Representation of Figurative Terms in Specialized Lexical Resources (Short Paper)

Ana Ostroški Anić*

Institute for the Croatian Language, Republike Austrije 16 HR-10000 Zagreb, Croatia

Abstract

The paper presents a proposal for representing figurative terminological units in an online frame-based specialized database in the field of aviation. The process of extracting and analyzing figurative terms and their constructions is described on examples of aviation terms related to the concept of AIR TRAFFIC.

Keywords

aviation terminology, figurative terms, metaphorical terms, terminological resources

1. Introduction

The management and representation of figurative terms and the constructions or multiword expressions they form, to which we jointly refer as *figurative terminological units*, vary depending on the type and purpose of a specialized resource. Although contemporary terminological work reflects the close link between knowledge-based and lexicon-based approaches to terminology, which has been steadily strengthening with the rising need to link general language and specialized knowledge resources [1], [2], there still remains the difference in the way the linguistic level of specialized categories is represented in different resources.

One of these differences concerns the way non-defining terminological units, e.g. multiword expressions (MWEs), are represented. In many terminological resources, such units are referred to as phraseological terminological units or simply phraseological units, and they include collocations, phrases, and predicate-argument constructions (e.g. ARTES database, https://artes.app.univ-paris-diderot.fr/). In knowledge-based or "traditional" terminological resources, a multiword expression is defined as a single unit when it denotes a specific concept in the conceptual framework of the field. In lexicon-based or lexical resources, however, one MWE can be listed under different terms because its constituents are defined individually. The definition of terminologically-relevant multiword expressions has important consequences on the way they are recorded in specialized resources [3], but apart from the definition, one must also take into account the purpose of including them in the resource.

This paper presents a proposal for the analysis and representation of figurative terminological units in an online frame-based specialized database in the field of aviation. Terminological units, including both figurative terms and their constructions or MWEs, are all aviation terms related to the concept of AIR TRAFFIC.

2. Theoretical background

In traditional terminology work, metaphorization is one of term formation processes, but terms created this way are often considered not accurate or specific enough to be used as preferred terms in specialized discourse. This understanding of metaphorical terms overlooks their important function in forming and propagating theories, which was greatly promoted by philosophers of science. Boyd's work [4] on a typology of metaphor in science particularly had a great impact on perceiving metaphor as a mechanism for shaping and describing new concepts. His typology of scientific metaphors, which distinguishes between constitutive, heuristic, and pedagogical functions of metaphors, introduced a significant innovation by describing the function of metaphor not only in scientific discourse but also in popular science discourse addressed to non-experts. While constitutive scientific metaphors participate in establishing theory by allowing scientists to "express theoretical claims for which there are no corresponding literal paraphrases" [4], heuristic metaphors assist in elaborating on concepts and theories introduced by constitutive metaphors. Both types of metaphorical expressions over time cease to be perceived as metaphorical and become full-fledged terms. However, this does not hold true for pedagogical or explanatory metaphors, which convey, explain, or illustrate concepts, mainly to laypeople or beginners in a specific domain. Therefore, pedagogical metaphorical expressions can mostly be found in textbooks and popular science texts, and in discourse aimed at introducing readers to a particular domain or discipline, which makes them an apt device in adapting expert texts into reader-friendly versions specific for "citizens' language" advocated by the European Parliament [5].

Knudsen [6] simplified Boyd's typology into two fundamental functions, constitutive and pedagogical, and challenged it by noting that the boundaries between them are not as clear-cut as suggested. A metaphorical expression serving a pedagogical function in the text can often be replaced by another expression (i.e., a term), whereas the same cannot be applied in the case of using a metaphorical constitutive expression. A true constitutive metaphor is thus irreplaceable because it not only has a proper place in the vocabulary of a specific domain, but also in a particular mental model [6].

A more systematic application of cognitive linguistic research on metaphor in specialized knowledge domains started only towards the end of the 1990s, but it flourished in the first two decades of the 2000s, e.g. [7], [8].[2] Within the cognitive approaches, frame-based approaches to lexical organization certainly take the lead, whether in forms adhering more closely to the original lexical theory of Frame Semantics or being closer to its terminological application, Frame-Based Terminology. Incidentally or not, in metaphor studies, frames have also re-emerged as the preferred mode of organization of conceptual knowledge. A number of different applications of Frame Semantics to specialized resources have been developed in order to

---

[2] For a recent overview of the research on conceptual metaphors in terminological studies, see Ureña [9].

provide a methodological connection between the linguistic and conceptual level of specialized knowledge, e.g. [10], [11], [12]. Since the domain of aviation is typically characterized by events, activities and processes, FrameNet's methodology of describing knowledge categories in terms of structured inter-related semantic frames [13] seemed particularly appropriate for the definition of this field. Given that many aviation terms are inherited from nautical terminology, a great deal of figurative terms with this etymology can serve as evidence of links between different registers as well as different, but related professional domains.

