Creating a bilingual scientific dictionary: Theoretical aspects of Lexicography and their practical implementation in the field of Environmental Engineering.

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Abstract: In this paper, the basic theoretical framework of Lexicography is presented, firstly, by clarifying the definition of this linguistic field. After that, the definitions of the basic concepts of Lexicography that will accompany and guide the creation of the dictionary throughout all its stages are demonstrated. The next milestone will be the introduction of the various types of lexicographic groups and procedures, according to a number of aspects, such as, the profile of the intended users (i.e. linguistic and non-linguistic competences) and the identification of their needs, the definition of the communicative and cognitive functions of the dictionary, the selection and organization of the components of the dictionary etc. These aspects will define our specialized LSP (Language for Special Purposes) dictionary and will give us the guidelines for constructing a useful and efficient scientific tool for the Environmental scientists. Finally, a number of examples of Environmental Engineering terms are presented, giving us a glance at this specific scientific field terminological particularity. **Keywords:** Lexicography, Environmental Engineering, Language for special purposes, Terminology, Bilingual Dictionary

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I. Definition Of Lexicography

When attempting to define a widely-used concept like lexicography we may discover various definitions that won't describe the wide range of fields and implementations it includes. For example the definition given by *The New Oxford Dictionary of English*: the practice of compiling dictionaries. [1] This is an inefficient definition that makes no provision for the theoretical component and gives no details regarding the compilation process. An extensive and thorough definition that incorporates the different aspects of Lexicography is proposed by Bergenholtz and Rufus [2] which comprises four sub-definitions:

"a. Lexicography is the discipline dealing with theories about recently completed and also older existing dictionaries but also about future dictionaries as planned and produced by lexicographers...

b. ...a branch of lexicography deals with the concrete conception, planning and editing of a dictionary. Such a conception could be made without any kind of scientific considerations, i.e. by trying to make a new dictionary according to the way of "how it used to be" — the lexicographer makes a dictionary following his/her intuition and by knowing the needs of the intended user...

c. Another type of lexicography is totally influenced by linguistics and tries to use the best linguistic theories and terms for the planning and compilation of dictionaries.

d. A final type of lexicography argues that lexicography is an independent discipline, perhaps somehow connected to a certain kind of information science or linguistics, but indeed not a subdiscipline of linguistics."

In this paper we will propose a mixture of practical lexicography combining the involvement of specialized Environmental scientists, who are field experts and know the needs of the intended user (b) with the supervision of linguistic experts who will try to use the best linguistic theories and terms for the planning and compilation of dictionaries (c).

II. Basic Concepts In Lexicography

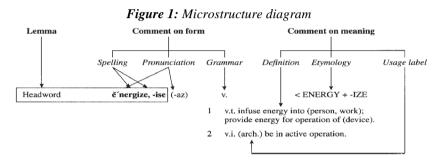
In order for a bilingual dictionary to have the right structure but also to provide its users a proper functionality, the knowledge, as well as the adequacy in using some essential lexicographical concepts throughout the process of forming is essential. A useful and solid set of definitions is been presented by H. Bergenholtz and S. Tarp [3]:

Lemma is the lexicographical term for what is popularly referred to as entry word or headword. The lemma

directs the user to the required dictionary article, headed by the lemma, which constitutes the relationships in the reference work within the overall (e.g. alphabetical) macrostructure. It also refers to the relationships within the microstructure, where it establishes the 'topic' on which the rest of the entry is a 'comment', e.g. the definition of the headword [4].

Equivalent designates the translation of the lemma or other source-language expression into the target language. Equivalents are thus only provided in bi-and multilingual dictionaries. There are different degrees of equivalence, namely full, partial and zero equivalence.

Macrostructure is the lexicographical term used to describe the arrangement of the stock of lemmata in the word list. A dictionary may have one or more macrostructures, according to the number of word lists. Macrostructure may be *systematic*, i.e. arranged according to a systematic classification, or it may be *alphabetic*. **Microstructure** refers to the arrangement of the information provided in the individual dictionary articles. According to the nature of the articles, a dictionary may have one microstructure or several different microstructures.



