

**GRAMMATICAL METAPHORS IN SCIENTIFIC ENGLISH**  
**A Metáfora Gramatical no Inglês Científico**

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**Abstract**

*The terms nominal compounds, complex nominal phrases, nominalizations, and grammatical metaphors (GMs) have been used by different authors and sometimes they are used interchangeably. In this paper we intend to clarify the scope of each term, paying special attention to grammatical metaphors. We believe that nominalizations in general and grammatical metaphors in particular are essential resources for constructing scientific discourse, so they should be taken into account in scientific writing courses.*

**Key-words:** *scientific English; grammatical metaphors; nominalizations; nominal compounds.*

**Resumo**

*Os termos “composto nominal”, “sintagma nominal complexo”, “nominalização” e “metáfora gramatical” foram usados por diversos autores, às vezes de maneira indistinta. Neste trabalho, tentamos delimitar o alcance de cada termo, prestando especial atenção à metáfora gramatical. Acreditamos que as nominalizações em geral e a metáfora gramatical em particular são recursos indispensáveis na construção do discurso científico. Por essa razão, devem ser levadas em conta nos cursos de escritura científica.*

**Palavras-chave:** *inglês científico; metáfora gramatical; nominalização; compostos nominais.*

## 1. Introduction

The language of science is, by its nature, a language in which theories are constructed and its characteristics are exactly those that make theoretical discourse possible. Scientific language uses two kinds of resources: lexical and grammatical. Lexical resources include the technical terms that scientific disciplines constantly create. Grammatical resources include the constructions of nominal compounds (NCs) deployed so that they can be combined to construe a particular form of reasoning. Scientific discourse is a highly nominalized register. Nominalization is functional since it contributes both to technical terminology and reasoned argument.

NCs have a high incidence in scientific writing. This incidence may be explained as the result of an increasing conceptual complexity together with economy constraints for publishing requirements. According to Bhatia (1993: 151), NCs are the main carrier of information in academic scientific writing. They communicate very specialized and precise knowledge to an audience who must share with the writer the required level of knowledge of the subject discipline. The more technical and specialized the subject, the more frequent and complicated the NCs.

There are several functional reasons why the language of science demands a very high degree of nominalization:

➤ **Objectivity:** Nominalizations produce a greater concentration of the experiential meaning and a smaller incidence of interpersonal elements, such as personal pronouns and modal verbs, thus presenting information in a less personalized way.

➤ **Thematic progression:** the use of nominalization is not a static but a dynamic one. According to Halliday (1993b: 131):

*(...) the core of a scientific text is the development of a chain of reasoning (...) in which each step leads on to the next. But in order to lead on to the next step it is necessary to be able to repeat what has gone before and is now being used as the springboard for the next move.*

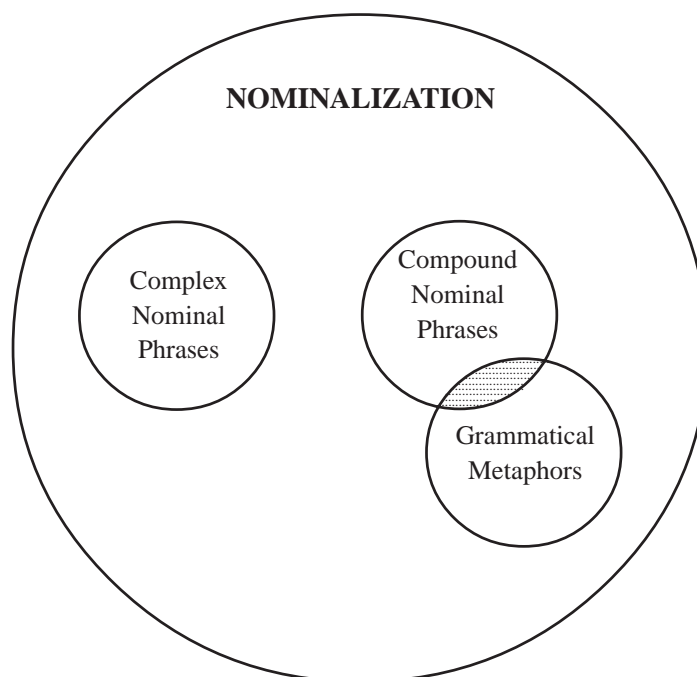
The rheme of a clause functions as the theme of the following because the grammar “packages” the previous information by turning processes into nominal entities. The use of grammatical metaphors (GMs) permits the thematic progression without tedious repetitions. Each clause consists of 1) a ‘taken for granted’ part, nominalizing what has been said before; 2) a ‘new information’ part, pointing forward to what is to come; and 3) the relation between them, in the form of a verb. For example: *The atomic nucleus **absorbs** and **emits** energy. Each **absorption** marks its transition to a state of higher energy, and each **emission** marks its transition to a state of lower energy.*

