ENGLISH AND SLOVAK CONCEPT SYSTEMS OF WHOLE NUMBERS

Marianna Hudcovičová
The University of Ss. Cyril and Methodius in Trnava, Faculty of Arts, Slovakia,
marianna.hudcovicova@ucm.sk
Ingrid Cíbiková
The University of Ss. Cyril and Methodius in Trnava, Faculty of Arts, Slovakia,
ingrid.cibikova@ucm.sk

Abstract: Terminology documents the knowledge of various subject fields. The paper describes the structure of knowledge and models the conceptual systems of ordinal numbers in English and Slovak language. In the theory of terminology, the designation can be expressed by a term, a symbol, and an appellation. Worth noticing is the fact that in the case of mathematical sciences, in algebra, both two types of designations are used, i.e., by a term and predominantly by a symbol. Mathematical science is precise and systemic. That is the reason why designation by the symbol is largely used in practice. An additional asset is that this type of designation is understandable across almost all languages and has an international character. It avoids ambiguation and misunderstandings. Moreover, the symbol saves time and is more economical. The paper focuses on bilingual conceptual systems of ordinal numbers. Conceptual systems facilitate understanding of relationships between the concepts, help to write definitions, and facilitate comparative analysis. Subject to bilingual conceptual and terminological analysis is also the decimal positional numeral system, the decimal referring to the use of 10 symbols 0,1,2,3,4,5,6,7,8,9 to construct all numbers. The comparative analysis contrasts conceptual systems of ones, tens, hundreds, thousands, ten thousands, hundred thousands, and millions in the English and Slovak language. The bilingual conceptual system can be represented by symbols, as well as by the terms in both languages. The conceptual system represents the hierarchy between the concepts and superordinate and subordinate relationships. Such hierarchical attitude is described in terminology as a generic and partitive relationship. In terminology research, the following methods have been used: observation, excerption, conceptual analysis, term analysis, comparative analysis of bilingual conceptual systems, classification of ordinal numbers, and synthesis of data. As a result of contrastive terminology work, (excerption, harmonisation, and terminography), English and Slovak bilingual conceptual systems of ordinal numbers have been modelled and displayed in the model of formal and graphical representation of bilingual conceptual systems of ordinal numbers. Systems have shown similarities and differences between the mathematical concepts of both languages. In the case of terminography, the bilingual conceptual systems and terminology records have been ready for multiple uses, for example, glossary, dictionary, and database …). The English language belongs to analytical languages, the Slovak language to synthetical languages. Due to different language types, differences in the concepts are present. In the conclusion of contrastive terminological research in the conceptual systems, there are some findings and recommendations for practice. Findings help to model concept structures based on specialised knowledge of the field and clarify the relations between concepts. The conceptual system facilitates the comparative analysis of concepts and designations across languages and helps specialists in writing the definitions.
Keywords: mathematical terminology, English/Slovak terminology work, conceptual system, ordinal number

1. INTRODUCTION

The main objective of the paper is to describe the structure of knowledge and model the conceptual systems of ordinal numbers in English and Slovak language. In the theoretical part the terminology, conceptual system, the relations between concepts and the terminology work has been defined. The research focuses on terminology work. Pavel and Nolet also define terminology in two ways, terminology can be understood either as a collection of special words belonging to a certain subject field, art, author or social entity, or as a linguistic discipline concerned with the scientific study of the concepts and terms used in specialised languages (Pavel, Nolet, 2001).

The paper focuses on bilingual concept systems of whole numbers. Concept systems facilitate understanding of relationships between the concepts, help to write definitions, and facilitate comparative analysis. Subject to bilingual concept and terminological analysis is also the decimal positional numeral system, the decimal referring to the use of 10 symbols 0,1,2,3,4,5,6,7,8,9 to construct all numbers.

