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Hedges and Textual Communicative Function in Medical English Written Discourse #*

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Abstract

This paper discusses how the communicative purpose of the different rhetorical sections of research papers (RP) and case reports (CR) in medical English written discourse influences the frequency and category distribution of the modulation devices (hedges) used in each section.

To this end, we analyzed a corpus of 15 articles drawn from five leading medical journals. Hedges were identified by means of a contextual analysis, their frequency was recorded in the different rhetorical sections of the 15 articles, and their percentages (over the total number of running words) were computed. The hedges recorded were then classified according to five pre-established categories, and their percentual distribution per category was evaluated in each rhetorical section. The results were analyzed by means of Chi-square tests.

Our research indicates that the three most frequently used hedging devices in both text-types (shields, approximators and compound hedges) account for over 90% of the total number of hedges used in our sample. The *Discussion* (RP) /*Comment* (CR) sections are the most heavily hedged sections, whereas the *Methods* (RP) and the *Case Report* sections (CR) are the least-hedged rhetorical divisions ($p=.001$ and $.071$ respectively). The *Introduction* section of both RP and CR favors shields (mainly epistemic verbs) as a hedging convention followed by approximators (negative or quasi negative expressions in RP *Introductions*, and adaptors of frequency in CR *Introductions*). In the *Introduction* hedges allow researchers to establish an "early niche" for their research. Scientific writers mostly resort to approximators as a hedging technique in the *Methods* section ($p=.0001$) as well as in the *Results* sections of RP and in the *Case Report* sections of CR. Shields (mostly modal verbs) are also used (although to a much lesser extent) in the *Result* section of RP to evaluate, interpret and comment on the findings of the research being reported. Both shields and compound-hedges are the most frequently encountered hedging devices in the *Discussion/Comments* sections of RP and CR. Finally, the distribution of hedges in the *Case Report* section in CR resembles that observed in the *Result* section in RP, but it is significantly richer in approximators ($p=.0001$) used for describing symptoms and for conveying the idea of range.

We conclude that the choice of expressions of tentativeness and flexibility is dictated by the general structure of the discourse, by its communicative purpose, by the level of claim the writers wish to make, and by the authors' pretension to universality and generalization.

Because hedging in scientific discourse is a necessary and vitally important skill, we finally provide some pedagogical implications of our research such as the use of sensitization, translation and rewriting exercises in ESP courses.

INTRODUCTION

Today's scientists are urged to use a style of writing which projects both personal modesty and honesty. Argumental arrogance and exuberance are not well seen by the scientific community. By

contrast, humility, coyness and cautiousness are. As Myers puts it (1988), researchers have to present themselves as "the humble servants of the discipline."¹ According to Blisset (1972: 141): "If a scientist is articulate, persuasive, if he goes to the heart of the matter, he is open to attack." As a consequence, everything must be toned down; speculation can obviously be made but it must be apologized for. In order to reach this goal, i.e., to tone down their statements, researchers have a variety of linguistic devices available which generally go under the rubric of "hedges." The literature on the subject provides us with two conflicting --although not mutually exclusive-- standpoints on the *raison d'être* of hedges.

The first (and most widely accepted) view associates hedges with unscientific imprecision and defines them as "linguistic cues of bias" (Fand 1989), i.e., understatements used to convey (purposive) vagueness and tentativeness, and to make sentences more acceptable to the hearer/reader, thus increasing their chance of ratification and reducing the risk of negation. This necessity for ratification is caused by the inherent refutability of sentences. Indeed, Lakoff (1972) pointed out that natural language sentences are very often neither true nor false nor nonsensical, but rather true to a certain extent and false to a certain extent, true in certain respects and false in others. He then referred to hedges as "words or phrases whose job is to make things more or less fuzzy." Along the same lines, Myers (1988) argued that claiming precision is not appropriate in all situations and that scientists do not always want to be precise: "Sometimes we want to be vague," assert Kong et al. (1986). This concept of fuzziness and (necessary) imprecision was developed further by other researchers, such as Brown and Levinson (1978) who considered hedges as strategies for minimizing the threat to face that lurks behind every act of communication, Lachowicz (1981), Prince et al. (1982), Rounds (1982), Powell (1985), Pindi et al. (1986), Skelton (1988), Dubois (1987), Vasquez (1987). They all, in one way or another, state that hedges are used to signal distance, to "unobtrusively inject an author's personal view into his communication" (Dubois 1987: 539), to protect one's own reputation as a scientist, to avoid absolute statements which might put the researchers (and the institution they work at) in an embarrassing situation, to express the extent to which the writers commit themselves to the truth value of their statements and to allow the researchers to be more open to other possibilities of interpretation. According to Swales (1990: 175), hedges are rhetorical devices used for "projecting honesty, modesty and proper caution in self-reports and for diplomatically creating space in areas heavily populated by other researchers." Quite originally (although not completely at variance with the previous definitions),

¹ Myers (1985) provides us with a nicely illustrated case study of two well-established biologists who struggled to get their papers published because their arguments were too arrogantly expressed. As Myers observes, the authors had to rewrite their article four times, "so that the published versions are hardly recognizable as related to the first submission." (1985: 594).

Myers (1988), basing his discussion on Brown and Levinson's work (1978), argues that hedges can be better understood as positive or negative "politeness strategies", i.e., as rational strategies used for dealing with the social interactions involved in publishing an article (e.g., solidarity with readers, unspeakability of direct criticisms, deference towards the scientific community).

The proponents of the other viewpoint consider that the association of hedging with vagueness or fuzziness can obscure some important function of hedging (cf. Salager-Meyer 1993). Instead of interpreting the use of hedges solely in this way, one could alternatively consider them as ways of being more precise in reporting results. Hedging may present the true state of the writers' understanding, namely, the strongest claim a careful researcher can make. Referring to academic writing, Rounds (1981) argues that hedges are not used simply to cover oneself and to make things fuzzy, but that they can also be used to negotiate the right representation of the state of the knowledge under discussion, i.e., to achieve greater preciseness in scientific claims. Indeed, as Tarantino explains (1991a.), all along scientific writers are aware that the fragment of truth they are exploring is only another step towards the discovery of other truths which will in turn advance knowledge and understanding of nature. In their search for truth (a direction in which all scientists are moving but which is not something one ever finally achieves) and "through the attentive and painstaking organization of their thoughts, scientists acknowledge that their contribution is a mere glimmer of light in the stream of endeavours to investigate and penetrate the wondrous mystery which include man and the universe." (Tarantino 1991b.: 33). We then partly agree with Skelton (1988) that hedges should not always be considered as a problem, as a "cover-up" tactic, but rather as a resource to express scientific uncertainty, skepticism and doubt. After all, scientific rationality is a myth, as Gilbert and Mulkay argue (1984), and science has always been oscillating between the desire to be precise and the impossibility of accurately quantifying the world. (This is why scientists' eagerness to accuracy is very often frustrated).

