TECHNICAL COMMUNICATION: COMPLEX NOMINALS USED TO EXPRESS NEW CONCEPTS IN SCIENTIFIC ENGLISH - CAUSES AND AMBIGUITY IN MEANING

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Abstract

The comprehension problems that multiword lexical units may give rise to is a common experience shared not only by readers of technical writings but also by lexicographers, lexicologists, terminologists and technical translators. An examination of the reader´s difficulties in comprehension may reveal that certain linguistic and discourse features are more liable to misunderstandings. Nominal compounds are a usual way of expressing new concepts in scientific English despite the problems of ambiguity they may convey. For this purpose, a survey has been conducted from a corpus of these structures extracted from technical texts, i.e. instruction manuals and technical reports or specifications of devices, textbooks, or general or specialized journals.

Key-words: *scientific English; complex modifiers; premodification; technical terminology.*

Resumo

Os problemas de compreensão que as unidades lexicais polimórficas podem suscitar são uma experiência constante partilhada não só por leitores de publicações técnicas, mas também por lexicólogos, lexicólogos, especialistas em terminologia e tradutores técnicos. Um exame das dificuldades de compreensão do leitor pode revelar que

determinados aspectos lingüísticos e discursivos são mais passíveis de incompreensões. Os compostos nominais são uma maneira comum de expressar novos conceitos em inglês científico, apesar dos problemas de ambigüidade que podem transmitir. Dessa forma, conduziu-se um estudo a partir de um corpus de tais estruturas extraídas de textos técnicos ou especificações de aparelhos, de livros ou periódicos gerais ou especializados.

Palavras-chave: *inglês científico; modificadores complexos; pré-modificação; terminologia técnica.*

1. Introduction

The point of departure of this study is an empirical survey based on an analysis of a corpus of 4235 complex nominals collected from written computer science sources. In our analysis of these lexical units, 3515 (82,9%) were composed of two elements, 631 (14,89%) of three elements, 84 (1,9%) of four elements and the remaining 5 (0,1%) of five elements. The head, the last element in the compound, was always a noun directly modified by another noun (50,48%) or by an adjective (49,62%), which in turn were modified by other nouns, adjectives or adverbs, all of them classifying, caracterizing or categorizing the head.

Technical communication involves content that is highly technical both conceptually and sometimes terminologically. Just as scientific knowledge progresses, language in science experiences an evident change. The extension of the scope of knowledge, mainly in scientific and technological fields, has resulted in the need for its linguistic representation through the creation of a wide terminology

capable of describing the new improvements and discoveries. In this way, scientific language has acquired its own syntactic and discursive characteristics. Once the validity of a new concept has been agreed on by specialists in the field, standardization takes place in a process of widening its areas of usage through its generalized use in oral and written sources which eventually contributes to its settling in the language.

As regards modern technology, the English language has been the main vehicle for the spread of new technological terms, as current scientific development is generally published in English. From a lexical point of view the main problem involved in technology is that very frequently there is a lack of suitable terms already available for the designation of new concepts. Apart from coining new words specially for new concepts, a very frequent designation method is the development of new terms which include modifiers indicating a specific property or essential quality involved in the concept, as in the following phrase:

(1) hierarchical database system, where the noun -*system*- is modified by another noun -*database*- which is in turn modified by the adjective -*hierarchical*-.

A single scientific concept is very often represented through a complex nominal, and not through a simple term. It sometimes happens that a new concept appears to be useful to name a new device, technique or method in a given field of knowledge. Such a concept may be identified by its definition. The more conceptual the abstraction, the more complex are its linguistic representations, as primary concepts interrelate to express more complex concepts (cf. Horsella et al. 1991: 126). Nowadays, neologisms sometimes fill the gaps of

vocabulary in a language; but different fields of knowledge, through the designation and specification of the same term, very often create their own terminological systems, which serve to name conceptual units represented by means of complex nominals:

(2)   a.   *language*
      b.   *programming language*
      c.   *high-level programming language*

This syntagmatic group in which the head -*language*- is a noun whose own characteristics are determined by the presence of modifiers is referred to as a complex nominal. The noun -*language*- either acting as subject or object, is liable to complementation so as to extend or specify its meaning. Heads together with their modifier/s form a compound structure or complex nominal, which has the same grammatical status as the head; the structure whose head is represented by a noun, acts as a noun in the whole sentence, i.e., as subject or object.

Different authors apply different denominations to this aspect of language. Salager calls them *Compound Lexical Phrases, Nominal Phrases, Nominal Compounds* or *Complex Nominals* (Salager, 1983: 135). Palmer refers to them as *Strings or Pliologs* (in Salager: 1983, 136), while for Varantola they are *Complex Nominals, Nominal Style* or *Noun Disease* (Varantola, 1984). Bache, referring to those which contain several adjective modifiers, writes about *Poly-adjectival Nominal Phrases (PNP's)*.