➤ **Synthesis:** Martin (1993b: 230) says that grammatical metaphors mean language “distillation”. Technical terms, like alcoholic beverages, are both less voluminous products of, and different in kind to, the meanings/materials from which they derive. Distillation means condensation. NCs reduce longer phrasal constructions, making scientific language more compact, more synthetic, more functional and direct to the specialist. This synthetic language that science has developed is achieved by means of:

- **Concise referencing:** Nominalizations act as powerful referents in discourse and serve as ad hoc names for concepts that will be referred to again, thus avoiding long descriptions; and
- **Summary:** Nominalizations sum up the contents of a previous discussion before introducing new information.

## 2. Types of nominalizations

The terms nominal compounds, complex nominal phrases, nominalization and grammatical metaphors have been used by different authors and sometimes they are used interchangeably. We intend to clarify the scope of each term. As shown in the following figure, nominalization includes: complex nominal phrases, compound nominal phrases (or nominal compounds) and grammatical metaphors.



**Figure 1: Types of nominalizations**

Trimble (1985:130-131) says that:

*Noun compounds (also called noun strings) can be defined as two or more nouns plus necessary adjectives (and less often verbs and adverbs) that together make up a single concept; that is, the total expresses a “single noun” idea... That compounding is a natural process in so few languages makes it a special problem for the majority of non-native students.*

Bhatia (1993: 148) considers three types of nominal expressions:

**Complex nominal phrases:** their typical syntactic structure is (Modifier) Head (Qualifier) where (M) is realized primarily in terms of a series of linearly arranged **attributes** as follows: (Det) (adj) (adj) (adj) (adj) H (Q). Those structures are mostly used in advertising because

they permit an attractive and detailed description of the product or service being promoted.

Examples:

- *The world's first packless, cordless, lightweight, compact, integrated video light.*
- *Coherent, illuminating, thought-provoking and fascinating book that will interest everybody.*

**Compound nominal phrases:** they usually have the following structure (M) (M) (M) (M) (M) (M) H (Q) where (M) is realized in terms of a series of linearly arranged **nouns**, occasionally incorporating adjectives and adverbs as well. It is the type most used in scientific writing.

Examples:

- *Boron-trichloride discharged ion spectra*
- *The world's potential human food supply*

**Nominalizations:** they are very common in legislative provisions, since they need to be precise, unambiguous and all-inclusive. This linguistic device promotes coherence and condensation and saves the writer from repeating lengthy descriptions.

Example:

- *No **obliteration**, **interlineation** or other **alteration** made in any will after the **execution** thereof shall be valid or have effect.*

This type of nominalization is also used in all kinds of academic, particularly scientific writing.

