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The Event-Domain Cognitive Model perspective on terminology: A case study of atmospheric environment terms

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Abstract

While terminology as independent discipline has moved toward two general orientations—the direction of the traditional terminology once predominating in early terminological development and the conflicting ones occurring afterward—some essential issues of terminology still remain of concern, for example, relations between terms, concepts, and the world. Following the literature review on earlier research of such relations, two triangles similar to the semiotic triangle based on previous pertinent philosophy and linguistics are proposed. One is the triangle underlying traditional terminology; the other is linked with the cognitive linguistic perspective on terminology or cognitive terminology, for instance, Temmerman (*Toward New Ways of Terminology Description: The Sociocognitive Approach*. John Benjamins, Amsterdam/Philadelphia 2000) and Faber (Investigar en terminología. Granada, Comares, 2002; *A Cognitive Linguistics View of Terminology and Specialized Language*. De Gruyter Mouton, Berlin, 2012). With the foundation of the cognitive terminological studies, in particular based on the theory of the Event-Domain Cognitive Model (ECM) by Wang (*Modern Foreign Languages* 28(1):17–26, 2005), along with the later proposal of the Environmental Event (EE) by the Faber group, understanding of special terms on atmospheric environment (AE) is enhanced. Before giving an explanation about construal of AE terms, I drew on relevant corpora and term extraction tools to retrieve the terms. Following analyses of the AE terms, exemplified by the term “air/空气”, with the ECM and its specific variants, it is concluded that the three-level ECM is truly valuable for revealing cognitive structures and corresponding semantic content of the term, which is also informative helping to identify other potential terms acting not just as nouns but also as verbs and adjectives, etc.

Keywords Event-Domain Cognitive Model · Terminology · Atmospheric environment · Conceptualization

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1 Introduction

A brief retrospect of how terminology as an autonomous subject has fared over the last eight decades and relevant research such as by Gaudin (1993, 2003), Cabré (1999, 2003), Temmerman (2000), Faber (2012), Campo (2012) and L'Homme (2015) will bring to light general information about principal varieties of approaches to terms. Two main types can be observed: one is the traditional method initiated by the founder of traditional terminology, Eugen Wüster; the other is the newly developed series of methods somewhat in opposition to the traditional kind, chiefly represented by socioterminology, for example, Gaudin (1993, 2003), communicative terminology, such as by Cabré (1999, 2003), and cognitive linguistic terminology instantiated by Temmerman (2000), Faber (2012, 2015) and others.

Whereas traditional terminology in essence advocates the priority and precision of concepts, univocity of terms, and synchronic research of concepts and terms, as also mentioned by other scholars like Temmerman (2000) and Cabré (2003), some of the new approaches of terminology in contrast argue for multidimensionality and prototypical structures of terms and concepts, along with emphasis on dynamic and diachronic investigations.[1] This study maintains the cognitive linguistic standpoint as well and treats terms as tied to both external linguistic forms and internal concepts in relations with other relevant concepts, together with communicative functions. More essentially, concepts and conceptualization of terms are regarded as the center of terms and a cognitive model is tentatively applied to understanding terms on the basis of preceding cognitive linguistic achievements.

In view of the significance and relatively inadequacy of the research on terms of atmospheric environment (AE), I drew on the cognitive model to analyze conceptualization of AE terms. Undoubtedly, in the development of human society, the environmental issue has long been of great concern to the world and will remain so well into the future. Among all the complex environmental problems, those involving the atmosphere and a host of issues related to the atmospheric environment have arisen on a more global level. Despite the springing up of a number of cognitive terminological studies such as by León-Araúz et al. (2008), Faber et al. (2014), L'Homme and Robichaud (2014), and L'Homme (2018) that focused on environmental terms, terminological explorations about the atmospheric environment demand further work and efforts.

In the following parts, I will present in Sect. 2 important research foundations, including discussion of relations between terms, concepts and the world, the theory of the Event-Domain Cognitive Model (ECM), the cognitive terminological proposal of the Environmental Event (EE), and pertinent terminological studies on the environment. In Sect. 3, I will take AE terms as the target and make use of term extraction tools based on corpora to identify and extract potential terms, and then in Sect. 4 apply the theory of ECM to the construal of AE terms, instantiated by the term "air/空气".

[1] Such a point was also held by Faber (2012) and L'Homme (2015).

2 Research foundations

The key part of this study is mainly motivated by the subsequent theories and research—the traditional and cognitive terminology in which two different types of theoretical triangles are extracted, by two kinds of cognitive models, and by two research groups which focus on environmental terms.

2.1 Two theoretical triangles

Whether explicitly accepted or not by terminologists in previous research, it is assumed in this paper that long history and development of different philosophical and linguistic theories have in fact paved the way for distinct terminological viewpoints of terms, concepts, and the world.

On the one hand, with respect to the influential traditional terminology, it is undeniably more or less tinted with the hues of philosophy like rationalism and objectivism, as also discussed by Campo (2012), and the linguistic theory, typically the semiotic triangle theory raised by Ogden and Richards (1923) first published in their work *The Meaning of Meaning*. I adapt the semiotic triangle by Ogden and Richards (1923) into the following graph to show some prototypical points of traditional terminology such as the priority of concepts over terms, the precision of concepts with clear boundaries, the univocity of terms, and absolute concentration upon entities (Fig. 1).

By the same token, newly developed theories such as socioterminology, communicative terminology, and cognitive-based terminology also have, to certain extent, roots in relevant philosophy and linguistic assumptions. For instance, as mentioned by Campo (2012), socioterminological standpoints are somewhat based on sociology, sociolinguistics, cognitive semantics, etc. Accordingly, the philosophy of social anthropology, symbolic interactionism, and experientialism must have exerted some impact on socioterminology. Both socioterminology and communicative terminology argue against priority and univocity of concepts and insist on dynamic

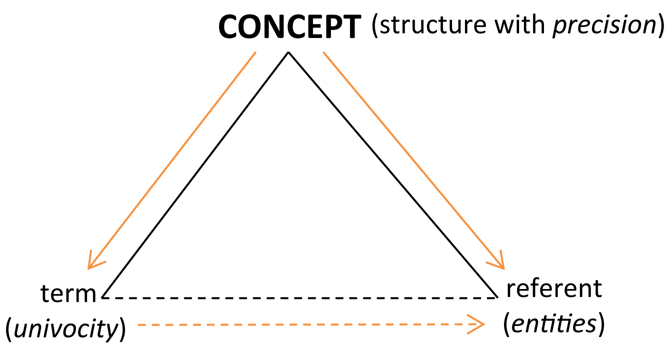

Fig. 1 The triangle underlying the traditional terminology

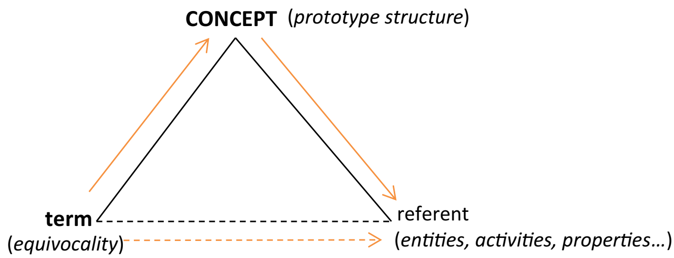

Fig. 2 The triangle underlying the cognitive terminology

explorations of terms in social discourses. In addition, communicative terminology typically emphasizes the purpose of terminology, that is, communication.

