

UNRAVELLING NOUN STRINGS: TOWARD AN APPROACH TO THE DESCRIPTION OF COMPLEX NOUN PHRASES IN TECHNICAL WRITING

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In this article we go into a thorough analysis of complex noun compounds in technical texts. We understand that a noun compound is a unit consisting of two or more nouns, plus such other parts of speech as are necessary, that together express a “single noun” idea or concept. We have analysed various examples taken randomly from different engineering publications in order to describe their use and, rather often, abuse in this context. The typology and main characteristics of complex noun compounds in ESP communication are discussed. Noun strings are not only specifically useful for enabling more concise, accurate and precise communication, but also because they often help to fill terminology gaps which refer to new concepts, improvements or discoveries. Besides, their semantic potential and high specialization are characteristics very much valued by technical writers.

Key words: complex noun compounds, EST, noun strings, noun clusters, technical writing.

En este artículo hemos llevado a cabo un análisis pormenorizado del uso de los nombres compuestos complejos en textos de carácter técnico. Entendemos por nombre compuesto una unidad formada por dos o más sustantivos, más las unidades del lenguaje que sean necesarias, que conjuntamente expresen una única idea o concepto. Hemos analizado varios ejemplos cogidos al azar de distintas revistas de ingeniería con el fin de describir su uso, y a menudo abuso, en este contexto. Hemos llevado a cabo un estudio de la tipología y de las principales características de los nombres compuestos complejos en IFE. Estas estructuras no son sólo especialmente útiles por permitir una comunicación más precisa y concisa, sino que también con frecuencia contribuyen a llenar vacíos terminológicos.

Palabras clave: nombres compuestos complejos, ICT, escritura técnica, cadenas de nombres, premodificación compuesta.

1.- INTRODUCTION

A very important aspect of the writing process in the technical world is the selection of the most appropriate and accurate terms to reflect the ideas being presented. Vocabulary is in fact one of the main distinguishing features of technical language. Following Pinchuck (1977), technical language is probably the most important source of new words in the world's languages today. The creation of these new terms usually seeks the most economic use of linguistic means to achieve standardization of vocabulary and usage. Technical language also aims to achieve the highest degree of precision in the use of words and a lack of ambiguity, i.e. one sole interpretation.

Among the main sources of vocabulary in technical language -nominal phrases, compounds, derivatives, new applications of words, neologisms and borrowings (Pinchuck, 1977)- noun compounds of various kinds have acquired a certain degree of notoriety in the past few years. In fact, it has been found (Salager, 1983) that these structures are significantly more numerous in scientific and technical writing than in general English.

Technical writing uses a broad variety of noun compounds which are employed for an ample range of purposes and the more specific the text is the higher the presence of these units. As a result, complex compounds are a matter of concern for linguists, given that they are considered key elements when it comes to the understanding of language, since these noun strings are the main carriers of information in technical texts.

2.- DEFINITION OF COMPOUND NOUNS

A noun compound is a unit consisting of two or more nouns plus such other parts of speech as are necessary -adjectives, and less often verbs and/or adverbs- that together express a 'single noun' idea or concept. Noun compounds are reductions from full clauses i.e. they are usually formed from prepositional phrases or relative clauses, and many can be back-formed into one or the other of these.

A noun compound is a syntagmatic group in which the head is always a noun whose characteristics are determined by the presence of modifiers which have the same grammatical status as the head. The head noun may act either as a subject or as an object, and it is usually complemented by modifiers so as to extend or specify its meaning.

It is not always easy to determine whether we are dealing with a compound noun or with a premodifier + head sequence but there are several aspects which may help in the identification of one type or the other:

- I. Orthography: A compound, which is a combination of words regarded as a unit, may take one of three forms: it may be spelled as separate words (open compound), it may be joined by one or more hyphens (hyphenated compound), or it may be spelled as one word (solid compound).
- II. Stress pattern: Sound patterns may indicate if the word group is a compound or a premodifier + head sequence. A compound usually has a falling intonation: "mémory devices", as opposed to the phrases "electrónic devíces".
- III. Analyzability: In general, the meaning of a compound is a specialization of the meaning of its head; in contrast the modifier limits the meaning of its corresponding head.

