

Chapter Three

The Structure of Popular Scientific Writing on ‘Climate Change’

3.1 INTRODUCTION

My overall analysis of the nature of popular scientific articles compares a total of thirty journal articles published between 1975 and 1996 in various popular periodicals such as *New Scientist*, *Discover*, *Time*, *Our Planet* and *The Amicus Journal*. These are magazines that include scientific writing drawn from many fields and which are not for specialized readers. In this chapter I analyse three of the ten articles on ‘climate change’ issues. The remaining seven will later be analysed and the results compared with those gained from this initial analysis. (The articles in full, together with accompanying visuals, are presented in Appendix 1.)

The purpose of this chapter is to demonstrate that during analysis we can refine the picture of the texts, and by keeping the three strata of context, semantics, and lexicogrammar in mind and by moving between these strata, building on the information identified in each strata, we can ask whether the texts constitute a particular genre. We can do this because the ‘structure statement’ proposals made about the ‘logogenetic’ unfolding of the discourse are continuously tested against the generalisation of ‘most typical’ meaning in the semantics. These are tested for substantiation based on the evidence of accumulating selections in the grammar. The evidence of grammar can then take us back to the semantics and the proposals relating to the discourse elements. In addition, the three strata perspective allows us to test our account of the texts; the texts can be seen as particular instances of ‘social process’; they can be seen for the variations that they suggest with respect to each other, and they can be seen as part of a genre or a typical pattern. These three perspectives are complementary rather than contradictory.

3.2 TEXT SELECTION CRITERIA

The content of the thirty texts used for the study aim to inform the reader generally on the issues of climate change, population growth and deforestation. Issues concerning policy-making or strategies to reduce heat in the atmosphere are not the focus of the study.

Environmental Abstracts CD-ROM 1975-1996 was used as a first step in data collection because this database identifies categories of written documents such as academic reports, conference papers, state/local government reports, research articles, journal articles, news articles and newsletter articles. This study concentrates on journal articles which are aimed at an educated readership. The journals themselves are well-known even though they may not be the most frequently read in their specific fields. The journals from which the articles have been selected are commonly found at newspaper and magazine outlets as opposed to specialty book stores.

On climate change, three articles were selected from *Discover*, four from *New Scientist*, two from *Time*, and one from *The Amicus Journal*. For ease of discussion in the present study, the ten climate change texts will be referred to by the following codes;

TITLE	SOURCE	CODE
Cold comfort	Discover, August 1992	Cold
The parasol effect	Discover, July 1993	Parasol
Son of ozone hole	Discover, October 1993	Ozone hole
Methane: the hidden greenhouse gas	New Scientist, May 6, 1989	Methane
Icy prospects for a warmer world	New Scientist, August 8, 1992	Icy
Can algae cool the planet?	New Scientist, August 21, 1993	Algae
Drying out the tropics	New Scientist, May 6, 1995	Drying
The heat is on	Time, October 19, 1987	Heat
The ozone vanishes	Time, February 17, 1992	Ozone vanishes
As the ozone thins, the plot thickens	The Amicus Journal, Summer 1991	Ozone thins

Table 3.1 Selected Texts, their Sources, and their ‘Code’ labelled Used in this Study.

3.3 SYNOPSIS OF THE SAMPLE TEXTS

These synopses give an overview of the topics which motivate the organisation of the texts.

Cold Comfort (Cold)

Recent research questions whether global warming will cause a rise in sea levels. New evidence from sediment records indicates that the ice age build up in the Canadian Arctic which began 120,000 years ago was occurring at a time when the world 'in general' was as warm as it is today. The warmer temperatures of the sea surface under global warming could cause more water to evaporate and be dropped as snow in the winter. Therefore, despite global warming the temperature in the Arctic would not be high enough to melt this extra ice. During the last ice age enough water was taken out of the ocean and locked up in ice sheets to cause sea levels to drop by more than two feet a century. The warm climate at the beginning of glaciation may have provided the precipitation needed to form the ice in the first place. The same process occurred previously in the South pole and may currently be occurring on Greenland. Regional effects of global warming cannot yet be forecast.

