

## *Procedural vocabulary as lexical signalling of rhetorical function in scientific discourse*

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### *Abstract*

Procedural vocabulary, specially the type defined by Widdowson (1983), consists of lexical items which do not belong to any particular schema, being highly context-dependent items with very little lexical content, which makes it the basic vocabulary in the elaboration of rhetorical functions like definition, description and classification. The role of part of this procedural vocabulary in the signalling of the rhetorical function of a specific stretch of discourse accounts for its sign-posting function when it indicates that information about specific concepts that occur in the article is being provided. We attempt to demonstrate that there exist a narrow relationship between procedural vocabulary and the communicative function of discourse.

The aim of this paper is to present a rather comprehensive list of lexical signals of rhetorical function in scientific discourse, classifying them, according to the degree of explicitness with which they signal illocutionary force, into three groups: signals of specific rhetorical function, signals of reflexive use, and items whose signalling function depends totally on the context. The choice of a specific item of procedural vocabulary to signal rhetorical function is determined by pragmatic principles like salience or the given/new contract.

### *1. Rhetorical function.*

Scientific research aims at describing, classifying and explaining phenomena of the external world, which implies that scientific discourse is highly specialized and taxonomic. Definition, description and classification have been mainly the concern of philosophy, but the special attention that has been paid to them recently in ESP (Trimble, 1985; Darian, 1981; Flowerdew, 1991, 1992a, 1992b) has revealed their importance in the development of scientific discourse. In this line, Mackay and Mountford (1978) suggest that examining scientific discourse in terms of rhetorical functions can be a fruitful area of research because scientists are constantly performing acts of defining, identifying and classifying, among others.

The scientific process must follow a series of steps, and language functions have a role at every stage: they are a part of the procedures used in scientific enquiry and discourse. As Radovsky (1979: 133) puts it, "Science advances along a spectrum —

from observation, description, definition, and classification through explanation and understanding to prediction, influence and control.” This means that these acts are needed in any scientific research, which requires a full knowledge of the concepts that are going to be dealt with.

One of the most influential studies of these functions has been Trimble’s (1985), where rhetorical function is defined as “a name for what a given unit of the discourse is trying to do”, which means that definitions, descriptions and classifications are speech acts. They are included in the representative class of speech acts (Searle, 1976), or “informative acts”,<sup>1</sup> as Sager *et al.* (1980: 25) call them. This class of speech acts differs from the others in that it presents reality as it is, without expressing any attitude or requiring further action. Informative speech acts involve the communicative and classificatory uses of language: “The speaker concentrates his efforts on conveying information to his interlocutor, i.e. adding to his knowledge” (Sager *et al.*, 1980: 25). These functions have an important role in interactive discourse, since they help to provide the reader with a conceptual framework that facilitates the comprehension of the scientific text. They contribute to *text monitoring* and *text management* (Beaugrande and Dressler, 1981), making interaction between participants possible when their knowledge of the world does not coincide.

Most of the research on these functions has focussed on their informing role in scientific discourse, their characterization in terms of their components and structure, and on the classification of the different types of each function following formal or semantic criteria (Weber, 1991; Trimble, 1985; Flowerdew, 1992a; Darian, 1981). Little attention has been devoted to the lexico-grammatical realization of these functions. In Master’s (1986) coursebook rhetorical functions are used to introduce and practice different grammatical aspects. Similarly, Darian (1981: 53) briefly mentions “general formulas” associated with definition (e.g. “relative clause with 3rd person singular verb”, “which/that+be+past verb”, “for+verb+ing”). Among them he includes the use of a limited number of verbs (“is read”, “means”, “refers to”, “is concerned with”, “is considered”) that link the term with the definition, providing definition markers. The use of these signals is also remarked by Flowerdew (1992a), who only lists “call”, “is called”, “known as”, “mean(s)”, “define”.

This paper concentrates on the study of the lexical signals which serve to draw attention to the function that a stretch of discourse is performing. The lists provided by Darian and Flowerdew show that these signals constitute a type of sub-technical lexis used by the writer as a device to help the reader understand the developing discourse, forming therefore part of procedural vocabulary (Widdowson, 1983). They are not concerned with the specialized content of the scientific paper, for they belong to the self-referential world of discourse.