Sageder states, that some experts "see terminology as a separate scientific discipline. They focus on developing a theoretical framework for Terminology ... Terminology as such is then used by linguists, scientists from cognitive sciences, and sociolinguists. The output of their effort is represented by a consolidated theory of Terminology" while the others "see terminology as a practice and an art ... Here, terminology represents a tool for communication; terminology is a target. The output of their effort culminates in the issuing of standardized dictionaries for

specialized fields, or dictionaries for specialized areas" (Sageder, 2010. p.127-128). Stefaniak describes terminology work as follows: "The aim of terminology work is, firstly, to give translators timely terminological support: to find a correct equivalent, to clear the meaning of a concept, to coin a brand new term or to help them choose the right equivalent in a given context, out of many equally correct terms, based on the criteria of consistency, accuracy and clarity. Secondly, the aim of terminology work is to manage the existing terminology resources. This work is both of a descriptive and prescriptive nature ..." (Stefaniak, 2017. p. 109). A concept is a mental representation of a certain object in a given specialised context/field, expressed by linguistic forms (a designation, a definition, a term, an appellation), by symbols, codes, formulae or even icons, diagrams, pictures etc. Concepts can be either general (depicting a set of two or more objects forming a group) or individual (depicting a single object) (ISO 704:2009).

2. METHODS

In terminology research, the following methods have been used: term and symbol observation, term excerption, conceptual analysis, term analysis, comparative analysis of bilingual conceptual systems, classification of ordinal numbers, and synthesis of data. Termium Plus states that terminological analysis is "The analysis of terms in context and of the concepts designated by them within a given subject matter in order to determine their interrelationships" (TERMIUM Plus, 2012).

3. CONCEPT SYSTEM OF WHOLE NUMBERS IN DECIMAL SYSTEM

The role of the concept system is to clarify concept relations in a given subject field and to describe the way of knowledge organisation (Cabré, 1999). ISO standard, which states that "A set of concepts structured according to the relations among them is said to form a concept system. ... Concept systems are represented graphically by concept diagrams. The basic relations among concepts, which has to be considered when modelling a concept system are: hierarchical relations: generic relations and partitive relations; associative relations" (ISO 704:2009. p. 8).

1. Hierarchical relations – concepts are organised into levels of subordinate and superordinate concepts (or, if being on the same level, the concepts are coordinate)

- generic relation – occurs when the intension (a unique group of characteristics) of the specific (subordinate) concept includes the intension of generic (superordinate) concept plus additional delimiting characteristic. In other words, the generic concept can be called a parent; the specific concept a child and concepts, which are coordinate, are siblings. Generic relations can be represented by the tree diagram or the intended list of concepts
- partitive relation – when a superordinate concept represents a whole and the subordinate concepts stand for the parts of the whole. Partitive relations can be represented by rake diagrams and intended lists

2. Associative relations – are non-hierarchical and occur when a thematic connection can be found among the concepts based on experience (ISO 704:2009).

A concept system systematically overviews the concepts employing either formal or graphical representation of the given system (Wrede, Štefčík, Drlík, 2016). Symbols, in the case of our study, ciphers are an important aid to international communication because their visual representation of concepts functions independently of any given language. Characters that replace words or parts of words, such as mathematical symbols or currency symbols, are considered symbols. (ISO/TC 37 SC 704 1999, Terminology work- Principles and methods, p. 22-26). Basic principle for designating the mathematical terms is disambiguation: one concept - one term. Naturally, this principle is typical for one closed mathematical discipline; in different disciplines, the same term can designate different concepts (Čižmár, 2009, p.8). In the presented study, the field of arithmetic has been analysed with focus on whole numbers and the decimal systems between them.

In the theory of terminology, the designation can be expressed by a term, a symbol, and an appellation. In mathematical sciences, in arithmetic, the following types of designations are used, i.e. by a term and predominantly by a symbol/formula. Mathematical science is precise and systemic. That is the reason why designation by the symbol is largely used in practice. An additional asset is that this type of designation is understandable across almost all languages and has an international character. Chinese language uses signs. Nevertheless, Arabic symbols (ciphers) are used next to signs because it avoids misunderstandings and ambiguations. Moreover, the symbol saves time and is more economical.

"Terminological activities can result in a variety of terminology products, such as terminology standards, SPL dictionaries, glossaries, terminology databases, etc. Terminology products and terminology services, such as terminology consultancy and training services, terminology information and documentation, outsourcing of terminological tasks, information services, etc., are usually used as tools for the implementation of a national policy" (UNESCO, 2005. p. 4).

