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A CHALLENGE TO THE CURRENT CONCEPT OF GENRE :  
WRITING UP RESEARCH

by

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## ABSTRACT

The study described in this thesis represents an attempt to develop a framework for genre analysis which reflects what it is that leads users of language to recognise communicative events as instances of particular genres. It does this by both testing and extending a definition of genre provided by John Swales which, to date, is unbacked by research evidence or investigation. This definition holds that genres are instanced by communicative events with shared sets of communicative purposes which, even though they may vary in their prototypicality, are constrained by various conventions as to what is allowable in terms of content, positioning and form. The texts which form the basis for the study are drawn from the area of written 'research reporting English'; that is, the writing up and publication of the results of experimental research in English.

Both social-semiotic and socio-psychological frameworks provide an initial basis for the examination of a collection of 'typical' instances of the specific genre (research reporting). The results of this examination then provide a basis for the presentation of a proposed *genre analysis framework* which synthesises a range of approaches and methods. The principal initial theoretical frameworks chosen for the study are *systemic functional linguistics*, a social-semiotic view of language originally formulated by M.A.K. Halliday, based largely on the work of Bronislaw Malinowski and J. R. Firth and *frame semantics*, a socio-psychological view of language proposed by Charles Fillmore and based on the work of Del Hymes, Eleanor Rosch and others working in the fields of cognitive science and artificial intelligence. Although the first

of these frameworks is shown to have certain strengths, it is also revealed to have certain limitations. The second of these frameworks is then proposed as the most comprehensive and adequate for explaining the assignment of communicative events as instances of particular genres.

A framework for genre analysis is then presented which draws on work in the areas of discourse analysis, pragmatics, language and cognition, natural language processing, artificial intelligence and critical theory and practice. The framework aims to reflect research on the interaction between meaning-creation and perception and arrangement, storage and retrieval in the context of the perception and production of specific communicative events as instances of particular genres. It also aims to establish a framework which allows us to account for the fact that certain instances of genres are further from what may be described as the genre prototype than others and for the fact that relationships are perceived between instances which may be structurally very different.

Within the context of the texts examined, the study, in general terms, validates Swales' definition of genre. In contrast to the position held by Swales, however, the study concludes that while it is possible to make statements concerning meaning-creation and goal-direction within the context of genre, it is a matter of much greater complexity to draw conclusions regarding the relationship between genre and the actual language of texts. The final chapter attempts to re-define the term 'genre' in the context of the research findings.

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## CHAPTER ONE

### INTRODUCTION TO THE STUDY: GENRE AND ENGLISH FOR SPECIFIC PURPOSES

#### 1.1 Introduction

Current interest in the notion of genre in educational linguistics has led to a number of important movements in the teaching and learning of language. One important strand of influence in this area stems from the work of linguists and language educators who have aimed to apply insights gained from systemic functional linguistics to language education.<sup>1</sup> Another important area of influence, particularly in the fields of second and foreign language learning and teaching (including what is generally described as English for Specific/Specifiable Purposes), comes from work such as that of John Swales and others who have investigated the use of English in academic and research settings.<sup>2</sup> Whilst both approaches to genre analysis offer interesting perspectives on the notion of genre, neither, as yet, has provided, within a single integrated framework, a model for genre analysis which incorporates both social and cognitive aspects of language comprehension and production. However, as Hatch states:

It is difficult to separate linguistic, social, and cognitive factors in the discourse system; they are tightly interwoven (Hatch 1992, 316).

This study is an attempt to integrate these key factors into a framework for genre analysis and aims to account for them, and for the relationship between them, in the perception and production of communicative events as instances of particular genres. It initially takes two different perspectives on language (one which is essentially social-semiotic in orientation and one which is essentially social-psychological in orientation) and uses them to examine the same body of texts. The next stage is to compare and contrast the results of the analyses in an attempt to produce an integrated framework which draws on insights that can be gained from each.

The study will, in addition, attempt to test and extend the following working definition of genre provided by Swales:

A genre comprises a class of communicative events, the members of which share some set of communicative purposes. These purposes are recognised by the expert members of the parent discourse community, and thereby constitute the rationale for the genre. This rationale shapes the schematic structure of the discourse and influences and constrains choice of content and style. Communicative purpose is both a privileged criterion and one that operates to keep the scope of a genre as here conceived narrowly focused on comparable rhetorical action. In addition to purpose, exemplars of a genre exhibit various patterns of similarity in terms of structure, style, content and intended audience. If all high probability expectations are realised, the exemplar will be viewed as prototypical by the parent discourse community. The genre names inherited and produced by discourse communities and imported by others constitute valuable ethnographic communication, but typically need further validation (Swales 1990: 58).

The texts which form the basis for the study are drawn from the area of written 'research reporting English'; that is, the writing up and publication of the results of experimental research in English. This is generally called 'research English' in the literature (see eg. Swales 1985). The term, 'written research reporting English' is used here, however, as a more precise term for referring to written, rather than spoken, research reports. The texts chosen for the study can be found at the end of thesis as Appendix I. The rationale for the selection of texts is provided in section 1.7.1.

The study will aim to demonstrate, within this particular context, that while it is possible to make statements concerning the meanings that are functioning in the texts and the stages through which they move in order to achieve their goal (Martin 1986a), it is a matter of much greater complexity to make statements regarding the relationship between genre and the actual language of the texts. It will, furthermore, argue that definitions of genres which include specific language selection as a *characterising* component of the particular genre need to be re-defined.

The two contrasting theoretical frameworks which have been chosen for the study are *systemic functional linguistics*, a social-semiotic view of language originally formulated by M.A.K. Halliday, based largely on the work of the linguist J. R. Firth and the anthropologist Malinowski<sup>3</sup> and *frame semantics*, a socio-psychological view of language proposed by Charles Fillmore, a model of language which aims to incorporate not only the social functions of language, but also a concern with the nature of language production and comprehension processes.<sup>4</sup>

The study will, thus, in examining the concept of genre within the context of 'specific purpose' English aim to re-define what it is that leads language users to recognise communicative events as examples of particular genres.

## 1.2 The concept of genre

Apart from the definition proposed by Swales, a number of other attempts have been made to define the concept of genre. Richards, Platt and Weber, for example, in a definition drawn from the work of Coulthard (1985) and Saville Troike (1982), describe genre as:

a particular class of speech events which are considered by the speech community as being of the same type (Richards et al 1985, 122).

Examples they give of genres are prayers, sermons, conversations, songs, speeches, poems, letters and novels. Genres, furthermore, according to Richards, Platt and Weber "have particular and distinctive characteristics" (Richards et al 1985, 122). Richards, Platt and Weber also point out that some groups of genre may be called 'complex genres' in that a single genre may, in itself, contain examples of other genres such as, for example, a church service which contains instances of other genres such as hymns, psalms, prayers and a sermon.

Elliot and McGregor in their review of Ian Reid's volume, *The Place of Genre in Learning: Current Debates*, point to five different definitions

of genre that are employed in his book (Elliot and McGregor 1990, Reid 1987). They describe these as:

- (i) *Folk definitions*, where genres are seen as types or classes of texts that are in some way recognised as significant by members of a given culture and where names are given to the particular discourse types by the members of that culture;
- (ii) *Structural definitions*, where genres are defined in terms of the structural characteristics displayed by the particular texts;
- (iii) *Social definitions*, where genres are defined in terms of the function of the text within a particular context;
- (iv) *Linguistic definitions*, where a text is described as an instance of a particular genre on the basis of patterns of language within the texts;
- (v) *Generic motifs*, where a genre is defined by the presence of a particular lexical or phrasal motif, such as "once upon a time" in fables and nursery tales. (Elliot and McGregor 1990, 2-3)

In their review of these definitions, Elliot and McGregor subscribe to the view that "the only way in which real substance can be given to notions of genre is through structural definitions" (Elliot and McGregor 1990, 3). It is worth bearing in mind, however, that both Russian Formalists and literary structuralists failed in the first half of this century both to provide structural definitions of 'literary genres' and to demonstrate that 'literary language' is different from 'ordinary language' or 'non-literary language', such as the 'language of

advertising' etc. It is also worth noting that the post-structuralist response to structuralism related, in part, to these failures.<sup>5</sup>

Swales, tracing more closely the development of the concept of genre, divides genre into the categories of:

- (i) *Folklore definitions*, where particular genres are seen to serve particular social and spiritual needs of a particular community, such as in the case of the narrative genres of myths, legends and tales;
- (ii) *Literary definitions*, where permanency of form is both argued for, such as in the early work of the Russian Formalists and the structuralist movement, and against, as in the later work of the Russian Formalists and the following post-structuralist movement.<sup>6</sup>
- (iii) *Linguistic definitions*, where emphasis is given to genres as types of goal-directed communicative events which have *schematic structures* and which are identifiably separate from registers or styles;
- (iv) *Rhetorical definitions*, where genres are classified according to which component in the communication event receives the primary focus such as, for example, expressive, persuasive, literary or referential genres, thus supporting the notion of genre "as a means of social action" and as a "mechanism for reaching communicative goals" as well as "clarifying what these goals might be" (Swales 1990, 44).

Swales, then, taking a much broader view of the notion of genre than have some others, proposes the definition of genre presented in section 1.1 above. His definition incorporates systemic functional definitions of genre such as that proposed by Martin, who describes genre as "a staged goal-oriented purposeful activity in which speakers engage as members of our culture" (Martin 1984, 25) and Christie who, in restating genre as "any staged purposeful activity" (Christie 1984, 270), incorporates also a structural component into her definition by characterising genre as having a distinctive beginning, middle and end, that is, a distinctive *schematic structure*.

Swales' definition of genre also incorporates the approach taken in the United Kingdom in the teacher education package developed by a group at the University of Nottingham (Language in the National the Curriculum: Materials for Professional Development 1991). This group also describes genres (taken from Martin (1984) and others) as staged goal-directed activities which are, at the same time, socio-cultural processes which fulfil functions "which are of significance within a society's language activity" (Language in the National the Curriculum: Materials for Professional Development 1991, 340).

Swales' definition of genre does not, however, go as far as those proposed by Hasan or Ventola who claim that the obligatory structural elements of a text are 'genre defining'.<sup>7</sup> Swales' definition of genre does, however, incorporate the linguistic definition of genre found in systemically-oriented descriptions where it is claimed that specific sets of linguistic features realise particular stages of texts.<sup>8</sup> A key notion in Swales' definition which is missing from many other definitions of genre, however, is that of the notion of *prototype*; that is, "the extent to

which an exemplar is *prototypical* of a particular genre" (Swales 1990, 52), a point which will be taken up in more detail later in this study.<sup>9</sup>

### 1.3 The concept of English for Specific Purposes

A number of attempts have been made to define the concept of English for Specific Purposes. Richards, Platt and Weber, for example, define English for Specific Purposes as:

The role of English in a language course or programme of instruction in which the *content* and *aims* of the course are fixed by the specific needs of a particular learner group (emphasis mine) (Richards et al 1985, 94).

Hutchinson and Waters define English for Specific Purposes as "an approach to language learning which is based on learner need" (Hutchinson and Waters 1987, 19), a definition which they go on to gloss as "an approach to language learning in which all decisions as to *content* and *method* are based on the learner's reason for learning" (emphasis mine) (Hutchinson and Waters 1987, 19). At the same time as referring to 'content', however, Hutchinson and Waters note that English for Specific Purposes is "*not* a matter of teaching 'specialised varieties' of English" (their emphasis) (Hutchinson and Waters 1987, 18). Indeed, as they continue to say:

The fact that language is used for a specific purpose does *not* imply that it is a special form of the language, different in kind from other forms (Hutchinson and Waters 1987, 18).

English for Specific Purposes is, thus, "*not* ... a matter of Science words and grammar for Scientists, Hotel words and grammar for

Hotel staff and so on" (their emphasis) (Hutchinson and Waters 1987, 18), nor is it "different in kind from any other form of language teaching" (Hutchinson and Waters 1987, 18).

Indeed, as Hutchinson and Waters point out:

There is no grammatical structure, function or discourse structure that can be identified with Biology or any particular subject. Such things are the product of the communication situation (lecture, conversation, experiment, instructions etc) and the level (engineer, technician, manager, mechanic, university etc) (Hutchinson and Waters 1987, 165).

There are, furthermore, as Hutchinson and Waters point out, "only two ways in which the subject has any kind of influence on the language content" (Hutchinson and Waters 1987, 165). These are in the vocabulary of the text and in certain grammatical and structural forms. Hutchinson and Waters describe four types of vocabulary item which can occur in any text. These are structural items such as 'are', 'this', 'only' and 'however', general items such as 'table', 'run' and 'dog', sub-technical items such as 'engine', 'spring' and 'valve' and technical items such as 'auricle', 'fissure' and 'electrophoresis'. They observe that it is only in the last group of items above that any significant variation occurs with subject. In discussing variation in grammatical form, Hutchinson and Waters also point out that grammatical forms found in scientific texts are also found elsewhere in English and that "the rules for their creation and use do not vary with subject" (Hutchinson and Waters 1987, 166). Clearly, then, the argument for selecting specific linguistic content (see the definition provided by Richards et al above) in ESP courses can relate only to

statistical probability of occurrence and statistical probability studies can only be taken seriously if they relate to large corpora, are statistically valid, and if the basis for inclusion in a corpus is clearly articulated within an adequate theoretical framework.

Pauline Robinson defines English for Specific Purposes (ESP) as "goal-oriented learning" (Robinson 1989, 395), normally aimed at adults rather than school children who are, normally, not beginning learners of English. Regarding the issue of language, she points out that:

For some people still, the study of ESP implies the study of a restricted language, different from that used outside the discipline in question. However, there are only rare instances where this is the case ... Perhaps on very short low level courses, for example for hotel porters and cleaners [where] students are simply equipped with sets of fixed phrases (Robinson 1989, 417).

Indeed, as she concludes, the common assumption that English for Specific Purposes is " 'the language of medicine' (or of economics or engineering or whatever) can be proved erroneous" (Robinson 1989, 427).

Hutchinson and Waters and Robinson do not, however, go as far as saying that there is not a specific *selection* of language in specific areas of language use. Indeed, they still imply that selection of language may be different for specific areas of language use and there may still be a preponderance of certain language forms in certain specific purpose areas.

Notwithstanding these cautionary comments, literature abounds in which it is assumed that there *is* a direct relationship between purpose and content. Indeed, this is a view that is often expressed in the context of genre study. Godsen, for example, quotes Swales as observing that since research article sections "perform different rhetorical functions, they require different linguistic resources to realise these functions" (Godsen, 1992, 207). Swales himself, furthermore, actually states that rhetorical function acts "as a determiner of linguistic choices" (Swales 1990, 41-42). This position is clearly supported by Godsen when, in describing a programme for non-native speaker researchers, he includes "rhetorical functions of academic article Introduction and Discussion sections ... and associated linguistic choices" (Godsen 1991, 145).

This direct correlation view is true, not only of the work of Swales. It is also found in the work of Dudley Evans, Maher, Weissberg and Buker , Murison and Webb and Nwogu.<sup>10</sup> All these writers describe teaching and learning programmes in the area of 'research English' in which a 'specific purpose' *language* is implied, if not, in all cases, explicitly stated. The notion that purpose and language choice are related in a specific way is also found in much of the work of systemic functional linguists where they discuss what they refer to as 'registers' in terms of labels such as 'the language of scientific reporting' and 'bureaucratic language' etc.<sup>11</sup> This is an issue that will be closely examined in the study which follows.

#### 1.4 Genre analysis and English for Specific Purposes

The definitions of genre provided above are reflected in a number of different approaches to genre analysis. The two main approaches to genre analysis that dominate the literature are those based on a systemic functional theory of language and those that follow in the tradition of the work of Swales. Analyses based on a systemic functional model of language have covered a range of genres and text-types whereas those in the line of the work carried out by Swales have been predominantly in the area of written 'research reporting English'.

Examples of genre analyses based on systemic functional descriptions of language are listed in Table 1. All of the analyses listed, apart from Hasan (1984a), present either the *schematic structure*,<sup>12</sup> *generic structure*,<sup>13</sup> or *generic structure potential*<sup>14</sup> for a particular genre, together with, in some cases, analysis of the *semantic attributes*<sup>15</sup> and *lexico-grammatical patterns*<sup>16</sup> found in the texts, and cohesive features such as *lexical cohesion, reference and conjunction*,<sup>17</sup> *conversational structure*<sup>18</sup> or *theme*.<sup>19</sup>

Many of the analyses which follow in the tradition of Swales' original (1981) work are reviewed by both Crookes (1985, 1986) and Swales (1990). Examples of these analyses are listed in Table 2. All of these analyses, as with Swales' original work, focus on the discourse structures of the Introduction section of research reports.

*Table 1: Examples of genre analyses based on systemic functional descriptions of language*

| Author(s)                                                  | Genre                                             | Focus of analysis                                                                      |
|------------------------------------------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------|
| Hasan (1984a)                                              | the nursery tale                                  | semantic attributes, lexico-grammatical patterns of the structural element 'placement' |
| Rothery (1984)                                             | 'observation/comment', 'recount' texts, 'reports' | schematic structure, transitivity, reference, theme, conjunction                       |
| Martin and Peters (1985)                                   | 'exposition'                                      | schematic structure, transitivity, lexical cohesion, reference, conjunction, theme     |
| Christie (1985)                                            | 'curriculum genre' <sup>20</sup>                  | schematic structure, theme, reference, lexical cohesion                                |
| Walker, Christie, Horvarth, MacCausland and Rothery (1985) | 'curriculum genre'                                | schematic structure, conversational structure, theme, lexical cohesion, reference      |
| Martin and Rothery (1986)                                  | 'observation/comment', 'recount' texts, 'reports' | schematic structure, transitivity                                                      |
| Rothery (1986a)                                            | narratives 'reports'                              | schematic structure                                                                    |
| Rothery (1986b)                                            | 'reports' 'exposition'                            | schematic structure                                                                    |
| Horvarth and Eggins (1986)                                 | 'opinion' texts                                   | schematic structure                                                                    |
| Ventola (1987)                                             | service encounters                                | generic structure, potential, conversational structure, lexical                        |

|                                |                                                                                                                                 |                                                                                        |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
|                                |                                                                                                                                 | cohesion,<br>reference,<br>conjunction                                                 |
| Christie (1989a)               | 'reports'                                                                                                                       | schematic<br>structure,<br>conjunction,<br>reference,<br>transitivity,<br>tense, theme |
|                                | narratives                                                                                                                      | schematic<br>structure,<br>transitivity,<br>reference,<br>conjunction.                 |
|                                | 'procedural' genre                                                                                                              | schematic<br>structure                                                                 |
|                                | 'advertisement' genre                                                                                                           | schematic<br>structure                                                                 |
| Rothery (1989a)                | 'observation'<br>'recounts'<br>'procedural' genres<br>'descriptions'<br>'judgement'<br>'explanation' genres<br>'factual' genres | schematic<br>structure,<br>transitivity,<br>theme                                      |
| Hasan (1989a)                  | service encounters                                                                                                              | generic structure<br>potential                                                         |
| Martin (1989)                  | 'recounts'<br>'procedures'<br>'reports'<br>'descriptions'<br>'explanations'<br>'exposition'                                     | schematic<br>structure,<br>transitivity,<br>lexical cohesion,<br>conjunction, theme    |
| Tan (1987)                     | travel guide<br>introductions                                                                                                   | generic structure<br>potential,<br>semantic<br>attributes,<br>transitivity,<br>theme   |
| Harris (1988)                  | court-room discourse                                                                                                            | generic structure                                                                      |
| Matthiessen (1988)             | recipes                                                                                                                         | generic structure                                                                      |
| Matthiessen and Mann<br>(1991) | recipes                                                                                                                         | generic structure                                                                      |
| Samraj (1989)                  | the curriculum genre,<br>'picture talk'                                                                                         | generic structure,<br>semantic<br>attributes,<br>transitivity, mood,<br>conjunction    |
| Perrett (1990)                 | language testing<br>interviews                                                                                                  | generic structure                                                                      |

|                               |                                                        |                                                  |
|-------------------------------|--------------------------------------------------------|--------------------------------------------------|
| Hasan (in press)              | the dissertation<br>defence                            | generic<br>structure                             |
| Conduit and<br>Modesto (1990) | research reports<br>(Materials and Methods<br>section) | generic structure,<br>nominal group<br>structure |

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*Table 2: Examples of genre analyses in the tradition of Swales' original (1981) work*

| Author(s)                    | Genre                               | Focus of analysis       |
|------------------------------|-------------------------------------|-------------------------|
| Swales (1984, 1990)          | research reports<br>(Introductions) | discourse<br>structures |
| Cooper (1985)                | research reports<br>(Introductions) | discourse<br>structures |
| Hopkins (1985)               | research reports<br>(Introductions) | discourse<br>structures |
| Dudley Evans (1986,<br>1989) | research reports<br>(Introductions) | discourse<br>structures |
| Crookes (1985, 1986)         | research reports<br>(Introductions) | discourse<br>structures |

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Other studies have looked at the Materials and Methods, and Results and Discussion sections of research reports. A number of these studies are listed in Table 3.

There are few analyses of the discourse structure of research reports as a whole, with Swales, for example, only citing the studies carried out by Hill, Soppelsa and West (1982) and Stanley (1984), each of which is based on an analysis of a single research report.

*Table 3: Genre analyses of other sections of research reports*

|                                             |                                                               |                                                  |
|---------------------------------------------|---------------------------------------------------------------|--------------------------------------------------|
| Wood (1982)                                 | research reports<br>(Methods and Results<br>sections)         | discourse<br>structures                          |
| Bruce (1983)                                | research reports<br>(Methods and Results<br>sections)         | discourse<br>structures                          |
| Belanger (1982)                             | research reports<br>(Discussion section)                      | discourse<br>structures                          |
| McKinlay (1984)                             | research reports<br>(Discussion section)                      | discourse<br>structures                          |
| Peng (1987)                                 | research reports<br>(Discussion section)                      | discourse<br>structures                          |
| Hopkins and<br>Dudley-Evans<br>(1986, 1988) | research reports and<br>dissertations<br>(Discussion section) | discourse<br>structures                          |
| Conduit and<br>Modesto (1990)               | research reports<br>(Materials and Methods<br>section)        | generic structure,<br>nominal group<br>structure |

Applications of genre analyses of research reports within language teaching and learning are listed in Table 4. All of these teaching and learning programmes, apart from that described by Hill, Soppelsa and West are based on analyses carried out in the tradition of the work of Swales.

Although most systemic functional approaches have not been related to the analysis of scientific texts, there are some notable exceptions. Halliday (1988, 1990), for example, examines grammatical problems in scientific texts and Conduit and Modesto (1990) research generic structure and nominal group structures in the Materials and Methods section of scientific reports. There have not yet, however, been any reports of attempts to apply the results of these analyses to second or foreign language teaching and learning.

*Table 4: Applications of genre analyses of research reports within language teaching and learning*

| Author(s)                             | Focus of instruction                              |
|---------------------------------------|---------------------------------------------------|
| Hill, Soppelsa<br>West (1982)         | reading and writing experimental research reports |
| Swales (1983, 1984, 1987)             | writing research reports (Introductions)          |
| Swales and Najjar (1987)              | writing research reports (Introductions)          |
| Hall, Hawkey, Kenny and Storer (1986) | information structuring in scientific reports     |
| Marshall (1991)                       | writing research reports                          |
| Weissberg and Buker (1990)            | writing experimental research reports             |
| Murison and Webb (1991)               | writing experimental research reports             |

Other studies have looked into the discourse structure of research reports as a side issue to the main focus of investigation. An investigation carried out by Hunston, for example, although focussing in principle on the linguistic phenomenon of 'evaluation' in experimental research reports, makes a broad analysis of the structural elements and semantic features of the Introduction, Results and Discussion sections of a number of research reports (Hunston 1989). There is, however, no attempt in her study to examine lexicogrammatical patternings and realisations, nor any attempt to draw up a generic structure potential for the genre as a whole.

There is also a substantial literature aimed at native speakers of English where the subject of research reports, theses and articles is widely treated. Much of what has been written in this particular area has, however, been "at a level of rhetorical generality" (Swales 1984: 78)

or "the analysis is deliberately abstract" (Crookes 1985: 23).

Furthermore, where generalisations have been made, "they tend not to be borne out in reality" (Swales 1984: 77).

The main problem, for Crookes, with existing analyses of research reports is that they have not attempted to verify their descriptions and are often not descriptively adequate. Indeed, as he says:

...the fact that composition manuals and writing teachers advocate the use of certain rhetorical structures in technical writing does not necessarily mean that such structures are in fact employed in technical writing (Crookes 1986: 60).

This is borne out by findings such as those reported by Swales and Najjar which reveal distinct mismatches between prescriptions offered in manuals and style sheets for prospective authors of research papers and actual practice (Swales and Najjar 1987).

There is, furthermore, very little research in the area that attempts to link the meanings made in the texts with the actual language of the texts, or in Hasan's terms, the *meaning* with the *wording* of the texts (Hasan 1989b). Also, as Crombie and Rika-Heke point out, most analyses of 'specific purpose' texts have not looked at the *interactional characteristics* of the texts; that is, not just what occurs, but how it occurs and how it interacts (from both a linguistic and *non*-linguistic perspective) (Crombie and Rika-Heke 1991). Nor have there been any attempts to look at 'specific purpose' texts within a socio-psychological framework. There is, therefore, a significant gap in this area of research.

### 1.5 Genre as an organising principle for language programme development

A number of arguments have been put forward in support of using the notion of genre as an organising principle for language programme development. Swales (1986), for example, argues that a genre-based approach to language programme development has the following advantages:

- (i) The units in a genre-based language learning programme are of about the right size; that is, they are neither too small, as in a structural or functional syllabus, nor too large, as in a skills-based syllabus;
- (ii) The units in a genre-based language learning programme emphasise communicative purpose and achievement;
- (iii) The units in a genre-based language learning programme are expressed in terms that are comprehensible to non-English language specialists;
- (iv) The units in a genre-based language learning programme operate within constrained communicative settings so that certain regularities of organisation and form-function correspondence are apparent and utilisable.

Each of these arguments could be seen as potential strengths of a genre-based approach to language programme development. The notion of genre as being the 'right size' for a unit on which to base a

language programme, for example, takes the principle of organisation beyond the grammatical or functional unit, yet excludes neither from a position in the overall programme. As with McCarthy and Carter's (1994) proposal for a *discourse-based approach* to syllabus design, a genre-based approach to language programme development *starts* with genre as the overall driving force of the syllabus, yet still includes all other aspects of language competence that one might expect to see in a communicative syllabus.<sup>21</sup> Equally, the focus on communicative purpose is consistent with other approaches to communicative syllabus design. It is also consistent with views of the notion of genre such as that put forward by Bhatia (1993) who sees communicative purpose as "the most privileged criterion for the identification of genres" (Bhatia 1993, 43). The description of *steps* and *moves* in terms that are comprehensible to non-language specialists is also a strength of Swales' proposal.<sup>22</sup> Swales' position that a genre-based approach to language programme development allows for the illustration of form-function correlations is, however, a more contentious argument in support of a genre-based approach to language programme development. As has been seen above, this is not a position which is universally held by those working within a field closely related to genre analysis, that of English for Specific Purposes. This 'direct correlation position' is one which be closely examined in the study which follows.

Dudley-Evans (1989) expands on Swales' arguments by adding that:

- (i) A genre-based approach to language programme development enables programme developers to "group together certain texts which have important similarities in terms of rhetorical purpose, form and audience" (Dudley-Evans 1989, 72);

- (ii) A genre-based approach to language programme development enables programme developers to "show how these texts are distinct from other texts; how they differ between themselves and how they differ from other text types" (Dudley-Evans 1989, 72);
- (iii) A genre-based approach to language programme development enables programme developers to "provide information about the rhetorical structure and linguistic form of different types of text that is of pedagogic value" (Dudley-Evans 1989, 72).

These arguments will also be closely considered in the study which follows as the relationship between genre and language is examined in a number of 'special purpose' written texts.

To summarise, a genre-based approach to language programme development incorporates insights into discourse level features of language use which are often ignored in language programmes based on lower level organisational units of language such as structures, functions or vocabulary. It, furthermore, for Swales, "gives the curriculum designer a manageable and meaningful framework within which to operate" (Swales 1986, 20).

Proponents of a genre-based approach to writing working within a systemic functional framework, whilst sharing the views of Swales and Dudley-Evans, add that empowering learners through intervening in the process of writing and making explicit the way in which writers make their meanings gives learners access to the "hidden curriculum" (Christie 1989b) of education and power.<sup>23</sup> A genre-based

approach to writing, thus, may aim to give learners "guidance in the acquisition of those genres which are crucial to educational discourse" (Kelly 1989, 84).

As convincing as these final arguments might seem, it is interesting to note that Bizzell (1992), with her life-time experience of teaching composition in Colleges and Universities in the United States, states that these are notions she has always been uncomfortable with and has never fully resolved for herself. Her interim conclusion, however, is that social change and empowerment might not come "through preparing previously marginalised students to speak with powerful voices against the mainstream" (Bizzell 1992, 9), but by using "rhetorical power to effect democratic political change" (Bizzell 1992, 30). Cope and Kalantzis, equally, have difficulty with the notion of the handing down of the 'discourses of power'. They describe this as "middle class conceit [which] assumes that the discourses of power are intrinsically more worthwhile than other discourses" (Cope and Kalantzis 1993, 17).

In a proposal for a genre-based approach to writing assessment, Macken (1989), whilst not a linguist herself, but having been strongly influenced by work such as that of Christie, Rothery and Martin, presents as the systemic position that:

- (i) A genre-based approach to writing assessment "specifies linguistic criteria which allow teachers to analyse student texts in context, ie. in relation to both the larger social purposes and to the specific task requirements of different subjects" (Macken 1989, 5.1);

- (ii) The linguistic criteria "allow teachers to analyse student achievement along different dimensions related to the context of the writing and to acknowledge both the achievements and the inadequacies of the writing in relation to different dimensions of the context." (Macken 1989, 5.1);
- (iii) The criteria "allow for teachers to discriminate between writing which is appropriate to learning in one subject and less appropriate in another" (Macken 1989, 5.1);
- (iv) The criteria "can be used to reveal a generalised writing proficiency amongst students" (Macken 1989, 5.1);
- (v) The criteria can be used to set writing goals and "can inform students' perceptions about what a writing task involves before they begin to write as well as afterwards" (Macken 1989, 5.1).

Again, these are statements which still need to be tested. In particular, the assumption that a direct correlation *can* be found between genre and language needs verification.

Inclusive in both the systemic argument and those put forward by Swales and Dudley-Evans, is the assumption that there is a one-to-one (or one to many) relationship between language form and rhetorical organisation and that the language of texts "can be related in a systematic way to context" (Macken et al 1989, 14) and that a deterministic relationship exists between genre and language, or between genre and language mediated by register.<sup>24</sup> An example of

this can be found in Macken et al (1989) who claim that both genre and register "determine the kind of language used to create a text" (Macken et al 1989, 5).

This is, perhaps, surprising when one considers that linguists such as Coulthard and Brown and Yule have argued that:

... the structure [of a text] ... cannot be expressed in *grammatical* terms; ... the linguistic *form* ... is almost irrelevant (original emphasis) (Coulthard 1977, 7)

and that:

... analysis of the *interaction* [of a text] can be made without taking account of language employed by the speakers (Brown and Yule 1983, 228).

As Candlin has stated, in describing this "lack of fit between grammar and discourse" (Coulthard 1985, 129):

... it is part of the essential ambiguity of language as communication that there is no one-to-one relationship between [language] function and form (Candlin 1981, 24).

This is an issue which will be closely examined in this study as an attempt is made to examine the relationship between language use and rhetorical organisation in a number of 'specific purpose texts'.

## 1.6 Purpose of the study

English has now largely replaced many other regional lingua francas as the medium of international communication in a number of areas, including science and technology (Maher 1986). It now clearly holds the position of the international language of research, not only in a receptive sense, but also in a productive sense (Swales 1985). Studies carried out by Baldauf and Jernudd, for example, have shown that, in some disciplines, the dominance of English may be at a level of as high as 85% of all published research reports (Baldauf and Jernudd 1983a, 1983b). The research report, thus, has become "the standard product of the knowledge-manufacturing industry" (Swales, 1987, 42).

It is a well attested fact, however, that neither academics nor students find it easy to write up their research in an acceptable form (Swales 1987, James 1984, Dudley-Evans 1988). A description of the textual organisation of the genre, with a focus on the language of the texts in relation to the meanings that are made in the texts, would, therefore, greatly benefit both students and academics and especially those for whom English is not a first language. Furthermore, making clear "the ways in which patterns of language work for the shaping of meanings" empowers both writers and writing instructors (Christie 1989b, 45) and would help prepare both students and academics to present themselves better to those "editorial gatekeepers" (Swales and Najjar, 1987, 187) who stand between them, their writing, and the publication of their research, and, thereby, membership of the *discourse community* (Swales, 1990) of international academic research.

The aim of the research described here was initially to provide a theoretical framework, as well as a source of language data for the development of language learning programmes which focus on the various levels of language and meaning for the genre of research reports. The framework, importantly, was to be derived from an analysis of actual language behaviour and would, therefore, be *data driven* rather than *intuition driven*; that is, it would be based on an analysis of what actually happens in texts as opposed to what some materials writers think, perhaps, happens. The data, furthermore, would be based on sets of *a posteriori* categories, that is, based on empirical investigation and observation rather than on pre-defined *a priori* categories (Swales 1990).

A further aim of the research was to examine the concept of genre within the context of English for Specific Purposes and, on the basis of the findings revealed in the study, to re-define the term in a way which reflects what it is that leads us to recognise communication events as examples of particular genres.

The two initial aims outlined above have, during the conduct of the research, merged and, from this merger, a new focus has been created and a new perspective has resulted. It would, of course, be useful to be able to provide language teachers with specific findings which point to specific approaches to the teaching of the writing of research reports. It appears, however, that they may be better served by an invitation to caution. What has emerged from this research is a reinforcement of the findings of Russian Formalists and literary structuralists - that is, the distance between prototype and stereotypical listings and actual textual configurations may be vast. It may, in fact, be misleading to

provide students with 'typical frameworks' unless they are so general as to be, in reality, of little real use. What must precede educational application, is further detailed research into (a) the prototype itself and (b) the interactional characteristics (in both linguistic and non-linguistic terms) which *may* be generally present in relation to that prototype. It is the exploration of these characteristics which will be the aim of this research.

### 1.7 Design of the study

The study was carried out in two stages. The selection of texts used for the study was also made in two stages. The first stage of the study employed a systemic functional perspective to examine a selected number of research reports and the second stage of the study employed a framework based on Fillmore's model of frame semantics to analyse the same selection of texts plus a further three exemplars of the genre. The purpose of the second stage of the study was to test the findings of the first stage as well as to submit the texts analysed in first stage of the study to a contrasting analytic perspective. Details of the method of selection of texts are provided below and in the relevant chapters which follow.

#### 1.7.1 Selection of Texts

In order to relate the findings of the analyses as closely as possible to the needs of second language learners, an attempt was made to identify key disciplines in which non-native speaker students were presently engaged in research at Macquarie University, in Sydney, where the research was begun. Enquiries to schools within the University

revealed that the largest numbers of international students engaged in research were in the area of Environmental Studies. This area was thus chosen as the focal area for the investigation. Individual texts were then chosen from related subject areas within this particular field. The number of texts chosen was such as to ensure both range and depth of analysis. Texts selected for analysis were, in the initial stage of the study, limited to twelve representations of the genre, drawn from the three different topic areas within the particular discipline.

In the second stage of the study, a further three texts were added to the analysis to test the findings of the initial stage of the study. These three extra texts came from the area of biochemical research and were on a single topic (DNA). Two of these texts were used in the investigation carried out by Hunston.<sup>25</sup>

The choice of journals from which to seek the specialist texts was made on the basis of specialist informants' recommendations as well as Garfield's ranking of journals in the Journal Citation Reports of the Science Citation Index (SCI).<sup>26</sup> This criterion was used by Crookes in his scientific text structure validation study (Crookes 1985, 1986). This method involves working down Garfield's ranked listing of journals based on the number of times a journal has been cited in a particular period. Thus, "it is possible to determine the importance of a particular journal in terms of its likelihood of being encountered by anyone reading or doing research in a given area" (Crookes, 1986, 62).

Both avenues were explored in order to find the required number of what Swales calls *prototypical exemplars* of the genre rather than

what may be highly valued, but in some way idiosyncratic, examples (Swales 1990). Reference to Garfield's rankings was also used to minimise the effect created by relying too heavily, or indeed, solely, on subject specialist informants' recommendations, where subjective features such as personality, allegiance or status, may influence recommendations (Swales, 1990).

Finally, a decision was taken to base the study on an analysis of the Introduction sections of the articles only as it is generally agreed that this is the section of research reports that students and academics find most difficult to write (Swales, 1981, 1983). The criterion used for establishing which part of the text forms the 'Introduction' was that section of the text which follows the Abstract (or Summary) and continues up to the section labelled Materials and Methods. Sometimes, the commencement of this section was marked by the heading 'Introduction'.

The Introduction sections to the texts were also chosen because they represent the section of research reports where most research has already been carried out (see Table 2). They would, thus, also provide the highest level of opportunity for the comparison of analyses.

### 1.7.2 Analysis of the texts

It became necessary at a very early stage to decide on the focus of the analyses and on the particular aspects of language to investigate.

It was, thus, decided not to analyse every language item from every possible linguistic point of view. Indeed, the length of the texts precluded such an analysis. This problem is raised by Hasan who

points out that the presentation of such a complete linguistic analysis becomes problematic in longer texts, the simple demand on time and space being a deterrent (Hasan 1989b).

Selective analysis is also supported by Halliday who states that:

The guiding principle is to select and develop what is needed for the particular purpose in hand. There are many different purposes for analysing a text, and the scope and direction of the analysis will vary accordingly. Often we may want to scrutinise only one or two features, but to follow them through to a considerable depth (Halliday 1985b, 54).

It was, therefore, decided to look at those aspects of the texts which would demonstrate the maximum information relevant to the purpose of the investigation being carried out. For the initial stage of the investigation, it was decided to examine the language and meanings of the texts as they relate to the discourse structures of the texts.<sup>27</sup> That is, the decision was made to investigate the relationship between *lexico-grammatical* patterning (Halliday 1985a) and the structural organisation of the texts, via the mediating role of *semantic attributes* (Hasan 1989b),<sup>28</sup> as well as to present a *generic structure potential* (Hasan 1989a) for the genre as a whole.<sup>29</sup> The second stage of the study examines the structural organisation of the texts from *social psychological* and *semantico-pragmatic* perspectives.<sup>30</sup>

## 1.8 Summary

This chapter has presented the background to the study which will be described in the chapters which follow. It has examined the concepts of genre and English for Specific Purposes as well as described and provided examples of a number of approaches to genre analysis. It has also provided arguments in support of the concept of genre as an organising principle for language programme development. It has, however, suggested that there may be weaknesses in some of the claims that have been made in this regard and, in particular, the claim that there is a direct correlation between genre and language, or between genre and language, mediated by register. Finally, it has outlined the purpose and design of the study, including a brief discussion of the process of selection and analysis of the texts used.

The chapter which follows will present the theoretical framework for the initial stage of the study. This framework will then be applied in the analysis to be described in Chapter 3. This initial stage of the study investigates the relationship between meanings, wordings and rhetorical function in twelve 'specific purpose' written texts.

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## NOTES

- <sup>1</sup> See, for example, Drury & Gollin (1986), Hammond (1987), Christie (1989a, 1989b, 1989c), Martin (1989), Macken (1989), Jones, Gollin, Drury and Economou (1989), Derewianka (1990), Carter (1990), Language in the National Curriculum: Materials for Professional Development (1991), Drury & Webb (1991).

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- 2 See, for example, Swales (1981, 1984, 1987, 1990), Hopkins and Dudley Evans (1988), Crookes (1985, 1986), Dudley Evans (1986, 1989).
  - 3 See Chapter 2 for a detailed discussion of systemic functional linguistics.
  - 4 See Chapter 4 for a detailed discussion of Fillmore's model.
  - 5 See Bennett (1979), Erlich (1965), Wales (1989).
  - 6 For further discussion on the work of the Russian Formalists and the structuralist movement, see Ehrmann (1970), Hawkes (1977), Sturrock (1979). For further discussion on the post-structuralist movement see Culler (1983), Harrari (1980), Lentricchia (1980).
  - 7 See Hasan (1978, 1989a, in press), Ventola (1984).
  - 8 See, for example, Martin (1984), Drury and Webb (1991).
  - 9 See Chapters 4, 5, 6 and 7.
  - 10 See Dudley Evans (1986), Maher (1981) Weissberg and Buker (1990), Murison and Webb (1991) and Nwogu (1991).
  - 11 See, for example, Couture (1986a).
  - 12 The term 'schematic structure' is used in systemic analyses to refer to the "beginning, middle and end structure of texts" (Martin 1989, 86), represented, for example, in expository texts as 'Introduction', 'Body' and 'Conclusion'.
  - 13 The term 'generic structure' is taken by those working within a systemic functional framework to be synonymous with 'schematic structure'.
  - 14 The term 'generic structure potential' refers to the "total range of textual structures available within a genre" (Hasan 1984, 79). The notion of generic structure potential is elaborated on in Chapter 2 and applied in the analysis described in Chapter 3.

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- 15 'Semantic attributes' refers to the *meanings* that are made in texts, as opposed to the *wording* of the texts (Hasan 1989b). This notion is further elaborated on in Chapter 2 and applied in the analysis described in Chapter 3.
  - 16 See Chapter 2, section 2.8, also Halliday (1985), Butt (1990).
  - 17 See Chapter 2, section 2.5, also Halliday and Hasan (1976), Halliday (1985a) for definitions of these terms.
  - 18 For the model on which these analyses are based see Sinclair and Coulthard (1975). See also Coulthard and Montgomery (1981) and Sinclair and Brazil (1982) for extensions and modifications to this model.
  - 19 'Theme', in systemic functional terms, refers to the elements of a clause which a language user selects as the point of departure for the message. For Halliday, the Theme of a message continues up to and including the first *ideational* (see Chapter 2, section 2.8) element in the clause (Halliday 1985).
  - 20 Christie uses the term 'curriculum genre' to refer to "any teaching/learning episode which may be said to be structured and staged" (Christie 1985, 2).
  - 21 See McCarthy and Carter (1994) for a fuller discussion of the relationship between a discourse-based approach to syllabus design and 'communicative' syllabus design.
  - 22 See Swales (1990) for numerous examples of this.
  - 23 See Martin (1986b), Christie (1989b), Kress (1986).
  - 24 See Chapter 2 section 2.2 below for an elaboration of the notion of register in systemic functional genre studies.
  - 25 Hunston (1989).
  - 26 See, for example, Garfield (1989).

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- 27 See Chapter 3, section 3.3 for a more detailed discussion of the analysis of the texts in the first stage of the study.
- 28 See Chapter 2 section 2.4 below.
- 29 See Chapter 2, section 2.6 for a discussion of the notion of *generic structure potential*.
- 30 See Chapter 4 for detailed explanation of these terms.

## CHAPTER TWO

### WORKING WITH GENRE: A SOCIAL-SEMIOTIC PERSPECTIVE

#### 2.1 Introduction

This chapter presents the theoretical framework for the initial stage of the study. First, it examines the notion of language as social-semiotic within the context of systemic functional linguistics. It then examines approaches to text analysis within a systemic functional model. The chapter then details theoretical notions which are central to a systemic functional approach to genre analysis and, in particular, those of generic structure potential, semantic attributes, and lexico-grammatical patterning including transitivity structure, nominal, verbal and adverbial group structure and logico-semantic relations. This chapter, then, provides the theoretical basis for the chapter which will follow in which a number of 'specific purpose' written texts will be examined employing the framework presented here.

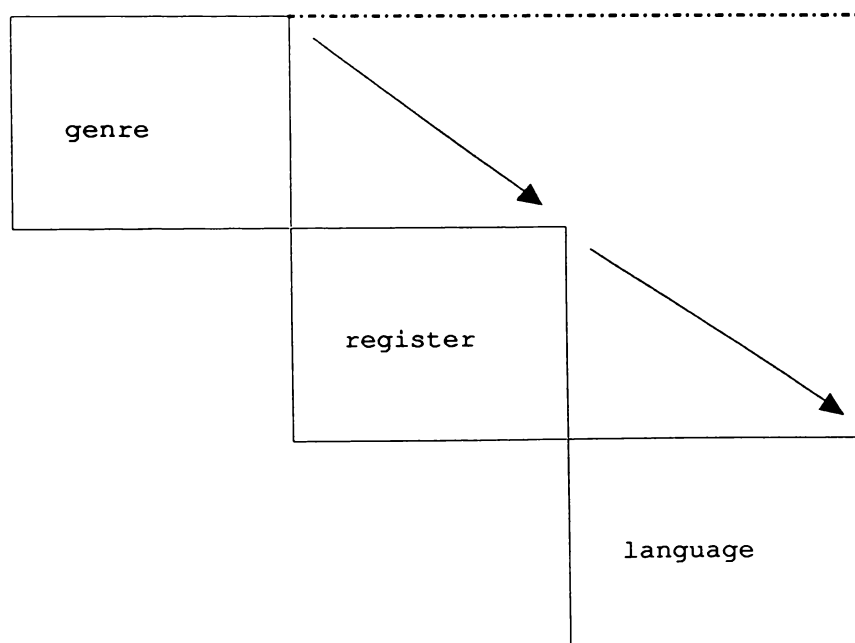
#### 2.2 Language as social-semiotic

The notion of language as social-semiotic is discussed at length by Halliday and Ventola.<sup>1</sup> Halliday defines the term *social-semiotic* as "referring to the definition of a social system, or a culture, as a system of meanings" (Halliday 1989a, 4). Ventola elaborates on this definition by defining social-semiotic as "referring to the total meaning potential we have as members of a society" (Ventola 1985, 275).

Halliday's theory of language as social-semiotic derives from the semantic theories of Firth, Malinowski's theories about the relationship between language and context, the work of Saussure and others (Crystal 1981, Halliday and Hasan 1989, Butt 1990).<sup>2</sup> In its development, the suggestion has been added that "typical social situations or contexts (the semiotic organisation of our social system) may be systematically correlated with the linguistic system" (Ventola 1985, 275); that is, typical meaning choices are selected from the linguistic system on the basis of particular semiotic or contextual variables in a particular situation. The variables which make up this *contextual configuration* (Hasan 1989a), or *register* (Halliday 1973) are those of 'field' (the experiential content and nature of the social activity), 'tenor' (the relationship between participants in the particular social activity) and 'mode' (the role of language in the communication and the medium and channel of communication) (Hasan 1989a). A contextual configuration, thus, represents a configuration of each of the values of field, tenor and mode in a particular communicative context. Halliday, further, argues that each of these contextual, or semiotic, variables has a direct correlation with the semantic and lexico-grammatical systems of a language (see Figure 4). That is, the social functions of language within a systemic functional framework "determine the pattern of language variation, or 'registers' " (Halliday 1973, 22).

The relationship between genre and language in a social-semiotic perspective is described by Ventola who, drawing from the work of Halliday (eg 1979) and Martin (1984), presents the connection between genre, register and language as being in a " 'content-expression' type

of relationship with one another" (Ventola 1985, 277); that is, the planes of register and language are each seen as being the realisation of the higher level planes of genre and register, respectively (Martin 1984). Thus, for systemic functional linguists, it is the levels of genre and register that "are responsible for the distinctive patterns of meanings found in texts " (Rothery 1989b, 220). This relationship, together with the concept of realisation (represented by downward-facing arrows), is illustrated by Martin (1984) thus:



*Figure 1. The relationship between genre, register and language in a social-semiotic perspective (Martin 1984, 25)*

The notion of genre is seen in the majority of systemic genre studies to represent the 'context of culture', whilst register is seen to represent the 'context of situation'.<sup>3</sup> This is expressed by Macken et al (1989) who claim that:

Both the context of culture (via genre) and the context of situation (via register) determine the kind of language used to create a text (Macken et al 1989, 5).