We have found different ways of naming these units in specialized literature. Huckin and Olsen (1983) as well as Trimble (1985) refer to them as *noun compounds*. The former also calls them *noun strings* and for Tobin (2002) they are *noun clusters*. Other authors use various names when alluding to them- Salager (1983) talks about *compound lexical phrases*, *nominal phrases*, *nominal compounds* or *complex nominals*; and Montero (1996) adds the terms *multiword lexical units* and *complex modifiers* to this list. Montero also gives an account of terms used by other writers- *strings* or *pliologs* (Palmer), *complex nominals*, *nominal style* or *noun disease* (Varantola), and *poly-adjectival nominal phrases* (Bache).

3.- TYPOLOGY OF NOUN STRINGS

The issue of defining noun compounds is closely linked to that of defining categories of noun compounds.

Montero (1996) groups noun compounds in terms of the number of elements

that they include. The simplest pattern being the two-element structure (N+N), which is fairly easy to recognize and construct and very common both in specialized and general English (*Memory devices, Batch processing, Encryption algorithm*).

Noun compounds can also be formed by three elements. In these, the base is still a noun plus noun unit, and they can be premodified by an adjective (Adj + N +N) which may be formed from non-finite verbal forms (*unusual energy stat, major distinguishing characteristic, input job stream, floppy disk drive*). The premodifying adjective can also be either an -ing adjective or an -ed adjective, e.g. *leading-edge techniques, harassing telephone calls, defined active centers, metallised-film electrodes*.

A variation of this structure are those compounds which are composed of three nouns (N+N+N) (*computer memory devices, text file name, network data packag, work file selection*). These three element units do not pose much difficulty for the technical readers and simply by applying the backward reading rule from the head of the string their meaning can easily be decoded.

The complexity of the unit increases with the four element structure. These combinations, even though they follow the regular rules of English grammar, are not very common in general English usage, resulting in a long chain with several possible patterns: Adv + Adj(-ed)+N+N (*carefully controlled growth techniques*), Adv+Adj(-ed)+ N +N (*carefully prepared material shapes*) or Adj (-ed)-N + N+Adj + N (*limited-life-time public channel*). We also find four element units composed only by nouns (*air quality regulation announcements, energy power distribution boards, fibre optics transmission system*). Here the number and types of elements are combined resulting in a long chain which needs to be unraveled carefully to avoid misinterpretation. In many instances hyphenation becomes indispensable to prevent ambiguous relationships and to state clear and accurate meaningful concepts.

Finally, we may encounter structures formed by five elements. The degree of complexity of these units is really high for unskilled readers since they can be interpreted in a wide variety of ways. These compositions can follow any of these three patterns: Adv+Adj(-ing)+N+N+N (*exponentially decaying average usage count*), Adj+N+N+Adj+N (*single-user programmer-operate systems*) and Adj+Adj+Adj+N+N (*interesting large electronic text projects*). Again, as it was the case with the four element units, we find examples of chains of nouns with no other type of modifiers, e.g. *mainframe computer database user group, 100-megabit Ethernet network technologies*.

Another possible means of categorization of noun compounds is by type of meaning relationship established among the components of these clusters

(Hucking and Olsen, 1983). These meaning relationships may have numerous combinations which correspond to the patterns of meaning displayed in table 1.

PURPOSE	used for	<i>Card punch</i> <i>Electric -furnace steels</i> <i>An address bus</i> <i>air-conditioning system</i>
COMPOSITION/ MATERIAL	made of /materials involved	<i>Stainless steel tubing</i> <i>Iron-based alloys</i>
PRINCIPLE OF OPERATION	operated with	<i>Ink-jet printers</i> <i>Spark ignition engines</i>
MODE OF OPERATION	operated by using	<i>Hand brakes</i> <i>Real-time alerts</i> <i>Vision-based vehicle guidance</i>
SHAPE	most important part is	<i>A roadheaded rivet</i> <i>Long-wire antenna</i> <i>U-shaped pipes</i>
SIZE	measurements	<i>21-inch monitor screen</i> <i>8-character password</i> <i>20-megabit memory</i>
LOCATION/ POSITION	located at	<i>Front panel</i> <i>Inlet valve</i> <i>Cross-engine section</i>
CREATOR/ DEVISER	designed by .../ developed by...	<i>Ghirling brakes</i> <i>A systems analyst</i> <i>A computer programmer</i> <i>Carot cycle</i> <i>Eddy current</i>
RESTRICTED REFERENCE/ PART		<i>Virus infection</i> <i>System commands</i> <i>Intrusion detection</i>