The Parasol Effect (Parasol)

Sulphur particles (aerosols) which are produced by industrial pollution form clouds which may have a cooling effect to counteract 'greenhouse' in some areas. Aerosol 'clouds' also reflect light producing an 'optical scattering', impairing views. Aerosols pull moisture from the air and condense it into droplets of water and acid thus forming a cloud - these are the acids in acid rain. The water vapour which condenses around a large number of these sulphur particles to form a cloud, creates a cooling effect by reflecting light and heat coming to Earth from the sun back into space--known as 'the parasol effect'. In the USA this effect is clearly greater in the Eastern third of the country where most industry is situated. Despite the parasol effect, under 'greenhouse' sea levels would still rise uniformly all over the globe as the warmer Southern waters expand.

Son of Ozone hole (Ozone hole)

The hole in the ozone layer over the Antarctic has been increasing in size yearly. Ozone destroying chlorine from the chlorofluorocarbons (CFCs) already in use will continue to accumulate in the atmosphere for another decade. Winds in the stratosphere which trap cold air over the South Pole form ice clouds, and chlorine on their ice surface is transformed in a chemical process which destroys ozone. These reactions begin each Spring and end when the sun has warmed the stratosphere, breaking up the polar vortex. As ozone absorbs ultraviolet sunlight -- thereby protecting life on Earth from radiation -- it also heats up the atmosphere, but because ozone-deficient air is left each year the stratosphere becomes even colder the following year, making the ozone hole more robust and bigger each year. A colder stratosphere under greenhouse could spread ice clouds to the North pole, causing an ozone hole above the Arctic also.

Methane: the hidden greenhouse gas (Methane)

Methane, a greenhouse gas second in importance to carbon dioxide, is helping to warm the Earth significantly. Like carbon dioxide, methane traps infrared radiation which would otherwise escape into the atmosphere. Concentrations of methane in the air have been increasing considerably, yet no-one is certain where the extra gas is coming from. Modern sources include cattle, bogs and marshes, and rice paddies, however uncertainty surrounds estimates of each source and no-one knows what the trends for these sources are. Possibly 90 per cent of the destruction of methane occurs in the atmosphere, however carbon monoxide from vehicle exhausts also accumulates in the atmosphere and plays a crucial role in allowing methane to accumulate there. The increase in carbon monoxide, may be the greatest contributor to the rising amounts of methane.

Icy Prospects for a Warmer World (Icy)

Scientists are looking at prior cycles of cooling and warming of the Earth, which resulted from periodic changes in the Earth's orbit and variations in the tilt of its axis, to try to better understand the effects of 'greenhouse'. Cores were drilled in the sea floor near the Antarctic to examine the types of sediment, as it is known that the types of sediment

found near ice-covered continents change with the climate. Sediment cores show that in the past a warmer climate has brought thicker ice and lowered sea levels. Many scientists ascribe the rising global temperatures over the last one hundred years to greenhouse gases. It seems likely that warmer temperatures would bring smaller ice sheets and rising sea levels, but while there is evidence of ice sheets melting at the lowest latitude margins, the ice in the interior of ice sheets is growing.

Can Algae Cool the Planet? (Algae)

Could cloud formation, which is influenced by algae, limit global warming? Marine algae produce a substance known as DMSP (dimethyl-sulphoniopropionate) which, when released (when algae die or are grazed by zooplankton) into the sea, breaks down to form dimethyl sulphide (DMS). Perhaps a tenth of the DMS enters the atmosphere where its components attract water vapour to form clouds. A prominent researcher has suggested that because one-half of the planet is made up of oceans, most of the cloud formed in the remote oceans may result from this process. Waters heated by global warming could encourage algae production, leading to more DMS and hence more cloud leading to more solar energy being reflected and a lowering of the Earth's temperature. Doubts exist about whether increased temperatures would lead to more DMS production and cloud formation because the full dynamics of algae are not yet fully understood.

Drying Out the Tropics (Drying)

Tropical climates are not as unchanging as previously thought. Theories that the tropics would be little affected by global warming while the polar regions and high latitudes would be most affected are now questioned. Global temperature increases may result in reduced rainfall in a band which circles the globe stretching from Southern Europe in the North to South Africa in the South, reducing food crop yields and putting up to 350 million people at risk of famine. Tropical temperatures have always remained stable during periods when the planet was becoming warmer or cooler. A rise in tropical temperatures under 'greenhouse', if true, would be devastating, leading to a drying out of

the land and severe droughts in tropical and sub-tropical locations. The possible effects of global warming are still not known, but once warmed the planet will be difficult to cool.