Martin now differs, however, from some other systemicists, in that he does not, at least in his more recent work, support the concept of realisation as being deterministic, in a 'top-down' sense, stating that such interpretations of the concept of realisation are misreadings. As he states:

Saying that language realises register means both that language determines register and register determines language; unfortunately it is not possible in English to say both things at once (Martin 1991, 146).

Genre and register are, thus, within a social-semiotic perspective, generally seen as being on different planes, each having its own separate (though inter-related) identity (see Figure 1).<sup>4</sup> For Halliday and Hasan, however, the terms 'genre' and 'register' are seen as being synonymous and interchangeable (Halliday and Hasan 1989).<sup>5</sup> They, as a consequence, "see no need to create two different communication planes or levels for analysis as Martin (1985) and others now argue [they] do" (Christie 1991, 80). Christie supports the position held by Martin (and others) in arguing that the distinction between genre and register enables her "to draw attention to the simultaneous sets of choices people must make in using language when they go about creating a text" (Christie 1991, 80). These choices relate to the schematic structure of the text (for the genre as a whole) and the language of the text (as the realisation of the particular register) (Christie 1991).

The majority of systemically-oriented genre analysts agree, however, notwithstanding differences of detail, that language represents the

realisation of the contextual configuration of field, tenor and mode, and, in turn, genre. This position is not dissimilar from that adopted by those working within English for Specific Purposes at a time when it was based on register theory and analysis. There are, however, problems associated with this approach. In her most recent work on ESP, Robinson, for example, observes that to identify and describe a specific 'register' is often to see it in terms of a discrete set of linguistic choices that is somehow or other "seen as being quite separate from the rest of the language" (Robinson 1991, 20). At its most extreme, we then begin to talk about 'the language of science' (Robinson 1991) and 'the language of newspaper reporting' etc (Couture 1986a) as if specific *contexts* of language use bring with them specific *selections* of language use.

### 2.3 Systemic functional linguistics

Systemic functional linguistics was originally formulated by M.A.K. Halliday and was "built on the work of Saussure, Malinowski and Firth, Hjelmslev, the Prague school, and the American anthropological linguists Boas, Sapir and Whorf, the main inspiration being J.R. Firth" (Halliday 1985b, 30).<sup>6</sup> It is generally described in the literature as a social-semiotic theory of language,<sup>7</sup> the implication being that the starting point and focus is socio-cultural universals and specifics rather than cognitive categories and constraints. This is not to say that cognitive modelling is ignored. The emphasis is, however, clearly different from approaches such as those outlined in Chapter 4 - in which the focus is cognitive rather than social-semiotic. It is also quite different from approaches such as those adopted by a number of theorists who might generally be described as post-structuralist and

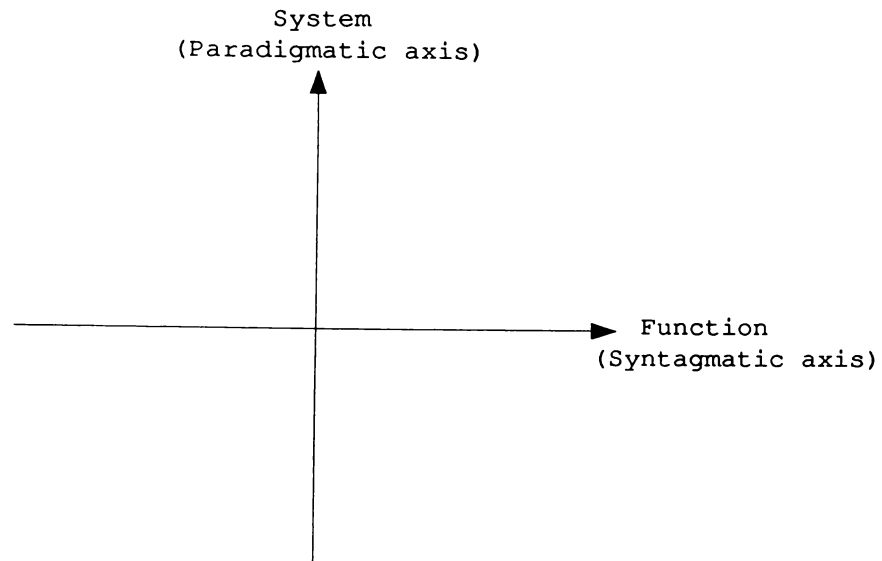
who emphasise not so much the potential to *create* meaning in the construction of text, as the potential to interact with text in the creation of meanings.<sup>8</sup> For these analysts, meaning *is* socially conditioned. It is, however, more fluid in that it is not so much in the text as in the interaction between text and reader or hearer - the context being wider than that inhabited by, or that could be predicted by, the speaker or writer.

A systemic functional theory of language was chosen as the theoretical framework for the first stage of the study because of its semantic orientation towards grammar and discourse as well as its focus on language in use (Martin 1986a); that is, because of its focus on the *functions* of language in real-life contexts. Systemic functional linguistics considers language primarily as a resource for making meaning and not as a set of rules. The theory is, thus, predominantly functional rather than formal.<sup>9</sup>

An essential component of the theory is that "each time language is used, no matter in what situation, the user is making constant choices" (Richards et al 1985, 286).<sup>10</sup> Systemic functional grammar, thus, aims to account for "the nature of the linguistic system available to the native speaker of a language and for the selection of options which a person makes when using the language" (Morley 1985, v). These options, furthermore, according to the theory, are "selected not from the syntax but from the semantics of the grammar and thus represent the choices of meaning which the speaker/writer is expressing" (Morley, 1985, v).

The systemic component of systemic functional grammar derives from the fact that the grammar describes language as being "made up of systems, each having a set of features which are in contrast with one another" (Morley 1985, 42). Furthermore, it "interprets language as being a system network of meaning *potential* " (Morley 1985, 42). The functional dimension of the grammar aims to describe what the language is doing in the particular context (Butt 1990); that is, the role it is playing in the particular social activity in which it is embedded. Thus, systemic functional grammar accounts not only for paradigmatic relations of system, but also for syntagmatic relations of structure and sequence (Morley 1985). In systemic functional grammar, the system, or paradigmatic choice is taken as the primary semantic dimension, with structure as the 'realisation' of choice. Functional choices are, thus, frequently presented as having implications for formal choices. The output of a systemic choice, thus, is a structural 'realisation', with structure being a configuration of functional constituents, which, in turn, are realised by formal items. In this way, form (in the sense of structure) is linked to function. Figure 2 (adapted from Butt 1990, 7) illustrates these two axes of system and function.

Examples of choices that are available to users of English at the level of system are the expression of finiteness, polarity and voice in verbal groups where choices are made from either finite or non-finite, positive or negative, or active or passive, respectively (Halliday 1976a). Once again, it should be observed that meaning-driven though the approach is, there are ever-present implications for choice from formal systems.



*Figure 2: Paradigmatic and syntagmatic axes of system and function (Butt 1990)*

There are, furthermore, closed sets within a language where the number of possibilities for choice are finite and open sets, such as in the case of most vocabulary, where the range of choices are more open (Halliday 1961). The final choice a language user will make at the level of system, however, will always be one and only one, from the number of choices available in the language (Halliday 1976b). The *generic structure potential*<sup>11</sup> for a particular genre is an example of *combination* (Butt 1990) at the level of function where a number of options will be available, from which language users will choose, and then combine, for the rhetorical purposes of the particular text. Choice, therefore, as it relates to genre, is necessarily combinatorial.

As well as describing language at the discourse level in functional terms, systemic functional linguistics also describes the clause in functional terms. Labels given to the components of a clause are thus described in terms of what they are doing in the clause in functional, rather than formal terms. For example, the *participants* (typically

realised by a nominal group) in a material (doing) *process* (typically realised by a verbal group) will be described as an 'Actor' and a 'Goal' and *circumstantial elements* (typically realised by adverbial groups and prepositional phrases) in the clause, are described by labels such as 'extent', 'location', or 'manner' etc.

Figure 3 is an example of the *transitivity structure* of a clause analysed in systemic functional terms:<sup>12</sup>

|               |              |               |                 |                      |
|---------------|--------------|---------------|-----------------|----------------------|
| The lion      | chased       | the tourist   | lazily          | through the bush     |
| participant   | process      | participant   | circumstance    | circumstance         |
| Actor         | Material     | Goal          | Manner          | Location             |
| nominal group | verbal group | nominal group | adverbial group | prepositional phrase |

*Figure 3: Transitivity structure of the clause in systemic functional terms: a sample analysis (Halliday 1985a, 102)*

Table 5 summarises Matthiessen's description of the place of systemic functional grammar in relation to other functional and formal theories of language (Matthiessen's 1990). Systemic functional grammar is, for Matthiessen, a theory of language based on the notion of language as resource, rather than language as rule. For Matthiessen, furthermore:

The differences between formal and functional grammars stem from the different set of questions they have been developed to answer (Matthiessen 1990, 41).

*Table 5: Systemic functional grammar and other theories of language  
(Matthiessen 1990)*

| Language as rule                     | Language as resource          |
|--------------------------------------|-------------------------------|
| philosophy                           | ethnography                   |
| logic                                | rhetoric                      |
| formal grammar                       | functional grammar            |
| Formal grammars                      | Functional grammars           |
| Transformational grammar             | Systemic functional grammar   |
| Categorial grammar                   | Prague School work on grammar |
| Government and binding grammar       | Functional grammar            |
| Generalised phrase structure grammar | Tagmemic grammar              |
|                                      | West-Coast functionalism      |

Matthiessen's representation of the relationship between systemic functional grammar and other theories of language is not, however, uncontroversial. His chart, for example, might suggest there is no overlap between one view and another. A closer look at just one of the 'other' theories of language in Matthiessen's chart reveals the difficulty in taking such an absolute position. For example, functional grammar, whilst adopting a pragmatic view of language as social interaction (Crystal 1987) focuses on the rules "which govern verbal interaction ... and on the rules (of syntax, semantics and phonology) which govern the linguistic expressions that are used as instruments of this activity" (Crystal 1991, 146).<sup>13</sup> Syntactic and pragmatic functions (such as case, agreement, order and intonation) in functional

grammar, further, are expressed in terms of sentence rules (Crystal 1991), even though they are described in functional terms.

Categorical views of the relationship between systemic functional grammar and other theories of language (and between functional and formal theories of language in general), such as that provided by Matthiessen, thus, need to be treated with some degree of caution.

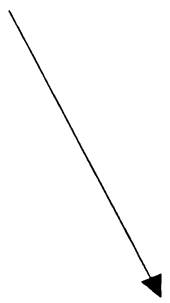
Systemic functional linguistics has been developed to describe, in functional terms, primarily, what language is doing in a particular context through the range of choices and combinations that are available to the language user in that particular context. It is worth noting, still, that functionally-driven grammars inevitably have formal choice as a component and are, thus, in some way, *both* functional and formal descriptions of language.

For Halliday, systemic functional grammar is particularly suitable for the type of investigation being carried out in this study in that it:

... enables us to analyse any passage and relate it to its context in the discourse, and also to the general background of the text: who it is written for, what is its angle on the subject matter and so on (Halliday 1990, 34).

Furthermore, with its focus on the relationship between language, context and text, it aims to provide "a model of language in which the relationship between meaning and wording is treated in a systematic, non-ad hoc manner" (Hasan, 1984b, 98).

This relationship between language and context, as described in systemic terms, is illustrated in Figure 4.

| <b>SITUATION:</b><br>Feature of the context      | (realised by)                                                                     | <b>TEXT:</b><br>Functional component of semantic system      |
|--------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------|
| Field of discourse<br>(what is going on)         |  | Experiential meanings<br>(transitivity, naming, etc.)        |
| Tenor of discourse<br>(who are taking part)      |                                                                                   | Interpersonal meanings<br>(mood, modality, person, etc.)     |
| Mode of discourse<br>(role assigned to language) |                                                                                   | Textual meanings<br>(theme, information, cohesive relations) |

*Figure 4: The relationship between context and text in a systemic functional perspective (Halliday and Hasan 1989c, 28)*

## 2.4 Representations of textual organisation in systemic functional analyses

A number of examples of investigations which look at textual organisation within a systemic functional framework have already been referred to in the previous chapter. Various differing ways of representing these analyses have emerged in the presentation of these analyses. Amongst these are:

- (i) Those that follow Hasan's early analysis of service encounters which Ventola describes as *linear* representations (Hasan 1978, Ventola 1984).<sup>14</sup> These analyses aim to identify obligatory and optional structural elements in texts as well as sequencing and recursion and are laid out in their descriptions in a horizontal fashion across the page (see Figure 6 for an example of a linear representation of textual organisation);

- (ii) Martin's (1985) 'genre network approach' which, by a paradigmatic illustration of choices such as "appointed vs unappointed" and "goods vs information" (in 'service encounters' texts) aims to capture those characteristics in texts which demonstrate *genre agnation*,<sup>15</sup> or, in the words of Ventola, "similarities in texts of a similar kind" (Ventola 1987, 63);
- (iii) The model of analysis employed by Ventola (1987) who concludes that a flow chart representation, rather than Hasan's linear representation, or Martin's genre network approach, better accounts for the dynamic and interactive nature of spoken texts, where the direction in which the text will head may be much less predictable than in written texts;<sup>16</sup> that is, for "the unfolding of [the] text in real time" (Martin 1992, 553);
- (iv) A further approach presented by Martin where the analysis of the *schematic structure* of texts involves the identification of the stages of the texts but where there is no attempt to identify obligatory or optional elements or recursion and with sequencing being left implicit in the way in which the analyses are presented;<sup>17</sup>
- (v) The multi-level approach to the description of discourse structure proposed by Harris for more interactive types of text which would have the ability to account for various, rather than just one, level of textual organisation (Harris 1988).

Hasan's linear representation of textual organisation (see (i) above) was chosen for this stage of the study because of its suitability to the more predictable nature of written texts as well as because of its attention to obligatory and optional textual elements, sequencing and recursion. In her discussion of this framework, Hasan states that "the essential attributes of 'the structurally important units' of any text type will have to be stated in semantic terms" (Hasan 1984a, 83). She then describes three levels of abstraction which she says are necessary for "a model of language description, which can be used for making non-ambiguous statements about the realisation of semantic attributes (of texts) by reference to which the structurally important units of text types can be identified" (Hasan 1984a, 84).

These three levels of abstraction are:

- (i) The *structural elements* of the texts; that is, the discourse-level *organisation* of the texts;
- (ii) The *crucial semantic attributes* of the structural elements of the texts; that is, the *essential meanings* in the texts;
- (iii) The *lexico-grammatical patterns* capable of realising the semantic attributes of the texts; that is, the intra- and inter-clause level organisation of the *language* of the texts.

No examples of investigations into the language of research reports have examined these three levels of analysis as part of the one, single, inter-related investigation.

Hasan (1984a) and (1989a) provide examples of how these three levels of abstraction can be identified and described. The following sections of this chapter and the next chapter discuss this approach to genre analysis in detail. It is this approach to genre analysis that will be employed in the initial stage of the study.

## 2.5 Boundaries of structural elements in texts

The question of how boundaries of structural elements in texts can be determined has not been widely treated in the literature on genre analysis. Ventola, for example, states that "discourse boundaries and frames have received too little attention in discourse studies" (1987, 181) whilst Martin points out that "work on the patterns of interaction between discourse and grammatical structures is only just beginning" (1986a 99).

Hasan has claimed that "the boundaries of a text can normally be determined by reference to patterns of cohesion" (1978, 242); that is, by examination of "the grammatical and/or lexical relationships between the different elements of a text" (Richards, Platt and Platt 1992, 62).

Examples of patterns of cohesion are:

- (i) *Lexical cohesion*, such as lexical items in a text "that are related in some way to those that have gone before" (Halliday 1985, 310). Examples of lexical cohesion are found when items are *repeated*, *synonyms* are presented, or items which *collocate* with other lexical items occur;

- (ii) *Reference*, where the identity of an item "can be retrieved from the text itself" (Ventola 1987, 147) such as "He" in "Once upon a time there was a giant. He was always hungry" (Ventola 1987, 146);
- (iii) *Conjunction*, where items such as "in other words", "however", "meanwhile", and "thus" provide structural indicators of relationships between clauses (Halliday 1985).

Little research, however, has been carried out which demonstrates support for Hasan's position. Ventola (1987), for example, in an attempt to establish the relationship between *conjunction* and *boundary marking* in a number of 'service encounter' texts, found conjunction to be the least indicative of these cohesive relations in terms of boundary marking. This position is also supported by Martin (1986a) who proposes that the *interaction* of lexical cohesion, reference and *theme*<sup>18</sup> and method of development of the text<sup>19</sup> may be the most distinctive in terms of illustrating patterns of interaction between discourse and grammatical structures in written texts. It should be noted, however, that neither Martin, nor anyone else, has yet attempted to carry out the studies which might verify such an approach.

A brief examination of the analyses presented by Ventola in her (1987) study of patterns of lexical cohesion, reference and the generic structures of texts, however, reveals no particular relationship between these cohesive features and the boundaries of generic stages in her texts.<sup>20</sup> An examination of patterns of lexical cohesion and reference in a number of the 'service encounter' texts presented by Hasan (1989a) further confirms this position. This is illustrated in the analysis

presented in Figure 5. As can be seen from this analysis, the lexical chain in Text 1 goes beyond the boundaries of the structural elements identified by Hasan. The reference chain in Text 2 also provides an example of items which go beyond the boundaries of structural elements in the texts. This analysis, as simple as it, clearly shows that, contrary to Hasan's (1978) statement, it is not always possible to determine the boundaries of structural elements in texts by reference to patterns of cohesion such as lexical cohesion or reference.

It would seem, however, from Hasan's more recent writing, that she has become aware of this and, for this reason, now asserts that "an element's criteria might be stated most clearly in terms of some *semantic property*" (emphasis mine) (Hasan 1989a, 68); that is, by reference to the *content* (or, in Hasan's terms, *semantic attributes*) of the structural elements in the text. Thus, as Hasan states, in order to be identified as a "stretch of language capable of realising a specific element of textual structure, [it] must 'have' the semantic property of this or that" (Hasan 1984a, 83). In fact, it is clear from the analysis presented here that Hasan can *only* have defined her structural boundaries in terms of semantic properties, or content, given the lack of boundary indication in linguistic patterning.

Martin, too, seems to demonstrate an awareness of the problems inherent in attempting to define boundaries in terms of structural elements. He writes, in 1986, that staging in written texts:

... tends to be more overtly signalled through devices such as tables of content, titles, subtitles, headings, introductory paragraphs, summary paragraphs, topic sentences in

paragraphs ... metatextual reference to sections, reasons, arguments and the like, and so on (Martin 1986a, 104).

---

Text 1 (Lexical cohesion)

| Structural element | Text                                                    | Lexical chain |
|--------------------|---------------------------------------------------------|---------------|
| SR                 | C: Can I have ten oranges and a kilo of bananas please? |               |
| SC                 | V: Yes, anything else?<br>C: No thanks.                 |               |
| S                  | V: That'll be dollar forty.                             | dollar        |
| P                  | C: Two dollars.                                         | dollars       |
| PC                 | V: Sixty, eighty, two dollars. Thanks you.              | dollars       |

---

Text 2 (Reference)

| Structural element | Text                                      | Reference chain |
|--------------------|-------------------------------------------|-----------------|
| SR                 | C: Can I have half a dozen Granny Smiths? | (Granny Smiths) |
| SE                 | C: Are they local?                        | they            |
|                    | They look very good.                      | They            |
|                    | V: Yes, they are from the Blue Mountains. | they            |
| SC                 | V: Will that be all now?                  | that            |
|                    | C: Yes, thank you.                        |                 |

---

KEY:

|                      |                      |
|----------------------|----------------------|
| C: Customer          | V: Vendor            |
| SR: Sales request    | SC: Sales compliance |
| S: Sale              | P: Purchase          |
| PC: Purchase closure | SE: Sales enquiry    |

---

*Figure 5: Patterns of cohesion and structural elements in texts : a sample analysis (service encounters)*

This position is further reinforced by Martin (1992) where, in a discussion of the relationship between theme and method of development, he points out that once texts reach a certain level of internal complexity in this area "titles, sub-titles, headings and subheadings are commonly deployed to keep track of the composition structure [of the texts]" (Martin 1992, 443)

The division of textual boundaries in the work of Swales is, also, content-based, although, as Crookes (1985) observes, Swales does not always define structural elements clearly, basing his divisions on the use of broad content-based terms such as "Establishing the field" and "Indicating a gap". In a validation study of a number of Swales' analyses, Crookes (1985, 1986) prefers to work with more detailed definitions of stages in the text which raters then refer to for their analyses. These definitions are, however, also content-based and differ from the approach used by Swales only in the amount of detail provided.

Hasan, Swales and Crookes, thus, all draw essentially on categories based on *content* to determine textual boundaries rather than on the way in which the content is expressed *linguistically*. These divisions, furthermore, are often *intuitive*: it is by no means always the case that headings and other textual indicators are found to be present.

Even where there are structural divisions, they may, as Hunston notes, be *fuzzy edged*. She observes that:

... some boundaries between units remain indeterminate, either because of poor writing, or because the writer deliberately

obscures boundaries in order to make the prose more 'flowing' (Hunston 1989, 333).

Thus, apart from physical indicators of boundaries, such as gaps on pages, paragraph divisions and chapters, indicators of boundaries are most clearly seen in terms of content; that is it is a *cognitive* rather than *linguistic* sense that guides our perception of textual division. It is interesting, in this context, to observe that Fodor (1980) takes the position that when one is dealing with linguistic matters, the theory of meaning must be taken from the linguistic elements in the text and, then, made consistent with the world. Whereas when one is dealing with non-linguistic matters such as textual divisions, it is our understanding of the world which conditions our perception of boundaries. In Leech's view, any attempt to treat such matters in linguistic terms is, an example of *over-grammaticalisation*. Indeed, for Leech, what many systemicists have done in the area of genre analysis is try to extend their model beyond the point at which it can actually be applied in trying to seek a grammatical explanation of textual aspects of language which more properly belong within the realm of pragmatics (Leech 1980, 1983). My conclusion is that the search for structural divisions in texts should be seen as a search for *cognitive* boundaries in terms of *convention*, *appropriacy* and *content* rather than as a search for linguistically defined boundaries.

This conclusion is also supported by Widdowson who provides the following much cited example:

- A: That's the telephone.
- B: I'm in the bath.
- A: O.K.

(Widdowson 1978, 29)

Brown and Yule, in discussing this example, make it clear "that it is only by recognising the action performed by each of these utterances" that we can determine the coherence and structure of the interaction (Brown and Yule 1983, 228).

Finally, the questions of validity and replicability of such analyses needs to be addressed. Hasan's position is, simply, "if you replicated my analysis, you would be able to check on its validity" (Hasan 1989b, 66). Hasan is, however, clearly referring to those parts of any analysis which are structurally-based and are, therefore, structurally replicable. Attempts at employing linguistic criteria to the validation of psychological perspectives are not, however, a *necessary* condition for the maintenance of functional approaches to language description and should not be seen as a threat to the central claims made by exponents of such approaches.

In the words of Fodor:

If linguistics is an empirical science, linguistic claims should be testable against empirical data. ... Putting a psychological interpretation on a linguistic theory increases the range of empirical facts about which claims can be made, and thus gives substance to the question of whether or not it is a true theory (Fodor 1980: 103-104).

Thus, with certain aspects of language, such as the analysis of group and clause structures, one looks for replicability through a tight description that links into language. In the area of genre, however, one has moved into the realm of psychological reality which is conditioned by the way we think of things in the world and the issue of replicability

must be looked at in wholly different terms. The issue of boundaries is not one that is linguistically constrained and cannot, therefore, operate in the realm of rules or conventions of the same kind.

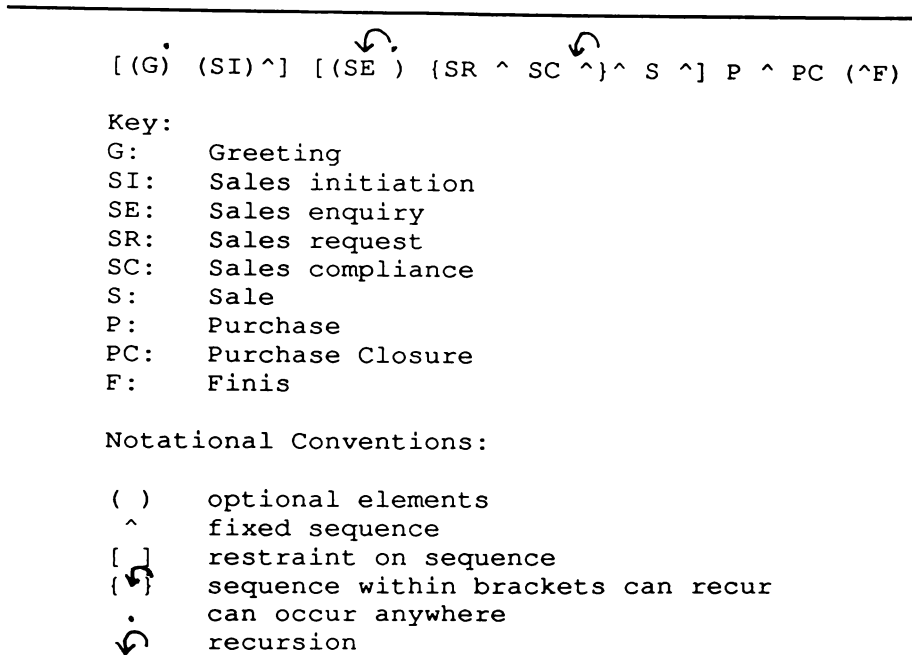
## 2.6 Generic structure potential

Hasan describes the *generic structure potential* of a particular genre as "a statement of the structural resources available within a given genre" (Hasan 1984a, 79). It is, thus, an abstract category and is "descriptive of the total range of textual structures available within a genre" (Hasan, 1984a, 79). To be capable of this, a model of the generic structure potential must specify those elements whose presence appears *obligatory* to the particular genre, and those elements which appear *optional* for the particular genre, as well as the ordering of the elements in relation to each other, including the possibility of recursion (Hasan 1984a). The analysis should, thus, demonstrate:

1. *What* elements *must* occur;
2. *What* elements *can* occur;
3. *Where* elements *must* occur;
4. *Where* elements *can* occur;
5. *How often* elements *can* occur.

The presentation of the generic structure potential for a genre, thus, needs to represent these particular features in its description. Such a presentation would, however, be essentially problematic in its implication that a text *must* be arranged in a certain way to be classified as an instance of a particular genre.<sup>21</sup>

The example of a generic structure potential for service encounters shown in Figure 6 illustrates Hasan's notational conventions which aim to convey the above characteristics.



*Figure 6: Generic structure potential: a sample analysis (service encounters) (Hasan 1989a, 64)*

Thus, according to Hasan's analysis, the elements Greeting and Sales Initiation are optional. If they both occur, the element Greeting may precede Sales Initiation, or it may follow it. Neither Greeting nor Sales Initiation can follow the elements to the right of Sales Initiation. The element Sales Enquiry may recur. It is, however, optional. It also may occur anywhere, as long as it does not precede Greeting or Sales Initiation and it does not follow Purchase, Purchase Closure or Finis. Sales Request and Sales Compliance must both occur. The combination of Sales Request followed by Sales Compliance can also recur. Sale, Purchase and Purchase Closure must also occur. Purchase must

follow Sale, and Purchase Closure must follow Purchase. Finis is optional but when it does occur, it must follow Purchase Competition.

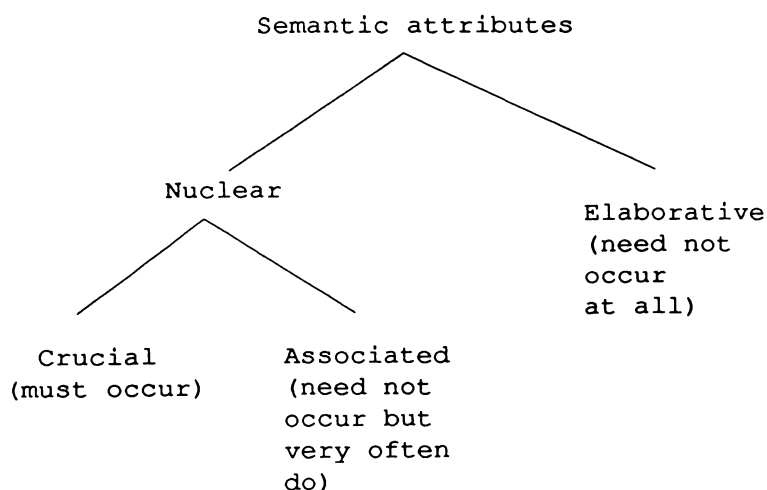
From looking at this analysis, it is not difficult to see why Ventola (1984) finds Hasan's representation of a generic structure potential for service encounters unsatisfactory: one only needs to consider that a person may very well decide not to make a purchase (not accounted for in Hasan's analysis) or indeed, may at any stage, decide to abandon the interaction altogether (also not accounted for in Hasan's analysis). It should also be pointed out that Hasan's analysis does not account for non-verbal representations of structural elements in texts, a point also made by Ventola (1983, 1985). Representations such as Hasan's (and, indeed, all systemic attempts at the representation of textual structures), equally, ignore the issue of *implicature*<sup>22</sup>; that is, instances where a structural element may not be explicitly represented but may be recovered by *interpretation* of the text in context.

## 2.7 Semantic attributes

Hasan describes two main types of semantic attribute which can be identified for describing the "essential attributes of the 'structurally important units' of any text type" (Hasan 1984a, 83). These are *nuclear* and *elaborative* semantic attributes (or as she, on occasion, calls them, semantic *properties*). The difference between these two attributes is that "at least some selection from among the nuclear properties is essential to the movement [of a text], while [a text] can progress without any selection from the elaborative properties" (Hasan 1984a, 88). Nuclear attributes, furthermore, can be divided into two categories, *crucial* and *associated* attributes. The difference between crucial and

associated attributes is that crucial attributes have to be present in a structural element whereas associated attributes "do not have to be present, but often are" (Hasan 1984a, 85). Nuclear semantic attributes, thus, *always occur* in a particular section of a text, associated attributes *need not occur but very often do* and elaborative attributes *need not occur at all*. The difference between each of these types of attribute is summarised in Figure 7.

Few analyses of texts working with a systemic functional theory of language have attempted to identify the semantic attributes of structural elements in texts. Hasan's (1989a) analysis of service encounters, however, provides a general description of the nuclear



*Figure 7: Types of semantic attribute (Hasan 1984a)*

semantic attributes of the elements 'Sales Request' and 'Sales Enquiry'. This analysis is summarised in Figure 8.

| Structural elements | Nuclear semantic attributes                                                  | Sample realisations                                         |
|---------------------|------------------------------------------------------------------------------|-------------------------------------------------------------|
| Sales request       | Demand<br>Reference to goods<br>Quantity of goods                            | "I'll have ten oranges and a kilo of bananas please."       |
| Sales enquiry       | Reference to the same general domain in which the participants are operating | "I wanted some strawberries but they don't look very nice." |

*Figure 8: Nuclear semantic attributes of the structural elements Sales Request and Sales Enquiry: service encounters ( based on Hasan 1989a)*

Elaborative semantic attributes are not discussed in Hasan's account of service encounter texts. An examination of these texts, however, reveals the reason for this: all the examples of Sales Request she cites contain *only* those (nuclear) semantic attributes she has previously identified. Even so, it is true that the element Sales Enquiry is different from the element Sales Request. In this element, different semantic attributes occur in different examples of the texts. Hasan defines these semantic attributes as elaborative (that is, optional) semantic attributes as they only occur in some, rather than all, of the texts. Figure 9 summarises this:

| Structural element | Elaborative semantic attributes                                                    | Sample realisations                                                |
|--------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| Sales enquiry      | Reference to the quality of the goods.<br><br>Reference to the origin of the goods | "these don't look very ripe"<br><br>"Where are these apples from?" |

*Figure 9: Elaborative semantic attributes of the structural element Sales Request: service encounters (based on Hasan 1989a)*

A more detailed analysis of the semantic attributes of structural elements in texts can be found in Hasan's description of the element 'placement' (eg "Once upon a time") in the nursery tale (Hasan 1984a). Here Hasan examines both nuclear and elaborative attributes of the structural element, including crucial and associated meanings, as well as analysing their lexico-grammatical encodings in detail. Tan's (1987) analysis of travel guide introductions and Samraj's (1989) analysis of the curriculum genre 'picture talk' are two further examples of analyses which aim to identify the semantic properties of structural elements in texts.

## 2.8 Lexico-grammatical patterns

The clause within a systemic functional framework is divided into three simultaneous strands of structural organisation, each of which realise/encode a simultaneous strand of meaning. Each of these structural strands realises, or encodes, a particular feature of the contextual configuration of field, tenor and mode. This relationship is shown in Figure 4. In systemic functional terms:

- (i) The *transitivity* system encodes the *experiential* content of the text; that is, "the different types of process that are recognized in the language, and the structures by which they are expressed" (Halliday 1985a, 101). For Halliday, a process consists of three components: the *process* itself, *participants* in the process and *circumstances* associated with the process. (Halliday 1985a);
- (ii) The *mood* system encodes the *interpersonal* meanings of the text. That is, it "refers to a set of related options which ... define

the relations between speaker and interlocutors in a linguistic situation" (Halliday 1969, 256). Included here would be, for example, *indicative, imperative, declarative* and *interrogative* constructions and *modality* etc (Halliday 1985a);

- (iii) *Theme* encodes the *textual* meanings in a text. It is "the element which serves as the point of departure of the message" (Halliday 1985a, 38). For Halliday, theme continues up to and including the first *experiential* component in the clause. The remainder of the clause is called the *Rheme* (Halliday 1985a).

A detailed analysis of the functional components of the semantic system within a systemic functional framework is provided in Table 6. This chart is provided to illustrate the relationship between those aspects of the clause chosen for analysis in this study (the ideational component) and other aspects of the clause.

*Table 6: Functional components of the semantic system within a systemic functional framework (Halliday 1978, 132)*

| IDEATIONAL                                   |                                               | INTERPERSONAL                                                            | TEXTUAL                                             |                                                                                                      |                                                         |
|----------------------------------------------|-----------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| LOGICAL                                      | EXPERIENTIAL                                  |                                                                          | (COHESION)                                          |                                                                                                      |                                                         |
| STRUCTURAL                                   |                                               |                                                                          |                                                     | NONSTRUCTURAL                                                                                        |                                                         |
| Complexes at all ranks (clause complex etc.) | (1) Clause structure                          |                                                                          |                                                     | reference<br>substitution/ellipsis<br>conjunction<br>lexical cohesion:<br>reiteration<br>collocation |                                                         |
|                                              | expansion<br>identity                         | clause:<br>transitivity, modulation;<br>polarity                         | clause:<br>mood, modality                           |                                                                                                      | clause:<br>theme                                        |
|                                              | projection<br>(paratactic<br>&<br>hypotactic) | verbal group:<br>types of process: tense                                 | verbal group:<br>person: polarity                   |                                                                                                      | verbal group:<br>voice; contrast                        |
|                                              |                                               | nominal group:<br>types of participant:<br>class, quality, quantity etc. | nominal group:<br>person ('role')                   |                                                                                                      | nominal group:<br>deixis                                |
|                                              |                                               | adverbial group:<br>prepositional group:<br>types of circumstance        | adverbial group:<br>prepositional group:<br>comment |                                                                                                      | adverbial group:<br>prepositional group:<br>conjunction |
|                                              |                                               |                                                                          |                                                     |                                                                                                      | (2) Information structure                               |
|                                              |                                               |                                                                          | information unit:<br>key                            |                                                                                                      |                                                         |

The analysis described in this stage of the study will investigate only the transitivity structure of the clause, associated group structures and logico-semantic relations (that is, clause complexes) (see Table 6), as it is these which, in systemic functional terms, carry the maximum semantic load in terms of the *ideational* content of the text. Transitivity was the only one of the three strands of structural organisation examined by Hasan in her (1984a) study of the relationship between semantic attributes and lexico-grammatical patterning in texts. It is also a commonly examined aspect of lexico-grammatical patterning in other systemic functional genre studies (see Table 1). It is an area about which many claims have been made in relation to genre specificity and lexico-grammatical patterning (see eg. Macken et al 1989, Christie 1989a, Derewianka 1990). It is for this reason that it was decided to concentrate on the transitivity structure of the language of the texts examined.

However, it is true that other components of the semantic system also carry a certain semantic load. The mood system encodes interpersonal meaning as well as encoding "options relating to the speaker's attitude and comment" (Halliday 1969, 256). The theme system, in contrast, presents "options whereby the speaker introduces structure into the discourse" (Halliday 1968, 179). The ideational component of a text, thus, represents "the 'content' function of language" (Halliday 1974, 95); that is, "the expression of the processes and other phenomena of the external world, including the world of the speaker's own consciousness, the world of thought, feelings and so on" (Halliday 1974, 95). It is with the encoding of 'content' in language that this analysis is concerned and, thus, transitivity structures in the texts.

### 2.8.1 Transitivity structure

The transitivity structure of the clause in systemic functional terms is made up of three basic components. These are the *process* itself, the *participants in the process* and the *circumstances associated with the process*. Table 7 summarises the main process types and their meanings, key participants and circumstantial elements in the transitivity structure of the clause within a systemic functional perspective.

*Table 7. Process types, their meanings, participants and circumstantial elements (Halliday 1985a)*

| Processes   | Meanings   | Participants                           | Circumstantial Elements |
|-------------|------------|----------------------------------------|-------------------------|
| Material    | 'doing'    | Actor<br>Goal                          | Extent<br>Location      |
| Behavioural | 'behaving' | Behaver                                | Manner<br>Cause         |
| Mental      | 'sensing'  | Sensor<br>Phenomenon                   | Accompaniment<br>Matter |
| Verbal      | 'saying'   | Sayer<br>Target                        | Role                    |
| Relational  | 'being'    | Token<br>Value<br>Carrier<br>Attribute |                         |
| Existential | 'existing' | Existent                               |                         |

### 2.8.2 Group structures

There are three main classes of group structure in systemic functional analyses. These are nominal groups, verbal groups and adverbial groups. Group structures, for Halliday, are also part of the experiential component of the semantic system (see Table 6 p 67) and, as such, will require detailed treatment in the analyses referred to in this, and the following, chapter.

Group structure in systemic functional grammar, as with transitivity structure, is described in terms of the role the elements play in the group. Nominal group structure is described in systemic functional terms as Deictic, Numerative, Epithet, Classifier, Head (or Thing<sup>23</sup>) and Qualifier (Halliday 1985a). These are most typically realised as in Table 8:

*Table 8: Structure of the nominal group (Halliday 1985a)*

---

|            |                               |            |           |                         |
|------------|-------------------------------|------------|-----------|-------------------------|
| the        | original                      | two        | old       | steam<br>electric       |
| Deictic    | Deictic 2                     | Numerative | Epithet   | Classifier              |
| determiner | adjective                     | numeral    | adjective | noun<br>or<br>adjective |
| <hr/>      |                               |            |           |                         |
| trains     | in the station<br>that we saw |            |           |                         |
| Head       | Qualifier                     |            |           |                         |
| noun       | phrase<br>or<br>clause        |            |           |                         |

---

Conduit and Modesto (1990) add a further element, Scientific Qualifier, to the nominal group; that is, a bracketed addition occurring in Qualifier position which contains further information such as circumstantial information, descriptive information or references. Although, as Conduit and Modesto state, in some instances a Scientific Qualifier acts like a Qualifier, the new category is introduced because it often, although not always, occurs in addition to a Qualifier. Examples of Scientific Qualifiers are shown in Figure 10.

The verbal group in systemic functional analyses is described somewhat differently from the way it is described in many other descriptions of verbal group structure. The primary tense, within a

---

|         |         |          |                      |
|---------|---------|----------|----------------------|
| The     | algal   | symbiots | (Pardy 1976)         |
| Deictic | Epithet | Head     | Scientific Qualifier |

|                |      |                      |
|----------------|------|----------------------|
| Sprague-Dawley | Rats | (20-250 gms)         |
| Classifier     | Head | Scientific Qualifier |

---

*Figure 10: Examples of Scientific Qualifiers (Conduit and Modesto 1990, 116)*

systemic functional framework, is that which functions as Head, expressed as either past, present or future with modifying elements, if present, being described as secondary tenses, which "express past, present and future time relative to the time selected in the previous tense" (Halliday 1985a, 177). In naming a tense, Halliday, thus, suggests "working backward, and using the preposition *in* to express the serial modification" (Halliday 1985a, 177). This process of naming is illustrated in the analysis of a verbal group shown in Figure 11 (Halliday 1985a, 178).

---

|      |          |           |           |
|------|----------|-----------|-----------|
| was  | going to | have been | walking   |
| past | ← future | ← past    | ← present |

---

"present in past in future in past"

*Figure 11: Structure of the verbal group: a sample analysis*

Finally, adverbial groups in systemic functional analyses are described in terms of a Head word which "may or may not be accompanied by modifying elements" (Halliday 1985a, 187). Postmodifiers, as with the nominal group, are embedded and may be either embedded clauses or embedded prepositional phrases. Figure 12 provides examples of analyses of adverbial group structures according to Halliday's (1985a) model.

---

|                       |          |                                  |
|-----------------------|----------|----------------------------------|
| easily                |          |                                  |
| Head                  |          |                                  |
| more                  | easily   |                                  |
| Modifier              | Head     |                                  |
| not so very much more | easily   |                                  |
| Modifier              | Head     |                                  |
| much more             | easily   | [[than you would have expected]] |
| Modifier              | Head     | embedded clause                  |
|                       | as early | [[as two o'clock]]               |
|                       | Head     | embedded prepositional phrase    |

---

*Figure 12: Structure of the adverbial group: sample analyses (Halliday 1985a, 187)*

It should, however, be noted that earlier systemic descriptions of adverbial groups make different distinctions from those described here in their analyses of adverbial groups. Muir, for example, divides adverbial groups into two different types; those which have a traditional 'adverb' operating as an element of their structure and those which he calls 'preposition-headed adverbial groups' (Muir 1972). Preposition-headed adverbial groups have two elements of structure, both of which must be present. These two elements are called the

prepend "at which operates the word-class preposition", and completeive, "at which operates a nominal group" (Muir 1972, 50). Halliday's more recent analysis of the adverbial group is taken for the purposes of this study. Adverbial groups could, however, be viewed in either way.

Finally, a systemic functional analysis of group structure also includes *prepositional phrases* such as *on the burning deck*, *at two o'clock* or *in the cupboard*.<sup>24</sup> Prepositional phrases consist of a preposition plus a nominal group and "usually signal orientation in space, in time, or in a task" (Butt 1989, 60). For Halliday, examples such as *on the burning deck*, and *at two o'clock* are phrases rather than groups because they are a contraction of a clause, rather than an expansion of a word (as is a group) and, unlike a group, "cannot be reduced to a single element" (Halliday 1985, 190). In the analysis carried out here the structure of the nominal group in prepositional phrases (with the head word described as as Thing rather than Head) has also been identified as "the nominal group within a prepositional phrase is like other nominal groups" (Butt 1989, 60). Hence, *the burning deck*, *two o'clock* and *the cupboard* can be regarded as including nominal group structures like those shown in Table 8. It should, however, be noted that, as these have been rank shifted as part of the prepositional phrase to the position of Qualifier, in Halliday's terms, they are no longer seen as nominal groups (see Halliday 1985, Morley 1985).

## 2.9 Logico-semantic relations

Finally, Halliday (1978, 1985a) divides the *logical* component of the semantic system into clauses which are in an 'even' or *paratactic*

relationship with each other and clauses which are in an 'uneven' or *hypotactic*, relationship with each other. These are referred to as being related in *logico-semantic* terms. Examples of paratactic relations are clauses linked by 'and' or 'but'. Examples of hypotactic relations are sentences involving 'main' and 'secondary' clauses. Within these two categories, clauses are divided into two further categories. These two further categories represent instances of *expansion*, where the secondary clause expands the primary clause such as in "John ran away because he was scared" and *projection*, where "the secondary clause is 'projected' through the primary clause such as in "John said he was running away" (Halliday 1985a).

Halliday's basic types of logico-semantic relation, or *clause complex*, are shown in Table 9.

The classification of logico-semantic relations to which I have referred is not the only one provided in the systemics literature. Different classifications are provided by Halliday and Hasan (1976) and Martin (1983, 1992). Each of these classifications, although different in certain aspects of organisation, shares the same basis of analysis in that it is based on a *linguistic*, rather than *propositional* classification. Outside of systemic functional linguistics, studies of logico-semantic relations have also been carried out by Longacre (1972, 1976), Beekman and Callow (1974) and Crombie (1985a, 1985b, 1987). These classifications differ from those of systemicists in that their basis for classification is propositional, rather than linguistic.<sup>25</sup>

Halliday's (1985a) classification will be used in this stage of the study because it is the one that is most commonly cited in the systemics

literature. Either of the other systemic classifications listed above could, however, have been used without any significant gain or loss in terms of the conclusion reached on the basis of the analyses.

*Table 9. Halliday's basic types of clause complex (Halliday 1985a, 197\*)*

|                |                 | (i) paratactic                                         | (ii) hypotactic                                                         |
|----------------|-----------------|--------------------------------------------------------|-------------------------------------------------------------------------|
| (1) Expansion  | (a) elaboration | John didn't wait;<br>1<br>he ran away.<br>= 2          | John ran away,<br>$\alpha$<br>which surprised everyone<br>= $\beta$     |
|                | (b) extension   | John ran away,<br>1<br>and Fred stayed behind.<br>+ 2  | John ran away,<br>$\alpha$<br>whereas Fred stayed behind.<br>+ $\beta$  |
|                | (c) enhancement | John was scared,<br>1<br>so he ran away.<br>$\times$ 2 | John ran away,<br>$\alpha$<br>because he was scared<br>$\times$ $\beta$ |
| (2) Projection | (a) locution    | John said:<br>1<br>"I'm running away"<br>"2            | John said<br>$\alpha$<br>he was running away.<br>" $\beta$              |
|                | (b) idea        | John thought to himself:<br>1<br>"I'll run away"<br>'2 | John thought<br>$\alpha$<br>he would run away.<br>' $\beta$             |

#### KEY

##### (1) Expansion:

|   |             |                      |
|---|-------------|----------------------|
| = | elaboration | ('equals')           |
| + | extension   | ('is added to')      |
| * | enhancement | ('is multiplied by') |

##### (2) Projection:

|     |          |                                         |
|-----|----------|-----------------------------------------|
| ' ' | locution | ('projected wording'/'direct speech')   |
| '   | idea     | ('projected meaning'/'indirect speech') |

\* NOTE. The chart presented in (Halliday 1985a) contains two significant typographical errors. In Halliday's chart, the first three examples of clause complex are grouped under the category 'projection' and the second two under the category 'expansion'. These headings should be reversed. Appropriate changes have been made in the table presented here.

## 2.10 Summary

This chapter has presented the theoretical framework for the initial stage of the study undertaken here. It has examined the notion of language as social-semiotic as well as presented the basic principles of systemic functional theories of language. It has also looked at examples of analyses working within a systemic functional model. The chapter has then elaborated on notions which will be central to the analysis outlined in the following chapter. In particular, generic structure potential, semantic attribution and lexico-grammatical patterning (including transitivity structure and nominal, verbal and adverbial group structure, and logico-semantic relations) have been outlined. The chapter which follows will apply the framework described in this chapter to a selection of 'specific purpose' written texts.