Horsella and Pérez (1997: 104) classify nominalizations as follows:

a) nominalization by affixation:

➤ by Latin affixation:

to speculate	the speculation <b>ion</b>
to extend	the extension <b>ion</b>

➤ by -ing affixation:

to begin	the <b>beginning</b>
to process	the <b>processing</b>

➤ by other type of affixes:

to develop	the <b>development</b>
to perform	the <b>performance</b>
to continue	the <b>continuity</b>

b) nominalization by conversion:

to change	the <b>change</b>
to increase	the <b>increase</b>

Halliday (1985, 1993b) considers nominalization from a systemic functional perspective and proposes the idea of GMs. His systemic theory is a theory of meaning as choice, by which a language is interpreted as networks of interlocking options. This theory is functional because a) it is designed to account for how language is used and the way it is organized to fulfil communicative functions; b) each element in a language is explained by reference to its function in the total linguistic system, that is, each part is functional with respect to the whole system; and c) it aims to account for three basic kinds of meaning, the ideational, the interpersonal and the textual because it relates text and context taking into consideration the variables of the context of situation: *field*, *tenor* and *mode*. The three situational variables mentioned (*field*, *tenor* and *mode*) are respectively related to the *ideational*, *interpersonal* and *textual* metafunctional components of the semantic system. *Field* refers to the nature of the communicative activity that is actually taking place. It is reflected in the experiential meanings of the text provided by the processes, participants and circumstances of the *transitivity* system. *Tenor* relates to the social roles the interactants are playing in the communicative event; these are provided by the interpersonal meanings realized through the patterns of *mood*. Finally, *mode*, provided by the textual meanings, contributes to defining the role language is playing in the interaction by means of the *theme* system.

The *transitivity* system is that part of grammar concerned with organizing the content of propositions providing options (fundamentally, roles, processes and circumstances) for the expression of cognitive

meaning. It is not concerned with the way in which content is presented: that is the purpose of *mood* that structures clauses as speech acts which facilitate social exchange. Finally, the system of *theme* organizes discourse meaning. It is the textual function of language and includes knowledge which allows to organize cohesive texts placing both cognitive and interactional meaning in context.

According to Halliday (1985:101), a fundamental property of language is that “it enables human beings to build a mental picture of reality, to make sense of their experience, of what goes around them and inside them”. The clause functions as representations of processes, expressing the experiential aspect of meaning provided, as we have already said, by the processes, participants and circumstances of the *transitivity* system. *Processes* (material, mental and relational) are typically realized by a verbal group; *participants* (actor, goal, attribute, etc), by a nominal group; and *circumstances* (time, place, etc.) by an adverbial group or prepositional phrase. When we represent our experience by means of a clause (ideational function), we distinguish different types of actions, processes and states accompanied by one or more participants, and different types of circumstances related to the process, besides the participants’ attributes.

### 3. Grammatical metaphors

Halliday (1985: 321) considers that there are two kinds of expressions: congruent, also called non-metaphorical or non-marked; and incongruent, metaphorical or marked. In general, it is considered that people, places and things are realized by means of a noun; actions are realized verbally; circumstances are realized by prepositional phrases and adverbs, and so on. This is the typical, congruent relationship between semantic and grammatical categories that usually happens in spontaneous spoken language. However, all meanings may have more than one way of realization, and sometimes, in written language and especially in the language of science, the realizations of the semantic functions of the clause are not typical, but marked. This realization constitutes a GM. A GM is “the process whereby meanings are multiply-

coded at the level of grammar” (Martin, 1993b: 230). Halliday (1985) considers two types of GMs, the *ideational* type, that reflects the *field*, and the *interpersonal* one, that reflects the *tenor*. In this paper we refer only to the ideational GM since it is one of the characteristics of scientific language.

**Grammatical metaphor** means a substitution of one grammatical class, or one grammatical structure by another. For example, *his departure* instead of *he departed*. Here the lexical items do not change in meaning but in function. When GMs constitute NCs (shaded area in the figure), two phenomena arise:

➤ **lexical density**, a measure of the density of information in any passage of text, according to how tightly the lexical items (content words) have been packed into the grammatical structure. Linguistic information is generally packed with a higher lexical density in science. For example, the sentence *lung cancer death rates are clearly associated with increased smoking;* and

➤ **syntactic ambiguity**: as regards the last example, Halliday (1993a: 67-68) asks:

What does *lung cancer death rates* mean?:

- a) how quickly lungs die from cancer;
- b) how many people die from cancer of the lung; or
- c) how quickly people die if they have it.