2. Causes of the rise of complex nominals

The special frequency of complex nominals in scientific English can be attributed to different causes:

a) **Linguistic economy principles** which stem from a desire for reduction and synthesis, give rise to these linguistic structures typical of scientific language, where information is condensed. It is becoming increasingly common to join a whole group of words together into a kind of compound and to use the latter as a premodifier. The following expression used to describe a robot, would not surprise an English reader:

(3)   *this four-and-one-half-foot-tall computer-controlled automaton* (Newsweek, 1982)

The various modifiers on the left of the head - *automaton*- delimit the extension of its content. An analysis of the transformations undergone will show that these modifiers have been moved from postnuclear position, eliminating prepositional markers as a result of which changes in the position of elements have taken place:

* *this automaton which is four-and-one-half-foot-tall and which is controlled by a computer.*
* *this automaton [which is] four-and-one-half-foot tall and [which is] controlled [by a] computer.*
* *this four-and-one-half-foot-tall computer-controlled automaton.*

This right to left movement of elements is associated with the effects of requirement of linguistic economy:

The principle of economy inherent to technical writing makes itself clearly felt in the intensive spread of compound nominal phrases also called strings, pliologs, or complex lexical items constructed from simple ones in which two or more units are juxtaposed.   (Palmer, 1968: 72)

and

Linguistic economy has an influence on the peculiar style of scientific writing which seeks to draw the attention of the reader. As information is shorter, more direct, more condensed, its message produces a greater impact on the reader. (Bartolic, 1978: 260)

Scientific prose has sometimes been blamed for accumulating too many modifiers on the left of the head; but this trend is not exclusive of scientific discourse, as other registers, such as publicity or newspaper language may be responsible for the abuse of complex nominals, specially in headlines where **brevity** and **concision** seem to be maximum requirements:

Titles are crucial, for they indicate what authors or editors think will arrest the eye of the typical reader skimming the title page. (Myers: 1986: 8)

and

Compounds are ideally suited for use in situations where there is a premium on brevity, yet no appropriate unitary system exists. Thus newspaper headlines are filled with compounds (...).

Compounding serves as a backdoor into the lexicon.
(Downing, 1977: 824)

Strictly speaking the process is the following:

> *First an embedded kernel sentence of the kind [NP is A] is transformed into a relative restrictive clause; next, a deletion transformational rule is applied to this output and adjectives are produced in postnominal position; finally, an adjective-shift transformation is applied to this latter output, and the result is a prenominal adjective.* (Cohen, 1978: 17)

Different operations are performed in the process which ends in the formation of a compound, e.g:

(4)   *device used for input operations*
a   Loss of grammar elements: *device* [*used for*] *input operations*
b   Alteration in the order of elements implied, together with the absence of grammar and lexical elements (*input device.*)

   In this way, the use of nominal structure with premodification becomes certainly more economical, as prepositions, relatives or verbs are removed; on the other hand, the semantic potential of this structure is greater, although it may sometimes imply, for example, the loss of the referent, which may cause serious difficulties to the reader.

   A desire for novelty may also contribute to the formation of multiword lexical units. In today´s world in which technical innovations are more and more productive,

information in newspaper headings or advertisements must be presented in such an attractive way that it rapidly catches the attention of the reader who skims through the content of a newspaper or magazine (Losada, 1981: 53), as for example the following title of an article:

(5)   *Accounting Software Group Test*

The need to name **new concepts** for which the language has not specific names already coined, is also closely related with the origin of many complex nominals. By using modifiers the characteristics of the new concept will be specified: i.e. the function of the head and its relation with other parts will be stated.

Terminological gaps in scientific prose are therefore very often the reason why new compounds are coined.

Generally speaking, scientific register is more prolific in using complex nominals than other registers in the English language, as Quirk (1985) states:

> *Scientific writing differs greatly from the other varieties in having a distinctly higher proportion of noun phrases with complexity (and multiple complexity); a distinctly lower proportion of names and pronouns among its simple noun phrases; and the weakest association of simple with subject and complex with nonsubject.* (: 1351)

and B.L. Dubois (1981) admits:

Extensive prehead modification in the noun phrase has been assumed to be the defining characteristic of written scientific English. (:151)

The use of complex nominals can be indicative of the degree of formality or specialization of the language; in fact, the more specialized the text is, the more frequent and complex the nominal structures[1]. Salager (1983:142) establishes a parallelism between poetry and scientific discourse when considering the recourse to nominal groups so as to transmit new ideas: "The scientific or technical writer resorts to compounds in the same way and for the same reason as the poet has recourse to metaphors or alliterations".