Whereas approaches like socioterminology and communicative terminology initially shift for a descriptive and usage-based direction of studying terminology, later research involving sociocognitive terminology represented by Temmerman (2000, 2006) and frame-based terminology, for example, exemplified by Faber et al. (2005, 2006), as a whole presents a more systematic and explicit picture about the descriptive and usage-based examination of terminology. Faber (2012: 17) named such later studies as cognitive-based theories of terminology, labeled as "cognitive terminology" in this research. Undoubtedly, foundations of such a method in general encompass experientialism and cognitive linguistics which lay great emphasis on conceptualization of the world in light of human bodily, psychological and social experience.

To compare this new approach with the traditional one, I list Fig. 2 to illustrate the essential relationships and roles of the term, concept, and referent within the cognitive terminology. The triangle underlying the cognitive terminology at least reveals that the term is the starting point of analyses with potential polysemous and synonymous terms; that the concept is not clearly bounded and precise, but a prototype structure with good and bad members (Rosch 1978); that the term and concept are not only related to entities, but also to activities, properties, etc.

2.2 Two cognitive models

The general level of theoretical bases of this study involves Frame Semantics represented by Fillmore (1976, 2006), Fillmore and Atkins (1998), and Fillmore and Baker (2010) as well as cognitive semantics, for example, by Lakoff and Johnson (1980), Lakoff (1987), Johnson (1987), Langacker (1987), Gärdenfors (1998), and Evans (2006). While within the range of Frame Semantics, a key concept is "frame", one of the nuclear notions in cognitive semantics is the "idealized cognitive model

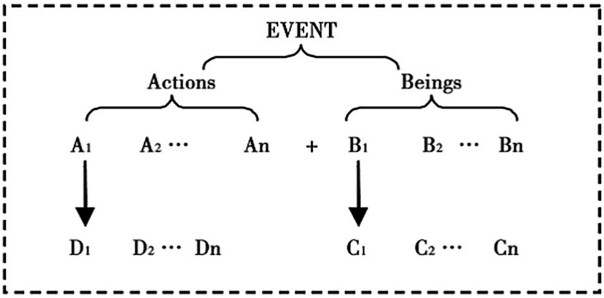

Fig. 3 Wang's Event-Domain Cognitive Model (Wang 2005)

(ICM)" or "cognitive model (CM)" (Peng 2013: 33).[2] This study prefers using "ICM/CM" and considering both "frame" and "ICM/CM" as broad synonyms referring to "a schematization of experience (a knowledge structure), which is represented at the conceptual level and held in long-term memory and which relates elements and entities associated with a particular culturally embedded scene, situation or event from human experience" (Evans 2007: 85–86).

2.2.1 The ECM

In light of strengths and drawbacks of the Billiard-ball Model and Stage Model from Langacker (1991, 2002), Force-Dynamic Model from Talmy (1985, 1988), Spatialization of Form Hypothesis from Lakoff (1987), Script Theory from Schank and Abelson (1975), and dynamic event analyses from the speech act perspective by Panther and Thornberg (1999), Wang (2005) proposed the Event-Domain Cognitive Model (ECM, outlined in Fig. 3). The main weaknesses of the aforementioned theories or models and what ECM manages to get over entail: the single-level analysis with no hierarchical explanation about elements of the events; mere focus on dynamic scenarios without attention to static situations; applicable only to illustration of syntactic structures with little or no coverage of semantics and morphology, etc.

ECM, as pointed out by Wang (2005), aims at providing one of a general cognitive means explaining various levels of linguistic phenomena such as semantics, syntax, and pragmatics. It is in line with the Generalisation Commitment of cognitive linguistics—"a commitment to the characterisation of general principles that are responsible for all aspects of human language" (Evans and Green 2009: 501). Central arguments of the ECM theory include: people are supposed to construe and experience the world through units of EVENT that are mainly composed of ACTIONS and BEINGS, both of which make up the first level of EVENT; under

[2] As uncovered by researchers like Evens and Green (2006: 279, 281) and Cienki (2007: 180), in one respect, "frame" and "ICM/CM" differ from each other in details; in another, the latter to some degree encompasses the former as its "symbolic model".

each of the first level unit lays the second level of the event, entailing specific ACTIONS (A_1, $A_2 \ldots A_n$) and BEINGS (B_1, $B_2 \ldots B_n$); in addition, downward in connection with the second level concepts is the third level of the event composed of distinctive features (D_1, $D_2 \ldots D_n$) of the particular ACTIONS and categorical information of BEINGS (C_1, $C_2 \ldots C_n$).

Wang (2005) mentioned that in the theory of ECM, the internal hierarchy and complexity of events are underscored; that both dynamic and static factors should be noticed; that basic conceptual structures of human beings are expected to be understood by hierarchical analyses of complicated events from different perspectives; that the basic conceptual structures can then be used to illustrate semantic comprehension and application. Moreover, according to Wang (2005), actions are necessarily connected with the initiator and recipient, so primary constituents of an event include BEING + ACTION + BEING (BAB); sometimes BA, with the recipient missing, may also be a case of the event structure. Since an event is limited in range but tied to other events with non-absolute boundaries, the dotted line around the event is used (Fig. 3).

So far, a number of studies have more or less verified the feasibility and explanatory strength of the ECM theory. Wang (2005) and other scholars such as Lu (2011), Wang (2012), and Liu (2014) have applied the ECM theory to research on syntax, semantics, pragmatics and other topics, specifically including relevant elucidation on naming of beings, metonymy, semantic variation, indirect speech acts, constructions, etc.

2.2.2 The EEM

Whereas ECM is designed to act as a general cognitive model responsible for all aspects of language, another model is a relatively specific one—the Environmental Event Model (EEM). EEM was gradually built up by Professor Faber Pamela and her followers in accordance with Frame Semantics. The first publication indicating the embryonic formation of the EEM is Faber's articles regarding terminological competence and knowledge acquisition (Faber 2002, 2003) in which a general model of medical event (ME) (Fig. 4) was proposed to represent relevant conceptual knowledge and relations to help translators acquire specialized medical texts. At this stage, except for offering a clear description and framework of the cognitive model, some major categories of the model were presented, for example, AGENT, PROCESS, RESULT, and PATIENT, together with revelation of certain connections between these categories.

Later Faber et al. (2005) put forward a similar model to ME, the Coastal Engineering Event (CEE) (Fig. 5), to improve comprehension of the complex field, coastal engineering. This time the CEE Model was overtly described by Faber et al. (2005) as a dynamic process-oriented model in which an agent affects a patient with production of a result. Moreover, within this model, two specific types of categories were delineated—the "macrocategories" entailing AGENT, PROCESS and PATIENT/RESULT, and the "peripheral categories" including INSTRUMENTS, and "concepts used for the measurement, analysis, and description of the processes, along with interrelations between these categories" (Faber et al. 2005).

