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FRAME BASED MODELLING OF SPECIALIST LANGUAGES

Abstract: The notion of *frame semantics* covers a wide range of approaches to the systematic description of meaning in natural languages. In most general terms the notion of *frame semantics* can be explained as any system of concepts related in such a manner that one term activates and indexes the entire system. Thus, the concept of frame bears an obvious affinity with terminology, which is also based on such a conceptual organisation. However, it needs to be stressed that *frame semantics* has not only been successfully applied to lexicology and syntax, but also it has been systematically applied to studies in the field of Terminology research. Consequently, such frames offer an opportunity to analyse both the potential semantic and syntactic behaviour of specialist language units.

The aim of this study is to propose the possible contribution of frame-based methodology to the analysis of specialist languages, which facilitate specialised knowledge acquisition. Furthermore, it offers a conceptual basis for the location of sub-hierarchies of concepts within a particular specialised domain event.

Key words: Frame Semantics, specialist languages, terminology, specialised knowledge

Introduction

The theory of frame semantics maintains that language users understand the meanings of words mainly by virtue of the frames which they evoke. One may say that the frames embody story fragments the function of which is to connect a group of words to a bundle of meaning. At the same time frame semantics aims to define ‘the participants and props’ involved in each frame and therefore, the theory serves to describe any natural language, or any variety of natural language, yet here we confine our attention to one form of specialist language

which has been given little attention so far and hence seems to be worthy of academic discussion.

The aim of this study is to come to grips with specialist language, which can be understood from a number of different perspectives and points of view, such as highly conventionalised, semi-natural and not fully autonomous communication codes limited to characteristic, mostly formal, situations. In most general terms, specialist languages can be portrayed by both subject matter and semantic content; however, undoubtedly the most distinctive feature in the makeup of specialist languages seems to be the frame of context in which they are anchored. Specialist languages seem to constitute an ontological gradient phenomenon which can be regarded as representations of microrealities that integrate specific linguistic expressions, scientific knowledge, special practices and special sociocultural settings. All these characteristic trades are jointly responsible for frame-based modelling in the form of dynamic scenarios with their interactional properties.

A cognitive frame refers to an assemblage of the knowledge people share about a certain situation. Frames arrange connections between experience and language and contain links to more complex knowledge structures. They are frequently activated and indexed by terms (or specialist terminology) related to them. Frames enable us to interpret the surrounding environment, formulate messages, understand the messages of others, and accumulate or create an internal model of one's world. This means that frame-based approaches allow account for the dynamicity inherent to specialist languages, and have much to say on the notion of specialist language in terms of an ongoing process.

Conceptual structure and terminology

A vital factor of terminology is undoubtedly the specification of the conceptual framework of specialised domains. Naturally, the way terms are portrayed influences the configuration of information within specific terminological entries and the contents of each data field, particularly with respect to individual conceptual description or definition (Faber *et al.* 2006:191). The representation of a given prototypical event provides a frame for the basic processes that take place within the particular subject field (Faber *et al.* 2006) and hence within this context, notions are arranged around an action-environment interface.

A particular subject domain is portrayed on the basis of the events that predominantly take place therein and can be represented accordingly. Indeed, each specialised knowledge field may be said to have its own event template. Consequently, part of the understanding of specialised knowledge is represented in reference to basic entities combined by various types of conceptual relations.

Depending on the area of expertise, different events can be enumerated. Both actions and events are easily comprehended via a conceptual system, thus construct the foundations for conceptual event structures that are in turn applied to deal with new events and actions, which are classified within the context of such idealised frames. The elaboration of an event template for a specialised area of knowledge enables the individual to process its conceptual content effectively.

The essential concepts of object, event and attribute are the starter aspects for any kind of terminology management, which also should primarily be carried out to enable comprehension. In turn, terminology management entails configuring notions with important information and in sensible arrangements or connections with each other so that the individual is able to process them, acquire the knowledge they transmit, and memorise them more efficiently and effectively (Faber and Tercedor Sanchez, 2001:192-204). Notice that flexibility gains much prominence in this approach and for this reason events are dynamic and real-world entities might perform various roles in them.

