revista.pucsp.br/esp | ISSN: 2318-7115

The Especialist

Volume 41 | Número 4 | Ano 2020

Aeronautical Meteorology in Aeronautical Language and in Aviation Language: a hybrid field?

Meteorologia Aeronáutica em Linguagem Aeronáutica e em Linguagem de Aviação: uma área híbrida?

Rafaela Araújo Jordao Rigaud PEIXOTO (DECEA)[1]
Janine Maria Mendonça PIMENTEL (PIPGLA-UFRJ)[2]

ABSTRACT

Although Aeronautical Meteorology language is not generally regarded as standard communication between air traffic controllers and pilots, it plays an important role in Air Traffic Control (ATC) communication since it comprises phraseology and plain language used to communicate weather phenomena which interfere in aviation operations. Then, this paper focuses on the meteorology terminology used by Brazilian experts and discusses whether Aeronautical Meteorology is a hybrid field. Based on the theory of lexical semantics for terminology proposed by L'Homme (2020), the syntactic and semantic properties of a small set of Portuguese terms were analyzed in two separate textual corpora, i.e. a corpus representative of Aviation language and a corpus representative of Aeronautical language. For that, the combinatorics of terms were examined by means of a concordancing tool and were categorized by means of semantic labels. Quantification and comparison of the results obtained seem to suggest that the behavior of the terms in the two corpora share a fair amount of similarities.

Keywords: Aeronautical Meteorology, Aviation, Terminology, Phraseology

RESUMO

Apesar de a linguagem da Meteorologia Aeronáutica geralmente não ser considerada comunicação padrão entre controladores de tráfego aéreo e pilotos, ela assume função relevante para a comunicação de Controle de Tráfego Aéreo (ATC), uma vez que compreende fraseologia e linguagem comum especializada para comunicar fenômenos meteorológicos que intereferem nas operações da aviação. Dessa forma, este artigo trata da terminologia utilizada por especialistas brasileiros para se referirem à Meteorologia Aeronáutica e discute se essa é uma área híbrida. Com base na teoria da semântica lexical para a terminologia proposta por L'Homme (2020), são analisadas as características sintáticas e semânticas de um pequeno conjunto de termos em português que ocorrem em um corpus representativo da linguagem da aviação e em um corpus representativo da linguagem aeronáutica. As combinatórias dos termos são examinadas por meio de um software de concordâncias e categorizadas conforme etiquetas semânticas. A quantificação e a comparação dos resultados obtidos parecem indicar que o comportamento dos termos nos corpora revela um grau razoável de semelhanças.

[1] Department of Airspace Control, Rio de Janeiro, Rio de Janeiro, Brazil. Subdepartment of Operations, Standards Division; ORCID: https://orcid.org/0000-0002-3504-8405; rafaela.peixoto@decea.gov.br.
[2] Federal University of Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, Brazil. Interdisciplinary Graduate Studies Program in Applied Linguistics; ORCID: https://orcid.org/0000-0001-6576-9898; janinepimentel@letras.ufrj.com.

Palavras-Chave: *Meteorologia Aeronáutica, Aviação, Terminologia, Fraseologia*

1. Introduction

Although Aeronautical Meteorology language about air traffic procedures is not generally regarded as standard communication between air traffic controllers and pilots, it plays an important role in Air Traffic Control (ATC) communication as it comprises phraseology[3] and plain language used to communicate weather phenomena which interfere in aviation operations. As a highly specialized field, Aeronautical Meteorology is critical to flight safety, because weather phenomena may pose major threats to all flight operations. The use of specialized language, whether phraseology or plain English, definitely contributes to risk management within this context. However, it is not clear if Aeronautical Meteorology terms share the same contextual meaning when used in Aeronautical language and in Aviation language.

This paper attempts to shed some light on that issue by comparing a small set of Aeronautical Meteorology terms, specifically regarding the way in which they are used by Brazilian experts. Since using corpora of ATC oral communication is more sensitive, we decided to use written texts published by experts of those two subsets of specialized language[4]. Although this is a small study, it is hoped that it will further the understanding that using a specialized language is not limited to knowing just a specific subset of this language, which comprises applied terminology, but it also involves the ability to understand terms within a broader textual environment.

In line with the viewpoint expressed in a recent publication by L'Homme (2020), this paper argues that one needs to consider the linguistic expressions used by experts of a given subject field, in order to study terminology. The author explains that terminology studies should not be restricted to concepts only because terminology is "deeply rooted in applications, such as specialized dictionary compilation, specialized translation, document indexing and/or classification, knowledge modeling, language planning, and standardization" (L'HOMME, 2020, p. 6) and, therefore, "[a]ny terminological analysis (regardless of the approach) must inevitably deal with linguistic content" (*ibidem*). Terms as linguistic expressions represent meanings or concepts that may very well undergo all kinds of variations (diachronic, diatopic, etc) and are not free from "polysemy, ambiguity or vagueness" as Condamines (2010, p. 43) reminds us.

Based on the theoretical foundation of lexical semantics for terminology (L'HOMME, 2020), our study analyzes ten key terms of the Aeronautical Meteorology phraseology used in radiotelephony, as

[3] 'Phraseology' refers to the set of standardized language, tailored for air traffic control (ATC) purposes, with specialized syntactic, semantic and phonological features, to be used during radiotelephony. The characteristics of ATC communication are prescribed in Doc 9835 (2010) and in Doc 4444 (2016), published by ICAO.

[4] In this paper, Aeronautical language and Aviation language are considered two "subsets of specialized language" since they are both part of a continuum of specialized language used within the aviation context.

mentioned in ICA 105-12[5] (BRAZIL, 2014): '*areia'* ('sand'), '*chuva'* ('rain'), '*granizo'* ('hail'), '*neve'* ('snow'), '*nevoeiro'* ('fog'), '*nuvem'* ('cloud'), '*temperatura'* ('temperature'), '*turbulência'* ('turbulence'), '*vento'* ('wind') and '*visibilidade'* ('visibility'). Two corpora are used to compare and contrast the semantic and syntactic patterns of these terms, so as to verify whether their use is identical in Aeronautical language and in Aviation language. The paper is organized as follows: section 2 defines Aeronautical language and Aviation language, by focusing, briefly, on their historic development as fields of specialized communication and research; section 3 specifically focuses on the Meteorology field as well as on the reasons that contribute to it possibly being a hybrid field; section 4 discusses the theoretical principles that guided the methodology designed to carry out this terminology study; section 5 describes the methodology which combined corpus methods with the theoretical principles of lexical semantics for terminology; section 6 presents and discusses the results obtained; and, finally, section 7 draws final remarks about the investigation.

2. Aviation and Aeronautical languages: from controlled languages to LSP

The concept of Language for Specific Purposes (LSP) has evolved throughout the years from the need to have a "standardized" controlled language to the understanding that specialized language follows a systematic way of communicating, which still comprises an applied terminology but also some common language (plain language) used within this specialized context. As Crabbe (2017) explains, the first definition of a controlled language was proposed in 1930 by Ogden, a British Linguist who designed "Basic English" to be an international language so as "to allow non-English users to learn English in the shortest time possible and to regularise the English of native English users [...] by reducing all the rules and vocabulary of English to just ten rules and 850 words" (CRABBE, 2017, p. 25).

Several decades later, in an effort to make communication more effective and to facilitate translation activities, companies worldwide created other controlled languages, such as Caterpillar Fundamental English (1972), Perkins Approved Clear English (1980), Ericsson English (1983), Nortel Standard English (1993) and Bull Controlled English (1993), whose features are discussed in Crabbe (2017). Although some of them considered other linguistic characteristics[6], such as the content-load of phrases, all these controlled languages follow a very similar pattern to the Basic English first proposed by Ogden, and were disseminated in Europe and in the United States mostly due to the widespread diffusion of technical documents ("technology-related publications") during the industrial revolution, first in

[5] It is a publication on VOLMET phraseology, i.e. aeronautical meteorology phraseology to be used in radiotelephony communication, as published by the Department of Airspace Control (DECEA).
[6] Characteristics of a controlled language are classified by Bloor and Bloor (2004) in six categories: grammatical, information load, information structure, lexical, stylistic and syntactic (Cf. CRABBE, 2017).

Britain, then in the United States and in Germany (CRABBE, 2017).