3. Extracting and validating figurative terms

3.1. Data

Figurative terms analyzed here are taken from two different sources based on corpus data. The first source is a small corpus of aviation texts in English, compiled of five manuals from the domain of air traffic management, covering topics such as airport planning and management, air traffic control, instrumental flight procedures, and general aviation and aviation computer navigation. All manuals were published between 2006 and 2011. The corpus consists of 753,656 tokens, and it was compiled and analyzed using Sketch Engine tools [14]. Considering that air traffic management is a subset of aviation introduced to non-experts or students after acquiring certain knowledge about aviation through exposure to other areas, it can be concluded that the textbooks and manuals chosen for corpus compilation are not intended for complete beginners and laypeople.

The second source of data was a glossary of aviation terms and collocations [15], which was compiled on the basis of data extracted from another corpus of pedagogical and other materials for pilots and air traffic controllers [16]. The list of terms and lexical combinations comprises around 10,000 different entries, from which 91 MWEs containing the term *air traffic* were extracted for this analysis. Since the glossary served mainly as reference point for the validation of extracted term candidates, we will focus in the remaining sections to describing the process of validating figurative term candidates.

3.2. Criteria for determining figurative terms

The process of determining figurative terms in the domain of aviation included both a knowledge-based, top-down approach of defining key concepts in the domain, as well as a lexicon-based, bottom-up standard method of term extraction by means of keywords extraction and a fine-tuned concordance analysis using tailored regular expressions [17]. The manual analysis of the word sketches of 50 most frequent terms from the corpus was also performed.

In addition to using personal knowledge of aviation and the air traffic domain,[3] the following criteria were applied in deciding what qualifies as a term:

1. the presence of a definition or explanation in the immediate linguistic context (i.e., the extended context displayed in the concordance in Sketch Engine), as in example (1):

---

[3] The author used to teach Aviation English university-level classes, and is an accredited Aviation English rater and examiner, which puts her in the position to be considered a semi-expert.

A flight level (FL) is defined as a level of constant atmospheric pressure related to a reference datum of 29.92 in. Hg. Each flight level is stated in three digits that represent hundreds of feet.

2. the existence of synonyms or acronyms in the immediate linguistic context, as in example (2): *The transition level (QNE) is the lowest flight level available for use above the transition altitude.*
3. the term is listed in terminological databases that contain aviation terminology, e.g. Struna (struna.ihjj.hr) and Termium Plus (www.btb.termiumplus.gc.ca), as well as in aviation dictionaries and manuals
4. expert validation.

The question of labeling a term as metaphorical and the challenge of distinguishing figurative from denotative meanings pose several difficulties, as the answer can be approached from various perspectives. Ureña emphasizes that the "the conceptual and psychological reality of specialized metaphoric thought is contingent on the type of user of these metaphors and the discourse context" [18]. He distinguishes metaphorical processes and their outcomes according to the people to whom they are inherent. Therefore, metaphoricity can be determined from the perspective of an expert who first names a specific concept, from the viewpoint of an expert proposing a metaphorical equivalent to an existing opaque term, and that proposed solution becomes a terminological unit, as well as from the perspective of a layperson who is introduced to a specialized field for the first time [18]. Additional perspectives could be considered, but those are not relevant for the analysis.

If we analyze terminological units from the expert's perspective, a significant number of terms would likely not be labeled as metaphorical because they have become conventionalized, and the original motivation for the metaphorical mapping is no longer known. However, even if experts may not consider them metaphorical, it does not mean that these expressions do not reflect metaphorical mappings. We decided to approach the analysis from the perspective of an expert, i.e. a semi-expert. The author's specific background of being a linguist with a professional experience in the aviation domain justifies suggesting author's intuition as a valid first criterion in distinguishing metaphorical from literal meaning.