With further efforts of the Faber group, the model in Fig. 5 was formally modified into the following version (Fig. 6), named the figure of PuertoTerm Coastal

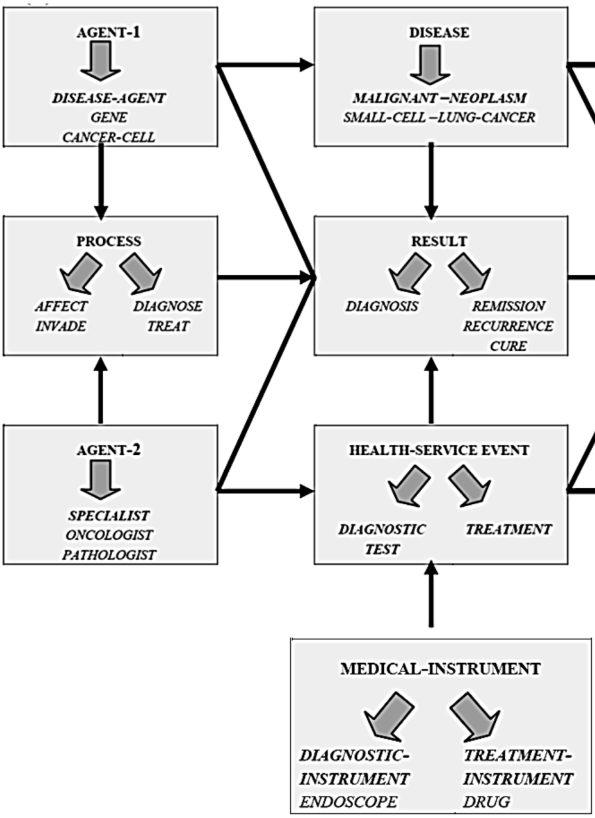

Fig. 4 The model of medical event by Faber (2003)

Engineering Event (CEE).[3] Notwithstanding the formal resemblance of Figs. 4 and 5, elucidation from the Faber group about the EVENT was enriched and enhanced. For instance, a sub-model of the CEE Model tied to Spanish and English as well as their internal conceptual relations were specifically discussed, which at least discloses more abundantly about the conceptual knowledge of the costal engineering domain.

Based on the CEE model, Faber et al. (2009) first publicly brought up the model of Environmental Engineering Event which was later named Environmental Event (EE) (León Araúz et al. 2009; Reimerink and Faber 2009; Reimerink et al. 2010) as a conceptual portion of the "frame-based multilingual knowledge resource on the environment", EcoLexicon (Faber et al. 2011; Faber and Buendía 2014; Faber et al. 2016). According to the research group of EcoLexicon, "the description of specialized domains is based on the events that generally take place in them, and can be represented accordingly (Grinev and Klepalchenko 1999). Each knowledge

[3] The model was applied under the project PuertoTerm concerning terminology of coastal engineering.

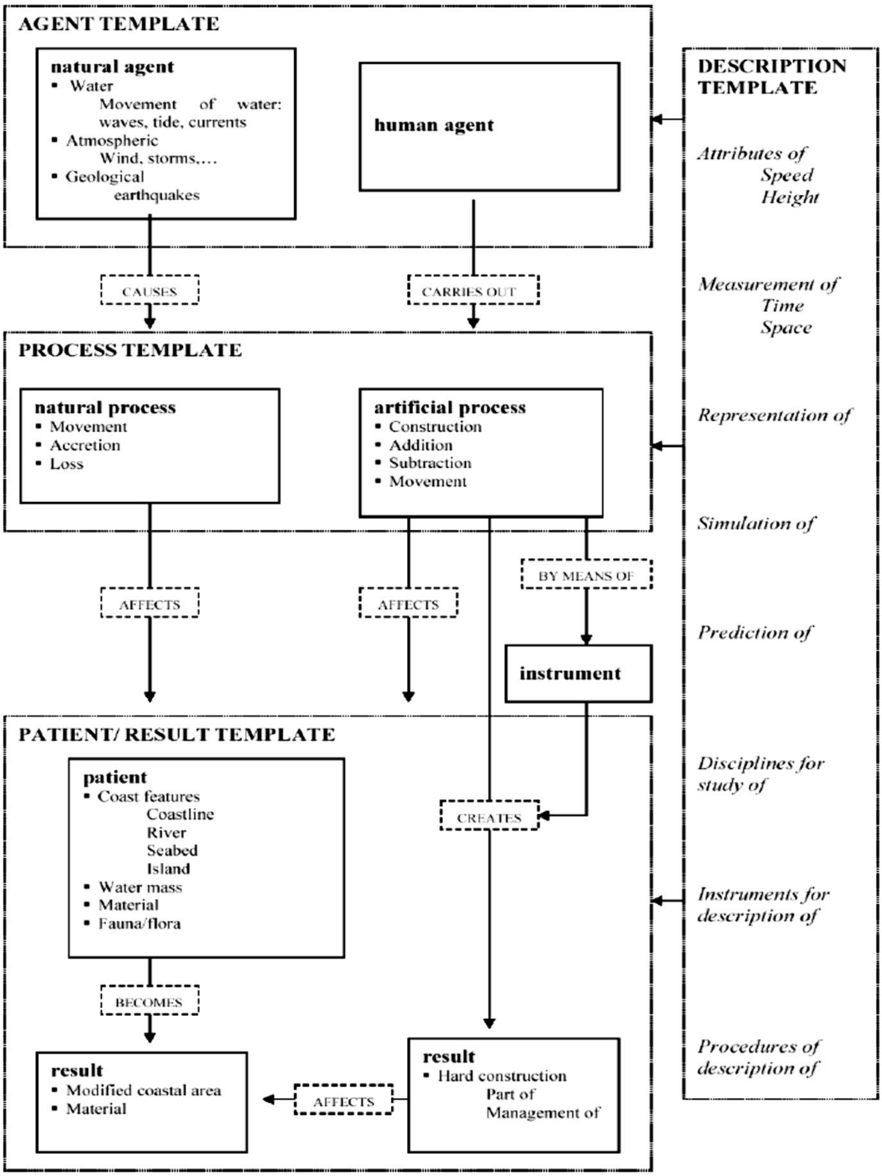

Fig. 5 The model of coastal engineering event by Faber et al. (2005)

area thus has its own event template".[4] They pointed out in a series of papers (for example, Reimerink and Faber 2009; Faber 2011; San Martin et al. 2017) that EE, similar to the above-mentioned CEE, is "a dynamic process that is initiated by an

[4] This is cited from the webpage: http://lexicon.ugr.es/fbt.

