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Extra-Linguistic Influence on the Syntax of the Technical English Register

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It is well known that the syntax of the technical English register differs in some features from that of general English.Technical English characteristics have been the predominant use of passive constructions, compounds, short forms of adjective clauses, nominalized structures, just to name a few. These facts have been usually only stated and no deeper reasons accounting for the particular flavour of this register have been offered. The present article will attempt to clarify the phenomenon from an extra-linguistic aspect.

Students trained in general classroom English often find themselves unable to cope with technical English texts. This becomes especially true when the learner goes into the professional world, where he is expected to read professional texts written for native speakers of English, or participate in discussions after lectures delivered in English, or even lecture in person on a particular topic. Moreover, writing an English paper and/or a summary of the paper discussing the phenomenon into which he has been researching is additional difficulty he will be facing as a scientist. Even those with a background in the English language find it difficult to achieve a particular *flavour* of written technical English.

Taking the role of the first-time reader of a technical text in English, we will first specify some of the general observations about the quality of the technical register. Then, we will give reasons for such quality and shed light on each of the phenomena from an extra-linguistic aspect. After that we will analyse how these phenomena are reflected at the lexical and/or syntactic levels, also giving some examples from the corpus collected for the purpose of this analysis from original metallurgical and mechanical engineering texts.

1. Technical information gives the impression of being hurried and concise. One of the reasons why this is so is to be found in the fact that the technical writer's verbosity is constrained by a non-linguistic factor – the expectation of the reader to find in the scientific technical paper only bare scientific facts. Shortly, he expects to have quick access to the

scientific issue under consideration without superfluous words and needless descriptions. In terms of graphics, this extra-linguistic demand results in a large number of tables, graphs, charts of all kinds, etc. which are valuable timesavers, giving the reader quick access to the core of a problem. In terms of syntax, however, it results in the predominant use of condensed constructions of various kinds, such as abbreviations and symbols, phrasal lexemes, reduced adjective clauses, to mention only some of them.

Meeting the standards of the technical register, abbreviations and symbols do contribute to conciseness, but sometimes may cause ambiguity, because in different technical fields they may have different meanings. Thus, for instance, the abbreviation *ID* may mean '*inside diameter'*, or '*industrial design'* or may have some non-technical meanings such as '*identification'*, '*Intelligence Department'*, etc. However, this may present problems only to non-technical readers of the text, because specialists know exactly what meaning a particular abbreviation bears in terms of their professional or research area. In case of any extra meanings, the full term will be presented in the text and its abbreviation given in parentheses, thus announcing its further use through the rest of the paper.

What is worth mentioning here is the fact that abbreviations, once formed, may tend to behave like "full-blooded" words, receiving a proper affix if necessary. Thus, for instance, the acronym *HIP,* made up from the first letters of the term *hot isostatic pressing*, has been found in a metallurgical magazine in its *–ing* form, i.e. as *HIPing.*

As for phrasal lexemes, popularly referred to as *compounds*[1], even superfluous inspection of the technical text will show that these condensed structures are much more frequent in technical English than in general English. There are two reasons for this: 1. Such lexemes are widely accepted terms used to denote special treatments, processes, tests, etc. and are therefore familiar both to the writer and the reader sharing the same technical background, 2. Technical English, for reasons explained above, tends to be concise and therefore uses phrasal lexemes which are not largely accepted but are rather an "ad hoc" coinage of the author.

Primarily, the former group of lexemes were what Lyons (1978 : 535) refers to as *syntactic compounds.* They were generated as a result of the productive mechanism of the English linguistic system, and therefore no rules were broken. Passing through the stage of becoming independent and generally accepted, these terms absorbed specific meanings and became phrasal lexemes. Some of the lexemes in the latter group may pass through the same procedure before their general acceptance.

The use of phrasal lexemes is quite justifiable from a non-linguistic, practical point of view. Imagine what burden it would be for the receiver of technical information if, for

[1] However, a difference is made here between *compounds*, i.e. word groups combined into a single unit, such as: *blackboard*, *mother-in-law*, *turnkey*, etc. which Frank (1993 : 206) refers to as *noun compounds*, and *phrasal lexemes*, as explained above.

instance, each time, instead of the phrasal lexeme *notched bar impact testing*, he would find *the testing of the toughness of the bar which has been notched by means of impact.* The result of the reduction is striking, but the semantic quality remains unchanged.

There is no doubt that technical background is necessary in the decoding of many of such structures because the syntactic role of their constituents is most frequently hidden at the surface level. Thus, for instance, *pot annealing* might mean '*the annealing of pots*' as one might conclude by analogy with the terms *bar drawing* ('*the drawing of bars*'), *gas purging* ('*the purging of the gas'*), *tube drawing* ('*the drawing of tubes*'). However, the constituents in this phrasal lexeme establish a different syntactic relationship, so that it does not mean '*the annealing* ***of*** *pots'* but '*annealing* ***in*** *pots*'.

