

Tense Study in Scientific Discourse

1) Introduction

The notion of time 'temps' (present time / past time / future time) is universal and is independent of any particular language. Tense (temps grammatical), on the other hand, is a linguistic device varying from one language to another. It means that the verb form or forms are used to express certain time relations. Thus, in English, one form, e.g. 'I speak' indicates present time, another form 'I spoke' indicates past time, still another form 'I shall speak' indicates the future time. However, this distinction is not 'crystal clear' in English as 'tense' does not always equal 'time'. Referring to the text 'Mastering American English' (MAE, 1956), Lackstrom et al. (1972) found that "MAE emphasises that one tense can express a large number of time concepts, and that one time concept can have several tenses." (Lackstrom et al., 1972 in Swales, 1985: 65). The following examples attest to this:

Example 1: We feed our cat on fish. (it is the simple present tense used to show a repeated action, and the time is true for the present, past and future);

Example 2: It is time I went home. (it is the subjunctive mood, simple past tense (= past subjunctive) expressing future time);

Example 3: If I trusted him (NOW) (it is the simple past tense / present time), I would lend him the money. To express past time, we would say: "If I had trusted him, I would have lent him the money."

In scientific discourse, tense study has other specific characteristics:

frequencies of occurrence (that is to say the extent to which one tense is used in texts compared to other tenses); and the functions they perform in these specific texts.

The present paper reports on the use of tenses in scientific discourse. It deals with their frequency of occurrence, the functions they perform in texts, together with their pedagogical implications.

2) Tense study in the literature

Tense study and the different teaching approaches
Throughout the world, the English language teaching/learning profession has moved from one specific kind of syllabus to another, focusing on one teaching approach or another. The most common ones are:

The structural approach: from the 1930s to the 1960s in which the teaching of the language, based on the selection of grammatical items and structures (tenses, sentence patterns, etc.), was regarded as synonymous with language teaching / learning. The teaching of tenses was based on teachers' intuition, and tenses were taught because they were present in texts, and also because they were part of the language system as a whole. Tenses were taught at the sentence level and lacked relationships to usage.

The 1970s witnessed the communicative approach which introduced functions and notions in teaching/learning English. In this approach, priority was given to communication, and the teaching of grammar as such was relegated to second rank. This approach was quite widespread in English language teaching in general, and in E.S.P. in particular, and it is still used nowadays.

With the advent of new technologies, the 1990s saw the emergence of computational linguistics (which first saw the light in the 1950s) and which uses corpus-based approach for empirical evidence (the study of the frequency of occurrence of verbs and tenses, and their functions in authentic texts).

Frequencies and functions of tenses in scientific discourse

Several studies have dealt with tenses in scientific and technical discourse focusing mainly on frequencies and functions. These studies were first based on small corpora and the analysis was done manually. With the computer, analyses use nowadays much bigger corpora (millions of words). The genres used in these studies are mostly theses (M.Sc. and PhD) and scientific journal articles. These two different genres presuppose two different linguistic textualizations.

Frequencies, in general, are important as they show us which words or structures are central in a language. Thus, they can help with decisions about what to include in teaching materials and what not.

Frequencies are of a particular importance to this paper as they show the use and distribution of grammatical verb forms (simple/progressive and perfect aspects).

Widdowson in "The description of scientific language" explained the difference between an approach that focuses on text and another that focuses on textualization. He stated that "Whereas the first is quantitative and tells us what linguistic forms occur and how frequently, the second is qualitative and tells us what the forms count as communication, and how they express elements of discourse." (1977: 57).

These two points (frequencies and functions of tenses in scientific discourse) will be explained one after the other, and illustrated in different works.

Tense frequency

Tense frequency in scientific discourse has been dealt with in quite a number of studies, using small or bigger corpora and focusing on the whole text, or on one or all the rhetorical sections of a text.

Barber (1962) used a small-scale study of verb tenses and subordinate clauses confined to a limited body of material of three texts represented in:

Text A is an excerpt from a textbook of university standard on the engineering applications of electronics (7, 500 words);

Text B deals with basic research, and is in the field of biochemistry (6, 300 words);

Text C is an elementary university textbook on astronomy, and consists of a chapter on astronomical instruments (9, 600 words). Thus, these three texts totalled a corpus of 23, 400 words.

The complete ranking-order of the ten tenses in Barber's material (1962) is as follows:

1. Present Simple Active (64%). 2. Present Simple Passive (25%). 3. Future Simple Active (3.7%). 4. Present Perfect Passive (1.7%). 5. Present Perfect Active (1.4%). 6. Past Simple Active (1.2%). 7. Past Simple Passive (1.2%). 8. Future Simple Passive (0.7%). 9. Present Progressive Active (0.6%). 10. Imperative (0.3%). (Barber, 1962 in Swales, 1985: 8)

Barber's results show that the simple present tense prevails (64 % Active form and 25 % Passive form, with a total of 89 %). It is then followed by the future tense (4.4 %); the present perfect (3.1 %) and Simple past tense (2.4 %).