The Heat is On (Heat)

Ozone depletion over Antarctica is caused by the group of man-made chemicals known as chlorofluorocarbons (CFCs) which are products of aerosol sprays, and refrigerators. The ozone layer shields Earth from ultraviolet radiation, which causes sunburn and skin cancer. Potentially more damaging than ozone depletion is the greenhouse effect; a long-term warming of the planet caused, principally by carbon dioxide (CO₂). CO₂ lets the warming rays of the sun into the Earth's atmosphere, but prevents excess heat from reradiating back into space. CO₂ is mainly produced by burning fossil fuels. The regional differences in effects of atmospheric warming are not clear, but the trend is towards dramatically altered weather patterns over the next half century and a rise in sea levels caused by the expansion of sea water as it warms up. Scientists are still not certain why the ozone hole remains centred on the Antarctic, and fear the ozone destruction may be irreversible.

The Ozone Vanishes (Ozone vanishes)

The Earth's stratospheric ozone layer, which shields the Earth from harmful ultraviolet rays, is being destroyed by man-made chemicals. Damage already done may be irreversible. Ozone destruction, currently confined to the Southern polar region, could soon occur over heavily populated regions of the Northern hemisphere. Record-high concentrations of chlorine monoxide, a by-product of the principal ozone destroyers, chlorofluorocarbons (CFCs) have been found in the Northern skies. Ozone shields Earth from ultra-violet radiation which can cause cataracts on eyes and can lead to skin cancers. Ozone depletion also threatens to reduce yields in basic crops such as soya bean. Further, ozone depletion has the potential to affect the earth's climate systems by changing the temperature structure of the stratosphere. The reduction in ozone which makes the stratosphere slower to warm over the Antarctic each year also creates conditions for its own self-perpetuation.

As the Ozone Thins, the Plot Thickens (Ozone thins)

Ozone depletion, first detected in 1985, is shown to be accelerating in the Northern hemisphere as well as the Southern, bringing heightened risks of skin cancer in humans and unknown damage to plants, animals and eco-systems. Bans on chlorofluorocarbons (CFCs) appear too little too late as taking measures against ozone depletion processes were delayed by politics, bureaucratic oversights, and intense lobbying by industry. The contribution which ozone makes to global warming has recently been a catalyst for new CFC bans. Despite this progress, damage already done is only now being appreciated while CFCs will continue leaking from products for decades. Lack of policy and action indicates that by the time warming is measured precisely it will be too late to do anything about it.

3.4 GSP ELEMENTS OF TEXTS ON CLIMATE CHANGE

The process of identification and classification of GSP elements in texts dealing with climate change was established by first analysing three texts randomly selected from different magazines. The remaining seven texts were then analysed and the results compared with those gained from the first analysis. The purpose of dividing the analysis into two steps was to provide an initial proposal for analysis and then use the second analysis as a check on the initial proposal. The stages of analysis are illustrated below.