Hartmann R.R.K. & James G., 2002. *Dictionary of Lexicography*. Routledge, New York

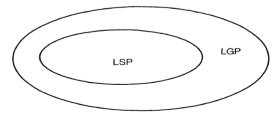
Outside matter is the overall term for dictionary components which are not part of the word list, including *preface, user's guide, encyclopedic section, dictionary grammar*, etc. According to the placement of the matter relative to the word list, outside matter may be subdivided into front matter, back matter and inside matter. **Frame structure** is used to refer to the arrangement in the dictionary of word list(s) and outside matter.

Access structure is the structure of the indicators directing the user to the required information. A distinction is made between inner and outer access structure. **Outer access structure** is the structure of the indicators starting on the dictionary cover and directing the user to the individual articles i.e. *the alphabetical order of headwords*. **Inner access structure** refers to the arrangement of the indicators directing the user further into the article to the information required i.e. *spelling*, *grammar*, *definition*, *etymology* and *usage*.

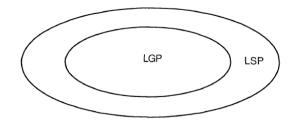
Cross-reference structure is a lexicographical term for the arrangement of those explicit and implicit indicators that direct the user within the dictionary for additional or supplementary information over and above that already found at the first lookup, i.e. the *see also* indicator.

III. Tracing Out The Connection Between Language For General Purposes And Language For Special Purposes.

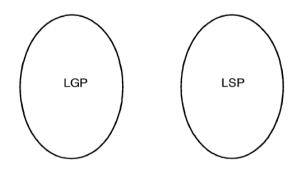
Most linguists make a basic distinction between language for general purposes and language for special purposes. But opinions differ as to the relationship between the two. According to the various existing theories presented by H. Bergenholtz and S. Tarp [3] language for general purposes (= LGP) may be seen as being synonymous with standard language and all languages for special purposes (= LSPs) are regarded as elements of general language. This conforms to the view that a certain language system is determined by the general-language system and that, to a greater or lesser extent, all LSPs make use of the general-language system.



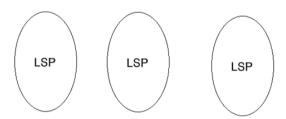
Other linguists take the exact opposite view. In their opinion, all general-language expressions are found in special language as well, with the latter concluding, collectively and individually, all the LSP expressions which characterise the different specialised worlds of LSP.



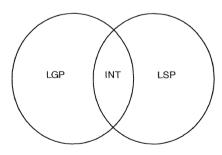
From a communicative point of view, LGP and LSP are used in completely different aspects of communication. Here LSP refers to the language used by experts communicating within their areas of expertise. On the other hand general language must be resorted to in everyday communication, as expert knowledge is not considered to be presupposed. Although to a certain extent it is possible to refer to the same things by using general language, communication has to be so simplified that the whole can no longer be considered LSP. LSP and LGP are thus equal, yet distinct, phenomena.



A fourth possibility is to dismiss altogether the existence of LGP as a phenomenon in its own right and instead to assume that each usage is specific to a certain situation. This approach suggests that every language variety is an LSP. Thus, a legal magazine or a handbook of medicine represents different LSPs.



In general, however, LSP uses only a part of this assumed general language, such as certain grammatical construction possibilities and not all general-language words, but then special technical terms and in some cases also register-specific structures are used as well. This interaction of languages is forming a communicative pattern, in which the intersection between LGP and LSP is made up of structures and elements occurring in both LGP and LSP.



IV. Identity Aspects That Format The Type Of A Dictionary

According to B. T. Sue Atkins and Michael Rundell [5], there are many different aspects of a dictionary to be taken into account when it's going to be composed and written. The most significant are the following:

Firstly the choice of the dictionary's language or languages: According to the purpose of the writer, a

dictionary could be monolingual, bilingual or multilingual. Moreover, unidirectional, meaning a dictionary that contains a single text in which the source language (SL) is in one language and the target language (TL) is in another, so it works one way or bidirectional, meaning a dictionary that contains two texts and works 'both ways': for example in a bilingual English-French dictionary there is one text in which the SL is English and the TL is French, and a second text where the SL is French and the TL is English.