Use of tenses in rhetorical sections

Tense choice in scientific discourse is also governed by rhetorical concerns, rather than time lines.

Hanania and Akhtar (1985) studied the use of tenses in the five rhetorical sections (Introduction, Review, Methods, Results and Discussion) of twenty M.Sc. theses in the fields of biology, chemistry and physics. The study showed that:

active verbs exceed passives in all rhetorical sections except in 'Methods' where more passives are used;

Present tense (46.8 % active and passive forms) exceeds the past (40.7 % active and passive forms) except in 'Methods'. It is used with a very high frequency in the 'Introduction'.

There is little use of perfective (4.4 %) and progressive aspects.

The table below shows these figures in details.

	Introduction %	Review %	Methods %	Results %	Discussion %	Total %
Active						
Present	50.4	36.1	17.4	36.2	41.8	33.3
Past	7.5	20.7	10.7	17.4	15.7	14.8
Perf/ Prog	1.8	2.7	0.6	2.2	2.0	1.8
Subtotal	59.7	59.5	28.7	55.8	59.5	49.9
Passive						
Present	18.4		12.2	13.0	13.5	
Past	6.9	11.8	55.3	10.2	25.9	
Perf/Progr	3.9		1.0	2.2	2.6	
		14.6				
		5.1		1.8		
Subtotal	29.2		68.5	25.4	42.0	
		31.5		37.3		
Modals						
Active	4.2	4.9	1.1	3.8	7.7	4.0
Passive	6.9	4.1	1.7	3.1	7.4	4.1
Subtotal	11.1	9.0	2.8	6.9	15.1	8.1
Total (%)	100.0	100.0	100.0	100.0	100.0	100.0
Totalverbs	930	1.780	2.391	1.724	1.450	8.275

Table 1: Use of tenses in rhetorical sections (Hanania and Akhtar, 1985: 52)

Hanania and Akhtar's results are similar to Barber's i.e. the simple present tense is more frequently used than the simple past tense in these two genres (university textbooks and M.Sc. theses).

As part of my doctoral thesis (2006), I studied the use of tenses in the rhetorical sections of biology journal articles and I found that:

The past tense in its two forms (Active / Passive) exceeds the present tense in 'Methods', 'Results', and it is used to some extent in 'Discussion'.

The present tense (Active form) is used in 'Abstract', 'Introduction', 'Results', and 'Discussion', and its frequency is highest in 'Introduction'.

There is very little use of perfective and progressive aspects.

The future is very rare. It is mainly used in the 'Introduction' where the writer informs the reader of what can be expected in the rest of the text and therefore 'will / shall' are used.

To summarise, we could say that the most frequent tenses used in the selected genres are the simple present, the simple past and the present perfect. Besides their frequency, these tenses also perform certain functions.

Functions of tenses in scientific discourse

Functions of tenses are determined by the subject-matter and the communicative purpose, e.g. use of the imperative mood/tense in technical manuals, use of 'let' in geometry, etc. In this context, Lackstrom et al. (1972) stated that "tense-choice is based on semantic notions unrelated to time." One of these semantic notions that is often referred to is the 'degree of generalization'.

(i) Degree of generalization

In most of the literature dealing with scientific discourse, it is claimed that tenses are related to the degree of generalization, and as such:

the present simple makes a general claim i.e. some sort of universal truth;

the simple past tense is used to indicate lack of generality, and

the present perfect gives a good generalization about past events.

To illustrate the above statements, Lackstrom et al. gave these examples:

A plant to convert cellulose of pine sawdust into fermentable sugar and that into ethyl alcohol failed because a sawmill couldn't sell as much lumber as plans called for, and thereby curtailed the alcohol plant's raw material supply.

Plants to convert cellulose pine of pine sawdust into fermentable sugar and that into ethyl alcohol have failed because sawmills haven't been able to sell as much as lumber as plans have called for, and thereby have curtailed the alcohol plants' raw material supply.

Plants to convert cellulose of pine sawdust into fermentable sugar and that into ethyl alcohol fail because sawmills can't sell as much lumber as plans call for, and thereby curtail the alcohol plants' raw material supply.

To explain the relationship between tenses and the function 'degree of generalization', Lackstrom et al. made the following comments:

The choice of the past, present perfect, or present tense in 1, 2 and ³, respectively is a choice based not on the time of the ethyl-alcohol-plant failures but on how general the author believes this phenomenon to be. To put it another way, the author will choose one or another of the tenses depending on how many instances of ethyl-alcohol-plant failures he knows about. If he has knowledge of a large number of cases, he will use the present tense. If he knows of fewer cases, he will use the present perfect. If he knows only one case, the past tense will be used. (Lackstrom, Selinker and Trimble, 1972, in Swales, 1985: 65)

Thus, tense choice in examples 1, 2 and 3 is based on semantic notions unrelated to time.