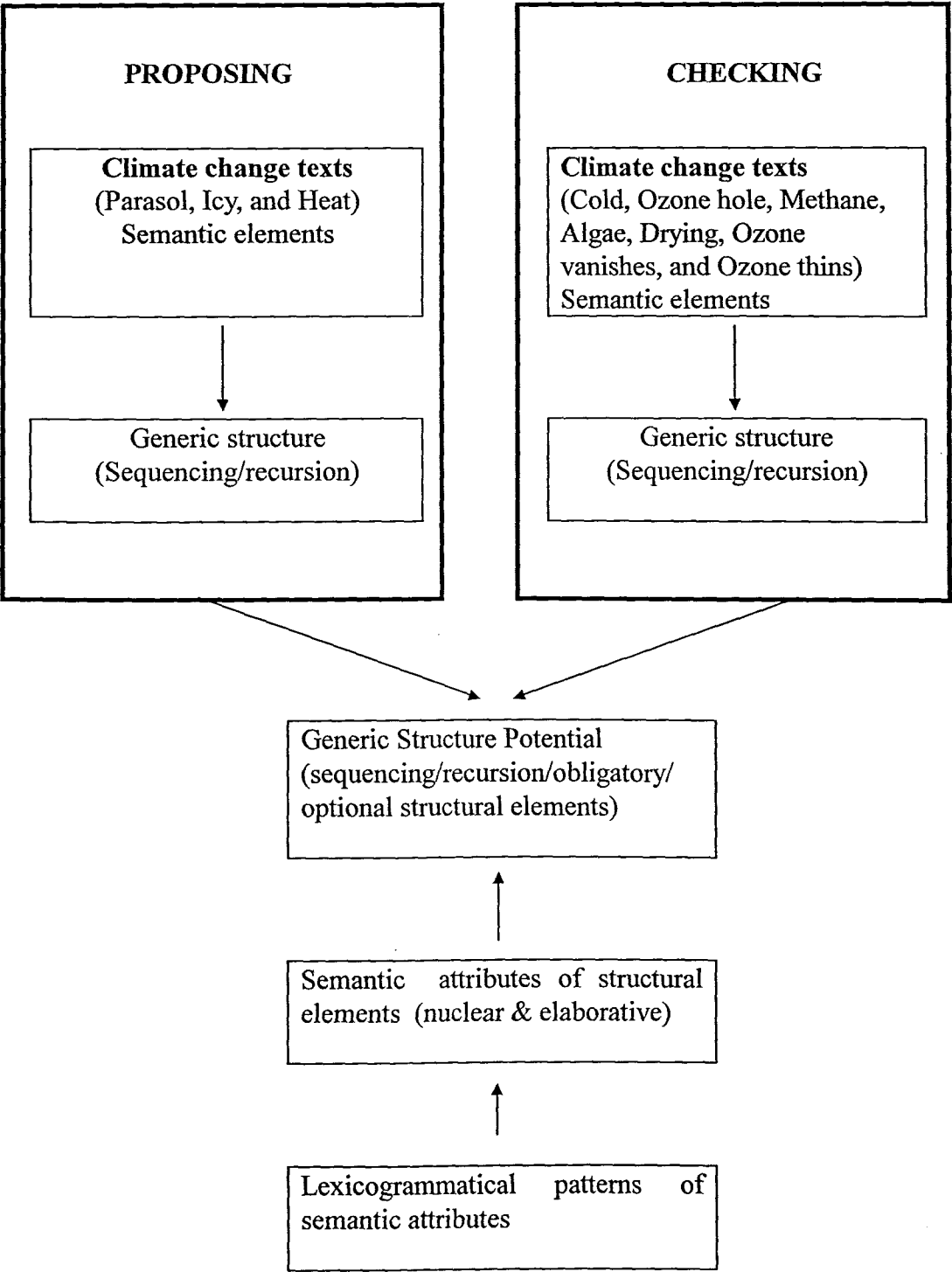


Table 3.2 Stages of Analysis

During analysis of the first set of three texts, I encountered difficulties in identifying the semantic elements. Table 3.3 shows the product of my initial attempt to identify semantic elements in the texts. The example is from ‘Parasol’ only because the remaining texts have similar elements in a comparable sequence.

TUNING	A comparison of two situations
FOCUSSING	1.1 Biography 1.2 Finding 1.3 Explanation [Analogy] 2.1 Explanation 3.1 Finding 3.2 Evaluation 4.1 Explanation 4.2 Invention [(Biography) (Property) (How things work)] 4.3 Finding 5.1 Explanation [Biography) (Finding) (Evaluation)] 6.1 Explanation [Evaluation] 7.1.Methodology 7.1.2 Explanation 7.1.3 Aims of project 7.2. Methodology
CLOSING	Concerns

Table 3.3 Elements in the ‘Parasol’ Text as a Result of the First Analysis.

The initial analysis reveals two orders of elements (see Table 3.3), the first comprising three global stages (TUNING, FOCUSSING, and CLOSING) and the second comprising their breakdown into detailed semantic elements (see second column in Table 3.3). In fact, I arrived at the second order first and found that its elements were merely a list of rhetorical moves which was insufficient to capture the notion of generic structure. Also, many elements could not be grouped within discourse units. Furthermore, it was difficult to establish a generic pattern that did not have too great a delicacy. My analysis was producing a map of individual rhetorical moves, such as ‘explanation’, ‘finding’ etc., and corresponding semantic terms constituting ‘moves’ in a single paragraph. For example, elements were identifiable in every sentence or every second sentence so that one paragraph might contain numerous terms or elements. Whereas I had considered that this was necessary in order to discern finer shifts of meaning, the result of this degree of delicacy was that I could not put the elements in a canonical sequence. This meant in turn that I could not develop an optional and obligatory structure of a straightforward kind. Using the identified elements, I created a ‘structure statement’ involving such a high number of

syntagmatic units, so much recursion, and so many multiples of elements, that the character of the genre could not be usefully established at this level of abstraction.

