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Translation and terminological challenges encountered in the compilation of the English-Polish, Polish-English photogrammetric dictionary

Abstract

Translation and terminological challenges encountered in the compilation of the English-Polish, Polish-English photogrammetric dictionary

This paper describes a terminology project aimed at creating a fully bilingual English-Polish, Polish-English photogrammetric dictionary that is targeted at both field and language experts. The dictionary includes terms, definitions, full names of terms and their abbreviations, indications of the field to which a term belongs, synonyms, cross-references to related concepts, grammatical information, and equivalents.

The starting point for the dictionary was the photogrammetric terminology glossary compiled by Granshaw (2016) from texts published in the *Photogrammetric Record* magazine.

Keywords: photogrammetric dictionary, terminology, glossary, equivalence, conceptual mismatches

1. Overview of the existing English-Polish, Polish-English photogrammetric dictionaries

Photogrammetry is the science and technique of recovering shapes, sizes, and mutual locations of objects based on images. It is a branch of a wider field called surveying, which determines the lengths, angles, and three-dimensional position of points on the Earth's surface. Practical applications of photogrammetry include the monitoring of landslides, annual inventories of crops on arable lands, and inventories of buildings and objects for possible future reconstruction requirements.

Due to its narrow scope and limited interest in the field, English-Polish, Polish-English photogrammetric dictionaries are scarce. In fact, only three such dictionaries have been published so far: the *Multilingual Dictionary for Photogrammetry* (English, French, German, Spanish, Polish, Swedish, and Italian) by the International Society for Photogrammetry (1961), *Słownik terminologiczny* (*pięciojęzyczny*) *z zakresu fotogrametrii i teledetekcji* 'Five-language terminological dictionary on photogrammetry and remote sensing' by Sitek (1990) and *Słownik polsko-angielski i angielsko-polski z zakresu fotogrametrii* 'Polish-English, English-Polish Dictionary on Photogrammetry' by Kurczyński (2014).

The study of Polish photogrammetric terminology began in 1934. *The Journal of the Polish Society for Photogrammetry* "Przegląd Fotogrametryczny" issued a glossary of terms in Polish, German, and French, which was based on the *Multilingual Photogrammetric Dictionary* (German, English, French, Spanish) compiled by the German Society of Photogrammetry in 1934 (Sitek 1992).

Another study on Polish photogrammetric terminology was undertaken between 1948 and 1956. After the Sixth International Society of Photogrammetry (ISP) Congress the *Multilingual Dictionary for Photogrammetry* (English, French, German, Spanish, Polish, Swedish, and Italian) was commissioned and financial support was granted. The dictionary consists of seven volumes. Each volume contains words in one language arranged alphabetically and consecutively numbered. Next to the words, numbers under which the word can be found in six other languages are put in separate columns each (Sitek 1992). Its entries were first compiled in English and later translated into the other six languages. The English part contains 4,259 entries, whereas the Polish part of the dictionary comprises 4,644 terms.

The dictionary was published in 1961 by the International Society for Photogrammetry N. V. Uitgeverij "Argus" in Amsterdam (ISP 1961). The English and Polish volumes of the dictionary are available in the archives of technical universities like the AGH University of Science and Technology in Kraków, the Military University of Technology in Warsaw, and the University of Warmia and Mazury in Olsztyn.[1]

The second photogrammetric dictionary was the *Słownik terminologiczny* (*pięciojęzyczny*) *z zakresu fotogrametrii i teledetekcji* or "Five-language terminological dictionary on photogrammetry and remote sensing" (Sitek 1990). The dictionary was created as part of a large project of the International Society for Photogrammetry and Remote Sensing (ISPRS), whose aim was the compilation of a multilingual dictionary of photogrammetry and remote sensing. A Polish section of the dictionary was created by the Polish Working Group, chaired by

1| http://katalog.nukat.edu.pl/lib/item?id=chamo:619269&fromLocationLink=false&theme=nukat, accessed: 18.09.2020.

Prof. Zbigniew Sitek from the AGH University of Science and Technology in Kraków.