## 2. *Procedural vocabulary*

Assuming that there is a “declarative” knowledge of lexis (i.e. the knowledge that a word has a meaning in the abstract lexicon) and a “procedural” knowledge of lexis (i.e. the knowledge of how to negotiate the meaning of a word in actually occurring discourse) (Winograd, 1975; Færch and Kasper, 1984), we can state that there is a type of vocabulary which is part of the procedures that help prevent communication from being disrupted through the reader’s ignorance of a concept.

Procedural vocabulary (henceforth PV) is a term coined by Widdowson (1983), who defines it by setting it in opposition to schematic vocabulary (henceforth SV). PV consists of words with a high indexical potential which are highly context-dependent since they have very little lexical content, and do not belong to any particular schema. On the contrary, SV items are schematically bound and have a high degree of specificity. PV and SV are defined in relation to the concepts of *symbol* and *index*,<sup>2</sup> and therefore, in order to understand this distinction it is important to know Widdowson’s use of the terms “symbol” and “index” (1983: 52). Linguistic elements operate as symbols when they are “abstracted from actuality and contract sense relations with other symbols as terms within the language system. Thus the meaning of symbols is constant and self-contained”. When they are considered in their context of occurrence linguistic expressions operate as indices. The distinction between symbol and index for Widdowson is related to the distinction between semantics and pragmatics: “the symbol is a unit of semantic meaning with a specifiable sense and denotation, whereas the index is a unit of pragmatic meaning used for the act of reference”(Widdowson, 1983: 52). While procedural items have a “high indexical potential” and are “almost entirely lacking in specificity as a symbol”, which implies that they have little meaning if they are not considered in context, schematic items are “symbolically highly specific and can be indexical in use to a relative narrow range of reference” (Widdowson, 1983: 92).

The assumption held above that procedural vocabulary is part of the procedural knowledge of lexis draws attention to its communicative function: it is used for the negotiation of specific concepts and for the definition of terms related to a particular schema. McCarthy (1992: 78) states that “procedural vocabulary is basically words that enable us to do things with the content-bearing words or schematic vocabulary”. This view is supported by Robinson (1988a, 1988b), who considers PV that used to constantly adjust the meaning of words so as to account for variation in the individual’s knowledge of the world, and regards it as “the ‘simple’ lexis of paraphrase and explanation” (Robinson, 1988a: 325). It is general or core language that allows the writer to fix the meaning of specific words belonging to different schemata and in this way makes it easier for the reader to identify the more specialized vocabulary of a specific subject area. Robinson (1988a: 325) gives an example with this dictionary entry :

**“vermiculite** : a type of mica that is very light material made up of threadline parts, that can be used for keeping heat inside, building, growing seeds, etc.”

The term “vermiculite” is a schematic item defined or explained with the use of procedural items: it is a “material”, “a type of” x, “made up of” a, b, and c, “used for” w, y, z. Each procedural item must have functional unity: it is a word or word-complex which signals a relationship (e.g. “be made up of”, “be used for”). In “X is made up of Y”, the whole complex “be made up of” constitutes a procedural item, since it is the whole complex that links X and Y.

When it consists of a multi-word item, the procedural item must not be identified with its lexical part. If we consider:

- 1) X is defined as Y.
- 2) C et al. defined X in their paper.

in the first case “be defined as” acts as a procedural item that links the concept to other concepts in terms of which it will be explained. In the second case the function of “defined” is reporting, not signalling a defining speech act.

We can now turn to examine more closely the role of some items of procedural vocabulary as lexical signals of rhetorical function (e.g. “be defined as”). As mentioned above, this role is going to be the central concern of the study that we present in this article.