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## NOTES

- 1 See, for example, Halliday (1978, 1989a), Ventola (1985), also Martin (1984).
- 2 Malinowski (1923, 1935), Firth (1957), Saussure (1916/1966). See also section 3.
- 3 See Halliday and Hasan (1989) and Matthiessen (1988) where this is not the case.
- 4 For further work based on this position see, for example, Martin (1985, 1986a 1986b), Ventola (1984, 1985, 1987, 1988, 1989), Poynton (1985), Hammond (1987), Plum (1988), Christie (1989a, 1989b, 1989c),

- 
- Rothery (1989), Martin and Rothery (1980, 1981), Macken (1990), Derewianka (1990).
- 5 See also Hasan (1978) and Matthiessen (1988).
  - 6 For descriptions of systemic functional theory and analyses see, for example, Berry (1975a, 1975b), Kress (1976), Morley (1985) Halliday (1985a), Halliday and Hasan (1989), Butt (1990).
  - 7 For discussion of the notion of language as social semiotic see Halliday (1978, 1989a) Ventola (1985), also section 2.2.
  - 8 For further discussion on post-structuralist views, see Culler (1983), Harrari (1980), Lentricchia (1980).
  - 9 See Matthiessen (1990) where this is expanded on in some detail.
  - 10 Note that a 'generalist' rather than 'specialist' definition has been deliberately presented here. This has been done to provide a 'summary' statement rather than one which may include minor, rather than significant, differences in position.
  - 11 See endnote 14, Chapter 1.
  - 12 See Halliday (1985a), Butt (1990), Matthiessen (1990), also section 2.7 for a fuller description of a systemic functional analysis of the clause.
  - 13 See note 10 above.
  - 14 See, for example, Tan (1987), Harris (1988), Matthiessen (1988), Hasan (1989a), Matthiessen and Mann (1991).
  - 15 See Martin (1992).
  - 16 See also Ventola (1983, 1989), also end note 17 below.
  - 17 See, for example, Martin (1986c), Martin and Peters (1985), Martin (1989), Jones, Gollin, Drury and Economou (1989), Conduit and Modesto (1990), Drury and Webb (1991).
  - 18 See section 2.8 for a discussion of the notion of Theme.

- 
- 19 See Fries (1983) and Martin (1992) for a discussion of the relationship between Theme and method of development in texts.
- 20 See Figure 5.2 and Figures 5.4 - 5.7 in Ventola (1987) for examples of lexical chains which extend beyond the borders of structural elements in texts.
- 21 See Chapter 3, also Chapters 6 and 7.
- 22 See, for example, Levinson (1983).
- 23 Where the nominal group is part of a Qualifier or adverbial group.
- 24 See Figure 3 for an analysis of a clause which includes a prepositional phrase.
- 25 See Chapter 5, section 5.2 for a comparison of linguistic and propositional relations in texts.

## CHAPTER THREE

### WORKING WITH GENRE: A SYSTEMIC FUNCTIONAL ANALYSIS

#### 3.1 Introduction

This chapter will draw on a systemic functional theory of language to investigate the relationship between language form and rhetorical function in a number of 'specific purpose' written texts. It will look, in particular, at one area of 'English for Specific Purposes' which is generally described in the literature as 'research English'; that is, the writing up and publication of the results of experimental research in English. The chapter will aim to demonstrate that while it is possible to make statements concerning the meanings that are functioning in the texts and the stages through which they move in order to achieve their goal (Martin 1986c), it is a matter of much greater complexity to draw conclusions regarding the relationship between genre and the actual language of the texts.

#### 3.2 Selection of the texts

Table 10 shows the specific topic areas from which the texts were chosen for this stage of the analysis, the titles of the journals, their Science Citation Index (SCI) impact rankings and the number of texts chosen for analysis from each journal. Complete references to these

texts can be found in the Bibliography section at the end of this thesis. Copies of the texts are attached as Appendix 1. The rationale for selection of the texts is provided in section 1.7.1 above.

*Table 10. Sample texts, journals and impact rankings: first stage of the study*

| Area                                                                      | Journal                               | SCI Impact Ranking | Number of texts |
|---------------------------------------------------------------------------|---------------------------------------|--------------------|-----------------|
| The effects of ozone on wheat crops                                       | Environmental Pollution               | 0.877              | 2               |
|                                                                           | Environmental and Experimental Botany | 0.822              | 1               |
|                                                                           | Agronomy Journal                      | 0.697              | 1               |
| The effects of acid rain on corn germination, reproduction and crop yield | Journal of Environmental Quality      | 1.331              | 3               |
|                                                                           | Environmental Pollution               | 0.877              | 1               |
| The effects of flooding on soybean growth and crop yield                  | Environmental and Experimental Botany | 0.822              | 1               |
|                                                                           | Agronomy Journal                      | 0.697              | 2               |
|                                                                           | Soil Science                          | 0.686              | 1               |

### 3.3 Analysis of the texts

The overall process of analysis in this stage of the study aims to identify:

- (i) the *structural elements* of the texts;

- (ii) the *generic structure* of the texts, accounting for sequencing and recursion of structural elements (Hasan, 1989a);
- (iii) a *generic structure potential* for the genre as a whole, identifying obligatory and optional structural elements, sequencing and recursion (Hasan, 1984a, 1989a);
- (iv) the *semantic attributes* of the structural elements in the texts, accounting for both *nuclear* and *elaborative* meanings (Hasan, 1984a);
- (v) the *lexico-grammatical patterns* which realise the semantic attributes in the texts;

and then, finally, to reflect on the analyses as a whole, draw conclusions and consider possible implications for teaching and further research.

The analysis of lexico-grammatical patterns undertaken at this stage of the study investigated the ideational component of the texts in *functional* terms; that is, the process types, participants, circumstances and logico-semantic relations that occurred in the texts. The analysis also investigated the *formal* structure of the language of the texts with a focus on verbal, nominal and adverbial group structures.

The analysis of the structural elements of the texts for this first stage of the study involved an investigation of all twelve texts.<sup>1</sup> The analysis of

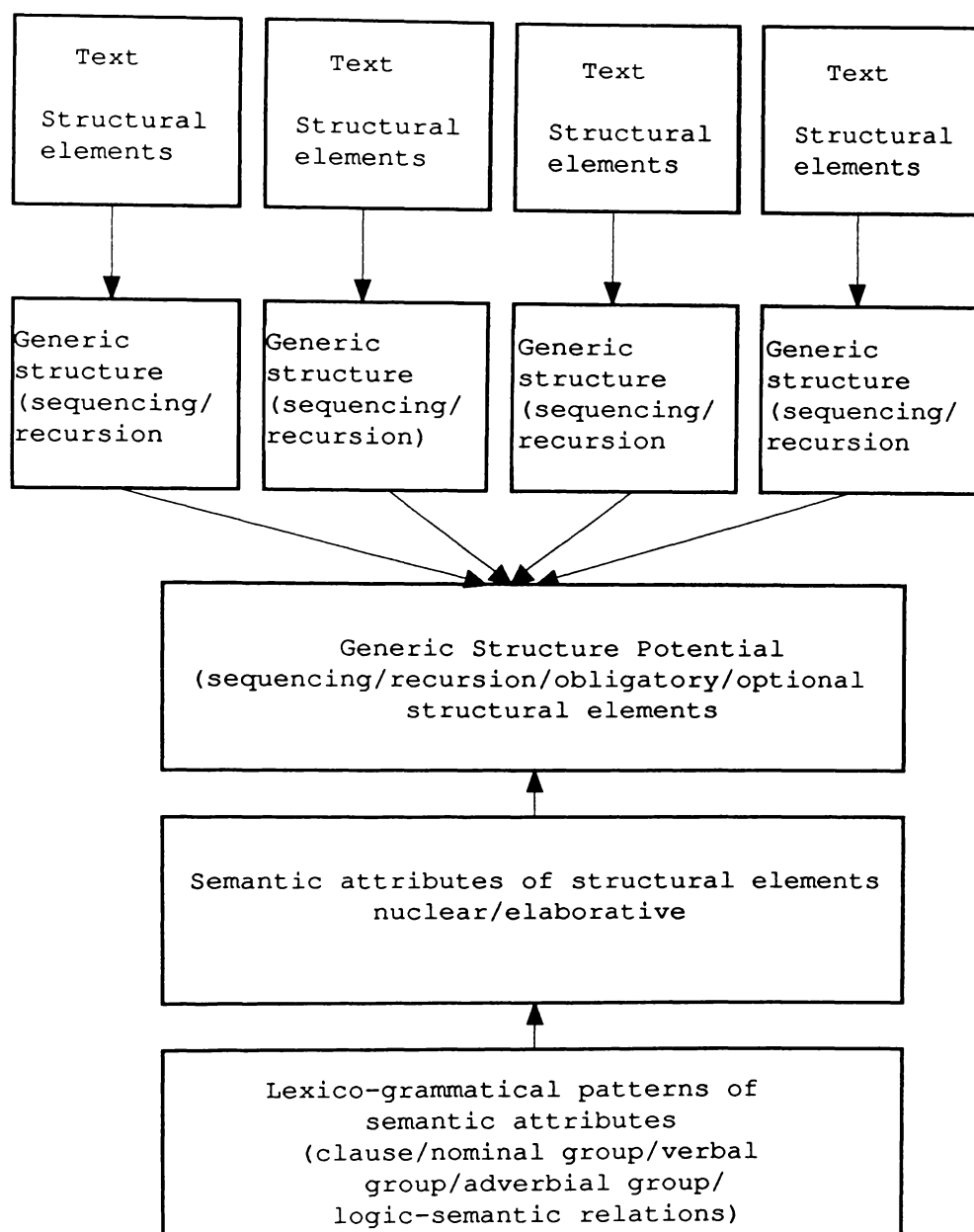
semantic attributes, transitivity, group structures and logico-semantic relations, however, was carried out only with the first four of these texts in order to identify the value that might be gained from further investigation at this particular level.<sup>2</sup> As will be seen below, the analysis of the semantic attributes, transitivity and group structures in these four texts revealed there would be little further to be gained from continuing with an analysis, at this particular level, of the remaining eight texts.

These stages and levels of analysis are summarised in Figure 13.

### 3.4 Generic structure potential

In order to provide a generic structure potential for the Introduction section to research reports, the actual structure of each of the twelve texts was first of all established. The criteria for the establishment of boundaries in these analyses were, as described above, in terms of the content of the texts, rather than how the content is expressed. Labels for each of these structural elements were then assigned which referred to the overall content area of each of the structural elements such as "Background Information and "Previous Research" etc. Patterns of sequencing and recursion of the structural elements of the texts were then identified. Finally, a generic structure potential was developed by an analysis of the obligatory and optional elements within the texts as well as sequencing and recursion.

As can be seen from the analysis presented in Table 11, only two structural elements emerged as being essential to the Introduction sections of the texts; that is, Previous Research (PR) and Purpose of



*Figure 13: Levels and stages of analysis: first stage of the study*

Study (PS). This is confirmed by the actual structure of Text 3 (see Table 11) which is made up of only these two elements. All other elements were, therefore, found to be optional. Also, only one element, Purpose of Study (PS), occurred in the same position in all the texts, that is, in the

final position. Beyond that, the analysis revealed a wide range of flexibility as regards sequencing of elements with only one element, Justification for Study (JS), having any restraint upon it; that is, when it did occur, it always directly followed the element, Information Gap (IG).<sup>3</sup> At this point, it is important to observe that the nature of the study is necessarily limited: the fact that an element appears, on the basis of the texts studied, to be essential, does not, in fact, mean that it *is* essential. Conclusions at this stage must, therefore, be seen as tentative.

### 3.5 Semantic attributes

Table 12 is a summary of the semantic attributes of one of the structural elements investigated in the analysis, Background Information (BI). These semantic attributes were identified by an examination of the semantic content of the structural element being examined, as in Hasan's identification of the semantic properties of the structural elements 'placement' in the nursery tale and 'sales enquiry' and 'sales request' in service encounter texts (Hasan 1984a, 1989a).<sup>4</sup> Categories were, thus, established which identified reference to notions such as Quantity, Subject (of the event), Agent (of the event), Time and Location etc. As with Hasan's analyses, an examination was carried out of the semantic attributes in the texts to the point where each 'content domain' in the texts under analysis was accounted for.

The summary shown in Table 12 is based on an analysis of the same four texts chosen for transitivity and group structure analysis. The

*Table 11: Generic structure potential: research reports (Introductions)*

Text 1: Actual Structure

PR ^ QR ^ IG ^ JS ^ BI ^ CS ^ RS ^ PS

Text 2: Actual Structure

PR ^ IG ^ CS ^ BI ^ IG ^ PS ^

1. 1. 1. 2.

BI ^ PR ^ IG ^ JS ^ PR ^ RS ^ PS

2. 2. 3. 3.

Text 3: Actual Structure

PR ^ PS

Text 4: Actual Structure

BI ^ PR ^ BI ^ PR ^ IG ^ CS ^ PS

1. 1. 2. 2.

Text 5: Actual Structure

BI ^ PR ^ IG ^ PS

Text 6: Actual Structure

BI ^ PR ^ PS

Text 7: Actual Structure

BI ^ IG ^ PR ^ PS

Text 8: Actual Structure

IG ^ PR ^ IG ^ PR ^ PS

1. 1. 2. 2.

Text 9: Actual Structure

BI ^ PR ^ IG ^ BI ^ PR ^ PS

1. 1. 2. 2.

Text 10: Actual Structure

BI ^ PR ^ BI ^ PR ^ BI ^ PR ^ PS

1. 1. 2. 2. 3. 3.

Text 11: Actual Structure

BI ^ PR ^ BI ^ PR ^ IG ^ PR ^ PS

1. 1. 2. 2. 3.

Text 12: Actual Structure

BI ^ PR ^ BI ^ PR ^ IG ^ PR ^ IG ^ PS

1. 1. 2. 2. 1. 3. 2.

Generic Structure Potential

BI

PR

IG ↺ ↺ ↺ BI PR IG ↺

{ [ (BI) ^ PR ^ (QR) ^ (IG) (^JS) ] ^ (CS) ] ^ (RS) ] ^ PS }

Key (based on Swales 1990, Hasan 1989b)

|                            |                                        |                      |
|----------------------------|----------------------------------------|----------------------|
| BI: Background Information | PR: Previous Research                  | QR: Question Raising |
| IG: Indicating a Gap       | JS: Justification for Study            | CS: Context of Study |
| RS: Rationale for Study    | PS: Purpose of Study                   |                      |
| ^ fixed sequence           | · can occur anywhere                   |                      |
| () optional                | ↺ element can recur                    |                      |
| [] restraint on sequence   | { } sequence within brackets can recur |                      |

Notes

1. Where elements can occur in any position, sequence in the GSP indicates 'typicality'. That is, half or more of the texts demonstrate that sequence.
2. If the symbol indicating fixed sequence occurs inside a bracket and follows an item which can occur anywhere, this indicates that where the element does occur, it always follows the item which precedes it.

number of occurrences of each of the semantic attributes across the four texts is represented by the numbers in brackets. As can be seen from the chart, the most common semantic attribute in this particular structural element was that described here as Quantity. This was followed by reference to the main Agent of the action in the particular text (such as, for example, ozone or acid rain) and the actual Subject of the text (such as, for example, wheat or soybean). Other essential, or nuclear, semantic properties were Time, Location, Information Source and some quality or characteristic of the Agent or Subject (Attribution) or some indication of what the Agent or Subject represents (Identification). Elaborative attributes of the element, Background Information were much less in evidence in the texts. There were, furthermore, a number of these attributes which occurred only once in the four texts analysed. There were no examples of semantic attributes which could be described as 'associated'; that is attributes which need not occur, but very often do.<sup>5</sup>

*Table 12. Semantic attributes: Background Information*

| Structural Element     | Semantic Attributes     |                   |
|------------------------|-------------------------|-------------------|
|                        | Nuclear Meanings        | Elaborative       |
| Meanings               |                         |                   |
| Background Information | Quantity (46)           | Status (5)        |
|                        | Agent (7)               | Occurrence (4)    |
|                        | and/or Subject (22)     | Value (3)         |
|                        | Time (25)               | Effect (2)        |
|                        | Location (21)           | Reference to      |
|                        | Information Source (15) | Present Study (2) |
|                        | Attribution (6) and/or  | Relationship to   |
|                        | Identification (6)      | Broader Research  |
|                        |                         | Program (1)       |
|                        |                         | Reference to      |
|                        |                         | Authors (1)       |
|                        |                         | Comparison (1)    |
|                        |                         | Observation (1)   |
|                        |                         | Demonstration (1) |
|                        |                         | Estimation (1)    |
|                        |                         | Standard (1)      |

### 3.6 Lexico-grammatical patterns

The discussion which follows will concentrate on transitivity and nominal, verbal and adverbial group structures in the lexico-grammatical patternings of the texts. The section which follows (3.7) will present the analysis of logico-semantic relations in the texts.

#### 3.6.1 Transitivity structure

The summary of the lexico-grammatical patterns which realise the semantic attribute, Quantity, presented in Table 13, starts to reveal the complexity of the actual language of the texts. In the analysis carried out here, the attribute Quantity was realised either by an entire participant (eg 51%) or as part of another participant which shares its meaning with another semantic attribute (eg ambient ozone concentrations). The same applies to circumstantial elements which, again, either completely realise, or otherwise just contribute to, the realisation of the semantic attribute Quantity. Thus, in Table 13, 'by/in' and 'as/in' refer to the fact that the semantic attribute may be realised either entirely by a single participant or circumstantial element, or may be part of only the semantic property realised by the particular participant or circumstantial element. Examples of these kinds of realisation are also given in the table.

A more detailed analysis of lexico-grammatical patterns which realise the semantic attributes of the structural element, Background Information, can be found in Appendix III. These analyses are accompanied by sample realisations which provide examples of each of the lexico-grammatical patterns described. Only the underlined section

*Table 13. Lexico-grammatical patterns and sample realisations: Quantity*

| Lexico-grammatical patterns                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Sample realisations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Realised by participant,<br>in participant,<br>by circumstantial element,<br>in Relational (Identifying<br>or Attributive),<br>or Material process environment;<br>as Circ: Loc (Spatial),<br>as Actor,<br>in Actor,<br>in Carrier,<br>as Attribute,<br>in Attribute,<br>in Value,<br>in Goal,<br>by nominal group with noun as Head<br>or Thing,<br>with<br>or without Epithet,<br>exact<br>or inexact Numerative,<br>with<br>or without Scientific Qualifier,<br>Classifier or<br>Qualifier as modification<br>or by abbreviation as Head<br>or by exact<br>or inexact Numerative as Head<br>or by verbal group: simple present<br>or modalised past in present,<br>positive polarity | <u>Episodes</u><br>(the 24h monthly) <u>means</u><br><u>in the range of 27 to 48 nl litre</u><br>(O3) <u>dominates</u> (the air pollution climate)<br>(Ozone concentrations ... often) <u>exceed</u><br>(Average concentrations) <u>may have increased</u><br><u>17 %</u><br><u>Episodes</u><br>(for ambient ozone) <u>concentrations</u><br>(the 24h monthly) <u>means</u><br><u>0.060 ul litre -1</u><br><u>low</u> (sulphur dioxide and nitrogen dioxide) <u>levels</u><br>(about) <u>11%</u><br><u>51 %</u><br><u>Episodes</u><br>(with peak) <u>concentrations</u><br><u>elevated</u> (O3) <u>concentrations</u><br><u>Episodes</u><br><u>0.060 (ul litre-1)</u><br><u>in the range of 27 to 48</u><br><u>elevated (60 to 129 ull-1) ... levels</u><br><u>low ... levels</u><br><u>maximum</u> (O3) <u>concentrations</u><br>(in terms of) <u>acreage planted</u><br><u>ugm -3</u><br><u>32 %</u><br><u>about 11%</u><br><u>dominates</u><br><u>may have increased</u><br><u>dominates</u> |

of the sample realisations refer to the semantic attribute being analysed. The bracketed sections are provided to illustrate, where possible, the group structure context in which the particular attribute occurs.

The situation regarding process environments is also the same as for transitivity structure in general in that the attribute Quantity was realised either by an entire process element (eg dominates) or, again, was part of a participant which shares, in part, the same semantic property (eg low sulphur dioxide and nitrogen levels) with another (in this case, that of 'Agent'). There was, furthermore, a choice of two process environments in which the semantic attribute of Quantity occurred; that is, either in a relational ('being') process environment or in a material ('doing') process environment. An analysis of the actual place of the attribute, Quantity, in the process environment revealed an even greater complexity; that is, it could be realised entirely, or as part of, a Circumstance of Location, either entirely or as part of an Actor or Goal (in a material process environment) or as part of the Carrier or Value (in a relational process environment) or wholly, or in part, by the process element itself. Likewise, the structure of the nominal groups in which the attribute, Quantity, was found revealed a range of possibilities as also did choices in verbal group structures.

The summary of process environments, verbal groups and nominal groups for the structural element, Background Information, presented in Table 14 shows the wide range of possibilities that were revealed by the analysis of just four examples of the texts. Although all but two of Halliday's process types occurred in this particular section of the texts, one, existential processes (verbs of being), does occur elsewhere in the

*Table 14. Process environment, verbal groups, nominal groups: Background Information*

| Structural element     | Process environment | Verbal group        | Nominal group               |
|------------------------|---------------------|---------------------|-----------------------------|
| Background information | Relational          | Simple present      | Noun, proper noun or        |
|                        | Material            | (active)            | numeration as Head or Thing |
|                        | Mental              | Simple present      | with or without             |
|                        | Verbal              | (passive)           | Deictic,                    |
|                        |                     | Simple present      | Numerative,                 |
|                        |                     | (active/modalised)  | adjective, noun or nominal  |
|                        |                     | Simple present      | group as Epithet,           |
|                        |                     | (passive/modalised) | noun or adjective           |
|                        |                     | Simple past         | as Classifier               |
|                        |                     | (active)            | in pre-modification;        |
|                        |                     | Simple past         | phrase, clause              |
|                        |                     | (passive)           | or Scientific Qualifier     |
|                        |                     | Present perfect     | as Qualifier                |
|                        |                     | (active/modalised)  | in post-modification.       |
|                        |                     | Present perfect     |                             |
|                        |                     | (passive)           |                             |
|                        |                     | Infinitive          |                             |
|                        |                     | Positive polarity   |                             |

texts (for example, in Text 4, "... there is an obvious need for more data on O<sub>3</sub> impacts to winter wheat yield."). Also, it is hard to imagine that examples of behavioural processes (for example, breathing, coughing etc) would not be present if the subject matter of the research articles were, for example, respiratory problems. Thus it seems perfectly possible to say, at least on the basis of the analysis carried out here, that all of Halliday's six process types are possible in the Introduction section of research articles. Clearly then, there will be problems in attempting to abstract from this type of research a teaching programme which will have much of value to say at a lexico-grammatical level in terms of the transitivity structure of the clause in scientific texts.

### 3.6.2 Group structures

A summary of nominal group structures reveals that every single possibility for nominal group structure occurs in the texts under examination. Indeed, the very first sentence in the very first text examined contained a nominal group as complete and complex as nominal group structure potential would allow (see Table 15).<sup>6</sup> This first sentence also includes an example of nominal group structure at the minimal level that the grammar would allow; that is, a single element (in this case, a personal pronoun) taking the place of Head in a single constituent nominal group (ie "We consider... ").

The summary of verbal group structures (Table 14) reveals the use of both active and passive voices of the simple present, the simple past and the 'past in present' or, in more traditional terms, the present

Table 15. Nominal groups : Text 1 Sentence 1

|                                  |                 |                           |                           |                |                                  |                    |                      |                 |
|----------------------------------|-----------------|---------------------------|---------------------------|----------------|----------------------------------|--------------------|----------------------|-----------------|
| We                               | consider        | ozone                     | to be                     |                |                                  |                    |                      |                 |
| Head<br>(personal<br>pronoun)    |                 | Head<br>(noun)            |                           |                |                                  |                    |                      |                 |
| the                              | most            | important                 | air                       | pollutant      | for                              | field              | grown                | crops           |
| Deictic                          | Num-<br>erative | Epithet<br>(adjective)    | Classifier<br>(noun)      | Head<br>(noun) | Qualifier (prepositional phrase) |                    |                      |                 |
| in                               | southern        | Sweden.                   |                           |                |                                  | Modifier<br>(noun) | Classifier<br>(verb) | Thing<br>(noun) |
| Qualifier (prepositional phrase) |                 |                           |                           |                |                                  |                    |                      |                 |
|                                  |                 | Classifier<br>(adjective) | Thing<br>(proper<br>noun) |                |                                  |                    |                      |                 |

perfect, as well as examples of the infinitive. Furthermore, although the polarity for all verbs that occurred in this section of the texts was positive, examples of negative polarity did occur elsewhere in the texts (eg "the results cannot be extrapolated" in Text 2).

The analysis of adverbial group structures in the structural element, Background Information, revealed very few examples of adverbial groups. In each case, the adverbial group was made up a single head word. Examples of this can be found in Texts 3 and 4 where, referring to the semantic attribute, Time, an adverb, referring to frequency of occurrence, occurs as head word; that is, "air pollution episodes ... would be typically characterised by" (Text 3) and "elevated O<sub>3</sub> concentrations may occasionally occur" (Text 4). Adverbial groups were also found in the realisation of other semantic attributes. For example, in Text 1, an adverbial group occurs in the realisation of the semantic attribute, Manner (ie. "have been shown to respond differently").

On the basis of the analysis of group structures carried out so far, the only observations that can be reached are that the occurrence of adverbial groups is low, and where they do occur, they are made up only of a single head word. It can also be noted that modalisation found in verbal group structures was in the active and passive voices of the present simple. Otherwise every possibility in terms of nominal group structure and a sufficiently wide range of verbal group structures occurs such as to suggest that it is not possible to make any meaningful statement about typicality of patterning and range of nominal and verbal group structures in the texts.

### 3.7 Logico-semantic relations

Table 16 presents a summary of logico-semantic relations in the section of the texts analysed. The analysis revealed a preponderance of *hypotactic projections*<sup>7</sup> in this particular section of the texts. That is, each text contained an example of clauses which were in an 'uneven' relationship with each other which contained both a 'main' and embedded (represented by double squared brackets) 'secondary' clause and the 'projection' of an idea or fact through the primary clause. The main clause in projections is referred to as a *phenomenon* and the embedded secondary clause (the projection) as a *metaphenomenon* (Halliday 1985a). Secondary clauses may contain a finite or non-finite verb.<sup>8</sup>

Examples of hypotactic projections found in the sections of the texts analysed were "We consider (main clause/phenomenon) ... ozone to be the most important air pollutant for field grown crops in southern Sweden (secondary clause/metaphenomenon)" in Text 1 and "... it was suggested (main clause/phenomenon) ... that average concentrations may have increased in Europe during the last century (secondary clause/metaphenomenon)" in Text 2.<sup>9</sup> An example of these relations occurred in the same section of each of the four texts examined, providing the only clear example of lexico-grammatical patterning to occur across *all* of the four texts examined. This analysis, whilst revealing a preponderance of one particular inter-clausal relation, was, nonetheless, not felt sufficiently genre defining, of itself, to warrant further detailed analysis at this particular level.

*Table 16. Logico-semantic relations: Background Information*

| Logico-semantic<br>relation  | Examples<br>Main clause                | Examples<br>Embedded secondary<br>clause                                                                                                                                   |
|------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| hypotactic/projection<br>(5) | We consider<br>ozone<br>[phenomenon]   | [[to be the<br>most important air<br>pollutant for<br>field grown<br>crops in<br>southern.<br>Sweden.]]<br>[metaphenomenon]                                                |
|                              | ...it was<br>suggested<br>[phenomenon] | [[that O <sub>3</sub> dominates<br>the air pollution<br>climate in an<br>area including<br>southern Germany,<br>parts of Austria<br>and Switzerland.]]<br>[metaphenomenon] |

### 3.8 Implications for teaching

Some analysts have claimed that the language of research articles varies according to the particular rhetorical functions of the texts. Consider, for example, Swales' overview of these analyses and Weissberg and Buker's pedagogic application of some of them (Swales 1990, Weissberg and Buker 1990). The language conventions presented in Weissberg and Buker's text as being specific to research articles (eg old vs new information order, general and specific noun phrases, reporting facts, making general statements, using modal auxiliaries etc) could, in fact, equally be applied to English language use *in general*. They need not have any *particular* relationship with research report writing at all. The analysis carried out here supports this

position; that is, that there is unlikely to be any direct or, indeed, mediated, correlation (except at a purely lexical level) between general communicative purpose and language selection.<sup>10</sup>

It is generally considered, however, to be the case that the implications for teaching of analyses of the type outlined above are considerable. The identification of a generic structure potential for the Introduction section of research articles could, for example, allow teachers to inform learners not only of the structural patterns which typically occur in such texts, but also the typical sequence of structural elements and the amount of flexibility the genre will allow. An analysis of this sort, then, could perhaps be a very useful teaching tool if it could be demonstrated that it could be sustained over a significant number of additional texts. Such an analysis, were the results to be sustainable, could not only reveal communicative processes but serve a pedagogic purpose as well (Hyland, 1992). If this were the case, theory would then become "a tool with real-world application" (Couture, 1986b, 3).

It has also been argued that an understanding of the semantic attributes of the structural elements of the texts could also prove useful in assisting in the development of teaching and learning materials. One way in which this might be done could be by the development of *probes* such as those shown in Table 17. Learners could perhaps use these probes as a guide to the creation of new texts as well as a checking device for the revision of texts they are currently developing. The probes shown in Table 17 have been created by the formulation of question forms based on the central property of each of the nuclear semantic attributes revealed in the study. Probes such as these, then, could perhaps be used to guide learners towards providing essential

Table 17: Nuclear Semantic Attributes: Probes

| Structural Element     | Nuclear Semantic Attributes       | Probes                                                                                                                    | Sample Realisations                                                                                                                                                                                                                                                                                                                                                              |
|------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Background Information | Agent and/or Subject              | What?                                                                                                                     | <u>Agent</u><br>We consider <u>ozone</u> to be the most important air pollutant ...<br><u>Subject</u><br>... <u>wheat</u> is one of the major crops                                                                                                                                                                                                                              |
|                        | Quantity                          | How much?<br>Has there been any change in quantity?                                                                       | <u>Only approximately 20%</u> of the wheat cultivars are spring sown.<br>... <u>average concentrations may have increased</u> in Europe during the last century                                                                                                                                                                                                                  |
|                        | Time                              | When?                                                                                                                     | Episodes reaching 100 to 125 litres -1 (1-hr means) may occur <u>in spring and summer</u> .                                                                                                                                                                                                                                                                                      |
|                        | Location                          | Where?                                                                                                                    | The occurrence of major phytotoxic gases <u>in rural areas of Southern Sweden</u> ...                                                                                                                                                                                                                                                                                            |
|                        | Information Source                | Who said so?                                                                                                              | (Volz and Kley, 1988)<br><u>As Mary and air quality data would confirm</u> ...                                                                                                                                                                                                                                                                                                   |
|                        | Attribution and/or Identification | <u>Attribution</u><br>What are the qualities/characteristics of x?<br><br><u>Identification</u><br>What does x represent? | <u>Attribution</u><br><u>Only approximately 20% of the wheat cultivars used are spring sown.</u><br><br><u>Identification</u><br>... <u>wheat is of major importance.</u><br>... <u>0.60 ul litre -1 ... is the National Quality standard for the 1-h Maximum O3 concentrations</u><br><u>We consider ozone to be the most important air pollutant for field grain crops</u> ... |

information in their texts as well as showing them ways in which they can create more elaborated texts, should they so wish. On the surface, this sort of thing may seem convincing in spite of the generality of the probes as outlined. It is, however, an argument that is likely to become weaker rather than stronger as results of analyses such as the present one become available.

### 3.9 Conclusions

The analysis in this first stage of the study has revealed a great deal of complexity in lexico-grammatical patternings and group structures in the Introduction section of scientific reports, the only 'typicality' being revealed in terms of the relationship between (a number of) clauses rather than the construction of the clauses themselves. It has, furthermore, demonstrated that there would be little to be gained from proceeding with further analysis at this particular level. The description of just the one structural element and semantic attribute presented here, for example, showed that a wide range of language resources and structures are possible in texts of the kind examined. The analysis revealed that no particular process type might typically occur at specific points in the texts. It also demonstrated that it is false to argue that a narrow range of verbal or nominal group structure could be identified as typical. Indeed, it is at this level that both Hasan's model and Halliday's system of categorisation proved to be the most revealing. What they revealed however, is *not* that aids to the teaching of 'special purpose' language can be abstracted from this but that they, in fact, cannot. The results of this stage of the study, then, already have substantial implications, not only for register and genre theory, but also for *not teaching* 'specific purpose' language use.

As Halliday says, grammatical resources such as those revealed in this study have not been *invented* by scientific writers. Rather, what they have done is taken the resources that *already exist* in English and used them for their own rhetorical purposes (Halliday, 1988). This position is also supported by de Beaugrande (1989) who holds that no 'specific purpose' language is composed exclusively of its own resources and one "could not, for example, state the 'rules' which determine what parts of the grammar or lexicon of English may or may not appear in 'scientific English' " (de Beaugrande, 1989, 6).

Halliday does, however, clearly believe in a *preponderance* of certain language items in specific contexts of use, much the same as many of those working in the field of English for Specific Purposes. That is, he believes, as it seems do they, in a specific *selection* of language items in the *realisation* of particular communicative events.<sup>11</sup> This can be seen in his more recently stated argument that the relationship between genre and language, or, in Halliday's terms, register and language, is *probabilistic*, rather than *deterministic*.<sup>12</sup> Many systemicists *have*, however, until recently, claimed a deterministic relationship between genre and language, or between genre and language mediated by register. Examples of this can be found in The Theory and Practice of Genre Based Writing, co-authored by Macken, Martin, Rothery, Kress, Cope and Kalantzis (1989) who state that:

Both the context of culture (via genre) and context of situation (via register) *determine* the kind of language used to create a text (emphasis mine) (Macken et al 1989, 5).

Christie (1989a), equally, in Writing in Schools, a Deakin University study guide, claims that:

... it is possible to identify three factors [field, tenor and mode] that ... operate in any context of situation, *determining* the kinds of linguistic choices a person makes (emphasis mine) (Christie 1989a, 15).

Drury and Webb, further, in a paper on the teaching of academic writing at the University of Sydney, also claim that:

By knowing the variables in a context (ie field, tenor and mode) it is possible to *predict* how they will be realised linguistically (emphasis mine) (Drury and Webb 1991, 7).

The fact that they have done this is endorsed by Halliday who, in Towards Probabilistic Interpretations (1991), says:

By investigating this kind of internal conditioning within the grammar, using a large-scale corpus of text, we can greatly improve on the present purely *qualitative* interpretation, according to which systems are either dependent or simultaneous, and recognise intermediate degrees of "partial association" between systems in a systems network (emphasis mine) (Halliday 1991, 56).

It is important to note, here, that by 'qualitative', Halliday refers to an 'either/or' position as opposed to a quantitative one, which refers to a 'more likely/less likely' position (Nesbitt and Plum 1988).

However, as Nesbitt and Plum (1988), themselves, point out:

"... the *quantitative* analysis of grammar and discourse patterns has hardly begun (emphasis mine) (Nesbitt and Plum 1988, 6).

The only serious published attempt at a probabilistic genre-based study (one that is data-driven rather than intuition-driven) is that carried out by Nesbitt and Plum (1988). About that study, which is flawed for a number of reasons (sample size, definition of logico-semantic relations, definitions of genres etc), Halliday (1991) says:

... if the pattern turns out to be repeated across other functional varieties then it can be regarded as a feature of the system of the English language at its present stage (Halliday 1991, 53).

That is, it can be regarded as a feature of *language*, although not necessarily of *genre*. Statements that the relationship between genre and language *are* probabilistic must, thus, at this stage, be seen as premature in that they are not yet supported by sufficient data driven, statistically based analyses of a large corpus which includes a range of different genres.

Arguments *for* a direct relationship, however, have not assumed there is no complexity on at least one side of the equation. The 'one' would not necessarily just be, for example, a discourse component; it could be a discourse component operating in the context of specific variables of, for example, field, tenor and mode; that is, in a 'one to many' relationship. The study carried out so far, however, demonstrates (at least as far as these particular texts are concerned) that there *is* no one to one relationship between genre and language. In addition, it indicates that claims for a one: many relationship need serious investigation before they can be taken as substantiated. It, thus,

supports Crombie and Rika-Heke's position that the term, English for Specific Purposes, "from a purely linguistic point of view ... [is] ... not only misleading, but also conceptually suspect" (Crombie and Rika-Heke 1991, 27).

These conclusions have been reached by the application of a theory of language which has its basis, the concept of linguistic correlates and exponents. The rejection of the notion of linguistic correlates is not a rejection of the theory *per se*, (although clearly this conclusion, for these purposes, must be drawn), it is, rather, a rejection of *any* theory based on the concept of exponents at this level which incorporates the notion that there is a one-to-one (or one to many) determined relationship between language form and function. The reason systemic functional linguistics has been given more attention here than any other similarly placed model is simply that it has been used so much in attempts to prove this particular point. The assumptions made about it, therefore, have needed to be addressed.

This conclusion has been reached by an analysis of one of the obligatory structural elements in the texts. Analysis of another obligatory element may reveal different patternings. It would not, however, alter the fact that the analysis carried out here has falsified the deterministic view of the relationship between genre and language. That is to say, if a one to one (or one to many) relationship cannot be found in one small section of a text, a claim of this nature can no longer be made for the text as a whole. This is not just to restate the self-evident fact that language resources are finite. It is also to state that there has, so far, emerged no evidence that a specific selection of language characterises a specific genre.

This is perhaps not so surprising when one remembers that investigations in other areas of language study with similar aims, such as that of literary structuralists and the Russian Formalists earlier this century in their attempt to define the 'specific language' of literary texts, reached the same conclusion (Erlich 1965, Bennett 1979).

Hutchinson and Waters, equally, from within the field of English for Specific Purposes, also conclude:

Though attractive at first, the assumption that language variation implies the existence of identifiable varieties of language related to specific contexts of use has, in effect, proved to be unfounded (Hutchinson and Waters, 1987, 30-31).

A probabilistic argument, within the framework being examined here, equally, could not provide a basis for genre definition as probability represents a *qualitative* position; that is, one of 'more or less likely to occur', rather than a *quantitative* one, that of necessity.

This may, within the context of systemic functional studies (and, in particular, in the context of the uses to which they are sometimes put), be an observation of some consequence.

A number of overview studies in the area of English for Specific Purposes have reached similar conclusions to the ones I have drawn regarding the notion of 'special purpose' language.<sup>13</sup> It is, furthermore, interesting to note that a state of the art article on the subject of English for Academic Purposes by Jordan all but ignores the issue of language, taking more of a skills-oriented approach to defining

the area (Jordan 1989). This, in fact, is indicative of the direction in which many 'specific purpose' courses are now moving; that is, in a direction in which the main focus is the development of what are essentially communication skills as they relate to particular contexts of language use. The main difference between courses of this sort and those offered to native speakers is, principally, that the teacher of non-native speakers:

... will concentrate from time to time on system repair and may focus more directly on the students' main area of academic interest than will the teacher of English to native speakers (Crombie and Rika-Heke 1991, 32).

As Hutchinson and Waters say, the reasons for teaching English for Specific Purposes may be more a matter of learner motivation, face validity and familiarity than their being any particular language selection that can be associated with any particular context of language use (Hutchinson and Waters 1987). That is, one may *choose* to present something as 'specific purpose' language use as a way of leading learners into an unfamiliar domain whilst at the same time making them "more aware of their real needs" (Hutchinson and Waters 1987, 167). These very often may be *general* language needs rather than 'specific purpose' language needs.<sup>14</sup>

The findings of this first stage of the study also present evidence in support of Leech's position that many systemic functional examples of genre analysis represent cases of *overgrammaticalisation* in that they try to "seek a grammatical explanation (in terms of rules and categories)" (Leech 1983, 58) for structural aspects of language.

The conclusions to be reached here then are:

- (i) there are *non*-linguistic, rather than linguistic, reasons for generic staging in texts, and
- (ii) there are *no* linguistic correlates for generic stages in texts.

This includes both syntactic and lexical correlates in that topic and related lexis cannot ever, *of their own*, be genre-defining as the subjects discussed in the papers analysed here could, equally, for example, be discussed in a dinner party conversation, a news broadcast, a newspaper article or a seminar presentation.

The approach to stage boundaries supported by this stage of the study, thus, is not one that relates to linguistic realisation.

As Leech points out, Halliday, himself, [if not all of his followers]:

... seems to be moving closer to a conception of language in which the ideational component is grammatical in an orthodox sense (dealing in constituent structures, rules, and systems), as distinct from the interpersonal and textual components, which are more pragmatic in conception (Leech 1983, 58).

This difficulty of describing a direct relationship between the language of a text and its discourse structures in grammatical terms could, in part, explain why in Halliday's own writings, there is very little reference to the notion of genre and the relationship between language and discourse structures in texts. An exception to this is the (1982)

paper How is a text like a clause? in which he points out that a text, like a clause, has structure. Even here, however, Halliday does not claim there are grammatical equivalences for structural elements in texts. A brief glance at de Joia and Stenton's (1980) Terms in Systemic Linguistics: A Guide to Halliday, equally, reveals a similar lack of reference to the notion of genre in Halliday's work and there is no mention of grammatical relationships between language and discourse structures. A further explanation of this could, however, be Halliday and Hasan's position that there is no reason to provide a separate 'level' for genre (Christie 1991) as do, for example, Martin (1984, 1985, 1986), Ventola (1985) and Christie (1989a, 1991). Indeed, a close examination of Hasan's (1978) paper, 'Text in the systemic functional model' reveals use of the terms 'genre' and 'register' interchangeably. The only other systemicist who would seem to agree with Halliday and Hasan is Matthiessen (1988) who describes register as "a generalisation of the traditional notion of genre" (Matthiessen 1988, 2), giving repair manuals and weather reports as examples of registers (rather than of genres as would most other systemicists). The actual term 'genre', nonetheless, occurs nowhere in Halliday and Hasan (1989), nor in Halliday (1985a), two extremely influential works in the systemic studies referred to earlier in this thesis, and also does not occur in Halliday's more recent (1991) paper on probabilistic interpretations where he continues to talk about "a wide variety of *registers*" (emphasis mine) (Halliday 1991, 57) .

At the same time, however, Halliday maintains in An Introduction to Functional Grammar that "a discourse analysis that is not based on grammar is not an analysis at all" (Halliday 1985, xvii). This may seem contradictory until one realises that the only discourse level aspects of

language use referred to in that particular volume are cohesive relations, which, as Hasan points out, refer to the *texture*, rather than the *structure* of a text (Hasan 1989a).

This tendency towards 'overgrammaticalisation' is, perhaps, less surprising when one considers that systemic functional linguistics, whilst calling itself a functional theory of language could, in many ways, be equally seen as formalist in its approach to language description. As Leech states:

... functionalist explanations look for relations between language and what is not language, whereas formalist explanations look for relations between the elements of linguistic text itself (Leech 1987, 76).

It is this latter position which is reflected in the majority of systemic functional examples of genre analysis. This point is supported by Hudson who concludes that there is no important difference between Halliday's goals (and, indeed, those of most other systemicists) once they are clearly analysed, and those of "other theories in the American structuralist tradition which are 'formal' ... though there is no doubt that his interests and emphases are different" (Hudson 1986, 804).<sup>15</sup>

Systemic functional theories of language, because they are motivated by a "functional theory that is both general and linguistic" (Halliday 1970, 324), find themselves at times driven to look for relationships between language and what is not language, even beyond the point that such a view is sustainable. As Fodor (1980) observes, there is a level at which one is able to describe (in grammatical terms) facts of language, beyond which there is a need to move into other theoretical preoccupations.

What seems clear is that the genre analyst needs to move away from the physical aspects of language and how they reflect reality to how the text, as a whole, is conditioned by external considerations. In the words of Todorov:

The notion of *text* is not situated on the same plane as that of *sentence* ... it constitutes a system which must not be identified with the linguistic system but put in relation to it: a relation both of contiguity and of resemblance (Todorov 1979, 294. Cited in Barthes 1981, 34).

Attempts to establish a direct relationship between language and discourse structures, such as in systemic functional examples of genre analysis recalls the early work of the Russian Formalists who, in their structuralist phase, looked for structural definitions of genres (Green 1990). Indeed, as Attridge (1987) points out:

... a description of a defining structural property can never anticipate or exhaust a culture's behaviour .... There are bound to be *many other ways* in which a set towards the message can be induced, such as a text's physical appearance or its categorisation within a particular framework (emphasis mine) (Attridge 1987, 18).

Why, then, is it that so many educational linguists have been so keen to employ systemic functional linguistics in their attempt to grammaticalise the relationship between language and structural elements in texts? Clearly, many educational linguists have failed to heed Butler's warning that:

There is a danger ... that consumers of systemic linguistics will assume that the claims made have been thoroughly tested ... this is by no means always the case (Butler 1989, 31).

Indeed, as Fodor, in Psychosemantics: The Problem of Meaning in the Philosophy of Mind, points out:

It is a deep fact about the world that the most powerful etiological generalizations hold of unobservable causes. Such facts shape our science. (They better!) It is thus a test of the depth of a theory that many of its generalizations subsume interactions among unobservables (Fodor 1987, 7).

Thus, although it is recognised in the philosophy of mind that it is beyond dispute that some categories are not represented in observable phenomena, many systemic functional linguists still maintain a rigid adherence to a contrary position. Where many systemic functional genre analysts go wrong, it would seem, is in trying to relate perceptual categories, such as the perception of textual boundaries, to textual components: that is, to the actual language of texts. Attempts to grammaticalise this relationship must be seen as the concretisation of intellectual categories, a process which both literary structuralists and Russian Formalists concluded to be impossible.

It is important, then, to emphasise that genre differences are not attributable to differences in language selection. The assumption that they are, is tantamount to the assumption that genre and language are one and the same thing (Crombie 1987). Such an assumption:

... is particularly dangerous where genre classification is assumed to be topic and/or theme related as is the case where, for example, 'religious discourse' is treated as a specific

discourse type. This is a position which may satisfy some linguisticians (although it less likely to do so in the light of recent advances in tagmemic analysis, ethnomethodology and discourse analysis); it is one one which will be unlikely to satisfy any literary theoretician (Crombie 1987, 97).

This is not to say, however, that genre analysis is not, or should not be a linguistic pursuit and is not within the domain of linguistics. Rather, it depends on how one defines the domain of linguistics. If one takes the position that linguistics is concerned with the understanding of how human beings process and use language, then it most certainly is. This does not have to mean, however, that everything that can be said about language use must relate to observable, textual phenomena.

What is at issue in systemic functional genre studies is not what kind of analysis is necessary or what level of delicacy is needed to make grammatical differences: these differences are not explicit in the text, nor can they, it appears, be made explicit. It would be inconsistent with the findings of this initial stage of the study to search for linguistic correlates of structural elements in texts.

What is now needed in systemic functional studies is a change in perspective and a different view of the concept of genre. To quote from a paper delivered by Candlin at the 19th International Systemic Functional Congress in Sydney:

... greater emphasis now needs to be placed on exploring and explaining the conditions of production and interpretation of ... text-types and the connections to be made between these conditions and these text-types .... To accomplish this ... systemic functional analysis needs to admit other traditions of discoursal and pragmatic analysis and to ground descriptions in

ethnographic study of the discorsal practices of the sites [where the texts are created] (Candlin 1992, 54).

This view is supported by Butler (1988) who points out that:

... the now substantial literature on pragmatics is all but ignored in the work of Halliday and most other systemic linguists (Butler 1988, 13).

As Hudson concludes:

Without such a change of attitude, [systemic functional linguistics] looks set to sail on into the next century as an autonomous school of linguistics unaffected by the developments in other schools (Hudson 1986, 793).

### 3.10 Further research

This stage of the study has revealed that while it is possible to make statements concerning meanings that are made in 'specific purpose' texts and the stages through which they move in order to achieve their goal, it is simply not possible to make statements about any particular typicality of language *selection* in the texts. It could, in fact, be that the designation of texts, such as those examined here, as 'specific purpose' texts, or examples of a particular genre, is not, as Bennett states, "a response to a property that is internal or natural to them but a signification that is bestowed on them from without" (Bennett 1979, 10). It is, in aiming to identify the nature of this signification, that the next stage of this study will be directed.