Therefore, in determining the figurative meaning, we applied the following criteria:

1. author's intuition in examples of explicit linguistic metaphors, e.g. *airspace boundary, air traffic density,* or *overcrowded airspace*
2. validation of figurative meaning in specialized resources
3. validation in the linguistic context in concordances, i.e., in definitions and explanations as explicit interpretations of motivation
4. validation of the primary meaning of lexical units that make up multiword terms or constructions in general language dictionaries (following the MIP method [19])
5. consultation with experts for their opinion on the origin of terms
6. review of images found in online resources as a visual description of the concept denoted by the term.

A list of 658 potentially figurative terms and collocations was first obtained applying the first criterion only. In the second phase of analysis, the remaining criteria were also applied,

resulting in the final list of 287 English figurative terminological units, and their linguistic contexts.

4. Results and discussion

Multi-word terms and linguistic constructions containing the term *air traffic* that are marked as figurative can be divided into several groups based on the lexical units that serve as carriers in linguistic metaphors. The terms of the first group are *air traffic flow* and *traffic volume*. Lexical units such as *flow* and *volume* are typical lexical units for the semantic frame `Rivers` or the domain of WATER, indicating the conceptualization of TRAFFIC as a river or the flow of water.[4] This is confirmed in examples of constructions expressing the characteristics of a river flow (e.g., *moderate traffic, smooth flow of traffic*), fundamental features of water constituting the river flow (e.g., *air traffic density*), and constructions expressing actions of controlling or directing traffic flow (e.g., *control air traffic*). All these examples confirm the metaphorical mapping of the domain of WATER to the domain of AIR, which is not surprising in aviation terminology because of its strong origins in nautical terminology. We suggest that these examples give rise to the conceptual metaphor AIR TRAFFIC IS WATER. However, following Al-Azary et al. [20], we can also group them under a more general metaphor AIR MOTION IS WATER MOTION.

The second group consists of linguistic metaphors that indicate a strong connection between AIR TRAFFIC and AIRSPACE. AIR TRAFFIC itself is conceptualized as a structure with paths and routes (e.g., *air traffic structure, air traffic pathway, air traffic route*, and *traffic pattern*). However, it is more likely that this represents a mapping of elements from airspace in which traffic occurs, and the elements are then metonymically highlighted in the mentioned terms. Multiword terms and constructions confirming that AIR TRAFFIC is the content of AIRSPACE as a container include lexical units associated with the frame of `Air_traffic`, e.g. *amount of the traffic, air traffic growth, air traffic congestion, increase in traffic, a drop in air traffic*, and *air traffic separation*.

The remaining figurative terminological units related to AIR TRAFFIC indicate the existence of the conceptual metonymy AIR TRAFFIC FOR AIRCRAFT, which is a specification of the general level metonymy PROCESS FOR AN INSTRUMENT OF THE PROCESS. Terms such as *departing traffic, arriving traffic*, and *conflicting air traffic* do not refer to traffic itself but to aircraft departing from or arriving at an airport, and aircraft flying at the same level in opposite directions. Examples (3) and (4) also demonstrate the metonymic use of TRAFFIC instead of AIRCRAFT, as confirmed by the collocation *make a turn* (which requires a specific entity in the agent role) in example (3) and the verb *operate* in example (4):

(3) If all *turns* are *made* to the right, it is known as right traffic.
(4) Separation cannot be provided by ATC between IFR and VFR traffic when *operating* in areas where there is no radar coverage.

---

[4] The names of concepts are written in small caps, while the names of semantic frames are capitalized and written in the Typewriter font. All terms are written in Italics.

Additionally, terms *IFR traffic* and *VFR traffic* are actually substitutes for the terms *IFR flights* and *VFR flights*, indicating the concept of FLIGHT instead of TRAFFIC. However, since *IFR flights* and *VFR flights* are also metonymic terms (conceptual metonymy FLIGHT FOR AN AIRCRAFT), meaning 'aircraft flying in accordance with the IFR rules' and 'aircraft flying in accordance with the VFR rules', there is no need to interpret them as linguistic realizations of a double conceptual metonymy – TRAFFIC FOR FLIGHT and FLIGHT FOR AIRCRAFT. Figure 1 shows figurative AIR TRAFFIC terms and their constructions grouped according to cognitive mechanisms present.

5. Representing figurative terms in AirFrame

AirFrame is a specialized frame-based lexical resource of aviation terminology, consisting of semantic frames and frame elements (FEs) with their accompanying definitions and examples, types of frame elements, lexical units and frame-to-frame relations [21]. Semantic frames are defined according to the FrameNet's methodology adapted for terminological purposes, as for the category of frame element example. In AirFrame it does not illustrate valency patterns for lexical units appearing in the syntactic position of a defined element, as it does in FrameNet, but it resembles the category of context from a traditional terminology database. A defined FE is still placed within an actual linguistic context, which can act as an illustration of different phraseological or combinatorial characteristics of terms. The reason why figurative terms are a welcome addition to the database is that as linguistic manifestations of the conceptual mappings between two frames, they establish clear links between general and specialized semantic frames, making it easier to build frame-to-frame relations.