The data for this study consists of 366 definitions, descriptions, and classifications occurring in a variety of English scientific texts. These texts include scientific books and a series of articles selected from popularized scientific magazines and scientific journals of various fields (Physics, Chemistry, Biology, Geology, Medicine), most of them published between 1991-1993. Two criteria were applied for the selection of the texts. Firstly, they should include some of the rhetorical functions above mentioned. Secondly, the text should be about science-related topics and not commentaries, opinion articles, educational matters, etc.

The choice of such a varied corpus is due to the fact that the nature of the subject under study, procedural vocabulary, defined by its high indexicality and wide coverage, requires for its analysis a corpus of scientific texts as varied as possible to show its potential use in any type of scientific discourse. The use of scientific texts belonging to different scientific fields shows that they differ in their specific or field-bound vocabulary, but not in the defining vocabulary, which is a tool of scientific research, not restricted to any field.

All the function-signalling items in the corpus examined have been listed and they have been classified depending on the way they effect the signalling.

### 3. *Lexical signals of illocutionary force.*

Stubbs (1986: 5) objects to Searle's (1969) claim that the use of explicit illocutionary verbs is normal or "canonical". If we consider the following utterances:

(1) "...a lattice plane is defined as any plane containing at least..."

(2) "...a lattice plane is any plane containing at least..."

both are definitions. However, these utterances are not equivalent and it would be difficult to maintain that the utterance with the explicit performative is the typical and canonical case. The lack of equivalence is evident from the fact that the latter could have indeterminate force (i.e. it may be a claim, a proposal), while the first one is marked and therefore more determinate. Thus, the presence or absence of an explicit performative verb on the surface structure is not arbitrary and it appears to be explainable in terms of salience. Flowerdew (1992b: 172) calls these items of vocabulary "boosters" (from Holmes, 1984), and considers them linguistic devices that affect the degree of salience of the speech act, signalling clearly its illocutionary force: a speech act containing an explicit illocutionary verb will be more salient than one lacking it. The lexical signal implies that the information conveyed by the act is an important point in the discourse.

When salience is considered within the act itself it plays an important role in the way a concept is explained and therefore in the language used for this purpose. Flowerdew (1992b: 165) defines it as "that quality which determines how semantic material is distributed within a sentence of discourse, in terms of the relative emphasis which is placed on its various parts". The area of pragmatics that is concerned with the distribution of information in text deals with the *given/new contract* and the *principle of end-focus*.<sup>3</sup> In its unmarked form the Theme is related to given information, thus the starting point of a message appears as established, while the last point (in an unmarked message) is the new information, the focus of the message. As the focus is neutrally placed at the end of the information unit, the elements that come at the end are the most salient ones. The function-signalling lexis used will depend on whether the concept defined, described, or classified is new or given information; that is, on whether the author wants it to be salient or not.

Flowerdew (1992b) remarks that "boosters" vary in their degree of explicitness in the signalling of the illocutionary force. This degree of explicitness will be the criterion used to differentiate between three types of lexical signals, which are as follows:

1. Lexical explicit signals of rhetorical function.
2. Lexical signals of reflexive use.
3. Lexical items that depend totally for the signalling of illocutionary force on the context.

### 3.1. *Explicit signals of rhetorical function.*

These signals make explicit the type of rhetorical function where they occur, allowing the reader to find out in which way the writer wants to explain the concept.<sup>4</sup>

- definition: e.g. "X is defined as Y".
- description: e.g. "X is described as Y", "X is characterized as Y".
- classification: e.g. "X, Y are classified as Z", "X, Y are categorized as Z".

It should be stressed that these items composed of perlocutive verbs, rather than being accurate signals of the illocutionary force of the speech act, reflect the way in which the writer chooses to interpret the fragment that follows: as a description, definition or classification. In line with Francis (1986: 11) and Leech (1983: 202) we reject that "the language we possess for talking about speech behaviour must be a faithful reflection of its nature." With these procedural items the writer uses the metalanguage of speech acts to label and describe his or her discourse. We can distinguish three types of verbs, according to whether the writer views the act he is performing as descriptive, defining or classificatory (the attribution of an element to a class), the last one being the most frequent:

#### 1. **Descriptive act.**

The procedural item assigns an attribute to the first element, which does not identify it but helps to categorize it within a class.