Frames in specialised fields

Linguists have recently explored new models for taking into consideration terms that are related to events and processes within a particular subject domain. The notion of *frame semantics* amounts to saying that in order to comprehend the meanings of terms in a language an individual needs to possess knowledge of the semantic frames or conceptual structures that underlie their application. On occasions, *frames* have been more broadly defined as a type of cognitive structuring device based on experience that provides the background knowledge and motivation for the existence of words in a language and also the way those terms are applied in discourse.

The notion of *frame* seems to have attracted much interest of terminologists.¹ In that context, frames can be based on *frame semantics*, and the methodology elaborated within the FrameNet (2014) project or the loose adaptations of the original framework.² There have been a number of influential applications of Fillmore's (1982, 1985, 2006) *frame semantics*, such as establishing equivalence relationships between English and Portuguese verbs in the field of law (Pimentel, 2013); discovering frames in the field of medicine applying natural language processing techniques and external resources (Wandji, 2013); and also offering a very general frame to account for the different processes observed in the field of environment (Faber, 2012).

¹ See, among others, Faber (2012), Pimentel (2013), Schmidt (2009), Wandji *et al.* (2013).

² On this issue see Fillmore (1985), Fillmore *et al.* (2003).

It follows that various elements of *frame semantics* have been applied to construct subject specific domains and form non-language specific representations. Such arrangements construct the conceptual meaning underlying specialised texts in various languages, and thereby enable simplified specialised knowledge acquisition. Some basic premises are connected with the description of specialized domains that are based on events that frequently occur in them, and also can be represented accordingly. It seems that significant premises of the FrameNet approach can also be applied to specialised language.

Frame Semantics and FrameNet

Frame semantics is based on the premise that meanings of lexical units are construed with respect to background knowledge, whose structure can be investigated with reference to semantic frames. Frames can be regarded as either schemas or knowledge structures emerging from everyday experience (Fillmore, 1985:222-254). More specifically, a frame can be referred to as the schematic representation of a situation that contains participants, *props*, and other conceptual components, which form its frame elements.

According to *frame semantics* methodology, lexical units are understood in terms of frames. Therefore, the signification connected with a given element cannot be perceived irrespectively of the frame it evokes. On the basis of this approach the aim set to the FrameNet is to explore different patterns of conceptualisation which are involved in the English lexicon.

Provided that it is the semantic frame evoked by a lexical unit (no matter whether it belongs to either general or specialised domains) that allows the understanding of its significance, the meaning of specialised lexical units considered in this paper is studied with respect to the semantic frames they evoke. Both frame semantics and the methodology of the FrameNet project can be successfully applied to the study of a specialised domain, because of the fact that the frame is evoked by a specialised lexical unit that enables its production and understanding.

The frame of MANAGEMENT

More generally cognitive models are applied in the description of terminology and enable one to establish the picture of the connections between various notions. To illustrate such a situation, a brief description of the MANAGEMENT frame will be sketched in the following section.

management.n	
Frame Element	Core Type
Concessive	Extra-Thematic
Controlling_entity	Core
Degree	Core-Unexpressed
Dependent_entity	Core
Dependent_situation	Core-Unexpressed
Dependent_variable	Core-Unexpressed
Manner	Peripheral
Place	Peripheral
Time	Peripheral