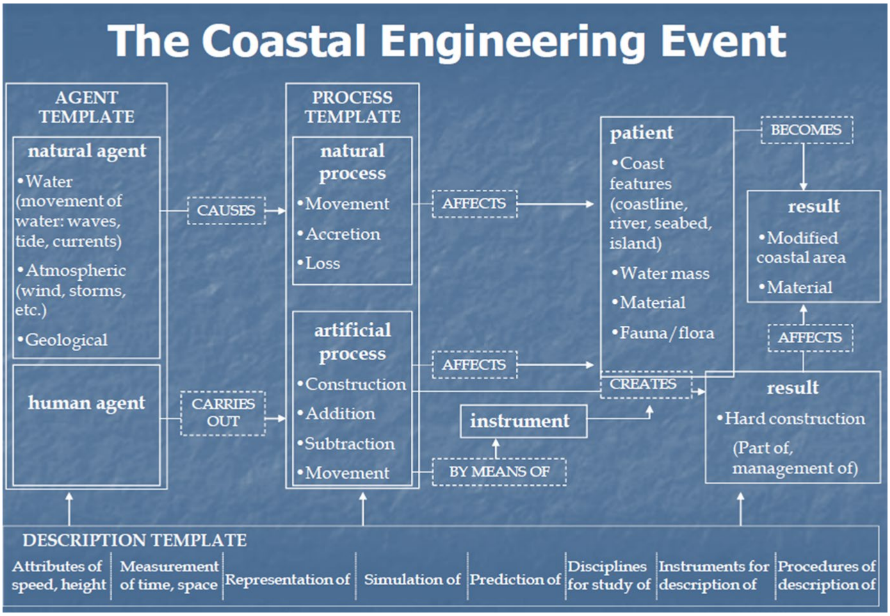

Fig. 6 PuertoTerm coastal engineering event by Faber et al. (2006)

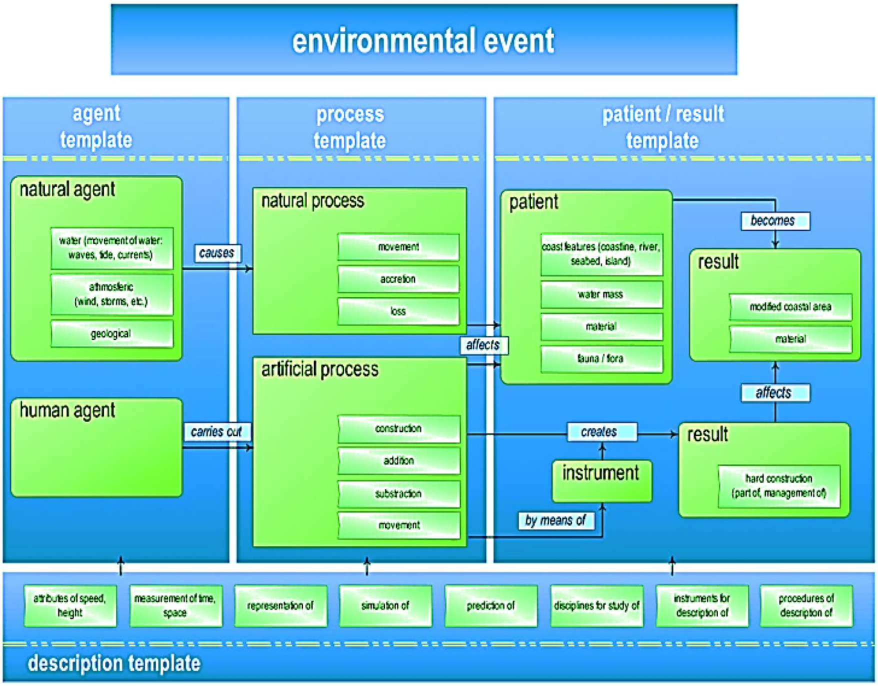

Fig. 7 The environmental event model by the EcoLexicon Group (the website is: http://ecolexicon.ugr.es/en/aboutecolexicon.htm)

agent (either natural or human), affects a specific kind of patient (an environmental entity), and produces a result in a geographical area" (Faber 2011). EE as a whole consists of a general level of EVENT and a basic level with central categories such as AGENT, PROCESS, and PATIENT as well as peripheral categories including INSTRUMENT and DESCRIPTION[5] (Fig. 7).

As indicated above, EEM is a specific version of ECM that is applied to the special field of environment. Both models to some extent contribute to the conceptual representation and are potentially helpful to understanding of terms. While EEM highlights the dynamic feature of event process, ECM incorporates both dynamic and static aspects of events. Also unlike ECM, EEM lacks the explicit presentation of levels of construal.

2.3 Two research groups

With the cognitive terminological stance, I then adopt this perspective on a specialized area demanding more attention given both its significance and its inadequate concern it has received thus far. The field is atmospheric environment (AE). Two research groups stand out for devoting themselves to the terminological work related to environment. One is the Faber group at the University of Granada, Spain; the other is the L'Homme team at the University of Montréal, Canada. The former is led by Professor Pamela Faber, together with her colleagues and students. Largely based on Frame Semantics (Fillmore 1982; Fillmore and Atkins 1992), the group members have been investigating terms of environment and their translation since 2003 and developing the Frame-based terminology (Faber et al. 2006; Faber 2012, 2015; San Martín et al. 2017). They take into account conceptual frames, especially the Environmental Event (EE) template, as well as various conceptual relations to illustrate the knowledge of environmental terms and set up a multilingual terminological knowledge base regarding environment, EcoLexicon[6] (Faber et al. 2011; Faber and Buendía 2014; Faber et al. 2016; San Martín et al. 2017), which further gives rise to a large number of publications around terminological issues of environment.[7]

Another terminological team absorbed in environment is directed by Professor Marie-Claude L'Homme. Apart from making use of Frame Semantics more systematically and the method used in FrameNet, the team also draws on the Meaning-Text Theory (Mel'čuk et al. 1995) and has contributed to the creation of the online terminological resource concerning the environment, DiCoEnviro,[8] enriched on a regular basis and containing English environmental terms in languages such as English, French, Spanish and Portuguese. L'Homme's team has been working more on the lexical part of environmental terms including, for instance, common lexical connections like hyponymy and synonymy, and paradigmatic and syntagmatic

[5] The Faber group also distinguishes two kinds of specific conceptual relations: the hierarchical and non-hierarchical relations, which will not be detailed in this study.

[6] The website is: http://ecolexicon.ugr.es.

[7] The website is: http://lexicon.ugr.es/publications.

[8] The website is http://olst.ling.umontreal.ca/cgi-bin/dicoenviro/search.cgi.