Some of the previously mentioned studies were concerned with the use of hedges in general language texts (McKinley 1983, Powell 1985, Stubb 1986, Zuck and Zuck 1987, Skelton 1988), others dealt with the phenomenon of hedging in academic writing (Adams Smith 1983, 1984 and Kubui 1988 in medical research papers, Rounds 1981, 1982 in social sciences, Prince et al. 1982 in physician-physician oral discourse, Pindi et al. 1986 in economic forecasting, Dubois 1987 in biomedical slide talks, Myers 1988 in a corpus of molecular genetics), and others discussed the problem from a contrastive rhetorics point of view (Markanen and Schröder 1988 a.b, Clyne 1991). However, we do not know of any study which has focused on the problem of how hedges are realized in different text-types (or sub-genres) within one and the same genre, i.e., how the communicative purpose or situational context of different text-types --each having its own quite

separate conventions, processes of reasoning and standards of arguments-- influences the range of modulations used and the variety of its linguistic realizations. In the words of Yearley (1981): "An analysis of the manner in which scientific texts are composed **argumentatively** will be central to any project concerned with the nature of scientific evaluation."

Last but not least, I believe that in spite of their undeniable contribution to the field, most studies which have been carried out so far on the topic of hedges have not made enough emphasis upon the fact that hedges are first and foremost the product of a **mental attitude** which looks for prototypical linguistic forms (such as modals, epistemic verbs, approximators, etc.) for its realization, but these linguistic forms do not always carry a hedging nuance. Such an ambiguity -- one linguistic form may serve many functions and the same function may be expressed using different forms-- leads to the difficulty of identifying which of these linguistic forms are hedges and which are not. Nevertheless, it is my contention that the gap which necessarily exists between the writer's mental processes (i.e., his/her intentions) and the linguistic realizations employed can be solved to a great extent by carrying out a rigorous contextual analysis.

THE STUDY

The research reported here is part of a wider genre-based contextual analysis on the use of hedging in today's medical English (ME) written discourse, the broad objective of which is to examine how the communicative function (or discursive practice) of the four fundamental ME text-types (viz., editorials [ED], review articles [RV], research papers [RP] and case reports [CR]) influences the frequency and distribution of hedging conventions used in each text-type (or sub-genre)² . As was said before, our research differs from most other studies in the sense that it is **both** a "bottom-up" applied study which examines the phenomenon of hedging in the specific written genre of ME scholarly papers, and a "top-down" study of discourse which aims at developing an understanding of this phenomenon across different text-types by quantitatively and qualitatively relating it to the communicative purpose of each text-type. That hedging is basic to academic discourse (Rounds 1982) is the underlying assumption of our research project.³

² The importance of genre studies and that of the classification and description of genres and sub-genres for both teachers and learners is now well-documented (e.g., Swales 1981, 1990; Hopkins and Dudley-Evans 1988).

³ In this respect, it is interesting to mention that Prince et al. (1982) found that the most salient feature of physician-physician oral discourse is the number and frequency of hedges: more than 1 every 15 seconds.

In a previous article (Salager-Meyer 1991), it was found that the four above mentioned text-types could be reduced to two on the basis of the frequency and category distribution of hedging conventions used in each text-type: ED/RV on the one hand (heavily hedged argumentative, persuasive and evaluative writing), and RP/CR on the other (more informative and descriptive discourse, less heavily hedged than the previous two sub-genres)⁴. However, in that previous paper, the frequency and distribution of hedging in RP and CR was "globally" recorded, i.e., hedges were recorded regardless of the rhetorical sections in which they occurred.

Because research papers have become "a standard product of the knowledge manufacturing industries" (Knorr-Cetina 1981), and because of their "qualitative and quantitative pre-eminence" (Swales 1990: 93), we decided to carry out a follow-up study to determine how medical writers modulate (or mitigate) their discourse in the different rhetorical sections of RP and CR. It is indeed well-established (e.g., Swales 1990) that research articles cannot be considered as homogeneous discourse: they are divided into 4 or 5 rhetorical sections and there are discernible differences in communicative function from one section to another. In 1958, Toulmin defined the five inter-related constituents of a scientific presentation as follows: the grounds (established information on the subject), the warrant (qualitative and quantitative facts supporting the new hypothesis), the modality (value indicating the degree of certainty regarding the event reported), the claim (the core of the discussion, the conclusion that the report proposes), and the rebuttal (elements of doubt concerning the claim made). It can readily be seen that Toulmin's five constituents closely correspond to what is today commonly referred to as the "IMRAD structure" of RP, i. e., this "intellectual straightjacket" (Lock 1988) composed of the *Introduction*, *Methods*, *Results* And *Discussion*. In CR, this structural pattern is reduced to three constituents, each one having a distinct communicative purpose as well: a short *Introduction*, a detailed *Case Report*, and a brief *Comment* (sometimes called *Discussion*) section.

PURPOSE

The objectives of the present paper are threefold:

- a. To determine whether the frequency and types of hedging techniques used in the different rhetorical sections of RP and CR vary from one section of the article to the other.
- b. Since one way in which choice of tentativeness, flexibility and/or politeness is guided is by the writer's perception of the general purpose of the text being created, we will secondly analyze how

⁴ For a thorough communicative analysis of the fundamental ME text-types considered in our research project, see Salager-Meyer 1991.

the communicative purpose (or discursive practice) of each rhetorical section influences the use of hedging conventions.

c. To elaborate a listing of the various hedging devices typical of today's ME written prose which could readily be used in EMP courses for pedagogical purposes. Indeed, as Rounds (1981), Bloor (1984) and Skelton (1988) agree, since hedging is a common technique of communicating information in scientific discourse, it should be explicitly studied and taught to the students in order to assist them in their studies and professional careers.

Before going any further, it should be kept in mind that the definition of hedges we adopted in the present research goes beyond their mere association with speculation. Indeed, it embraces a three-dimensional concept: 1. that of purposive fuzziness and vagueness (threat-minimizing strategy); 2. that which reflects the authors' modesty for their achievements and avoidance of personal involvement; 3) that related to the impossibility or unwillingness of reaching absolute accuracy and of quantifying all the phenomena under observation.