Table 1. FrameNet display for the lexical entry MANAGEMENT.³

The elements given in *Table 1* were provided for the <BEING_IN_CONTROL> frame. According to the FrameNet project, the notion of MANAGEMENT can be defined as the act of managing, direction or control. Observe that FrameNet identifies different types of frame elements, depending on how central they are to a particular frame. In the case of the concept of MANAGEMENT, the following elements can be enumerated: core, peripheral, extra-thematic and non-core. On the basis of *Table 1*, DEPENDENT_ENTITY and CONTROLLING_ENTITY are conceptually central constituents, and they are responsible for the specificity and exceptional nature of the frame in question. The Core-unexpressed elements, that is DEGREE, DEPENDENT_SITUATION and DEPENDENT_VARIABLE, are instances of core elements which may not be used in descendent frames. CONCESSIVE constitutes an extra-thematic frame element which does not have a frame-specific understanding and is that which can explicitly portray an independent scene that evokes a separate frame. Here the elements MANNER, PLACE and TIME belong to non-core frame elements and do not uniquely characterise a frame and can be instantiated in any semantically appropriate frame.

To illustrate some language evidence, several example sentences from FrameNet are here provided:

³ <https://framenet.icsi.berkeley.edu/> (accessed on March 21th, 2017).

After they lost Jerusalem, a Mongol invasion swept through, and [Time_{in} 1244] [Controlling_entity_{the Mameluke dynasty of Egypt}] [took]^{Supp} CONTROL^{Target}, ruling Jerusalem for the next 250 years.[Dependent_entity]

[Controlling_entity_{She}] was [in]^{Supp} CONTROL^{Target} [Dependent_entity_{of the empire}] " [Time_{within two days of his death}], said Tory MP David Shaw.

[Dependent_situation_{A large forest fire that started on Monday, June 9}] is still [out]^{Supp} [of]^{Supp} CONTROL^{Target} [Place_{in the municipality of Froland in southern Norway}].[Controlling_entity]

Such [Manner_{precise}] CONTROL^{Target} [Dependent_variable_{of the shapes and sizes of areas/regions of genetically engineered cells}] would be very difficult to achieve with free viral vectors, which can diffuse freely in solution.[Controlling_entity]

But in order to regain [Degree_{some}] CONTROL^{Target} [Dependent_entity_{over their lives that they firmly believe they 've lost}], they 're now trying to determine, with unwavering certainty, that we 've all been doing this wrong the whole time and if we just get back to what the founders wanted, everything will be ok .[Controlling_entity]

He already told me: [Controlling_entity_I] [have]^{Supp} [Degree_{no}] CONTROL^{Target} [Dependent_situation].⁴

Semantics frame labeling allows us to mark particular constituents in the extracted data according to the frame elements that they exemplify.

In order to understand the notion of MANAGEMENT and its relations, it is helpful to review its most important constitutive elements. The first step is the identification of the most essential element, that is the CONTROLLING_ENTITY, which can be defined as a thing or person whose behaviour controls a DEPENDENT_ENTITY, DEPENDENT_SITUATION, or DEPENDENT_VARIABLE. In turn, the DEPENDENT_ENTITY constitutes an entity, frequently a thing, that is influenced in its behaviour by a CONTROLLING_ENTITY. In turn, the DEGREE is the extent to which the CONTROLLING_ENTITY effects the DEPENDENT_ENTITY. Furthermore, the DEPENDENT_SITUATION is a situation whose temporal or other characteristics are influenced by a CONTROLLING_ENTITY. The DEPENDENT_VARIABLE can be portrayed as a scalar variable whose value depends on the behaviour of a CONTROLLING_ENTITY. Finally, the MANNER is characterised as any description of the event which is not covered by more specific frame elements, including force, secondary effects, and general descriptions comparing events. Likewise, it may indicate salient characteristics of a CONTROLLING_ENTITY that also affect the action in equal measure. A more peripheral element, PLACE, refers to the location at

⁴ The sentence examples belong to the lexical entry – CONTROL which was taken from FrameNet (accessed on April 17th, 2017).

which the controlling occurs. Logically, TIME concerns the time at which the controlling occurs.