This need of standardizing language for technical purposes is mentioned by Brazilian researcher Bocorny (2011), who explains how English was formally defined as lingua franca in the regulations issued by the International Civil Aviation Organization (ICAO) and consolidated during the period from 1944 to 1977. The classification of a language as a lingua franca is sometimes entangled with the perspective of a language for specific purposes. On this issue, Estival and Farris (2016) make some considerations regarding the definitions of Aviation English (AE) and of English as a Lingua Franca (ELF). While Aviation language can be considered a lingua franca (a working language) and a variety of English, ELF is not the same as AE (ESTIVAL; FARRIS, 2016), since EFL is a less stable register, and by definition it is a language used by speakers with no common language, i.e. non-native English speakers (NNES).

Nonetheless, nowadays, native English speakers (NES) may also be included as users of ELF, according to an "expanded view of EFL", as explained by Estival and Farris (2016), but NES are required to adapt to specificities of ELF, since some phonological and even syntactic rules differ from general English, in order to avoid errors and misunderstandings, and also promote a more efficient radiocommunication. For example, phonemes and lexical stress of numbers are tailored for that purpose in the aeronautical context, as in the case of numbers 'three' (pronounced /tree/), 'four' (pronounced /fower/) and 'nine' (pronounced /niner/). Regarding syntax, some determiners and prepositions are ommited, as in the case of 'to', as a way to avoid confusion with 'two' or 'too' (Cf. ESTIVAL, 2016). Nickerson (2013) adds to this discussion by saying that "native speakers of English tend to cause difficulties in interactions where ELF is being used" (NICKERSON, 2013, p. 451).

Estival (2016) argues that Aviation language should be regarded as a lingua franca, and not just specialized language, because there are specific features of this specialized language, especially concerning ATC communication, which would be rendered incomprehensible even for native English speakers (NES) without proper training. As a comparison, Business English has jargon and specialized vocabulary but would not be unintelligible to a NES while Aviation English requires users to "learn not only the special vocabulary and the scripted phrases, but also the specialised pronunciation and the organization of the speaker turns" (ESTIVAL, 2016, p. 24).

Within this context, the widespread use of English as a Lingua Franca (EFL) in specific domains is believed by some authors, as Nickerson (2016), to have created the specialized category of English for Specific Purposes (ESP), which, in a broader context, refers to the specialized language aimed at addressing users' needs to make use of a language for specific purposes, differently from a general use of the language, and comprises the four abilities: reading, listening, speaking and writing. The key difference regarding this specialized use is being aware of those needs, something that may be taken for granted in

a general use of the language.

In her research on English for Specific Purposes (ESP), Bocorny (2011) explains that the paper "Language and Communication-Related Problems of Aviation Safety", by Steven Cushing (1988), was the first one to objectively relate language and flight safety. As a rising concern, the need for an expanded proficiency of specialized aviation language was debated, and motivated the publication of textbooks with tailored objectives for best preparing pilots and/or air traffic controllers: *Aviation English* (EMERY; ROBERTS, 2008), *Cleared for takeoff: English for pilots* (MARINER, 2008), *English for aviation* (ELLIS; GERIGHTY, 2008), *Check your Aviation English* (EMERY; ROBERTS, 2010), *Airspeak* (ROBERTSON, 2008) and *Flightpath* (SHAWCROSS, 2011). Within this scenario, the International Civil Aviation Organization (ICAO) also revised, in 2010, guidelines of its Doc 9835 to include plain English as a language proficiency requirement.

Aviation English is one of the aviation languages, whose characteristics are regulated by ICAO (Cf. ESTIVAL, 2016), and it includes three different specialized environments: terminology (as nomenclature, a list of isolated terms), written specialized texts contained in manuals and oral specialized texts of aeronautical phraseology.

Within the specialized aviation field, Tosqui-Lucks and Silva (2020) verified that the nomenclatures "Aeronautical English" and "Aviation English" have been used interchangeably. Based on Borowska (2017), the specificities of each were discussed and the authors proposed a distinction between "Aeronautical English" and "Aviation English", which has been applied in order to make a clear-cut reference to English used during radiotelephony and to English used in other situations. This distinction between Aeronautical English and Aviation English is described by Tosqui-Lucks and Silva (2020) as follows:

> The first is 'Aeronautical English', understood as the typical language of communication by radiotelephony, mainly between pilots and ATCO, but also between pilots, or between pilots and flight service professionals, always via radio, as a very specific way of communication, which comprises the use of standard phraseology and plain English for aeronautical communication. The second is 'aviation English', which serves to designate a broader concept, comprising several domains in which English may be used within the aviation context (TOSQUI-LUCKS; SILVA, 2020, p.110).[7]

[7] Original: "O primeiro é "inglês aeronáutico", entendido como a linguagem própria à comunicação por radiotelefonia, principalmente entre pilotos e ATCOs, mas também entre pilotos, ou entre pilotos e profissionais de serviços de apoio ao voo, sempre via rádio, como forma de comunicação muito específica, que inclui o uso de fraseologia padrão e de inglês comum para comunicação aeronáutica. O segundo é "inglês para aviação", que serve para designar um conceito mais amplo, abarcando vários domínios nos quais o inglês pode ser usado no contexto da aviação" (TOSQUI-LUCKS; SILVA, 2020, p.110). All translations by the authors of this paper, unless otherwise noted.

Regarding Aeronautical English, it comprises both phraseology and plain English used during radiotelephony. Phraseology accounts for a formulaic language designed to have a one-way interpretation, without room for ambiguity or comprehension hindrance due to possible elision of words, for example. Doc 9835 (ICAO, 2010) defines it as "the formulaic code made up of specific words that in the context of aviation operations have a precise and singular operational significance" (ICAO, 2010, p. 6). Therefore, this set of language is limited, having approximately 200 words typically used by pilots and some 200 words typically used by air traffic controllers during air traffic communication (Cf. TAJIMA, 2004; TOSQUI-LUCKS et al., 2016). In contrast, plain English is the specialized aeronautical language used freely – beyond phraseology, during radiotelephony within an ATC environment – and it does not comprise general English used in daily activities. On this issue, ICAO (2010) states in Doc 9835 that:

> Plain English in aeronautical radiotelephony communications means the spontaneous, creative and non-coded use of a given language, although constrained by the functions and topics (aviation and non-aviation) that are required by aeronautical radiotelephony communications, as well as by specific safety-critical requirements for intelligibility, directness, appropriacy, non-ambiguity and concision (ICAO, 2010, p. 3-5).

As for the use of specialized aeronautical and aviation language in this high-stake environment, Pacheco and Gonçalves (2017) show how linguistic elements related to the pragmatic use of language were more determinant in cases of aeronautical accidents. For their study on communication problems which occurred in accidents, as debated in Cushing (1997), Gonçalves and Pacheco focused on ten aeronautical accidents in which linguistic aspects were more significant. From those, 80% of accidents were related to pragmatic causes; 30% were related to phonetic and phonological causes; 10% were related to syntactic causes; and 10%, to semantic causes [8]. This study shows how the mere use of phraseology is insufficient to avoid communication problems, an understanding which already prompted ICAO to revise their Doc 9835 in 2010, as mentioned before, and to include the use of plain English as a linguistic proficiency requirement for pilots and air traffic controllers. It also shows that the original concept of controlled language, as idealized at first (Cf. CRABBE, 2017), did not foresee the pragmatic nature of language, something which is currently verified as the main source of communication issues.

Based on these findings, it seems that it is necessary and extremely relevant to analyze Aeronautical Meteorology terminology in Portuguese, as used in radiotelephony communication in Brazil. Similarly to the situation concerning English, phraseology and plain language in Portuguese, within the context of air traffic control operations, also require an in-depth analysis of their characteristics, something which tends to be overlooked, as English is used more broadly.

[8] The categories shown here do not compete in this showcase, i.e. the percentages of all linguistic factors do not comprise 100%, since two or three linguistic factors may have contributed to cause the same aeronautical accident.

3. Aeronautical Meteorology: a hybrid field?

Considering the previous discussion, it seems that Aeronautical Meteorology, as a critical element to air traffic operations, corresponds to phraseology and to plain English, on the one hand, and to a broader use in the specialized aviation context, on the other. This raises the question whether Aeronautical Meteorology may be considered a hybrid field.

In fact, within this scope of language use, boundaries between General Meteorology and Aeronautical Meteorology are somewhat blurred, because the former is also used in applied meteorology subfields, as in the case of air or naval navigation. When aviation emerged in World War I, efforts were made to try to regulate this field, and meteorology, in particular, was a critical issue because unfavorable conditions posed imminent risks (Cf. DINES, 1917). At first, know-how from naval navigation was applied but long-term forecasts were not a reality yet, mostly due to the limitations of instruments at the time. Dines (1917) clarifies that:

> The weather is, and must remain, a very important factor for many years to come. Since the foundation of the Meteorological Office under Admiral Fitzroy a large part of its business has been the issuing of storm warnings at certain selected coast stations for the benefit of shipping; and there is no doubt that such warnings during the fifty years or so in which they have been issued have been of great use, and indeed are so still (DINES, 1917, p. 424).