The next stage of the study will also investigate whether the conclusions reached in the first stage of the study regarding the

generic structure potential for the genre under examination can be sustained over a number of additional texts. Attention will also be given to the notion of 'specific purpose' vocabulary as the investigation further explores the possible place of language in a model for genre analysis.

### 3.11 Summary

This chapter has described the analysis of texts in the first stage of the study being outlined here. It has presented a generic structure potential for the Introduction section of research reports. That generic structure potential is, however, very general indeed with few apparently obligatory components and the obligatory nature of these is currently hypothetical in that the next stage of the study needs to be conducted before even any preliminary conclusion about its real nature can be reached. In the chapters which follow, then, the generic structure potential (outlined in this chapter) will be tested against further texts.

This chapter has also identified nuclear and elaborative semantic attributes in one of the structural elements in the text, Background Information. This, too, needs to be validated by further testing. It has investigated transitivity and group structures in the texts and reached the conclusion that it is not possible to make statements, at least as far as the texts studied here are concerned, about typical selections of language in particular contexts of language use.

Finally, the conclusion has been reached that systemic functional genre analyses which aim to grammaticalise the relationship between

language and the structural organisation of texts cannot be sustained and that the search for linguistic correlates of structural elements in texts may be discontinued in that there may be much to gain by a concomitant shift of emphasis.

The chapters which follow will present an analysis of the same body of texts, plus a further three exemplars of the particular genre, using a framework different from that employed here. This second stage of the study will be based on a socio-psychological, rather than social-semiotic, view on language. The main difference in this analysis will be a focus on how we perceive communicative events as instances of particular genres, in terms of how the mind is understood to store, categorise and retrieve information rather than in terms of social, or linguistic, systems. That is, the orientation of the following chapters will be towards *explanation* rather than *description*. It will also aim to reveal the *cognitive* structuring typical of the particular area of enquiry (Bhatia 1993). It will then aim to present a framework for genre analysis which accounts for the perception and assignment of communicative events as instances of particular genres.

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#### NOTES

- 1 See Appendix I.
- 2 See Appendix II.
- 3 Such as, for example, in Texts 1 and 2.
- 4 See Chapter 2, section 2.6 for a fuller discussion of the notion of semantic attributes.

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- 5 See Chapter 2, section 2.6 for the differences between 'nuclear', 'elaborative' and 'associated' semantic attributes.
  - 6 See section 2.7.2, also Halliday (1985a), Butt (1989, 1990) and Conduit and Modesto (1990) for a discussion of nominal group structure within a systemic functional framework.
  - 7 See section 3.3.
  - 8 See Halliday 1985a, pp 248-241, Butt 1990.
  - 9 For a detailed presentation of this analysis see Appendix 1.
  - 10 See, Crombie and Rika-Heke (1991) for a discussion which supports this view.
  - 11 See, for example, Halliday (1989d) where this position is very clearly expressed.
  - 12 See Halliday (1991). Also see Nesbitt and Plum (1988), Plum and Cowling (1987).
  - 13 See, for example, Corbluth (1975), Coffey (1984).
  - 14 It should be noted, however, that not everyone in the field of English for Specific Purposes would agree with Hutchinson and Waters' position. Johns and Dudley-Evans (1991), for example, in a further state of the art article on English for Specific Purposes feel that "the case made by Hutchinson and Waters is overstated" (Johns and Dudley-Evans 1991, 304). Johns and Dudley-Evans claim support for their position from a study carried out by Hansen (1988) who showed that "*rhetorical* conventions differ between anthropology and sociology" (emphasis mine) (Johns and Dudley-Evans 1991, 305). Hansen, however, based his conclusions on an analysis of only two texts and, further, did not investigate *linguistic* differences in the texts he examined. Hutchinson and Water's argument is, basically, that teachers should not confuse what students have to cope with in

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a particular situation with what they require in order to cope with it. That is, teachers should supply students with the broad-based underlying competence they need, rather than rehearsing superficial features of what will happen in the target situation (Hutchinson and Waters 1980, Swales 1988).

- 15 Note that although it is Halliday's model that has been used for the analysis here, similar conclusions would be likely to be reached with other versions of the model such as that put forward by Matthiessen (1990) in that they, too, draw for their central framework on Halliday's categorisations. The reason Halliday's model was chosen over any other here is that it is in connection with this model that the greatest claims have been made in systemic genre studies.

## CHAPTER FOUR

## WORKING WITH GENRE:

## A SOCIO-PSYCHOLOGICAL PERSPECTIVE

4.1 Introduction

This chapter will present the theoretical background for a framework for genre analysis which will aim to integrate into a single model, both social and cognitive aspects of language comprehension and production. It will, in addition, examine the place of language within such a framework. In doing so, it will draw from studies in the areas of discourse analysis, pragmatics, language and cognition, natural language processing, artificial intelligence and critical theory and practice. The framework which will then be proposed will attempt to allow for the inclusion of both more and less prototypical instances of genres as well as attempting to accommodate the relationship between instances of genres in the production and interpretation of texts.

The theoretical framework for the perspective to be proposed here draws, principally, on the work of Charles Fillmore and, in particular, his model of *frame semantics* (Fillmore 1976). A central element in the proposed framework will be the attempt to explore the question of what it is that leads users of a language to recognise particular activities as examples of particular communicative events as instances of particular genres, and what it is that leads a *discourse community* (Swales 1990) to lend particular terms, or labels, to these particular events. The key to a solution to this problem, it will be argued, lies in

the notion of *prototype*, *inheritance* and *intertextuality*<sup>1</sup>. A prototype is a very typical example of a particular object (Hurford and Heasley 1983). The work of the psychologist, Eleanor Rosch, suggests that when people categorise objects, they do so on the basis of a prototypical representation of the particular object.<sup>2</sup> An exemplar may, or may not, however, be prototypical (Swales 1990). The extent of prototypicality relates to *inheritance*. Thus, the extent to which an exemplar relates to a prototype depends upon the extent to which qualities or properties are *inherited* (Hudson 1984) from other texts. Intertextuality describes the process by which a text may "echo and reecho" aspects of other texts (Crombie 1989). This notion is important in terms of the framework for genre analysis to be proposed in this study in that it accounts for the relationship within and between instances of genres in the production and interpretation of texts.

I shall argue that the notion of prototypicality which is generally discussed largely in lexical terms, has important implications for a discussion of genre. The notion of prototype is explicitly stated in Fillmore's model. The notions of inheritance and intertextuality are, however, only implicitly present in his model and are, it will be argued, actually more important than Fillmore seems to allow.

#### 4.2 Frame semantics

Frame semantics was developed by Charles Fillmore with the aim of presenting a model of language which incorporates a description of cognitive and interactional frames according to which language users interpret their environment, formulate their own messages, understand the messages of others and accumulate, or create, an

internal model of their world. In doing so, it aims to incorporate "an awareness of the importance of the social functions of language, a concern with the nature of the speech production and comprehension processes, and an interest in the relationship between what a speaker says and the context in which he (or she) says it" (Fillmore 1976, 23). It is the second of these concerns (the concern with speech production and comprehension) that gives it a rather different focus from systemic functional approaches.

Within frame semantics, it is argued that a person has in memory a repertory of prototypes of particular frames. These prototypical idealisations may be of concepts, situations, semantic relations or they "may depend for their existence on symbolization" (Fillmore 1976, 25); that is, they may be idealisations of concepts such as colours,<sup>3</sup> situations such as eating in a restaurant,<sup>4</sup> semantic relations such as cause and effect<sup>5</sup> or they may be "conventional (in the sense of socially determined) representations of whatever it is they represent" (McNeill 1979, 5) such as forms of speech or writing and other codes of communication.

From the point of view of genre analysis, the notion of prototype has considerable appeal in that it releases the genre analyst from the task of having to produce "unassailable definitions of a particular genre" (Swales 1990, 52) with the understanding that instances of a genre will, indeed, vary in their prototypicality. They may still, however, maintain membership of this or that particular category of a genre. Swales identifies properties such as form, structure and audience expectations as characteristics by which membership of a particular category can be measured. Fillmore, however, extends the notion of prototype by also

including concepts, situations, semantic relations and instances of symbolization. The act of perception, thus, within such a framework, involves recognising in what way characteristics of this kind relate to instances of one or another prototypical example of the particular object or, it will also be argued, genre.

It is, however, by the related notion of *stereotype* (Putnam, 1975), rather than prototype, that category membership is actually established; that is, by reference to an "idealized mental representation" (Lakoff 1987, 116) which contains characteristics, or properties, which may occur in many, but not necessarily every, actual instance of the prototype; that is, by examination and reference to "family resemblances" (Wittgenstein 1953, Rosch and Mervis 1975) of the particular instance of object. Thus, for example, a robin may be recognised as a 'best example' of the category of 'bird', an ostrich, emu or penguin, less so, and a bat the least of all.<sup>6</sup>

Family resemblances alone are not, however, the only principle of prototype formation. Other factors which also contribute to prototype formation are the frequency of the items, the perceptual, social or memorial salience of the particular attributes or members of the categories as well as "as yet undefined Gestalt properties of stimuli and stimulus combinations" (Rosch 1975a, 599). Family resemblances are, however, as Rosch and Mervis demonstrate, a major factor and a perfectly feasible basis for the formation of prototypes (Rosch and Mervis 1975). Rosch's notion of prototype, together with the processes of inheritance and intertextuality, thus provides a framework for communication which allows for people to judge instances of concepts, events and genres against prototypical images stored in memory.

Figure 14 is a schematic representation of Fillmore's model, the details of which will be discussed in the sections which follow below. The arrows in the diagram represent the relationship and interaction between each of the components of the model. There are three key notions which make up the background to Fillmore's model. These are the concepts of *context*, *prototype* and *semantic memory*. This is indicated by the arrows leading from the central concept, *frame*, to each of these three key notions. A frame, in Fillmore's terms, *must* relate to all three of these key notions, but *may* relate to any one or a combination of concepts, situations, semantic relations or instance of symbolization (indicated by the arrows leading from the notion, *frame*, to each of these four further notions, then rejoining again at 'interactional' and 'cognitive/conceptual' frames).<sup>7</sup> The discussion which follows will focus principally on the areas of context, prototype and semantic memory, as well as on the central notion of *frame*, itself, including interactional and cognitive/conceptual frames.

#### 4.3 Frames

Fillmore's notion of frame draws from work carried out in the areas of cognitive science and artificial intelligence such as that of Bartlett (1932), Minsky (1975), Winograd (1975) and Bower (1972). Frames, for Fillmore, are "a kind of outline with not necessarily all the details filled in" (Fillmore 1976, 29); that is, they are "knowledge representations about the "world" which enable us to perform basic acts of perception, action and language comprehension" (van Dijk 1981, 19) and represent knowledge "about properties of objects, courses of events and actions which typically belong together" (van Dijk 1977, 159). These outlines

guide comprehension and provide a framework for making sense of new experiences (Nunan 1991). The technical definition of *frame* "has evolved to mean something like a *fixed set of named slots whose values vary across applications*" (Barsalou, 1992, 28).

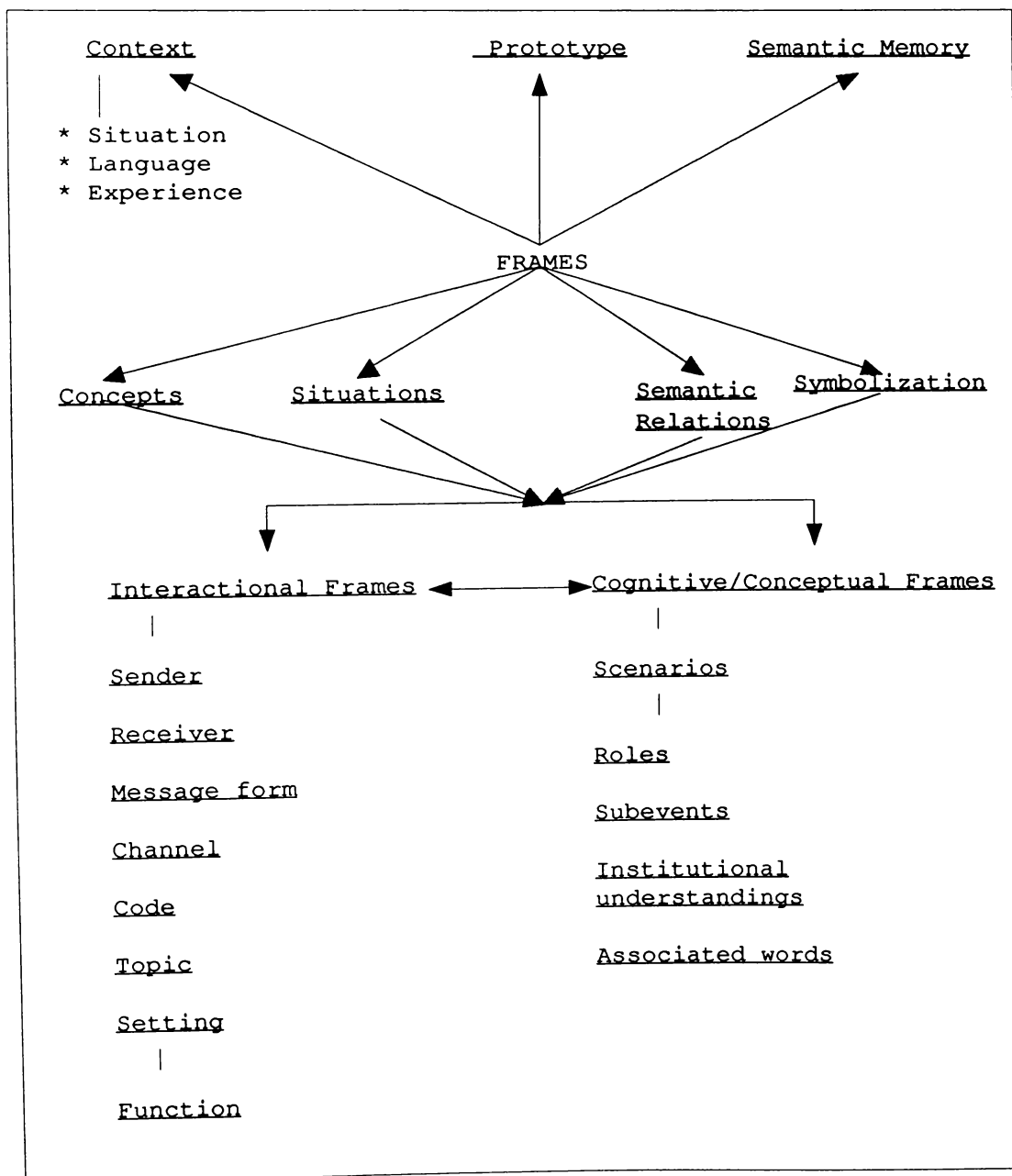


Figure 14: Frame semantics: Fillmore model

Examples of frames are general, but culture dependent, knowledge of the organisation and conventions of restaurants,<sup>8</sup> going to a child's birthday party or being in a certain kind of room.<sup>9</sup> They are, in the words of Widdowson, "crucial to an understanding of how we project perceptual and conceptual order on reality" (Widdowson 1983, 67).

Frames, furthermore,:

... not only provide a natural means of representing specific exemplars but also of representing general information across exemplars (Barsalou, 1992, 47).

Frames are not, however, just chunks of knowledge. They are, rather, "units of conventional knowledge according to which mutual expectations and interactions are organised" (van Dijk 1981, 21). They are, thus, an *organisational principle* which relate concepts which somehow, by convention and experience, belong together (van Dijk 1977). These concepts may then be "actualised in various cognitive tasks, such as language production and comprehension, perception, action and problem solving" (van Dijk 1977, 159).

According to frame semantics, language users have, or rather acquire, a repertory of frames and mental processes for operating with them. Language users are, equally, able to create new frames and to transmit them. Language users, via this repertory, or inventory, of frames, thus, structure, classify and interpret experiences as well as access their repertory of frames in order to structure and create new communications of their own.

Frame semantics is, thus, a view of language perception and production in the same line of tradition as schema theory and script theory. Schema theory was first presented by the psychologist Bartlett (1932) as an explanation for how readers/listeners draw on background knowledge and past experiences to understand and recall text.

Rumelhardt describes schema theory thus:

A schema theory is basically a theory about knowledge - a theory about how knowledge is represented and about how that representation facilitates the use of language in particular ways. According to schema theories, all knowledge is packaged into units. These units are schemata. Embedded in these packets of knowledge, in addition to knowledge itself, is information about how this knowledge is used. A schema, then, is a data structure for representing our knowledge about all concepts ... (Rumelhart 1984, 23).

Script (or conceptual dependency) theory draws from work in artificial intelligence<sup>10</sup> and aims to describe the knowledge people have of stereotypical event sequences in such a way as to serve as a theory of how humans process language as well as to provide descriptions that can be programmed and computer simulated (Hatch 1992). *Scripts* include "a set of actions in temporal sequence to meet a *goal*" (Hatch 1992, 85). All scripts, furthermore, incorporate "typical roles exhibited by individuals in the script" (Hatch 1992, 86) and a series of *props* associated with the particular event, such as in a grocery shopping script, signs, scales, checkout registers etc (Hatch 1992).

The similarity of frame semantics to schema theory and script theory lies in its psychological basis as well as the fact that each of these theories aim to present schematic frameworks for the organisation and

creation of meaning in texts. The psychological basis of these models is especially important in that they are, each of them, "concerned with how people acquire and represent knowledge about their world (and) how they organise and use that knowledge" (Bower and Cirilo 1985, 71).

Fillmore's concern is with the nature of language production and comprehension processes, *as well as* the social function and contextual basis of language. It is, this, together with his attention to the detail of *both* social (interactional) *and* psychological (cognitive/conceptual) aspects of frames, that differentiates Fillmore's work not only from schema and script theory, but also from systemic functional-based genre analysis. Another significant difference between Fillmore's model and schema and script theories is Fillmore's use of the notion of prototype, as well as his use of the notion of inheritance. Fillmore also stresses a general psychological, rather than purely linguistic perspective on intertextuality.<sup>11</sup>

#### 4.3.1 Interactional and cognitive frames

Fillmore describes two specific kinds of frame which are particularly relevant to the discussion here. These are *interactional frames* and *cognitive, or conceptual, frames*. These frames are not, however, separate or isolated from each other but are, rather, in constant interaction with each other. This constant interaction is illustrated in Figure 14 by the bi-directional arrows between interactional and cognitive/conceptual frames. In Fillmore's view, the knowledge of any language includes the knowledge of a range of such frames and a knowledge of what particular language is associated with each of these frames.

*Interactional frames* derive from work in ethnomethodology and, in particular, from Hymes' notion of the ethnography of speaking (Hymes 1962). Hymes describes a number of aspects of communication which contribute equally to communicative events. These are the *constituent factors* of communicative events and the *functions* of communicative events. The *constituent factors* of communicative events in Hymes' framework consist of:

- (i) the sender of the message;
- (ii) the receiver of the message;
- (iii) the form of the message (that is, the language of the communicative event, such as English, French or Japanese etc);
- (iv) the channel of communication (such as writing or speaking);
- (v) the code of communication (the dialect or variety of the particular language);
- (vi) the topic;
- (vii) the setting (including the scene and situation).

Other, more recent, descriptions of Hymes' framework vary slightly in their organisation and arrangement of these factors.<sup>12</sup> These descriptions are based on Hymes' later writings.<sup>13</sup> I have taken here,

however, the original framework referred to by Fillmore; that is, the constituent factors of communicative events described in Hymes (1962).

An example of an interactional frame is a greeting frame, where it is clearly specified who initiates the greeting, who it is directed to, what topics and expressions can be included, in what contexts and under what conditions it can occur and what is its general purpose, or function (Fillmore 1976).

*Cognitive, or conceptual, frames* are the semantic domains which relate to particular communicative events. Each frame, furthermore, contains certain *scenarios* which, in turn, contain particular *roles*, such as 'buyer' and 'seller' in a 'buying and selling' frame (Fillmore 1977).

Actions within these scenarios are described as *sub-events*. Cognitive frames also include *institutional understandings* of what takes place in particular events and key words which are associated with the particular event. Cognitive frames can be accessed, or activated, by these associated words, such as the words 'buy' or 'sell' etc in the case of a 'buying and selling' frame. Indeed, words such as 'buy' and 'sell' do not have any meaning until the language user has a frame, such as, for example, 'commercial activity' to which to relate these words. Associated words, then, have the capacity to activate the much broader frame and draw a relevant context to the mind of the language user. Particular words, thus, become associated in memory with particular frames, as well as with who is involved in the interaction, what happens and with understandings and expectations of how the event will proceed.

Table 18 (based on Saville-Troike 1989) is an example of the interactional and cognitive frames associated with a particular communicative event.<sup>14</sup> The *frame* is a Japanese marriage proposal, with an accompanying *scenario* which incorporates certain *roles*, a (male) 'Proposer' and a (female) 'Proposed to'. The scenario also includes certain steps or *subevents* through which the event should move and a number of norms of interaction or, *institutional understandings*, all of which should hold for the event to 'work' or be *felicitous* (Austin 1962).<sup>15</sup> Some of the exact specifications of these components of the framework may, however, vary. An illustration of this is that when the Japanese Crown Prince Naruhito proposed to his bride to be she did not accept the proposal immediately but took nearly three months to give a reply. He did, however, use the words "Will you please marry me" (Asahi Newspaper 1993). His younger brother, when he proposed to his bride to be, less directly, used the words "Will you become with me" (Asahigraph 1990). It is also not unusual, in Japan, for a female to propose to a male, but in a less direct way than saying, for example, "Will you marry me?" It is, important, thus, to recognise that Saville-Troike's example is an idealised version of how such an event might take place. For the purposes of the discussion here, it does, however, present clear examples of each of the categories in Fillmore's model.

Fillmore's notions of interactional and cognitive frames, thus, draw together work in ethnomethodology, pragmatics and artificial intelligence: they represent an attempt to achieve a synthesis of each of

*Table 18. Interactional and cognitive frames: an example (Japanese proposal of marriage)*

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|                                     |                                                                                                                                                                                                          |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>Frame:</u>                       | A Japanese marriage proposal                                                                                                                                                                             |
| <u>Interactional frames:</u>        |                                                                                                                                                                                                          |
| <u>Sender:</u>                      | Male, young adult                                                                                                                                                                                        |
| <u>Receiver:</u>                    | Female, young adult                                                                                                                                                                                      |
|                                     | (occupation and status not relevant)                                                                                                                                                                     |
| <u>Message form:</u>                | Japanese                                                                                                                                                                                                 |
|                                     | Kinesics, eye gaze                                                                                                                                                                                       |
| <u>Channel:</u>                     | Spoken, non-verbal, silence                                                                                                                                                                              |
| <u>Code:</u>                        | Standard Japanese                                                                                                                                                                                        |
| <u>Topic:</u>                       | Proposal of marriage                                                                                                                                                                                     |
| <u>Setting:</u>                     | May vary but usually somewhere quiet such<br>as in a restaurant, a park etc                                                                                                                              |
| <u>Function:</u>                    | To declare intention to marry.<br><br>To establish or develop an appropriate role<br>relationship.                                                                                                       |
| <u>Cognitive/conceptual frames:</u> |                                                                                                                                                                                                          |
| <u>Scenario:</u>                    | A proposal of marriage                                                                                                                                                                                   |
| <u>Roles:</u>                       | Proposer (male)<br><br>Proposed to (female)                                                                                                                                                              |
| <u>Subevents:</u>                   | 1. Male takes female's hand (optional).<br>2. Male looks at female.<br>3. Male says 'Please marry me'<br>4. Female stands with head down.<br>5. Silence.                                                 |
| <u>Institutional</u>                |                                                                                                                                                                                                          |
| <u>Understandings:</u>              | A man must propose to a woman.<br><br>At an emotional climax, there should be silence.<br><br>The woman's head should hang down, and the<br>direction of her eye gaze should be lower than<br>the man's. |
| <u>Associated</u>                   |                                                                                                                                                                                                          |
| <u>words:</u>                       | 'Will you please marry me'                                                                                                                                                                               |

---

these approaches giving, in Widdowson's words, "due recognition to both the conventional and creative features of natural language use" (Widdowson 1983, 77). There is, therefore, within a single model, an integration of socio-pragmatic, ethnomethodological and psychological approaches to language comprehension and production. This approach has the potential to provide an integrated basis for a genre analysis framework.

#### 4.4 Frames and context

The next key notion in frame semantics is *context*. There are three key aspects of the notion of context which, for Fillmore, are crucial to the concept of framing. These are:

- (i) the "real-world" situation in which the language is produced;
- (ii) the language which surrounds the language in discourse, or, the *co-text* ;<sup>16</sup>
- (iii) the experiences, or percepts that make up the base of a user's understanding of a word;

that is, the pragmatic, linguistic and perceptual context of the language.

Beyond these three particular aspects of context, Fillmore describes three levels of knowledge or ability which combine to enable language users to communicate successfully. These are:

- (i) an actual ability to express language;
- (ii) an awareness of the communicative function of utterances;
- (iii) an understanding or knowledge of appropriate and meaningful contexts in which a particular utterance can be used to achieve a particular purpose;

that is, language ability, functional awareness and pragmatic knowledge.

An important point Fillmore makes is that, although this may seem a very complex situation from an analyst's point of view, this is not necessarily the case from a language user's point of view. This position is supported by Goldstein and Scheerer, and Arnheim whose work on behaviour and perception demonstrates that acts and judgements that occur naturally in context are, in fact, cognitively less complex than those which are abstracted from context (Goldstein and Scheerer 1941, Arnheim 1969).

Fillmore stresses the relevance of context and perception thus:

... the meanings of words may, more than we are used to thinking, depend on contexted experiences; that is, the contexts within which we have experienced the objects, properties or

feeling that provide the perceptual or experiential base of our knowledge of the meaning of a word (or phrase, or grammatical category) may be inseparable parts of those experiences. ... the process of interpreting an utterance may depend, more than we are used to thinking, on our perception of the context in which the utterance is produced and our memories of the contexts for earlier experiences with the utterance or its constituent parts (Fillmore 1976, 24).

Evidence of this comes from work in child language acquisition where, for example, in a study carried out by Leopold, the child involved refused to accept that the word *white* could be used for a blank sheet of paper as she had only, prior to then, associated it with snow<sup>17</sup> that is, she had assumed the word occurred in a narrower range of contexts than it, in actual fact, does.<sup>18</sup> The meanings we share in language, thus, may depend, more than has sometimes been allowed, on the relationship between memory, context and perception (Aitchison 1987).

#### 4.5 Frames and prototypes

Another key notion in frame semantics is the concept of *prototype*. This concept is, in many ways, the central notion so far as the framework for genre analysis to be proposed here is concerned. This notion is present in Swales' working definition of genre although it is not, even there, given the prominence that, it will be argued, it should be allowed.

Prototype theory derives from the work of the semantic theorist Erdmann, the philosopher Wittgenstein and the psychologist, Eleanor Rosch.<sup>19</sup> Prototype theory aims to explain why people and cultures categorise the world in the way they do. According to prototype theory,

people categorise objects according to a prototypical image they build in their mind of what it is that represents the object in question. As Grandy summarises:

This conception of categorisation was originally proposed for perceptual categories by Wertheimer (1938) and generalized by Attneave (1957) but was only systematically explored in the 1970s, probably under the stimulus of Berlin and Kay (1969), Posner and Keele (1968), and Reed (1972) (Grandy, 1992 112).

It was then brought into prominence in the work of Rosch. Rosch's theory is in direct contrast to classical theories of categorisation where items were believed to be reducible to a number of essential components, or primitives and where it was argued that there were:

- (i) clear and inflexible boundaries between categories without borderline cases of any kind;
- (ii) shared properties as a condition of membership;
- (iii) uniformity amongst all category members;
- (iv) strictly objective conditions for category membership.<sup>20</sup>

Rosch's experiments disproved these classical theories of categorisation and led to a theory of "natural categorisation" (Rosch 1977) wherein people are shown to categorise in relation to prototypes which have a common core at the centre and fade off at the edges.

Rosch's prototype semantics, furthermore, challenges the validity of 'checklist theory' by claiming that concepts cannot be reduced to the sum of simple components: they depend, rather, on a prototype that is

conditioned by sociocultural factors. Rosch's most commonly cited example of birds<sup>21</sup> demonstrates how people have in mind a prototypical image against which to match actual instances. This, plus the notion of 'family resemblances', allows language users to see instances as being more or less typical of a particular category. Rosch's experiments demonstrate, furthermore, that when people think of a member of a particular category, they generally think of typical instances of that category (Anderson 1985). As Grandy states:

An informal intuitive characterisation of a prototype for a category would be an item that would be a "good example" of the category (Grandy 1992, 112).

Other experiments have also indicated that people do make distinctions between 'good examples' of a category and those which are more marginal in their membership.<sup>22</sup> They have shown, furthermore, that children, like adults, learn meanings by picking on a prototypical example which they then analyse and matching "other possible examples of (the) category against the characteristics of the prototype" (Aitchison 1987, 92). If there is sufficient agreement, they then assign membership of the example to the same category.

To summarise:

Prototype Semantics contrasts with ... 'checklist' theories in holding that ... meaning is associated with a cognitive schema, or prototype, which may or may not consist of a list of features, or elements. Where such a list is an apt representation of a prototype, the prototype itself consists of the full application of all elements, and objects matching the prototype are 'best examples' of the category. However, other objects within the category may

match the prototype to varying degrees. The absence of an element, (however), does not necessarily remove the object from the category; elements may apply to greater or lesser degrees, and some may contribute more to category membership than others. Category membership is thus gradient rather than absolute (Coleman 1992, 289).

Categories do not, thus, have fixed, clear-cut boundaries, a point also supported by Labov.<sup>23</sup> This notion of *fuzziness*<sup>24</sup> or *blurred edges*<sup>25</sup> is central to the notion of prototypes. The example provided by Fillmore of the word 'bachelor' as applied to the Pope, gives a clear example of Rosch's theory in that the Pope may be an unmarried adult male (the semantic components of the word 'bachelor'), but does not represent a prototypical image of a bachelor being, rather, a borderline, or 'blurred edge' example of the category 'bachelor'.

If the categorisation of individual language items and concepts is based on a system of relations between instances and their models, with qualities, or properties, of the model being selectively inherited by their instances, the same, too, could be said for genres. Thus, the closer the representation of a genre is to the prototypical image of the genre, the clearer an example it will be as an instance of that particular genre. The further away it is from the central prototypical image, the more fuzziness there will be and the less clear-cut an example of the particular genre the representation will be. Examples of research articles in journals such as *Nature* and *Scientific American*, for example, where research reports are presented as 'letters to the editor' rather than as 'typical' research reports represent cases in point. These texts, thus, if subjected to the defining features criteria<sup>26</sup> implied in Hasan's systemic functional model of genre analysis, would fail to

qualify as examples of the genre 'research article' when matched against the vast majority of research articles published across the world in scholarly journals. A prototypical theory of categorisation, however, allows for the inclusion of such cases within the umbrella of the one single genre by basing deviations from the central prototypical core on how the world sees particular instances of a genre, rather than the much less flexible approach held in classical theories of categorisation where "entities are classified into sets with clear-cut boundaries and where an entity is seen as either belonging or not to a set" (Forbes 1992, 378-379).

Central to this cognitive approach to the identification of genres, then, is the argument that meaning "is determined by cognitive structures outside language" rather than "by the relation of signs within a language" (Forbes 1992, 379). Within such a framework, instances of genres are assigned to particular categories, not on the basis of a response to a property that is internal to them, but on the basis of "a signification that is bestowed on them from without" (Bennett, 1979, 10); that is, on the basis of pragmatic and perceptual, rather than linguistic, aspects of communicative events. This perspective contrasts strongly with the systemic functional view of genre assignment where texts are seen as being different because of different *contextual configurations* of field, tenor and mode and, as a consequence, different linguistic realisations (Hasan 1989a).

There are, it is agreed, however, problems with the actual specification of prototypes. Aitchison lists three particular problems and Forbes another. These are:

- (i) the difficulty of identifying the characteristics, or properties, of a prototype and the diversity of these characteristics or properties (Aitchison 1987);
- (ii) the difficulty of arranging these characteristics or properties in an order of priority (Aitchison 1987);
- (iii) the difficulty of knowing where a prototype stops (Aitchison 1987);
- (iv) knowing why some members of a category should be better members of one category than another (Forbes 1992).

Akmajian, Demers and Harnish also raise problems with prototype theory, citing research that highlights the difficulties of discovering the structures of categories experimentally (Akmajian, Demers and Harnish 1987). However, none of these difficulties invalidates prototype theory. They simply point to the need for more detailed research of the kind carried out by Rosch and her colleagues, and studies such as those described in Tsohatzidis' (1990), and Lehrer and Kittay's (1992) collections of papers on the application of prototype theory to different linguistic concerns.

As Geerhardts states, however,

... [even though] the approach is only beginning to take shape, and a considerable number of topics require clarification, ... there can be no doubt about the growing success of the prototypical model of conceptual structure (Geerhardts 1989, 606).

#### 4.6 Frames, semantic and episodic memory

The final key concept in frame semantics is what Fillmore calls *semantic memory*. This term is used in Fillmore's work rather differently from the way in which it is generally used elsewhere in the literature. Semantic memory for Fillmore is the network of interlinked relationships representing items of knowledge and the ways in which these items of knowledge are integrated into a model, or image, of the world. This model, or image, includes a record of a person's beliefs about the world, their past experiences, knowledge of their place in space, time and society, together with their version of the world models or images of other relevant people in their environment.

Communication is, thus, seen as an interaction between individuals' models, or images, of the world, involving appeal to contexts, frames and prototypes.

The term, 'semantic memory', elsewhere in the literature,<sup>27</sup> however, refers to a hierarchical way of establishing class membership such as in a network approach to categorisation or the organisation of memory according to abstract semantic categories. The term 'episodic memory', as used by Schank and Abelson (1977),<sup>28</sup> describes the organisation of propositions which are linked together by occurrence in some event or time span. An episodic view of memory, furthermore, holds that "memory is organised around personal experiences or episodes rather than around abstract vs semantic categories" (Schank and Abelson 1977, 17).<sup>29</sup> Notwithstanding the differences of detail, Schank and Abelson make it clear, as does Fillmore, that memory and language are inextricably bound together.

If memory is organised around personal experience then one of the principal components of memory must be a procedure for recognising repeated or similar sequences. When a standard repeated sequence is recognised, [memory] is helpful in "filling in the blanks" in understanding. Furthermore, much of the language generation behaviour of people can be explained in this stereotyped way (Schank and Abelson 1977, 18).

Furthermore,

Some episodes are reminiscent of others. As an economy measure in the storage of episodes, when enough of them are alike they are remembered in terms of a standardised generalised episode which we will call a script (Schank and Abelson 1977, 19).

*Episodic memory*, then, contains the records of a language user's own experiences, whereas *semantic memory* (in Schank and Abelson's terms) "reflects the inherent patterns of organisation of knowledge", that is, "what is true of the world at large and how it all fits together" (Beaugrande and Dressler 1981, 89). *Episodic memory*, thus, for Schank and Abelson, is related to actual, original events and semantic memory to instances the events have in common. Episodic and *semantic memory*, thus, represent "two different principles of storing and utilizing knowledge" (Beaugrande and Dressler 1981, 89).

As Schank and Abelson state, however, "the whole question of episodic vs semantic memory is controversial" (Schank and Abelson 1977, 19). Nevertheless, whether they are essentially separate or integrated, it is clear that both concepts are required in order to explain prototype formation and, thus, to provide an adequate basis for the discussion of genre. Indeed, if we remember in terms of episodes and these episodes,

via the processes of semantic memory, lead to the formation of prototypes of particular genres, then perhaps this is what we have in mind when we talk about a particular genre; that is, a prototype formed on the basis of the experiences we have had with other similar such texts.<sup>30</sup>

Finally, as Fillmore states, every experience:

... is remarkable precisely because the experience has some cognitive schema or frame for interpreting it. This frame identifies the experience as a type and gives structure and coherence - in short meaning - to the points and relationships, the objects and events, within the experience (Fillmore 1977, 26).

The inclusion of the notion of semantic memory in the framework to be proposed in this study is particularly important as it may well be that it is this bringing together, in memory, of these key aspects of communication events which leads us to the identification and description of communicative events as instances of particular genres.

#### 4.7 Intertextuality and inheritance

Two notions which are central to an understanding of the relationship between frames are *intertextuality* and *inheritance*. Both of these notions are discussed in the sections which follow.

##### 4.7.1 Intertextuality

Beaugrande and Dressler describe intertextuality as:

... the factors which make the utilisation of one text dependent upon knowledge of one or more previously encountered texts (Beaugrande and Dressler 1981, 10).

Indeed, in the words of Lemke:

What is often missing in contextual models ... is reference to intertextual contextualisation.... It is not just by construing semantic relations to the immediate textual, or even situational, context that we make a word or phrase mean. It is also by construing relations to other texts and situations in which that word or phrase has been used (Lemke 1988, 165).

This notion of intertextuality is crucial to Fillmore's model in that it accounts for the relationship within and between scenes (which include scenarios) and frames (Fillmore 1977).<sup>31</sup> For Fillmore, scenes and frames operate in such a way that a certain frame may activate a particular scene, which may in turn activate another frame which may, then, activate yet another scene, and so on (frame-scene, scene-frame, scene-scene, frame-frame etc) (Snell-Hornby 1988). This interaction and activation process between scenes and frames illustrates in one further way why Fillmore's model is again more satisfactory than either schema theory or script theory: it provides a framework for explaining the complexity of the activation process in situations where, working with schema or script theory alone, it would not always be clear which frame might be selected to guide comprehension or production.

Such an example is cited by Brown and Yule (1983) who describe the beginning of a newspaper article:

The Cathedral congregation had watched on television monitors as Pope and Archbishop met, in front of a British Caledonian helicopter, on the dewy grass of a Cathedral recreation ground (*The Sunday Times*, 30 May 1982, cited in Brown and Yule 1983, 240).

As Brown and Yule point out, this situation potentially contains a 'cathedral' frame, a 'television watching' frame, a 'helicopter' frame and a 'recreation ground' frame. Fillmore's solution to this problem is that any number of scenes or frames may be activated in the comprehension and production process. Each of the scenes or frames selected foregrounds its own particular aspect of the communication context. Comprehension in such contexts may then be the result of the activation of a matrix of *interrelated patterns* of scenes and frames, rather than just the activation of one scene, or frame, or another.

Fillmore does not, however, restrict the notion of intertextuality to whole texts or to areas of background knowledge as might perhaps be inferred from the statements taken from Beaugrande and Dressler and Lemke above. He, rather, extends the notion of intertextuality to words *within* scenes and frames. He points out that:

We sometimes find that a single word has concurrently more than one frame, even though the same history of experiences was responsible for both frames (Fillmore 1976, 26).

so that:

... any sentence containing one of these words could have the effect of introducing other frames (Fillmore 1976, 28).

An example Fillmore provides of this process is the use of the words 'breakfast' and 'money'. Each of these may be common to a large number of different frames and may bring up different frames for different people.

An equally important example of intertextuality is provided by Griffith who discusses the notion thus:

If someone says "The word 'fanbelt' makes me think of strawberries", that can perhaps be written off as a quirk or aberration.... However, if I use the word 'fanbelt' a couple of pages from now, there is some slight possibility that you will think of strawberries as a result of reading that passage.... In this fairly trivial example, then, we can see a very simple instance of the way in which one text can leave traces on another (Griffith 1987, 42).<sup>32</sup>

This echoing and reechoing of other texts can, thus, occur in a variety of different ways .

It is in the area of critical theory and practice, however, rather than in linguistics, that the notion of intertextuality is further developed. For example, the American deconstructionist, Bloom, regards "every text as inherently an intertext and every poet as inescapably influenced by precursors" (Leitch 1983, 139). For poststructuralist analysts such as Foucault, this produces "an inevitable and inescapable network" (Leitch 1983, 150) which draws from its "dependence on an infiltration by prior practices, concepts, conventions, unconscious practices and texts" (Leitch 1983, 161). Foucault, thus, sees writing as not being a private or free creative process, but rather the activation of "a complex historical archive" that effectively delimits what may or may not occur

in a text, to whom it may be addressed and so on (Leitch 1983). Indeed, Foucault's theory of intertextuality includes all "economic, social, intellectual, ideological, moral, institutional, and political thoughts and limitations that constitute and regulate the life of society" (Leitch 1983, 157). This "comprehensive cultural discourse", thus, "determines the production of any new text" (Leitch 1983, 157) in that "every text emerges out of, through and back into (this) complex cultural network" (Leitch 1983, 157). Finally, the notion of intertextuality is further extended by Derrida who, in his discussion of readings of texts, points out that there is no such thing as *the* single meaning, correct or right meaning of a text but rather only an individual's own reading, or intertextuality (Birch 1989). Indeed, as Birch says :

... no matter how appropriate you think your reading to be, there is no way that you can make that reading the 'correct' one by implying or declaring it to be the same as the writer's (Birch 1989, 25).

Furthermore,

Different cultures, societies, and individuals classify and understand the world in different ways and this recognition needs to be a crucial part of the thinking involved in a *dynamic* textual interpretation (Birch 1989, 25).

The notion of intertextuality is, thus, crucial to the concept of frames in that it accounts for the relationship within and between frames, as well as between instances of genres in the production and interpretation of texts.

#### 4.7.2 Inheritance

Beaugrande and Dressler describe *inheritance* as "the translation of knowledge among items of the same or similar type of sub-type" (Beaugrande and Dressler 1981, 91) and point to three particular kinds of inheritance. They describe these three kinds of inheritance thus:

- (i) An instance inherits all the characteristics of its class unless expressly cancelled. For example, we assume that Napoleon had toes even though nobody has ever told us so, because Napoleon is an instance of the class 'human beings';
- (ii) Subclasses inherit from superclasses only those characteristics that the narrower specification of the subclasses allows. For example, the subclass of 'ostriches' differs from the superclass of 'birds' in being unable to fly, but able to run extremely fast;
- (iii) Entities can inherit from those with which they stand in analogy; that is, they are of different classes but comparable in some useful respects. For example, researchers in cognitive science and artificial intelligence make assumptions about the human mind by analogy with the computer. Without claiming that minds and computing machines are the same thing, they can still discover comparable characteristics that are helpful in building complex models of cognition. (Beaugrande and Dressler 1981).

The relationship between inheritance of properties and prototypes is further expanded upon by Hudson who describes the "inheritance-of-

properties principle" as being "of great benefit not only to practising linguists (who can use it for making generalizations), but also to the practising speaker/hearer" as the speaker/hearer gains "access to the information they already have about the model as soon as they link the instance to the model" (Hudson 1984, 16).

These notions of intertextuality and inheritance are crucial to the framework to be proposed here and, in particular, to explaining the relationship between instances of genres in the production and interpretation of texts. The notions of intertextuality and inheritance are, of course, implicit in the writing of Halliday. It is not, however, a notion that is exploited to any great extent in that, for systemic linguists, a text *has* meanings which may be *discovered* by reference to a particular context of situation (within a particular context of culture) or, rather, the linguistic encodings of a particular contextual configuration of 'field', 'tenor' and 'mode' (Halliday 1989d, Hasan 1989a). It may be, of course, that for a particular interpretative community, this view essentially works most of the time. Even so, it is perfectly clear that the notion of an interpretative community is, itself, an idealisation and that, therefore, there can be no guarantee of interpretative co-incidence. It is clearly the case that whereas scripts and frames guide interpretative practices, they do not - given the complexity of selection processes - guarantee semantic stability. In particular, a new member of an interpretative community will not necessarily have access to all of the scripts and frames available to others.

#### 4.8 Frames, schemata and genre analysis

To summarise, frame semantics is a view of language which aims to integrate the notions of interactional and conceptual schemata, or (frames), and pragmatic, linguistic and perceptual contexts which operate together in the formation of prototypes. Framing, thus, can be seen in part as an elaboration of schema-theoretical views of language comprehension and production.<sup>33</sup> What the framework for genre analysis to be proposed in the following chapter, however, adds to such theories is the explication of the relationship between memory, context and frames and the notion of prototype as a principle of selection and organisation of genre frames.

The notion of prototype (together with the associated notions of intertextuality and inheritance) is, thus, an essential central element of the framework for genre analysis to be proposed in the following chapter. Indeed, if the establishment of genres could be taken to operate by a process of prototype formation, with the associated concepts of fuzzy edges and inheritance, it could well be that this is a *sufficient* condition (Lemmon 1965) for the establishment of communication. Genres, indeed, it will be argued, are neither more nor less than fuzzy-edged frames. Assigning a text to a prototype genre, however, does not necessarily involve an exact match in terms of characteristics or properties. Rather, it involves the notion of 'sufficient similarity'. In the absence of a sufficient number of properties which match the stereotypical properties of the prototype, we then assign texts on a *pragmatic* basis; that is, on the basis of whether conditions such as, in the case of research reports, the text was written by a researcher in the field and appears in a scientific journal etc.

Examples of such a situation are the scientific reports described above which appear in *Nature* and *Scientific American*. Similar examples can also be found in the work of the philosophers Wittgenstein and Austin. Wittgenstein's writings, for example, are accepted as books on the philosophy of language, even though they are written in terms of a series of short episodes<sup>34</sup> and Austin's most influential book, *How to do Things With Words*<sup>35</sup> is actually the transcript of a series of lectures. Both of these books, however, are accepted as major works on the philosophy of language, even though they both depart significantly from the stereotypical characteristics of the particular prototype genre. Thus, in the absence of the stereotypical properties of the particular prototype genre, it is argued, we then draw on *pragmatic* criteria alone to assign category membership for the particular text.

Just as Rosch's work suggests that when people categorise objects, they do not *expect* them to be on an equal footing, so it is argued here that texts are assigned as instances of genres without that expectation. The framework to be proposed in the next chapter will be tested in relation to a group of texts which seem intuitively to belong to the same genre, notwithstanding the fact that they could not be assigned the same genre category membership on the basis of a defining features analysis such as that implied in some of the studies to which reference was made in Chapter 2. The framework for genre analysis to be proposed in the next chapter will aim to *explain* not only how people deal with *typical* instances of a genre, but also *how* and *why* they assign texts to genres in the absence of those features which are found, on analysis, to be present in most instances which are intuitively seen as typical. A *pragmatic* assignment (that is, one based on who wrote the text, where

it appears etc), thus, occurs in the absence of a significant number of the stereotypical properties of the prototype.

#### 4.9 Summary

This chapter has outlined the background to a framework for genre analysis which will be presented in the next chapter of this study. The chapter has described the basis for the framework which draws from work in the fields of discourse analysis, pragmatics, language and cognition, natural language processing, artificial intelligence and critical theory and practice. It has given details of key aspects of this framework including the notions of context, prototype, semantic and episodic memory and interactional and cognitive frames. The chapter has also examined the relationship *between* frames in its discussion of the notions of intertextuality and inheritance. The next chapter will propose a framework for genre analysis based on work in these particular areas. It will also present an interim analysis as an example of how the framework may be applied to provide an explanation for genre assignment. This proposed framework will then be tested against a further number of 'specific purpose' texts in the chapter which follows (Chapter 6).

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#### NOTES

- 1 See sections 4.4 and 4.6.
- 2 For details of Rosch's work on prototypes see Rosch (1973a, 1973b, 1974, 1975a, 1975b, 1975c, 1976, 1976, 1977, 1978), Rosch & Mervis

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(1975). See also section 4.6 for further discussion of the notion of prototype.