- be described as.
- be characterized as.

"The phenocrystic garnet in general can *be described as* grossular-rich almanitic garnet."

#### 2. **Defining act.**

The procedural item signals a relation in which the first element is identified by means of the second.

- be defined as.

"A quark can *be defined as* a fermion that carries the colour charge of QCD."

#### 3. **Classificatory act.**

The vocabulary expressing this act can be divided into two types: categorizing and classifying.

(a) *Categorizing.* These items assign an element (with an individual or collective reference) to a class.

- be assigned to.
- be attributed to.
- be counted as.
- be grouped with/as.
- be placed in.
- categorize as.

-be excluded. -include within.

“So far it has been convenient to *categorize* the matrix *as* feldspathic peridotite.”

(b) *Classifying*. An element (with a collective reference) is divided into different classes. The difference between categorizing and classifying items can be related to the distinction between intensive and possessive processes of being (Halliday, 1985).

-be divisible into. -classify into.

-be separated into. -divide into.

-be subdivided into.

“Precious metals may *be separated into* four groups: (1) silver and its alloys, (2) gold and its alloys, (3) platinum and its alloys, (4) palladium and its alloys.”

When the verbs signal the illocutionary force of a classification, this can include not only the class to which the concept belongs but also the basis for the classification (introduced by “according to”, “on the basis of”, etc.)

“These can *be divided into* syn-tectonic intrusions and post-tectonic intrusions *depending on* the presence or absence of planar and linear fabrics.”

### 3.2. *Lexical signals of reflexive use.*

In the drive to demonstrate the signalling role of these items we must distinguish between the real world concepts and the terms used to refer to them. Related to this distinction is the traditional difference between *use* and *mention* (Lyons, 1977: 5), based on *reflexivity*, that is, the capacity language has for referring to itself. When a word is mentioned, rather than used, it has a reflexive function, it refers to itself and not to an external reference. In the following example what is being done is to assign a name (“peroxime”) to a concept, using “peroxime” reflexively.

“This type of microbody was called a peroxime”

Lyons (1977) points to the need to distinguish between the reflexive and the non-reflexive uses of language. There are items that allow us to recognize that a word is being mentioned and that the author is interested in the word itself, in naming a concept (e.g. “be called”). He wants to inform about how something is referred to. This purpose has priority over the description of the concept.

The procedural items that indicate that a word is being used reflexively (e.g. “be called”, “be referred to as”, etc.) do not relate two concepts, but link a concept to the term that designates it. They are used either to relate the real world object to the term, that is, to name the object, or to inform that the concept can be referred to by different terms, as in the following example:

“The extrinsic muscles, *also known as* the soft muscles of the neck, raise and lower the laryngeal skeleton.”

In some cases PV is helped in this signalling function by other descriptive expressions, like “term”, “word”, or “name”:

“We use the *term* capsulitis of the shoulder to refer to an idiopathic painful condition.”

According to the end-focus principle these signals of reflexive use can be divided into two types depending on whether the reader wants to assign a term to a concept already given or defined or to explain the meaning of the concept designated by a term already mentioned. In the first case the term is salient, in the second case it is non-salient.

### 1. Procedural vocabulary with a non-salient term.

The term is already given information in the discourse and the author’s purpose is to indicate what this term refers to. The salient information is the definition or description of the concept, which appears in end-position. Therefore, the structure of the definition is “Defined term+PV+definition”. These procedural items serve to express an intensive identifying function, to put it in Halliday’s terms (1985). The term (Token) is identified by means of the meaning it has (Value):

- be applied to/ apply to.      -mean.
- be restricted to.              -refer to.
- be used for.

“...but for the purpose of this article, the term “stem cell” *refers* only to the hematopoietic stem cell.”

### 2. Procedural vocabulary with a salient term.

In this case the concept is the given information, which must be assigned a name in order to refer to it. These procedural items also have an intensive identifying function (Halliday, 1985). In this case the Token (term) is the Identifier, while the Value (the meaning) is the Identified.