After some preliminary work, the second, refined edition of the dictionary was published in 1990. It contains 2,530 terms and consists of two volumes. Volume 1 includes Polish terms in alphabetical order, which are numbered in such a way that the dictionary can be extended without changing the numbering of terms previously assigned. It also provides definitions of terms and their equivalents in English, French, German, and Russian. Volume 2 comprises multiple bilingual glossaries: English-Polish, German-Polish, French-Polish and Russian-Polish. The foreign terms in glossaries are also arranged alphabetically, and a list of acronyms in the field of photogrammetry and remote sensing is also attached (Sitek 1992).

The third available photogrammetric dictionary, the *Słownik polsko-angielski i angielsko-polski z zakresu fotogrametrii* "Polish-English, English-Polish Dictionary on Photogrammetry" compiled by Kurczyński (2014) is the most recent publication. It is still very valid and contains many new entries when compared to the dictionary by Sitek (1990). However, the content of entries is limited, as the dictionary provides only terms (sometimes enhanced with their abbreviations or full forms if the main term is an abbreviation) and their equivalents.

The dictionary by Kurczyński (2014), like the other two dictionaries, is directed mainly at technicians, researchers, and students who work in the field. Technical writers, translators, or even scholars who do not know this field may not find this dictionary particularly useful as they will not be able to build a concept structure within the field and find semantic relations between concepts based solely on the terms and equivalents the dictionary offers.

As photogrammetry is quickly developing and relies on achievements in other disciplines such as computer science and computer vision, the repository of entries in the dictionary needs to correspond with and reflect these changes. As the dictionary by Kurczyński (2014) is the only recent terminology source in the photogrammetry field, an attempt has been made to compile a photogrammetric dictionary which does not comprise a simple glossary of terms, but rather functions as a genuine dictionary.

2. Evaluation of the source material for the compilation of a new dictionary

The photogrammetric terminology glossary described in the article *Photogrammetric Terminology: Third Edition* (*2016*) *Listing* by Granshaw published in *Photogrammetric Record* sparked the creation of the English-Polish, Polish-English photogrammetric dictionary.

The original glossary is in English and contains 1,032 entries. Data in the glossary is split into two columns: entry and definition (Figure 1). The definition field

is quite expanded as apart from the explanation of the term, it may provide full forms of the term, grammatical and orthographic information, cross-references to other terms, (indicated as *See also* or *Cf.*) and information on preferred or deprecated uses of some word forms as well as identification of the source of the term (indicated as *Photogrammetric Record* volume number (issue number): pages).

error	Difference between a measurement and its (usually unknown) true value. Normally subdivided into **random errors**, **systematic errors** and **gross errors**. See also **accuracy**. *PR* 12(71):637
error ellipse, error ellipsoid	Ellipse (**2D**) or ellipsoid (**3D**) used to visually depict **errors** or **residuals** at representative points. See also **accuracy**, **error**, **precision**. Cf. (unrelated earth) **ellipsoid**, ***CE***. *PR* 31(153):71; 28(142):178, 196, 211; 25(129):24; 24(127):246; 22(117):22; 20(111):205
error theory, theory of errors	Traditional approach to **accuracy** in surveying and **geomatics**, including **photogrammetry**, characterised by the use of Gaussian statistics and the analysis, elimination or minimisation of sources of error. Cf. **uncertainty** approach promoted by **ISO**, **JCGM** and **BIPM**. See also **gross error**, **least squares**, **precision**, **maximum likelihood**, **random error**, **RMSE**, **standard deviation**, **standard error**, **stochastic**, **systematic error**, **variance**. *PR* 12(71):637
error-free	Hyphen when used adjectivally; otherwise "free of error" preferred. See also **check point**.

Figure 1. Photogrammetric Terminology: Third Edition (2016) Listing

The original glossary includes a large proportion of proper names, which are the names of satellites, software packages and national and international organizations. Most of these terms, apart from the names of widely known organizations, such as *ESA* (European Space Agency) are not valid terms that should be included in the dictionary. The glossary also includes entries which are general language words, e.g. *computer*, *Internet*.