Only in 1919 was created an institution that focused on meteorology, i.e. the American Meteorological Society, which dealt with a wide range of applied subfields. As of the 1950's, aviation further developed and gained the sponsorship from the Air Force Cambridge Research Center in some projects. The first specialized congresses hosting aeronautical scientific discussions took place in the 1970's and 1980's, as the "Conference on Air-Sea Interaction" (now "Interaction of Sea and Atmosphere"), in 1971; the "International Conference on Aerospace and Aeronautical Meteorology", in 1972; the "(International) Conference on Meteorology and Air/Sea Interaction of the Coastal Zone", in 1978; the "Conference on Aviation Weather System" (now "Aviation Range and Aerospace Meteorology"), in 1981; and the "Conference on Meteorology and Air/Sea Interaction of the Coastal Zone (now Meteorology and Oceanography of the Coastal Zone)", in 1982 (Cf. SEITTER et al, 2019). The American Meteorological Society still remains one major institution fostering academic and commercial development of Aeronautical Meteorology in the US and in the world.

Within the context of aviation, meteorology has been considered a broader area while Aeronautical Meteorology is an applied domain with more specific purposes. The International Civil Aviation Organization (ICAO), for example, commonly refers to this segment of applied Meteorology as "Meteorology for International Air Navigation", as mentioned throughout "Annex 3 – Meteorological

Service for International Air Navigation" (ICAO, 2018), while "Aeronautical Meteorology" is more specifically mentioned when referring to METAR and SPECI figure codes[9] introduced by the World Meteorological Organization (WMO), and referred in Doc 10003 as "global aeronautical meteorological constructs" (ICAO, 2019), as defined in Annex 3 (ICAO, 2018) and in Doc No. 49-ii (WMO, 2018). The WMO also has a commission dedicated to aeronautical meteorological discussions, named "Commission for Aeronautical Meteorology (CAeM)", which comprises themes related to air navigation in specific and broader scopes, as focusing on meteorological services for aviation, and on governance guidance (Cf. WMO, 20-?).

Therefore, it can be said that, in reality, both General Meteorology and the applied domain of Aeronautical Meteorology are part of a continuum, working jointly to achieve the purpose of forecasting weather phenomena which affect air traffic operations. In this sense, an applied domain would be regarded as a field which aims at some economic return. In Malone's (1957) words,

> Basically, applied meteorology is the application of knowledge concerning the atmosphere to an operational decision or problem in a fashion such that the operation shall be optimized insofar as the weather factor is concerned. Frankly, it is expected to provide an economic return. It is our task to investigate how that economic return can be maximized. In essence, this almost invariably involves prediction (MALONE, 1957, p.152-3).

In Brazil, the Aeronautical Meteorology phraseology used in radiotelephony is regulated in institutional instructions of the Department of Airspace Control (DECEA), mainly in ICA 105-12 (BRAZIL, 2014) on VOLMET phraseology. But it is important to highlight that Aeronautical Meteorology language in radiotelephony is used by air traffic controllers and pilots when applicable, and does not have the participation of meteorologists, although those specialists may help through a specific channel if questions arise.

As explained by Barshi and Farris (2013, p. 1): "[c]ontrollers issue instructions, or clearances, to pilots, providing such information as altitudes, speeds, and navigation directions, as well as information about the weather and the flow of air traffic." In fact, weather information is so critical that controllers also need to provide pilots with updated reports on meteorological conditions (Cf. FARRIS; MOLESWORTH, 2016), something which is automated at busy airports (BARSHI; FARRIS, 2013) by means of an Automated Terminal Information Service (ATIS), to offer weather and airport information

[9] In Annex 3 (ICAO, 2018), there are 43 occurrences of 'aeronautical meteorological', 25 occurrences of 'meteorology' (from which only one is combined with 'aeronautical'), and other 722 occurrences of 'meteorological' without association to 'aeronautical'. This publication also mentions 'aeronautical meteorology' as some specific training for meteorological personnel, when informing in a note that "requirements concerning the qualifications and training of meteorological personnel in aeronautical meteorology are given in the Technical Regulations (WMO-No. 49), Volume I — General Meteorological Standards and Recommended Practices, Part VI — Education and Training of Meteorological Personnel" (ICAO, 2018, p. 2-2).

as a recorded radio transmission. Nonetheless, both ATC and pilots need to have more vocabulary than phraseology, since the reporting of weather phenomena may also require a more contextualized description, as explained in the following excerpt:

> When weather conditions are unstable or changing rapidly, it is common for controllers to ask pilots for weather reports and then pass on that information to other pilots. Example (6) below illustrates such an exchange where the controller is inquiring about the cloud condition:
> (6a) Approach: Horizon niner uh is there still scattered layer below you?
> (6b) Horizon 9: Uh. scattered layers right about fie thousand feet here, but it's wide open over the river (BARSHI; FARRIS, 2013, p. 33).

Silva (2016) also mentions other situations where meteorological issues in air traffic communication were described in a freer way by pilots, as reported by participants (with codenames FOG and FBK) in her research:

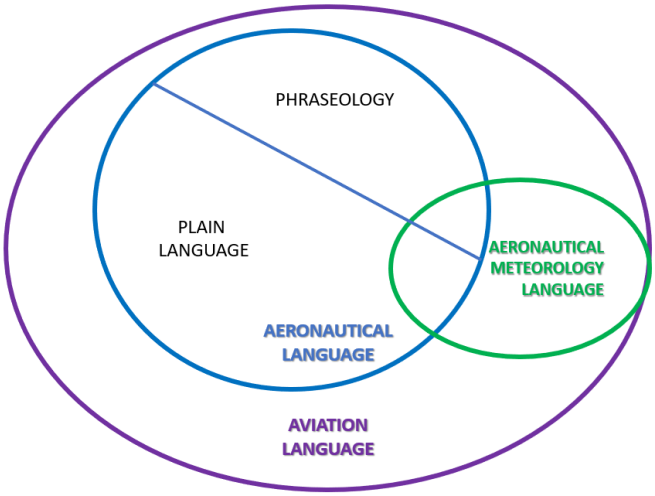
> 70. FOG [...] GENERAL ENGLISH helped me more than technical English, (+) [...] general English made me be understood by the (air traffic) control, you know' […] made them understand my needs, (+) [...] this was the most important to me, because it did not put at risk the safety of the Squadron (SILVA, 2016, p. 190, emphasis in original). [10]
> [...]
> 72. FBK: we several times got caught in bad weather when going to the United States (+) where the Squadron parted (+) eeh (+) there were some (+) let's say well, (+) éhh (+) the boss (+) the leader (+) had to talk to the controller (+) explaining what what (sic) happened (+) 'The Squadron here entered bad weather and some aircraft parted (+) but we are trying to regroup' (+) so those are things which (+) are a little beyond that (+) that formal aviation language, (+) because he has to report what is going on, (+) 'I entered a num cumbulus nimbus, [sic] (+) I caught a lightning' (+) and this had already happened to us indeed (SILVA, 2016, p. 191)[11].

Considering the ways in which Aeronautical Meteorology language is used in ATC situations, it is possible to hypothesize that this is a hybrid field at the interface of Aeronatucal language and Aviation language. One possibile visual representation of it can be found in Figure 1 below.

[10] Original: "70. FOG [...] O INGLÊS GERAL me ajudou mais do que o inglês técnico, (+) [...] o inglês geral fez com que eu me fizesse entender com o controle, (de tráfego aéreo) entendeu' […] fez com ele entendesse as minhas necessidades, (+) [...] isso pra mim foi o mais importante, porque não colocou em risco a segurança da Esquadrilha" (SILVA, 2016, p. 190, emphasis in original).

[11] Original: "72. FBK: nós pegamos várias vezes mau tempo indo pra os Estados Unidos (+) onde a Esquadrilha se separou (+) eeh (+) houve algumas (+) digamos assim, (+) éhh (+) o chefe (+) o líder (+) teve que conversar com o controlador (+) explicando o que que (sic) aconteceu (+) 'A Esquadrilha aqui entrou em um mau tempo e algumas aeronaves separaram (+) mas nós estamos tentando reagrupar' (+) então são coisas que (+) fogem um pouco daquele (+) daquela linguagem formal de aviação, (+) porque ele tem que relatar o que está acontecendo, (+) 'Entrei num cumbulus nimbus, [sic] (+) peguei um raio' (+) e isso já aconteceu de fato conosco" (SILVA, 2016, p. 191).

