inevitable with the development of knowledge in time, when people are redesigning some subject fields, introducing the new terms to denote the new concepts, and modifying structures of conceptual continua. Studies of terminological systems over the years, diachronically, prove that the only constant here is change, which is certainly natural.

Synchronous variance of terminology presents more difficulties to perception due to its more subtle character. However, this is what terminology managers should first and foremost take care of, because here we deal with actual usage, not registered in dictionaries yet, but strongly affecting the sort of terminology we will have in future. Let us consider a simple example of lexical internationalisms as they fluctuate in the Russian texts of Mathematical Logics. "Terminology dynamics" here will mean historical changes of the quantitative aspect only. Three lexical classes have been investigated: pure internationalisms, hybrids, primordial terms.

The corpus of 2980 English-Russian pairs of terms has been selected from scholarly paper titles and their translations in the monthly Abstracts Journal of Mathematics (AJM) covering a
thirty-two-year-period. This analysis was meant to show dynamics in terminology usage with respect to internationalisms, while the "static" data have been taken from four classic monographs that use universally accepted, standardized terminology. The results, briefly, are as follows:

<table>
<thead>
<tr>
<th>Periods</th>
<th>Sources</th>
<th>Pure internationalisms</th>
<th>Hybrids</th>
<th>Primordial terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Monographs</td>
<td>29.68%</td>
<td>38.91%</td>
<td>32.41%</td>
</tr>
<tr>
<td>1</td>
<td>AJM, 1954-1963</td>
<td>37.13%</td>
<td>38.41%</td>
<td>24.44%</td>
</tr>
<tr>
<td>2</td>
<td>AJM, 1964-1973</td>
<td>36.66%</td>
<td>45.10%</td>
<td>18.24%</td>
</tr>
<tr>
<td>3</td>
<td>AJM, 1974-1986</td>
<td>34.60%</td>
<td>49.79%</td>
<td>15.61%</td>
</tr>
</tbody>
</table>

Table 1: Internationalism Dynamics in Mathematical Logics

We received experimental evidence that present data fall into three periods; already in the first period the ratio of the three aforementioned term classes differed from the static state (i.e., analogous distribution in monographs). Thus, in monographs these three classes are approximately equal, while in actual usage in 1954-1963, the primordial terms quantity considerably drops, and the quantity of internationalisms increases. Later, the quantity of primordial terms was constantly dropping, the quantity of hybrids—constantly increasing, while the quantity of pure internationalisms did not change significantly. The tendency to relative stabilization of this process indicates, in our opinion, that over time Russian terminology developed with a sufficient degree of independence. Nevertheless, the revealed excesses of internationalization—which cannot be substantiated in the narrow frames of this paper—make it clear that self-regulation in LSP is far from sufficient; so, ordering of terminology of the rapidly developing subject fields, like Mathematical Logics, should be well-grounded by comparative-terminological analysis; harmonization of national terminologies and renovation of bilingual dictionaries must be preceded by studying terminologies not only in statics, but in dynamics as well, because this is the only way to learn about real usage.

Both types of terminology dynamics should be consistently studied by terminology managers in order to introduce timely improvements into the terminology structure to date.

5. Hypothesis of Terminological Relativity

Knowledge engineering specialists, whether they want it or not, work with signs that represent concepts. These may be the signs of either formal or natural language, and, inevitably, the structure of signs they use for communication and knowledge representation imposes its structure on knowledge organization (or on knowledge base) that they build. This happens because the specialists intuitively tune in this knowledge base structure to the sign (language) structure inherent in them, i.e., they naturally build knowledge base according to the way they structure knowledge—in accordance with their native language and native terminology. More exactly, being positively ancestral to B. L. Whorf and the Sapir-Whorf linguistic relativity hypothesis, we may speak here of hypothesis of terminological relativity. Really, structures of terminological systems, reflecting the conceptual structures, are not constant and can change from language to language, from one subject field to another, so they are relative. Each of us views reality through the lattice/prism of our own terminology, representing a system of concepts in our native language. This is why interdisciplinary and international efforts in science often bring about success—because they allow to view reality from different angles, they allow our vision of our subject field (to a great extent predetermined by our terminology) be complemented by
another vision, equally right, so that this double vision could prompt us to pay attention to
different relations/properties of objects and phenomena under analysis.

As different from linguistic relativity, a situation here, in terminological relativity, is two
dimensional. Thus, here we deal not only with system divergences resulting from language
structure, but also with divergences determined by specific subject field vision of the object of
study. Some subject fields are closer than the others, some even overlap, some just study the same
objects/phenomena from different points of view, with different purposes, applying different
methods. So, the properties revealed by them about same object under study may be essentially
the same, but the concepts/notions land different networks, different systems of concepts that are
pre-established in the given subject field; meanwhile, the new terms are placed into pre-established
tenminological systems. This is the added dimension of terminological relativity: different vision
and frame of mind, when investigating same object/phenomena, bring the concept into different
systems of concepts, and put the term into different terminological systems.