3. Design of bilingual LSP dictionaries

A bilingual LSP dictionary is a type of multilingual LSP dictionary. In contrast to a standard multilingual LSP dictionary, it describes linguistic units of only two languages but like a multilingual LSP dictionary it contains terminology of one or more specific domains of knowledge (Lukszyn 2005). Bilingual LSP dictionaries are typically discussed in the context of multilingual dictionaries of the specialized language (Łukasik 2016; Klejnowska-Borowska 2016; Zagórska 2017).

> The multilingual dictionaries of different technical terminologies have a high, if limited, usefulness within their own field: they usually have a strong encyclopaedic component and help much to guarantee the precise use of terms in different languages (Zgusta 1971: 297).

Nowadays, multilingual LSP dictionaries are relatively common. The same tendency may be observed in the case of terminological dictionaries with English and Polish. Łukasik (2016: 268) points out that 849 such dictionaries were published between 1990 and 2013, in contrast to only 331 works issued in the period between 1945 and 1989.

The aim of this section is to investigate theories on the macrostructure and microstructure of LSP dictionaries in order to design the structure of the English-Polish, Polish-English photogrammetric dictionary that was compiled on the basis of the English photogrammetric glossary developed by Granshaw (2016).

Macrostructure is the structure of the central list of entries which enables the dictionary user to identify the information they search for (Zagórska 2017: 188). Some researchers use the term macrostructure with reference to the overall design of a dictionary (cf. Atkins/ Rundell 2008: 177; Łukasik 2016: 268; Hartman/ James 1998: 92).

According to Łukasik (2016: 268), macrostructure of the LSP dictionaries covers: field coverage, directionality, number of entries, standards of the entry input, bibliography, indexes and presentation of entries in the dictionary.

Most of the LSP dictionaries with English and Polish published in Poland after 1989 are scientific and technical dictionaries. Other common types of dictionaries cover such fields as law and economics. The dictionaries were mainly English into Polish dictionaries (37%); Polish into English LSP dictionaries were less frequent (19%). A similar tendency may be observed in the case of bilingual English into Polish, Polish into English dictionaries. Multilingual dictionaries with English and Polish, although quite popular (28%), were typically one-directional. They included broad information on terms in only one language, whereas for other languages indices or glossaries were provided (Łukasik 2016: 272). Recently, bilingual dictionaries are gaining popularity as they are more universal and may be used by different user groups.

As for the disciplines, around one third of them do not have their dictionaries (Łukasik 2016: 271). The number of entries in the LSP dictionaries is typically between 1,000 and 10,000 (Łukasik 2016: 271), whereas in the didactic LSP dictionary (e.g. for students) it is around 5,000 entries in one language (Klejnowska-Borowska 2016: 167). Very specialized dictionaries may have fewer entries than 1,000.

Terminological dictionaries in principle should include only standardized terms. However, this condition is difficult to meet as these terms get outdated very quickly. Moreover, LSP dictionaries should be compiled according to principles specified in the standards. This condition is rarely fulfilled as it refers mainly to paper dictionaries, whereas nowadays many dictionaries are in an electronic form or are often replaced by termbases.

Both Łukasik (2016: 277) and Klejnowska-Borowska (2016: 164) emphasize the importance of providing the bibliography for information used to compile the dictionary (e.g. terms, definitions). Terminological compilations should be corpus-based and the corpus of texts should be documented in the bibliography.

Indices are of great importance in terminological dictionaries. They are lists of terms arranged alphabetically which refer the user to main entries through the entry number or the page number as they facilitate the access to the individual

entries. Many recent lexicographic publications lack indices which affects their functionality, especially for translators who have problems finding equivalents quickly.

The access structure in terminological dictionaries can be alphabetic, thematic or chronological (Hartman/ James 1998: 89). The majority of bilingual LSP dictionaries with English and Polish published between 1990 and 2013 are arranged alphabetically, whereas non-alphabetic dictionaries are thematic dictionaries (Łukasik 2016: 279); they are systematic and have a concept-based organization of entries which facilitates establishing relations between concepts and building a network of concepts within the field (Klejnowska-Borowska 2016: 164).