Figure 1. The hybrid field of Aeronautical Meteorology language



Hybrid fields may well be related to the phenomenon of multidimensionality which will be discussed in the next section. To test this hypothesis, it is argued in this paper that a valid starting point would consist in the investigation of how meteorology terminology is used by experts in the contexts of Aeronautical language and Aviation language. The following section presents the theoretical framework that was used to design the methodology of this study and analyze a small set of meteorology terms in those two contexts.

4. The study of Terminology: theoretical principles

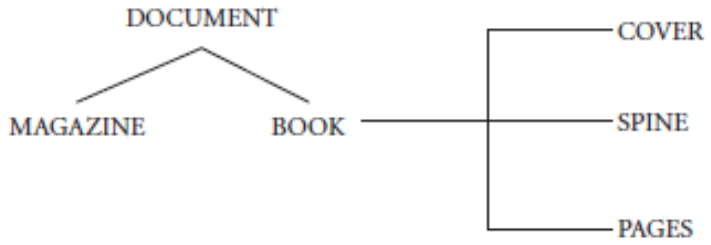
Terminology is a field of academic research that has long dealt with the study of concepts that pertain to specialist fields. Back in the first half of the 20th century, its founder, the Austrian engineer Eugen Wüster, proposed that terminologies should be standardized so as to eliminate ambiguity in the communication among experts within and across language communities. To achieve that, one of Wüster's theoretical principles was univocity, i.e. a given term should refer to one concept only and each concept should be expressed by one term only. That is why, nowadays, term banks that follow the Wüsterian approach create separate term entries whenever terms have distinct meanings. For example, the term 'distress' is considered an emergency in search and rescue operations (translated to Portuguese as '*socorro*') but only an imminent situation in air traffic operations (translated to Portuguese as '*perigo*') and would, therefore, be placed in separate entries in a term bank (Cf. PEIXOTO, 2020).

Eventually, most principles put forward by Wüster were challenged by terminology scholars that considered his proposal idealistic. In fact, contemporary terminologists have shown that terminological variation is unavoidable, incompatible with univocity, and a challenge to strict standardization. Diachronic and diatopic variation aside and, based on the classification by Condamines (2010), there are other kinds

of variation that are particularly relevant for the purpose of the study carried out in this paper, i.e. variation depending on textual genre and variation concerning points of view. The first one refers to genre conventions and their impact on the linguistic aspects of texts (e.g. register, terminology density), which are relevant not only for terminologists but for researchers working with Corpus Linguistics, in general.

As for the variation concerning points of view, Condamines (2010) explains that experts may not be aware that there are different facets for the same language referent, a phenomenon that is responsible for polysemy, because the meaning of terms may stem from distinct perspectives held by different groups of experts. Variation concerning points of view has also been called "multidimensionality" and it has been defined by many authors as the phenomenon in which certain concepts can be classified according to different points of view or conceptual facets, which has an impact in the way specialist fields are categorized and modelled. For example, Rogers (2004) creates the following figure to illustrate the "multidimensional view of the concept BOOK" (ROGERS, 2004, p. 220):

Figure 2. Multidimensional view of the concept BOOK



Source: Rogers (2004, p. 220)

According to this visual representation, the term 'book' can be classified as either a type of "document" or as having specific parts, i.e. "cover", "spine" and "pages". Another classic example of classification difficulties is 'tomato', which can be considered a fruit in the field of Biology or a vegetable in the field of Food Industry. A more complex example is given in León Araúz and Reimerink (2010), according to whom the term 'sand' can be conceptualized differently in the same field.

The last three decades have seen the developement of descriptive approaches to terminology by several researchers working from different parts of the world. Most of them have derived terminology from texts and based their selection and description of terms on authentic linguistic productions, because they argue that terms need to be examined in their linguistic, sociolinguistic and cultural context. In order to do that, they have proposed the application of different linguistic theories to the study of terminology (Frame Semantics, Sociolinguistics, Explanatorial and Combinatorial Lexicology, just to mention a few) and, often, they have used corpus methods stemming from Corpus Linguistics. In fact, corpora now hold

an important place in terminology work. In the field of Aviation English, for example, Prado's thesis (2015) focuses on the phraseological patterns in the surroundings of five lexical items ('runway', 'aircraft', 'emergency', 'fuel' and 'engine') found in a corpus of spoken communication in English. She uses the methodological principles of Corpus Linguistics to analyze concordancing lines and identify the lexico-grammatical structures in which those five lexical items occur.

The approach put forth here to analyze the aeronautical meteorology terms belongs to this group of descriptive research in terminology and it is called "Lexical Semantics for Terminology" (L'HOMME, 2020). As a combination of lexico-semantic frameworks and methodologies that are applied to most steps of terminology work, Lexical Semantics for Terminology deals with the authentic use of terms in textual corpora, it addresses issues of polissemy and identifies patterns of combinatorics (called "combinatorics") that contribute to the meaning of terms. A key concept in this approach concern "relations", categorized by the author as follows:

> […] ***relations*** between terms can be ***paradigmatic*** (in the lexicon or at a specific point in a sentence), or ***syntagmatic*** (between words that co-occur in the same sentence). Knowledge-driven approaches are usually interested in a set of relations that belong to the first category if those labels were used. If we want to take all relations into account, a more flexible system must be sought (L'HOMME, 2020, p. 32, emphasis in original).

In this approach, contexts are examined by means of concordancing software that helps identify the paradigmatic and syntagmatic patterns, i.e. the linguistic behavior of terms. Semantic labels, such as Agent, Patient, Instrument, just to name a few, are then used to capture generalizations across lexical items. For example, based on the inspection of a corpus on climate change, the term 'influence' is analyzed, then defined as: "Influence of Cause on Patient (*The* INFLUENCE *of external factors on climate*)" (p. L'HOMME, 2020, p. 137). This indicates that combinatorics of the term 'influence' may denote factors that have an impact (i.e. Cause) on something, most likely the environment or climate (i.e. Patient). Overall, this is a taxonomical means to represent semantic and syntactic relations between terms.

Although there are shortcomings in the use of approaches based on corpora, because these do not cover all information that experts possess, as well as in the use of this specific theoretical approach, because it does not capture domain knowledge the way other taxonomical approaches do, it may be regarded as a very robust framework for those researchers that are familiar with working with specialized texts. Therefore, its main principles will be combined with corpus methods in the research design described below.

5. Methodology

As mentioned, this paper uses the theoretical approach of lexical semantics to analyze Aeronautical Meteorology terms as they occur in Brazilian texts representative of aeronautical language and aviation language. Then, for the methodology design, it was decided that written texts published by experts of those two subsets of specialized language would be used, instead of oral communication, because the former are much less sensitive and more accessible than the latter. However, it is important to note here that Portuguese texts pertaining to the Aeronautical Meteorology field are much scarcer when compared to the high number of texts written in English that are available (Cf. PEIXOTO, 2020).

Table 1 presents some information about the corpus compiled for this research and it shows that the total number of words (i.e. word tokens) is much lower in the corpus of Aeronautical language as it was not possible to find and use more texts pertaining to that field.

Table 1. Aeronautical Meteorology Corpora

Corpus	Description	Nr. Texts	Word types	Word tokens
Aeronautical language (AER), in Portuguese	Institutional documents published by DECEA[12]	47	13.888	587.575
Aviation language (AV), in Portuguese	Academic documents, comprising theses, dissertations and books	344	99.760	9.123.593

Once the corpus was compiled, decisions had to be made on the terms that would be studied and how they would be analyzed, categorized, quantified and compared; so, for this research, the methodology stages were planned as shown in Table 2 below.

Table 2. Stages of the methodology design

#	Stage	Procedures
1	Selection of terms	Extraction of ten relevant key terms from ICA 105-12 on VOLMET phraseology, based on frequency and criticality of the weather phenomena.
2	Analysis of terms	Selection of the most recurrent combinatorics (nouns, verbs and adverbial clauses) and lexical relations in both corpora using the concordancing tool AntConc.
3	Analysis of combinatorics	Pattern categorization, attribution of semantic labels to the combinatorics and creation of graphical representations of the semantic types of combinatorics that occur in both corpora (separately).

[12] Department of Airspace Control.