Kudashev delineating the difference between the nomenclature and terminology; while terminology (as vocabulary) is a system of designations denoting groups of concepts, nomenclature is a set of designations denoting a group of objects (Kudashev, 2013, p.52). Andrews et al., in the same way as Kudashev, outline the difference between the terminology (in the meaning of vocabulary) and the nomenclature, which may seem almost identical at the first sight. They claim that "The system of choosing or revising names of terms is nomenclature. Nomenclature is the naming of terms (from the Latin nomen [name] + calator [caller]). Although sometimes used as a synonym for terminology, we understand nomenclature to be the system for devising or choosing names, which are the body of named terms that belong to a specific terminology" (Andrews et.al., 2016. p. 8).

Similarly, Horecký also sees the difference between terminology and nomenclature. Horecký defines terminology as a collection of specialised terms used in the scientific disciplines. Consequently, in terminology understood in this way, a nomenclature as an individual group of terms naming certain things or concepts classified according to the field system is identified. Horecký states an example for botany – botany terminology is a collection of morphological, physiological and botanical terms, while botany nomenclature includes names of individual plants (Horecký, 1956). ISO 704:2009 provides a slightly different definition stating, "The coming together of a unique set of characteristics to make a concept is an everyday occurrence. The concept made up of this set of characteristics is represented by a designation (i.e. a term, appellation or symbol). Since a designation is not attributed to an object but to a concept, the latter depicting one or more objects, terminological analysis is based upon a representation of the concept in the form of a designation or a definition" (ISO 704:2009, p.4).

Termium Plus defines terminological analysis as "the analysis of terms in context and of the concepts designated by them within a given subject matter in order to determine their interrelationships" (TERMIUM Plus, 2012). Terminological analysis is based upon a representation of the concept in the form of a designation or a definition" (ISO 704:2009, p.4). Terminography – part of terminology work concerned with the recording and presentation of terminological data. NOTE Terminological data may be presented in the form of term banks, glossaries, thesauri or other publications" (ISO 1087-1:2000, p.10).

According to Devlin numbers, come from known structures of the world around us. Structures expressed by numbers are abstract as well as numbers, which describe these structures. Further mathematical attribute is a sequence. Numbers exist in a row 1,2,3,4, ... and every following number is higher in 1 value than the previous one. (Devlin, 2011). When we write a number, the value of the digit in each of the first four columns, starting from the right, is e.g. thousands, hundreds, tens, units, i.e. 3 652. Thus, in the number 3 6 52, the value of the 2 is two units and the value of the 6 is six hundreds (Johnson, 2018, p.2). Modern Western numerals are of Hindu-Arabic origin. These include the assertion that the origin is to be found among the Arabs, Persians, Egyptians, and Hindus. It is not improbable that the intercourse among traders served to carry such symbols from country to country, so that modern Western numerals may be a conglomeration from different sources. However, as far as is known, the country that first used the largest number of these numeral forms is India (Britannica.com). The first definite external reference to the Hindu numerals is a note by Severus Sebokht, a bishop who lived in Mesopotamia about 650. Since he speaks of "nine signs," the zero seems to have been unknown to him. By the close of the 8th century, however, some astronomical tables of India are said to have been translated into Arabic at Baghdad, and in any case the numeral became known to Arabian scholars about this time. About 825 the mathematician al-Khwārizmī wrote a small book on numbers. The earliest European manuscript known to contain Hindu numerals was written in Spain in 976 (Britannica.com).

Hindu-Arabic system became favourite almost everywhere because of many advantages connecting with the perfectly distinctive positional system.

The principle of the concept system can be modelled and based on ordering numbers into ones, tens, hundreds, thousands, ten thousands, hundred thousands, millions, etc. Large numbers are based on Pelletier's system in the Slovak language. The comparative analysis contrasts concept systems of ones, tens, hundreds, thousands, ten thousands, hundred thousands, and millions in the English and Slovak language. The bilingual concept system can be represented by symbols, as well as by the terms in both languages. The concept system represents the hierarchy between the concepts and superordinate and subordinate relationships.