METHODOLOGY

We analyzed a corpus of 15 "high-brow level" articles (see Huddleston 1971) distributed as follows: 10 CR (making up a total of 13,958 running words) and 5 RP (making up a total of 11,871 running words). The articles, all published between 1980 and 1990, were drawn from leading medical journals such as *The British Medical Journal*, *Annals of Internal Medicine*, *The Lancet*, *Archives of Internal Medicine* and *The New England Journal of Medicine*. These journals were chosen because they embody some of the best in medical journalism.

The number of hedging devices was recorded in each rhetorical section in each article separately, and the percentage of hedges (with respect to the total number of running words making up each rhetorical section in each article) was computed. The results were analyzed by means of Chi-square tests. The alpha value was set up at .05.

For the reasons stated in the Introduction and in order to identify hedges as accurately and precisely as possible, we carried out a rigorous contextual analysis (both from a linguistic and medical standpoint) of the linguistic expressions commonly considered as hedges. This is why the taxonomy we adopted in this research (see herebelow) contemplates both formal and functional criteria. Obviously, such a procedure does not guarantee a 100% reliability rate in the adscription of a given linguistic form to a hedge, but we believe that it is much more reliable than a "blind" (i.e., non-

functional, purely formal) identification which would undoubtedly lead to the distortion of the data both in their quantity and their distribution.

The taxonomy of hedges we adopted in this paper is then the following:

1. **Shields:** all modal verbs expressing possibility⁵ ; semi-auxiliaries like "*to appear*," "*to seem*" (also called "plausibility shields" in Prince et al. [1982]); probability adverbs like "*probably*," "*likely*" and their derivative adjectives; epistemic verbs (that is, verbs which relate to the probability of a proposition or a hypothesis being true) such as "*to suggest*," "*to speculate*".
2. **Approximators:** stereotyped "adaptors" as well as "rounders" (see Prince et al. 1982) of quantity, degree, frequency and time (e.g., "*approximately*," "*roughly*," "*somewhat*," "*quite*," "*often*," "*occasionally*") which express heed and coyness. According to our working definition of hedges (see page 6 above), even though not all approximators serve to make things vague -- some are indeed used when exact figures are irrelevant or unavailable or when the state of knowledge does not allow the scientists to be more precise-- they were all recorded as "hedges".⁶ Approximators is the hedging category which most closely reflect what we could call the "institutionalized" language of science.
3. Expressions such as "*I believe*," "*to our knowledge*," "*it is our view that ...*" which express the **authors' personal doubt and direct involvement**;
4. **Emotionally-charged intensifiers** (comment words used to project the authors' reactions) such as "*extremely difficult/interesting*," "*dishearteningly weak*," "*of particular importance*," "*particularly encouraging*," "*unexpectedly*," "*surprisingly*."
5. Finally, we decided to add a fifth category labelled "**compound hedges**" which comprised "strings of hedges" (i.e., the juxtaposition of several hedges). Such compound hedges can be double hedges (*It may suggest that ...; "it could be suggested that ...*), treble hedges (*It would seem likely that ..., it seems reasonable to assume*), quadruple hedges (*It would seem somewhat unlikely that ...*), etc.

The hedges recorded in our sample were thus classified according to the five above mentioned categories. In order to appreciate how hedging conventions were distributed in the two text-types under study, the number of hedges per category was computed as a percentage of the total number of hedges recorded in each text-type (the 5 RP and the 15 CR altogether). The same procedure was adopted for the rhetorical sections of RP and CR, i.e., in each rhetorical section the number of

⁵ Modals expressing capability were not recorded as hedges, e.g, "No conclusion *can* be drawn," "We *could* not detect any clinical parameter," "We *may* now turn to review the data so far obtained."

⁶ Obviously, such expressions as "*more than half (58%)*" were not recorded as hedges because in such cases the parenthesis provides the readers with the exact figure.

hedges per category was computed as a percentage of the total number of hedges recorded in each section in order to appreciate how hedging conventions are distributed among the different sections of RP and CR. For the analysis of the data we sought the assistance of a specialist informant, expert in medical research and fluent reader of English, who helped us to confirm and expand the hypotheses generated by the written data analysis.

Finally, we want to mention that the linguistic examples given in this paper are to be considered as typical exponents of a particular rhetorical section (i.e., they belong to the most frequently used categories in a given section and/or text-type). They are all presented in an abbreviated form and in all the cases they have been taken from the articles making up our corpus.

RESULTS AND DISCUSSION

We will present and discuss the results of the present research as follows⁷ :

- a. those related to the overall percentage of hedges in the different rhetorical sections of RP and CR (with respect to the total number of running words in each section);
- b. those concerned with the categorical distribution of hedging conventions in the two text-types under study (with respect to the total number of hedges recorded in each text-type) ;
- c. those obtained for the categorical distribution of hedges in the different rhetorical sections of RP and CR (with respect to the total number of hedges recorded in each section).

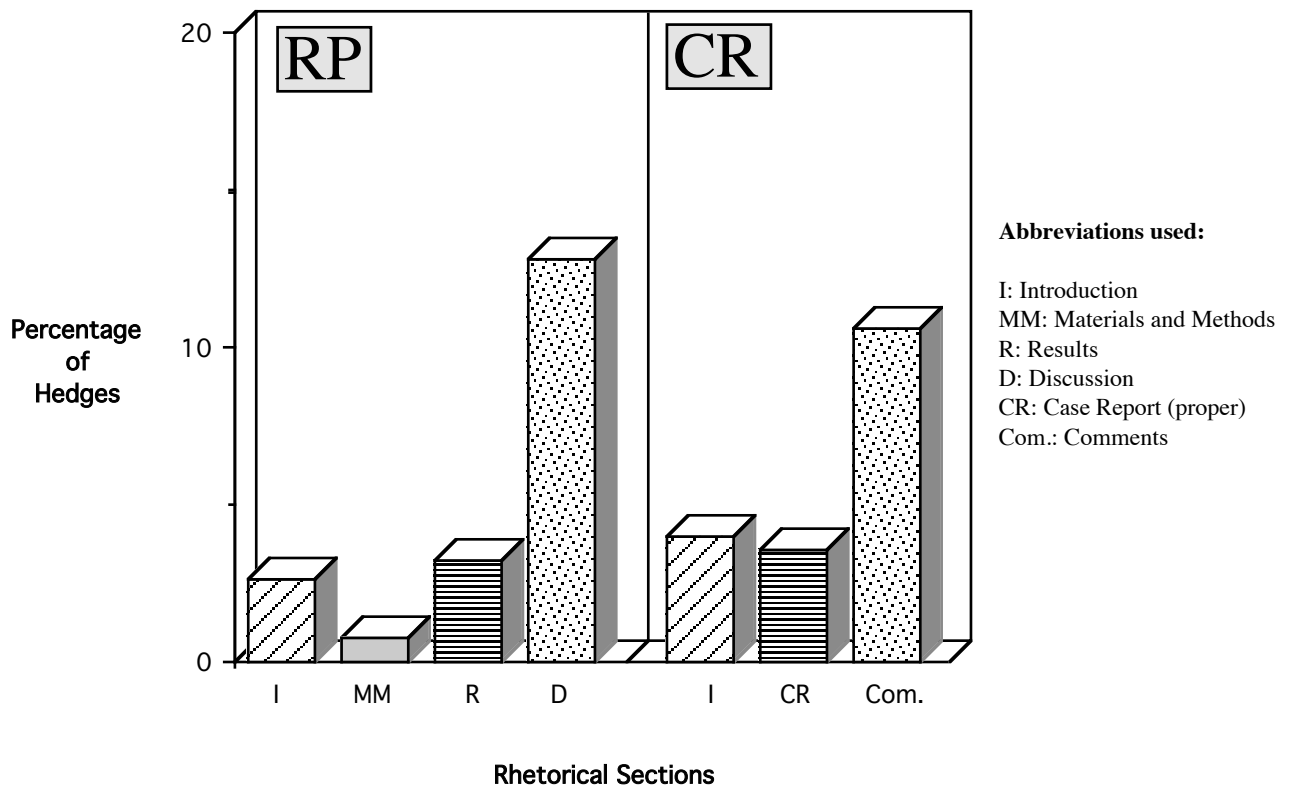
A. Overall percentage of hedging devices in the different rhetorical sections of Research Papers and Case Reports (with respect to the total number of running words in each division).