The choice of the dictionary's coverage: Taking into account the target group that a dictionary aims, there are some distinctions concerning its coverage. It could be in general language, it could cover encyclopedic and cultural material, it could get involved with terminology or sublanguages (e.g. a dictionary of legal terms), or it could cover a specific area of language (e.g. a dictionary of phrasal verbs, idioms etc)

The choice of the dictionary's size: it could be a standard (or 'collegiate') edition, concise edition or a pocket edition. The choice of the dictionary's medium: it could be printed, electronic (e.g. DVD or handheld) or web-based. Each category implies a different process handling of the Microstructure and the Access structure of the dictionary. The choice of the dictionary's organization: This choice refers to the access structure. One choice could be the directing a dictionary user from word to meaning which is the most common structure. Another, more complex, choice could be the word to meaning to word structure, where looking up one word leads to other semantically related words.

The choice of the users' language(s): This choice refers to a dictionary that is meant for either a group of users who all speak the same language, or two specific groups of language-speakers or learners worldwide of the dictionary's language.

The choice of the users' skills: We can categorize the potential users of a dictionary based on their skills in a number of groups such as a. linguists and other language professionals, b. literate adults, c. school students, d. young children and e. language learners.

The choice based on what they use the dictionary for: There are two main categories that allow us to decide the structure of a dictionary based on the user's linguistic needs. One may choose one of the following or combine them in a more complex structure: The first refers to decoding, which is the understanding of the meaning of a word and the translating from a foreign language text into their own language and the second refers to encoding, which is the use of a word correctly, the translation of a text from their own language into a foreign language, but also language teaching.

Taking into account all the above mentioned aspects, the aiming in our case in creating a specialized LSP (Language for Special Purposes) dictionary should concentrate in a) a unidirectional bilingual dictionary, which would permit the reader to clarify terms from the English into the Greek Language. The choice of English as the dictionary's source language is based on the fact that this is used as a mother-tongue or secondary language by almost one billion people. Additionally, English as the most common "lingua franca" (a language used by speakers with no common mother tongue) is a daily reality in the professional field and social life of many people, their language of communication and their "property" [6]. Apart from that, English is the most widely used language in the scientific field of Environmental Engineering since it was founded in English-speaking countries (the first Wastewater Treatment Units were developed by Clark and Cage in Massachusetts in 1913 and by Ardern and Lockett in Manchester in 1914) [7], providing a great amount of academic text books that can be used as a rich source of term gathering.

Other aspect choices that formulate our dictionary's attributes should focus on b) terminology or sublanguages in the field of Environmental Science, c) a standard size dictionary that could cover most of the scientific field it deals with, d) a printed dictionary, but at the same time to keep in mind the option of transferring the data into an electronic version, e) a word to meaning dictionary organization, f) a dictionary meant for a group of users who all speak the same language, i.e. Greek, who are literate adults i.e. academic students and scientists, and lastly g) a dictionary that the user needs for decoding, i.e. for understanding the meaning of a word and for translating from a foreign language text (English) into their own language (Greek).

V. Unique Aspects Of Specialised Bilingual Dictionaries

As pointed out by H. Bergenholtz and S. Tarp, [3] in contrast to their monolingual counterparts, most of specialised bilingual dictionaries published nowadays contain linguistic information, primarily in the form of equivalents, providing translations into and from the native language. In order to enable non-expert users to find the right equivalent, the dictionary should at least provide some kind of encyclopedic note or label.

It is often desirable that specialised bilingual dictionaries (and in many cases monolingual dictionaries too) conclude a set of different functions and not only to be limited as for instance pure translation dictionaries. Hence, linguistic information on the foreign language should be included with a view to foreign-language translation and production.