Subsequently, I reinterpreted the analytical process more abstractly and from there worked back to the more delicate discourse units exemplified by Hasan (1984). Consequently, I began by identifying TUNING, FOCUSSING and CLOSING. These three global terms by themselves are so broad and relative that they did not discriminate between the texts, such as with the broad Aristotelian categories of Beginning, Middle and End used in a narrative. However, they provided me with an organising reference point so that I could then interpret my own textual elements together. They are also useful in order to help distinguish non-factual genre such as popular scientific discourse from a narrative. For the second order of discourse units, I managed to find a middle ground of terms that combined the more specific semantics together into larger semantic elements with respect to the total curve of the text. It should be noted that the production of the very detailed semantic units was quite helpful in that it led me to look very carefully at what constituted the semantics of each of my later discourse proposals. Stepping back to TUNING, FOCUSSING, and CLOSING helped solve the problem of the overly instantial nature of the elements. The results of the reinterpretation of those elements are presented in Table 3.4 below.

	Parasol	Icy	Heat
TUNING	TTL GLM SET [PRB]	TTL GLM PRB TLI	TTL GLM SET PRB
FOCUSSING	SPC 1 [EVN] [BRG] EVN [BRG] EVN SPC 2 [BRG] EVN [CNS] ONP	SPC 1 [BRG] SPC 2 [BRG] BRG EVN SPC 3 EVN	GCL EVN BRG CNS SLN BRG GCL PRE BRG [EVN] SPC 1 [BRG] [EVN] EVN BRG EVN BRG GCL BRG SPC 2 [EVN] [PRE] [CNS] [EVN] BRG CNS [EVN] SPC 3 [PRE] SLN EVN
CLOSING	CNS	PRE	SUM CNS

Table 3.4 Actual Structure of the Three Texts and Their Semantic Elements
(Refer to Appendices 1.2, 1.5, and 1.8 respectively.)

As Table 3.4 suggests, beginning the analysis by establishing the three categories TUNING, FOCUSSING, and CLOSING, facilitates an organisation of other semantic proposals--proposals which lie between an overly sensitive rhetorical analysis and the excessive generality of the Aristotelian Beginning, Middle, and End. Principally the terms are effective, as suggested by the table, because the ‘-ing’ forms draw attention to the actions brought about by the text. Hence, these actions are distinguishable from narration. Having said that, we can now say that a return to the more abstract three part ‘design’ reveals what operates in popular texts as a trigger to whet the appetite of the reader, what counts to motivate the readers to read further, and what develops or elaborates the main argument while the reader’s appetite is being stimulated. We also

see how in fact CLOSING is achieved whether by summary, commentary or some less 'final' way of resolving what is set out in TUNING. Furthermore, a popular text is a form of journalism therefore we should not be surprised by commercial purposes inherent in the organisation of the periodical.

Therefore, a number of terms used earlier that were considered too discriminating appear again in the second order in Table 3.4 since they are now reconceptualised at a different level of abstraction. For example, 'explanation' did not serve its purpose very well initially (Table 3.3) because it could correspond to each clause in the way of speech function and because it was not sufficiently specific to characterise the text. The term 'explanation' was replaced by BRIDGING because whereas the notion of 'explanation' implies a great deal more description in relation to this particular text type, BRIDGING becomes a kind of background explanation that a reader needs in order to proceed from claim to claim, and, in particular, to accept the popular science writer's evaluation of what has been presented. Consequently, terms that did not work, such as 'explanation', were removed and new terms were introduced to cover larger chunks of text and the more specific drift of the popular scientific article. One of the characteristics of this genre was found to be that many texts involve predictions, concerns and speculations about the future whereas texts in other types of discourse might utilise a single term for the future. When we work at this degree of abstraction, analysis of this genre quickly reveals that attitudes to the future are quite distinctive and motivate quite separate approaches to the future.