As Fig. 1 indicates, the *Discussion* sections in RP -- as well as their equivalent *Comment* sections in CR-- are the most heavily-hedged divisions of these two text-types (13% and 10.7% respectively of the total number of words making up these sections are hedges). By contrast, the *Methods* sections in RP and their (situationally) corresponding *Case Report* sections in CR exhibit the lowest percentage of hedges (0.8% and 3.6% respectively). The results of the statistical tests performed show that the difference between the percentage of hedges recorded in the *Discussion* sections of RP and that observed in the *Methods* sections of RP is statistically significant ($p = .001$). What is more, the percentage of hedges recorded in the *Discussion* sections of RP by far outnumbers that observed in any other section of RP. The results of the tests performed also show that the difference

⁷ The overall percentage of hedges in RP and CR (regardless of their frequency of occurrence per rhetorical section) is reported in our first article on the use of hedges in medical prose (Salager-Meyer 1991).

between the frequency of hedges recorded in the *Case Report* sections of CR and that observed in the *Comment*

Figure 1
Percentage of Hedges per Rhetorical Section
in Research Papers (RP) and Case Reports (CR)
 (with respect to the total number of running words in each section)



Statistically significant differences (p>.05)
 D(RP) compared with I, MM and R(RP)
 Com.(CR) compared with CR(CR)

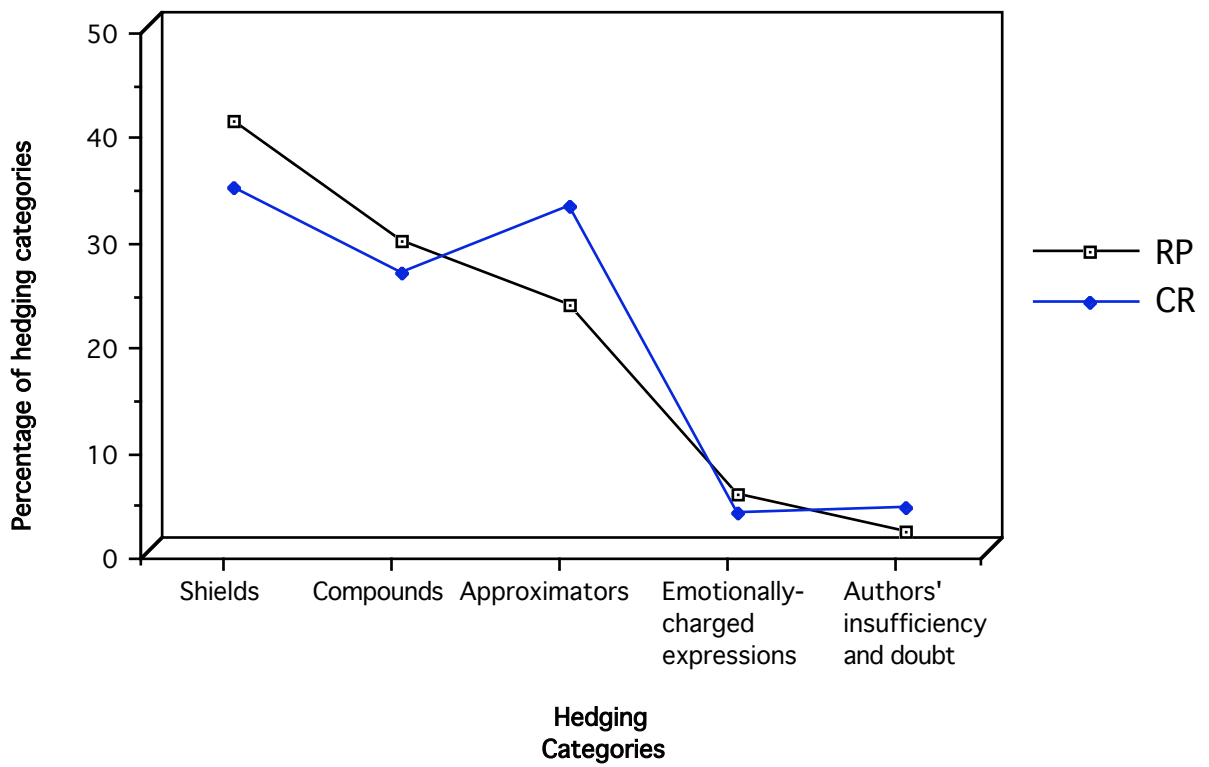
sections of CR almost reaches statistical significance ($p = .0713$). This confirms other researchers' findings (Swales 1981, 1987, 1990; Yearley 1981) that the *Discussion/Comments* section of scholarly papers are marked by a heavy use of hedging and modality. The "level of claim the writers wish to make" (Myers 1985) in the different rhetorical sections of a scholarly paper accounts for the difference observed in the percentage of hedging devices used in them. This level of claim --which is in close relation to the writers' pretension to universality or generalizability (see Salager-Meyer 1993)-- is in turn related to the particular communicative purpose of each rhetorical division. (This point will be dealt with in greater detail in section C. below). In this respect, it is interesting to note that the overall percentage of hedges recorded in the *Discussion* sections of RP (13%) is greater (although not significantly so) than that observed in the *Comment* sections of CR (10.7%). This is very likely due to the fact that CRs (as their name indicates) present a single, rare and unusual entity. This means that their authors cannot pretend to universalize their findings as much as RP writers (who present a "cohort" of cases) do, and, as a consequence, they do not need to tone down their statements as much as RP writers do.