4	Data interpretation	Quantification and comparison of the graphical representations. Discussion of the identified similarities and differences.

The selection of the terms themselves (stage 1, Table 2) was not based on the corpus, but on a document called ICA 105-12 (BRAZIL, 2014), on VOLMET Phraseology, written in Portuguese; and the following ten terms were selected for their relevance in air traffic operations: '*areia'* ('sand'), '*chuva'* ('rain'), '*granizo'* ('hail'), '*neve'* ('snow'), '*nevoeiro'* ('fog'), '*nuvem'* ('cloud'), '*temperatura'* ('temperature'), '*turbulência'* ('turbulence'), '*vento'* ('wind') and '*visibilidade'* ('visibility').

Then, by using the concordancing software AntConc (ANTHONY, 2018), the terms were analyzed in both corpora separately (stage 2, Table 2). The most frequent right and left combinatorics was selected – those that occurred at least twice in the Aeronautical corpus (AER) and more than four or five times in the Aviation corpus (AV). Combinatorial relations were categorized by means of semantic labels and graphical representations were built so that regularities among the selected terms could be more easily identified (stage 3, Table 2). In total, 28 labels were attributed to categorize the patterns of term combinatorics found in the AER corpus and in the AV corpus, as defined in the following Table 3.

Table 3. Description of semantic labels

#	Label [$n_{1,2,3}$]*	Description
01	CHARACTERISTIC [9] [6] [15]	It refers to the trait, quality or property of the meteorological condition. E.g. '~ *gelado'* ['cold ~']
02	CHARACTERISTIC / INTENSITY [9] [13] [22]	It is a label which combines the labels characteristic and intensity.
03	DIMENSION [7] [5] [12]	It refers to the size or dimension of the meteorological condition E.g. '~ *pequeno'* ['small ~']
04	DURATION [15] [-] [15]	It refers to the time elapsed since the beginning of the meteorological condition or continuously. E.g. '~ *durante a noite'* ['~ during the night']
05	EPISODE [18] [3] [21]	It refers to an occurrence as an episode or instances of the meteorological condition. E.g. '*registro de ~'* ['~ registration']
06	EPISODE / INTENSITY [-] [1] [1]	It is a label which combines the labels episode and intensity.
07	EQUIVALENT [-] [1] [1]	It refers to an equivalent term in another language. E.g. '*nevoeiro'* | 'fog' (EN)
08	FORECAST [2] [4] [6]	It refers to a forecast, observation or notification of a meteorological condition.

 DOI: 2318-7115.2020v41i4a2

		E.g. '~ *observada'* ['observed ~']
09	FORM [13] [6] [19]	It refers to the objective form of the meteorological condition, generally of concrete nature. E.g. '*pelotas de ~'* ['~ pellets']
10	INFORMATION FACTOR [2] [4] [6]	It refers to an information or data factor with the purpose of quantifying the meteorological condition in some way. E.g. '*dados de ~'* ['~ data']
11	INSTRUMENT [2] [1] [3]	It refers to instruments or devices used to measure or forecast a meteorological condition. E.g. '*sensores de ~'* ['~ sensors']
12	INTENSITY [1] [-] [1]	It refers to the level of intensity of a meteorological condition, generally associated with another feature (label). E.g. '~ *forte'* ['strong ~']
13	LAYOUT [26] [9] [35]	It refers to the layout or arrangement of the meteorological condition in the overall scenario. E.g. '*perfil vertical de ~*' ['~ vertical profile']
14	LAYOUT / INTENSITY [-] [1] [1]	It is a label which combines the labels layout and intensity.
15	LOCATION [25] [5] [30]	It refers to the location where the meteorological condition takes place, which can range from a cardinal direction or a geographical position, to a city or an airport. E.g. '~ *no aeroporto'* ['~ at the airport']
16	MOVEMENT [1] [7] [8]	It refers to movement or continuous occurrence of a meteorological condition. E.g. '~ *soprada'* ['blowing ~']
17	PARAMETER [10] [10] [20]	It refers to a standard used as comparison within a framework of meteorological conditions. E.g. '~ *mínima'* ['minimum ~']
18	PHENOMENON [12] [6] [18]	It refers to an occurrence which precisely characterizes the meteorological condition. E.g. '*precipitação de ~'* ['~ precipitation']
19	PHENOMENON / INTENSITY [1] [1] [2]	It is a label which combines the labels phenomenon and intensity.
20	PHENOMENON / INTENSITY + LOCATION [2] [-] [2]	It is a label which combines the labels phenomenon, intensity and location.
21	REFERENCE [15] [14] [29]	It refers to a standard used as spatial indication of a meteorological condition. E.g. '*altura mínima da ~'* ['minimum height of ~']
22	RELATED TERM [45] [32] [77]	It refers to another term which is semantically related to the term analyzed. E.g. '~ *e precipitação'* ['~ and precipitation']
23	TYPE [27] [7] [34]	It refers to a meteorological condition of a particular kind, class or group. E.g. *'~ da superfície'* ['surface ~']
24	TYPE / DIMENSION [1] [-] [1]	It is a label which combines the labels type and dimension.
25	TYPE / INTENSITY [1] [-] [1]	It is a label which combines the labels type and intensity.

26	UNIT OF MEASUREMENT [1] [1] [2]	It refers to a unit of measurement used to indicate a physical quantity regarding the meteorological condition. E.g. '~ *em (200) hP'* ['~ in (200) hP']
27	VARIATION [10] [6] [16]	It refers to a variable state of a meteorological condition. E.g. '*gradiente de ~'* ['~ gradient']
28	VARIATION FACTOR [3] [1] [4]	It refers to a factor which causes some variation of the meteorological condition. E.g. '*anomalias de ~'* ['~ anomalies']

***[$n_{1,2,3}$]** = number of word combinations of this label (1) in the AV corpus, (2) in the AER corpus, and (3) in the AV and AER corpora altogether.

The tentative definitions for the labels described in Table 3 were elaborated based on the regularities that they attempt to capture. Then, in order to quantify the collected data (stage 4, Table 2), these semantic labels attributed to all combinatorial relations of the terms (as they occur, individually, in the AER and in the AV corpora) were counted. Also, two kinds of graphical representations were drawn: in the first kind, they illustrate the different labels that the combinatorics of the terms received when examined in each corpus; and, in the second kind of representation, only those labels that represent shared combinatorics were retained. The following section presents the results obtained and provides examples of the two kinds of illustrations (Figures 3-6).

6. Results and discussion

This section starts with a brief overview of the syntactic aspects of the studied terms, then it goes into details about the semantic features of the combinatorics. The behavior of the terms in the AER corpus and in the AV corpus was quantified and contrasted based on the semantic labels attributed to the combinatorial relations and on the graphical representations of the terms (Figures 3-6).

Regarding the syntactic aspects of the relations that the studied terms establish with other terms, most word combinations take the following forms: 1) TERM + ADJECTIVE, e.g. '*temperatura máxima*' ('maximum temperature'); 2) TERM + ADVERBIAL PHRASE, e.g. '*granizo na superfície*' ('hail on the surface'); 3) TERM + NOUN PHRASE, e.g. '*temperatura e umidade*' ('temperature and humidity'); and, 4) NOUN PHRASE + TERM, e.g. '*precipitação de neve*' ('snow precipitation'). There are also cases of very similar phrase structures of adjectival or adverbial nature, such as '*gelo de ~*' ('~ ice') and '*gelo na ~*' ('ice in clouds'). Verbs were not as frequent and were disregarded from this study, but two combinations with verb forms working as past participles were retained: '*levantadas pelo ~*' ('lifted by the ~') and '*gerada pelo ~*' ('generated by the ~'). Other few combinations include prepositions, numeral phrases and compoundings per juxtaposition: '*dentro da ~*' ('within the ~'); '*maior parte da ~*' ('most part of the ~'); and '*intra-~*' ('intra-~') and '*solo-~*' ('ground-to-~').

Most left occurrences are nouns (NOUN/NOUN PHRASES + TERM) and most right occurrences are adjectives (TERM + ADJECTIVE), which is the standard position of adjectives in Portuguese. However, two word combinations with the term '*visibilidade*' ('visibility') included adjectives positioned on the left: '*baixa* ~' ('low ~') and '*menor* ~' ('lower ~'). The research with these corpora has shown that there are no significant differences in the syntactical behavior of terms in the AER corpus and in the AV corpus. Adverbs are more recurrent in the AV corpus, mainly regarding the terms '*vento*' ('wind') and '*chuva*' ('rain'), which may be an indication of more subjectivity in this subset of language.