As for the microstructure, it is "the internal design of individual dictionary entries" (Zagórska 2017: 188). Each entry contains a headword and accompanying information. Headwords may be simple lexemes, compounds, borrowings, abbreviations, proper names or multi-word units. Headwords which have more than one meaning are different concepts and are presented as separate entries. Accompanying information in a prototypical terminological multilingual LSP dictionary consists of obligatory information and optional information. Obligatory information covers equivalents in other languages and definitions, whereas the optional information comprises abbreviations (or full forms), comments on pronunciation, spelling variants, irregular plural forms, collocations, idioms, etc. (Hartman/ James 1998: 94). The inclusion of optional information makes the dictionary entry richer but it may make the search for equivalents more challenging, particularly if the data is very extensive and the dictionary user is not familiar with the dictionary structure (Zagórska 2017: 192).

Klejnowska-Borowska (2016: 164) stresses the importance of building a network of concepts for a terminological lexicon and warns against the omission of basic terms within the field (hyperonyms). This can be achieved by combining an onomasiological and semasiological approaches to terminology work. The onomasiological approach starts from concepts and looks for their names, whereas the semasiological approach starts from words and looks for their meaning (Sager 1990: 56). Van der Vliet (2006: 62) suggests that a system of concepts describing the knowledge in a particular domain should be built by combining a top-down approach, which uses the domain knowledge, and a bottom-up approach, which uses a corpus.

The overview of theories on macrostructure and microstructure of the terminological dictionaries enables the following conclusions to be drawn:

a) the original photogrammetric glossary by Granshaw (2016), which is based on the corpus of texts published in *the Photogrammetric Record*, is a list of candidate terms that need verification and represents only the semasiological and bottom-up approach to term collection. The ultimate goal of the dictionary is to create a network of concepts in English and Polish within

the field of photogrammetry, thus the onomasiological and top-down approaches to term collection should also be applied;

b) the number of entries after rejecting proper names and general language words was limited from 1032 to 882 items in the English glossary;
c) as for the microstructure of the English-Polish dictionary, it was decided that it would contain the following data categories: main term, subject field, part of speech, status, full form/abbreviation, definition, synonyms, related terms and the Polish equivalent, whereas the Polish-English dictionary provides: main term (alternative form), part of speech, subject field, definition, synonyms, related terms and the English equivalent;
d) the dictionary is bilingual, thus information in the English-Polish dictionary is given in English (apart from the equivalent), whereas in the Polish-English dictionary the main language is Polish (apart from the English equivalent);
e) the dictionary includes subject field specification, where relevant, as many terms in the field of photogrammetry are borrowed from overlapping disciplines, e.g. computer vision;
f) the uniform system of writing up definitions was established. A traditional definition consists of a *genus* term, which specifies what sort of thing the entity is, and any number of *differentia*, which distinguish the entity from members of related sets (Hanks 2006: 399). It was established that definitions in the new dictionary may start from hyperonyms (more general words), holonyms (words denoting the whole) or entity type (ontological category that the conceptual constituent represents such as EVENT, STATE, THING, PROPERTY, PLACE, etc). (Kwiatek 2013: 55). Definitions from the original glossary can be re-used only if they meet these criteria;
g) cross-references from the original glossary showing relations between concepts are used in the new English-Polish dictionary after their validation;
h) the Polish-English dictionary is created by translating the English-Polish dictionary. The conceptual mismatches identified at the translation stage are solved at the revision stage of the project.

4. Terminology project

The terminology project involved three stages:

- translation (carried out by students),
- revision (carried out by the project coordinator, i.e. the author of the chapter),
- customer review (carried out by field experts).

It is important to note that so far two stages of the terminology project have been completed – the translation stage and the revision stage. The project is currently being consulted by field experts, so the excerpts from the dictionary do not include corrections made by experts.

4.1. Translation

The task of translating the glossary was entrusted to a group of 15 MA students within the Specialised Translation Module. It was organized as a team translation project. At the beginning of the project, the workload (882 entries) was divided into 15 parts, thus each student was assigned 58 entries.