It is interesting to note that the overall findings of our research parallel in some way those of West (1980) with respect to the frequency of occurrence of *that-nominals* across the different sections of biology RP. Indeed, West found that *that-nominals* were very rare in *Methods*, fairly uncommon in *Results*, frequent in *Discussion* and most frequent in *Introductions*. West explains his findings in functional/communicative terms: he reasons that the fact that the function of the *Introduction* is to make claims about statements from other research accounts for the high density of *that-nominal* constructions. Similarly, the *Discussion* section, which makes many claims about the research findings, contains many *that-nominals* (and, we can now assert, many hedging tactics). By contrast, the *Results* and the *Methods* sections rarely make claims about other statements and are consequently poor in *that-nominals* (and, as our research showed, in hedging devices).

B. Distribution of hedging categories in Research Papers and Case Reports (with respect to the total number of hedges recorded in each text-type)

As can be seen in Figure 2, the most frequently used hedging device in RP and CR corresponds to the shield category (40.7% and 34.3% respectively). In RP these are followed by compound hedges (29.3%) and approximators (23.2%), and in CR by approximators (32.5%) and compound hedges (26.1%). Nevertheless, although in both text-types shields are the most frequent hedging technique, they are not significantly more frequent than approximators or compound hedges. As our data indicate, these three hedging categories (shields, approximators and compound hedges) account for over 90% of the total number of hedges used in each text-type. It is interesting to note that the remaining two categories of hedges --which occur with an extremely low frequency in RP and CR

Figure 2
Percentual Distribution of Hedging Categories in Research Papers (RP) and Case Reports (CR)
 (with respect to the total number of hedges in each text-type)



(they together account for less than 7% in each text-type)-- were found to be quite frequent in editorials and review articles (cf. Salager-Meyer 1991, 1993).

The frequent use of shields (mostly verbal modality) encountered in RP and CR provides further support to the finding that modals are frequently used in scientific-technical literature to tone down and enhance quantitative and qualitative information as well as to modulate the degree of certainty on the author's part (Selinker 1979, Adams-Smith 1984, Trimble 1985, Vasquez 1987, Kubui 1988, Tarantino 1991b).

Since the distribution of hedges per category differs quite strongly across the IMRAD structure of research papers (as well as across the structural pattern of CR), we will now present our findings in a more detailed fashion by considering the distribution of hedges per category across the different rhetorical sections of RP and CR.

C. Distribution of Hedging Categories per Rhetorical Section in Research Papers and Case Reports

C.1. As can be seen on Figures 3 and 4, *Introduction* sections in both RP and CR favors shields as a hedging convention (37.5% and 44.5% respectively), followed by approximators in RP (25%) and by compound hedges in CR (33.3%). However, although shields outnumber approximators in the *Introduction* sections of RP (as well as compound hedges in the *Introduction* sections of CR), in neither case is the difference statistically significant.

In the *Introduction* sections of CR and/or RP, shields mostly take the form of epistemic verbs ("*to speculate* ," "*to suggest* " , "*to indicate* " , "*to tend* ") and, although less frequently, of modal verbs (see examples below).

- . Surveys of physicians and other estimates *suggest* there exists up to 22.600 alcoholic physicians in the US, or a prevalence of 12%. (RP)
- . Earlier studies *indicate* a cell cycle dependent effect ... (RP)
- . Shmerling *suggested* that sensitization took place during the first hours after birth. (CR)
- . Previous estimates of the incidence of acute mountain sickness *suggest* that ... (RP)
- . Alternatively, ω-3 PUFAs *may* modulate the vasoconstrictor response to pressor hormones and *may* decrease BP viscosity.(RP)
- . Small sample sizes *may* have hindered the interpretation of many studies.(RP)
- . Several lines of evidence *suggest* that supplementation of diet with fish oils *may* reduce BP.(CR)

Figure 3
Percentual Distribution of Hedging Categories in the Different
Rhetorical Sections of Research Papers
 (with respect to the total number of hedges in each section)