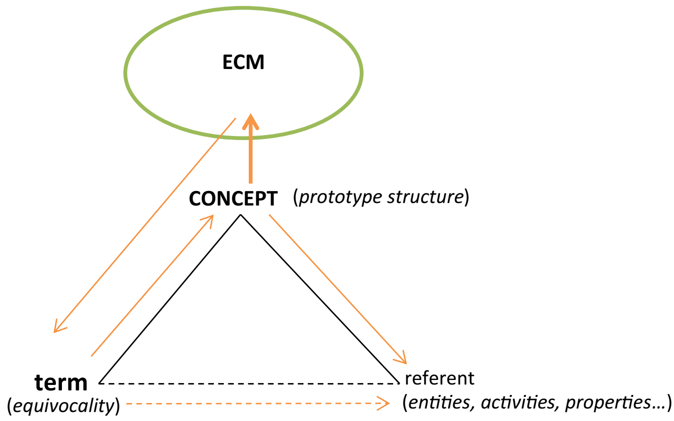

Fig. 8 The ECM perspective on conceptualization of terms

relations (L'Homme et al. 2018). In addition to DiCoEnviro, L'Homme, together with her colleagues and students, has also opened up two other pertinent terminological resources on the environment. One is the Framed DiCoEnviro (L'Homme and Robichaud 2014) which discloses conceptual frameworks and associations of environmental terms.[9] Another informative resource is EcoRessources that incorporates "online dictionaries, glossaries and thesauri focusing on the environment".[10]

3 Application of the ECM and its variants to analyses of AE terms

While, as mentioned before, the ECM is a general model committing to illumination of various aspects of language, the EEM is a comparatively detailed one developed for the area of environment. When the general cognitive model, ECM, is utilized to comprehend terms, it can be summarized as below (Fig. 8). A featured part of this figure is that a term is connected with a concept which is further inevitably linked with an ECM. Hence to understand a term, we can make use of its relevant ECM.

3.1 The AEEM

In this section, a more specific model involving conceptualization of AE terms will be analyzed. I will take the model as Atmospheric Environmental Event Model (AEEM). To understand terms of atmospheric environment discussed in the following section, it is sensible to refer to both Wang's ECM and the Faber group's EEM discussed previously. On the one hand, the EEM will be more

[9] The website is: http://olst.ling.umontreal.ca/dicoenviro/framed/index.php.
[10] The website is: http://termeco.info/ecoressources/infos-e.html.

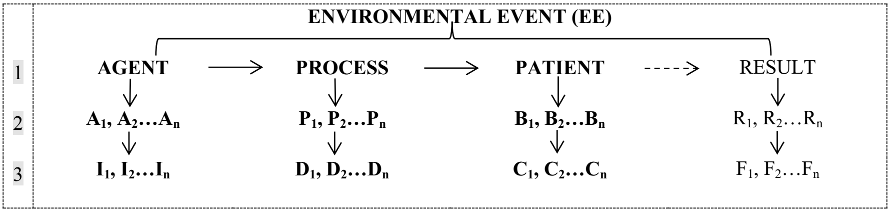

Fig. 9 The new prototypical environmental event model

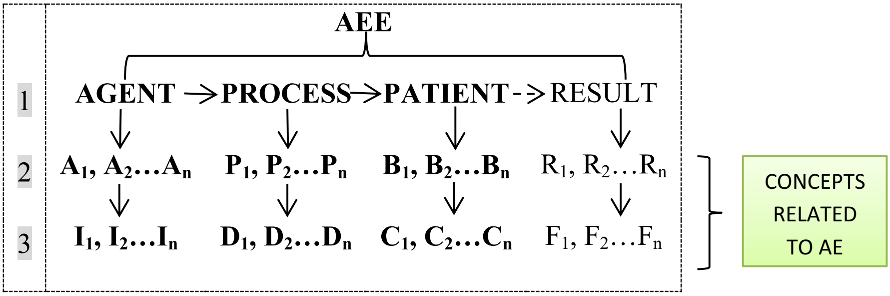

Fig. 10 The prototypical atmospheric environmental event model

rationally and explicitly multilayered and hierarchical with consideration of Wang's ECM. On the other, the general ECM is naturally more detailed and comprehensive if typical event process and sequence are taken into account. In particular cases in reality, BEINGS are often presented in the forms of AGENT or PATIENT; ACTION is actually included in PROCESS and in general leads to some RESULT. PROCESS may contain ACTION, STATE, and other elements of events. It is also assumed that AGENT, PROCESS, and PATIENT are relatively more prototypical event concepts than RESULT in terms of our natural experiences. The original EEM can be adapted into the new version displayed in Fig. 9.

Figure 9 displays the whole ENVIRONMENTAL EVENT construed in a prototypical structure with three levels of concepts, including the superordinate level of the concepts, AGENT, PROCESS, PATIENT, and RESULT, in which RESULT does not occur that frequently and thence is not that prototypical (indicated by the non-bold word led by the dotted arrow); the basic levels of primary AGENT (A_1, $A_2 \ldots A_n$), PROCESS (P_1, $P_2 \ldots P_n$), PATIENT (B_1, $B_2 \ldots B_n$), and RESULT (R_1, $R_2 \ldots R_n$), along with the third and subordinate level of further particular information of the basic level concepts, respectively, are represented by I_1, $I_2 \ldots I_n$ of AGENT, D_1, $D_2 \ldots D_n$ OF PROCESS, C_1, $C_2 \ldots C_n$ of PATIENT, and F_1, $\mathrm{F}_2 \ldots \mathrm{F}_n$ of RESULT. Such a newly adapted EEM is better regarded as a dynamic prototypical structure or category where good and bad members of the same or different structure(s) will change. For example, in some cases, AGENT and PROCESS are highlighted, while in others, PATIENT and RESULT may be underscored. Sometimes, certain conceptual members may not exist.

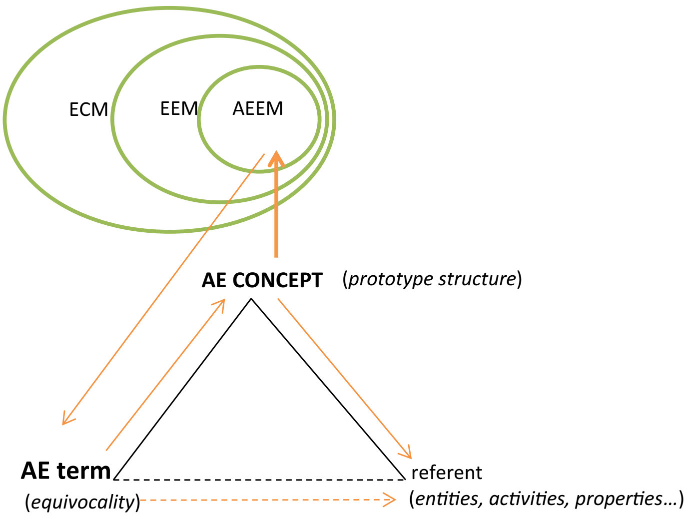

Fig. 11 The ECM perspective on conceptualization of AE terms

Moreover, the new EEM, as an adapted and integrated version of the EEM and ECM, in turn owns the strengths of the two models, including, for example, providing "more consistent, flexible, and complete representations" for terms (Martin 1998), offering three-level hierarchical and more comprehensive analyses on elements of the events tied to the terms, displaying concern about both dynamic and static events, and exposing both linguistic and conceptual knowledge of terms. Apart from the advantages of former cognitive event models, it is expected that application of the new EEM and its variants to AE terms in corpora will help unearth and substantiate potential terms, entailing not just nouns but also verbs and adjectives, etc., since conceptualization based on units of events naturally involves entities, activities, properties, and their interactions. When applied to the field of atmospheric environment, the new EEM turns into AEEM (Fig. 10) in which the basic and subordinate levels of concepts are related to AE.