To ensure a consistent data entry format, a table was created in Google docs containing the columns which reflect the microstructures of the English-Polish and Polish-English photogrammetric dictionaries described in section 3. The form was available online, and students were required to populate the fields with relevant information. Most of the information came from the original glossary, i.e. definitions, cross-references, synonyms. The note on orthography was omitted as only correct and valid forms of the terms are used (deprecated forms are omitted in the table). Moreover, the identification of the source of the term was disregarded.

After preparing the table, students were requested to verify the lexicographic correctness of definitions. When this part was completed, their next task was to translate terms, definitions, synonyms, and related terms into Polish.

The students did not have any background in photogrammetry, which is a very narrow but rapidly evolving discipline. They were instructed on quality lexicographic and terminology sources they needed to consult in the search for equivalents. These sources include the photogrammetric dictionary by Kurczyński (2014), *Słownik naukowo-techniczny angielsko-polski* "English-Polish Dictionary of Science and Technology" (Berger et al. 2018) and *CEON Biblioteka Nauki*[2], which is a Polish database of research paper abstracts that includes many abstracts in Polish and English. Students were also encouraged to browse web pages to identify more problematic terms and their equivalents. It is a very common phenomenon to encounter difficulties when looking for terms in the fields of computer vision and photography as no dictionaries were published for those fields (Łukasik et al. 2018).

During the translation stage various types of problems were identified. For certain terms such as *blobs, interest points,* or *pushbroom,* no equivalents could be found in the available photogrammetric or scientific dictionaries. However, by the analysis of their definitions and related concepts, it was possible to establish that *pushbroom* is a type of scanning along the track which is contrasted with *whiskbroom* scanning (which is scanning across the track). They are metaphors that prove the hypothesis that scientific language is highly metaphorical in nature (Locke 1992).

When looking for equivalents, it also turned out that different researchers in Poland use different terminology, e.g. Kurczyński (2014) translates "feature-based

2| http://yadda.icm.edu.pl/yadda/search/general.action?cid=bcc354ff-17fc-4870-b22a-025aadbf926a, accessed: 05.03.2019.

matching" as *dopasowywanie obrazów cechami*, whereas Chwastek and Mikrut (2006) use *korelacja obrazów oparta na cechach*. The question arises as to which solution is correct. The most sensible approach seems to be to select one of these solutions and use it consistently throughout the whole glossary as many other concepts are related to feature-based matching, e.g. *surface-based matching* and *object-based matching*. Using diversified terminology would cause unnecessary confusion.

Additionally, when splitting information included in the original entries into the appropriate columns in the Word form, it turned out that some terms were not provided with definitions but only include the full form of the term, e.g. *BRDF* (Figure 2). Students did not notice this fact and used full forms in the full form and definition columns.

BRDF bidirectional reflectance distribution function. *PR* 29(146): 144; 26(134):229

Figure 2. Entry BRDF in the original glossary

Last but not least was the problem of circularity. Most of the terms appeared in the glossary not only as its entries, but also as cross-references to other terms. Therefore, close cooperation between students was necessary in order to provide identical equivalents for the same entries. Ideally, terms should be translated before translating definitions and related terms, and these translations should be spread among the group members and used consistently. However, students worked at different paces – some had their entries ready in the second week of the project, but there were many who did not start working on their parts until the very end of the semester. This resulted in many incongruities and mistakes to be corrected by the reviewer.

4.2. Revision

At the beginning of the revision phase the table created in Word was converted into the English-Polish and Polish-English glossaries using the Mail Merge tool in Word. Then, the author of the paper had to verify correctness, completeness, cohesion and symmetry of the English-Polish and Polish-English dictionaries.

It turned out that lack of professional knowledge in the field of photogrammetry affected the translation quality. In some cases, it was evident that students depended upon unreliable sources as some equivalents were quite bizarre. *SIFT* 'scale-invariant feature transform' was translated as *skalo-zmiennicze przekształcenie cech* 'feature transformation caused by the change of scale' (translation provided by Wikipedia), whereas researchers in the field use *algorytm SIFT* 'SIFT algorithm'. When dealing with abbreviations, typically the English terms are used as Polish equivalents preceded by a word indicating the entity type, e.g. method, technique, error, etc.