Table 1: Classification of noun compounds according to meaning

This classification has been further developed by different authors and we here present our own version. In the following list some common types of semantic relations between N2 and N1 are identified:

'made of/from': plastic pipe
 'made using': mark-up language file
 'consisting of': machine language
 'similar to': star-ring topology
 'belonging to': computer screen
 'having ... in/at it': e-mail nettique
 'occurring in': window pop-up menu
 'which can be kept in': desktop computer
 'coming from': information retrieval;
 'caused by': virus infection
 'affecting': program errors
 'affected by': cracker intrusion
 'intended for': encryption code
 'producing': computer factory

Trimble (1985) establishes a classification of noun compounds, regardless of their grammatical categories, in terms of their length and difficulty of paraphrasing, in order to achieve the full meaningfulness of what the structure represents. The degrees of complexity marked by Trimble are:

- Simple (two elements: adj/noun +noun): *metal shaft, stainless steel, wristwatch, main filter capacitor, water-based solutions.*
- Complex (three elements: N+N+N): *liquid storage vessel, heat-resistant materials, energy conservation measure.*
- More complex (four elements: miscellaneous): *Emergency power distribution boards, TV remote control systems, well-insulated high-value resistor, low-frequency ultrasonic inspection technique, high-frequency radio services.*
- Highly complex (five elements or more) which are mainly aimed at knowledgeable and skillful experts in the specific area, as these complex strings can present difficulties in their understanding due to the highly specialized technical meaning of some terms: *Applications employ high-performance data-signal processing technology, Non-visible infrared light-emitting diode illuminator, AT&T's long-distance telephone high-switching system, Information retrieval system implementation, The mainframe computer database user group, Water quality testing proficiency reports.*

Another way of categorizing complex noun compounds is in terms of their grammatical origin, i.e. the type of clause they can be back-formed into:

- A single, or a string of, prepositional phrases. The prepositions they commonly include are: of, for (purpose, operation), in (place/ location), on, with (containing or including a property). Some examples are: *Effective health care systems, Existing health care systems.*
- Nouns modified by relative clauses. Example: *On-chip cache memories.*
- Nouns modified by gerund phrases which most commonly come from an abbreviated relative clause. Example: *neuron scattering capabilities.*
- Or a combination of all the above mentioned structures when the structure is complex. Example: *Automotive collision avoidance system* (A system which is used for avoiding collisions among vehicles)

The graphical appearance of noun compounds is also an important parameter of difference. These units can be constructed in a wide variety of ways and hyphenation becomes a useful tool to help interpret these complex units. We find:

-ed constructions: *Water-based hydroelectric power plant.*

-ed+ acronyms: *Internet-based LSVT (Large Scale Vocabulary Test) applications.*

Non-verbal adjective constructions: *Low-quality frequency rates, High-frequency radio devices, Real-time processing.*

Numbers and measurements: *40-character buffer variable entry, 100-megabit Ethernet network technology, the full five-year transition period*

Shapes: *H-bomb, U-boat, T-shaped, V-neck .*

4.- CHARACTERISTICS

There are several outstanding reasons for writers of technical texts to consider the use of noun compounds appropriate and useful for their writing. These writers often have to face the lack of a suitable term to be used for the designation of a new idea, improvement or discovery. This lack of denomination can be overcome by referring to the new concept through a complex compound noun. This way the compound summarizes the initial definition created of the concept. As Downing puts it: “compounding serves as a backdoor into the lexicon.” (Downing, 1977:824). This way, a new term is

developed which includes modifiers referring to specific properties or to essential qualities of the term being designated (*Low-power short-range radio technology*). In short, new knowledge is converted into known technical concepts, and the specialized writers' use of complex compounds is a dynamic one, since they create new compounds as they go on building up new information for their readers.

Following with this need of filling terminology gaps, we may as well find new complex compounds being created in order to further refine an existing term which needs a more accurate designation; in fact these compounds facilitate a greater semantic potential (*Satellite based global communications systems*).

Noun compounds are also used by writers in order to avoid the repetition of a specific technical concept that needs to be referred to repeatedly throughout the text, thus facilitating reference to specific concepts already mentioned.