For a bidirectional dictionary to utterly incorporate the function of foreign-language production, corresponding information on the lemma should be provided in the opposite language direction. But today, this is the exception rather than the rule.

Creating a bilingual scientific dictionary: Theoretical aspects of Lexicography and their practical ...

Specialised dictionaries that are intended for translation from the foreign into the native language should provide, in addition to relevant collocations, at least some grammatical information on the native language, in particular in uncertain cases, thus enabling non-expert users to make correct native-language text production. As was the case with specialised monolingual dictionaries, the issue of adding a monolingual dimension to an otherwise bilingual dictionary arises here too. Since it cannot be expected that several different types of dictionaries be published for the same subject area, it may be relevant to incorporate native-language production and reception of LSP texts as well as the introductory encyclopedic function in a bilingual dictionary.

Another point that one may take into consideration is the intended users' native language in connection to specialised bilingual dictionaries. Many existing bilingual dictionaries claim to have been designed for native speakers of each language, but in practice they hardly ever provide the linguistic information necessary to conform to the requirements of both user groups. Such dictionaries should provide information on both source and target language, attempting at the same time to keep explication language at such a level that it can be understood by both user groups, for instance by using internationalisms in the grammar notes and encyclopedic labels. This will ensure that dictionaries fulfill the supplementary functions of production and reception of LSP texts in the users' individual native languages.

Finally, dictionaries may be designed with a view to third-language users, especially technical and scientific dictionaries. Thus the common means of communication for many academic groups based outside the English-speaking countries is English, translation into other languages made in and by translators from the country in question are often based on English. In this case detailed information on the source language is required to enable such users to find the right term.

VI. An Innovating Aspect In Evaluating The Terms While Creating A Specialised Bilingual Dictionary

One of the main issues in the process of setting up a Specialised bilingual dictionary is the evaluation of the gathered terms. These terms would have been picked out by spesialised scientists, who even though possess the necessary skills to identify the importance and meaning of each term, they will not fulfill the needed linguistic academic background to evaluate their scientific knowledge. This is the reason why, for example, the Hellenic Society for Terminology (EAETO) has always had as members of board both special scientists and linguists [8]. Furthermore, a great number of the established academic terminology arose directly from the source language, permitting many misunderstandings, false usages of terms and a general distancing from the right use of the native speakers` language terms.

In order to minimize the probability of using such terms while creating a Specialised Dictionary, a control mechanism is proposed, for evaluating the gathered terms, but also in order to propose to the scientific society new translational options that would clarify a terms` meaning or correct a mistranslated established term.

This evaluation mechanism is based on the translation strategies developed by the Belgian translatologist Dirk Delabastita [9]. Delabastita based the development of his strategies on the techniques used by the ancient Latin rhetoricians, as they were explained by Heinrich Lausberg [10] in his extensive presentation of the figures of speech used by ancient Greek rhetoricians. These figures of speech were copied by the Latin rhetoricians, starting by Cicero. This typology includes the following translation strategies:

(1) Repetitio: The sign is formally reproduced in an identical manner;

(2) Adiectio: The sign is reproduced with a certain addition;

(3) **Detractio**: The reproduction is incomplete, it implies a reduction;

(4) **Transmutatio**: The components of the signs are repeated in a somewhat different internal order, there being an alteration of the sign's textual relations;

(5) **Substitutio**: The sign is replaced with an altogether different sign.

All the above refer to the lexical, semantic and morphosyntactic level. Hence there is a variant of detractio, where all the elements of the translation unit are erased. This case is considered a different strategy and is called (6) **deletio** (deletion).