To illustrate the similarities and differences among the three texts, they will first be compared in terms of their generic shape, meaning and its realisation. By identifying the differences, especially when all texts under the study are analysed, we can get a good picture of the range of presentation styles available to science popularisers. The discussion of the realisation of textual structures will focus on the three following aspects:

1. elements of a GSP.
2. their crucial semantic attributes (characteristics).
3. the lexicogrammatical pattern(s) most probable in realizing the semantic properties.

3.5 SEMANTIC ELEMENTS WITHIN TUNING: DEFINITION AND REALIZATION

TUNING covers the first section of the article, in which the writer seeks to tune the reader in to the purpose of the article, at the same time using devices to attract the reader's attention, maintain their interest, and ensure that their knowledge is adequate to follow the text to its end. Within TUNING, I have identified four semantic elements which will be treated individually. These semantic elements have been given the labels TITLE, GLIMPSE, SETTING, PROBLEM, and TECHNICAL LEAD-IN.

3.5.1 TITLE (TTL)

The first semantic element found in the three texts is TITLE. Two TITLES, *Icy Prospects for A Warmer World*, ('Icy') and *The Heat is On* ('Heat') inform the reader briefly about negative phenomena occurring in the world while a third, *The Parasol Effect* (Parasol), imparts a more 'neutral' message. 'Parasol' may appear more neutral because the 'parasol effect' is a term with which lay readers are not familiar. In fact, for conversant readers, a negative aspect is inherent in the term. One obvious reason for the TITLES of the three texts to contain negative messages is that they are articles written for consumption by the general public. The content of the magazines may have to be of general public interest to encourage members of the general public to buy them. The first, fastest, and most effective way to catch a reader's attention is through TITLE, and as a result the TITLES of the three texts are evocative and succinct. What is usually appealing to readers are events containing emotion. In other words, events which "stop people in their tracks" and "which affect their daily routine, their livelihood and standard of living" (Hudsen 1994:14-15).

Linguistic resources used in the three TITLES in order to catch the reader's attention are Epithet and Attitudinal Epithets. The attitude expressed in the TITLE can be either optimistic or pessimistic and in both cases 'affect' is usually high. In one of the sample texts ('Icy'), the writer uses the contradictory Attitudinal Epithets, *icy* and *warmer* to give affectual loading to the reader. In other words, the contradiction between coldness and hotness is used to give a sense of paradox in the reader's mind. Knowing that the reader is aware of the fact that the greenhouse effect causes the Earth to be warmer, the writer uses this awareness to attract the reader's attention. The common features found in the TITLE in each of the three texts were a nominal group (*The Parasol Effect* and *Icy Prospects for a Warmer World*) and a clause (*The Heat is On*). Since the effect of 'greenhouse' is expected to be an increase in global temperatures which may cause potentially disastrous phenomena, an optimistic meaning is realised by Epithets contrasting with heat, namely, *icy*. A pessimistic statement in the TITLE is semantically realised by an inanimate 'Thing' relating to the greenhouse effect, such as *heat*.

TITLES in the climate change texts are assumptive in three ways: firstly, they require the reader to have a pre-conception of the issues; secondly, the reader must be conversant with English idiomatic expressions in order to appreciate the 'gist' of the title (its punning or wordplay); and thirdly, one needs to be able to appreciate the cultural-attitudinal stance implicit in the wording which the writer is already evaluating. By comparison, technical writing avoids such early use of subjectivity.

Moreover, one can observe how the three metafunctions work together and reflect the characteristics of popular articles in the element TITLE. Experientially, TITLE intimates to the readers that we are facing possible dire consequences in relation to the environment; interpersonally, it creates a sense of paradox in readers' minds to make them read further to find more information; and textually, it provides the gist of the whole article in an economical manner.

3.5.2 GLIMPSE (GLM)

GLIMPSE, the second element which is always marked off by different type-face, performs almost the same function as TITLE. It can be viewed as an extension of TITLE because it exhibits the same strategies in the three metafunctions. The difference is that GLIMPSE is presented in a few clauses whereas TITLE is presented in only one nominal group. Thus, by reading GLIMPSE, the reader is provided with a general idea about the issue to be followed up in the main text. It is noticeable that GLIMPSE usually provides a sensational forecast about the future in relation to global warming. GLIMPSE has several features which distinguish it from Abstracts in academic articles. While GLIMPSE and Abstract both appear second in order after the Title of the articles they have different functions. GLIMPSE may touch on the most disturbing theme of the text while the Abstract gives a succinct summary of the research or the text. The reader can treat an Abstract as an independent discourse for it tries to give objective information and results in order that the reader can decide whether it is an area of relevance to her (Van Dijk 1980 cited in Swales 1990:179). GLIMPSE, on the contrary, cannot be regarded in the same way as an Abstract because it extends the information packed in the TITLE, but not sufficiently to enable the reader to understand the entire argument.