The following frame, which is proposed for the concept of MANAGEMENT, results from combining various data taken from electronic sources, such as: FrameNet and WordNet.⁵ Frame elements were taken from FrameNet, and related conceptual units were elaborated on the basis of the WordNet source.⁶ The data has been subject to selection and formulation. In other words, only what was somewhat subjectively considered to be relevant information has been included in the model proposed and – at the same time – certain formal frames have been adapted for the purpose of encoding relevant information that would be taken into account, for example: charge, direction, commission, counsel, counselling, guidance, instruction, way, focus, centering, steering.

Because the account offered in WordNet is far from formalised, we have decided to adopt the following conventions. To start with, the focal concept of <MANAGEMENT> are presented with the convention of the angle brackets, constitutive elements of the frame are formalised by means of square bracketed capitals, while related conceptual units are coded by means of round bracketed capitals.

Frame elements	Related conceptual units
[CONTROLLING ENTITY]	X sets and holds a course of Y. X is in charge of running a company. X manages Y. X provides direction/advice for Y. X assigns a duty/responsibility/obligation to Y. X provides financial liability. X imposes a task upon, assigns a responsibility to Y. X instructs/commands Y. X pays attention / implies responsibility for safety toward Y. X files a formal charge against Y. X is a person committed to care of Y. X attributes responsibility to Y. X is in charge of running a business. X gives advice to Y.
	Steering Guidance Counsel Commission Charge Focusing

⁵ WordNet Solution has been developed and deployed at the Faculty of Electronics, Telecommunications and Informatics at Gdansk University of Technology. WordNet Solution is strongly related to WordNet developed by linguistic engineers at Princeton University, which is a large lexical database of English. Nouns, verbs, adjectives and adverbs are grouped into sets of cognitive synonyms (synsets), each expressing a distinct concept.

⁶ <http://wordventure.eti.pg.gda.pl/> (accessed on April 9th, 2017).

[DEPENDENT ENTITY]	Y is in charge of a task. Y is a representative/delegate. Y is regarded as a special person to consider some matter. Y does as one pleases/chooses.
[DEGREE]	The concentration/attention/energy expressed by X and Y. Special emphasis attached to something by X and Y. Maximum of clarity/distinctness of an idea provided by X and Y.
[DEPENDENT SITUATION]	A general course along which a situation has a tendency to develop. The act of bringing into focus.
[DEPENDENT VARIABLE]	The special relation between X and the course along which X points or moves. A course of conduct of X.
[MANNER]	A formal statement of a command /injunction addressed to Y. X describes to Y how something can be done. X elaborates a special assignment that is given to a Y. X directs Y's attention to something. X becomes focused or comes into focus. The activities of educating/instructing provided by X. Activities that impart knowledge or skill elaborated by X. X guides/shows a way to Y. X explains how something is done or how something happens.
[PLACE]	
[TIME]	

Table 2. Frame elements and related conceptual units of the frame <MANAGEMENT>.

The elements tabled above are by no means all the elements that are variously involved in the conceptual frame <MANAGEMENT>. However, we have restricted the list of units only to those in the working of the <MANAGEMENT> frame. Some of the elements that have been distinguished here are conceptually distant and the reason for connecting them is that they are bridged by a number of conceptual elements, such as: the frame units <MANAGEMENT> and (charge) are related indirectly by a chain of such intermediate units as: (a formal statement of a command or injunction to do something), (direction), (the act of managing something). It should be noted that no examples representing related conceptual units of PLACE and TIME were found in WordNet.

In the following, a frame-based organisation of this specialised field is presented. This frame provides the conceptual underpinnings for the location of sub-hierarchies of concepts within a specialised domain event. The initial stage in this approach was the formulation of a comprehensive list of terminological elements. Once this list was available, the second step was the formation of the following frame (*Figure 1*) in which all the elements represented could fit in a logical and consistent way since it provides very useful information on text typology and consequently specialisation level.