Finally, Sofia Christidou [11] [12] proposed through her academic research studies a new term: (7) **non-translation**¹ for the following cases: (a) where the term is not translated, not even transliterated but appears as it is in the source language; (b) where only part of the term is translated (e.g., a compound term which consists of two terms and has its first part kept in the source language without transliteration while its second one is

¹ As far as the term **non-translation** is concerned, it could be related to a term used in translation theory in order to distinguish between what is not translation and what translation is however there is divergence amongst scholars as to the circumstances that this term is used. According to the definition given by Edward H. Schafer [14], Leo Tak-hung Chan [15] and Katherine Shields [16] the term may refer to parts of the original text that are remain untranslated in the target text. Additionally one of the subcategories listed by us as non-translation is covered by the definition given by Lee-Jahnke H., Delisle J. and Cormier M. in the dictionary Opología $\tau\eta\varsigma$ Metá $\phi\rho\alpha\sigma\eta\varsigma$ (Translation Terminology) Mesogeios Publishing, Athens, 2008 for the term "direct transfer".

translated in the target language with the employment of one of the aforementioned strategies); (c) where a term from the original index is omitted from the Greek index; (d) where acronyms and proper names remain in the source language without transliteration; and (e) where the wrong employment of one of the aforementioned strategies leads to a mistake in the translation of a term.

The aforementioned typology serves as the basis for the study of the terms which will be first studied as they appear in the indexes and then will be processed as they appear in context within the texts. The recording of the terms will be done in the alphabetical order of the index in the source language. Term variations, when they appear, will be mentioned under the same entry, even if they had been recorded originally in the book as different entries of the same index. This will be done in order to present the terms in their entirety and, consequently, analyze them in every respect. If the Greek index contains extra terms that do not appear in the original index, those will be recorded separately. The next step that follows is the explanation of the translation strategy employed, including comments on the translation process. Moreover, a lexicographic and bibliographic research will be performed, and, where necessary, suggestions of more accurate translations are going to be made. Finally a statistical recording of the frequency of appearance of the translation strategies will be presented which helps us come to conclusions regarding the decision-making processes.

6.1 Term processing

Term processing examples using environmental scientific textbooks [12] [13]:

English term	Greek term and/or phrase	Translational choice
1) "Opportunity to Recycle"	 Ευκαιρία για ανακύκλωση 	1) Detractio
laws (index, 3.1,	(ευρετήριο [index], 119)	
3.13–3.14) →	2) Εντούτοις, το ψήφισμα της	
2) However, the passage of	νομοθεσίας του Όρεγκον το	2) Adiectio
Oregon's "Opportunity to	1983 με τίτλο «Ευκαιρία για	
Recycle" legislation in 1983,	ανακύκλωση» (Opportunity to	
3.1, p. 87, 1.18	Recycle), 3.1, σ.[page] 119,	
	γρ. [line] 21-23	
	3) Νόμοι «Ευκαιρία για	
	ανακύκλωση», 3.10,	
	σ.[page]137, γρ. [line]18	
3) "Opportunity to Recycle"	4)που έχουν νόμους	3) Transmutatio
Laws, 3.10, p.99, 1.1	«Ευκαιρία για ανακύκλωση»,	
4)that have "Opportunity to	3.10, σ.[page]139, γρ. [line]33	
Recycle" laws, 3.10, p.100, l.12-		4) Transmutatio
13		

Comments – Suggestions

1) A Detractio occurs through the removal of the noun "laws", which subtracts information from the term. Additionally, a Deletio of the quotation marks takes place.

2) An Adiectio occurs by adding the by adding the whole term in English in brackets, an indication that the translator is not sure about his translation option. Moreover, an Adiectio occurs through inserting the preposition and the noun « $\mu\epsilon$ tít λ o» [with the title] in the Greek phrase. Additionally, a Transmutatio occurs by shifting the noun "legislation" from the ninth position of the English phrase to the fifth position of the Greek phrase «voµoθεσίας». Also, a Transmutatio occurs by shifting the number indicating the year "1983" from the last position of the English phrase to the ninth position of the Greek phrase. Furthermore, a Substitutio arises by replacing the preposition "in" with the article «to» [the] alongside with a Transmutatio by shifting it from the tenth position of the English phrase to the eighth position of the Greek phrase. Finally, a Deletio of the proposition "of" takes place because it is replaced with the genitive case in the Greek language.