- be (past) named.              -be known as.
- be called.                      -be labelled.
- be denoted by.                -be referred to as.
- be designated.                -be termed.
- be dubbed.                    -refer to...as.

“The points in a Bravais lattice that are closest to a given point *are called* its nearest neighbours.”

“Be designated by” and “be denoted by” are used when the concept is assigned a symbolic expression, rather than a name, as the examples below show:



“Microanalyses by SEM-EDX on whole specimens *are designated as* such in the text, while those by EPMA on this section are referred to as microprobe analyses.”

“They *are denoted by* the first letter of their names.”

There is a subtle difference between “be known as” and the other items in terms of degree of commitment. It seems that “be known as” is used to speak about a term not totally fixed and accepted. For this reason it often collocates with adverbs that show certain degree of detachment: “generally”, “often”, etc.

“They are therefore *sometimes known* collectively *as* ostracoderms.”

However sometimes there is no difference in use between “be known as” and “be called”:

“Those that lie near Hayassi tracks corresponding to one solar mass or less *are known as* T Tauri Stars. Their more massive counterparts *are called* Herbig AE and BE stars.”

Owing to the fact that the defining item “(be) known as” is used when the term is not well established, when it is preceded by “also” an alternative name is being provided. Probably, the second one is less often used or less specific (technical), as in the following example, or it is used in a different context :

“The extrinsic muscles, *also known as* the soft muscles of the neck, raise and lower the laryngeal skeleton.”

A particular procedural item belonging to this category is the adjective “so-called”, which, according to Stubbs (1986), is an obvious marker of detachment. Its use implies that the lexical item “is being mentioned rather than, or as well as, being used” (Stubbs, 1986: 13):

“We are particularly interested in the *so-called* rybozymes, the RNA molecules that have catalytic function.”

As Stubbs remarks, this item indicates that the term used to refer to the concept is problematic, perhaps there is no agreement about its use or it is used only by some group, from which the writer is separating himself.

Since lexical signals of reflexive use link a concept to the term that designates it, they also serve to relate the concept to a term only used in a specific text. When the concept is specified in some way and there is no term to designate it, this term is created in the text, by means of formulas like the following:

X is designated as Y in this text.

X is referred as Y in this text.

Thus, this vocabulary may co-occur with deictic expressions referring to the discourse (e.g. “in this text”), which indicates that the writer of the article chooses a

name for a concept, usually to distinguish specific cases of a concept. The co-occurrence of the lexical signals of reflexive use and the deictic expressions makes it explicit that the term has been created for a particular text or experiment. This can be seen in the following examples:

“Any general cell that differentiates into several more specific varieties may be considered a stem cell, but *for the purpose of this article*, the term “stem cell” refers only to the hematopoietic stem cell.”

“*In this paper* we use the term capsulitis of the shoulder to refer to an idiopathic painful condition of the shoulder...”

There is a difference between the general meaning of the term and that used in a specific discourse, this distinction being marked by lexical and syntactic signals. In these cases the use of the personal pronoun “we” is frequent. The use of “we” is a modification device which conveys *mitigation* and *immediacy* (Flowerdew, 1991: 257). It suggests positive feelings towards the subject and brings the speaker and the hearer together:

“When we speak of gauge forces we will *mean* forces which respect a gauge symmetry.”

The contrast, for instance, between “we refer to X as Y” and “X is referred to as Y” is one of immediacy/distance, deriving both from the immediacy effect of “we” and the distance effect of the passive.

The discussion of the role of lexical signals of reflexive use has shown that the relation between procedural vocabulary and the metalinguistic function of language has two different aspects: textual reference and meaning negotiation.

In the first place, we have already noted how lexical items can signal that a word is being used reflexively. When words have this reflexive use they are prototypical examples of textual reference: the writer refers from one linguistic item to another, which he assumes to be known, in order to explain the previous one. The defining items mentioned above are signals that this process is being performed: “by X I mean Y”, “X, also known as Y” etc. Therefore, the main use of this metalinguistic discourse is to describe or explain and thereby “bridge differences in knowledge of designations” (Sager *et al*, 1980: 85) between the writer and the reader.