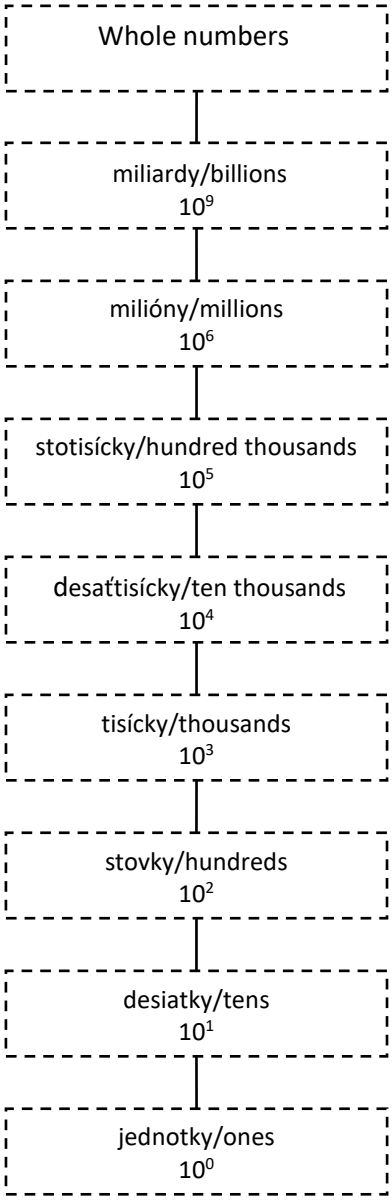
4. DISCUSSION

For 10^0 the Slovak term is *jednotky*, the English is *ones*; for 10^1 the Slovak term is *desiatky*, the English is *tens*. In the case of 10^2 the Slovak term is stovky, the English term is hundreds. The higher level in the decimal system is 10^3, the Slovak term is *tisícky*, the English term is *thousands*. Even higher level is represented by the symbol 10^4, which is represented by the Slovak term *desaťtisícky* and the English term *ten thousands*. The following decimal level is 10^5, the Slovak term is *stotisícky*, the English one is *hundred thousands*. Even higher system in the decimal row is 10^6. This symbol is represented by the Slovak term *milióny*, the English term *millions*. In the concept system,

the higher symbol is 10^7 and 10^8. For the two mentioned symbols, mathematical terms do not exist. There are different reasons, e.g. such large numbers are not so often used in everyday life; the ortographic written form would be too long. Even pronunciation of the possible term would take time. Moreover, the mathematics is a precise discipline without ambiguations. Symbols and ciphers are clear-cut, pure and precise in the meaning. Using ciphers is more effective way of recording numbers.

In ortography, in compound numbers in tens and ones, we put a hyphen between the words in the English language, e.g. twenty-six. In the Slovak language, the numerals are written together as one word, without a hyphen. Recording by number is identical. Numbers between 100 and 199 can be written or spoken as one hundred, when we would like to be precise or a hundred, as an aproximate amount, it is more used in informal contexts. We say six hundred and forty-two (642), using a conjunction and to link the hundreds and the tens. In American English and is often omitted (six hundred forty-two). In a more mathematical context, we might say the individual figures instead: (six four two). Numbers over 10 are often written in figures but in some contexts, words are more preferred. When writing a cheque, words are preferred for the pounds and dollars and figures for the pence. In Slovak, when writing a cheque, words are used, too.

Figure 1 Concept system of whole numbers in Slovak and English



5. CONCLUSION

As a result of contrastive terminology work, (excerption, harmonisation, and terminography), English and Slovak bilingual concept systems of ordinal numbers have been modelled and displayed in the model of formal and graphical representation of bilingual concept systems of ordinal numbers. Terminological data are data related to concepts or their designations.

Systems have shown similarities and differences between the mathematical concepts of both languages. In the case of terminography, the bilingual concept systems and terminology records have been ready for multiple uses, for example, glossary, dictionary, and database …). The English language belongs to analytical languages, the Slovak language to synthetical languages. Due to different language types, differences in the concepts are present. In the conclusion of contrastive terminological research in the concept systems, there are some findings and recommendations for practice. Findings help to model concept structures based on specialised knowledge of the field and clarify the relations between concepts. The concept system facilitates the comparative analysis of concepts and designations across languages and helps specialists in writing the definitions.

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