Concerning the semantic aspects of the combinatorics, Table 4 indicates the number of times that the 28 semantic labels used to classify the combinatorial relations were associated to the terms in the AER corpus and in the AV corpus. For example, patterns of combinatorics of the term '*chuva*' ('rain') were classified with 11 different labels when they occured in the AV corpus and with 5 different labels when the term was examined in the AER corpus. This means that they share 3 labels, and that 8 labels are specific to the AV corpus and 2 labels are specific to the AER corpus.

Table 4. Number of semantic labels for categorization of term combinatorics

Term	AV	AER	Equal	Different AV	Different AER
areia	2	3	0	2	3
chuva	11	5	3	8	2
granizo	13	3	3	10	0
neve	6	9	4	2	5
nevoeiro	7	6	1	6	5
nuvem	6	8	6	0	2
temperature	10	8	7	3	1
turbulência	9	7	5	4	2
vento	17	13	10	7	3
visibilidade	6	11	4	2	7
Total	87	73	43	44	30

As it can be observed, semantic labels are more varied in the AV corpus than in the AER corpus, since 87 different labels were used to classify combinatorics in the AV corpus and only 73 to classify combinatorics in the AER corpus. This is because more distinct labels were attributed to the combinatorics of six terms when they occurred in the AV corpus than in the AER corpus, whereas the other four – '*areia'* ('sand), '*neve*' ('snow'), '*nuvem*' ('cloud') and '*visibilidade*' ('visibility') – have a higher number of labels in the AER corpus than in the AV corpus . To illustrate this, Figure 3 below details the categorization of the combinatorics of '*visibilidade'* ('visibility').

As shown in Figure 3, combinatorial relations of '*visibilidade*' ('visibility') that are specific to the AER corpus are depicted in blue, instances of combinatorics of '*visibilidade*' ('visibility') that are specific to the AV corpus are represented in red and combinatorial occurrences of '*visibilidade*' ('visibility')

shared in both corpora are coloured in green. '*Visibilidade*' ('visibility') was the term with the highest number of different semantic labels in the AER corpus (Figure 3); and, in contrast, *'chuva'* ('rain') had the highest number of different semantic labels in the AV corpus (Figure 4).

Figure 3. Semantic classification of the combinatorics of '*visibilidade*' ('visibility')

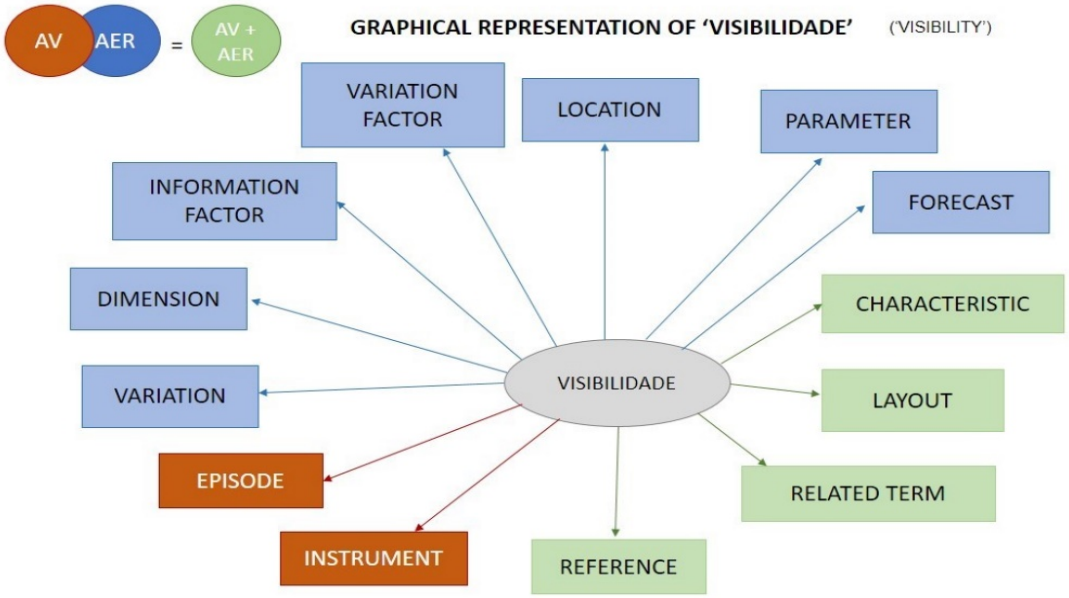
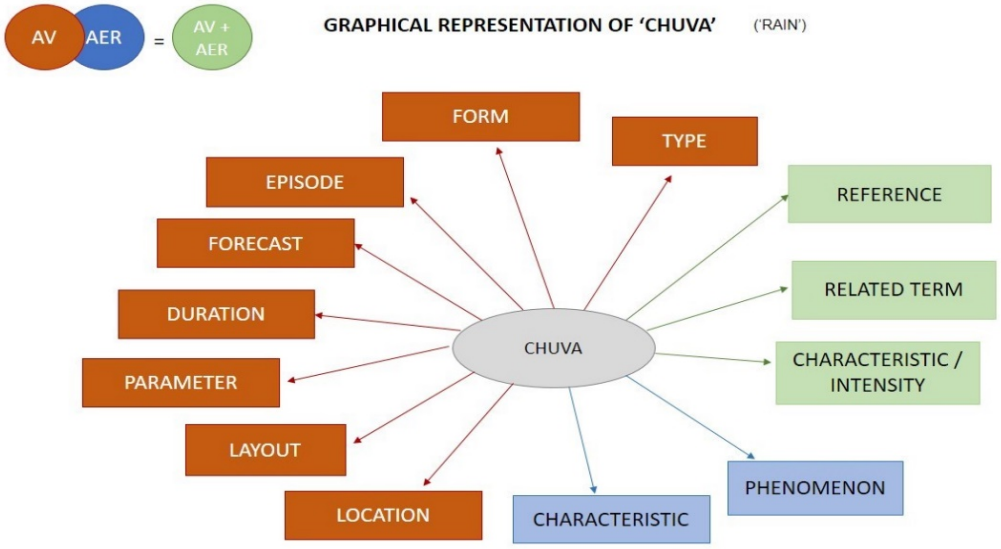


Figure 4. Semantic classification of the combinatorics of '*chuva*' ('rain')



DOI: 2318-7115.2020v41i4a2

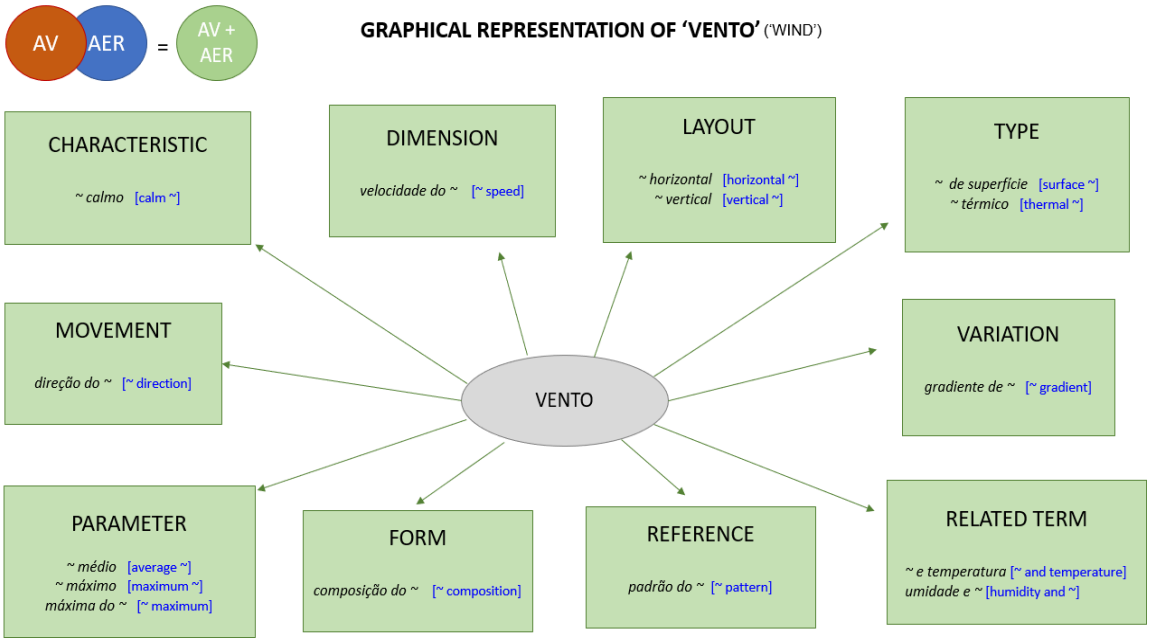
Instances of combinatorics of the term '*vento*' ('wind') were the ones that received the closest semantic classification in both AV and AER corpora, whereas the patterns of combinatorics of '*areia*' ('sand') in both corpora were totally different, and the combinatorial relations of *'nevoeiro'* ('fog') were almost entirely different as well. Overall, half (49%) of the total number of semantic labels of combinatorics from the AV corpus coincided with those of the AER corpus and just over half (58%) of the total number of semantic labels of combinatorics from the AER corpus coincided with those of the AV corpus. This means that the use of terms overlaps in about half of the times.