The proposed methodology of defining figurative terms is, however, not without certain limitations, particularly in terms of relying heavily on manual validation in resources or by consulting experts, both of which are often not at one's disposal. Automatic extraction of figurative term candidates could be possible with the use of lexical markers in querying corpora, esp. markers used for definition extraction, synonym detection or those suggesting that the term's meaning is not the same as the primary meaning either of the term itself or its constituents, e.g. *originally known as*, *derived from*, etc. Regardless of the methods used in detecting figurative language, knowing the domain and its basic conceptual organization remains the most important criteria for terminological analysis of any kind. That is why the analysis of a less technically oriented domain, e.g. music or linguistics, will focus less on activities and process as the key domain categories, and more or at least as much on abstract entities as key categories in the conceptualization of the domain.

Terminological units that are not proper terms as they do not denote another concept often provide valuable information about certain concept characteristics, and therefore, should be included in the terminological entry along with terms. The idea of explicitly identifying figurative terms as such in terminological and specialized lexical resources holds valid for several reasons. Since figurative terms can in many instances be replaced with their more transparent equivalents, including them in a database reflects the terminological variation in the field, and provides the users with an option to decide in which register and for which purpose they can use figurative terms.

	LINGUISTIC METAPHOR/METONYMY		LEVEL	CONCEPTUAL METAPHOR/METONYMY
Frame: Air_traffic				
ENGLESKI				
TERM	air traffic flow traffic volume		specific general	AIR TRAFFIC IS A FLUID PROCESS IS MOTION
CON.	*moderate* traffic air traffic *density* *expedite* traffic authorized to *control* air traffic *smooth flow* of traffic			
TERM	air traffic separation air traffic *congestion* traffic growth		specific (Container image schema)	AIR TRAFFIC IS THE CONTENTS OF AIRSPACE
CONSTRUCTION	*amount* of the traffic *increase* in traffic air traffic *decreased* *a drop* in air traffic *separate* air traffic *within* a designated airspace *reduce* air traffic *on* dense short haul *routes* *reduce* traffic on existing *airways*			
TERM	conflicting traffic arriving traffic departing traffic IFR traffic VFR traffic		specific general	AIR TRAFFIC FOR AN AIRCRAFT PROCESS FOR AN INSTRUMENT OF A PROCESS
CONSTRUCTION	an evasive maneuver to either *climb* or *descend* to avoid *conflicting* traffic if all *turns* are made to the right, it is known as *right* traffic automatically *sequencing arriving* traffic *separation* cannot be provided by ATC *betweeen* IFR and VFR traffic when *operating in* areas where there is no radar coverage			

Figure 1: Figurative terminological units in the frame AIR_TRAFFIC.

Explicitly identifying figurative terms as figurative helps promote the function of pedagogical metaphor in defining and explaining specialized knowledge, which is particularly relevant for the creation of instructive texts or other educational material. Finally, figurative terminological units as lexical instances of the cognitive mechanisms of conceptual metaphor and metonymy also reflect the transfer of our general knowledge and experience to the domain of specialized knowledge. For many NLP tasks, such as machine learning, text simplification, or figurative language generation, lexical resources that combine general and specialized vocabulary in

thematically organized semantic networks such as frames provide an invaluable source of both linguistic and conceptual information.

Acknowledgements

References

[1] M.C. L' Homme, C. Subirats, B. Robichaud, A proposal for combining "general" and specialized frames, in: Proceedings of the 5th Workshop on Cognitive Aspects of the Lexicon (CogALex – V), Osaka, pp. 156–165, 2016.

[2] Faber, P. et al. (2011): Linking specialized knowledge and general knowledge in EcoLexicon. In: Actes de la conférence Terminologie & Ontologie: Théories et Applications (TOTh) 2011. Annecy, pp. 47–61.

[3] M.C. L'Homme, Terminology and lexical semantics, in: P. Faber, M. C. L'Homme (Ed.), Theoretical Perspectives on Terminology. Explaining Terms, Concepts and Specialized Knowledge, John Benjamins, Amsterdam/Philadelphia, 2022, pp. 237–259.