Technical knowledge is particularly important for the correct decoding of some ambiguous phrasal lexemes, in which the constituents may form sense groups in two different ways, thus producing two diametrically different meanings, both of them absolutely acceptable but in different contexts. Thus, for instance, the three-word lexeme *low pressure loss* may be divided into 1+2 or 2+1 sense groups. In the former case, it is paraphrased as '*a low loss of pressure'*. In the latter case, however, it is paraphrased as '*the loss of low pressure'*.

Each potential writer of scientific texts who wants to attain the flavour of the scientific style must try to master the skill of using such condensed structures. Accepted two-word phrasal lexemes can be found in any technical text. Accepted phrasal lexemes having more than two constituents appear in the literature of both high and low levels of technicality. "Ad hoc" coined phrasal lexemes are more typical of a higher level of technicality where the encoder and the decoder share approximately the same amount of technical knowledge.

However, the reason for the use of such condensed structures may not always be the necessity to maintain the standards of the technical register. Such predominant use of phrasal lexemes may have extra-liguistic, even very down-to-earth justification. Thus, such condensed structures may be encountered in technical literature where conciseness is necessary because of *space limitations*, as in summaries of scientific works, diagrams and other kinds of illustrations, in captions above or below photographs, tables, and charts, in advertisements and symposium announcements, etc.

Reduced adjective clauses are another example of the tendency of the technical register towards conciseness. For reasons of brevity, this register will use the reduced adjective clause in the form of the participial phrase (e.g., *the force* ***acting upon a body***), rather than its full form (e.g., *the force* ***which acts upon a body***).

Likewise, as will any technical English corpus show, non-restrictive participial phrases are very characteristic of this register. Their predominant use in the technical register is not only due to their concise and therefore convenient form, but also to their mobility and adaptability, as well as their ability to express a wide variety of adverbial meanings, the most frequent among them being as follows: -*time*, e.g.:

(1) ***Having measured the design and manufacturing Cpk for the critical parameters of the design*** *...the overall total or rolled-up product TCpk can be measured-manner**,** e.g.:*

(2) ***Using the method outlined,*** *the results shown in Table I were obtained.-result*, e.g.:

(3) *This has resulted in the adoption of new technologies at a faster rate,* ***…leading to unknown consequences on the cost and quality of the manufacturing process or product.-cause, e.g.:***

(4) ***Being beyond the elastic limit***, *the stress will cause permanent deformation. -condition*, e.g.:

(5) ***Using these criteria,*** *the desired hole diameter can be calculated.*

Some types of sentences were not at all found in the corpus. This, of course, does not show evidence of their complete absence from this register, but rather suggests their very rare occurrence. This holds true of the clauses of purpose, due to their rather "clumsy" sentential structure, unsuitable to technical English standards. For example:

(6) *At the beginning of each "blow" the converter is turned down* ***in order that the molten iron may be poured from a ladle into the mouth of the converter.***

Since the time denoted by the purpose clause is always oriented towards the future in comparison with the time represented by the main clause verb phrase, the technical register uses some other constructions also oriented towards future, which are structurally far more condensed and therefore more suitable to this register than the purpose clause. Thus, for instance, sentence (6) has been found in the corpus in a slightly different form, more typical of the technical register, with the clause of purpose replaced by the infinitive phrase:

(6a) *At the beginning of each "blow" the converter is turned down* ***to allow the molten iron being poured from a ladle into the mouth of the converter.***

Some other means of expressing the idea of *purpose* in a more concise way, found in the corpus, are as follows: - the prepositional phrase with the gerund phrase, e.g.:

(7) *This electronic heat meter is designed* ***for the purpose of measuring the heat consumed in hot water heating systems.***

- the infinitive phrase, e.g.:

(8) *Such results may be used* ***to find the most efficient means to obtain improved quality at reduced cost …***

the prepositional phrase with the abstract noun, e.g.:

(9) *Advanced materials offer exciting possibilities* ***for the development of new technologies as well as further improvements in current technology.***

Similarly, for reasons of conciseness, reductions are frequently applied in the case of identical subjects of the main and subordinate clauses. Here, instead of subordinate clauses, the technical register uses some of the following phrasal constructions expressing the same idea as the subordinate clause but in a more condensed manner. For example:

-the prepositional phrase with the gerund, substituting the *clause of time*:

(10) ***In analyzing the various methods by which a riveted connection may fail,*** *we will first consider the stress situations that exist for a single rivet.*

- a reduced form of the clause of time with the adjective phrase after **when**, substituting the clause of time:

(11) *Experimental data are expensive to obtain and,* ***when available****, usually cover only a small "window" in the total process-material space...*

- a reduced form of the concessive clause with the participial phrase after **although**, substituting the concessive clause:

(12) *The materials industry,* ***although growing dramatically****..., has not been a source of new employment.*

- the infinitive phrase, substituting the conditional clause:

(13) ***To meet this objective****, the designer must have more than just a "passing acquaintance" with manufacturing processes.*

-the prepositional phrase, substituting the conditional clause:

(14) ***With this in mind****, we can think of a point on a larger body as a particle*

*- the participial –**ing** phrase* substituting the *clause of cause :*

(15) ***Being stressed beyond its elastic limit****, the material will be permanently deformed.*

2. *Technical information gives the impression of being generic in quality.* The generic quality of technical information results from another extra-linguistic factor – the lack of interest of the technical register in the agent. It goes without saying that behind all processes in the technical world stands an agent – a specialist who controls a particular process or performs other required activities. However, dominating this register is the desire to learn about the *results* of such activities, rather than about their performer, and therefore the agent is usually ignored. If mentioned, he is given a generic name *the operator*, *the engineer*, *the scientist, the consumer, the mechanic*, etc. But most usually he is not mentioned at all.

The rare occurrence of an animate surface subject in this register results in the rare occurrence of some personal pronouns. This is particularly true of the pronoun *she,* which is almost completely absent from this register. The pronouns *he* and *you* appear only in a generic sense, mostly in the instructive types of technical information. The pronoun *we*, though often used in a specific sense to refer to the author, thus contributing to the formal style, or a group of authors, may also be used in a generic sense in the texts dealing with mathematics, statics, mechanics, etc.

(16) *Substituting equations (5-20) into equation (5-21) and using the stress-strain relationships ...* ***we*** *obtain...*

On the other hand, the personal pronoun *it*, whether substituting a thing, a process, a test, a phenomenon, etc. or functioning as an expletive *it*, and its plural counterpart *they,* are frequently found in all kinds of technical information.

The lack of interest of the technical register in the agent also accounts for the predominant use of fixed generic expressions, such as ***technically speaking, generally speaking, to begin with, considering everything, to take a simple example***, or some constructions used in particular situations, in which the underlying subject is a generic person, as in the following examples:

(17) ***Taking the boundary free energy Y to be 0.5 J/m²,*** *such change could have the following effecs.*

(cf. If *anyone* takes the boundary free energy to be …)

(18) *A screw thread is always understood to be single right-hand* ***unless otherwise specified****.* (cf.…unless *someone* specifies otherwise)

A direct consequence of such attitude towards the agent is the predominant use of passive constructions in which the subject is eliminated as a redundant element, which also contributes to the conciseness of information, and where the object is moved into the initial sentence position. An additional advantage resulting from passivization is the fact that now the predicate is released from complementation and free to establish new relations with adverbial postmodifiers of various meanings. These adverbials are far more important than the generic subject, because they offer the data of crucial importance to the user of technical information, such as:

-the *temperature* and the *duration* of the process under consideration, e.g.:

(19) *They were annealed* ***at 900º C*** ***for over 20 minutes****…*

-*time*, e.g.:

(20) *Twinning is usually accompanied by a sharp click* ***during deformation*** *...*

-*the region*, *place*, e.g.:

(21) *Ti-6-2-4-2 was forged* ***in the alpha beta region****...*

-*the manner*, e.g.:

(22) *Melting is performed* ***by electron beam energy****.*

The lack of interest in the agent results in a whole series of other syntactic and semantic characteristics which differentiate this register from general English and contribute to the predominantly generic flavour of technical information. Thus, unlike general English, technical English is characterized by gerund phrases without an animate surface subject within the gerund phrase in any possible form (cf. a general English form of the gerund phrase with the "subject" ***His*** *singing of the song* and the technical register subjectless gerund phrases such as *the refining of pig iron* or *reducing grain size*).

Further, the gerund in such subjectless gerund phrases appears in the technical register only in the active neutral form (e.g., *refining*) and the passive neutral form (e.g., *being refined*). It does not appear in perfective gerund forms. The reasons for this are again to be found in the lack of interest of this register in the agent and, consequently, in its generic quality. Namely, technical English uses predominantly two types of gerund phrases, respectively referred to by Lees (1968: 64-72) as *action nominals,* such as ***The refining of pig iron*** *(lasts for hours),* and *action type gerundive nominals* (ibid.: 71-72), such as ***Reducing grain size*** *(is useful).*[2] In the former, the gerund denotes an activity. Its "subject" is a generic person and therefore left out. The latter type combines the characteristics of both action and gerundive nominals. Its underlying subject also denotes a