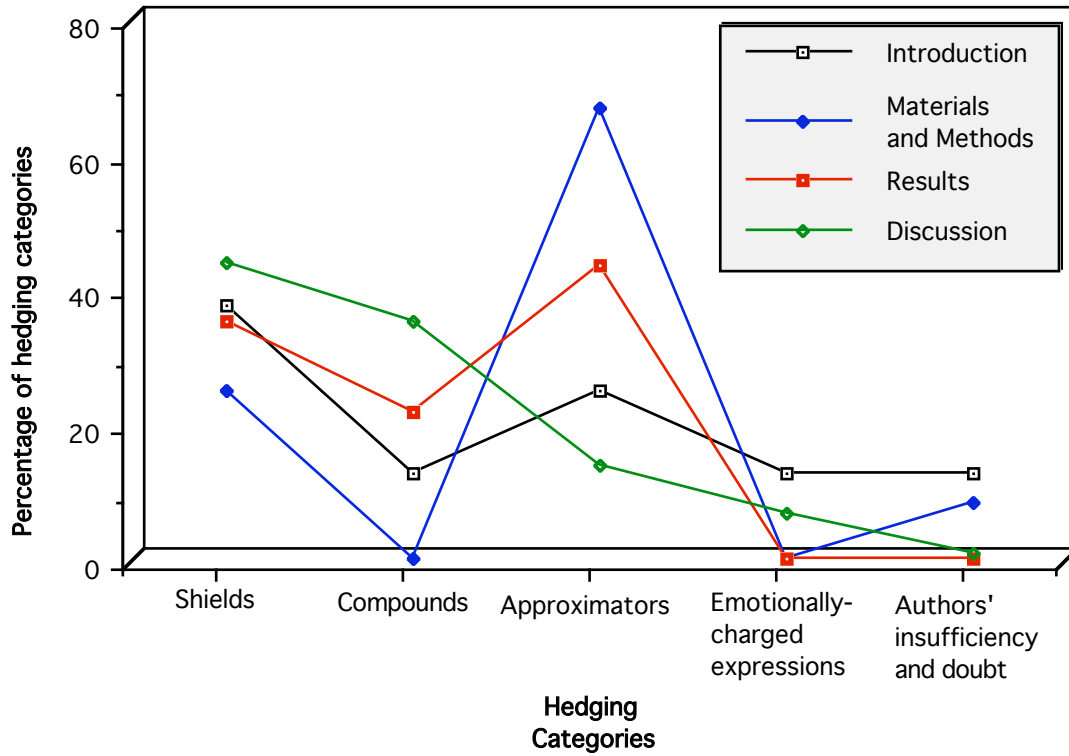
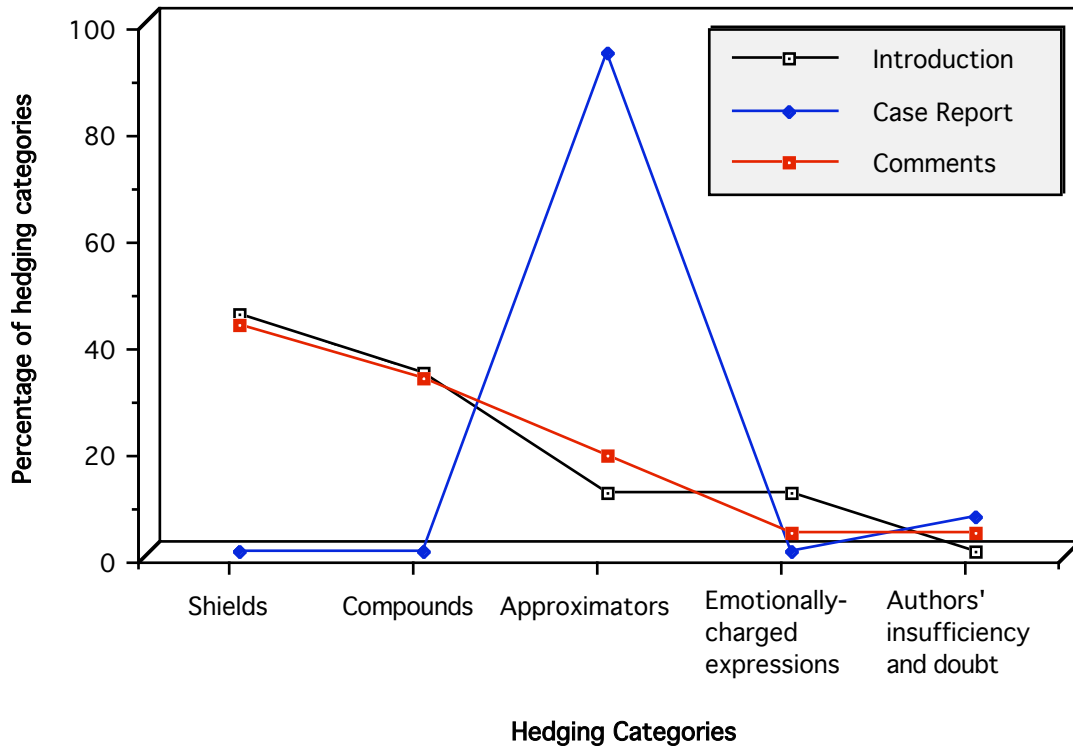


Figure 4
Percentual Distribution of Hedging Categories in the Different
Rhetorical Sections of Case Reports
 (with respect to the total number of hedges in each section)



. Several authors *have speculated* that abnormal aggregation *might* result inIn addition, three clinical studies *suggested* a lower than expected prevalence of ... (RP)

A difference was observed in the use of approximators in the *Introductions* of CR and that in RP *Introductions*: indeed, whereas approximators mostly take the form of negative or quasi-negative quantifiers in RP *Introductions*, they generally correspond to rounders/adaptors of frequency in CR *Introductions*, as the following examples illustrate:

- . There is *little* research that ... (RP)
- . It is therefore *quite possible* that ...(RP)
- . *Very few studies* have been carried out on ...(RP)
- . *Little information exists* on the frequency and severity of the disorder.(RP)
- . *More needs to be learned* about the incidence of ...(RP)
- . At present, the mechanism by which ω -3 PUFAs reduce BP *remains uncertain*..(RP)
- . Ciguatera poisoning is *usually* a clinical diagnosis. (CR)
- . *Very rarely*, primary pneumonia is overwhelming and complicated by respiratory failure. (CR)

From a rhetorical standpoint, *Introductions* (which Swales called "encapsulated problem-solution texts") motivate the study, justify the reason for the investigation (West 1980: 486) and make claims about statements from other research⁸. The examples presented above (the majority of which illustrate contrastive comments) point to a controversial research area, an important but unresolved issue, and present (especially in RP) evidence which questions existing theory, or calls into question some problems with the accepted knowledge. By citing numerous studies which bear on the same issue, scientists hope to build an argument to support their own work. This, as was said before, serves to justify the publication of the study "by showing that the author's contribution to the discipline, whilst previously established as significant and reference-worthy, is as yet incomplete" (Swales 1990: 138).

To use Gilbert and Mulkay's expression (1984), the examples provided above are part of a "subtle and organized social analysis". The beliefs expressed are presented in a way which enables the authors to contrast them unfavorably with those of another group of scientists, to which the authors themselves belong. What is particularly noticeable about such examples is how the beliefs which they summarize are prepared for immediate rejection. Instead of presenting the central idea as a

⁸ According to Swales (1990), centrality claims are to be taken as bold statements or appeals to the discourse community whereby members are asked to accept that the research about to be reported is part of a lively, significant or well-established research area.

reasonable, though inconclusive, interpretation associated with at least some experimental evidence, it is depicted in the text as mere assumption. The impression is conveyed that, although the ideas expressed in such sentences have been around for some time, they have no firm scientific foundation and are not to be taken seriously. The nature of such sentences prepares the readers to expect and welcome the contrasting views to be presented by the researchers in the remaining sentences of their article *Introduction*. It should be noted that the authors' desire to highlight a knowledge gap (which justifies their own research), and to contrast other researchers' views with their own, is not as intense in CR as it is in RP because, as we previously stated, CR writers do not pretend as much to universality and generalization as RP writers do.

To sum up, all the above examples (typical exponents of modulating signals in the *Introduction* section of RP and CR) allow the researcher to establish what Swales (1990: 155) calls an "early niche" for the research being reported (as if none of the evidence the researchers are using is conclusive) and to explain what the author's unexplored territory consists of.