[4] R. Boyd, Metaphor and theory change: What is 'metaphor' a metaphor for?, in A. Ortony (Ed), Metaphor and Thought, Cambridge University Press, Cambridge, 1993, pp. 481–533.

[5] K. Järve, Figurative terminology in IATE: Analysing the needs of professional users, in: G. M. Di Nunzio, G. M. Henrot, M. T. Musacchio, F. Vezzani (Ed.), Proceedings of the 1st International Conference on Multilingual Digital Terminology Today, Padua, 2022.

[6] S. Knudsen, Scientific metaphors going public, Journal of Pragmatics 35 (2003)1247–1263. doi:10.1016/S0378-2166(02)00187-X.

[7] R. Caballero, Talking about space: Image metaphor in architectural discourse, Annual Review of Cognitive Linguistics 1/1 (2003) 87–105. doi:10-1075/arcl.1.05cab.

[8] M. Tercedor Sánchez, J. M. Ureña, J. A. Prieto Velasco, Grasping metaphoric and metonymic processes in terminology, Jostrans. The Journal of Specialized Translation 18 (2012) 187–205.

[9] J. M. Ureña Gómez-Moreno, F. J. Ruiz de Mendoza Ibáñez, Conceptual metaphors, in: P. Faber, M. C. L'Homme (Ed.), Theoretical Perspectives on Terminology. Explaining Terms, Concepts and Specialized Knowledge, John Benjamins, Amsterdam/Philadelphia, 2022, pp. 377–396.

[10] A. Dolby, M. Ellsworth, J. Scheffczyk, BioFrameNet: a domain-specific FrameNet extension with links to biomedical ontologies, in: O. Bodenreider (Ed.), Proceedings of KR-MED. Formal Biomedical Knowledge Representation, Baltimore, 2006, pp. 87–94.

[11] V. Pilitsidou, V. Giouli, Frame semantics in the specialized domain of finance: building a termbase to translation, in: Z. Gavriilidou, M. Mitsiaki, A. Fliatouras, (Ed.), Euralex XIX. Lexicography for inclusion, 2020, pp. 263–271.

[12] J. Pimentel, Using frame semantics to build a bilingual lexical resource on legal terminology, in: H. J. Kockaert, F. Steurs (Ed.), Handbook of Terminology, John Benjamins, Amsterdam, 2015, pp. 427–450. doi:10.1075/hot.1.usi1.

[13] J. Ruppenhofer et al. FrameNet II: extended theory and practice, 2016, https://framenet2.icsi.berkeley.edu/docs/r1.7/book.pdf.

[14] Kilgarriff, Adam; Vít Baisa, Jan Bušta, Miloš Jakubíček, Vojtěch Kovář, Jan Michelfeit, Pavel Rychlý i Vít Suchomel. 2014a. The Sketch Engine: ten years on. Lexicography 1 (1), 7–36.

[15] M. Bratanić, A. Ostroški Anić, T. Radišić, Aviation English Glossary of Terms and Collocations, Fakultet prometnih znanosti, Zagreb, 2010.

[16] M. Bratanić, A. Ostroški Anić, Compiling lexical information for an aviation English dictionary, in: C. Heine, J. Engberg (Ed.), Reconceptualizing LSP. Online proceedings of the XVII European LSP Symposium, Aarhus School of Business, Aarhus, 2009.

[17] A. Ostroški Anić, Metafora u terminologiji [Metaphor in terminology], Institut za hrvatski jezik i jezikoslovlje, Zagreb, 2019.

[18] J. M. Ureña Gómez-Moreno, Metaphor in Specialised Language: An English-Spanish Comparative Study in Marine Biology, Ph.D. thesis, Universidad de Granada, Granada, Spain, 2011.

[19] Pragglejaz Group, MIP: A method for identifying metaphorically used words in discourse, Metaphor and Symbol 22/1 (2007) 1–39. doi: 10.1080/10926480709336752.

[20] H. Al-Azary, C. L. Gagné, T. L. Spalding, From the Sea to the Sky: Metaphorically Mapping Water to Air, Metaphor and Symbol, 35:3 (2020) 206–219. doi: 10.1080/10926488.2020.1804809.

[21] A. Ostroški Anić, I. Brač, AirFrame: Mapping the field of aviation through semantic frames, in: A. Klosa-Kückelhaus et al. (Ed.), Dictionaries and Society. Proceedings of the XX EURALEX International Congress, IDS Verlag, Mannheim, 2022, pp. 334–345.