Having discussed the three cognitive models, ECM, EEM, and AEEM, in the preceding part, I will present Fig. 11 to reveal interrelations between the three models and their association with AE terms. The AE term is tied to the AE concept which is linked with AEEM that serves as part of EEM and ECM, and the three models are informative to construal of the AE term.

3.2 Extraction of AE terms

Before application of the ECM and its variants to AE terms, AE terms need to be identified. Nowadays, creating terminology with the assistance of computer and large corpora has become very popular, giving rise to a relatively easier job of extracting terms. However, such a method of retrieving terms still demands a certain amount of time and energy to collect large volumes of corpora and, to some extent, naturally highlights the result of predominance of terms as nouns, while terms as verbs and adjectives, on the contrary, always seem hard to obtain in the term list despite their infrequency compared with nouns. ECM and its specific derivations will be helpful for offering a supplementary way of extracting and corroborating terms, especially terms as verbs and adjectives.

To make sure the example terms to which I will apply the ECM later are typical AE terms in English and Chinese, I capitalize on appropriate corpora and term extraction tools to extract the terms. Another essential reason to take advantage of the corpora is to testify to the supplementary role played by the ECM in uncovering potential terms of not only nouns, but also verbs and adjectives.

First, I built up two specialized corpora of the atmospheric environment, respectively, in English and Chinese.[11] Both of the corpora are based on contemporary specialized texts in the field of atmospheric environment, mainly including journal articles as well as official reports and regulations. For example, I selected English articles from the journal *Atmospheric Environment* and Chinese articles from *Chinese Environmental Science*. In addition, I downloaded the official reports and regulations centering on the atmospheric environment from English and Chinese websites. Within limited time, I temporarily set up a Chinese specialized corpus with 3,867,781 occurrences and 138 texts, together with an English corpus amounting to 25,831,354 words and 354 texts. Such reference corpora were then manually refined and evaluated so as to avoid subsequent erroneous extraction of the terms.

Second, retrieval of the English AE terms was carried out with the help of the term extraction tool TermoStat developed by Drouin (2003). Considering that TermoStat has already taken advantage of the Canadian English newspaper *The Gazette* and BNC as its default corpora with 8,000,000 English words for reference, I did not need to find an English reference corpus for this study. The assumption behind taking into account the reference corpus is to extract the real pertinent terms practically used in reality in comparison with the usage of common language. I uploaded the English corpus within the area of atmospheric environment to TermoStat and obtained the following result, with only the top 25 terms listed (Table 1).

Third, since TermoStat is still adjusted to the retrieval of Chinese candidate terms, I exploited Sketch Engine (Kilgarriff et al. 2014) to extract the Chinese AE terms. Before extracting the term candidates, I also needed a Chinese reference corpus in comparison with the Chinese specialized one. The Sketch Engine per se already contains a Chinese corpus called “Chinese Web 2011” with 1,729,867,455 Chinese words that can be chosen as the reference corpus.[12] After uploading the Chinese AE corpus built by ourselves, selecting “Chinese Web 2011” as the reference corpus, and clicking the “Keywords” button in Sketch Engine, I finally acquired the top 25 Chinese AE terms shown in Table 2.

[11] With the lack of such resources of corpora concentrated on the atmospheric environment, it is optimal to set up relevant corpora manually, which also presents a similar situation faced by other terminologists to find out adequate and reliable information from the corpus (L’Homme 2018).

[12] Though I also managed to build a Chinese reference corpus based on *People’ Daily* from the year 2012 to 2018 and obtained 103,800,691 Chinese words, the limit of Sketch Engine temporarily prevents me from uploading the corpus.

Table 1 Top 25 AE term candidates in English extracted by TermoStat

Candidate	Frequency	Score (specificity)
Emission	20,206	136.22
Concentration	12,881	107.06
Aerosol	8696	90.38
Particle	8177	86.09
Air	9953	83.93
Ozone	4791	66.26
Pollutant	4466	63.74
Dust	4354	61.42
Pollution	3928	55.48
Wind	3125	47.7
Temperature	3193	45.92
Combustion	2104	43.83
Carbon	2589	42.99
Mass	2596	42.74
Biomass	1779	40.45
Climate	2331	40.06
Transport	2419	39.2
Particulate	1621	38.97
Soil particles	2071	36.71
Nitrogen	1585	36.08
Gas	2666	35.16
Fuel	2187	34.86
Burning	1674	34.55
Monitoring	1460	34.32
Nitrate	1315	34.17

I did not spend time balancing the specialized and reference corpora in English and Chinese, for the focus of this study is not to extract the terms and the term extraction results are just a small part of helping to pick out one typical and persuasive AE term separately from English and Chinese. Therefore, even if for the time being either the English specialized corpus or the Chinese reference corpus is much larger than the one compared, at least it will not influence our study of choosing one certain AE term. In view of other terminological resources such as the DiCoEnviro database, EcoLexicon, and the Chinese term base TermOnline, coupled with observation of the counterparts of the two languages and reflection, I selected two prototypical AE terms, "air" and its equivalent in Chinese "空气", for the subsequent analysis of construal of the terms.

While, as displayed above, with the assistance of corpora and term extraction tools, I did retrieve a number of terms or term candidates, a second look at Tables 1 and 2 demonstrates that the top lists of term candidates are all nouns instead of verbs and other parts of speech. I maintain that analyzing just a few examples of the common terms of "air" and "空气" will help unearth some relevant candidate terms of verbs and adjectives.

Table 2 Top 25 AE term candidates in Chinese extracted by Sketch Engine

Word	Focus corpus	Reference corpus
O_3	2927	461
NO_2	1145	425
PM	1782	2083
颗粒物	2158	3232
SO_2	1211	1896
滤膜	700	1088
NOx	515	871
浓度	7113	41,684
气溶胶	502	2235
臭氧	775	5084
CO	781	6796
粒径	390	2542
气态	249	1329
前体	231	1121
硫酸盐	236	1263
污染物	2525	37,489
超标率	148	396
采暖	471	6603
大气	3642	66,422
沙尘	296	3673
扬尘	285	3669
雾霾	113	214
风速	350	5169
空气	4585	96,037
水溶性	237	3027

3.3 The application

Now with the two AE terms, "air" and "空气" which are on the top 25 candidate term lists in the above two tables and undoubtedly prototypical candidate terms in the area of AE, the general ECM, EEM, and AEEM are applied. Similarly, the aforementioned Figs. 11 and 12 unearth outlines of relationship between "air/空气" and its concept which is further linked with relevant ECM, EEM, and AEEM.

After resorting to the English and Chinese specialized corpora, I listed two example sentences containing the two terms from the corpora. The first sentence originated from a professional article of the English journal, *Atmospheric Environment*, written in 2018.