The revision also involved writing up definitions of the terms when students neglected them and copied the full form of the term into the definition field, e.g. for BRDF (Figure 3). Definitions were first written in English and then they were translated into Polish.

BRDF (n.)
full name: bidirectional reflectance distribution function
def: Function of jour real variables that defines how light is reflected at an opaque surface.
PL: dwukierunkowa funkcja rozkładu odbicia

Figure 3. Entry BRDF in the English-Polish photogrammetric dictionary

Some definitions were spotted as incorrect or containing some inconsistencies, e.g. *Euler angles* defined as 'Conventional angles in a given sequence about the X, Y, Z axes (x, φ, j) to form rotations', whereas the angles are marked in the literature as (ω,φ, κ).

There are also flaws in the Polish lexicographic sources on photogrammetry as they seem not to make any distinction between *DEM* (Digital Elevation Model) and *DTM* (Digital Terrain Model) and translate both of them as *NMT* (Numeryczny Model Terenu, i.e. Digital Terrain Model). The difference between the two is that *DEM* is a 'bare earth' elevation model, unmodified from its original data source which is supposedly free of vegetation, buildings, and other 'non ground' objects, and *DTM* is a *DEM* that has been augmented by elements such as breaklines and observations other than the original data to correct for artifacts produced by using only the original data. Thus, *DEM* should be translated as *Cyfrowy Model Wysokości* (*Digital Height Model*). This translation was found in some abstracts but it should be popularized, as it shows the difference between the two.

The next problem encountered at the revision stage comprised polysemous entries. Some entries under the same term have different meanings in different fields, e.g. *EO* means *earth observation* in remote sensing and *exterior orientation* in photogrammetry. They were treated as one entry in the original glossary but they represent different concepts. In line with the concept orientation and term autonomy principles (Schmitz 2006), they were treated as separate concepts and separate entries in the new dictionary.

The analysis of definitions and cross-references also revealed that some headwords should be added to the dictionary to fill in the holes in the network of concepts. For example, the original glossary includes only such a term as *ultra-wide lens*, whereas the new dictionary lists all types of lenses: standard lens, ultra-wide angle lens, fisheye lens. It even includes the entry *lens* as the hyperonym for different types of lenses.

The Polish-English photogrammetric dictionary contains 854 entries which is fewer than in the English-Polish dictionary. It results from the fact that synonymous entries such as *patch / image patch / blob* have just one equivalent in Polish (i.e. fragment obrazu).

4.3. Customer review

The customer review stage to be conducted by field experts will depend on further revision and correction of the dictionary by experts from different fields. The glossary includes terms from such disciplines as surveying, photogrammetry, remote sensing, optics, photography, and computer vision, so it is reasonable to consult experts from many different fields. It may help to establish whether the newly created definitions are correct for concepts in these fields and to discover lexical gaps, when the concept is known in the target language but is not lexicalized.

5. Conclusions

The terminology project proved to be very challenging both at the translation and the revision stage. The compilation of the dictionary requires close co-operation of translators, lexicographers and experts from different fields.

In summarizing the translation part, a question may arise about whether non-specialists are able to translate a highly-specialised glossary. Around 30% of the students followed guidelines for writing definitions, used the lexicographic sources they were provided with, closely cooperated with each other, and did in-depth research when it was necessary, proving that it is possible to produce the high-quality dictionary sample. There was also a group of students (around 40%) who did not bother writing new definitions, understanding terms and concepts or consulting dictionaries and simply provided direct translations. Finally, there was also a group of so-called 'average students' who used the lexicographic sources correctly but did not have the translator's insight and did not manage to analyze the available data to write correct definitions or to predict what other, similar terms could mean.

The revision stage was necessary to increase the quality of the new dictionary, but the customer review phase is absolutely essential to eliminate terminological and translation errors and to ensure the complete network of concepts.

As a result of the project, a monolingual glossary of photogrammetric terms, which is a type of hybrid dictionary, as it provides definitions only for some entries and is useful to a very narrow group of experts, was transformed into the fully bilingual, systematic English-Polish, Polish-English dictionary which comprises uniform definitions and cross-references to related concepts and can be used by experts from different fields and by translators.

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