- 3 See, Rosch (1973a, 1973b).
- 4 Van Dijk (1977), Schank and Abelson (1977).
- 5 See Crombie (1985a).
- 6 See Rosch (1975a) for details of the experiment on which this is based.
- 7 See section 4.3.1.
- 8 See van Dijk (1977).
- 9 See Minsky (1975).
- 10 See, for example, Schank (1972, 1984), Schank and Abelson (1977), Schank and Riesbeck (1981), Abelson (1981).
- 11 See Halliday (1989b) and Kress (1989) for linguistic perspectives on the notion of intertextuality.
- 12 See, for example, Coulthard (1985), Saville-Troike (1989).
- 13 For example, Hymes (1967, 1972).
- 14 The material on which this analysis is based was collected by Harumi Williams (Saville-Troike 1989, 164-165).
- 15 See Chapter 5, section 5. 3 for a discussion of the relationship between felicity conditions and frames.
- 16 See Brown and Yule (1983).
- 17 Leopold (1948), in Bar-Adon and Leopold (1971).
- 18 This example is cited in Aitchison (1987).
- 19 See Erdmann (1910), Wittgenstein (1953), Rosch (1973a, 1973b, 1974, 1975a, 1975b, 1975c, 1976, 1977, 1978), Rosch and Mervis (1975). See also Aitchison (1987), Lakoff (1987), Taylor (1989), Geerhardts (1989).
- 20 Snell-Hornby (1988).
- 21 See Rosch (1977).
- 22 See Rosch (1977, 1983), Kay and McDaniel (1978).

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- 23 See Labov (1973).
- 24 See Bolinger (1961), Quirk (1965), Labov (1973), Leech and Coates (1980), Channell (1980, 1983).
- 25 See Wittgenstein (1953).
- 26 For a discussion of 'defining features' see, for example, Clark and Clark (1977), Smith, Shoben and Rips (1974).
- 27 See, for example, Clark and Clark (1977), Schank and Abelson (1977).
- 28 See Schank and Abelson (1977).
- 29 It should be noted, however, that Fillmore's use of the term 'semantic memory' is closer in use to Schank and Abelson's 'episodic memory' than their use of the term 'semantic memory'. That is, both Schank and Abelson's 'episodic memory' and Fillmore's 'semantic memory' refer to an individual's experiences of the world.
- 30 See section 4. 8 and Chapter 5 section 5. 2 for further discussion of how it is that texts might become recognised as instances of a particular genre.
- 31 In his 1977 paper, Fillmore describes scenes as *including* scenarios as well as other sorts of visual scenes, interpersonal interactions, familiar layouts, institutional structures, enactive experiences and body images. That is, "any kind of coherent segment, large or small of human belief, actions, experiences or imaginings" (Fillmore 1977, 63).
- 32 Quoted in Crombie (1990).
- 33 See section 4.3.
- 34 See, for example, Wittgenstein (1953).
- 35 Austin (1962).

## CHAPTER FIVE

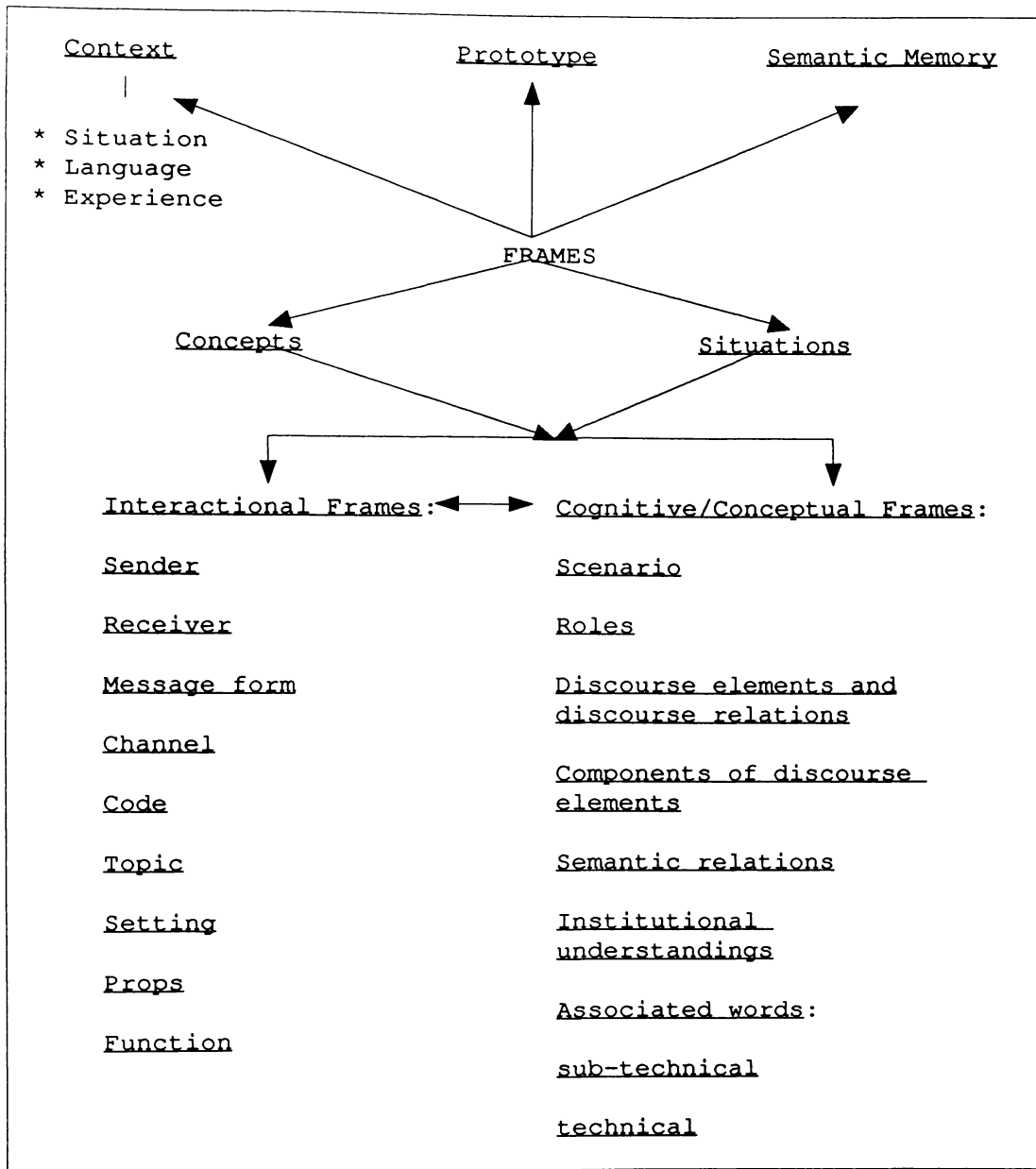
### AN INTERIM FRAMEWORK FOR GENRE ANALYSIS

#### 5.1 Introduction

This chapter will outline an interim proposal for a framework for genre analysis which draws from the work in the fields of discourse analysis, pragmatics, language and cognition, natural language processing, artificial intelligence and critical theory and practice. It will also outline the ways in which the proposed framework differs from the Fillmore model described in the previous chapter. The chapter will then present an interim analysis of one of the texts used in the study as an illustration of how the framework may be applied to provide an explanation for genre assignment. The chapter which follows this chapter will test this analysis against a further number of 'specific purpose' texts in the area of written research reporting.

#### 5.2 An interim framework for genre analysis

Figure 15 outlines the interim framework for genre analysis. The aspects of the framework which are drawn from Fillmore's model and those which differ from his proposal are outlined in the sections which follow.



*Figure 15: An interim framework for genre analysis*

The aspects of the framework which draw directly from Fillmore's model are:

- (i) The central concept of frames and their relationship with the notions of context, prototype and semantic memory. It should be noted here that context here includes not only situational, linguistics and experiential, but also cultural context;

- (ii) The relationship between frames, concepts, or abstract meanings, and situations,
- (iii) The components of interactional frames of sender, receiver, message form (language used), channel (spoken or written) code (dialect or variety), topic, setting and communicative function;
- (iv) The components of cognitive/conceptual frames of scenario and roles (people or agents involved in the events etc).

There are also, in this framework, a number of departures from the original Fillmore model. These are:

- (i) The inclusion of semantic relations in cognitive/conceptual frames rather than their treatment as an overarching category above that of 'frame' - an inclusion which reflects their direct relationship with other levels of discourse structure within the cognitive/conceptual frame;<sup>1</sup>
- (ii) The removal of symbolization as a key prototypical idealisation in the framework, a removal which reflects the fact that *all* uses of language are, in fact, instances of the use of symbols, or signs, for the representation of meaning. Symbolization is, thus, seen as being too vast a notion, and having too many potential realisational possibilities, to be a feature by which it might be possible to demonstrate some typicality in an instance of a particular genre. It is, thus, removed in the sense of its reference to *language* use, as opposed to the broader *semiotic interpretation* of symbolisation used in other areas of enquiry;

- (iii) The inclusion of *props* as a constituent factor of communicative events although 'props' derive from script theory (Schank and Abelson 1977) rather than from frame theory. 'Props' represent various physical objects associated with particular communication events or situations. Examples of props are 'tables' and 'menus' in an 'eating in a restaurant' frame, or technical apparatus in a scientific report, such as, for example, 'open top chambers' and 'air fumigation systems';
- (iv) The division of associated words into *sub-technical* and *technical* words (Hutchinson and Waters 1987); that is, the division of lexical items into those associated with research reporting in general (for example, 'investigation', 'study' etc) and those which are associated with the particular subject of the research report (such as 'ozone', 'winter wheat' etc). All of these lexical items, it should be pointed out, however, are subject specific and not genre specific and are *not*, it will be demonstrated, characterising features of the particular genre. <sup>2</sup>
- (v) The division of sub-events into four co-occurring aspects of discourse structure.<sup>3</sup> These are *discourse elements*, *discourse relations*, *components of discourse elements* and *semantic relations*. Each of these aspects of discourse structure will be discussed in the sections which follow.

### 5.2.1 Discourse elements

*Discourse elements* refer to divisions in a text "in terms of the way in which their parts function to convey various types or categories of information" (Crombie 1985b, 58) such as 'Situation' and 'Problem' in 'situation-problem-solution-evaluation' texts (Crombie 1985b). Each discourse element "is classified in terms of the communicative function which it performs in relation to the discourse as a whole" (Crombie 1985b, 58). A 'problem/solution' text, thus may have *four* discourse elements: 'Situation', 'Problem', 'Solution' and 'Evaluation'.

The notion of discourse elements is not to be confused with the *macrostructure* (van Dijk 1980) of a text. The macrostructure of a text refers to the:

... higher level semantic and conceptual structures that organise the 'local' microstructures of discourse interaction and their cognitive processing (van Dijk 1980, v);

that is, the:

... sequences [of a text] which somehow 'belong together' (van Dijk 1977, 152).

In scientific reports, for example, this refers to the Introduction, Materials and Methods, Results and Conclusion sections of the text. The macrostructure of a text, in fact, represent a *further* aspect of discourse structure which co-occurs with other discourse structures in a text.<sup>4</sup>

### 5.2.2 Discourse relations

*Discourse relations* refers to the relationship *between* discourse elements, such as, 'Problem-Solution' and 'Solution-Evaluation' in a 'Problem/Solution' text. One discourse element, thus, combines with another discourse element to form a discourse *relation*. A 'Problem/Solution' text may, thus, have *three* discourse relations: 'Situation - Problem', 'Problem - Solution' and 'Solution - Evaluation'. Discourse relations occur in all coherent texts and co-occur with all other discourse structures in the text. Other examples of discourse relations found in expository texts are 'Topic - Restriction' and 'Restriction - Illustration' in 'Topic/Restriction/Illustration' texts (Crombie 1985b).

### 5.2.3 Components of discourse elements

*Components of discourse elements*, refers to *moves* (Swales 1981, 1985, 1990) within each of the discourse elements. Moves represent smaller functional units in communication equivalent to that of *speech acts* (Austin 1962, Searle 1965, 1981). The notion of moves first appeared in work in the area of genre analysis in Swales' work (1981) in which he proposed a 'four move model' for the Introduction section of research articles.<sup>5</sup> These moves were:

- |         |                                |
|---------|--------------------------------|
| Move 1: | Establishing the field         |
| Move 2: | Summarizing previous research  |
| Move 3: | preparing for present research |
| Move 4: | Introducing present research   |

This model was subsequently revised by Swales (1990) on the basis of further analyses to three moves; that is:

- Move 1: Establishing a territory
- Move 2: Establishing a niche
- Move 3: Occupying the niche

Examples of components of discourse elements in scientific reports, as described here, are 'Previous Research' and 'Background Information' within the discourse element 'Situation' of a 'situation-problem-solution-evaluation' text. Components of discourse elements correspond to those aspects of text structure referred to by Hasan as *structural elements* which, taken together, make up the *generic structure* of a text (and, when taken over a range of texts, the *generic structure potential* of a text) (Hasan 1984a, 1989a).

#### 5.2.4 Semantic relations

*Semantic relations* refer to the relationship between propositions in texts such as Reason-Result, Condition-Consequence etc within and between the discourse elements of the texts (Crombie 1985a). These relations are few in number and each of them is classified in terms of the perceptual process involved. Semantic relations, further, are divided into three broad categories, *associative*, *logico-deductive* and *tempero-contiguity* (Crombie 1987, 1993). These categories and associated relations are listed in Table 19. Examples of semantic relations are given in Table 20.

*Table 19. Categories of semantic relations (Crombie 1993)*

| Associative relations        | Logico-deductive relations | Tempero-contigual relations |
|------------------------------|----------------------------|-----------------------------|
| Simple Contrast              | Condition-Consequence      | Chronological Sequence      |
| Comparative Similarity       | Means-Purpose              |                             |
| Statement-Affirmation        | Reason-Result              | Temporal Overlap            |
| Statement-Denial             | Means-Result               | Bonding                     |
| Denial-Correction            | Grounds-Conclusion         |                             |
| Concession-Contraexpectation |                            |                             |
| Supplementary Alternation    |                            |                             |
| Contrastive Alternation      |                            |                             |
| Paraphrase                   |                            |                             |
| Statement-Exemplification    |                            |                             |

*Table 20. Semantic relations: Some examples (Crombie 1985a)*

| Relation                  | Description                                                                                                                                                                                                  | Example                                                                                         |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Reason-Result             | Here, the reason member (which very often follows the result member in English) gives a reason <i>why</i> a particular effect came or will come about.                                                       | Agamemnon was pleased because the princes fought.                                               |
| Statement-Exemplification | Here, the first member provides a general statement and the second adds a proposition (or more than one proposition), which is presented as an exemplification of the general statement of the first member. | Battle always leads to unnecessary savagery. Witness Achilles' treatment of the body of Hector. |

|                       |                                                                                                                                                     |                                                                 |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Simple Contrast       | This is relation involving the comparison of two things, events or abstractions in terms of some particular in respect of which they are different. | Paris was a Trojan; Helen, a Greek.                             |
| Means-Purpose         | In this relation, the purpose member outlines the action that is/was/will be undertaken with the <i>intention</i> of achieving a particular result. | Agamemnon surrendered the girl in order to propitiate Apollo.   |
| Condition-Consequence | In this relation, the consequence is dependent on a realizable or unrealizable condition or on a hypothetical contingency.                          | If Agamemnon confiscates Brises, (then) Achilles will withdraw. |

---

Semantic relations are not to be confused with Halliday's (1985a) or Martin's (1983, 1992) *logico-semantic relations* which are *linguistic* and *clause*-based as opposed to semantic relations which are *proposition*-based. That is, semantic relations describe the relationship between *propositions* in a text as opposed to the relationship between *clauses*. This is an important distinction to make as the way in which semantic relations are sometimes encoded may lead one to think they equate with logico-semantic relations as described by Halliday et al. The following example:

I left because of sickness

demonstrates that this is not the case as this example, in fact, represents two propositions: 'I left' and 'I felt sick'.

Semantic relations may, equally, hold between two sentences with no conjunctive signalling, such as in the example of a Reason-Result relation given by de Beaugrande (1980, 37):

2. Peter burned the book. He didn't like it.  
       [Result]                -                [Reason]

which, as de Beaugrande demonstrates, could equally be expressed by :

3. Peter burned the book because he didn't like it.  
       [Result]                -                [Reason]

A systemic analysis of these two examples, such as in Halliday (1985a), would describe example 3 as *hypotactic expansion* whereas it would describe example 2 as either two separate clauses with no 'logico-semantic' relation between them or, if the two sentences were joined by a semi-colon rather than separated by a full-stop, as *paratactic elaboration*, even though the set of propositions underlying both examples *is the same*.

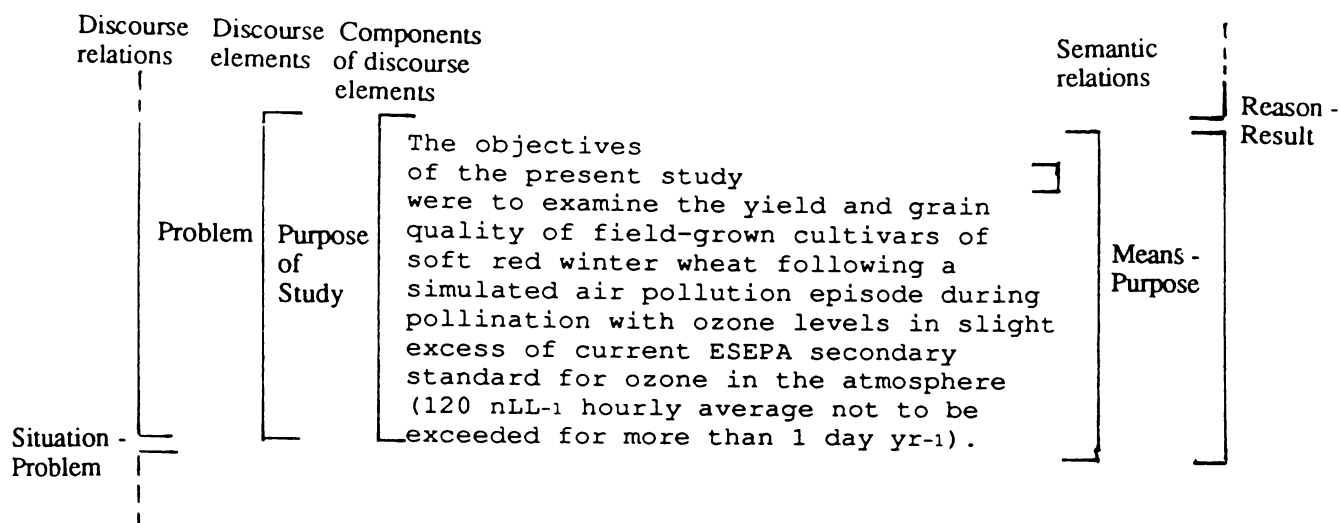
Notwithstanding the fact that relations are not clause bound, the systemic approach in this area is essentially non-propositional in nature and linguistic realisation-based, rather than proposition-based.<sup>6</sup> Semantic relations, as they are intended here, then, might more accurately be described as *semantico-pragmatic relations* in that they will be recovered by inferencing which is based on the text and world knowledge together with cultural/contextual assumptions rather than by direct reference to linguistic aspects of the text (Crombie 1987).

Semantic relations are, thus, *different* from the clausal and interclausal relations described in systemic analyses. They are based on propositional categories and not (as with systemic analyses) grammatical (or linguistic) categories. Semantic relations, further, may be implicit or explicit and may be cued and encoded in a large number of different ways (Crombie 1987). Thus, even though types of semantic relations are few in number, their *potential* encodings are not. Semantic relations are equivalent to *perceptual strategies* and are, thus, "classified in terms of the perceptual process involved" (Crombie 1987, 2).

Figure 16 is an illustration of one of the texts used in the study (Text 3) analysed in terms of discourse elements, discourse relations, components of discourse elements and semantic relations. An important feature of this illustration is the layers of semantic relations revealed by the analysis; that is, the layers of semantic relations *within* semantic relations, such as the examples of Simple Contrast and Statement-Exemplification within Statement-Exemplification relations and the overarching Reason-Result relation which contains all the other relations revealed in the analysis.

Figure 16. A sample analysis: discourse elements, discourse relations, components of discourse elements and semantic relations.

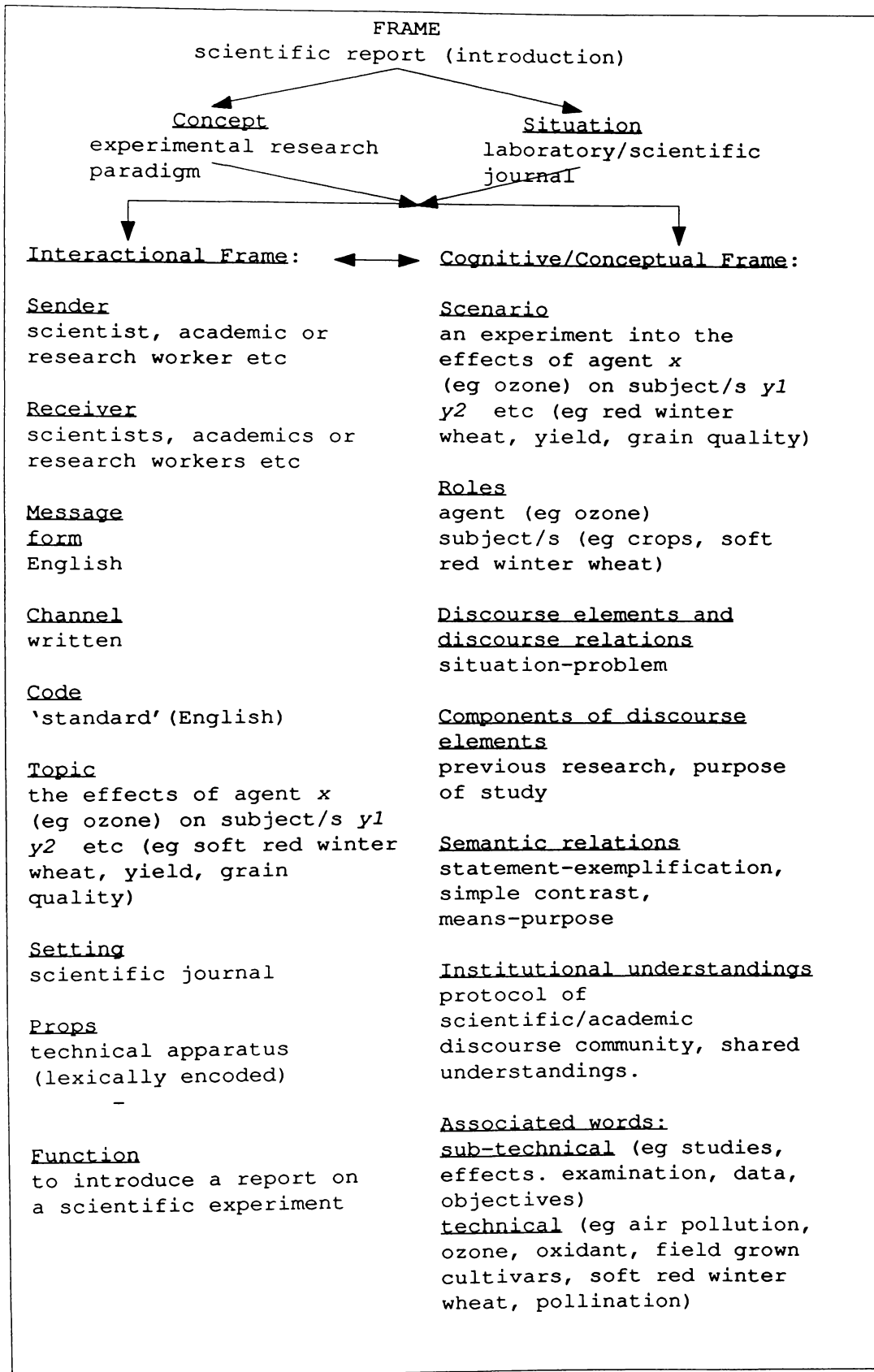
| Discourse relations | Discourse elements | Components of discourse elements                                                                                                                                                                                                                                                                                                                                    | Semantic relations          |
|---------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Situation           | Previous Research  | <p>In a recent review of ozone effects on grain crops, Noggle and Jones concluded that ambient concentrations are sufficiently high to damage grain crops in some areas of the USA but probably have little impact in major growing regions.</p>                                                                                                                    | Simple contrast             |
|                     |                    | <p>An examination of ambient photochemical oxidant data (Environ, Health Admin., Maryland Dep. of Health and Mental Hygiene) for southern Maryland, averaged yearly and quarterly for the period 1972-1979, revealed an average of 140 h annually with oxidant levels in excess of 80 nLL-1.</p>                                                                    | Simple contrast             |
|                     |                    | <p>However, an average of 39 h or 28% of the elevated oxidant levels occurred during the period April through June, the primary reproductive and grain-filling period for small grains in the mid-Atlantic states.</p>                                                                                                                                              |                             |
|                     |                    | <p>Ozone injury to wheat vegetation has been described by several researchers. In long-term studies, Heagle et al. reported the mean threshold ozone concentration for significant injury and decreased growth and yields of soft red winter wheats (<i>Triticum aestivum</i> L.) was between 60 and 100 nLL-1 with differences being observed among cultivars.</p> | Statement - exemplification |
|                     |                    | <p>Ambient ozone concentrations in excess of 120 nLL-1 were reported during the study period 10-20 May 1977.</p>                                                                                                                                                                                                                                                    | Statement - exemplification |
|                     |                    | <p>Following exposure of wheat cultivars to 200 nL L-1 ozone concentration for 4 h day-1 for 7 days during anthesis, Shannon and Mulchi noted significant reductions in yields.</p>                                                                                                                                                                                 | Statement - exemplification |
|                     |                    | <p>Estimates of yield losses for winter wheats exposed to mean ozone concentration of 60, 80, and 100 nLL-1 for 7 h day-1 during the spring season were 11.0, 17.2, and 23.5%, respectively,</p>                                                                                                                                                                    | Simple contrast             |
|                     |                    | <p>compared with ozone levels in filtered air treatments of 25 nLL-1.</p>                                                                                                                                                                                                                                                                                           |                             |
|                     |                    | <p>As Maryland air quality data would confirm, air pollution episodes in the mid-Atlantic states during the spring months would be typically characterised by elevated (60 to 120 uLL-1) ozone levels from 2 to 6 h days-1 for 2 to 5 days' duration.</p>                                                                                                           |                             |
|                     |                    |                                                                                                                                                                                                                                                                                                                                                                     | Reason - Result             |



### 5.3 An interim analysis

Figure 17 is an example of the framework proposed here applied to the Introduction section of a single scientific report. The subject matter of this particular research report is the effect of ozone on the yield and grain quality of soft red winter wheat.<sup>7</sup> Details of the analysis of discourse elements, discourse relations, components of discourse elements, and semantic relations on which this summary is based can be found in Figure 16.

As can be seen from this interim analysis, there is one key concept underlying the scientific report of the kind described here; that is, the concept of an experimental research paradigm.<sup>8</sup> That is, the paradigm underlying a piece of research in which "an idea or hypothesis is tested or verified by setting up situations in which the relationship between different subjects or variables can be determined" (Richards, Platt and Weber 1985, 100). This concept is central to the particular genre being discussed here (as it is to some other genres such as, for example, laboratory reports, seminar and conference presentations of



*Figure 17: An interim analysis: Scientific reports (Introductions) (based on Mulchi, Sammons and Baenziger, 1986)*

experimental research). It is, furthermore, very often (although not always<sup>9</sup>) accompanied by a highly conventionalised *macrostructure*<sup>10</sup> of Introduction, Materials and Methods, Results, and Conclusion. A change in this key concept to a qualitative research paradigm,<sup>11</sup> for example, such as that of case studies<sup>12</sup> or ethnographic research<sup>13</sup> may, in many cases, allow for more variation in the macrostructure of the text as the different paradigm may also bring with it different expectations of how a report based on such a paradigm might typically proceed. That is, the text may no longer follow the macrostructure of Introduction, Materials and Methods, Results, and Conclusion typically associated with experimental research but, rather, take a different format for presentation altogether.

Other more general concepts, such as time, quantity, location, attribution and identification are taken as being equally likely to occur within the context of other genres and cannot therefore, be seen as necessarily characteristic concepts in terms of the particular frame being analysed here.

The *situation* of the text analysed in Figure 17 is both physical, that is, that of a scientific laboratory or such space, and encoded in language in a scientific journal. Expectations of how the research process and reporting of that process should proceed are part of the institutional understandings, or protocol, of the particular scientific and/or academic discourse community. These understandings include a number of conditions emerging from the context, whose existence is necessary for the communication event to 'work' or be *felicitous*.

*Felicity conditions* derive from work in the area of *pragmatics*.

Pragmatics is not an easy area to define, although as Levinson points out:

... in one sense there is no problem of definition at all: just as, traditionally, syntax is taken to be the study of the combinatorial properties of words and their parts, and semantics to be the study of meanings, so pragmatics is the study of language *usage* [emphasis mine]. Such a definition is just as good (and bad) as the parallel definitions of the sister terms, but it will hardly suffice to indicate what the practitioners of pragmatics actually do; to find out, as in any discipline, one must go and take a look. (Levinson 1983, 656).

Areas of investigation which have concerned pragmaticians include *conversational implicature*,<sup>14</sup> *speech acts*<sup>15</sup> and *conversational analysis*.<sup>16</sup>

Felicity conditions are a key aspect of the framework proposed in this study. For a communicative event to be felicitous:

- (i) the persons and circumstances must be *appropriate*;
  - (ii) the event must be executed *completely* and *correctly* by all involved;
  - (iii) the participants must have the appropriate *intentions*
- (Austin 1962).

The *felicity conditions* for the communication event analysed here, thus, include the fact that *a piece of research must have been carried out* in order to write a report on it. The research *must include the*

*testing of some hypothesis by means of a particular research process.* The person carrying out the research and reporting on it *must be a scientist, academic or research worker and must have a knowledge of the area in question* including related *previous research* as well as *an understanding of what constitutes experimental research* itself. The resultant text, further, must appear in a scientific journal.<sup>17</sup> Thus, for example, a report on a test carried out in a kitchen and published in a woman's magazine, even though it could be considered a kind of experiment, would be excluded from category membership of the genre, 'scientific report'. The research, therefore, must be carried out and reported on by the *right person*, in the *right place* and at the *right time* with a *specific intent* or else it would simply 'not work'. The felicity conditions for communicative events are, thus, essentially non-linguistic. The circumstances of the text, furthermore, are genre assigning even when the elements are essentially untypical. This accounts for the genre categorisation of untypical texts. These *pragmatic* aspects of communication are not only crucial to the framework being presented here but are also central to the notion of linguistic pragmatics itself (Levinson 1983).

Within the interactional frame presented here, the sender needs to be identified as a scientist and/or academic (or some variant of these categories such as research worker), the message form, channel and code that of 'standard' written English.<sup>18 19</sup> The topic of the report follows that of all experimental research, that is, the effects of an agent (in this case, ozone) on a particular subject (in this case, the yield and grain quality of soft red winter wheat). The setting of the text is, as with the situation, that of a scientific journal. In this particular example, there is no reference to any particular technical apparatus, although it

will be seen that this is not always the case.<sup>20</sup> Finally, the overall function of the particular communication event is to introduce something, that something being genre-defined as being a report on a scientific experiment if all of the felicity conditions are met.

The scenario contained within the particular cognitive/conceptual frame is, as with the interactional frame, an experiment into the effects of an agent on one or a number of particular subjects. This scenario is not, however, of itself genre-defining and needs to *interact* with all other components of the frame for this to be the case. Key roles contained within this particular scenario are the agent itself (in this case, ozone), and the particular subject/s of the text (in this case, the yield and grain quality of soft red winter wheat).

The discourse elements and discourse relations present in this particular section of the text are Situation-Problem and the Problem member of a Problem-Solution discourse relation (in relationship with the rest of the text).<sup>21</sup> The components of discourse elements in this particular section of the text are Previous Research, as a component of the discourse element, Situation, and Purpose of Study as a component of the discourse element Problem.<sup>21</sup> The text, furthermore, contains three particular groupings of semantic relations, that is, Statement-Exemplification and Simple Contrast, and Means-Purpose, each of which grouping relates directly to the discourse element components, Previous Research and Purpose of Study, respectively.<sup>22</sup>

Institutional understandings of the particular communication event draw from the protocol and institutional understandings of the particular scientific/academic discourse community, all of which,

together, provide pragmatic conditions for the assignment of a texts as an instance of a particular genre. This incorporates, not only the shared understandings of how the particular text should proceed, but also what is assumed to be generally accepted as common knowledge within the particular area (and therefore not needing to be sourced) and what is considered more recent and new or more liable to challenge (and perhaps needing the citation of particular sources to support statements being made and, thus, being part of the discourse element component, Previous Research, rather than that of Background Information).

Technical words associated with this particular frame include 'air pollution', 'ozone', 'oxidants', 'field grown cultivars', 'soft red winter wheat' and 'pollination'. All of these lexical items, however, could, obviously, be associated with any kind of communication event on this same topic such as a lecture, seminar presentation or newspaper report and are, therefore, not necessarily characteristic of the particular genre. Sub-technical words found in the text such as 'studies', 'effect', 'data' and 'objectives', could, equally, be found in any other text, or genre, dealing with any number of different kinds of research.<sup>23</sup> They are, thus, the feature of the frame which is the *least* closely tied to the particular genre and do not (along with lexicogrammatical patterns and realisations) form part of the conditions for the assignment of a text to a particular generic category.

Conditions for the assignment of a text to a particular genre are, thus, in the case of stereotypical representations, an *interaction* of both *pragmatic* conditions, such as the fact that it was written by a particular person with a particular intention and appears in a particular place and *perceptual* conditions, such as the fact something

is the Introduction section of a research report and includes various internal discourse and semantic relations such as Problem-Solution, Reason-Result etc. In the case of untypical representations of the prototype, however, it is then the *pragmatic* (or *socio-semiotic*) conditions which hold. At no point, however, it is argued, are the conditions for the assignment of a text as an instance of a particular genre, of its own, structural, or *at any point*, linguistic.

#### 5.4 Summary

This chapter has outlined a proposal for a framework for genre analysis which draws from the work in the fields of discourse analysis, pragmatics, language and cognition, natural language processing, artificial intelligence and critical theory and practice. It has also outlined the ways in which the proposed framework differs from the Fillmore model described in the previous chapter. The chapter has then presented an interim analysis of one of the texts used in the study as an illustration of how the framework may be applied to provide an explanation for genre assignment. The chapter which follows will test this analysis against a further number of 'specific purpose' texts in the area of written research reporting.

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#### NOTES

- 1 For discussion of the cognitive basis of semantic relations see (iv) below. For examples of semantic relations in scientific reports see Chapter 6, section 6.4.2.
- 2 See Chapter 6 section 6.3.

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- 3 Note that Van Dijk (1980), in his discussion of macrostructures and superstructures, also points to a number of different aspects of discourse structures but does not extend the discussion to the relationship between these structures and the stages of a text, nor does he place his descriptions within an overall framework for genre analysis.
  - 4 See Chapter 6, section 6.4.2 for a more detailed illustration of the relationship between these various aspects of textual organisation.
  - 5 See Sinclair and Coulthard (1975) for use of the term 'move' in exchange structure analysis.
  - 6 See Chapter 6, Table 24, for a comparison of logico-semantic and semantic pragmatic relations.
  - 7 This analysis is based on Text 3 of the study. (See Appendix I). For an analysis of all 15 texts see Chapter 6, section 6.3.
  - 8 For a discussion of experimental research see, for example, Bailey (1982), Cohen and Manion (1985), Wiersma (1986).
  - 9 See section 4.5 for examples of research reports which do not follow this pattern yet, nevertheless, are very clearly examples of scientific reports based on an experimental research paradigm.
  - 10 See Chapter 6, section 6.4.1.
  - 11 For a discussion of qualitative research methods see, for example, Bogdan and Bilken (1982), Cohen and Manion (1985).
  - 12 For a discussion of case studies see Bartlett and Kemmis (1983).
  - 13 For a discussion of ethnographic research see Wilson (1982), Nunan (1992).
  - 14 See, for example, Grice (1975), Levinson (1983), Mey (1993).
  - 15 See Austin (1962), Searle (1965, 1981), Fraser (1983), Mey (1993).

- 
- 16 See, for example, Levinson (1983), Richards and Schmidt (1983), Mey (1993).
- 17 Note that other writers, such as Searle, might consider these conditions to be *constitutive rules* (Searle 1965). That is, for Searle, they do not simply regulate the activity but, when taken together are constitutive of the actual activity itself (Levinson 1983). Here, however, I am taking them to be *felicity conditions* in that it is possible for someone who is not, for example, a physicist to write a text on physics. It is just that the discourse community might not *accept* it as a text on physics because it is not actually written by a physicist, even though it clearly remains a physics text.
- 18 See Strevens (1983) for a discussion of the notion of 'standard' English.
- 19 See Hatch (1992) for a discussion of different institutional understandings and expectations of research reports in languages other than English.
- 20 See Chapter 6, section 6.3.
- 21 See Fig 20 in Chapter 6, also Chapter 6, section 6.4.2 for a more detailed discussion of discourse relations in scientific reports.
- 21 See Chapter 3, section 3.3, for a discussion of texts with more discourse element components than those found in the text here.
- 22 See Chapter 2, section 2.5 for a discussion of how structural elements were defined in these analyses. Also this chapter, section 5.2 for a detailed discussion of discourse relations, discourse elements, components of discourse elements and semantic relations.
- 23 See section 5. 2 (v) for a definition of technical and sub-technical words.

## CHAPTER SIX

### WORKING WITH GENRE: A SOCIO-PSYCHOLOGICAL ANALYSIS

#### 6.1 Introduction

This chapter will present the analysis of a number of 'specific purpose' texts as a demonstration of how the framework described in the preceding chapter can be applied to provide an explanation of genre assignment. It will, first of all, describe the process of selection of the texts added at this stage of the study. It will then present an analysis of all the texts which includes an investigation of the potential relationship between 'specific purpose' vocabulary and the discourse structures of the texts. Finally, it will consider implications for teaching and further research before outlining the conclusions reached on the basis of the material in this and the preceding chapters of this study.

#### 6.2 Selection of the texts

In this second stage of the study, a further three texts were added to the analysis in order to provide a more adequate test of the conclusions reached in the initial stage of the study. These three extra texts are taken from the area of biochemical research and are on a related topic (DNA). Two of the texts were used in the investigation carried out by Hunston;<sup>1</sup> the third was not. Table 21 shows the specific topic areas from which the texts were chosen, the titles of journals, and their

Science Citation Index impact rankings. Complete references to the texts can be found in the Bibliography section at the end of this thesis. Copies of the texts are attached in Appendix 1.

*Table 21. Sample texts, journals and impact rankings: Texts 13-15*

| Area | Journal                          | SCI Impact Ranking | Number of texts |
|------|----------------------------------|--------------------|-----------------|
| DNA  | Experimental Cell Research       | 2.73               | 1               |
|      | European Journal of Biochemistry | 3.154              | 1               |
|      | Cell                             | 23.913             | 1               |

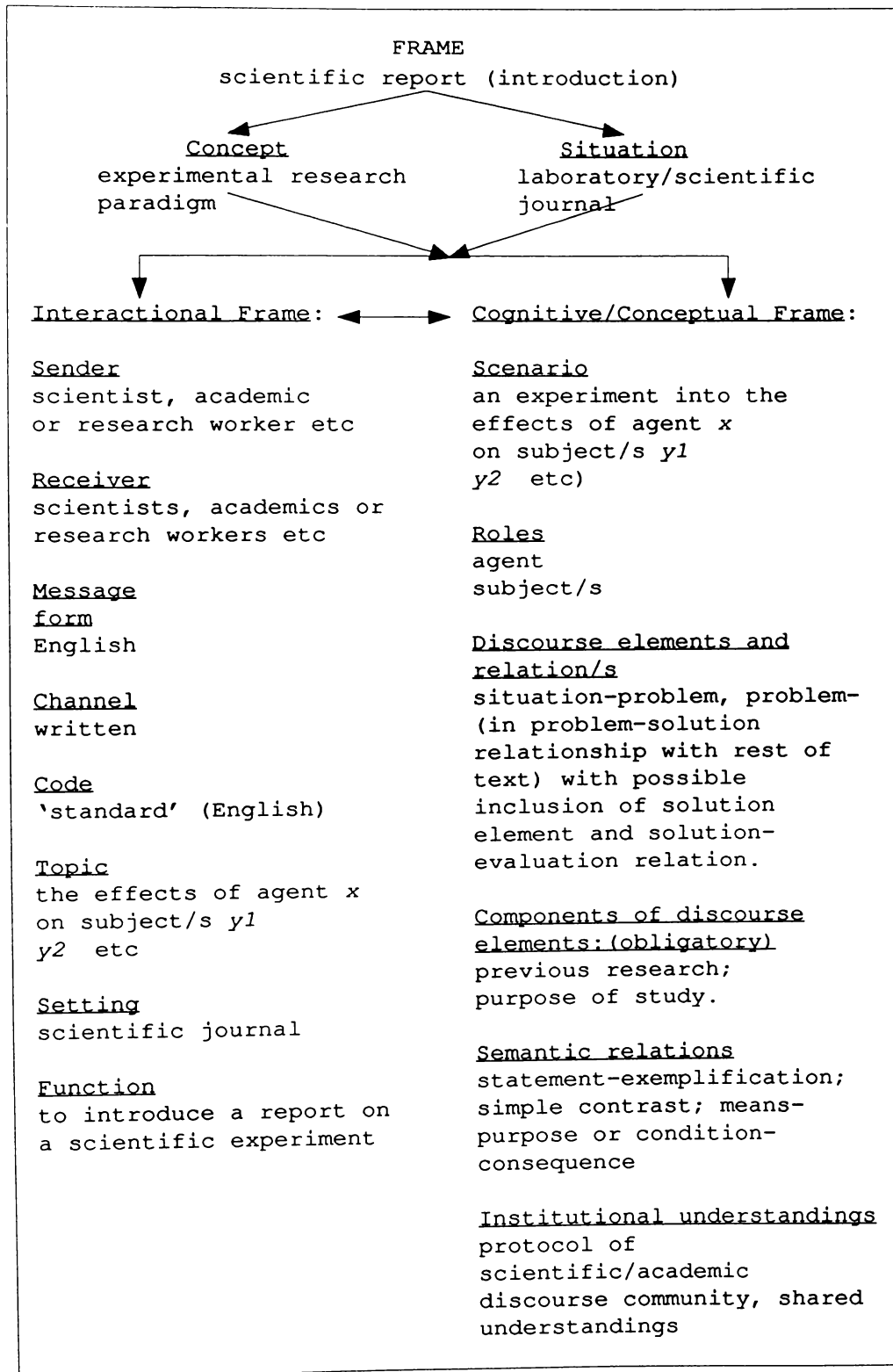
### 6.3 Analysis of the texts

On the basis of conclusions reached in the first stage of the study - that is, that the language of the texts under examination is in no significant way different from English language use in general - it was decided to exclude lexico-grammatical patterns as a characterising feature for the genre from any further analyses and, therefore, from the framework itself. It was also decided not to proceed with further analyses of the semantic attributes of the texts for the same reason.<sup>2</sup> This stage of the analysis aimed, rather, to place the texts already analysed, plus the further three exemplars of the genre, within the framework for genre analysis proposed above as well as to test the tentative conclusions reached in the first stage of the study regarding a generic structure potential for the particular genre.

Figure 18 is a report of the analysis of the Introduction sections of all fifteen texts. The areas of significant variation from the interim analysis presented in the previous chapter<sup>3</sup> are in the areas of props (now removed), associated words (now removed), discourse relations and components of discourse elements.

In the area of associated words, no single sub-technical or technical words occurred in all of the texts.<sup>4</sup> The examination which was carried out focussed on technical words related to the key semantic attributes 'Agent' and 'Subject' as well as the 'props', or technical apparatus, employed in the research. It also examined sub-technical 'research-related' lexis. The analysis looked not only for the repetition of lexical items but also for words which were in some kind of semantic or taxonomic relationship with the particular item such as *synonyms*, *antonyms*, *superordinates*, *hyponyms* and *meronyms* of the particular words; that is:

- (i) words which have "the same, or nearly the same meaning as another word" (Richards et al 1992, 368) such as 'study' and 'investigation' (synonyms);
- (ii) words or phrases which are "opposite in meaning to another word" such as 'acid rain' and 'non-acid rain' (antonyms);
- (iii) words or phrases which are synonymous at "some higher level of generality" (Halliday 1985a, 310) such as 'rain' and 'acid rain' (superordinates);



*Figure 18: A sample frame: Scientific reports (Introductions)*

- (iv) words or phrases which are in a specific-general relationship with each other where "the meaning of one of the words includes the meaning of the other word" (Richards et al 1992, 169) such as 'field-grown crops' and 'wheat' (hyponyms);
- (v) words which are in a part-whole relationship with each other such as in 'corn silks' and 'corn' (meronyms).

No single lexical item in any of the areas examined was found to occur in the first twelve texts analysed. The categories of 'associated words' and 'props' have, thus, on the basis of these further analyses, been removed from the frame as they, along with structure of the language itself,<sup>5</sup> can no longer be seen as being specifically characteristic of the texts under analysis.<sup>6</sup>

Texts 13-15 also revealed a more complex arrangement of discourse elements and discourse relations than had the earlier texts analysed with reference also being made to the discourse relation 'solution-evaluation' within the Introduction section of the texts. Analysis of the components of the discourse elements of the extra three texts also revealed further complexity than had the initial stage of the analysis. This can be seen by looking at the patterns of discourse element components in Texts 13 and 15 in Table 22 and comparing this with the patterning of discourse element components presented earlier, in Chapter 3.<sup>7</sup>

Text 13, it can be seen, has added two new components, Materials (M) and Results (R) to the range of potential discourse element components for the particular genre. These discourse element components are

typically found in later sections of such texts but here are included in the section of the text which for this analysis has been labelled 'Introduction'.

*Table 22: Components of discourse elements: Texts 13-15*

---

Text 13

PR ^ QR ^ PR ^ PS ^ M ^ R

Text 14

BI ^ PR ^ BI ^ PR ^ IG ^ PS

Text 15

BI ^ PR ^ IG ^ PR ^ BI ^ PR ^ PS ^ R ^ C

KEY

BI: Background Information

IG: Indicating a Gap

QR: Question Raising

PR: Previous Research

^ : followed by

PS: Purpose of Study

M: Materials

R: Results

C: Conclusions

---

The component, Purpose of Study (PS), also, no longer occurs in final position as it had in all the other texts. Text 14 does, however, fit the patterning of the previous analyses with no introduction of new components and the component Purpose of Study (PS) once more in final position. Finally, Text 15 follows the same typical structure of Texts 1-12 up to the component Purpose of Study (PS), but then adds two new components, Result (R) and Conclusions (C). The only components of discourse elements that can be seen as obligatory to the texts are, still, as with the earlier analysis, those of Previous Research (PR) and

Purpose of Study (PS); they are the only two components which occurred in *all* of the texts examined.

As a result of these analyses, sequencing and recursion of discourse element components are omitted from the frame: the further analyses revealed too much variation for a fixed statement about typicality of the *patterning* of components of discourse elements to be made. The only generalisation that could, perhaps, be made is that the discourse element component, Previous Research (PR), always precedes the discourse element component, Purpose of Study (PS). Purpose of Study, however, can no longer be seen to occur necessarily in final position. Also, where the components Materials (M), Results (R) and Conclusions (C) do occur, they always follow the component Purpose of Study. This may not seem, on the surface, such an unusual occurrence until one realises that these components have now been seen to occur *within* the Introduction section of the texts, *as well as* in the respective sections which follow. This represents a distinctively different position from that shown in the analyses of the first twelve texts in which no reference to materials, results or conclusions occurred in the Introduction sections of the texts *at all*.

The conclusion that fixed statements cannot be made about patternings of components of discourse elements reflects the conclusions now also being reached by a number of genre theorists such as Kress (1993) and Cope and Kalantzis (1993). As Cope and Kalantzis point out, "teachers keep stumbling over important 'new' texts which just don't seem to fit the generic descriptions" (Cope and Kalantzis 1991, 12). Thus, as genre theory evolves, "it becomes obvious that more and more text is generically problematic" (Cope and Kalantzis 1993, 16). Indeed, for



instances of particular genres. The important difference between the framework proposed here and structurally-based frameworks, then, is that, at no point, in an integrated framework, is the structure of the text, *of its own*, seen as being genre defining.