Thus, knowledge structure reflects terminological structure, as the structure of terminology
in our native language imposes a structure of knowledge representation upon us. Consequently,
if we want to create knowledge organization which could be universal enough, we cannot rely only
upon analysis of terminology and knowledge structure in ONE LANGUAGE. Comparative
Terminology Science is an indispensable tool for harmonization and for creating knowledge
representation that would be language-independent.

6. Comparative Terminology Science and Terminology Harmonization

Comparative Terminology has recently evolved into a relatively autonomous trend, forming
on the basis of General Terminology Science, Comparative Linguistics, and Translation Studies.
In fact, we can speak of the new paradigm under way in the peripheries of these universally
accepted linguistic giants and of a new trend emerging there, the trend that claims to be
autonomous (for more details see (Citkina, 1994)). This autonomy claim is methodologically
correct, based on the fact that Comparative Terminology Science (CTS) has a clearly distinguished
object, subject, and methods of investigation, as well as theoretical and applied products, and goals
of its own. Most importantly, it has its very own applications in terminological practice: analysis
and establishment of interlanguage correspondences and correlations of terms and terminological
systems on different language levels generate adequate terminological maintenance for
international unification, standardization and harmonization of terminological systems, for bilingual
lexicography, for computer-assisted translation and multilingual terminological banks. Though
within this trend we can see no uniformity either in subjects and goals or in methods of
investigation, a certain experience has been accumulated, and the trend's inner logic of
development points to the necessity of consolidating on a uniform theoretical platform. To
establish this platform, we should define specific object and subject of investigation in CTS, as well
as specific system of methods and products. Let us introduce these definitions in succession.

The object of investigation in CTS are bilingual terminological pairs and terminological
systems as the wholes. The subject of CTS are the regularities of the system of similarities and
divergences in lexical, grammatical and semantic structures of terms and terminological systems
of the languages compared, along with the principles of term translation.

With respect to methods of investigation, CTS, as many other emerging trends, makes use
of a number of methods provided by neighboring branches of Linguistics. These methods include
structural-comparative, comparative-typological, semaseological, contrastive-definitive, and
contextual analyses, procedures oflinguo-statistics and engineering linguistics, of informants poll,
of information theory; besides, a number of procedures of investigation appeared anew. Two
types and four kinds of CTS methods and procedures are described in (Citkina, 1993).

Theoretical products of CTS are the revealed types of correlations of confronted terms and
term systems on lexical, grammatical, and semantic levels. Applied products have already been
briefly mentioned above. Both theoretical and applied aspects of CTS have been clearly
distinguished to date, and the distinction will be enhanced as research progresses.

The present-day goal of CTS as a science in its own right is further deepening comprehen­
sion of the subject of CTS, and further elaboration of its methods and procedures of investigation;
a more remote goal is creation of a comprehensive theory of comparing terminological systems,
which presupposes establishing general interlingual and interterminological regularities, based on
different language pairs and terminologies of different types. CTS is currently on the stage of
"sensual contemplation", making its first steps towards the stage of "abstract thinking". Therefore,
now the comparative-terminological analysis goal is not immediately reaching any universal
conclusions but just accumulating more particular comparative material, and working out universal,
generally accepted methods, critically necessary at present for obtaining the comparable
results on the broad range of terminological systems and languages. This unheroic background
work will prepare solid ground for consolidating theoretical and applied works in CTS. Thus,
we believe that short-term tactics should prevail for now, though the long-term strategy should
be born in mind.

Comparability of results obtained by different linguists engaged in Comparative Terminology
research is what we are after right now, and this is a realistic objective in the frames of CTS. Comparison here is made in four areas:

- Intrasystem comparison, i.e., investigation of correlation of different parameters, or
dynamics of one parameter
- Comparison of data within a terminological system of the same subject field in different
languages
- Comparison of data in different terminological systems within a fixed language pair
- Comparison of terminological systems of different types (for instance, sciences and
humanities types)

Consistent terminology work in these areas will reveal relevant changes and divergences
embedded in a multitude of languages for special purposes and provide us a sound basis for
 terminology harmonization.

7. Conclusions

On considering some practical aspects of terminology organization with respect to change,
we can see two kinds of reasons for the changes, immediate and deep. While the immediate
reasons come out clear on different levels of change, each characterized by its own type of
dynamics, deep reasons are accounted for by terminologic relativity. Terminological relativity
phenomenon, however backstage and unseen, has a profound impact on terminology and
knowledge organization. Harmonious, universal terminology and knowledge organization—this
is what we are seeking. A great deal of work should be done to achieve this goal, even given the
best of circumstances. However, it is doable, and a powerful instrument to do it is Comparative
Terminology Science.
References