This brings us to the second aspect, meaning negotiation, which manifests itself in more specific uses of procedural vocabulary. These are as follows:

(i) creation of a synonymy relation, of a single exact correspondence between two terms designating the same concept:

“Chert, *known also* as hearthstone, is a silicate sedimentary.”

A concept can be expressed by means of different terms, depending on the text type in which it occurs. However, although the terms are usually absolute cognitive<sup>5</sup>

synonyms, they are not available for free variation because they are bound to a specific text type. Thus, the procedural item usually introduces a term used for the same concept in a different text type, although this is not always the case.

(ii) restriction in the reference of a term: when the conventional concept associated with a term is broader than the concept referred to in a given frame of reference this term is redefined:

“Reworked tuff *is used here* for deposits of ash that were remobilized prior to lithification.”

(iii) isolation of a concept from a set of concepts designated by the same term:

“Now we want to study the strong isospin symmetry (...) We will see later on that the strong isospin symmetry that we will study is the most fundamental one. Whenever we say “isospin” in the rest of the book we will *mean* the weak isospin.”

### 3.3. Lexical signals of illocutionary force highly dependent on context.

Within this type of vocabulary that signals the illocutionary force of the speech act, there are two particular groups that should be mentioned. They consist of items that only indicate the function they are included in because of their occurrence in a particular context, which makes of them the least explicit signals.

#### 1. Reporting verbs.

They do not signal an illocutionary force on their own: their signalling function is a result of their combination with a particular grammar word (especially “as”) and with the context in which they appear. Thus, their role as signals of illocutionary force depends on pragmatic factors. The following are some examples:

“Nettleton et al. (1970) *reported* hydrobiotite, vermiculity, montmorillonite and kaolinite *as* weathering products of biotite.”

“Kaolinite and Halloysite have been *recognized as* natural weathering products of biotite.”

“The procedure injury rate *was calculated as* the percentage of procedures with one or more injuries, the procedure recontact rate as the percentage of persons procedures with one or more injury.”

“Thorne and Carpenter *dismiss* Mastotermes *as* living fossils.”

“Stem cell factor is of particular interest because it has been *identified as* the hormone that interacts with a cell receptor produced by the cellular oncogene c-kit.”

The italicized lexical items could be considered “research verbs”, which refer primarily to the processes (mental or physical) that are part of the research work. The

writer's description of these processes is mostly neutral, without showing any negative or positive attitude towards them. They create relationships (identity, inclusion, etc.) that depend on the immediate context.

## 2. Defining items occurring in the texts that accompany and explain graphics.

Visual aids occurring in scientific papers are in fact a kind of definition or description, similar to *ostensive definition*. When dealing with these visual aids we should consider that there exist three elements: the real concept, the term used to refer to it, the graphic representation in the text. PV never appears in a graphic, since the relations between the schematic items that may occur are signalled by the graphic itself. However, there is often a text accompanying a graphic representation. The procedural vocabulary in these stretches of text can be used to establish the equivalence between the elements of the graphic and those of reality. The following are some examples:

“In the case of the dickisoniids, the lateral pneu boundaries *are indicated by* the familiar radiating pattern of lines, marking the sites of struts.”

“In figure 19-1 the bar that binds the hydrogen atom to the carbon atom *represents* two valence electrons.”

“Operating principle of the CCD imager is depicted in this sequence of schematic diagrams, each of which *corresponds to* a small segment near the top edge of the device.”

“The boundary curves for mixtures of oxidized biotite (...) *are drawn as* dashed lines in Fig. 4”

“Points in the lower part of the diagram in Fig. 4 can now be *interpreted as* mixtures of hidrobiotite and kaolinite...”

Both in 1. (reporting verbs) and 2. (lexis of graphics) defining items signal intensive processes of being (Halliday, 1985). This is specially clear in the second case, where a sign (Token) is identified by means of its meaning (Value).