#### 6.4 Frames and language

The section which follows will present an analysis of the relationship between frames and language. It will look, in particular, at the relationship between frames, discourse structures and language. This will include the relationship between discourse element components, semantic relations and language.

##### 6.4.1 Frames, discourse structures and language

Figure 19 presents an illustration of the relationship between frames, discourse structures and language based on an examination of the first twelve texts employed for the study. It is important to point out that the aspects of discourse structure shown in Figure 19 are not hierarchically arranged, even though this may appear so from the way in which they are presented in this table. The relationship between each of these aspects of textual patterning is one of *co-occurrence* rather than of hierarchy.

The first aspect of discourse structure shown in the example is that of the macrostructure of the texts. This term (and concept) is used here in preference to that of *schematic structure* (Martin et al) because of its cognitive, rather than social-semiotic, basis.<sup>9</sup> The macrostructure of the texts, in the initial stage of analysis, revealed a patterning of:

Introduction ^ (followed by) Materials and Methods ^ Results ^ Discussion,

Co-occurring with the macrostructure of the texts are the discourse elements and discourse relations in the texts, all of which, in turn, co-occur with components of the discourse elements. What defines the discourse structure of a genre, thus, is the *co-occurrence* and *interaction* of these aspects of discourse organisation rather than the presence of any one aspect of textual organisation in isolation. The co-occurrence and interaction of these aspects of textual organisation, furthermore, is what is omitted from models such as that based on the notion of schematic structure (Martin etc) or generic structure potential (Hasan etc). Both of these approaches to textual organisation, in fact, only account for one of a number of possible aspects of discourse structure and both omit the *intermediate* aspect, that is, discourse relations. It is, in fact, the *interrelation* of each of these aspects of discourse structure, with components of discourse elements in a *mediating role* between discourse relations and semantic relations, which underlies, "those complex patternings of meaning which are at the core of human discourse." (Crombie 1985b, 57).

The second stage of the analysis revealed further variation in the patterning of discourse structures than had, however, the analysis of the first twelve texts. Analysis of Text 15,<sup>10</sup> for example, revealed a macrostructure of:

Introduction ^ Results ^ Discussion ^ Materials and Methods.

This pattern is significantly different from that of the previous texts analysed and from what is probably considered the 'general' organisational pattern of such texts. Analysis of the discourse elements components of Texts 13-15 also revealed reference to an additional discourse relation ('solution-evaluation') and introduced the discourse element components Materials (M), Result (R) and Conclusion (C) to the range of possible discourse patternings for the particular section of the genre.

Each of these three further texts is, however, notwithstanding the structural difference, a clear example of a scientific report. They are, furthermore, by virtue of their very acceptance into refereed journals<sup>11</sup> in the area to be regarded as successful texts. Quite clearly the relevant scientific and academic communities regard the texts as being valid exemplars of the scientific report genre. It is only, however, a model such as the one being presented here (based on a notion of prototype, rather than defining features) that allow texts such as these to be included as instances of a particular genre without requiring an adaptation of the structural framework.

The patterns of discourse elements, discourse relations, components of discourse elements and semantic relations shown in Figure 19 reflect those patterns identified in this study. Where the analysis shows certain patterns as 'eg', this indicates that a number of variants of these patterns can occur. Thus, even though only two discourse element components were revealed in the study as being obligatory (Background Information and Previous Research), others such as those listed may also occur. Equally, even though only a number of

|                                            |                                                                                                                                      |  |                                          |                       |         |            |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------|-----------------------|---------|------------|
| Frame                                      | Scientific report                                                                                                                    |  |                                          |                       |         |            |
| Macro-structure                            | Introduction                                                                                                                         |  |                                          | Materials and methods | Results | Discussion |
| Discourse elements and discourse relations | eg Situation — Problem — Solution — Evaluation<br>Problem — Solution — Evaluation                                                    |  |                                          |                       |         |            |
| Components of discourse elements           | eg Background Justification for Previous study, Context of research, Question study, raising, Rationale Indicating for study. a gap, |  | Purpose of study                         |                       |         |            |
| Semantic relations                         | eg Reason — Result<br><br>Statement - Exemplification, Simple contrast                                                               |  | Means - Purpose/ Condition - Consequence |                       |         |            |
| Language                                   | Lexico-grammatical encodings                                                                                                         |  |                                          |                       |         |            |

*Figure 19: Frames, discourse structures and language: a sample analysis*

semantic relations are shown in the chart, others are equally likely to occur, depending on the selection of discourse element components. The semantic relations shown in the chart are those which were found to occur in the discourse element components Background Information and Previous Research.

#### 6.4.2 Components of discourse elements, semantic relations and language

The relationship between components of discourse elements, semantic relations and language within the framework can be seen in Figure 19. The term 'semantic relations' here is used to refer to the relationship *between* and *within* propositions in a text.<sup>12</sup> It is, however, with relationships *between* propositions that the analysis here is concerned.

Inter-propositional semantic relations are different from discourse relations in that semantic relations may apply to pairs of propositions only; that is, they are always binary in that it is not possible to have a Reason without a Result or a Result without a Reason. Discourse relations, however, are not necessarily binary in that it is possible to have a Problem without a Solution even though it is not possible to have a Solution without a Problem. The same also applies to the discourse macro pattern Topic - Restriction - Illustration (see Crombie (1985b) in that it is possible to have a Topic without a Restriction but not a Restriction without a Topic. This suggests perhaps a further difference between discourse relations and semantic relations in that there may be a directional factor in discourse relations which determines what *must* occur whereas within semantic relations there clearly is not.

Examination of the semantic relations within the texts is important to the discussion here precisely because such an analysis encapsulates a method of identifying relations between *meanings* in a text in relation to the linguistic and situational context in which they occur (Crombie 1985a).

Analysis and description of the semantic relations which occur within the discourse element components Background Information and Purpose of Study are summarised in Figure 20 below.<sup>13</sup> The descriptions of semantic relations in this chart are taken from Crombie (1985a, pp 20 and 24). The examples which illustrate these semantic relations are from Texts 9, 11 and 13 (see Appendix V).

This summary presents an important point in terms of the relationship between discourse element components, semantic relations and *language*. It supports the position taken in the previous chapter that semantic relations should be part of a framework for genre analysis even though their lexico-grammatical encodings should not. That is, the analysis of the texts revealed typical patternings of semantic relations within the particular components of discourse elements analysed even though the analysis of the lexico-grammatical encodings of these same discourse element components did not (see Chapter 3).

Analysis of semantic relations in the texts, furthermore, not only revealed typical patterns within discourse element components, but between discourse element components as well. Thus, even though the semantic relation Statement-Exemplification was found to typically

occur in the discourse element component Background Information and the semantic relations Means-Purpose and Condition-Consequence to typically occur in the discourse element component Purpose of Study, the discourse element component Purpose of Study was also found to be typically in a Reason-Result relationship with all of the text which precedes it, with the discourse element component, Purpose of Study, furthermore, providing the Result component of the relation and with the preceding text providing the Reason (that is, the reason for carrying out the study) component of the relation (see Fig 19). Groupings of semantic relations were, thus, found to occur both within and between discourse element components as well as (as in the example presented here) co-occurring within the propositions that make up each part of the semantic relation. Further studies still need to be carried out, however, of texts in fields other than that of research reports to determine whether this co-occurrence is a feature of the particular genre, or of the occurrence of the particular relations themselves.

The analysis of semantic relations in the texts also revealed important differences between this propositionally-based analysis and the linguistic realisation-based analysis of Chapter 3. This is illustrated in the example shown in Table 24 below where the same sentence (from Text 1) is described in systemic functional terms as being an example of a single logico-semantic relation<sup>14</sup> whilst being shown in this chapter's *semantico-pragmatic* analysis as being just a single part of a binary semantic relation. The second component of this binary relation, in a systemic analysis, would be shown as being an independent clause, in no semantic relationship with the first. Even though semantic relations may be lexico-grammatically signalled, it is

| Components of discourse elements | Semantic relations        | Description                                                                                                                                                                                                                           | Examples                                                                                                                                                                                                         |
|----------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Background Information           | Statement-Exemplification | The first member of the relation provides a general statement and the second adds a proposition (or more than one proposition), which is presented as an exemplification of the general statement in the first member of the relation | Growth and yield of soybean are influenced by a number of soil and climatic factors during the growing season. One of these important factors is water.                                                          |
| Purpose of Study                 | Means-Purpose             | In this relation, the means member refers to an action that was taken and the purpose member outlines the reason for taking the action.                                                                                               | This research was conducted to determine the effects of flood duration on yield, agronomic characteristics, and yield components of soybean flooded at the vegetative and reproductive growth stages.            |
|                                  | Condition-Consequence     | In this relation, the consequence is dependent on a realizable or unrealizable condition                                                                                                                                              | If DNA ... methylation ... affects nonspecific interactions involving the creation of the active chromosomal state, such methylated molecules may demonstrate an altered, inactive nuclease-intensive structure. |

*Figure 20: Components of discourse elements and semantic relations: Background Information, Purpose of Study*

by no means always the case, that they, in fact, are. Equally, what may operate as a specific signal in one context may not do so in another. A decoder, thus, needs to reconstruct the relation though the use of appropriate perceptual schemata.

*Table 24. Logico-semantic relations and semantico-pragmatic relations: A comparison.*

---

Logico-semantic relations:

We consider ozone  
(phenomenon/main clause)

[[to be the most important air pollutant for field grown crops in  
southern Sweden.]]  
(metaphenomenon/embedded secondary clause)

The occurrence of major phytotoxic gases in rural area of southern  
Sweden is characterised by low sulphur dioxide and nitrogen dioxide  
levels compared to ozone.  
(phenomenon/independent clause)

Semantico-pragmatic relations:

We consider ozone to be the most important air pollutant for field  
grown crops in southern Sweden.  
(Statement)

The occurrence of major phytotoxic gases in rural area of southern  
Sweden is characterised by low sulphur dioxide and nitrogen dioxide  
levels compared to ozone.  
(Exemplification)

---

As can be seen from the example given in Table 24, it is only the propositionally (and perceptually) based analysis which reveals the semantic relationship between these propositions.

## 6.5 Technical taxonomies

Although associated words can now no longer be seen as being characterising components in the frame being discussed here, it is interesting to note that an analysis of the relationship between lexical items within technical word groupings revealed a complexity not previously highlighted in many other analyses of technical taxonomies in scientific texts. Halliday (1990) for example, basing his work primarily on the conclusions of Wignall, Martin and Eggins (1987/1989), points to two basic kinds of lexical taxonomy that typically occur in scientific texts: *superordination* and *composition*. These two taxonomies are based on "the semantic relationships of: '*a* is a kind of *x*' (superordination) and '*b* is part of *y*' (composition)" (Halliday 1990, 18). Examples of both types of taxonomy, drawn from the texts analysed in this study, can be seen in Figure 21 below.

In each kind of taxonomic relationship, an understanding of one particular item in the taxonomy may very often depend on an understanding of other items in the taxonomy and on the organisation and relationship between the items in the taxonomy. Furthermore, as Halliday points out, these taxonomies "can become very complicated, with many layers of organisation built into them" (1990, 19). There is also the problem for a reader that these relationships are usually not made explicit with the result that, if the reader does not already know

the relationship between the items, he or she is left to work it out from a reading of the text (Halliday 1990).

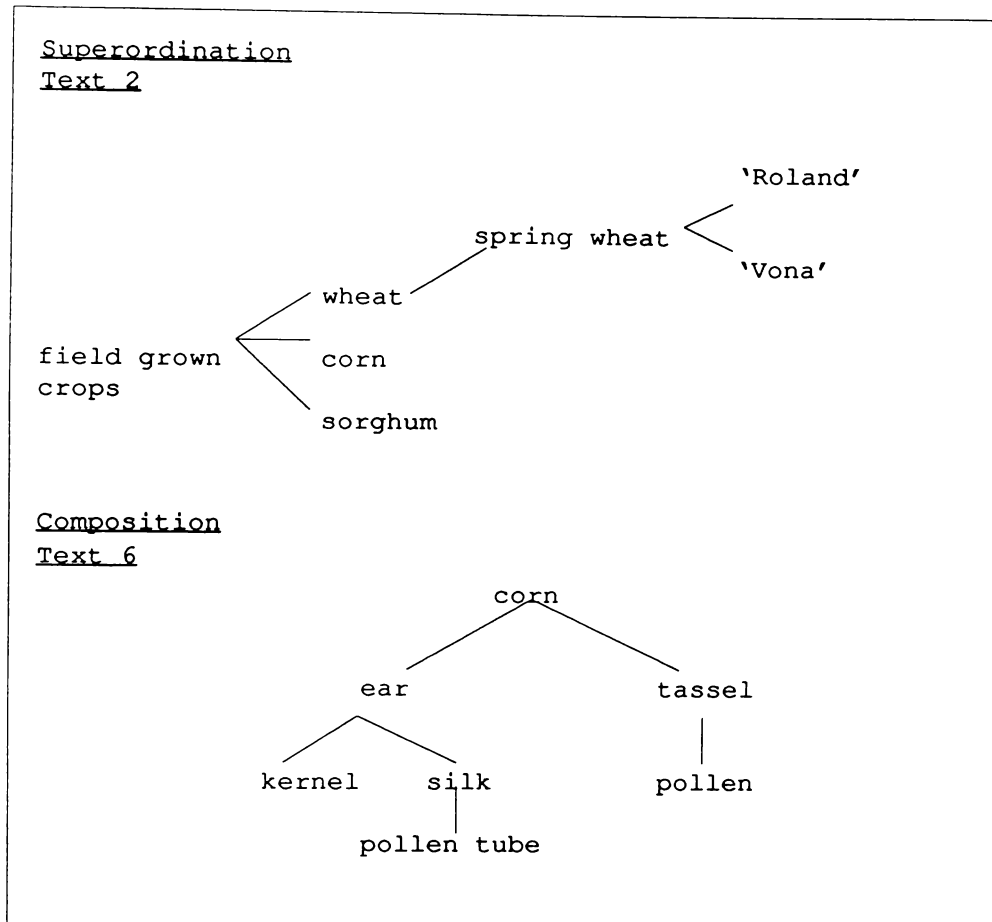
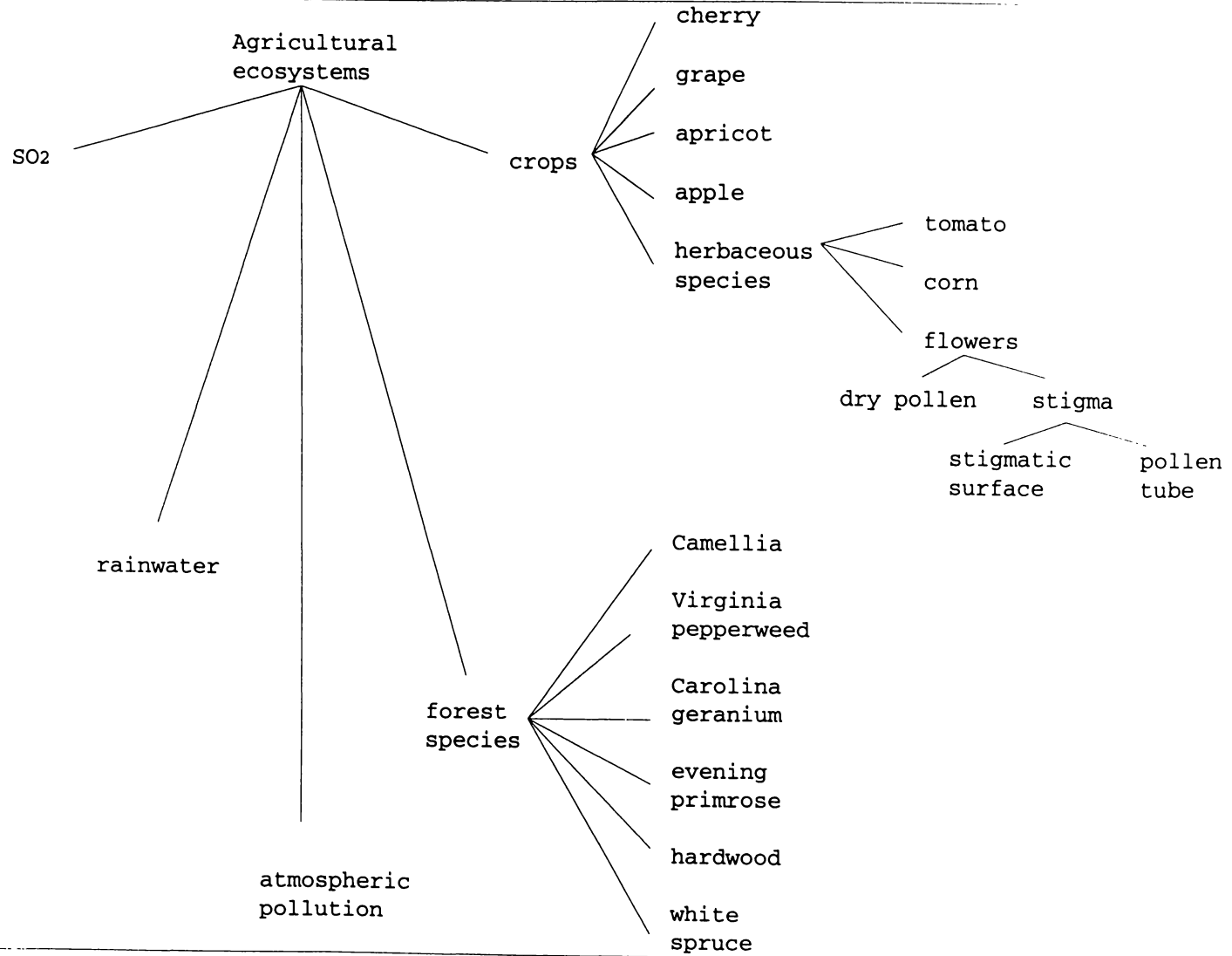


Figure 21: Technical taxonomies: superordination and composition

Consideration of the taxonomies in the texts analysed here revealed, however, not just examples of superordination and composition, but also examples of taxonomies which presented an *integration* of both superordinational and compositional arrangements, the *understanding of both* being necessary for complete *comprehension* of the relationships between the lexical items in the texts. An example of such a taxonomy can be seen in Figure 22 below.

Superordination and  
Composition  
Text 8



*Figure 22: An integrated taxonomy*

## 6.6 Implications for teaching

Applications of the analysis of discourse structures in second language teaching and learning materials have, generally, only focussed on one or two of the levels of discourse structure presented in this chapter.

Materials based on systemic functional analyses, for example, have generally focussed on the highest level of textual organisation of the texts, that is, their schematic structure and attempted to make correlations between these stages and the language of the texts.<sup>15</sup>

Applications of analyses which draw on the work of Swales have typically focussed on the schematic structure of the texts as well as *moves* and *steps* (Swales 1990) within stages of the texts and then aimed to show how these stages are realised in language.<sup>16</sup> There are also examples of materials which focus on writing in academic contexts which concentrate on the overall schematic organisation of the texts and semantic relations in combination with specific features of language use.<sup>17</sup>

All of the teaching and learning materials referred to above have attempted to identify a relationship between the rhetorical organisation of the texts and their language. They have done this, despite the fact that researchers both from within and beyond the world of English for Specific Purposes have, on numerous occasions, pointed out that there is no one-to-one relationship between rhetorical structure and language choice and that there is, simply (apart from very restricted or 'formulaic' examples of language use such as the use of English by air traffic controllers or certain instances of the use of English in a court of law) no such thing as 'specific purpose language'.

Nevertheless, there is a need for teaching and learning materials which focus on an integrated view of discourse structure in particular contexts of language use. As this study indicates, such materials must, if they are to be effective, take account of pragmatic aspects of language use, such as the protocol of different speech communities and their understandings and expectations of how different texts, constructed for different purposes, should proceed. These materials should, furthermore, be derived from an analysis of actual language behaviour and, therefore, be *data driven* rather than *intuition driven*. Analyses of this sort could thus be a very useful source of information for language programme development. It is no longer, really, the number of texts that matter: the prototype will emerge on the basis of analysis of very few texts in fact.

## 6.7 Further research

This chapter has indicated a number of areas requiring further research. A critical direction for future research is for the scientific testing of the framework proposed here such as, in the experiments carried out by Rosch and Rosch and Mervis.<sup>18</sup> That is, there is a need to establish experimentally, whether the initial prototype framework proposed is adequate and the extent to which an exemplar may vary in terms of stereotypical characteristics and still retain membership of the genre of scientific reports.

There is also a need to establish whether an experimental research paradigm involving the testing of an hypothesis is, in fact, the only key central concept in scientific reports or whether there are also other key

concepts which are integral to such texts and which may, equally, characterise instances of the particular genre. This is important for gaining further detailed knowledge of the stereotypical properties of the texts.

Research should also be carried out with texts based on other research paradigms to see if a change in this key concept alters the ways in which the text/s proceed in terms of textual patternings. It is only when this is done that we will be in a position to know how important this particular paradigm is in influencing discourse structures and expectations.

An investigation could also be usefully carried out into the extent to which the shared understandings of the particular discourse community impact upon what is sourced in the texts and what is not as well as how this changes over time (as information moves from being 'new knowledge' to part of the 'shared knowledge' of the particular discourse community). Knowledge of conventions such as this would provide important information for the development of programmes which focus on writing in research and academic settings.

It would also be useful to examine the extent to which integrated technical taxonomies (which require an understanding of both superordinational and compositional relations) occur in scientific texts. What this will reveal is whether the taxonomies revealed in this study are particular only to the texts under investigation or whether they are, indeed, a widespread phenomenon in scientific writing.

The groupings and patternings of semantic relations both within and between components of discourse elements is a complex matter requiring detailed investigation in order to establish whether further typical patternings can be identified. It would be useful, for example, to explore whether the semantic relation of Statement-Exemplification is as prevalent in other sections of the texts as it is in the components investigated here. Information such as this could also be usefully employed in scientific writing programmes.

Very little has been done to establish the extent, and nature of 'semi-formulaic' language in scientific texts such as Hasan reveals in her analysis of the element, 'placement' in the nursery tale (Hasan 1984a). Although an investigation of this sort may reveal as wide a range of realisational possibilities as has Hasan's analysis, elsewhere, of lexico-grammatical patternings of 'offers' (Hasan 1985), it would still be a important piece of research in that it may yet reveal that there is a distinction that can be made between the lexico-grammatical encodings of 'semi-formulaic' and 'non-formulaic' discourse elements in texts.

Finally, it is important that all of the above be carried out with a significantly larger range and number of texts than those analysed here in order to reveal to what extent the conclusions reached in this study can, indeed, be sustained. Future research might usefully concentrate on a few features over a large number, and wider range, of texts in order to gain further and more detailed information on each of the particular aspects of language use investigated in this study. It is here that a probabilistic argument *may* become relevant in that certain language features may emerge as *characteristic* of the particular

genre, rather than as features by which the particular genre may be *defined*. Indeed, the notion of probabilism has relevance *only* within a framework for genre analysis based on the notion of prototype (rather than a *definitional* view) in which "unassailable definitions" (Swales 1990) of the particular genre are no longer required.

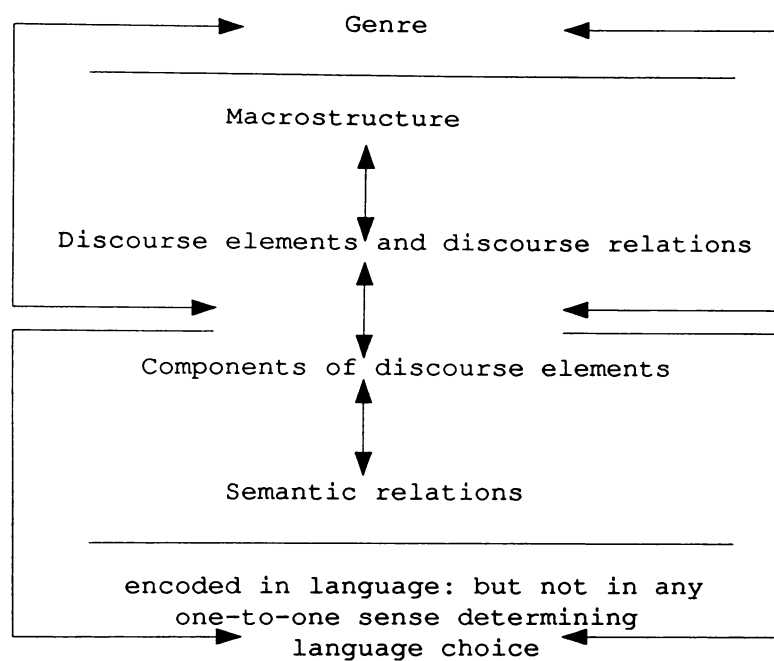
All of the above, further, must be carried out with large corpus of texts, which includes a range of different genres. Much research is, thus, still required in order to fully validate the conclusions reached in this study.

## 6.8 Conclusions

In this chapter and the preceding one, the aim has been to present a coherent framework for genre analysis which is sufficiently comprehensive to explain what it is that leads users of a language to recognise particular communication events as examples of particular genres. It has aimed to do this by constructing an analytic framework which is socio-psychological in orientation and which has a level of delicacy sufficient to uncover a genre prototype, and the range of stereotypical properties associated with it, at the same time as having sufficient explanatory power to accommodate the assignment to the genre of texts which lack a number of properties which, at first sight, might seem to be essential if a text is to be treated as an instance of the genre-prototype. Further research still needs to be carried out, however, to determine the *actual* range of stereotypical properties associated with the particular genre and their frequency of occurrence in actual texts.

The study has also aimed to show that what typifies a genre at the discourse level is not dependent on the presence on any one particular aspect of discourse structure in isolation, but on the *interaction* and *co-occurrence* of a number of aspects of discourse structure, that is, those of macrostructure, discourse elements and discourse relations, components of discourse elements and semantic relations. This integrated perspective on the relationship between genre (or frames), textual organisation and language is summarised in Figure 23 below. This perspective incorporates the position that, even within the constraints specified by each of these particular aspects of discourse organisation, there is still a vast range of language possibilities for the encoding of texts. It is, therefore, simply not possible to predetermine *exactly* what these language choices will be. That is, in the words of Candlin, "there *is* no one-to-one relationship between [language] form and function" in texts (emphasis mine) (Candlin 1981, 24).

The study has, equally, aimed to show that, in typical instances of a particular genre, it is not the presence *alone* of these various aspects of discourse structure which leads to the recognition of a text as an instance of a particular genre; it is, rather, the co-occurrence and interaction of each of these aspects of discourse structure with other components of the interactional and conceptual frames *in their entirety*. Genre assignment is, thus, in the case of typical instances of a genre, on the basis of both pragmatic *and* perceptual conditions. The structure of a text is, at no point *of its own*, genre defining. In the case of untypical, or *fuzzy edged*, examples of the genre, it is argued, it is on the basis of *pragmatic* conditions alone that genre membership is assigned. In neither case, however, are the conditions for genre assignment related to language selection.



*Figure 23: Genre, textual organisation and language: an integrated perspective*

## 6.9 Summary

The purpose of this chapter has been to test the findings of the first stage of the study as well as submit the texts analysed in the first stage of the study to a contrasting analytic perspective. It has also presented an analysis of a number of 'specific purpose' texts as a demonstration of how the socio-psychological framework described in Chapter 4 can be applied to provide an explanation of genre assignment. This chapter has also investigated the relationship between frames and language. Finally, it has reached a number of conclusions based on this further stage of the study. The chapter which follows will summarise the

findings presented in this and in previous chapters of the study as well as highlight implications for teaching and further research.

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## NOTES

- 1 See Hunston (1989).
- 2 See Chapter 3, section 3.5.
- 3 See Figure 17.
- 4 See Appendix IV for the analyses on which this statement is based.
- 5 See Chapter 3.
- 6 See, however, Murison and Webb (1991) for an example of teaching materials which include a focus on semi-technical vocabulary on the assumption that it *does*, in some way, characterise scientific report writing.
- 7 See Table 11.
- 8 See Chapter 2, section 2.6 for an explanation of the notational descriptions employed in this table.
- 9 For further discussion of the cognitive basis of macrostructures see van Dijk (1980).
- 10 Keshet, Lieman-Hurwitz and Cedar (1986).
- 11 And, in the case of Text 15, an extremely prestigious journal in the area as can be seen by its high SCI impact ranking.
- 12 See Chapter 5, section 5.2.4 for a fuller discussion of semantic relations.
- 13 This summary is based on an analysis of Texts 1-12 (Background Information) and Texts 1-15 (Purpose of Study). The analyses are attached as Appendix V.
- 14 See Halliday (1985a) for a key to this analysis.

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<sup>15</sup> See, for example, Derewianka (1990), Drury and Webb (1991).

<sup>16</sup> See, for example, Weissberg and Buker (1990).

<sup>17</sup> See, for example, Jordan (1990).

<sup>18</sup> As in Rosch (1973a) and Rosch and Mervis (1975).

## CHAPTER 7

### SUMMARY, CONCLUSIONS AND IMPLICATIONS FOR TEACHING AND FURTHER RESEARCH

#### 7.1 Introduction

This study has aimed to develop a genre analysis framework which reflects what it is that leads users of a language to recognise communicative events as instances of particular genres as well as provide the basis for a re-definition of the term 'genre' itself. It has also aimed to establish a framework which allows us to account for the fact that certain instances of genres are further from what may be described as the genre prototype than others and for the fact that relationships are perceived between instances which may be structurally very different. It has done this by testing and extending a definition of genre provided by Swales which, to date, has been unbacked by research evidence or investigation as well as by submitting a number of texts to both social-semiotic and socio-psychological oriented analyses.

#### 7.2 Conclusions

Within the context of the texts examined, the study, in general terms, has validated Swales' definition of genre. In contrast to the position held by Swales, however, the study has concluded that while it is possible to make statements concerning meaning-creation and goal-direction within the context of genre, it is a matter of much greater

complexity to draw conclusions regarding the relationship between genre and the actual language of texts. It has indicated, in particular, that patterns of textual organisation do not determine language encodings and that *characteristic* choices in such texts occur at the *semantico-pragmatic* level of language use; that is, in terms of choices of discourse relations, semantic relational interactions etc, rather than that of language selection. That is, whereas the number of semantico-pragmatic choices in a particular text are finite, their potential encodings in the grammar and lexis of the language are not.

The study, furthermore, has demonstrated that while it is possible to analyse and describe the textual structures within the context of a particular genre, this notion needs to be extended to incorporate *each* of the various aspects of textual organisation which co-occur within a text. Thus, any description of structural patternings within a genre needs to incorporate descriptions of the patternings of macrostructure, discourse elements and discourse relations, components of discourse elements *and* semantic relations. It is clearly the case that they are each part of the one inter-related whole.

In typical instances of a genre, it is not the existence of particular textual patternings alone, however, which leads to the assignment of a text as an instance of a particular genre, but rather the co-occurrence and interaction of each of these particular patternings with other components of interactional and cognitive frames; that is, with other *pragmatic* and *perceptual* aspects of communication events. In the case of untypical instances of a particular genre, it tends to be the *pragmatic* aspects of the frame which account for genre assignment. Indeed, structural definitions of genre, such as those which underlie

systemic functional analyses of genre, do not provide a basis for genre assignment because they fail to accommodate the notion of prototype and the interactional characteristics of genres above the level of encoding. They are, furthermore, essentially atomistic and we have seen that atomistic descriptions are inadequate because it is not possible to identify an instance of a genre solely by reference to such a list of defining features. Nor can it finally be concluded that particular configurations of field, tenor and mode in any way determine the range of lexico-grammatical patterns which are encoded in language as instances of particular genres.

A definition of genre which incorporates the conclusions reached in this thesis is proposed below. This definition is an elaboration and extension of that originally presented by Swales<sup>1</sup> and is fundamentally socio-psychological in orientation. The definition proposed excludes the essentially structuralist definition of genre which underlies systemic functional examples of genre analysis on the basis that the claims that have been made have *yet* to be conclusively demonstrated. These claims are:

- (a) that obligatory elements of textual structure "define the genre to which a text belongs" (Hasan 1989a, 61),
- (b) that particular configurations of field, tenor and mode can be used for making predictions about the structural organisation of a text (Hasan 1989a),

- (c) and that "the context of culture (via genre) and context of situation (via register) determine the kind of language used to create a text" (Macken et al 1989, 5)

### **7.2.1 A socio-psychological definition of genre**

**Our perception of the concept of genre is an instance of a particular communicative event. This instance incorporates prototypical idealisations of particular concepts and situations. These concepts and situations comprise a common set of interactional and cognitive (or conceptual) characteristics.**

**The interactional characteristics of a genre include specific speaker/s and receiver/s of the message, a particular channel of communication and, at a certain level of abstraction, a particular 'topic'. The communicative event, furthermore, occurs in a particular setting and has a particular communicative function.**

**Co-occurring with this interactional frame is also a cognitive (or conceptual) frame which incorporates a certain conceptual scenario. This scenario includes certain roles, co-occurring patternings of textual organisation and shared understandings, or protocols, of how the text might proceed.**

**Typical instances of genres demonstrate patterns of similarity in terms of the components of these interactional and conceptual frames. Genre assignment, in the case of typical instances, is on the basis of both pragmatic and perceptual aspects of the communicative event. Instances of genres, however, vary in their prototypicality. Where they**

are less typical, category membership tends to be on the basis of pragmatic, rather than conceptual, aspects of language use.

The names and classification of genres given by particular discourse communities provide important information for the analyst in that they reflect a community perception of these events.

### 7.2.2 Summary of conclusions

To summarise the conclusions reached in this study:

- (i) The study has, in general terms, validated Swales' original definition of genre, but has re-stated this definition in socio-psychological terms. This definition also aims to provide a framework which accounts for the assignment of communicative events as instances of particular genres. In contrast with Swales' definition, however, this definition incorporates the view that characterising choices in genres occur at the semantico-pragmatic level of language use rather than that of language selection ;
- (ii) Studies which aim to demonstrate that there are linguistic correlates for specific genres, that patterns of textual organisation determine language encoding, and that textual organisation can be described in *linguistic* terms are premature and may be misleading;
- (iii) The language of English language 'special purpose' written texts, at least so far as the texts under examination in this study

are concerned, is in no way different from that of English language use in general and that courses based on the assumption that it *is*, are premature and may be misleading.

This final conclusion is supported by Biber (1988) who, in a large scale study of examples of texts representing twenty three genres, found a wide range of linguistic variation within the particular genres examined, some of which he describes as "surprising and contrary to popular expectation" (Biber 1988, 178).

Biber concludes:

the linguistic form of a text ... is simply not highly constrained .. and is not able to provide a basis for genre assignment (Biber 1988, 170).

Biber's conclusions - conclusions that this study supports - are that:

Genre categories ... are assigned on the basis of use rather than on the basis of form (Biber 1988, 170)

and that:

Genres are defined and distinguished on the basis of systematic *nonlinguistic* criteria, and they are valid in those terms [emphasis mine] (Biber 1989, 39).

### 7.3 Implications for teaching

The research described here provides a framework for genre analysis which could be employed in language development programmes. Such analyses should be based on actual language behaviour and, therefore,

be data driven rather than intuition driven. That is, they should examine what actually happens in texts rather than what might be assumed happens. The analysis of the texts, however, will not - as it relates to genre - be essentially linguistically orientated because it will be *above* the level of encoding. Such programmes would, thus, have as their prime focus *rhetoric* rather than language. That is, they would examine how effective writing (in *non-linguistic* terms) achieves its goals. The framework proposed here, thus, could provide the basis for a *socio-semiotic* and *perceptually-oriented*, rather than language-oriented approach to genre-based language programme development. Such a programme would be based on an understanding of how it is that we arrange and organise information for particular rhetorical purposes as well as how it is that we recognise events as instances of particular genres.

This is not to say, however, that learners will not have language needs and that these language needs should not be attended to. What it is to say, rather, is that these language needs will very often be *general* language needs, rather than 'genre-specific' or 'specific purpose' language needs.

#### 7.4 Further research

A number of implications for further research have already been outlined in some detail in Chapter 3 and Chapter 6 above. Although these will not be re-stated here, attention should be brought once more to the fact that the framework for genre analysis presented here needs to be tested on a greater number of examples of research article Introductions as well as on other spoken and written texts. This is

important in order to reach a fuller understanding of prototype and of the extent to which there is variation within and between instances of particular genres.

A further avenue of research which would increase our understanding of how people assign texts to different genre categories could be carried out with a research design somewhat different from that employed here. That is, raters could be asked to assign texts to different genre categories and then record the reasons for their assignment. These introspections could then be analysed for similarities and differences in criteria.

Equally, a useful area of exploration would be an inter-rater reliability study of the analyses presented here such as that carried out by Crookes (1985, 1986) in his validation study of Swales' (1981) four-move model for the Introduction section of research articles.

## 7.5 Summary

The study described in these chapters has aimed to present a genre analysis framework based on social and psychological aspects of text production and comprehension. It has done this by examining a sample of texts from both social-semiotic and socio-psychological perspectives. Although the first of these perspectives has been shown to have certain strengths, it has also been revealed to have certain limitations. The socio-psychological perspective, much of which is drawn from work in the area of the psychology of comprehension and production of texts, has been proposed as the most comprehensive and

adequate for explaining the assignment of communicative events as instances of particular genres.

A framework for genre analysis has then been presented which draws, equally, on work in the areas of discourse analysis, pragmatics, language and cognition, natural language processing, artificial intelligence and critical theory and practice. The framework aims to reflect research on the interaction between meaning-creation and perception and arrangement, storage and retrieval in the context of the perception and production of specific genres, or instances of communicative events. It also aims to account for the fact that certain instances of genres are further from what may be described as the genre prototype than others and for the fact that relationships are perceived between instances which may be structurally very different.

Finally, this chapter has proposed a definition for the term 'genre' in the context of the research findings. This study has examined current concepts of genre within a particular context of language use; that is, the writing up and publication of experimental research in English. It has concluded that the notion of 'genre-specific' language, along with that of 'specific purpose' language, may not be sustainable. Certainly, it cannot be promulgated in the absence of further, relevant research.

More investigations still, however, need to be carried out to further explore those aspects of the analysis only touched upon here, as well as to further test the proposals that have been made and conclusions that have been reached. The results of the study, however, already, have implications, not only for genre theory and analysis, but also for

language teaching and learning and language programme development.

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## NOTES

- <sup>1</sup> See Chapter 1, section 1.1.

## APPENDICES

- APPENDIX I: Texts analysed
- APPENDIX II: Transitivity and group structure analysis
- APPENDIX III: Summary: Structural elements, semantic attributes and lexico-grammatical patterns
- APPENDIX IV: Associated words
- APPENDIX V: Semantic relations

## APPENDIX I: TEXTS ANALYSED

## KEY

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|                            |                             |
|----------------------------|-----------------------------|
| BI: Background Information | JS: Justification for Study |
| IG: Indicating a Gap       | PS: Purpose of Study        |
| RS: Rationale for Study    | QR: Question Raising        |
| PR: Previous Research      | CS: Context of Study        |
| M: Materials               | R: Results                  |
| C: Conclusions             |                             |

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# Yield and Grain Quality of Spring Wheat (*Triticum aestivum* L., cv. Drabant) Exposed to Different Concentrations of Ozone in Open-Top Chambers

H. Pleijel, L. Skärby,

G. Wallin & G. Sellden

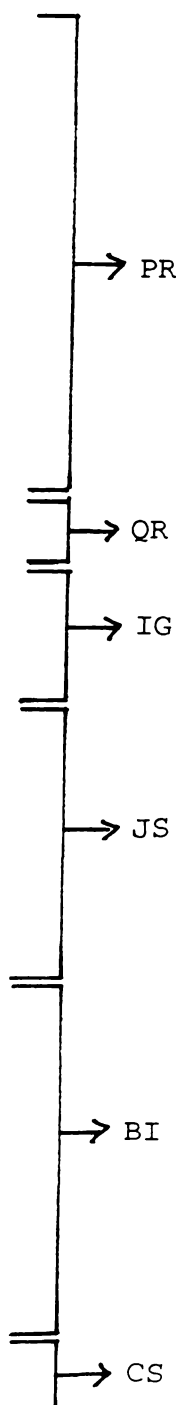
## INTRODUCTION

Several studies in the United States, within the National Crop Loss Assessment Network (NCLAN), have shown that ambient concentrations of ozone over large areas of the country are high enough to reduce the yield of field-grown crops (Heck *et al.*, 1983). In these, and other studies, wheat was found to be sensitive to ozone (Heagle *et al.*, 1979; Kress *et al.*, 1985; Amundson *et al.*, 1987; Kohut *et al.*, 1987). Information regarding the impact of ambient concentrations of ozone on the yield of important crops in Europe is scarce compared to the US. However, to assess the effect of ambient concentrations of ozone on crops, spring wheat (cv. Albis) has been used in a Swiss open-top chamber study. The results suggested that it was sensitive (Lehnherr *et al.*, 1987), as grain yield and net photosynthesis decreased with increasing ozone concentration. These results, together with negative results on yield of spinach and potatoes exposed to elevated concentrations of ozone in open-top chambers in southern Sweden (Skärby & Jönsson, 1988), raised the question whether negative effects of ambient concentrations of ozone on the yield of crops occur also in Sweden.

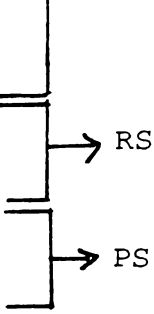
The concentrations of ozone in southern Sweden are in the same range as in the NCLAN and Swiss studies. However, caution must be exercised, if results concerning effects of air pollutants on plants are to be extrapolated from one geographical region to another, e.g. from North America to Europe. The wheat cultivars grown in North America are not the same as those used in Europe and different cultivars of wheat have been shown to respond differently to ozone exposure under similar conditions, in the laboratory (Shannon & Mulchi, 1974) as well as in the field (Heagle *et al.*, 1979). Furthermore, while little information regarding how weather conditions influence plant response to ozone is available, the NCLAN data show that the effect of ozone on yield can vary from year to year (Heagle *et al.*, 1988).

We consider ozone to be the most important air pollutant for field grown crops in southern Sweden. The occurrence of major phytotoxic gases in rural areas of southern Sweden is characterized by low sulphur dioxide and nitrogen dioxide levels compared to ozone. In 1985-87, the 24-h monthly means for ambient ozone concentration on the Swedish west coast were in the range of 27 to 48 nl litre<sup>-1</sup> during April to September. Episodes reaching 100 to 125 nl litre<sup>-1</sup> (1-h means) may occur in spring and summer. During 1985-87, from April to September the 24-h monthly means for sulphur dioxide and nitrogen dioxide were  $3.6 \pm 1.5$  and  $3.2 \pm 1.0 \mu\text{g m}^{-3}$ , respectively (Lövblad *et al.*, 1985; Lövblad *et al.*, 1986; Dahlberg *et al.*, 1987).

In 1984, The Commission of the European Communities (CEC) initiated an experimental programme to evaluate crop loss due to air pollution in



Europe. The co-operative programme (COST 612) mandates the use of open-top chambers, with filtered and non-filtered air, sited in field-grown crops. Spring-sown cereals or legumes are strongly recommended. The present study is a part of that programme. Wheat was chosen since it is of great agricultural importance in southern Sweden. The study was conducted in south-west Sweden in 1987 and 1988, and was designed to follow the common programme of the CEC co-operation. The aim was to evaluate the impact of ambient and elevated ozone concentrations on grain yield and quality of an important spring wheat cultivar in southern Sweden.



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# Effects of Ozone on the Yield of Spring Wheat (*Triticum aestivum* L., cv. Albis) Grown in Open-Top Field Chambers

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& W. Tschannen<sup>a</sup>

## INTRODUCTION

Air pollution by ozone (O<sub>3</sub>) can decrease the yield of agronomically important crops (Heck *et al.*, 1986). Based on studies with open-top chambers, yield losses due to O<sub>3</sub> of various crops have been estimated in different parts of the USA (Heck *et al.*, 1983). Comparatively little is known about the possible impacts of O<sub>3</sub> on crops in Europe (Roberts, 1984). In view of this lack of information, a co-ordinated experimental programme to evaluate crop losses due to air pollution in Europe was initiated by the Commission of the European Communities (CEC). The present study carried out in Switzerland was designed to accompany the CEC programme.

Based on air quality data, it was suggested that O<sub>3</sub> dominates the air pollution climate in an area including southern Germany, parts of Austria and Switzerland (Last *et al.*, 1986). From the analysis of present-day and historical O<sub>3</sub> data, it was suggested that average concentrations may have increased in Europe during the past century (Volz & Kley, 1988). Ozone concentrations observed during the growing season in central Switzerland often exceed 0.060 µl litre<sup>-1</sup>, which is the National Air Quality Standard for the 1-h maximum O<sub>3</sub> concentration (Bundesamt für Umweltschutz, 1988). Episodes with peak concentrations above 0.06–0.07 µl litre<sup>-1</sup> have been shown to cause visible damage to sensitive species (Becker *et al.*, 1989). Little is known, however, about the effect such O<sub>3</sub> exposure might have on the yield of agricultural crops. Based on observed reductions in wheat leaf photosynthesis, yield losses are expected to occur (Lehnherr *et al.*, 1988). The aim of this study was to evaluate possible effects of different levels of O<sub>3</sub> in ambient air on the yield of spring wheat, grown in a major agricultural area of the country, and to rank different components of yield according to their sensitivity to O<sub>3</sub>.

Wheat is one of the major crops used in Swiss agriculture. In 1985, 32% of arable land was used for wheat production (Bundesamt für Statistik, 1986). Only approximately 20% of the wheat cultivars used are spring sown. Nevertheless, a spring wheat cultivar was used for this study, in order to comply with the common protocol of the co-ordinated CEC programme, which prescribed the use of spring-sown crops. The effects of O<sub>3</sub> on wheat yield have previously been studied in the USA: Kress *et al.* (1985) observed higher O<sub>3</sub> sensitivity of wheat as compared to corn or sorghum. In the case of one cultivar (Roland), potential yield reductions due to ambient O<sub>3</sub> were suggested. Yield reductions due to ambient O<sub>3</sub> levels were also observed in experiments by Amundson *et al.* (1987) for the cultivar 'Vona', and for the cultivars 'Roland' and 'Vona' by Kohut *et al.* (1987). However, these results cannot be extrapolated to European conditions without caution. Significant cultivar and year-to-year variability, as observed by Heagle *et al.* (1979), Mulchi *et al.* (1986) and Kohut *et al.* (1987), indicate that different agronomic practices, and different soil and climatic conditions, can have an important effect on the response of crops to O<sub>3</sub>.

PR

IG

CS

BI

IG

PS

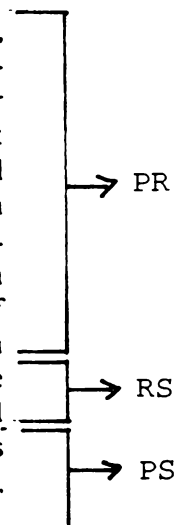
BI

PR

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In many earlier studies which evaluated  $O_3$  effects on field-grown crops, open-top chambers were used (Heck *et al.*, 1983). Other techniques like open-air fumigation systems (McLeod *et al.*, 1988) have been used successfully for other pollutants. One of the advantages of using open-top chambers is that  $O_3$  levels can be reduced below ambient concentrations. The CEC protocol suggests the use of open-top chambers for the co-ordinated project in Europe. This technique introduces a number of changes in the environmental conditions the plants are exposed to. These include changes in temperature, humidity, rainfall, radiation and wind velocity. The extent of the changes depends on the technical specifications of the fumigation system, as well as on-site conditions. It is thus important to investigate these changes and to relate them to differences in growth, development and yield between plants grown inside and outside of open-top chambers. In this paper, the effects from enclosure on different yield parameters are included, as well as the yield response to  $O_3$ .