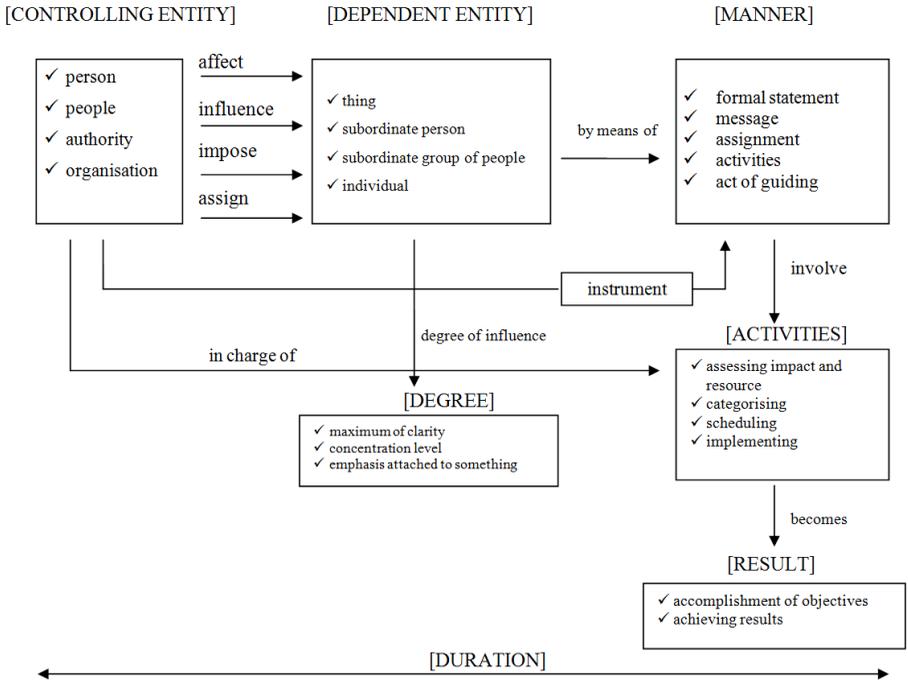


Figure 1. A possible representation of the frame <MANAGEMENT>.

On the basis of the data taken from FrameNet and WordNet, the frame of <MANAGEMENT> is conceptualised as a process that is initiated by a [CONTROLLING ENTITY] having either a higher position or rank. This entity affects a specific kind of [DEPENDENT ENTITY] that is in a subordinate position, in order to produce a result. These macrocategories [CONTROLLING ENTITY] → [DEPENDENT ENTITY] → [RESULT] are the concept roles characteristic of the domain, and provide a model for representing their interrelationships. Moreover, there are peripheral categories that comprise INSTRUMENTS that are typically used during the MANAGEMENT PROCESS, as well as a category in which the concepts of planning, analysis, and description of the processes in the main event are classified together. The [CONTROLLING ENTITY], [DEPENDENT ENTITY] and [RESULT] macrocategories present a parallel structure.

Conclusions

This paper proposes a method for discovering semantic frames in specialised knowledge areas. It is believed that frames are especially relevant for capturing

the lexical structure in specific domains and that they appear better suited to representing particular relationships between entities. The method is based on FrameNet and WordNet. Selected relevant information on MANAGEMENT was extracted and analysed.

The work argues for a frame-based modelling of specialised fields in which a process-oriented frame supplies the conceptual base for the location of sub-hierarchies of concepts within a specialised area of expertise, and the elaboration of a definition template, thus opening new vistas to a more adequate representation of specialised spheres, and providing a better way of combining terms into concepts.

The work consisted in evaluating the extent to which existing terminological descriptions could be used to discover semantic frames in a specific subject field: that of <MANAGEMENT>. Perhaps the outlined framework would have acquired a different shape if all the relations had been taken into consideration. Through the use of FrameNet and WordNet we hope to have demonstrated how it is possible to represent such an event, and create a dynamic frame which enriches and enhances the comprehending of specialised field concepts.

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