(ii) 'Temporary' versus 'permanent' use of equipment/tools

Another significant interpretation of the use of tenses in scientific and technical writing is the notion of 'temporary' as opposed to 'permanent' use of equipment/tools.

Widdowson (1977: 58) referred to another paper by Lackstrom et al. 1972 in which "there is a suggestion that the past tense is used to describe experimental apparatus which is temporary, set up, perhaps solely for the particular experiment being reported, whereas the present tense is used to refer to apparatus which is permanent."

This interpretation would send us back to the most widespread belief in the traditional way of teaching tenses i.e. simple present tense used to refer to permanent actions, and the simple past tense used to refer to an action that took place and finished in the past.

(iii) Tense and Space relationships

Some tenses are used in scientific discourse to show space relationships. This notion is well-represented in Swales' s work (1981).

Swales' s study (1981: 41) of the introduction section of 48 academic journal articles drawn from academic disciplines (16 articles from the hard sciences, 16 articles from biology and medical field, and 16 articles form social sciences) suggests that the 4 moves that form the 'Introduction section' are sometimes lexically signalled and sometimes grammatically signalled (tense choice). Swales focused on 'Move 2' that is 'Discussion of Previous Research' (DPR), the most extensive section of introductions, to relate the history by describing what previous researchers have found, reported, demonstrated, suggested.

Swales suggests that tense selection may indicate the author's stance towards the cited work.

The use of present perfect might imply closeness to the study while past tense would distance the writer from the cited

work. This is clearly exemplified in a table (Swales, 1981:42) from which the examples below are taken:

Strong Author-Orientation is expressed by using the simple past, e.g. Mercerau and Feynmann (1956) investigated the case of a ferromagnetic sphere...

Weak Author-Orientation is expressed by using the present perfect, e.g. Local failure rates as high as 18% have been reported (Cantin et al 1968) ...

Subject-Orientation is expressed by using the present simple, e.g. Immunological mechanisms are also involved in patients with scabies (Mellenby, 1944; Falk, 1980; Falk & Bolle, 1980a, b).

In (a) the focus is on the authors, rather than on the work cited. In (b) the focus is on the study 'local failure rates' and as such the present perfect shows 'closeness to the study'. In (c) the focus is on the subject-matter.

3) Pedagogical implications

In Point (2), we have tried to cover tense usage in scientific discourse through the notions of 'frequency' and 'functions'. The studies cited to illustrate such points showed that the most recurrent tenses are: the simple present, the simple past and the present perfect, with little use of the future tense. We have also explained some of the functions expressed by tenses in scientific discourse. The questions that one might ask are :

Should we teach all tenses to science students ? or

Should we teach only those present in science texts, and ignore the others ?

The answer (as we see it) could be that:

Figures do indicate what should be the priorities of a teacher when dealing with tenses;

Less frequent tenses 'even a figure of 1%' cannot be completely neglected by the teacher. However, Barber (1962) advised us that "it is obviously undesirable, for example, to

spend a great deal of time on the progressive tenses, and to neglect the present simple', one of the most frequent tense in scientific discourse.

4) Conclusion

In this paper, we have tried to shed light on the use of tenses in scientific discourse through frequency study and through examples of functions that some recurrent tenses might express. Compared to tense usage in General English, the field of tense study in scientific discourse is still being explored and more research needs to be done, and their pedagogical implications to be applied.

REFERENCES

- Barber, C.L. (1962) 'Some Measurable Characteristics of Modern Scientific Prose' in Contributions to English Syntax and Phonology, Almqvist & Wiksell, Stockholm.
- Belkhenchir, K. (2006) Access to the Discourse Community of Biologists in Algeria: Improvement in English Language Pedagogy Using a Corpus-based Approach, Doctoral Thesis (Forthcoming).
- Hanania, A.S. and Akhtar, K. (1985) Verb Form and Rhetorical Function in Science Writing: A Study of MS Theses in Biology, Chemistry, and Physics, The ESP Journal, Volume 4, pp.49-58, Pergamon Press.
- Lackstrom, J.E Selinker, L. and Trimble, L.P. (1972) Grammar and Technical English, English Teaching Forum, X, 5, 1972.
- Swales, J. (1985) Episodes in ESP, Pergamon Press.
- Swales, J. (1981) Aspects of Article Introductions, The Language Studies Unit, The University of Aston in Birmingham.
- Widdowson, H.G. (1977) The Description of Scientific Language, (First published in Le Français dans le Monde, N° 129, May / June 1977) at:
www.oup.com/pdf/elt/library_classics/AppLing_C4.pdf