C. 2. As stated before, the *Methods* section of RP is the least hedged division of RP (hedges account for 0.8% of the total number of running words making up the *Methods* sections). This relative absence of hedges can be explained by the fact that the *Methods* section is essentially a listing of procedural formulae, a simple description of the process which led to the obtainment of the data, an elliptical checklist which offers the step-by-step "residual" description of what was done in the laboratory and rarely make claims about other statements (Gilbert and Mulkay 1984, Myers 1985, Huckin 1987). It is then characterized by the virtual absence of problems, matters of discussion (even though the co-authors of the article might have had to discuss the procedures used in the experiment), statement of rationale, discussion of the choices made or evidence of failure. In Swales' terms (1990: 121), the *Methods* section of a research article is "a highly abstracted reformulation of final outcomes in which an enormous amount is taken for granted". This is why this section can be considered as the most rigid of the four making up the IMRAD pattern, i.e., it can be considered as explicit standard academic description⁹.

Of the 12 hedges recorded in the 5 *Methods* sections of our sample, 8 (66.7%) were approximators and 3 (25%) belonged to the shield category. The χ^2 test shows that the difference between the frequency of occurrence of both hedging categories is highly significant ($p=.0001$). Approximators

⁹ It is interesting to note (cf. Bazerman 1984, Hopkins and Dudley Evans 1988) that the *Methods* section is increasingly de-emphasized and downgraded to the point where some journals publish it in smaller print than that which is used in the other sections. On the contrary, the Discussion/Conclusion sections have, since 1930, become the most important divisions to the detriment of the Materials/Methods sections. In other words, there has been a marked shift away from the unevaluated reporting to lengthy and explicit writers' comments.

or "rounders" (e.g., "*approximately*", "*usually*", "*about 5 hours*", "*roughly the same as*") are extremely common in the domain of measurements (henceforth, their justification in the *Methods* and the *Results* sections, see C.3. below), but they do not necessarily reflect uncertainty or fuzziness. They are sometimes used as a shorthand device when exact figures are irrelevant or unavailable (Prince et al. 1982).

C.3. Only 3.3% of the total number of running words making up the 5 *Results* sections of RPs were hedges (see Fig. 1). The rationale of this low frequency of hedging devices lies in the fact that the *Results* section of RP is a quite straightforward unfolding of findings: it presents a clear description of the results, describes the process of manipulating the data obtained during the experimental stage, and makes limited claims about the statistical tests. (Such claims are as a rule put forth in the *Discussion* sections). As for the distribution of hedging categories in the *Results* sections of RP, it somewhat reflects that observed in the *Methods* section. Indeed, here too, approximators are the most frequently used hedging device (43.2%), followed by shields (35.1%), but, contrary to what was observed in the *Methods* section of RP, the difference between the frequency of occurrence of these two hedging categories is not significant.

In the *Results* section of RP, shields mostly take the form of verbal modality or epistemic verbs, e.g.,

- . It *can* be seen that ...
- . These dysfunctions *might* be *slightly* overestimated ...
- . It *appeared* that all heat-treated cells progress through mitosis ...
- . These results *indicate* that ... and *suggest* that the process of DNA synthesis *might* also show thermotolerance.

It is interesting to remark that the above sentences (especially the last one) correspond rather to an evaluation/ a discussion of the results than to the results *per se*. Such examples are an indication of a tentativeness on the part of the writers to commit themselves to absolute statements about their results. Whereas observed facts are expressed strongly ("*We have found that* ") and are not subjected to "*maybe*", interpretations, explanations and comments on the findings themselves -- which express some measure of doubt as to what is actually responsible for the results-- are invariably subjected to such "*maybe* ".

C. 4. The *Discussion* section "mirror-images the *Introduction* by moving from specific findings to wider implications" (Swales 1990: 133). According to Huckin (1987), it describes an inside-out circle, whereas the *Introduction* describes an outside-inside one. This "mirror-imaging" is reflected

in the use each rhetorical section makes of hedges: as was found in the *Introduction* sections, the *Discussion/Comment* sections of RP and CR (see Fig. 3 and 4) is most heavily marked by shields (43.8% and 42.7% respectively), followed by compounds (35% in RP and 32.5% in CR). Nevertheless, the results of the statistical analysis performed showed that the difference between the frequency of occurrence of these two hedging categories is significant neither in RP nor in CR. It is finally worthwhile mentioning that in the *Discussion* section (and contrary to what was observed in the *Introduction* section), shields mostly take the form of verbal modality rather than epistemic verbs.

The primary rhetorical function of this section is to make claims about the research findings (i.e., to explain the statistical findings in non-statistical English), to summarize results, state conclusions and suggestions with reference to previous research and/or to the current work, to set further questions sometimes with possible explanations, references and future developments and applications in the field of study (what Toulmin [1979] refers to as "fertility"). These functions call for analysis and re-synthesis of the information which has to be transmitted through language structures with consequent influence on choice and value of grammatical categories, argument types, functions and exposition strategies (Weaver 1953). Then, the very high frequency of hedges in this section --as compared to that observed in the other three sections--is due to the fact that the claim is the core of the *Discussion* and, as Tarantino (1991a.) argues, every structure and function in the text must produce reasons for its justification. It is in this last section of research papers that writers speculate, argue, contrast and extrapolate from the described results, and at the same time avoid stating results too conclusively so as the readers can note that the authors are not claiming to have the final word on the subject. Hypotheses are by nature tentative and understated, and this is reflected in their linguistic realization. As McKinlay (1983) observes, for every explanation of the results, there might always be some alternative explanation somebody else might come up with. This explains why it is in this section of RP and CR that compound hedges are most frequently used. The following examples of compound hedges (see below) all illustrate the "clear-cut break between the objective detached reporting found in the *Methods/Results* sections and the more subjective author involvement in the *Discussion/Comments* sections." (Adams-Smith 1984).

- . *It may be possible* to give the differential effects a place in the model. (RP)
- . Non-invasive methods *may suggest* the diagnosis (CR).
- . Continuous wave Doppler *would* be expected to delineate ... (CR)
- . *It seems reasonable* to assume that ... (CR)
- . The rhythm *should* be treated accordingly. (CR)
- . *Several possible* factors *may* be reflected in dental X-rays. (CR)

- . It *seems more reasonable* to combine measles and measles vaccination together as a *possible* protective factor against leukemia. (RP)
- . Our data *may suggest* that left ventricular ejection phase indices are *fairly* normal regardless of the duration of COPD. (CR).
- . This *can* be discussed in terms of (RP)

By resorting to such expressions, researchers can avoid absolutes and thus negotiate exactly with what degree of certainty they draw their conclusions and also how strongly they want to align themselves with their claims. Room for disagreement is provided in this way. The above examples illustrate the fact that hedges are a consequence of the fact that research results are indicative rather than definitive.