(1) *High-pure **air** was dehumidified by silica gel and molecular sieve before flowing into the gas supply system.*[13]

[13] The example is from *Atmospheric Environment* and can be accessed at: https://doi.org/10.1016/j.atmosenv.2018.08.008.

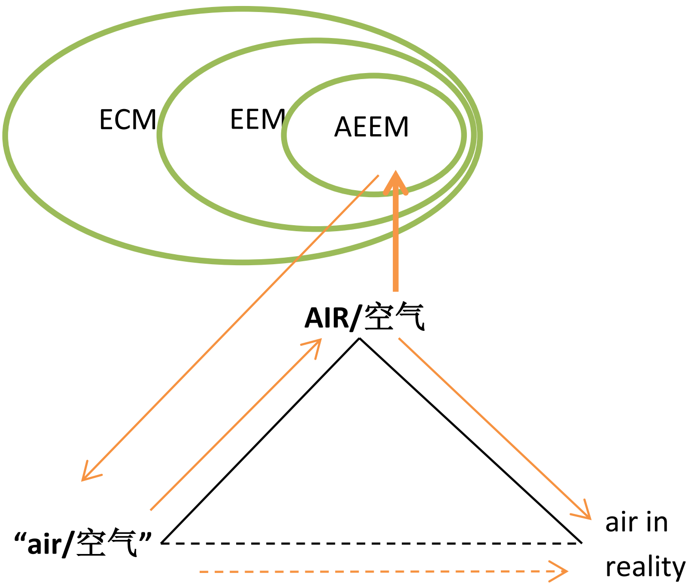

Fig. 12 The ECM perspective on the term "air/空气"

It is at least within the real linguistic context provided by the sentence of the text from experts that a better understanding of the concept of the term is offered. AEEM, as implied subsequently in Fig. 13, brings forth clarity about pertinent conceptual structures of "air".

According to the above figure, it is clearly detected that the specialized linguistic background in fact reveals and correlates with rich levels of conceptual and linguistic knowledge. At the bottom, example (1) is associated with two atmospheric environmental events—AEE1 and AEE2. In AEE1, the concept AIR as PATIENT linked with the RESULT OF BEING HIGH-PURE AND DEHUMIDIFIED is emphasized. By comparison, the AGENT and PROCESS OF DEHUMIDIFYING are placed in relatively non-prominent positions. It is also the highlighted RESULT of AEE1 that connects the two events together, which is exhibited by the solid arrow. When playing a role of PATIENT IN A RESULT of AEE1, AIR tied to the term "air" acts as THEME of AEE2, AIR FLOWING INTO THE GOAL—GAS SUPPLY SYSTEM. Within AEE2, THEME, PROCESS, and GOAL[14] are comparatively foregrounded more than the final particular GOAL (WITH HIGH-PURE, DEHUMIDIFIED AIR) which has to be inferred indirectly. The indirect information deduced from the language is marked by the shading and the related arrow indicating such deduction is marked by the dotted arrow. AEE2, like AEE1, is another derivation of ECM and EEM.

[14] The semantic roles of PATIENT, THEME and GOAL were proposed in Frame Semantics (Fillmore 1968), respectively, referring to the entity undergoing or enduring the effect of certain action, the entity moving toward a location, and the location or entity to which something moves.

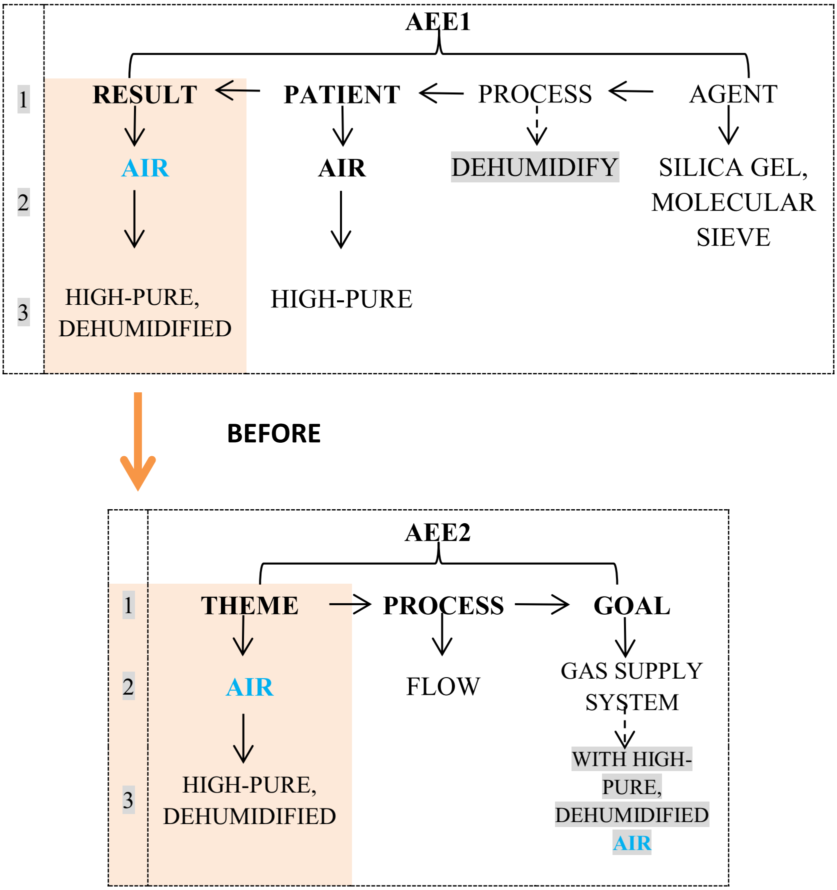

Fig. 13 Application of the AEEM to analysis of example (1) (from a different perspective, following FrameNet, AIR as PATIENT in AEE1 can also be regarded as SOURCE and AIR as RESULT can also be treated as GOAL. Semantic roles in AEE2 are variants of the new ECM in Fig. 7, instantiating Fig. 8. I insist despite distinct labels of semantic roles, what is more important is the three-level prototypical structure per se)

With further generalization, Fig. 13 discloses at least the following aspects about concepts of terms and other forms of language: concepts are construed in a variety of complex events and involved in mutual relations with other concepts; concepts are variable and multidimensional in that they can serve in distinct semantic and conceptual roles in various events; concepts in the same event or dissimilar events can be observed and organized from diverse perspectives; for instance, in AEE1 tied to example (1), the whole event is viewed in a passive order—RESULT ← PATIENT ← PROCESS ← AGENT—rather than the normal sequence—AGENT → PROCESS → PATIENT → RESULT—as shown by Fig. 14 which nonetheless explains the sentence with active voice, the example (2); the three-level AEE and other events differentiate the specificity or detail the extent of