[2] The gerund phrases referred to by Lyons as *gerundive/factive nominals*, denoting factivity, such as ***Repairing that lamp*** *(was useless)* have not been found in the corpus.

generic person and, as a redundant element, is deleted on the surface. Neither the former nor the latter nominals have perfective gerund forms.[3]

3. General English and the technical English register differ in the choice of verbal lexis. Even a casual glance at the corpus will show that the verbs in the predicate function appear in a limited number of meanings in technical English, as opposed to general English. There are two reasons for this: 1.Technical English uses only those verbs whose meanings range within the semantic scope of the technical register. Thus, the verbs requiring an animate subject, like *love, like, hate*, *pretend, cannot bear,* etc. have not been found in the corpus. 2. The occurrence of some verbs depends on the type of technical information in which they are to appear. Some verbs from the corpus, like *see, notice, remember, forget,* have been found only in the instructive, less formal types of technical information, such as manuals. However, the phrase *keep in mind,* replacing the verb *remember,* has been found in a more sophisticated technical paper, thus illustrating a frequently formal tone of this register:

(23) *In comparing QC curves for different processes, it is important* ***to keep in mind*** *that some cost elements depend strongly on production volume.*

Further, the reduced choice of predicate verbs, together with some other factors, accounts for a less complex issue of predicate verb complementation in the technical register. Namely, it is well known that the object complementation of the main clause predicate verb is a very complex problem in general English. Besides ordinary nouns or pronouns, functioning as the predicate verb complements may be nominalized constructions like the infinitive phrase, the gerund phrase, the *that*-clause or the abstract noun phrase. Some verbs can use all these constructions as their objects, others only one or two. This issue is very complex and cannot be embraced by rules and systematized.

However, the technical register does not reflect this issue in all its complexity. There are, at least, three reasons for it: 1. The occurrence of some predicate verbs requiring such complementation in the technical register is semantically limited and reduced to only those verbs having to do with the technical subregister under consideration. Therefore, some verbs having a complex, multiple-choice complementation do not appear at all in this register. 2. Due to the predominant use of the passive, the predicate verb requiring a complex complementation may not have any complement at all. 3. The choice of a proper complement, if any, does not only depend on the predicate verb, that is, it is not only the predicate verb that governs a particular nominalized complement. The influence may be reciprocal. The nominalized constructions, like the infinitive and gerund phrases, have some inherent meanings that are compatible or incompatible with the meaning of a particular predicate verb.[4] Thus, for instance, due to their meanings, some verbs will not combine with the infinitive phrase, which is oriented to the future. In the technical register it is

[3] Šestić (1988: 6 – 11)

[4] Bolinger (1977:13-14) postulates that the reasons for the idiosyncrasy of the predicate verb complementation should be found in the inherent meaning of the infinitive and gerund phrases.

reflected in the following manner: if the combination of the predicate verb and its nominalized complement is not typical of the technical register for any reason, it will not be realized. Thus, some verbs that in general English may be completed with all the above-mentioned nominalized complements, in the technical register are found to use only one or two. As evinced by the corpus, the verb *mean* uses only the gerund phrase complementation, in which case it means '*result in*', and the *that*-clause complementation, in which case it means '*imply, indicate*'. Both of these meanings are compatible with the technical register, e.g.

(24) *This means* ***concentrating several processes in one factory***.

(25) *This means* ***that the results are only valid for the welding processes***.

The meaning '*aim, plan'*, however, which the verb *mean* expresses when completed with the infinitive phrase, due to a frequently formal style of the technical register, is preferably expressed with the verb *intend*, as in the example found in the corpus:

(26) *The analysis relies on the development of relatively simple ... models* ***intended to capture*** *the essential interactions between the material and its processing environment*

Similarly, the verb *remember*, which, judging by the corpus, appears only in the instructive types of technical information, uses only the *that*-clause complementation because the meanings it assumes when combined with the infinitive or gerundive complements are not compatible with the technical register.

(27) *Remember* ***that, in general, unstable systems possess higher energy than stable systems.***

However, the choice of a complement can be influenced by some passive transformations typical of the technical register, such as RASING, due to which the subordinate clause subject is raised to the position of the main clause subject. As a result, the predicate verb complementation is limited to the infinitive phrase, as in the following examples:

(28) *Plasma spraying has been found* ***to cause less oxidation … than flame spraying***.

(29) *In the region where the QC curve is relatively flat, conventional cost models are more likely* ***to be accurate*** *since cost is little affected by these assumptions.*

The present paper does not pretend to have offered an exhaustive analysis of all the phenomena in which the technical register differs from general English. Such investigation would require much more time and space. However, we do hope that analysing the technical register from an extra-linguistic aspect will make it more interesting and attractive to the reader unaccustomed to it.

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