Combined labels (with INTENSITY) were more recurrent in the AV corpus, which also has INTENSITY, without any combination. The semantic labels DURATION, INSTRUMENT, TYPE / DIMENSION and TYPE / INTENSITY only appear in the AV corpus; and 'INFORMATION FACTOR' only appears in the AER corpus. In addition, the most recurrent semantic labels common to both corpora were REFERENCE, LAYOUT, CHARACTERISTIC and CHARACTERISTIC / INTENSITY. It seems that more descriptive semantic labels, such as CHARACTERISTIC', 'FORM' and 'TYPE', are used in the two subsets of language (AV and AER) in a similar fashion, while more informative semantic labels, such as PARAMETER, VARIATION, LOCALIZATION and INFORMATION FACTOR tend to be more recurrent in the AER corpus.

Results seem to point to the tendency of using a more objective structure of description in the AER corpus, whereas the AV corpus appears to be of a more subjective nature, as there are more adverbs, such as '~ *durante a noite*' ('~ during the night') and '~ *a curto prazo*' ('~ on a short-term basis'). It was also observed that terms with a semantic load closer to a more general use of aeronautical meteorology words, such as '*neve*' ('snow'), '*nuvem*' ('cloud') and '*visibilidade*' ('visibility'), had more combinatorics in the AER corpus, which may be an indication that more general terms have major relevance from a specialized perspective for the Aeronautical Meteorology field.

Figure 5. Semantic classification of the combinatorics of '*vento*' ('wind')

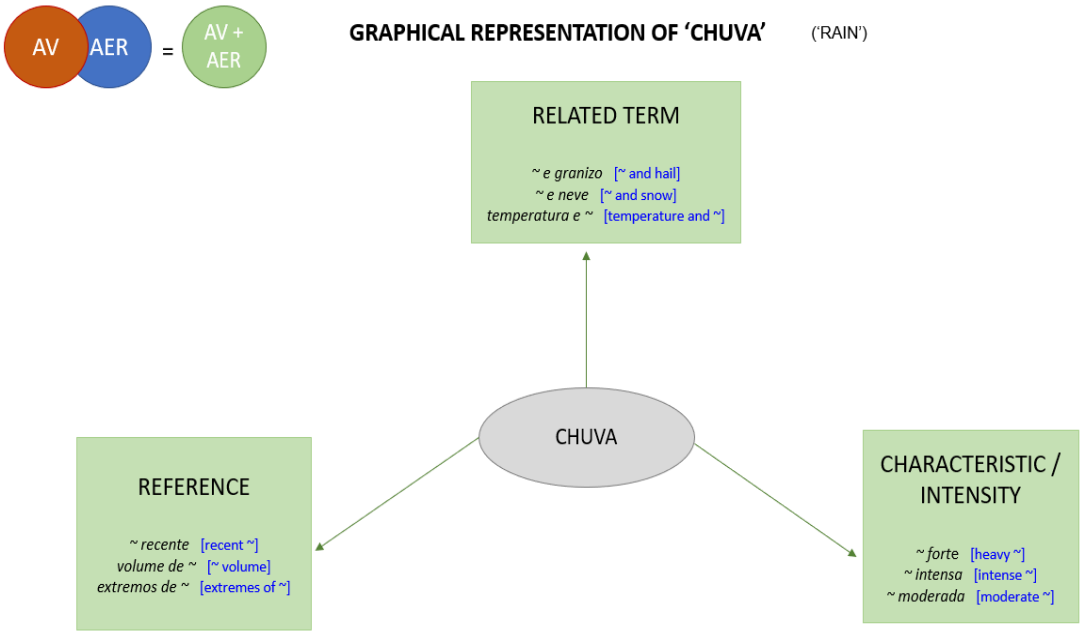
 DOI: 2318-7115.2020v41i4a2



The semantic classification of the combinatorics of '*vento*' ('wind') and '*chuva*' ('rain') are presented in Figure 5 and Figure 6, respectively. Figure 5 illustrates the term with the highest number of similar labels along with the combinatorial relations that were found in both corpora. Most labels include one or two combinatorics only. Other instances of combinatorics that fit into the same semantic label but were not in both corpora were mostly disregarded, which was often the case. Figure 6 shows one of the terms with the lowest number of similar labels with the patterns of combinatorics that were found in both corpora. The three semantic labels that the combinatorics of '*chuva*' ('rain') share include three terms found in both corpora, which seems to indicate some closeness in the use of the term '*chuva*' ('rain') in the corpora, even though only a small portion of the semantic labels used to classify all combinatorics coincide.

Figure 6. Semantic classification of the combinatorics of '*chuva*' ('rain')

 DOI: 2318-7115.2020v41i4a2



Considering Table 4, one last time, it is possible to note that only '*vento*' ('wind'), '*temperatura*' ('temperature'), '*nuvem*' ('cloud') and '*turbulência*' ('turbulence') have the highest number of similar labels in both corpora. '*Vento*' ('wind') and '*nuvem*' ('cloud') are the terms whose behavior, all things considered, is the most identical. However, when it comes to the linguistic expressions of their combinatorics, coincidences drop in a very significant way.

7. Conclusion

The study of lexical relations in Aviation language and in Aeronautical language is important to address linguistic trends and possibly lead to some modification of language used during ATC communication, as to improve efficiency of communication. As explained by Estival, "there are regular updates to the AIP [Aeronautical Information Publication] every 3 months and ICAO is constantly reviewing possible modifications" (ESTIVAL, 2016, p.45). However, one limitation of this study was that the aeronautical language corpus (AER) was much smaller than the aviation language corpus (AV). Publications of the Department of Airspace Control (DECEA), the institution in charge of regulating the Aeronautical Meteorological field in Brazil, are very scarce and, although they were all included in the AER corpus, they still make for a small portion of the corpus when compared to the AV subset.

Overall, the analysis carried out in this paper suggests that the Aeronautical Meteorology language is a hybrid field, since it mostly comprises a very similar pattern for the use of specialized terms in both subsets of aeronautical language and aviation language. For example, syntactic patterns are mostly

 DOI: 2318-7115.2020v41i4a2

identical, with a possible greater use of subjectivity in the aviation language, given the higher use of adverbs, especially regarding the terms '*vento'* ('wind') and '*chuva'* ('rain').

As for the semantic patterns, although the AV corpus was overall more varied, semantic labels of combinatorics coincided in approximately half the cases, with labels in the aeronautical language being slightly more similar to labels in the aviation language than the other way around. Similarly to the results obtained from the examination of the syntactic patterns, it was noted that the semantic content of combinatorics is less subjective in the AER corpus, since the labels they received were more informative than the labels of the combinatorics in the AV corpus. In addition, the fact that more general terms, i.e. terms also used in daily interaction within non-specialized communities, such as '*neve'* ('snow'), '*nuvem'* ('cloud') and '*visibilidade'* ('visibility'), have major relevance from a more situated perspective of the Aeronautical Meteorology field, since the their instances of combinatorics are greater in the AER corpus, may reinforce the same conclusion. This way, aviation language may be considered complementary, and oftentimes essential, to aeronautical language in the case of the Aeronautical Meteorology field, which makes this a hybrid field that also resorts to a general meteorology use of terms.

To conclude, results of the study also seem to suggest that it is not possible to disentangle those two subsets of specialized language, in contrast to other sharp-tailored fields. Therefore, they must be understood in a more functional way as an applied field. Alongside the peculiarities of aviation language and aeronautical language, a possible situated use of Aviation Meteorology and Aeronautical Meteorology language could also be considered.

References

ANTHONY, L. 2018. AntConc Homepage. Available at : <http://www.laurenceanthony.net/software/antconc/>. Access: 27 May. 2020.