Once a connection has been established between two devices an Asynchronous Connection-Less (ACL) link is formed between them. An ACL link provides packet-switched communication and is the most common link used to handle data traffic.

As can be seen, complex noun compounds may often appear in a text as a name and again as a large noun compound, or they are shortened to an acronym in order to avoid repetition or avert long unmanageable phrases.

These linguistic structures are very appropriate in situations where there is a need for brevity but a lack of a suitable term to express the desired idea, as is the case of technical communication. If there is no need to include the full form -for reasons of emphasis or explanation- it is more appropriate to use the shorter, condensed form, i.e. a noun string, thus avoiding long descriptions. Given the specialized dimension of the technical world, using a noun compound instead of a prepositional phrase permits a much more succinct form of communication. Since prepositions, relatives or verbs are removed, "the advantages of this structure [are] the economy of the language and the conciseness of the idea being expressed." (Salager, 1985:4).

Apart from this linguistic economy principle, technical communication endeavours to define its terms accurately, to use a type of vocabulary that is specific and to achieve the highest degree of precision in the use of words (*It passes from the all-optical long-haul network to the lower bandwidth metropolitan area network*). If this isn't so, communication among specialists may become extremely cumbersome and time consuming.

Noun compounds are also useful cohesive devices. These multiword lexical units are often used to provide lexical cohesion over extended passages and they

contribute to making information more integrated. They can as well be used as a means for more easily shifting noun phrases around in a sentence, since simpler phrases are more likely to appear at the beginning of a text whereas more difficult compound nominal phrases tend to appear later in the passage, once the reader is more familiar with and knowledgeable of the subject the text deals with.

Specialized writers may also use complex noun compounds due to a desire for novelty. It is a fact that, in today's academic world, technical writers must realize that few of their readers will have time to go through every piece of literature in the field, therefore information in technical writing must be presented in such an attractive way that it rapidly catches the attention of the reader who skims through the content of the text, making him want to continue reading it.

Noun strings may pose great difficulties to the reader, especially if he does not share the same background knowledge of the subject at a specific point, since they are the result of applying the concepts and vocabulary of technology addressed exclusively to a specific group of professionals. Very complex compounds require a thorough knowledge of the subject matter to be understood and, even in some cases, the writer has to explain them in the text for his colleagues to understand. Sometimes extra linguistic knowledge may even be required so as to be certain of the exact meaning they convey. But if a reader is already familiar with a noun string and the writer uses it skilfully, it can definitely ease communication.

5.- ABUSE

Scientific discourse, where brevity and concision seem to be maximum requirement, has sometimes been blamed for accumulating too many modifiers on the left of the head. As we have seen in the previous section of this article, this trend is very useful for several reasons, and it can facilitate communication. But, if not used correctly, it can become abusive and produce difficulties in comprehension. Let's review some of the most common causes of abuse.

Nominal compounds, when not built correctly, may cause problems of ambiguity if they have more than one sense within a single area of study. Therefore, some complex strings may require several readings before they can be interpreted correctly, since different combinations, all grammatically correct, can be inferred.

Following Warren (1969) we can identify two types of ambiguities. The real ambiguity takes place when there is more than one possible standard interpretation. The other type of ambiguity has to do with various possible relations within the different elements of a compound.

A second source of abuse in noun compound formation has to do with over-elaboration. Technical writers should try to build texts that are easy to comprehend and are transparent, but in many instances these authors tend to over-elaborate their constructions. Nouns pile up, one modifying the next, and clarity is lost, even to the risk of being misinterpreted (Kvam, 1990) thus being detrimental for comprehension.

Another good reason against the excessive use of noun clusters is that they require more background knowledge from the reader (Dubois, 1981), since they pack nouns and modifiers together without doing enough to show the reader the relationship between the parts. In fact, they impose a great burden on the reader who must do the work of unpacking, deciphering and sorting these complex units. This results in the distraction of the reader from concentrating on the science, threatening the openness of the text to outside examination.

Finally, the excessive use of noun compounds is often inelegant, not contributing to a good professional style.

6.- CONCLUSION

This article has reviewed the importance and most outstanding features of noun strings used in scientific and technical communication. If logic, precision and clarity are achieved, then the use of compounds will provide a more concise and accurate communication, often helping to fill terminology gaps which may refer to new concepts, improvements or discoveries. If, on the contrary, compounds are not used appropriately, important problems of comprehension may arise.

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