What is *increased smoking*?:

- a) more people smoke; or
- b) people smoke more.

What does *are associated with* mean:

- a) cause; or
- b) are caused by.

A great deal of semantic information is lost when clauses are replaced by NCs. The ambiguity arises especially in two places: in strings of nouns, leaving inexplicit the semantic relations among them; and in the relational verbs, which are often indeterminate. In general this



language is ambiguous only to the non-specialist who does not have the required knowledge of the subject matter.

The difference between grammatical and lexical metaphors is that in GMs (as we have said), the lexical item does not change in meaning but in function, for example: *we consider = our consideration*. In the lexical metaphor the lexical item changes in meaning and there is a 'non-literal' use of words. For example:

*A flood of protests = a large quantity of protests.*

Angela Downing, another author interested in GMs (1991: 113), says that GMs as nominalizations are:

➤ **A verbal process realized as a nominal entity**

The light that is emitted by a fluorescent tube ... (congruent)

The emission of light by a fluorescent tube... (metaphorical)

➤ **An epithet realized as a nominal entity**

Diamond is an energetically unstable substance... (congruent)

Diamond is a substance of energetic instability ... (metaphorical)

➤ **A time circumstance realized as a nominal entity**

In the seventeenth century scientific works began to be published systematically... (congruent)

The seventeenth century saw the development of systematic scientific publications... (metaphorical)

The first type, that is, **verbal process as nominal entity** is the GM most used in science.

Examples of sentences in which a congruent realization is turned into a GM:

- It is well known today that water can spread massive epidemics.

*The potential of water to spread massive epidemics is well known today* (GM)

- Chlorination was applied in large scale for the first time in 1908.

*The first large scale application of chlorination was in 1908.* (GM)

- The benefits to irrigate at large scale in Northern Nigeria.  
*Large scale irrigation benefits in Northern Nigeria.* (GM)
- Climate gets warmer and soil emits CO<sub>2</sub> in response to this phenomenon.  
*CO<sub>2</sub> emissions from soil in response to climatic warming.* (GM)
- Climate changes and it is assessed whether the coast is vulnerable to this phenomenon.  
*Assessment of coastal vulnerability to climatic change.* (GM)

As we can see, GMs as nominal compounds have more content words and less functional words than their congruent realizations, increasing the lexical density in the clause.

When teaching scientific discourse writing, a distinction should be made between the use of nominal compounds and grammatical metaphors. They both constitute a very relevant textual resource, since they help to organize and structure discourse.

NCs, which are specially used in titles of written scientific articles, help to condense information. Thus they reduce longer phrasal constructions, making scientific language more compact, more synthetic, more functional and direct to the specialist and save the writer from repeating lengthy descriptions.

GMs, together with mechanisms such as reference, theme and rheme patterns, and logical connectors, contribute to the cohesion of discourse (Ventola, 1997:33). GMs generally appear in the form of “summary words” preceded by some deictic element like *the, this, these* as in *this transformation* or *the reaction*, packaging previous information and promoting the progression of the message without tedious repetitions.

However, this capacity to condense information may cause high levels of ambiguity, leading to a great difficulty in understanding the message, sometimes even to the specialist.

#### 4. Final considerations

Language and science go together and learning science is to learn a language created for codifying, extending and transmitting scientific knowledge. As Martin expresses (1993a: 200):

*(...) in science, language is a fundamental tool. It is used to classify, decompose and explain, and to recount the investigations that form the basis of a scientific world view. It follows that to be illiterate in science is to be denied access to a crucial aspect of its technology. (...) Science cannot be understood 'in your own words'. It has evolved a special use of language in order to interpret the world in its own, not in common sense, terms.*

Nominalization in general and GMs in particular, far from being arbitrary features, are essential resources for constructing scientific discourse. Our concern is to help our students to handle the kind of language they need to write in English in order to meet the publication standards required, enabling them to face an increasing demand for academic writing competence in the new millennium.

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