This is a type of relationship that could be called “significance”. In it a symbol is given a value, it is related to an entity of the real world by means of a code established by the writer of the article. A similar type of relation appears in the definition of scientific formulas and in definitions used in the discourse of mathematics, where every element of the formula is given a value:

“A bundle is a triple (E, P, M) where E and M are topological spaces and P: E-M is a continuous map. E is called the total space or bundle space. The map P is known as the projection map.”

#### 4. *Conclusion.*

This paper has brought to light the fact that there exists a set of lexical items that signal the occurrence of certain rhetorical functions, whose use is ruled by pragmatic principles. These signals highlight and bring to the foreground the rhetorical function in which they are included, acting as signposts that inform the reader that specific concepts that will be necessary to develop the discourse are being explained. They are lexical items which are part of the procedural vocabulary that contributes to meaning negotiation in actually occurring discourse, its use being a basic strategy for discourse understanding.

The set of lexical signals of rhetorical function has been sub-categorized in three different sub-sets according to the degree of explicitness in their signalling role. The first sub-set includes explicit signals of specific rhetorical function, that is, signals that play a discourse labelling role, naming the act where they occur; the second sub-set consists of items that indicate that a word is being used reflexively; the third sub-set is made up of lexical items that, without having a signalling character by themselves, occur in a context which turns them into signals of rhetorical function. The occurrence of a specific lexical signal within a function will be determined by the writer's purpose: to explain a term, to name a new concept, to establish a connection between a semiotic element and its meaning, etc. This paper provides a list of lexical signals of the illocutionary force of three informative speech acts (definition, description, clasification), characterized in terms of their function in discourse.

We believe that the categorization of lexical signals presented here can be useful both for researchers and for teachers. Research in scientific discourse has dealt both with sub-technical vocabulary and with rhetorical functions, but no attempt has been made, as far as we know, to look at the role of some items of sub-technical vocabulary as elements that signal and provide salience to rhetorical functions. This paper shows that the investigation of the relation between lexis and other levels of discourse yields interesting results. Further research can be carried out on the role of lexis in discourse as a basic procedure for comprehension. A still under-researched area is the lexical signalling of the relations between different parts of the discourse, and of the evaluative development and rhetorical structure of discourse. Teachers of ESP could take advantage of these results to make students understand that there is not a one-to-one relationship between a particular function and a particular structure and to help them develop this function giving them a basic type of lexis for this purpose. The set of lexical signals described here can be used as teaching material both for reading and writing tasks involving the identification, understanding and elaboration of the three rhetorical functions considered in this paper.

*Notes*

1. These informative acts form a group within "communicative acts" (term used in German linguistic literature, e.g. Sager et al. (1980), Weber (1991). In English literature, they are referred to as "acts of communication" (Widdowson, 1979), or as "rhetorical functions" (Trimble, 1985). Communicative acts are those that fulfil communicative tasks, that is, tasks that result from the requirements of communication.  
Following Sager et al. (1980) we use the term "informative acts" to refer to a subgroup of communicative acts including definition, description, and classification. They inform about objects and notions in science and technology. In addition to informative acts, there are other types of communicative acts, e.g. Giving Reports, Summarizing, Debating.
- 2 Widdowson borrows the terms "symbol" and "index" from C.S. Peirce, but imposes his own interpretation on them. For a detailed discussion of the use of these terms in semantics see Lyons (1977: 99-109). Lyons puts a special emphasis on the different meanings that have been given to "index", "indexical", and "indicate".
- 3 More information about this issue can be found in Clark and Havilland, 1977; Halliday, 1985; Lyons, 1977; Quirk, Greenbaum, Leech and Svartvik, 1985.
- 4 Flowerdew (1992 b) regards performative verbs of this type salient boosters while considering signals of reflexive use neutral boosters.
- 5 We follow Cruse's (1986: 88) terminology, who defines cognitive synonymy in terms of truth-conditional relations: "X is a cognitive synonym of Y if (i) X and Y are syntactically identical, and (ii) any grammatical declarative sentence S containing X has equivalent truth-conditions to another sentence S, which is identical to S except that X is replaced by Y." For instance, "fiddle" and "violin" are cognitive synonyms.

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