It has been suggested that the frequent occurrence of such probabilistic concepts (hedging devices) represents an impairment in medical communication and education. Indeed, as Bryant and Norman (1980), Kong et al. (1986), Schwartz and Griffin (1986) and Politser (1987) argue, because the numerical meanings of expressions of likelihood vary greatly from one individual to another, they should be reduced and replaced by numerical ratings, i.e., by an "agreed-upon correspondence" between numbers and other verbal expressions (e.g., it could be agreed that "*almost certain*" correspond to a 90% chance, "*probable*" to a 70% chance etc.). Such an "agreed-upon code", so argue its proponents, could gradually catch on just as do the meanings of most words encoded in a dictionary. But, as was briefly mentioned in the Introduction of this paper, numbers may communicate unwarranted and/or undesired precision! Claiming precision is not appropriate (sometimes, it is even impossible) in all situations. As Skelton (1988) so rightly remarks, "without hedging, the world would be purely propositional, a rigid and dull place where things either are the case or are not." With a hedging system, Skelton claims, "language is rendered more flexible and the world more subtle."

C.5. The *Case Report* section of CR presents a very low percentage of hedges, as low as that recorded in the Results sections of RP (3.3% vs. 3.6%). This should come as no surprise because the communicative function of both sections is very similar: the *Case Report* section of CR provides the reader with a listing of the patient's signs and symptoms, the results of the various tests performed on the patient, the diagnosis reached and the outcomes of the treatment administered. It is an essentially factual section, i.e., it avoids commenting on the patients' signs and symptoms, on the results of the tests performed or on those of the treatment administered. Such comments are usually left to the *Comment* section of CR.

In the *Case Report* section of CR, approximators (which make up 93.5% of the total number of hedges used in that section) mostly take the form of adverbs of quantity, e.g., "*almost*", "*quite*", "*markedly/greatly enlarged*", "*slightly irregular*". This confirms Prince et al. (1982) finding that such "adaptors" occur most frequently in the description of symptoms in physician-physician (oral) discourse. "Rounders" such as "*less than 24 hours later*", "*on several occasions*", "*almost 2 hours*", are also very frequent in this section of CR. This is why it is in this section of Case Reports that the frequency of approximators was found to be the highest in our sample ($p = .0001$). As was said before (C.3 above), such expressions are mostly used when exact figures are irrelevant or unavailable, or when the authors want to convey the idea of a range, i.e., when they attempt to correlate a particular situation/case with some prototypic or normative situation/case. *Almost, approximately, about, quite* etc. indicate that the case being described is close (but not similar) to the prototypic situation.

PEDAGOGICAL IMPLICATIONS

The vagueness used to present information is frequently overlooked by non-native speakers of English (Lackstrom et al. 1972). One reason might be because, as Zuck and Zuck (1987) remarked, little information is available in ESL textbooks to help students familiarize themselves with hedgings. These authors add that the treatment of hedging should at least be sufficient to raise the issue. The same feeling is shared by Rounds (1982), Skelton (1988), Kubui (1988) and Fand (1989) who all agree that hedging in scientific discourse is a necessary and vitally important skill which should be seen as a tool for making thought subtle rather than fudged, and taught to the students in order to assist them in their studies and professional careers. Rounds (1982: 5) considers that hedging is "an important problem [for non-native speakers of English] which is worthy of consideration and instructional attention." Fand (1989) further agrees that consistent categories of "linguistic items linked to bias" might provide helpful guidelines for learners. Non-native speakers of English who want to function in the academic world must be able to recognize hedgings in written texts and use them when necessary in the preparation of their own research work.

Students should be made aware of the need to mediate their claims and of making the difference between observed facts (which, as we said before, are said strongly) and interpretation (i.e., explanations which are invariably subjected to "*may be* ") in order to be effective readers and writers of scientific genres. The problem lies in the fact that NNSs tend to give the same weight to observed facts and interpretations. Instructors should then teach their students how to choose their reporting verbs; how to make the difference between the verbs whose use asserts the authors' commitment to the attendant proposition (*to show, to demonstrate, to establish*) and those whose

use carries no such commitment (*to suggest*). As Swales (1990: 151) remarks, this distinction "is a powerful rhetorical tool in authors' attempts to create research spaces for themselves because it allows them to signal early whether claims are to be taken as substantiated or not."

I would like to suggest a few exercises which ESP instructors could use in their classes in order to make their students aware of the various techniques (available in English) employed to mitigate and modulate scientific discourse.

a. **Sensitization and translation exercises.** Students could work in groups and underline all the hedges they can find in an article, justify their use, and provide equivalents (if possible) in their native language. Language instructors could also delete the hedges from a *Discussion/Comment* section of a scholarly paper and ask their students to rewrite it by hedging it when convenient.

b. **Rewriting exercises.** It has been demonstrated (Dubois 1986, Fachnestock 1986, Myers 1988) that the tentative note characteristic of research articles is replaced, in popularization articles and in textbooks (Myers 1992) by accredited fact and/or definite assertions ("*this suggests the possibility*" is replaced by "*they discovered*") that need no hedging, and that terms suggesting a possible association are reworded to state a direct cause-effect relationship. Students could then be asked to "rewrite" a popularization article according to the stylistic "hedging guidelines" of present day scientific prose.

Conclusions

It is clear from the medical data obtained that choice of vague expressions, of tentativeness and flexibility is partly dictated by the general structure of the discourse of this type of academic papers: *Introduction* (general and vague), the body of the paper itself (particular and precise), and the *Conclusion* (general and vague), as well as by the general communicative purpose of the written discourse. Our study on hedging in ME prose corroborates the fact that there are discernible differences between sections of research papers (Heslot 1982, Hopkins and Dudley-Evans 1988), and that these sections perform different rhetorical functions which are realized by various linguistic resources (Adams-Smith 1984). The evidence thus suggests a differential distribution of hedging frequency and categories across the standard sections of CR and RP. By and large, we have seen evidence for a two-way division between the extremely low-hedged *Methods* and *Results* sections as compared to the heavily hedged *Introduction* and *Discussion/Comment* sections of RP and CR.

Referring to expository writing, Parkhurst (1990) reported that technical vocabulary must be used with complete precision and that adjectives must be avoided as too imprecise. One medical doctor, he reports, describing the need for accuracy, said "We don't say 'pretty small'. We say '2.8 centimeters.' A pretty small tumor does not mean anything. " This seems to contradict reality. It does not seem that science can be as precise as many would like it to be. Hedges are precisely used for that purpose: as Gilbert and Mulkay (1984) assert, scientific rationality is a myth.

We would finally like to suggest at least one line of future research: since the conventions for scientific writing and the style of argumentation has been shown to vary from culture to culture (Galtung 1979, Markkanen and Schröder 1988a.b., Clyne 1991), it would be very interesting to carry out cross-linguistic studies on the way scientific writers modulate their discourse in different text-types and in different languages.

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