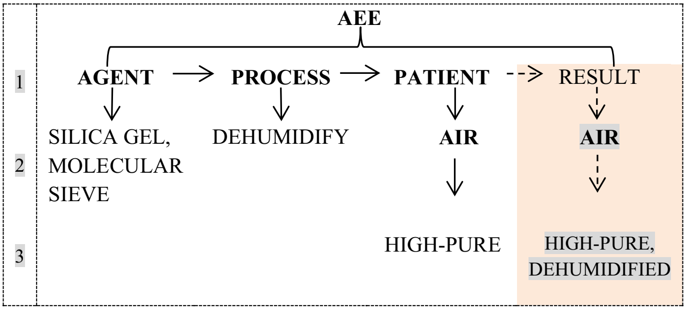

Fig. 14 Application of the AEEM to the analysis of example (2)

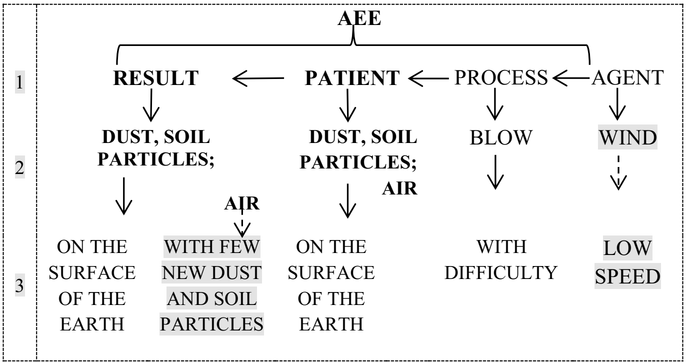

Fig. 15 Application of the AEEM to the analysis of example (3)

information, with the lower the more detailed; events are prototypical categories with major and marginal members; discrete events have various major and marginal members; events are interrelated with other events.

(2) *Silica gel and molecular sieve dehumidify high-pure air.*

In addition, since the concept of a term is as a rule naturally in association with other relevant concepts of terms occurring for the same event, the ECM, EEM, and AEEM are helpful to more explicitly uncover other potential terms linked with the term that I already extracted beforehand. In the light of AEE1 and AEE2, other candidate terms having to do with the term "air" primarily include "silica gel", "molecular sieve", "high-pure", "dehumidify", and "flow".

To substantiate the preceding analysis and supplement additional findings, I chose a Chinese sentence embracing the AE term, "空气" (air), and excerpted from a journal article on environment in China. This article is incorporated in the Chinese specialized corpus mentioned previously. I then applied the ECM and its extensions to parse the basic level concept of "空气" and its affiliated concepts within the whole AEE (Fig. 15).

(3) 在此风速下，地表的沙尘和土壤很难吹起至空气中[15] (At this wind speed, the dust and soil particles on the surface of the earth are difficult to blow into the air.)

Just like the construal of AEE1 of example (1), Fig. 15 shows the passive observation of the AEE, with RESULT and PATIENTS highlighted and PROCESS and AGENT backgrounded. Moreover, the RESULT OF AIR BEING WITH FEW NEW DUST AND SOIL PARTICLES is indirectly drawn out and shaded in the figure. The concept, WIND WITH LOW SPEED as AGENT, is also not directly expressed through language and covered with shade above.

A new discovery unmasked by Fig. 15 is that ECM is instrumental for clearly delineating conceptual or semantic roles acted by more than one type of concept with dissimilar information at distinct levels. For example, at Level 2 of the AEE in Fig. 15, two kinds of concepts—DUST AND SOIL PARTICLES, AIR—serve as specific RESULTS and PATIENTS. They further correspond to individual content at Level 3. This again verifies the significance of a hierarchical and coherent conceptual model.

On the whole, analyses of the three examples involving the term "air/空气" from the ECM perspective disclose corresponding cognitive models and concepts listed in Table 3. Since only three examples are selected as a trial application of the ECM perspective on AE terms, only partial ECM, EEM, and AEEM of the term are exposed. According to such ECMs, "air/空气" can at least be understood as: (1) a natural patient enduring the effect from certain natural or artificial agents; (2) a result of the effect in which the natural patient changes its state; (3) a natural entity that moves toward certain goals. The sequence of the range of the three models is: ECM > EEM > AEEM. ECM is the most general model that can describe various kinds of language aspects; EEM focuses on the field of the environment, including AE and other events of the environment such as renewable energy, climate change, and endangered species; AEEM is the most specific model among the three delineating AE. More examples of "air/空气" will obviously reveal more cognitive models and concepts related to the term, which will not be done further in this study.

4 Concluding remarks

In sum, I have generalized two main directions of terminology and important terminological approaches, with a proposal of two triangles underlying traditional terminology and cognitive terminology. More essentially, under such background and on the basis of the ECM and EEM, along with a number of other studies of cognitive terminology and linguistics, I exploited the general ECM and its specific derivations such as EEM and AEEM to conceptualization of AE terms.

The ECM and its variants as three-level hierarchical structures of concepts are conducive to bringing to light the conceptual content of terms. With the preceding application of the ECM and its potential versions, at least the following cognitive linguistic points are further corroborated: ECM can serve as a general cognitive means of understanding and illustrating terms and other types of language; people

[15] The example is from the article in *Environmental Monitoring in China* 2017 (2): 158–164.

Table 3 Partial ECM, EEM, and AEEM of the term “air/空气”

ECM	**ACTION**: DEHUMIDIFY, FLOW, BLOW…		**BEING**: SILICA GEL, MOLECULAR SIEVE, WIND, AIR, DUST, SOIL PARTICLES, SUPPLY SYSTEM…	
EEM	**AGENT**: SILICA GEL, MOLECULAR SIEVE, WIND	**PROCESS**: DEHUMIDIFY, FLOW, BLOW	**PATIENT**: AIR, DUST, SOIL PARTICLES	**RESULT**: AIR, DUST, SOIL PARTICLES
	THEME: AIR	**PROCESS**: FLOW	**GOAL**: SUPPLY SYSTEM	
	(OTHER COGNITIVE MODELS OF ENVIRONMENT CONCERNING AE AND OTHER PARTS OF ENVIRONMENT) …			
AEEM	**AGENT**: SILICA GEL, MOLECULAR SIEVE, WIND	**PROCESS**: DEHUMIDIFY, BLOW	**PATIENT**: AIR, DUST, SOIL PARTICLES	**RESULT**: AIR, DUST, SOIL PARTICLES
	THEME: AIR	**PROCESS**: FLOW	**GOAL**: SUPPLY SYSTEM	
	(OTHER COGNITIVE MODELS OF AE) …			

tend to construe the world in terms of units of event; the conceptual event consists of a dynamic prototypical structure and connects with various kinds of other events; it is rational to take meaning or conceptualization of language as the core which in nature lays a foundation for syntax, as supported by the case of expressing active or passive voice; concepts of terms are dynamic and multidimensional, which correspondingly gives rise to changing forms and syntactic behaviors of terms; terms and their concepts should not be examined separately from other terms and concepts within relevant practical discourses of certain specialized fields. Additionally, the ECM, with explicitly different levels of typical concepts appearing in the EVENT, is also illuminating; it demonstrates how to explicitly identify and verify pertinent candidate terms that are not only nouns, but also verbs and adjectives.

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