## Yield and Grain Quality Responses of Soft Red Winter Wheat Exposed to Ozone During Anthesis

C. L. Mulchi, D. J. Sammons, and P. S. Baenziger

IN A RECENT review of ozone effects on grain crops, Noggle and Jones (8) concluded that ambient concentrations are sufficiently high to damage grain crops in some areas of the USA, but probably have little impact in major grain growing regions. An examination of ambient photochemical oxidant data (Environ. Health Admin., Maryland Dep. of Health and Mental Hygiene) for southern Maryland, averaged yearly and quarterly for the period 1972-1979, revealed an average of 140 h annually with oxidant levels in excess of  $80 \text{ nL L}^{-1}$  (7). However, an average of 39 h or 28% of the elevated oxidant levels occurred during the period April through June, the primary reproductive and grain-filling period for small grains in the mid-Atlantic states.

Ozone injury to wheat vegetation has been described by several researchers (9, 10). In long-term studies, Heagle et al. (2) reported the mean threshold ozone concentration for significant injury and decreased growth and yields of soft red winter wheats (*Triticum aestivum* L.) was between 60 and  $100 \text{ nL L}^{-1}$  with differences being observed among cultivars. Ambient ozone concentrations in excess of  $120 \text{ nL L}^{-1}$  were reported during the study period 10-20 May 1977.

Following exposure of wheat cultivars to  $200 \text{ nL L}^{-1}$  ozone concentration for  $4 \text{ h day}^{-1}$  for 7 days during anthesis, Shannon and Mulchi (11) noted significant reductions in yields. Estimates of yield losses for winter wheats exposed to mean ozone concentrations of 60, 80, and  $100 \text{ nL L}^{-1}$  for  $7 \text{ h day}^{-1}$  during the spring season were 11.0, 17.2, and 23.5%, respectively, compared with ozone levels in filtered air treatments of  $25 \text{ nL L}^{-1}$  (3). As the Maryland air quality data would confirm, air pollution episodes in the mid-Atlantic states during the spring months would be typically characterized by elevated ( $60$  to  $120 \mu\text{L L}^{-1}$ ) ozone levels from 2 to  $6 \text{ h day}^{-1}$  for 2 to 5 days' duration.

The objectives of the present study were to examine the yield and grain quality responses of field-grown cultivars of soft red winter wheat following a simulated air pollution episode during pollination with ozone levels in slight excess of current USEPA secondary standard for ozone in the atmosphere ( $120 \text{ nL L}^{-1}$  hourly average not to be exceeded for more than 1 day  $\text{yr}^{-1}$ ).

→ PR

→ PS

L. W. KRESS, J. E. MILLER and H. J. SMITH

## INTRODUCTION

WHEAT has been among the top four U.S.A. crops in terms of acreage planted and dollar value since 1960. It accounts for about 11% of the total cash value of U.S.A. crops, and 51% of that value is generated in six states: Kansas (17%), N. Dakota (9%), Oklahoma (8%), Washington (7%), Montana (5%) and Texas (5%).<sup>(1,4)</sup>

→ BI

Although data for pollutant concentrations are limited in many of the areas where crops are grown, research and field observations suggest that ozone ( $O_3$ ) may be responsible for up to 90% of all crop loss in the U.S.A. caused by air pollution.<sup>(2,5,11)</sup> The available air quality monitoring data suggest that elevated  $O_3$  concentrations may occasionally occur in much of the Midwest where wheat is of major importance.<sup>(1,12,15)</sup> Mean growing season  $O_3$  concentrations ranging from 0.04 to 0.06 ppm (seasonal 7-hr/day mean, 0900–1600 ST) occur over most of these regions. (Subsequently, all  $O_3$  concentrations referred to in this paper will be the 7-hr/day mean for the growth period of the plants unless otherwise noted.) A growing season mean concentration of 0.05 ppm  $O_3$  has been estimated to reduce the yields of soybean, 13.4%; field corn, 1.6%; wheat, 2.3%; cotton, 11%; kidney bean, 3.1%; peanut, 12.6%; lettuce, 22.2%; turnip, 14.1%; and spinach, 9.2%.<sup>(6)</sup>

→ PR

→ BI

Previous work with four cultivars of soft red winter wheat (Blueboy 11, Coker 47-27, Holly and Oasis) exposed to  $O_3$  in open-top chambers indicated that yields were reduced from 1 to 11% at 0.06 ppm  $O_3$  (seasonal 7-hr/day mean) and 11 to 25% at 0.10 ppm  $O_3$  compared to a 0.03 ppm control treatment.<sup>(4)</sup> A comparison of the yield responses to  $O_3$  of the four cultivars showed that the responses were homogeneous and a common response model could be used to describe them.<sup>(6)</sup>

→ PR

Given the importance of winter wheat and the absence of information on the  $O_3$  sensitivity of midwestern cultivars, there is an obvious need for more data on  $O_3$  impacts to winter wheat yield. The study reported herein is a portion of the research at Argonne National Laboratory (Argonne, IL) as a member of the National Crop Loss Assessment Network (NCLAN) in 1982 and 1983. The study was initiated to provide further biological response data suitable for evaluating ambient air quality standards and for use in the NCLAN economic assessment of the consequences of  $O_3$  exposure to crops. The specific objective was to establish the exposure-response relationships between yield of three important cultivars of soft red winter wheat grown in the Midwest and chronic exposures to a range of  $O_3$  concentrations.

→ IG

→ CS

→ PS

## Acid Rain and Pollen Germination in Corn

Frank S. Wertheim & Lyle E. Craker

### INTRODUCTION

Seed formation in corn, *Zea mays* L., and most other higher plants requires the germination and growth of a pollen tube on the stigma surface until the tube penetrates the stigmatic tissue and continues growth inside the style to the egg nucleus. Any environmental stress that prevents or alters the close physical and/or chemical association between pollen and stigma, necessary for the germination of pollen grains and elongation of pollen tubes, could disrupt the reproductive process, reducing seed production and perhaps modifying the genetic constitution of the plant population as genes in non-germinating pollen are lost. Acid rain, an environmental phenomenon that exposes the reproductive parts of plants to acidity and various associated rain contaminants in higher concentrations than those present in non-acid rain, has been demonstrated to reduce pollen germination in corn (Waldron *et al.*, 1985; Wertheim & Craker, 1987) and other plants (Sidhu, 1983; Cox, 1984). The reasons for reduced pollen germination are, however, unknown. The objectives of this study were to investigate the contribution of the sulphate ion, the effect of acidity, and the effects of duration and timing of acid rain episodes on the reduction in pollen germination observed on corn silks exposed to simulated acid rain.

→ BI

→ PR

→ IG

→ PS

## Acid Rain and Seed Yield Reductions in Corn

Lyle E. Craker and Peter F. Waldron

**I**N CORN (*Zea mays* L.) and other angiosperms, seed production depends on successful completion of the sexual reproductive process. Following pollination, this process requires a physical/chemical interaction of pollen with the stigmatic surface that enables the pollen grain to germinate and the resulting pollen tube to penetrate the tissue and grow inside the style to the egg nucleus. Environmental stresses that change the stigmatic structure or chemistry could be expected to inhibit pollen germination and/or tube elongation, reducing the number of fertilizations and resulting in a decrease in the number of seeds formed. → BI

Acid conditions are known to adversely affect in vitro germination and growth of pollen from several plants (Brink, 1924; Cox, 1984; Sidhu, 1983; Van Ryn et al., 1985). In addition, previous investigations in our laboratory (Wertheim and Craker, 1987, 1988) have demonstrated that germination of corn pollen is reduced on silks treated with a simulated acid rain. Both of these observations suggest that acid rain falling on exposed stigmas may hinder pollen-silk interaction and/or the development of pollen tubes required for fertilization of an egg cell, causing a reduction in the number of fertilizations and resulting in a decrease in the number of seeds formed. → PR

The objective of these experiments was to determine if an acid rain event on the silks would affect seed yield in corn and if any yield reductions were related to the quantities of pollen used in the pollination process. → PS

## Effects of Acid Rain on Corn Silks and Pollen Germination

FRANK S. WERTHEIM AND LYLE E. CRAKER

Corn (*Zea mays* L.), like other wind-pollinated plants, requires the movement of pollen in the open atmosphere from the male to the female reproductive organs during pollination. Consequently, both the tassel and silks of corn are subject to exposure to any atmospheric pollutants present during the time of pollination. If these pollutants are toxic to parts of the plant reproductive system, seed formation and thus yield of the plant could be diminished due to a failure of the plant to successfully complete the pollination and/or fertilization process. For fertilization to be completed, the pollen, through a series of biochemical and enzymatic reactions related to viable pollen and silk chemistry, must germinate and grow on the surface of the silk tissue until the pollen tube penetrates the silk. A pollution stress that altered silk structure or chemistry, creating a hostile environment for pollen germination and growth, could be expected to limit fertilization.

→ BI

Although evaluations of the susceptibility of corn to acid precipitation have generally indicated the plant is tolerant of acid rains, conclusions have been based on injury to vegetative portions of the plant. Lee et al. (1981) demonstrated that simulated acid rain of pH 3.0 caused some degree of foliar injury, yet the total above-ground weight (stem plus leaves) was greater than control plants not treated with acid rain. Simon (1983) has reported that corn seedlings have the ability to absorb and utilize S deposited on the plants by either sulfur dioxide (SO<sub>2</sub>) or simulated acid rain. An investigation by Craker and Bernstein (1984) has demonstrated that corn leaves will buffer only very small amounts of acid compared to the other crops tested, yet this was one of the species least injured by simulated acid rain. Waldron et al. (1985) and Ziegler et al. (1985) have reported that lower yields in corn plants treated with a simulated acid rain were due in part to fewer kernels per ear.

→ IG

Acid conditions have been demonstrated to affect pollen germination and growth in in vitro studies. Karnosky and Stairs (1974) have observed that germination of pollen from forest trees is decreased by SO<sub>2</sub>, and Cox (1983) has reported significant inhibition of pollen germination of several forest tree species growing on a medium with pH 3.0. Kratky et al. (1974) have demonstrated that germination and tube elongation of tomato (*Lycopersicon esculentum* Mill.) is inhibited by rain water of pH 4 to 4.4. Experiments by Masaru et al. (1980) have demonstrated that both the hydrogen ion and the associated anions are important in limiting growth of pollen tubes in camellia. More recently, Cox (1984) has suggested that in vivo germination of pollen is less affected by pH than in vitro pollen germination due to the buffering capacity of the stigmatic surface.

→ PR

The objective of this study was to determine if acid precipitation affected the germination and growth of pollen on silk tissue of corn.

→ PS

## Direct Effects of Simulated Acid Rain on Sexual Reproduction in Corn

Denis T. DuBay

THE EFFECTS of the deposition of acidic substances on plant growth and development are not well understood. The acidity of simulated rain may increase, have no effect upon, or decrease crop yields (Lee et al., 1981; Irving, 1983), and the role of acidic deposition in incidences of forest decline is unclear (Johnson and Siccama, 1983; Scott et al., 1984). Assessing the effects of atmospheric pollutants in general and of acid rain in particular on agricultural and forest ecosystems will be difficult until the physiological and developmental mechanisms involved in plant response to atmospheric deposition are better understood.

One way in which the deposition of acidic substances may influence the seed or fruit production of plants is through their direct impact on processes of sexual reproduction. Karnosky and Stairs (1974) observed that sulfur dioxide ( $\text{SO}_2$ ) inhibited the in vitro germination and tube elongation of moist pollen from three forest tree species, but had no effect on dry pollen. They reported that absorption of  $\text{SO}_2$  by the moist germination medium resulted in its acidification. Sulfur dioxide at or below  $0.26 \text{ mg m}^{-3}$  (0.1 ppm) also reduced in vitro germination of pollen from several herbaceous and forest tree species (Varshney and Varshney, 1981; Keller and Beda, 1984), increased chromatid aberrations (Ma et al., 1973), and reduced mitotic activity of cultured *Tradescantia* pollen tubes (Ma and Khan, 1976).

In contrast to these reports, Facteau and Rowe (1981) found that cherry (*Prunus avium* L.) and apricot (*Prunus armeniaca* L.) pollen tube growth in vivo was unaffected by  $\text{SO}_2$  concentrations up to  $15.72 \text{ mg m}^{-3}$  (6 ppm), and DuBay and Murdy (1983a) reported that Virginia pepperweed (*Lepidium virginicum* L.) pollen germination and tube elongation was significantly less sensitive to  $\text{SO}_2$  when exposed on the stigma than when exposed in vitro. These results suggest that the sensitivity of pollen in vitro to  $\text{SO}_2$  may not be a valid indicator of its sensitivity in vivo, nor of the sensitivity of plant sexual reproduction. However, Murdy (1979) and Murdy and Ragsdale (1980) reported that  $\text{SO}_2$  reduced the seed production of treated flowers when relative humidity (RH) was at or above 90% during treatment and suggested that the results of in vitro studies using moist culture media may correspond to in vivo studies carried out at high RH since  $\text{SO}_2$  is very soluble in water (Hocking and Hocking, 1977).

→ IG

→ PR

→ IG

→ PR

DuBay and Murdy (1983b) observed that the decline in the seed production of Carolina geranium (*Geranium carolinianum* L.) reported by Murdy and Ragsdale (1980) was caused by an interaction of SO<sub>2</sub> and high RH that inhibited pollen germination on the stigma surface, and suggested that acid rain might have similar effects. Simulated acid rain at or below pH 3.8 inhibited the in vitro germination of pollen from white spruce [*Picea glauca* (Moench) Voss] (Sidhu, 1983), three hardwood tree species (Van Ryn et al., 1986), and nine other forest species (Cox, 1983). Masaru et al. (1980) noted that simulated acid rain at or below pH 3.2 inhibited *Camellia* in vitro pollen tube growth, and Forsline et al. (1983a,b) reported that simulated rain below pH 2.75 inhibited in vitro pollen germination in apple (*Malus domestica* Borkh.) and grape (*Vitis labrusca* Bailey). Kratky et al. (1974) noted that rainwater (pH 4.0) collected downwind of an active volcano reduced the in vitro germination of tomato (*Lycopersicon esculentum* Mill.) pollen when compared to distilled water (pH 5.6). In studies of the effects of acid rain on pollen germination in vivo, Cox (1984) observed that pH 3.6 simulated rain applied before pollination to the stigma of evening primrose (*Oenothera parviflora*) decreased subsequent pollen germination, and Wertheim and Craker (1987) noted that simulated rain at pH levels 4.6 and below applied to silks inhibited subsequent pollen germination in corn. Although these reports of pollen sensitivity suggest that plant sexual reproduction is sensitive to acid rain, only Craker and Waldron (1986), working with corn, have reported a direct adverse effect of acid rain on seed development.

The objective of this study was to determine the direct effects of simulated acid rain applied before or after pollination on the processes of sexual reproduction and seed development of corn (*Zea mays* L.)

→ PS

## Flood Duration Effects on Soybean Growth and Yield

H. D. Scott,\* J. DeAngulo, M. B. Daniels, and L. S. Wood

GROWTH AND YIELD of soybean are influenced by a number of soil and climatic factors during the growing season. One of the most important of these factors is water. Water is required in significant amounts by soybean during the growing season (Scott et al., 1987), and yet water can modify the potential plant growth rates when either too much or too little is available (Scott and Batchelor, 1979). The effect of too much water is known as aeration stress and too little water is referred to as drought stress. The effects of temporary or continuous flooding on plant response have received little attention as compared with plant response to water deficits (Kozlowski, 1984).

In the humid region of the USA both drought and aeration stress conditions can occur during a soybean growing season. Too much water in a field can occur from intense rainfall events or from the application of excessive amounts of irrigation water. In general, both of these conditions result in the ponding of water due to inadequate surface drainage from a nonuniformly sloping soil surface. The combination of these conditions has occurred with such frequency that some soybean growers hesitate to irrigate at all or irrigate too infrequently. Therefore, this lack of irrigation tends to increase drought stress.

Detrimental effects of prolonged flooding on plant growth are usually attributed to an inadequate oxygen supply to sustain root respiration (Grable, 1966; Russell, 1977). In soybean, excessive water may be detrimental to root growth, and nodule formation and function (Huck, 1970; Sallam and Scott, 1987a; Turner et al., 1983).

The objective of this research was to determine the influence of flood duration at two growth stages on the growth and yield of soybean grown on two poorly drained, slowly permeable soils.

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## EFFECTS OF PROLONGED FLOODING ON SOYBEANS DURING EARLY VEGETATIVE GROWTH

A. SALLAM AND H. D. SCOTT

Plants vary widely in their sensitivity to injury in anaerobic soils, and within the same species the effect may vary depending on its stage of growth and on the environmental conditions. In sensitive plants, symptoms of injury can become evident in both roots and shoots. Soon after flooding, leaves may wilt, show epinasty (the downward curvature of petioles), or become chlorotic and senesce prematurely (Russell 1977). Stem elongation is often reduced and root growth is restricted. Exposure to anaerobic conditions for short periods, e.g., 24 h, can sometimes lead to permanent reduction in plant growth (Erickson and van Doren 1961), whereas longer exposure may lead to death.

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The absence of oxygen in the soil initiates a sequence of chemical and biochemical reduction reactions, producing compounds that may be injurious to root metabolism (Jackson and Drew 1984). Anaerobic metabolism within oxygen-deficient roots may also give rise to such products as ethanol that are potentially injurious to metabolism if they accumulate to abnormally large concentrations (Fulton and Erickson 1964). A comparison by Crawford (1967) of the metabolism of plants that varied in their tolerance to waterlogging suggested that the concentrations of ethanol were higher in sensitive plants.

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The threshold concentration of oxygen at which root extension begins to decrease is commonly about half that in air (Turner et al. 1981; Bretani and Brambilla 1982a,b). Lateral root extension and number can also be reduced by low concentrations of oxygen (Geisler 1965).

Flooded plants can change some of their morphological and physiological characteristics to tolerate anaerobic conditions. One of the most obvious anatomical adaptations is a considerable increase in the intercellular air spaces in the cortex, thus providing canals parallel to the axis of the root through which gases can diffuse longitudinally. This aerenchyma is particularly well developed in rice (*Oryza* species) and numerous aquatic plants (Arikado 1955; Coult 1964). In such species it is able to supply much of the oxygen requirement of the roots and the surrounding rhizosphere soil (Bidwell et al. 1968). Another survival feature of flooded plants is their ability to develop adventitious roots close to the soil surface, where the oxygen tension is usually higher or is more quickly restored after transient waterlogging. It is widely as-

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sumed that adventitious roots functionally replace the original root system, which is inhibited or killed by lack of oxygen, because their development coincides with a partial recovery from waterlogging injury to shoots (Arikado 1961; Yu et al. 1969). Complete replacement of function, however, is improbable because of the inevitable delay in the formation of the new root system and its limited size (Trought and Drew 1980). Its restriction often to regions that may be nutrient-poor (e.g. rice; Vamos 1957) and its vulnerability to subsequent drying after drainage (Wenkert et al. 1981) also make it difficult for the adventitious root system to completely replace the function of the original plant root system. Anaerobic conditions are also known to arrest nitrogen fixation of soybeans (Hoch et al. 1957).

The purpose of this study was to investigate the effects of flooding on soybean roots and shoots during early vegetative growth. Particular attention was given to root and shoot parameters that characterize soybean growth and development.

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## Response of Solid-Seeded Soybean to Flood Irrigation. II. Flood Duration

James L. Griffin and Arnold M. Saxton

IRRIGATION of soybean in the southern United States has increased in recent years, primarily as a means of reducing yearly variation in yields. Yield increases from both furrow and sprinkler irrigation have been reported for soybean grown on soils ranging in texture from clay to sandy loam (Ashley and Ethridge, 1978; Cassel et al., 1978; Doss et al., 1974; Heatherly, 1983; Heatherly and Elmore, 1986; Martin et al., 1979). The magnitude of response has been dependent on cultivar, seasonal rainfall, and timing of water application. BI

In southwestern Louisiana, the majority of soybean is grown in rotation with rice (*Oryza sativa* L.). Land is normally graded to facilitate flood irrigation in both crops. In a flood irrigation system, contour levees separate field areas of differing elevations. Water enters the field at the highest elevation and is gravity-fed to lower elevations. Water must continuously flow from the highest portion of the field to supply lower areas. Consequently, the highest graded portions of large fields may be inundated for extended periods of time. PR

Several studies have dealt with the effects of drought stress on soybean (Doss and Thurlow, 1974; Mederski and Jeffers, 1973; Momen et al., 1979; Sionit and Kramer, 1977), but information is limited on the effects of excessive water on yield and yield components. IG

Waterlogging affects plant growth through reduction of oxygen needed for root respiration and production of microbial toxins (Russell, 1977), and in legumes through reduction in nodule function (Troedson et al., 1981a). Stanley et al. (1980) studied the effects of high water tables on top and root growth in soybean and concluded that yields were decreased more by drought than inundation. In addition, they noted that even though yields were not affected, individual root tolerance to high water table was greater before than after flowering. Under season-long wet soil conditions, soybean produced higher seed yield and more prolific root growth and nodule formation than plants grown with conventional intermittent irrigation (Garside et al., 1979). After a short lag period, soybean acclimates to the waterlogged environment, and normal growth and development resume (Troedson et al., 1981b). PR

Spooner (1961) reported decreased yields of 'Lee' and 'Dorman' soybean planted on 0.91-m row spacings on raised beds when water was allowed to stand for longer than 7 d. Griffin et al. (1985) reported minimal injury and no yield reduction in solid-seeded soybean when flood water was allowed to stand for 1 d. PS

This research was conducted to determine the effects of flood duration on yield, agronomic characteristics, and yield components of soybean flooded at the vegetative and reproductive growth stages.

# PHYSIOLOGICAL RESPONSES OF TWO SOYBEAN [*GLYCINE MAX* (L.) MERR] CULTIVARS TO SHORT-TERM FLOODING

D. M. OOSTERHUIS, H. D. SCOTT, R. E. HAMPTON and S. D. WULLSCHLEGER

## INTRODUCTION

THE growth and productivity of many agricultural crops, including soybean [*Glycine max* (L.) Merr], are adversely affected when the soil is either temporarily or continuously flooded. Growth responses to flooding vary with plant species, the duration and timing of flooding, and conditions of the flood water.<sup>(10)</sup> Moving flood water may aerate to a limited degree and is, therefore, potentially less harmful than standing water. Plants considered to be somewhat tolerant to flooding are often injured following exposure to standing water.<sup>(9)</sup> Flooding stress inhibits various normal biochemical processes and often results in morphological alterations.<sup>(10)</sup> However, compared to the number of studies on crop response to drought, there have been relatively few studies concerning the physiological responses of crops, particularly soybean, to excess water. This is despite the fact that flooding is a common phenomenon throughout the world.<sup>(15)</sup>

Previous research concerning the effects of flooding on the physiology and growth of crops generally has been conducted in glasshouses with coarse-textured soils having a low water-holding capacity and for extended periods of water-logging.<sup>(1,14)</sup> BENNETT and ALBRECHT<sup>(1)</sup> indicated that for flooded soybeans, grown on a sandy soil, significant effects on leaf water potential or stomatal diffusive resistance were not observed during a 14-day flooding treatment. GRIFFIN and SEXTON<sup>(6)</sup> and SCOTT *et al.*<sup>(16)</sup> investigated flood-duration effects on soybean yields and found that yield was reduced significantly when water was allowed to stand for longer than 2 days on a (Crowley) silt loam soil. Since few studies have adequately documented the physiological processes of soybean that are influenced by soil flooding, our study investigated the short-term effects of flooding, at two developmental growth stages, which occur frequently on fine-textured (clayey) soils during the growing season.

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## ORGANIZATION OF CHROMOSOMES IN MITOTIC HeLa CELLS

KENNETH W. ADOLPH

Recent results which describe the structure of chromatin in terms of nucleosomes continue structural studies which, over a number of years, have given evidence for a variety of chromosome fibers. HeLa cell metaphase chromosomes that are spread on water show fibers of 250–300 Å [1]. Thin-sectioned human metaphase chromosomes and critical point dried chromosomes reveal the supercoiling of the 100 Å thread into a 250 Å fiber [2]. Thin-section studies of interphase nuclei also reveal the chromatin to be organized into threads of around 300 Å [3]. Other studies with water-spread chromosomes strengthen the evidence for the existence of a fundamental chromosome fiber of around 250 Å, which is formed by the coiling of a subfiber [4, 5]. These and other investigations strongly support the concept of various levels of substructure in chromosomes [6, 7]. The manner in which these fibers are folded to produce the characteristic morphology of metaphase chromosomes has been the subject of considerable conjecture. One current model for the condensation of chromosome fibers into the metaphase morphology is the folded-fiber model [8, 9]. A model of metaphase chromosome structure has also been presented which includes the concept of 'epichromatin' loops and 'core' fibers [10]. A more recent paper has taken a different approach in proposing that the morphology of human metaphase chromosomes is based on the helical coiling of a 4000 Å 'supersolenoid' [11].

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This paper is an electron microscopy study of thin sections of chromosomes in mitotic HeLa cells. Mitotic cells were studied, rather than isolated chromosomes, to minimize any distortions or disruptions of the native organization of the metaphase chromosome fibers. It was found that when mitotic cells were fixed in growth medium with glutaraldehyde before preparing the cells for electron microscopy, it was difficult to define the arrangement of the chromosome fibers. But when the cells were hypotonically swollen while maintaining the chromosomes in a condensed state, the organization of the chromosomes became easier to describe. The fundamental organization of the nucleosome-containing DNA fibers was seen to be a radial distribution of fibers (probably loops) which extend from the centers of the chromatid arms.

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# Properties and Characterization of a Spinach Chloroplast RNA Polymerase Isolated from a Transcriptionally Active DNA-Protein Complex

Jean-François BRIAT and Régis MACHE

An important step of chloroplast biogenesis involves transcription of chloroplast DNA (ctDNA) and its regulation. One approach consists in the reconstruction of the transcription apparatus *in vitro* with the minimum appropriate components including RNA polymerase, regulatory molecules and DNA template. An alternative approach consists in the isolation of plastid transcription complexes containing known and unknown components assembled *in vivo* and the study of their properties *in vitro*. Such complexes have been obtained from *Euglena gracilis* [1, 2] and more recently from spinach plastids [3]. An important feature of the transcriptionally active complex isolated from spinach plastids is that rDNA is preferentially transcribed since 40 % of the transcripts are rRNA [3]. Furthermore, we have recently shown that the transcripts obtained *in vitro* are constituted of a great variety of RNA species analogous to those synthesized *in vivo* (unpublished data).

It is tempting to isolate RNA polymerase from these transcription complexes in which the enzyme should be undegraded. Partial purification and properties of RNA polymerase from higher plant plastids have been reported for wheat [5, 6] and for maize [7] (but the polypeptide subunit composition has only been established for maize [8]).

In the present work, we report the isolation of the DNA-dependent RNA polymerase from spinach plastids and we compare (a) the properties of the spinach ctDNA-protein complex with the properties of the RNA polymerase purified from this complex; (b) the polypeptide subunit structure of these two preparations.

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# DNA Methylation Affects the Formation of Active Chromatin

Ilana Keshet, Judy Lieman-Hurwitz,  
and Howard Cedar

## Introduction

Several lines of evidence suggest that DNA methylation may play a role in the regulation of gene activity in animal cells. In addition to a strong in vivo correlation between gene expression and DNA undermethylation in specific cell types, in vitro methylation of many gene sequences causes an inhibition of their expression when measured either in fibroblasts or in *Xenopus* oocytes (Cedar, 1984). Furthermore, in some cells, gene functions can be activated following treatment with 5-aza-cytidine, a potent hypomethylating agent (Jones, 1984). Despite the recognition that DNA methylation can inhibit gene expression, the mechanism of action of this modification is not understood, but it is usually assumed that these nucleotide modifications alter the specific binding of either regulatory proteins or other elements of the transcriptional machinery. Consistent with this concept are the experiments showing that some genes are influenced by DNA methylation in their 5' regulatory regions but remain unaffected by modification in the body of the gene, which is in many cases probably devoid of specific protein-interactive sequences (Busslinger et al., 1983; Kruczek and Doerfler, 1983; Langner et al., 1984). In contrast to this, massive methylation of the coding sequences of the Herpes *tk* gene had a profound effect on transcription in mouse fibroblasts even though the clearly defined promoter region of this gene was left unmodified (Keshet et al., 1985). This experiment suggested that DNA methylation may also influence RNA synthesis by interfering with factors not related to the specific protein-DNA interactions that take place in the promoter region.

DNA-mediated gene transfer into mouse L cells represents an excellent system for studying the effect of DNA methylation on chromatin structure. Presumably because of the selection process required to obtain stable transformants, almost all gene sequences introduced into this system are actively expressed, albeit occasionally at very low levels. Furthermore, whenever examined, these genes and even other nonexpressible transfected sequences have always been found in an active chromatin structure as determined by their nuclear sensitivity to DNAase I or other nucleases (Weintraub, 1983; Sweet et al., 1982; Davies et al., 1982).

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We reasoned that if DNA methylation mediates its inhibitory effect through specific protein-DNA interactions at certain critical sequences in the gene domain, a methylated construct should be present in transfected cells in a DNAase I-sensitive conformation similar to other nonexpressed, nonmethylated sequences inserted into cells in the same manner (Weintraub, 1983). If, on the other hand, DNA methylation also affects nonspecific interactions involving the creation of the active chromosomal state, such methylated molecules may demonstrate an altered, inactive nuclease-insensitive structure.

Using a combination of different types of methylated gene constructs, we demonstrate that the presence of this modification on transfected DNA alters its overall DNAase I sensitivity and inhibits the formation of DNAase I and restriction enzyme-hypersensitive sites, creating a structure similar to that seen when a gene is in its inactive state. These studies suggest that methylation may be one of the important elements necessary for casting the correct chromosomal structure throughout the genome.

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Text 1

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Transitivity

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|--------------------------|---------|-------|--------|-------|----------|---------|----------|-------------|--|
| Background Information → |         |       |        |       |          |         |          |             |  |
| Ref. phrase to author    | Opinion | Agent | Status | Agent | Location | Subject | Location | Attribution |  |
|                          |         |       |        |       |          |         |          | Occurrence  |  |

<sup>1</sup>We consider <sup>2</sup>ozone to be the most important air pollutant for field grown crops in southern Sweden. <sup>3</sup>The occurrence

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| Entity             | Pr: Relational (obligation) | Token             | Pr: Rel    | Value   |           |               |                   |             |                    |                  | Circ: Loc (Spatial) |              | Carrier → |             |
| a: Phenomenon      |                             | b: Metaphenomenon |            |         |           |               |                   |             |                    |                  |                     |              |           |             |
| Head phrase phrase | Pr: simple                  | Head (noun)       | Inhi-itive | Pr: Rel | Numer-als | Epithet (adj) | Classi-fer (noun) | Head (noun) | Qualifier (phrase) |                  | Qualifier (phrase)  |              | Pr: Rel   | Head (noun) |
|                    | Positive Polarity           |                   |            |         |           |               |                   |             |                    | Qualifier (noun) | Classifier (verb)   | Thing (noun) |           |             |

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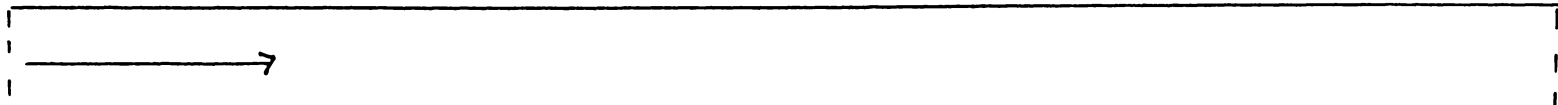
of major phytotoxic gases in rural areas of southern Sweden is characterised by low sulphur dioxide and nitrogen dioxide

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| →                  |                  |              |             | Circ: Loc (Spatial) |                    |                   |              | Pr: Relational                              |  | Attribute →       |                              |  |                              |  |
| Qualifier (phrase) |                  |              |             | Qualifier (phrase)  |                    |                   |              | Presat simple positive<br>Positive polarity |  | Epithet (adj)     | Classifier 1 (nominal group) |  | Classifier 2 (nominal group) |  |
| Epithet (adj)      | Classifier (adj) | Thing (noun) | Class (adj) | Thing (noun)        | Qualifier (phrase) | Classifier (noun) | Thing (noun) |                                             |  | Classifier (noun) | Thing (noun)                 |  |                              |  |

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| Structural element  | <div></div>                                                                                                                          |                    |                     |         |                   |                  |             |                    |                    |                  |
| Semantic attributes | <div></div>                                                                                                                          |                    |                     |         |                   |                  |             |                    |                    |                  |
| Text                | levels <sup>+</sup> [compared to ozone] In 1985-87, the 24-h monthly means for ambient ozone concentration on the Swedish west coast |                    |                     |         |                   |                  |             |                    |                    |                  |
| Transitivity        | <div></div>                                                                                                                          |                    |                     |         |                   |                  |             |                    |                    |                  |
| Group               | Head (noun)                                                                                                                          | Qualifier (phrase) | Appositional phrase | Deictic | Classifier (noun) | Classifier (adj) | Head (noun) | Qualifier (phrase) | Qualifier (phrase) |                  |
|                     |                                                                                                                                      | Thing (noun)       | Thing (noun)        |         |                   |                  |             | Epithet (adj)      | Classifier (noun)  | Thing (noun)     |
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| Semantic attributes | <div></div>                                                                                                                                                  |                    |             |                      |              |             |                    |              |           |           |
| Text                | were in the range of 27 to 48 nl litre <sup>-1</sup> during April to September. Episodes <sup>s.</sup> [reaching 100 to 125 litre <sup>-1</sup> (1-h means)] |                    |             |                      |              |             |                    |              |           |           |
| Transitivity        | <div></div>                                                                                                                                                  |                    |             |                      |              |             |                    |              |           |           |
| Group               | Pr: Relational                                                                                                                                               | Attribute          |             | Circ: loc (Temporal) |              | Actor       |                    |              |           |           |
|                     | Single present                                                                                                                                               | Inexact Numerative | Head (noun) | Qualifier (phrase)   |              | Head (noun) | Qualifier (phrase) |              |           |           |
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may occur in spring and summer.<sup>6.</sup> During 1985-87, from April to September the 24-h monthly means for sulphur dioxide

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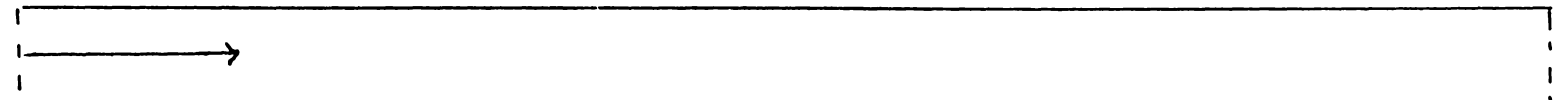
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| Modalized<br>present simple<br>positive<br>polarity | prepositional phrase |                 | prepositional phrase |                    | prepositional phrase   |                        | Disc-<br>hit | classified<br>nom. sg. | classified<br>(adj) | Head<br>(nom) | Qualifier           |                |
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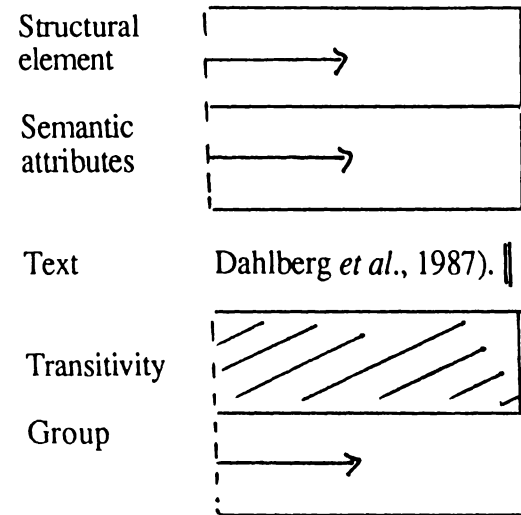
and nitrogen dioxide were  $3.6 \pm 1.5$  and  $3.2 \pm 1.0$   $\mu\text{gm}^{-3}$ , respectively (Lovblad *et al.*, 1985; Lovblad *et al.*, 1986;

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|  |                     | Present simple<br>positive<br>polarity | Numerative <sup>1</sup> | Numerative <sup>2</sup> | Head<br>(abstract<br>noun) |  |
|  | classified<br>(nom) | Thing<br>(nom)                         |                         |                         |                            |  |





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Text was suggested<sup>4.</sup> that average concentrations may have increased in Europe during the last century (Volz & Kley, 1988).

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| Transitivity | Pr: Verbal        | ///                   | Actor            | Pr: Material | Circ: loc (Spatial)    | Circ: loc (Temporal)           | ///                  |
| Group        | →                 | β: Metaphor, metaphor |                  |              |                        |                                | ///                  |
|              | Post-in post      | ///                   | Numerative (adj) | Head (noun)  | Modalized post-in post | Propositional phrase           | Scientific Qualifier |
|              | Positive polarity | ///                   |                  |              | Positive polarity      | Propositional phrase           |                      |
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|                     | Agent         | Quantity | observation | Time | Location | Attribution | Identification |  |
|                     |               |          |             |      |          | Time        | Quantity       |  |

Text <sup>5.</sup> Ozone concentrations<sup>-1</sup> observed during the growing season in central Switzerland often exceed 0.060 ul litre<sup>-1</sup>, which is

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| Group        | classified (noun) | Head (noun) | Qualifier (noun)    |                   | Qualifier (phrase)  |                   | Adverbial group adv. as head | Attribution | ///         | Pr: Retention     |
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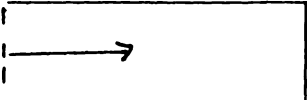
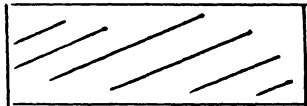
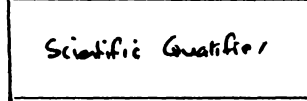
Text the National Air Quality Standard for the 1-h maximum O<sub>3</sub> concentrations (Bundesamt für Umweltschutz, 1988).]

|              |                      |                    |                         |                  |
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|              |                      |                    |                         | Thing (nom)      |
|              | Scientific Qualifier |                    |                         |                  |

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| Structural element  | →     |          |                 |                |
| Semantic attributes | Agent | Quantity | Instrumentation | Effect Subject |

Text 6. Episodes [with peak concentrations above 0.06-0.07 ul litre] 1 have been shown to cause visible damage to sensitive species

|              |               |             |                           |               |               |
|--------------|---------------|-------------|---------------------------|---------------|---------------|
| Transitivity | Actor (Agent) |             | Preterite                 | Goal          | Beneficiary   |
| Group        | Head (nom)    | Qualifier   | Post in preterite passive | Epithet (adj) | Head (nom)    |
|              |               | Number      | Positive polarity         |               | Epithet (adj) |
|              |               | Thing (nom) | Inherent                  |               | Head (nom)    |
|              |               |             | Number                    |               |               |
|              |               |             | Thing (nom)               |               |               |

|                        |                                                                                   |
|------------------------|-----------------------------------------------------------------------------------|
| Structural<br>element  |  |
| Semantic<br>attributes |  |
| Text                   | (Becker <i>et al.</i> , 1989).                                                    |
| Transitivity           |  |
| Group                  |  |

Structural  
element

Background Information →

Semantic  
attributes

Text

Wheat is one of the major crops used in Swiss agriculture. In 1985, 32% of arable land was used for wheat production

Transitivity

Group

| Token         | Pr:<br>Rel          | Value         |             |                 |               |                      |                  | Classifier<br>(Temporal) | Actor             |                   | Pr: Material   |                     | Goal          |  |
|---------------|---------------------|---------------|-------------|-----------------|---------------|----------------------|------------------|--------------------------|-------------------|-------------------|----------------|---------------------|---------------|--|
| Head<br>(nom) | Pr:<br>Rel<br>(nom) | Head<br>(nom) | Qualifier   |                 |               |                      |                  | App. phrase<br>(Nominal) | Head<br>(Nominal) | Qualifier         |                | Classifier<br>(nom) | Head<br>(nom) |  |
|               |                     |               | Part.<br>ti | Epith.<br>(adj) | Head<br>(nom) | Qualifier (relative) |                  | Thing<br>(nominal)       |                   | Relative<br>(adj) | Thing<br>(nom) |                     |               |  |
|               |                     |               |             |                 |               |                      | Epithet<br>(adj) | Thing<br>(noun)          |                   |                   |                |                     |               |  |

plowing

Structural  
element

→

Semantic  
attributes

Text

(Bundesamt für Statistik, 1986) Only approximately 20% of the wheat cultivars used are spring sown. Nevertheless,

Transitivity

Group

|                      |  |  |  |                               |           |                   |                |                               |                         |  |
|----------------------|--|--|--|-------------------------------|-----------|-------------------|----------------|-------------------------------|-------------------------|--|
| Scientific Qualifier |  |  |  | Carrier                       |           |                   |                | Pr:<br>Rel                    | Attribute               |  |
|                      |  |  |  | Head<br>(mixed<br>Numerative) | Qualifier |                   |                | Pr:<br>Rel<br>(verb response) | Head<br>(verb response) |  |
|                      |  |  |  |                               | Pr:<br>ti | relative<br>(nom) | Thing<br>(nom) | Qualifier<br>(verb)           |                         |  |

|                     |   |
|---------------------|---|
| Structural element  | → |
| Semantic attributes |   |

Text a spring wheat cultivar was used for this study, in order to comply with the common protocol of the co-ordinated CEC

|              |                                    |            |            |                                        |                    |                          |            |                           |                          |
|--------------|------------------------------------|------------|------------|----------------------------------------|--------------------|--------------------------|------------|---------------------------|--------------------------|
| Transitivity | Actor                              |            |            | Pre-Material                           | Goal               | Circ: Cause (Purpose) →  |            |                           |                          |
| Group        | Agr-hic Classifier (nominal group) |            | Head (nom) | Simple past possible positive polarity | Agr-hic Head (nom) | Agr-hic Classifier (adj) | Head (nom) | Qualifier (phrase)        |                          |
|              | Class. (adj.)                      | Head (nom) |            |                                        |                    |                          |            | Agr-hic Classifier (verb) | Qualifier (substructure) |

|                     |   |
|---------------------|---|
| Structural element  | → |
| Semantic attributes | → |

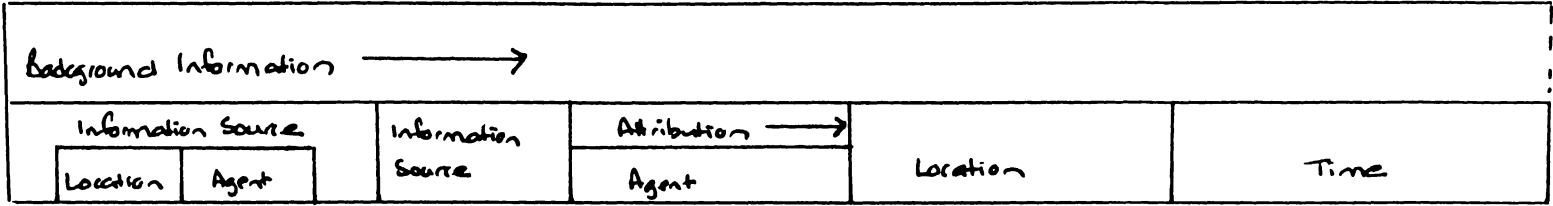
Text programme, [which prescribed the use of spring-sown crops.]

|              |                                                                                                                                                                                                                         |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transitivity | →                                                                                                                                                                                                                       |
| Group        | <div> <div> Thing<br/>(nom)</div> <div> Single Post<br/>Positive<br/>polarity</div> <div> Agric-<br/>hic</div> <div> Thing<br/>(nom)</div> <div> Qualifier<br/>(verb compound)</div> <div> Thing<br/>(nom)</div> </div> |

Text 3

Structural  
element

Semantic  
attributes

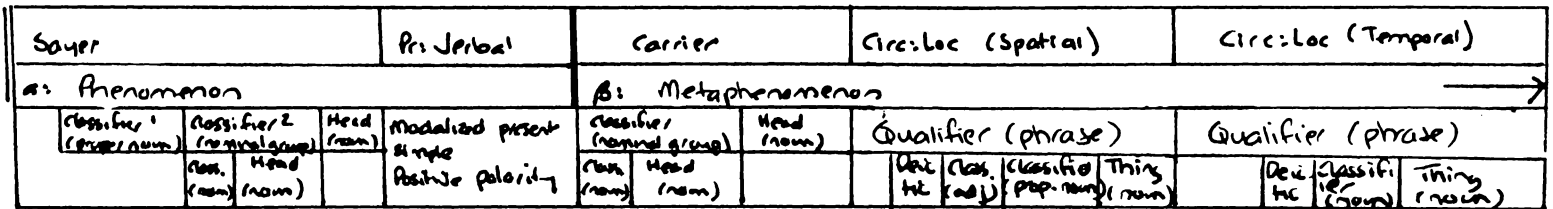


Text

1. As Maryland air quality data would confirm 2. air pollution episodes in the mid-Atlantic states during the spring months

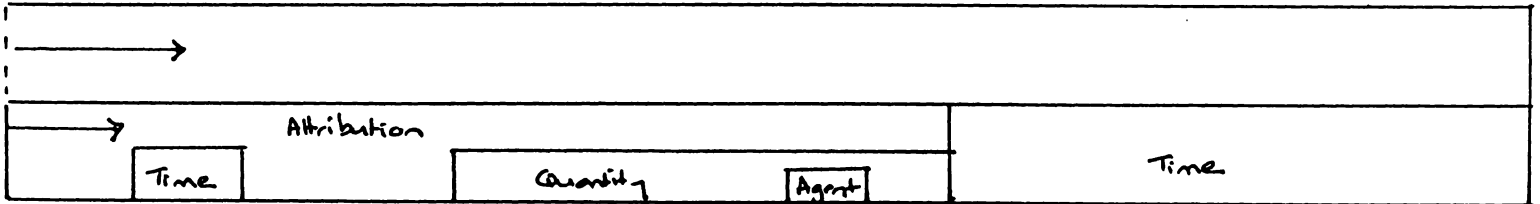
Transitivity

Group



Structural  
element

Semantic  
attributes

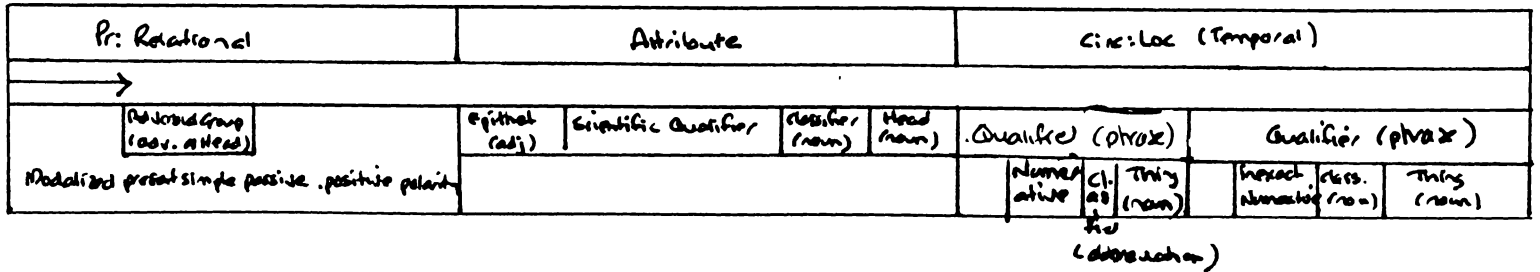


Text

would be typically characterised by elevated (60 to 120 uLL ) ozone levels from 2 to 6h day<sup>-1</sup> for 2 to 5 days' duration. ||

Transitivity

Group



Text 4

Structural  
element

Semantic  
attributes

Text

Transitivity

Group

|                          |  |        |          |         |          |       |      |         |                |
|--------------------------|--|--------|----------|---------|----------|-------|------|---------|----------------|
| Background Information → |  |        |          |         |          |       |      |         |                |
| Identification           |  |        |          |         |          |       |      |         |                |
| Subject                  |  | Status | Location | Subject | Quantity | Value | Time | Subject | Identification |