3) A Transmutatio occurs by shifting the noun "Laws" from the last position of the English term to the first position of the Greek term «Νόμοι».

4) A Transmutatio occurs by shifting the noun "laws" from the last position of the English phrase to the third position of the Greek phrase «vó μ ouç».

English term		Greek term and/or phrase	Translational choice
□ Seismic impact	zones	1) Σεισμικές ζώνες επίδρασης	1) Transmutatio
(index, 2.5)		(ευρετήριο [index], 63)	
		2) Σεισμικές ζώνες επίδρασης	
□ Seismic impact zon	nes 2.1,	2.1, σ.[page]63, γρ. [line]15	2) Transmutatio

p.51, l.41

Comments – Suggestions

1) A Transmutatio occurs by shifting the noun "impact" from the second position of the English term to the third position of the Greek term $\kappa\epsilon\pi$ iδρασης».

2) A Transmutatio occurs by shifting the noun "impact" from the second position of the English term to the third position of the Greek term «επίδρασης».

English term	Greek term and/or phrase	Translational choice
1) Uniform Fire Code (index,	1) -	1) Non-translation
10.16-10.17)		2) Substitutio
2) Uniform Fire Code 10.3,	2) Επίσημος κώδικας για τις	
p.342, 1.38-39	πυρκαγιές 10.3, σ.[page]505, γρ.	
	[line]27	3) Substitutio
3) In the Uniform Fire Code	3) Στον Επίσημο κώδικα για τις	
10.3, p.343, 1.18	πυρκαγιές 10.3, σ.[page]506,	
-	γp[line]21	

Comments – Suggestions

1) Non translation of this particular term, on account of its absence from the Greek Index.

2) A Substitutio occurs by replacing of the English adjective "Uniform" with the Greek adjective " $E\pi i\sigma\eta\mu\sigma\varsigma$ " that means official or formal. Additionally a Transmutatio occurs, through the shifting of the noun "fire" from the second position of the English term to the fifth position of the Greek term, while at the same time an Adjectio occurs by inserting the preposition and the article « $\gamma\iota\alpha\tau\iota\varsigma$ » [for the] in the third and the forth position of the Greek term.

3) A Substitutio occurs through the replace of the English adjective "Uniform" with the Greek adjective " $E\pi i\sigma\eta\mu\sigma\varsigma$ " that means official or formal. Additionally a Transmutatio occurs, through the shifting of the noun "fire" from the fourth position of the English term to the sixth position of the Greek term, while at the same time an Adjectio occurs by inserting the preposition and the article «για τις» [for the] in the forth and the fifth position of the Greek term.

VII. General Conclusions

The aforementioned lexicographical procedure aims in preventing the existence of several scientific errors that lead to the lack of the complete accuracy of the content and, of course, to the ambiguity of terminology. Moreover, possible incorrect syntactic structures (as described in Christidou's former academic research studies [10] [11]) underline the lack of compatibility between common language and terminology. Usually in a communicative way the translation manages to remain equivalent to the original text, as it is required to achieve the same purpose and this is obvious in all its style. However, as part of our hypothesis, sometimes the grammar-syntactic rules of the Greek language may not be followed to a significant degree, we can argue whether some translations would be typical of the Greek scientific literature.

VIII. Proposal For The Environmental Science Field

We believe that by using the aforementioned bilingual control mechanism in creating a specialised bilingual dictionary in the environmental science field, it would assist building consensus and hence a standardized Greek terminology in the environmental domain which constitutes a top priority. In particular, at university level, this should constitute a primary concern. Those who will promote science in the future are going to be prepared by the academic community and it is necessary to teach them the use of national terminology, but above all the right use of the Greek language.

We also consider that a result of this suggestion, would not only be the promotion of Greek language and terminology at national level but also the reassurance of a better and more effective communication and collaboration between scientists, as well as the improvement of the provided teaching to students who will be able to study, through translation, the foreign-language bibliography without encountering ambiguities and problematic terms with double or even triple translation versions.

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