3.   Ambiguity in the interpretation of complex nominals

In general, a lexical unit is likely to prove ambiguous when it has more than one technical sense within the same subject field. In this sense, complex nominals very often show ambiguity and may need re-reading to enable the meaning to be puzzled out. But sometimes, as is often the case in technical English translations, extralinguistic knowledge may be even required so as to be certain of the exact meaning they convey:

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[1] [1]F.Salager (1983:142) compares Technical English (TE) with General English (GE):

	Nº NP	NºW/NP	Aver.length	%NP/text
TE	1179	3073	2.61	15.37
GE	69	173	2.51	0.87

Nº NP: Nº noun phrases
Aver. length: average length
Nº W/NP: Nº of words/noun phrase
%NP/text: % noun phrases/text

A great deal of information can be packed in a fairly small space (...), by using heavy NP structures frequently we discard most of the requirements of a smooth and elegant style or easy readability and expect a great deal of background knowledge and perseverance from the readers. (Varantola, 1984: 157)

Thus, if a head is premodified by more than one word, the interpretation of the complex structure can pose doubts as different combinations, all grammatically correct, can be inferred, due to the fact that no semantic relations between constituents are formally indicated:

(6)   *data link control procol* could be understood as:
      - the data protocol of control link:
      [(data ((link control (protocol))]
      - the control protocol of a data link:
      [(data link (control protocol)]
      - the protocol of a data link control:
      [(data (link control)) protocol][2]

(7)   *translator writing system*, presents, on the other hand, a single interpretation as regards the extent of the modifiers, [*translator (writing system)*] but the semantic relation may be questionable as it may indicate purpose or source: *writing system for the translator* (purpose), or *writing system of translators* (source).

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[2]57% of our students were insecure guessing the real scope of the modification in this structure.

Therefore, paying more attention to ideals than reality, B. Warren writes:

Performance constraints in the analysis of multi-member combinations are the reason why structures consisting of more than two compounds (i.e) two N + N combinations, are not common. (Varantola, 1984: 40)

However, our analysis of technical texts shows that complex nominals are very productive formations in English. To be able to interpret them adequately, extralinguistic knowledge related to the semantic content of their components and the way they relate syntagmatically is required; and even so, we find many complex nominals in which their components can interrelate in more than one possible way and will therefore require the context in order to be interpreted and classified; and even this final check is not always effective unless the reader has an adequate technical knowledge, especially when many modifiers are involved.

There are two types of ambiguities (cf.Warren, 1978: 68-69): the most obvious (the real ambiguity), although relatively rare, arises when the structure has more than one possible standard interpretation:

(8) *English teacher - teacher of English?* or *a teacher who is English*?

A second ambiguity is caused when only one referent is feasible but there is more than one possible relation between the parts of the compound:

(9)   *batch control   control of the batch?*
                        control for the batch?
                        control in the batch?
                        control from the batch?

This kind of ambiguity is more common than the former and it is especially frequent in possession, purpose, source and place relations. Sometimes a single extralinguistic reality may be expressed in more than one possible way.

(10)   *system software   - software which is in the*
                        -system (place); or
                        -software for the system (purpose).

The ambiguity posed by premodification can be a serious problem for the non-specialized reader and even for the linguist who uses the language for specific purposes both in the phase of comprehension or interpretation of the source text and in the corresponding conversion into the object language or translation.

4.   Conclusion

Technical English establishes communication between writers/speakers and an audience of readers/listeners with different degrees of expertise both in the subject involved and in the command of the language. The basic requirement of a good scientific or technical text in all disciplines is to provide logical, clear, precise and concise information to the reader. As premodifying structures very frequently impede comprehension and contribute to ambiguity, nouns should be modified by no more than two other nouns and preferably by no more than one. In order to enhance easy readibility, the

total number of modifiers (nouns, adjectives, qualifiers or adjectives, *-ing/-ed* forms) for a noun should rarely exceed three. Linguistically speaking, the coinage or formulation of neologisms for technological discoveries is always an easy way out when faced with changes in technology. However, the wide-spread habit of adding premodifiers to the noun can be a barrier to communication not only in oral presentation but also in written information. In speech the use of a different intonation can make the meaning slightly clearer but still the listener cannot always find out, as in writing, the scope of modification and the semantic relations implied among the elements of the compound. Thus, if the meaning of a compound cannot be grasped in a straightforward way, it is advisable to break it down into smaller sense units and interpret them as post-positional structures.

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Appendix

In our corpus of 4244 of multiword lexical units, the following structures have been devised according to the number of elements involved.

A) Two elements (82,9%)

a)Ad N	*electronic devices.*
b)N+N	*memory devices.*
c)Adj(-ed)+N	*detailed understanding.*
d)Adj(-ing)+N	*switching mechanism.*

B) Three elements (14,8%)
a)Adj+Adj+N   *vital economic advantages*
b)Adj+N+N   *unusual energy states.*
c)dj +Adj(-ing)+N   *major distinguishing characteristics.*
4)Adj(-ed)+Adj+N   *defined active centers.*
5)N+N+N   *computer memory devices.*
6)Adv+Adj+N   *fairly short time.*

C) Four elements (1,9%)
1)Adv + Adj(-ed)+N+N   *carefully controlled Growth techniques.*
2)Adv+Adj(-ed)+ Adj+N *carefully prepared crystalline material.*

D) Five elements (0,4%)

1)Adv+Adj(-ing)+N+N+N *exponentially decaying average usage count*
2)Adj+N+N+Adj+N   *single-user programmer operated-systems*
3)Adj+Adj+Adj+N+N   *interesting large electronic text projects*

Begoña Montero is involved in the research of scientific discourse (ESP, Technical Translation, Terminology), as well as in the application of new technologies to language teaching and the production of EAP teaching materials.