BARSHI, I.; C. FARRIS. 2013. Misunderstandings in ATC Communication: Language, Cognition, and Experimental Methodology. London and New York: Routledge; Taylor & Francis Group.

BOCORNY, A. E. P. 2011. Panorama dos estudos sobre a linguagem da aviação. RBLA. 11.4: 963-986.

BOROWSKA, A. P. 2017. Avialinguistics: The Study of Language for Aviation Purposes. Frankfurt: Peter Lang.

BRAZIL. 2014. Comando da Aeronáutica. Departamento de Controle do Espaço Aéreo. ICA 105-12: Fraseologia Volmet. Rio de Janeiro. Available at: <https://publicacoes.decea.gov.br/?i=publicacao&id=4072>. Access: 09 Dec. 2019.

CRABBE, S. 2017. Existing Controlled Languages for Technical Documents. In: CRABBE, S. Controlling Language in Industry: Controlled Languages for Technical Documents. Portsmouth, UK: Palgrave Macmillan. pp. 23-48.

_____. 2017. Introduction and Historical Development of Technical Documents. In: CRABBE, S. Controlling Language in Industry: Controlled Languages for Technical Documents. Portsmouth, UK: Palgrave Macmillan. pp. 1-22.

CONDAMINES, A. Variations in terminology: Application to the management of risks related to language use in the workplace. Terminology. 16.1: 30-50.

DINES, W. H. 1917. Meteorology and Aviation. Nature. 99.2491: 424–426.
ELLIS, S.; T. GERIGHTY. 2008. English for Aviation: for pilots and air traffic controllers. Oxford, UK: Oxford University.
EMERY, H; A. ROBERTS. 2008. Aviation English. Oxford, UK: Macmillan.
_____ ; _____. 2010. Check your Aviation English. Oxford, UK: Macmillan.
ESTIVAL, D. 2016. Aviation English: A linguistic description. In: ESTIVAL, D.; C. FARRIS; B. MOLESWORTH. Aviation English: A lingua franca for pilots and air traffic controllers. New York: Routledge. p. 22-52
ESTIVAL, D.; C. FARRIS. 2016. Aviation English as a lingua franca. In: ESTIVAL, D.; C. FARRIS; B. MOLESWORTH. Aviation English: A lingua franca for pilots and air traffic controllers. New York: Routledge. p. 1-18
FARRIS, C.; B. MOLESWORTH. 2016. Communications between air traffic control and pilots. In: ESTIVAL, D.; FARRIS, C.; B. MOLESWORTH. Aviation English: A lingua franca for pilots and air traffic controllers. New York: Routledge. p. 92-110.
INTERNATIONAL CIVIL AVIATION ORGANIZATION. 2010. Manual on the implementation of ICAO language proficiency requirements. 2. ed. Montreal (Doc. 9835 AN/453).
_____. 2016. Air traffic management. 16. ed. Montreal. (Doc. 4444- ATM/ 501).
_____. 2018. Annex 3 to the Convention on International Civil Aviation. Meteorological Service for International Air Navigation: parts I and II. 20. ed. Montreal.
_____. 2019. Manual on the ICAO Meteorological Information Exchange Model. 2. ed. Montreal. (Doc. 10003).
LEÓN ARAÚZ, P.; A. REIMERINK. 2010. Knowledge Extraction and Multidimensionality in the Environmental Domain. In: Proceedings of the Terminology and Knowledge Engineering (TKE) Conference. Dublin: Dublin City University. Available at: <http://lexicon.ugr.es/pdf/leonreimerink2010.pdf>. Access: 25 May 2020.
L'HOMME, M.-C. 2020. Lexical Semantics for Terminology: An introduction. Amsterdam / Philadelphia: John Benjamins Publishing Company.
MALONE, T. 1957. Applied Meteorology. In: LANDSBERG, H. E. et al. Meteorological Research Reviews: summaries of progress from 1951 to 1955. 3.16: 152-158.
MARINER, L. 2008. Cleared for takeoff: Aviation English made easy. Emmett, ID: Aelink Publications.
NICKERSON, C. 2013. English for Specific Purposes and English as a Lingua Franca. In: PALTRIDGE, B.; S. STARFIELD (Ed.). The handbook of English for specific purposes. West Sussex: John Wiley & Sons. p. 445-460.
PACHECO, A.; G. M. GONÇALVES. 2017. Problemas de linguagem em inglês aeronáutico: uma análise de comunicação técnica sob diferentes ramos linguísticos. Aviation in Focus. 8.1: 3-13.
PEIXOTO, R. A. J. R. 2020. Nas Asas da Tradução: elaboração de glossário de meteorologia aeronáutica. Revista CBTecLE. 2.1. 19 p.
PRADO, M. 2015. Levantamento dos padrões léxico-gramaticais do inglês para aviação: um estudo vetorado pela Linguística de Corpus. Master's Dissertation, Campinas State University.
ROBERTSON, F. 2008. Airspeak: Radiotelephony Communications for Pilots. Essex, UK: Pearson Longman.
ROGERS, M. 2004. Multidimensionality in concepts systems Terminology. 10.2: 215–240.
SEITTER, K. L.; J. NATHANS; S. MANKINS. 2019. American Meteorological Society: 100 Years of Supporting the Scientific Community. In: AMERICAN METEOROLOGICAL SOCIETY. A Century of Progress in Atmospheric and Related Sciences: Celebrating the American Meteorological Society Centennial, Meteorological Monographs, v. 59. Boston: American Meteorological Society. pp. 1.1:1.23. Available at: <https://journals.ametsoc.org/toc/amsm/current>. Access: 4 Mar. 2020.

SHAWCROSS, P. 2011. FlighPath: Aviation English for pilots and ATCOs. Cambridge: Cambridge University Press.
SILVA, A. L. B. de C. e. 2016. Uma análise de necessidades de uso da língua inglesa por oficiais aviadores do esquadrão de demonstração aérea da Força Aérea Brasileira. Master's Dissertation, Campinas State University.
TAJIMA, A. 2004. Fatal miscommunication: English in aviation safety. World Englishes. 23.3: 451-470. Available at: <https://www.semanticscholar.org/paper/Fatal-miscommunication%3A-English-in-aviation-safety-Tajima/221b3816d1ce3997b022d1802a1a4d5befe77f7e>. Access: 25 May 2020.
TOSQUI-LUCKS, P.; P. R. e SOUZA; N. de A. RAYMUNDO; N. de C. GUERREIRO; B. F. ARAGÃO. 2016. Ensino e Avaliação de Língua Inglesa para Controladores de Tráfego Aéreo como Requisito de Segurança em Voo. Conexão Sipaer. 1.7: 44-54. Available at: <http://conexaosipaer.cenipa.gov.br/index.php/sipaer/article/view/383/326>. Access: 25 Ago. 2019.
_____; SILVA, A. L. B. de C. e. 2020. Da elaboração de um glossário colaborativo à discussão sobre os termos "inglês para aviação" e "inglês aeronáutico". Revista Estudos Linguísticos. 49.1: 97-116.
WORLD METEOROLOGICAL ORGANIZATION. 20-? Aeronautical Meteorology Programme. Available at: <https://www.wmo.int/aemp/>. Access: 30 Feb. 2020.
_____ . 2018. Technical Regulations. Basic Documents No. 2. Volume II: Meteorological Service for International Air Navigation. Geneva. (WMO, n.49-ii).

Rafaela Araújo Jordão Rigaud Peixoto *is Translator / Interpreter at the Department of Airspace Control, in Rio de Janeiro (Brazil), where she develops research on Terminology in the aviation field. She holds a Ph.D. in Language Studies / Letters, an M.A. in Linguistics, a Graduate Specialization degree in English / Portuguese Translation, a Graduate Specialization degree in Pedagogical Neuroscience, and a major in Letters Portuguese / English. Her recent research interests include terminology, English for Specific Purposes, and intercultural relations. She is Researcher in the "Aeronautical English Study Group" (GEIA). E-mail: rafaelarajrp@decea.gov.br*

Janine Maria Mendonça Pimentel *is Associate Professor at the Federal University of Rio de Janeiro (Brazil), where she teaches graduate and undergraduate courses on translation and supervises Master's and Doctorate students. She holds a Ph.D. in Translation Studies from the University of Montreal (Canada), an M.A. in Linguistics and a Bachelor's degree in Modern Languages and Literature from NOVA University of Lisbon (Portugal). Her recent research interests include specialized translation, translation technologies and activism in translation. She is Coordinator of the Research Group "Núcleo de Estudos de Tradução" at UFRJ. E-mail: janinepimentel@letras.ufrj.br*