1. Wheat has been among the top four U.S.A. crops in terms of acreage planted and dollar value since 1960. 2. It accounts for

|            |                   |         |            |                          |            |                    |                      |             |                   |
|------------|-------------------|---------|------------|--------------------------|------------|--------------------|----------------------|-------------|-------------------|
| Token      | Pr: Relational    | Value   |            |                          |            |                    | Circ: Loc (Temporal) | Token       | Pr: Relational    |
| Head (nom) | lost in present   | inexact | Numerative | Classifier (proper noun) | Head (nom) | Qualifier (phrase) |                      | Head (nom)  | Simple present    |
|            | Positive polarity |         |            |                          |            | Thing (nom)        | Qualifier (verb)     |             | Positive polarity |
|            |                   |         |            |                          |            | Classifier (nom)   | Thing (nom)          | Thing (nom) |                   |

Structural  
element

Semantic  
attributes

Text

Transitivity

Group

|          |  |       |  |                  |          |       |          |
|----------|--|-------|--|------------------|----------|-------|----------|
| →        |  |       |  |                  |          |       |          |
| →        |  |       |  |                  |          |       |          |
| Quantity |  | Value |  | Subject Location | Quantity | Value | Location |
|          |  |       |  |                  |          |       | Quantity |

3. about 11% of the total cash value of U.S.A. crops and 51% of that value is generated in six states: Kansas (17%),

|                |                  |             |                  |            |                  |                      |  |
|----------------|------------------|-------------|------------------|------------|------------------|----------------------|--|
| Value          |                  |             |                  | Goal       | Pr: Material     | Circ: Loc (Spatial)  |  |
| Head (inexact) | Qualifier        |             |                  | Head (nom) | Qualifier        | Prepositional phrase |  |
|                | Classifier (nom) | Thing (nom) | Qualifier        |            | Classifier (nom) | Positive polarity    |  |
|                | Classifier (nom) | Thing (nom) | Classifier (nom) |            | Classifier (nom) | Scientific Qualifier |  |
|                |                  |             |                  |            |                  | Scientific Qualifier |  |

Structural  
element

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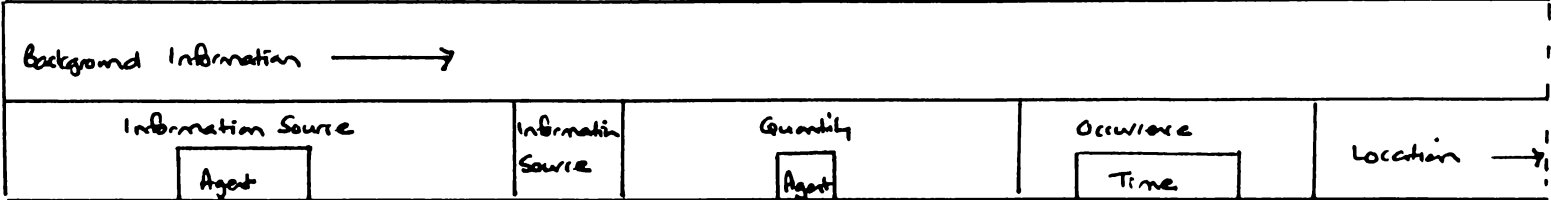
Structural  
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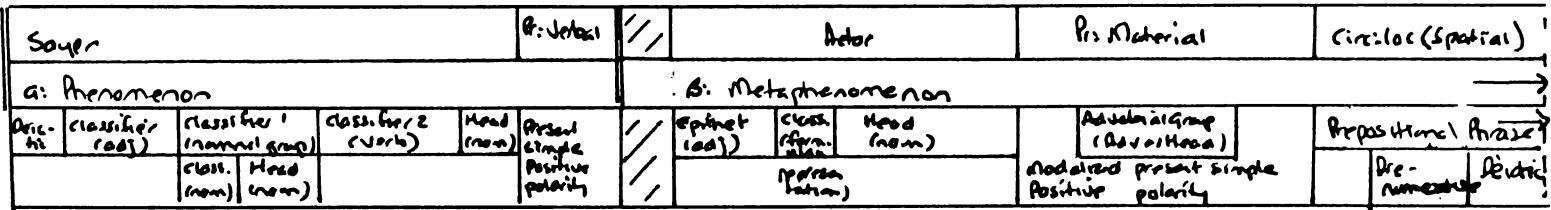
Text

Transitivity

Group



1. The available air quality monitoring data suggest<sup>2.</sup> that elevated O<sub>3</sub> concentrations may occasionally occur in much of the



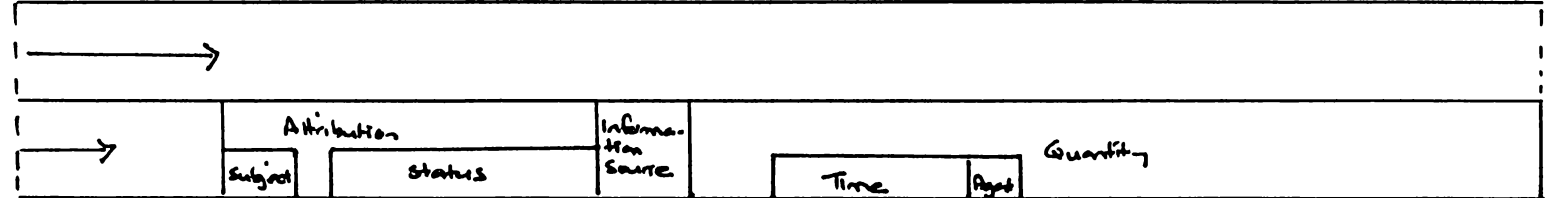
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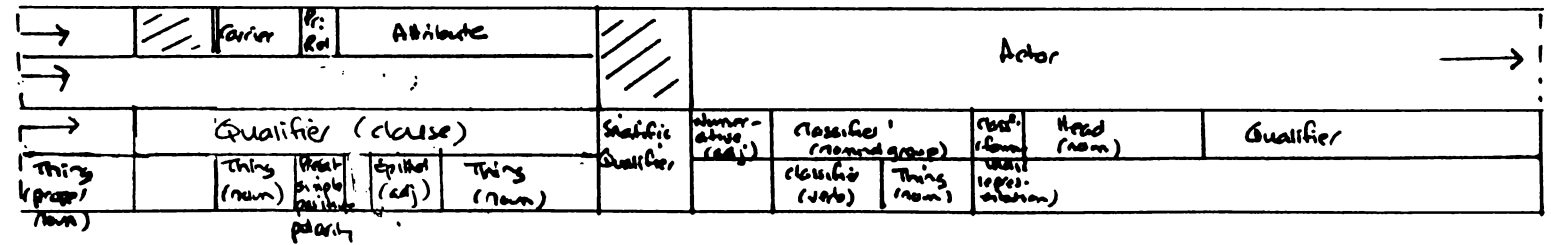
Text

Transitivity

Group



Midwest<sup>(1,12,15)</sup> where wheat is of major importance<sup>3.</sup> Mean growing season O<sub>3</sub> concentrations ranging from 0.04 to 0.06



|                     |          |  |            |          |                |          |                            |
|---------------------|----------|--|------------|----------|----------------|----------|----------------------------|
| Structural element  | →        |  |            |          |                |          |                            |
| Semantic attributes | Time     |  | Occurrence | Location | Identification |          | →                          |
|                     | Quantity |  |            |          | Agent          | Quantity | Reference to present study |

Text (seasonal 7-hr/day mean, 0900-1600 ST) occur over most of these regions. Subsequently, all O<sub>3</sub> concentrations referred to

|              |                      |                  |             |                               |         |             |            |           |
|--------------|----------------------|------------------|-------------|-------------------------------|---------|-------------|------------|-----------|
| Transitivity | Circ:loc (Temporal)  |                  | Present     | Circ:loc (Spatial)            |         | Carrier     |            | →         |
| Group        | Scientific Qualifier |                  | Present     | Prepositional phrase          |         | Agent       | Head (nom) | Qualifier |
|              | Classifier (adj)     | Classifier (nom) | Thing (nom) | Scientific Qualifier (number) | Present | Agent (nom) | Head (nom) | Qualifier |
|              | Classifier (adj)     | Classifier (nom) | Thing (nom) | Scientific Qualifier (number) | Present | Agent (nom) | Head (nom) | Qualifier |

|                     |                |   |   |   |   |      |          |
|---------------------|----------------|---|---|---|---|------|----------|
| Structural element  | →              |   |   |   |   |      |          |
| Semantic attributes | Identification |   |   |   |   | Time | Quantity |
|                     | →              | → | → | → | → | →    | →        |
|                     | →              | → | → | → | → | →    | →        |

Text in this paper will be the 7-hr/day mean for the growth period of the plants unless otherwise noted. A growing season mean

|              |   |              |                  |            |           |  |                            |                   |            |
|--------------|---|--------------|------------------|------------|-----------|--|----------------------------|-------------------|------------|
| Transitivity | → | R:Rel        | Attribute        |            |           |  | Actor (Agent)              |                   | →          |
| Group        | → | Future tense | Classifier (nom) | Head (nom) | Qualifier |  | Classifier (nominal group) | Classifier (verb) | Head (nom) |
|              | → | Future tense | Classifier (nom) | Head (nom) | Qualifier |  | Classifier (nominal group) | Classifier (verb) | Head (nom) |
|              | → | Future tense | Classifier (nom) | Head (nom) | Qualifier |  | Classifier (nominal group) | Classifier (verb) | Head (nom) |

|                     |   |       |            |        |         |          |         |          |         |          |
|---------------------|---|-------|------------|--------|---------|----------|---------|----------|---------|----------|
| Structural element  | → |       |            |        |         |          |         |          |         |          |
| Semantic attributes | → | Agent | Estimation | Effect | Subject | Quantity | Subject | Quantity | Subject | Quantity |

Text concentration of 0.05 ppm O<sub>3</sub> has been estimated to reduce the yield of soybean, 13.4%; field corn, 1.6%; wheat, 2.3%;

|              |            |           |                        |                   |          |            |                    |                      |                    |                      |
|--------------|------------|-----------|------------------------|-------------------|----------|------------|--------------------|----------------------|--------------------|----------------------|
| Transitivity | →          |           | Pr: Material           |                   | Goal     |            | Circ:loc (spatial) | Circ:loc (spatial)   | Circ:loc (spatial) | →                    |
| Group        | Head (nom) | Qualifier | Past in past, passive. | Infinitive        | App: dic | Head (nom) | Qualifier          |                      |                    |                      |
|              |            | Narrative | Positive polarity      | Positive polarity |          |            | Thing (nom)        | Scientific Qualifier | Thing (nom)        | Scientific Qualifier |
|              |            | (noun)    |                        |                   |          |            |                    |                      |                    |                      |

|                     |         |          |         |          |         |          |         |          |         |          |         |          |                    |
|---------------------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|--------------------|
| Structural element  | →       |          |         |          |         |          |         |          |         |          |         |          |                    |
| Semantic attributes | Subject | Quantity | Subject | Quantity | Subject | Quantity | Subject | Quantity | Subject | Quantity | Subject | Quantity | Information Source |

Text cotton, 11%; kidney bean, 3.1%; peanut, 12.6%; lettuce, 22.2%; turnip, 14.1%; and spinach, 9.2%. (6)

|              |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      |                      |
|--------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|----------------------|
| Transitivity | →                  |                      |                    |                      |                    |                      |                    |                      |                    |                      |                    |                      | Information Source   |
| Group        | Circ:loc (spatial) | Circ:loc (spatial)   | Circ:loc (spatial) | Circ:loc (spatial)   | Circ:loc (spatial) | Circ:loc (spatial)   | Circ:loc (spatial) | Circ:loc (spatial)   | Circ:loc (spatial) | Circ:loc (spatial)   | Circ:loc (spatial) | Circ:loc (spatial)   | Scientific Qualifier |
|              | Thing (nom)        | Scientific Qualifier | Thing (nom)        | Scientific Qualifier | Thing (nom)        | Scientific Qualifier | Thing (nom)        | Scientific Qualifier | Thing (nom)        | Scientific Qualifier | Thing (nom)        | Scientific Qualifier | Scientific Qualifier |

APPENDIX III: SUMMARY: STRUCTURAL ELEMENTS, SEMANTIC ATTRIBUTES AND LEXICO-GRAMMATICAL PATTERNS

| Structural Element     | Nuclear Semantic Attributes | Lexico-grammatical Patterns                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Sample Realisations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Background Information | Quantity                    | Realized by/in participant, by circumstantial or process element in Relational (Identifying or Attributive) or Material process environment; as Circ:Loc (Spatial), as/in Actor, in Carrier, as/in Attribute, in Value, in Goal, by nominal group with noun as Head or Thing with or without exact or inexact Numerative, Epithet with or without Scientific Qualifier as sub-modification, Classifier or Qualifier as modification <u>or</u> by abbreviation as Head <u>or</u> by exact or inexact Numerative as Head <u>or</u> by verbal group: simple present tense or modalized past in present, positive polarity. | (the 24h monthly) <u>means</u><br>(for ambient ozone) <u>concentrations</u><br>((1-h)) <u>means</u><br><u>0.060 ul litre -1</u><br><u>in the range of 27 to 48 nl litre -</u><br><u>low</u> (sulphur dioxide and nitrogen dioxide) <u>levels</u><br><u>elevated (60 to 120 ull -1) (ozone)</u><br><u>levels</u><br><u>maximum (O<sub>3</sub>) concentrations</u><br><u>concentrations ranging for 0.04 to 0.0</u><br><u>ugm -3</u><br><u>51%</u><br><u>Only approximately 20%</u><br>(O <sub>3</sub> ) <u>dominates</u><br><u>may have increased</u> |
|                        | Agent                       | Realized by/in participant element in Relational (Identifying or Attributive) process environment; in Carrier, in Attribute, in Token or in Value; by nominal group with noun as Head or Thing with or without Classifier as modification                                                                                                                                                                                                                                                                                                                                                                               | <u>ozone</u><br>(of major) <u>phytotoxic gases</u><br><u>ambient ozone</u> (concentration)<br><u>air pollutant</u><br><u>air pollutant episodes</u>                                                                                                                                                                                                                                                                                                                                                                                                  |

|                                    |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                |
|------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Background Information<br>(cont'd) | Subject | <p>Realized by/in participant element in Relational (Identifying or Attributive) or Material process environment; as Token, in Value, as/in Carrier, in Attribute, as Actor, as/in Goal or as Beneficiary;</p> <p>by nominal group with noun as Head with or without Epithet or Classifier as modification or noun as Thing with or without Classifier as modification <u>or</u> by pronoun as Head <u>or</u> in Circ: Cause (Purpose) by noun as Thing</p>                                                                                              | <p><u>Wheat</u><br/><u>sensitive species</u><br/><u>wheat cultivar</u><br/>(the yield of ) <u>soybean</u><br/>(of the) <u>wheat cultivars</u><br/>(the use of spring grown) <u>crops</u></p>                                                                                                   |
|                                    | Time    | <p>Realized in circumstance, by/in participant or in process element in Relational (Identifying or Attributive) or Material process environment;</p> <p>as Circ: Loc (Temporal), in Actor, in Carrier, as/in Attribute, in Value, in Circ: Loc (Spatial), in Circ: Cause (Purpose);</p> <p>by nominal group with noun, numeral or verb compound as Head with or without Numerative, Epithet or Classifier as modification or noun as Thing with or without Numerative or Classifier as modification <u>or</u> by adverbial group with adverb as Head</p> | <p>(in) <u>spring and summer</u><br/>(In) <u>1985-87</u><br/><u>spring-sown</u><br/><u>the last century</u><br/>(during) <u>the growing season</u><br/>(for) <u>2 to 5 days duration</u><br/>(for) <u>the growth period</u><br/>(may) <u>occasionally</u> occur<br/><u>the 24h monthly</u></p> |

|                                    |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Background Information<br>(cont'd) | Location           | <p>Realized by/in circumstance or in participant element<br/>in Relational (Identifying), Mental or Material process environment;<br/>as/in Circ: Loc (Spatial), in Value, in Actor or in Sayer;<br/>by nominal group with noun as Head or Thing with or without Pre-numerative, Numerative, Classifier or Qualifier as modification<br/><u>or</u> by adjective, proper noun (abbreviation) or verb compound as Classifier or by adjective as Epithet<br/>as/in Qualifier</p> | <p><u>in much of the Midwest</u><br/><u>in six states</u><br/><u>in central Switzerland</u><br/><u>in rural areas of southern Sweden</u><br/>(of) <u>arable land</u><br/>(of) <u>USA</u> (crops)<br/>(for) <u>field-grown</u> (crops)<br/><u>in Swiss</u> (agriculture)</p>                                                                                                              |
|                                    | Information Source | <p>Realized in circumstance, in participant or as process element<br/>in Verbal process environment;<br/>in Circ: Loc (Spatial) or in Sayer;<br/>by numeral or proper noun plus numeral as Scientific Qualifier<br/><u>or</u> by nominal group with noun as Head or Thing<br/><u>or</u> by verbal group: present tense, modalized present tense or past in present, positive polarity.</p>                                                                                    | <p><u>(1, 12, 15)</u><br/><u>(Last et al. 1986)</u><br/><u>As</u> (Maryland air quality) <u>data</u><br/><u>would confirm</u><br/><u>From the analysis of</u> (present-day and historical O3 ) <u>data</u><br/><u>The available</u> (air quality) <u>monitoring</u><br/><u>data suggest</u> (that)<br/><u>Based on</u> (air quality) <u>data, it was</u><br/><u>suggested</u> (that)</p> |

|                                    |                |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Background Information<br>(cont'd) | Attribution    | <p>Realized by Relational (Intensive or Attribute) process in Carrier ^ Process ^ Attribute pattern;<br/>by nominal group with inexact Numerative or abbreviation as Head or noun as Head or Thing with or without exact or inexact Numerative, Epithet, Scientific Qualifier, Classifier or Qualifier as modification;<br/>with verbal group: present tense, modalized present passive or simple past tense, positive polarity.</p> | <p><u>Only approximately 20% of the wheat cultivars used are spring grown.</u><br/><u>Air pollution episodes ... would be typically characterised by elevated (60 to 120 ull-1) ozone levels</u><br/><u>... the 24-h monthly means for sulphur dioxide and nitrogen dioxide were 3.6+/- 1.5 and 3.2 +/- 1.0 ugm -3</u></p>                                                                 |
|                                    | Identification | <p>Realized by Relational (Intensive or Attribute) process in Token ^ Process ^ Value pattern;<br/>by nominal group with exact or inexact Numerative as Head or noun as Head or Thing with or without Numerative, Classifier, Epithet or Qualifier as modification;<br/>with verbal group: simple present tense, past in present or infinitive, positive polarity.</p>                                                               | <p><u>0.060 ul litre -1 (which) is the National Air Quality Standard for 1-h maximum O3 concentrations</u><br/><u>Wheat is one of the major crops used in Swiss agriculture.</u><br/><u>Wheat has been among the top four USA crops in terms of acreage planted and dollar value ...</u><br/><u>(We consider) ozone to be the most important air pollutant for field grown crops..</u></p> |

| Structural Element                 | Elaborative Semantic Attributes | Lexico-grammatical Patterns                                                                                                                                                                                                                                                               | Sample Realisations                                                                                                                                                                                                                                   |
|------------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Background Information<br>(cont'd) | Status                          | Realized in participant in Relational (Intensive or Attribute) process environment; in Value, Carrier or Attribute; by nominal group with noun as Head with Epithet as modification, by adjective as Epithet or by exact or inexact Numerative.                                           | <u>major importance</u><br><u>major</u> (crops)<br><u>among the top four</u> (USA crops)                                                                                                                                                              |
|                                    | Occurrence                      | Realized as process element in Relational (Attribute) process environment;<br>or in participant in Material process environment;<br>in Carrier;<br>by nominal group with noun as Head<br><u>or</u> by verbal group: simple present tense with or without modalisation, positive polarity. | <u>The occurrence</u> of major phytotoxic gases ...<br>Episodes reaching 100 to 125 litre -1 (1-h means)<br><u>may</u> occasionally <u>occur</u> ..<br>Mean growing season O <sub>3</sub> concentrations ... <u>occur</u> over most of these regions. |

|                                    |        |                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                            |
|------------------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Background Information<br>(cont'd) | Value  | Realized as process element in Material process environment;<br>or in participant in Relational (Intensive or Attribute) process environment;<br>in Value or in Goal;<br>by nominal group with exact or inexact Numerative as Head with Qualifier as modification,<br>noun as Thing with Classifier as modification<br><u>or</u> by verbal group: present simple tense, passive, positive polarity. | <u>51% of that value</u> ...<br><u>about 11% of the total cash value</u> ...<br>... in terms of acreage planted and <u>dollar value</u> ...<br>... <u>is generated</u> ... |
|                                    | Effect | Realized by process element or participant in Material process environment;<br>in or as Goal;<br>by nominal group with noun as Head with or without Epithet as modification<br><u>or</u> by verbal group: infinitive, positive polarity.                                                                                                                                                            | ... have been estimated <u>to reduce the yield</u> (of soybean)...<br>... have been shown <u>to cause visible damage</u> (to sensitive species) ...                        |

|                                    |                                          |                                                                                                                                                                                                  |                                                                                                                                        |
|------------------------------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Background Information<br>(cont'd) | Reference to Present Study               | Realized by/in participant in Relational (Attribute) or Material process environment; in Carrier or as Goal; by embedded clause with noun as Head <u>or</u> by nominal group with noun as Thing. | <u>this study</u><br>(all O3 concentrations) <u>referred to in this paper</u>                                                          |
|                                    | Relationship to Broader Research Program | Realized by circumstance in material process environment; as Cir: Cause (Purpose); by infinitive plus nominal group with noun as Head with Classifier and Qualifier as modification.             | A spring wheat cultivar was used for this study, <u>in order to comply with the common protocol of the co-ordinated CEC programme.</u> |

| Structural Element                 | Elaborative Semantic Attributes | Lexico-grammatical Patterns                                                                                                            | Sample Realisations                                                                                              |
|------------------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Background Information<br>(cont'd) | Reference to Authors            | Realized by participant in Mental process (Cognition); by personal pronoun as Senser                                                   | <u>We</u> (consider)                                                                                             |
|                                    | Comparison                      | Realized by participant in Relational (Attributive) process; by embedded clause with noun as Thing in Qualifier.                       | ... <u>compared to ozone</u> .                                                                                   |
|                                    | Observation                     | Realized by circumstance in Relational (Attributive) process environment; in Circ: Loc (Temporal); by verb element in embedded clause. | (Ozone concentrations) <u>observed during the growing season</u> ...                                             |
|                                    | Demonstration                   | Realized by process element in Material process environment; by verbal group: past in present, passive, positive polarity.             | Episodes with peak concentrations above 0.06-0.07 ul litre -1 <u>have been shown to</u> cause visible damage ... |

|  |            |                                                                                                                                                                     |                                                                                                                                |
|--|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
|  | Estimation | Realized by process element in Material process environment;<br>by verbal group: past in present, passive.<br>positive polarity.                                    | A growing season mean concentration of 0.05 ppm O <sub>3</sub><br><u>has been estimated</u> to reduce the yield of soybean ... |
|  | Standard   | Realized by participant element in Relational (Identifying) process environment;<br>in Token;<br>by nominal group with noun as Head and Epithet(s) as modification. | <u>the National Air Quality Standard</u>                                                                                       |

## APPENDIX IV: ASSOCIATED WORDS

| Sub-technical words    | Technical words                             |                                 |                               |
|------------------------|---------------------------------------------|---------------------------------|-------------------------------|
|                        | agent                                       | subject                         | apparatus                     |
| study/ies              | air pollution                               | field grown crops               | open-top chambers             |
| effect/s               | air pollutants                              | spring wheat cultivars          | filtered and non-filtered air |
| experimental programme | ozone                                       | spring sown cereals and legumes |                               |
| information            | concentrations of ozone                     | wheat cultivars                 |                               |
| laboratory             | ozone exposure                              | wheat                           |                               |
| results                | phytotoxic gases                            | wheat                           |                               |
| aim                    | sulphur dioxide and nitrogen dioxide levels | spring wheat                    |                               |
| evaluate               |                                             | grain                           |                               |
|                        |                                             | spinach and potatoes            |                               |

Associated words: Text 1

| Sub-technical words    | Technical words              |                      |                        |
|------------------------|------------------------------|----------------------|------------------------|
|                        | agent                        | subject              | apparatus              |
| study/ies              | air pollution                | crops                | open-top chambers      |
| experiments            | pollutants                   | agricultural crops   | air fumigation systems |
| project                | ozone                        | field grown crops    |                        |
| effect/s               | O <sub>3</sub>               | spring sown crops    |                        |
| experimental programme | ambient O <sub>3</sub>       | sensitive species    |                        |
| data analysis          | O <sub>3</sub> levels        | plants               |                        |
| results                | O <sub>3</sub> concentration | wheat                |                        |
| investigate            | O <sub>3</sub> exposure      | wheat cultivars      |                        |
| evaluate               |                              | spring wheat         |                        |
|                        |                              | 'Roland'             |                        |
|                        |                              | 'Vona'               |                        |
|                        |                              | wheat leaf synthesis |                        |
|                        |                              | corn                 |                        |
|                        |                              | sorghum              |                        |

Associated words: Text 2

| Sub-technical words | Technical words       |                       |
|---------------------|-----------------------|-----------------------|
|                     | agent                 | subject               |
| study/ies           | air pollution         | cultivars             |
| effects             | ozone                 | field grown cultivars |
| examination         | ozone concentration   | grains                |
| researchers         | ozone levels          | grain crops           |
| data                | oxidant               | wheat cultivars       |
| objectives          | photochemical oxidant | soft red winter wheat |
| examine             |                       | wheat vegetation      |
|                     |                       | pollination           |

Associated words: Text 3

| Sub-technical words | Technical words                                          |                       |                   |
|---------------------|----------------------------------------------------------|-----------------------|-------------------|
|                     | agent                                                    | subject               | apparatus         |
| study               | air pollution                                            | crops                 | open-top chambers |
| research            | pollutant                                                | cultivars             |                   |
| data                | ozone                                                    | midwestern cultivars  |                   |
| laboratory          | O <sub>3</sub>                                           | wheat                 |                   |
| objective           | O <sub>3</sub> concentrations<br>O <sub>3</sub> exposure | winter wheat          |                   |
|                     |                                                          | soft red winter wheat |                   |
|                     |                                                          | Blueboy 11            |                   |
|                     |                                                          | Coker 47-27           |                   |
|                     |                                                          | Holly                 |                   |
|                     |                                                          | Oasis                 |                   |
|                     |                                                          | soybean               |                   |
|                     |                                                          | field corn            |                   |
|                     |                                                          | cotton                |                   |
|                     |                                                          | kidney bean           |                   |
|                     |                                                          | peanut                |                   |
|                     |                                                          | lettuce               |                   |
|                     |                                                          | turnip                |                   |
|                     |                                                          | spinach               |                   |

Associated words: Text 4

| Sub-technical words | Technical words      |                              |
|---------------------|----------------------|------------------------------|
|                     | agent                | subject                      |
| study               | rain contaminants    | corn                         |
| effects             | environmental stress | corn silks                   |
| objectives          | acid rain            | seed formation               |
| investigate         | simulated acid rain  | stigma surface               |
|                     | acid rain episodes   | stigmatic tissue             |
|                     | non-acid rain        | reproductive parts of plants |
|                     | acidity              | pollen tube                  |
|                     | sulphate ion         | egg nucleus                  |
|                     |                      | pollen grains                |
|                     |                      | pollen germination           |
|                     |                      | seed production              |

Associated words: Text 5

| Sub-technical words | Technical words      |                         |
|---------------------|----------------------|-------------------------|
|                     | agent                | subject                 |
| investigations      | environmental stress | angiosperms             |
| experiments         | acid conditions      | corn                    |
| laboratory          | acid rain            | corn pollen             |
| observations        | simulated acid rain  | silks                   |
| objective           |                      | seeds                   |
| affect              |                      | seed production         |
|                     |                      | seed yield              |
|                     |                      | pollen                  |
|                     |                      | pollen grain            |
|                     |                      | pollen tube             |
|                     |                      | tube elongation         |
|                     |                      | pollen-silk interaction |
|                     |                      | egg nucleus             |
|                     |                      | egg cell                |
|                     |                      | pollination             |
|                     |                      | pollen germination      |
|                     |                      | stigmas                 |
|                     |                      | stigmatic structure     |
|                     |                      | stigmatic surface       |

Associated words: Text 6

| Sub-technical words | Technical words        |                        |
|---------------------|------------------------|------------------------|
|                     | agent                  | subject                |
| study               | pollutants             | wind-pollinated plants |
| in vitro studies    | atmospheric pollutants | crops                  |
| experiments         | acid conditions        | corn                   |
| investigation       | acid rain              | corn plants            |
| affect              | simulated acid rain    | ear                    |
| objective           | acid precipitation     | corn leaves            |
|                     | pollution stress       | kernels                |
|                     | acid                   | corn seedlings         |
|                     | sulphur dioxide        | pollen                 |
|                     | SO <sub>2</sub>        | pollination            |
|                     | hydrogen ion           | pollen germination     |
|                     | associated anions      | in vivo germination    |
|                     | rain water             | stigmatic surface      |
|                     |                        | tassel                 |
|                     |                        | silks                  |
|                     |                        | silk structure         |
|                     |                        | silk tissue            |
|                     |                        | pollen tube            |
|                     |                        | forest trees           |
|                     |                        | tomato                 |
|                     |                        | Camellia               |

Associated words: Text 7

| Sub-technical words | Technical words                |                                           |
|---------------------|--------------------------------|-------------------------------------------|
|                     | agent                          | subject                                   |
| study               | rainwater                      | agricultural ecosystems    apricot        |
| reports             | simulated rain                 | forest ecosystems    Virginia pepperweed  |
| effects             | atmospheric pollutants         | forest tree species    Carolina geranium  |
| objective           | acidic substances              | herbaceous species    white spruce        |
|                     | sulphur dioxide                | crop    hardwood tree species             |
|                     | SO <sub>2</sub>                | corn    forest species                    |
|                     | SO <sub>2</sub> concentrations | silks    Camellia                         |
|                     | acid rain                      | flowers    apple                          |
|                     | simulated acid rain            | pollen    grape                           |
|                     | acidic deposition              | dry pollen    tomato                      |
|                     |                                | pollen tube    evening primrose           |
|                     |                                | cultured <i>Tradescantia</i> pollen tubes |
|                     |                                | pollen germination                        |
|                     |                                | tube elongation                           |
|                     |                                | stigma                                    |
|                     |                                | stigmatic surface                         |
|                     |                                | mitotic activity                          |
|                     |                                | cherry                                    |

Associated words: Text 8

| Sub-technical words | Technical words           |                  |
|---------------------|---------------------------|------------------|
|                     | agent                     | subject          |
| research            | soil and climatic factors | soybean          |
| objective           | water                     | root respiration |
| effect              | irrigation water          | root growth      |
|                     | aeration stress           | nodule formation |
|                     | water deficits            | nodule function  |
|                     | drought                   |                  |
|                     | drought stress            |                  |
|                     | aeration stress           |                  |
|                     | flooding                  |                  |
|                     | temporary flooding        |                  |
|                     | continuous flooding       |                  |
|                     | intense rainfall          |                  |
|                     | inadequate oxygen supply  |                  |

Associated words: Text 9

| Sub-technical words | Technical words      |                  |
|---------------------|----------------------|------------------|
|                     | agent                | subject          |
| study               | flooding             | plants           |
| purpose             | anaerobic conditions | aquatic plants   |
| investigate         | waterlogging         | rice             |
| effects             | ethanol              | soybeans         |
|                     |                      | roots            |
|                     |                      | shoots           |
|                     |                      | leaves           |
|                     |                      | stem             |
|                     |                      | cortex           |
|                     |                      | axis of the root |

Associated words: Text 10

| Sub-technical words | Technical words                                                           |                                                                                    |
|---------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|                     | agent                                                                     | subject                                                                            |
| study<br>effects    | water<br>drought stress<br>excessive water<br>flood water<br>waterlogging | legumes<br>soybean<br>solid-seeded soybean<br>rice<br>nodule<br>'Lee'<br>'Doorman' |

Associated words: Text 11

| Sub-technical words | Technical words    |                              |
|---------------------|--------------------|------------------------------|
|                     | agent              | subject                      |
| study               | flooding           | crops                        |
| effects             | flood water        | plants                       |
| investigate         | waterlogging       | soybean                      |
|                     | flooding stress    | leaf water potential         |
|                     | flooding treatment | stomach diffusive resistance |
|                     | drought            |                              |

Associated words: Text 12

| Sub-technical words          |                          |
|------------------------------|--------------------------|
| effect/affect<br>(11 texts)  | results<br>(1 text)      |
| objective/s<br>(7 texts)     | observations<br>(1 text) |
| study/ies<br>(10 texts)      | examine<br>(1 text)      |
| experiment/s<br>(3 texts)    | examination<br>(1 text)  |
| research<br>(3 texts)        | project<br>(1 text)      |
| data<br>(3 texts)            | analysis<br>(1 text)     |
| laboratory<br>(3 texts)      | report<br>(1 text)       |
| investigate<br>(4 texts)     | researchers<br>(1 text)  |
| investigation/s<br>(2 texts) | aim<br>(1 text)          |
| evaluate<br>(2 texts)        | purpose<br>(1 text)      |

Associated words (sub-technical) : Texts 1-12

## APPENDIX V: SEMANTIC RELATIONS

## KEY

| Relation                  | Description                                                                                                                                                                                                  | Example                                                                                                                                                                                                       |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statement-Exemplification | Here, the first member provides a general statement and the second adds a proposition (or more than one proposition), which is presented as an exemplification of the general statement of the first member. | Growth and yield of soybean are influenced by a number of soil and climatic factors during the growing season. One of these important factors is water.                                                       |
| Means-Purpose             | In this relation, the purpose member outlines the action that is/was/will be undertaken with the <i>intention</i> of achieving a particular result.                                                          | This research was conducted to determine the effects of flood duration on yield, agronomic characteristics, and yield components of soybean flooded at the vegetative and reproductive stages.                |
| Condition-Consequence     | In this relation, the consequence is dependent on a realizable or unrealizable condition or on a hypothetical contingency.                                                                                   | If DNA ... methylation affects non specific interactions involving the creation of the active chromosomal state, such methylated molecules may demonstrate an altered, inactive nuclease-intensive structure. |

### Semantic relations: Background Information

#### Text 1

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statement       | We consider ozone to be the most important air pollutant for field grown crops in southern Sweden.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Exemplification | The occurrence of major phytotoxic gases in rural areas of southern Sweden is characterised by low sulphur dioxide and nitrogen dioxide levels compared to ozone. In 1985-87, the 24-h monthly means for ambient ozone concentration on the Swedish west coast were in the range of 27 to 48 nl litre during April to September. Episodes reaching 100 to 125 litre (1-h means) may occur in spring and summer. During 1985-87, from April to September the 24-h and nitrogen dioxide were $3.6 \pm 1.5$ and $3.2 \pm 1.0$ ugm, respectively (Lovblad <i>et al.</i> , 1985; Lovblad <i>et al.</i> , 1986; Dahlberg <i>et al.</i> , 1987). |

Semantic relation: Statement-Exemplification

#### Text 2

|                 |                                                                                                                                                                                                          |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statement       | Based on air quality data, it was suggested that O <sub>3</sub> dominates the air pollution climate in an area including southern Germany, parts of Austria and Switzerland (Last <i>et al.</i> , 1986). |
| Exemplification | From the analysis of present-day and historical O <sub>3</sub> data, it was suggested that average concentrations may have increased in Europe during the last century (Volz & Kley, 1988). Ozone        |

concentrations observed during the growing season in central Switzerland often exceed 0.060 ul litre, which is the National Air Quality Standard for the 1-h maximum O<sub>3</sub> concentrations (Bundesamt fur Umweltschutz, 1988). Episodes with peak concentrations above 0.06-0.07 ul litre have been shown to cause visible damage to sensitive species (Becker *et al.*, 1989).

Statement

Wheat is one of the major crops used in Swiss agriculture.

Exemplification

In 1985, 32% of arable land was used for wheat production (Bundesamt fur Statistik, 1986). Only approximately 20% of the wheat cultivars used are spring sown. Nevertheless, a spring wheat cultivar was used for this study, in order to comply with the common protocol of the co-ordinated CEC programme, which prescribed the use of spring-sown crops.

Semantic relation: Statement-Exemplification

#### Text 4

Statement

Wheat has been among the top four U.S.A. crops in terms of acreage planted and dollar value since 1960.

Exemplification

It accounts for about 11% of the total cash value of U.S.A. crops and 51% of that value is generated in six states: Kansas (17%), N. Dakota (9%), Oklahoma (8%), Washington (7%), Montana (5%) and Texas (5%).

Statement

The available air quality monitoring data suggest that elevated O<sub>3</sub> concentrations may occasionally occur in much of the Midwest where wheat is of major importance.

**Exemplification**      Mean growing season O<sub>3</sub> concentrations ranging from 0.04 to 0.06 (seasonal 7-hr/day mean, 0900-1600 ST) occur over most of these regions. (Subsequently, all O<sub>3</sub> concentrations referred to in this paper will be the 7-hr/day mean for the growth period of the plants unless otherwise noted). A growing season mean concentration of 0.05 ppm O<sub>3</sub> has been estimated to reduce the yield of soybean, 13.4%; field corn, 1.6%; wheat, 2.3%; cotton, 11%; kidney bean, 3.1%; peanut, 12.6%; lettuce, 22.2%; turnip, 14.1%; and spinach, 9.2%.

**Semantic relation: Statement-Exemplification**

### Text 5

**Statement**      Seed formation in corn, *Zea mays* L., and most other higher plants requires the germination and growth of a pollen tube on the stigma surface until the tube penetrates the stigmatic tissue and continues growth inside the style to the egg nucleus.

**Exemplification**      Any environmental stress that prevents or alters the close physical and/or chemical association between pollen and stigma, necessary for the germination of pollen grains and elongation of pollen tubes, could disrupt the reproductive process, reducing seed production and perhaps modifying the genetic constitution of the plant population as genes in non-germinating pollen are lost.

**Semantic relation: Statement-Exemplification**

Text 6

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statement       | In corn ( <i>Zea mays</i> L.) and other angiosperms, seed production depends on successful completion of the sexual reproductive process.                                                                                                                                                                                                                                                                                                                                                                         |
| Exemplification | Following pollination, this process requires a physical/chemical interaction of pollen with the stigmatic surface that enables the pollen grain to germinate and the resulting pollen tube to penetrate the tissue and grow inside the style to the egg nucleus. Environmental stresses that change the stigmatic structure of chemistry could be expected to inhibit pollen germination and/or tube elongation, reducing the number of fertilizations and resulting in a decrease in the number of seeds formed. |

Semantic relation: Statement-Exemplification

Text 7

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statement       | Corn ( <i>Zea mays</i> L.), like other wind-pollinated plants, requires the movement of pollen in the open atmosphere from the male to the female reproductive organs during pollination.                                                                                                                                                                                                                                                                  |
| Exemplification | Consequently, both the tassel and silks of corn are subject to exposure to any atmospheric pollutants present during the time pollination. If these pollutants are toxic to parts of the plant reproductive system, seed formation and thus yield of the plant could be diminished due to a failure of the plant to successfully complete the pollination and/or fertilisation process. For fertilisation to be completed, the pollen, through a series of |

biochemical and enzymatic reactions related to viable pollen and silk chemistry, must germinate and grow on the surface of the silk tissue until the pollen tube penetrates the silk. A pollution stress that altered silk structure or chemistry, creating a hostile environment for pollen germination and growth, could be expected to limit fertilisation.

Semantic relation: Statement-Exemplification

### Text 9

**Statement** Growth and yield of soybean are influenced by a number of soil and climatic factors during the growing season.

**Exemplification** One of the most important of these factors is water.

**Statement** In the humid region of the USA both drought and aeration stress conditions can occur during a soybean growing season.

**Exemplification** Too much water in a field can occur from intense rainfall events or from the application of excessive amounts of irrigation water. In general, both of these conditions result in the ponding of water due to inadequate surface drainage from a nonuniformly sloping soil surface. The combination of these conditions has occurred with such frequency that some soybean growers hesitate to irrigate at all or irrigate too infrequently. Therefore, this lack of irrigation tends to increase drought stress.

Semantic relation: Statement-Exemplification

Text 10

|                 |                                                                                                                                                                                                                                                                                                            |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statement       | Plants vary widely in their sensitivity to injury in anaerobic soils, and within the same species the effect may vary depending on its stage of growth and on the environmental conditions.                                                                                                                |
| Exemplification | In sensitive plants, symptoms of injury can become evident in both roots and shoots. Soon after flooding, leaves may wilt, show epinasty (the downward curvature of petioles), or become chlorotic and senesce prematurely (Russell 1977). Stem elongation is often reduced and root growth is restricted. |

|           |                                                                                                                           |
|-----------|---------------------------------------------------------------------------------------------------------------------------|
| Statement | Flooded plants can change some of their morphological and physiological characteristics to tolerate anaerobic conditions. |
|-----------|---------------------------------------------------------------------------------------------------------------------------|

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Exemplification | One of the most obvious anatomical adaptations is a considerable increase in the intercellular air sources in the cortex, thus providing canals parallel to the axis of the root through which gases can diffuse longitudinally. ... Another survival feature of flooded plants is their ability to develop adventitious roots close to the soil surface, where the oxygen tension is usually higher or is more quickly restored after transient waterlogging. |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Semantic relation: Statement-Exemplification

Text 11

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statement       | Irrigation of soybean in the southern United States has increased in recent years, primarily as a means of reducing yearly variation in yields.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Exemplification | In southwestern Louisiana, the majority of soybean is grown in rotation with rice ( <i>Oryza sativa</i> L.) Land is normally graded to facilitate flood irrigation in both crops. In a flood irrigation system, contour levees separate field areas of differing elevations. Water enters the field at the highest elevation and is gravity-fed to lower elevations. Water must continuously flow from the highest portion of the field to supply lower areas. Consequently, the highest graded portions of large fields may be inundated for extended periods of time. |

Semantic relation: Statement-Exemplification

## Text 12

|                 |                                                                                                                                                                                                |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statement       | The growth and productivity of many agricultural crops, including soybean [ <i>Glycine max</i> (L.) Merr], are adversely affected when the soil is either temporarily or continuously flooded. |
| Exemplification | Moving flood water may aerate to a limited degree and is, therefore, potentially less harmful than standing water.                                                                             |

Semantic relation: Statement-Exemplification

### Semantic relations : Purpose of Study

#### Text 1

|         |                                                                                                                                                              |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Purpose | The aim                                                                                                                                                      |
| Means   | (of this study) *                                                                                                                                            |
| Purpose | was to evaluate the impact of ambient and elevated ozone concentrations on grain yield and quality of an important spring wheat cultivar in southern Sweden. |

\* ellipsis/embedded proposition

Semantic relation: Means-Purpose

#### Text 2

|         |                                                                                                                                                                                                                                                                                                                                                                                            |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Purpose | The aim                                                                                                                                                                                                                                                                                                                                                                                    |
| Means   | of this study                                                                                                                                                                                                                                                                                                                                                                              |
| Purpose | was to evaluate possible effects of different levels of O <sub>3</sub> in ambient air on the yield of spring wheat, grown in a major agricultural area of the country, and to rank different components of yield according to their sensitivity to O <sub>3</sub> ... the effects from enclosure on different yield parameters are included, as well as yield response to O <sub>3</sub> . |

Semantic relation: Means-Purpose

Text 3

|         |                                                                                                                                                                                                                                                                               |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Purpose | The objectives                                                                                                                                                                                                                                                                |
| Means   | of this study                                                                                                                                                                                                                                                                 |
| Purpose | were to examine the yield and grain quality responses of field-grown cultivars of soft red winter wheat following a simulated air pollution episode during pollination with ozone levels in slight excess of current USEPA secondary standard for ozone in the atmosphere ... |

Semantic relation: Means-Purpose

Text 4

|         |                                                                                                                                                                                                                   |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Purpose | The specific objective                                                                                                                                                                                            |
| Means   | (of this study) *                                                                                                                                                                                                 |
| Purpose | was to establish the exposure-response relationships between yield of three important cultivars of soft red winter wheat growth in the Midwest and chronic exposures to a range of O <sub>3</sub> concentrations. |

\* ellipsis/embedded proposition

Semantic relation: Means-Purpose

Text 5

|         |                                                                                                                                                  |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Purpose | The objectives                                                                                                                                   |
| Means   | of this study                                                                                                                                    |
| Purpose | were to investigate the contribution of the sulphate ion, the effect of acidity, and the effects of duration and timing of acid rain episodes on |

the reduction in pollen germination observed on corn silks exposed to simulated acid rain.

Semantic relation: Means-Purpose

#### Text 6

|         |                                                                                                                                                                                          |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Purpose | The objectives                                                                                                                                                                           |
| Means   | of these experiments                                                                                                                                                                     |
| Purpose | was to determine if an acid rain event on the silks would affect seed yield in corn and if any yield reductions were related to the qualities of pollen used in the pollination process. |

Semantic relation: Means-Purpose

#### Text 7

|         |                                                                                                              |
|---------|--------------------------------------------------------------------------------------------------------------|
| Purpose | The objective                                                                                                |
| Means   | of this study                                                                                                |
| Purpose | was to determine if acid precipitation affected the germination and growth of pollen on silk tissue of corn. |

Semantic relation: Means-Purpose

#### Text 8

|         |               |
|---------|---------------|
| Purpose | The objective |
| Means   | of this study |

**Purpose** was to determine the direct effects of simulated acid rain applied before or after pollination on the processes of sexual reproduction and seed development of corn.

**Semantic relation: Means-Purpose**

### Text 9

**Purpose** The objective

**Means** of this research

**Purpose** was to determine the influence of flood duration at two growth stages on the growth and yield of soybean grown on two poorly, slowly permeable soils.

**Semantic relation: Means-Purpose**

### Text 10

**Purpose** The purpose

**Means** of this study

**Purpose** was to investigate the effects of flooding on soybean roots and shoots during early vegetative growth.

**Semantic relation: Means-Purpose**

Text 11

|                |                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Means</b>   | This research was conducted                                                                                                                                                  |
| <b>Purpose</b> | to determine the effects of flood duration on yield, agronomic characteristics, and yield components of soybean flooded at the vegetative and reproductive growth stages ... |

Semantic relation: Means-Purpose

Text 12

|                |                                                                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Means</b>   | our study                                                                                                                                                              |
| <b>Purpose</b> | investigated the short-term effects of flooding, at two developmental growth stages, which occur frequently on fine-textured (clayey) soils during the growing season. |

Semantic relation: Means-Purpose

Text 13

|                |                                                                                   |
|----------------|-----------------------------------------------------------------------------------|
| <b>Means</b>   | This paper                                                                        |
| <b>Purpose</b> | is an electron microscopy study of thin sections of chromosomes in mitotic cells. |

Semantic relation: Means-Purpose

Text 14

**Means** In the present work,  
**Purpose** we report the isolation of the DNA-dependent RNA polymerase from spinach plastids and we compare (a) the properties of the spinach ctDNA-protein complex with the properties of the RNA polymerase purified from this complex; (b) the polypeptide subunit structure of these two preparations.

Semantic relation: Means-Purpose

Text 15

(We reasoned that)

**Condition** if DNA methylation mediates its inhibitory effect through specific protein-DNA interactions at certain critical sequences in the gene domain,

**Consequence** a methylated construct should be present in transfected cells in a DNAase I- sensitive conformation similar to other nonexpressed, nonmethylated sequences inserted into cells in the same manner (Weintraub, 1983).

**Condition** If, on the other hand, DNA methylation also affects nonspecific interactions involving the creation of the active chromosomal state,

**Consequence** such methylated molecules may demonstrate an altered, inactive nuclease-insensitive structure.

Semantic relation: Condition-Consequence (ie statement of research hypothesis)

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