Another differentiating aspect of the GLIMPSE concerns its functions and its physical location in the text in contrast to those in specialist articles; specialist articles contain an Abstract while in popular papers we find a GLIMPSE whose purpose is to whet the reader's appetite for more information rather than give a succinct summary of the work. To achieve this the author provides striking information and thus restricts GLIMPSE. The GLIMPSE is less structured; it depends on an individual writer or probably the editor to decide on the style and length whereas the Abstract is more formal, structured and extended, with limited length.

Given that GLIMPSE has to be noticed by the readers in order to stimulate their interest, it is necessary for the GLIMPSE to be set off as a discrete element. It can be argued that GLIMPSE is a form of article advertising. To illustrate my point, TITLE and GLIMPSE in each of the three texts are presented together below to show the

close relationship between the two elements. (The numbers in the GLIMPSE text denote the clauses which will be referred to below).

The Parasol Effect

¹A hazy umbrella of sulfur particles is reflecting enough sunlight and heat back into space ||
²to offset global warming. ³You might think ⁴that's good news. ⁵Think again.

Semantically, in 'Parasol', the meaning in the TITLE is quite neutral in tone. It does not have Attitudinal lexis to indicate either positive or negative aspects. So too, clause 1 in GLIMPSE which tries to be informative by merely explaining the term "the parasol effect". Knowing that the first clause in the GLIMPSE gives an impression to the reader that the "parasol effect" may counteract the unwanted "global warming", in the third and fourth clauses, the writer evaluates the situation for the readers, giving them a clue that the "parasol effect" may not be a solution to "global warming". The last clause (5), *Think again*, which takes an imperative form, performs two functions: one is to attempt to engage the readers with the text by challenging them to read further to find out why the "parasol effect" does not counteract global warming, the other is to convey a sense of threat by asking the readers to re-think the consequences of the "parasol effect".

Icy Prospects for A Warmer World

¹In the past, a warmer climate has brought thicker ice. ²If this happened in a greenhouse world of the future, ³sea levels would fall, ⁴not rise.

For 'Icy' , the strategy employed in the TITLE to draw the reader's attention is the contradiction of the meanings in *icy* and *warmer*. Assuming that the reader has some basic idea about the "warmer world" -- that it may bring catastrophic changes in the environment -- the writer tries to attract attention by contrasting the *warmer world* with *icy prospects*, which can lead the readers to infer that it is likely that the world can become cooler. Then in GLIMPSE, the writer gives a brief idea of the relationship between a warm climate and ice to correct the idea that one may associate a warm climate with the melting of ice. In fact, the greenhouse effect may result in the accumulation of ice, which contradicts conventional beliefs.

Compared with 'Parasol', 'Icy' does not employ a fear arousing technique; there is no lexis containing extremely negative aspects. The GLIMPSE merely explains the fact. Propositions concerning the future of the relationship between a warmer climate and ice melting are made in a neutral way.

The Heat Is On

¹Chemical wastes spewed into the air threaten the earth's climate.

Among the three texts, TITLE and GLIMPSE in 'Heat' are the most emotional in terms of language; *heat* in the TITLE gives the reader a negative feeling. The use of Deictic *the* shows that there is some shared knowledge between the writer and the readers. It is understood that *the heat* is the heat resulting from global warming. Without any scientific background, the reader can infer that *heat* does not imply a pleasant state. Lexis containing negative aspects (*chemical wastes* and *threaten*) are used in GLIMPSE to heighten the reader's fears about global heat. In 'Heat', the writer explicitly creates anxiety in the reader's mind by using the word *threaten*. These three lexical items are sufficient to arouse fear among readers while building up their curiosity for more information. Here the author relies on the common concerns of most people and assumes anything that jeopardises their well-being ought to be able to capture their interest.

Given that part of the importance of semantic design in any segment of the discourse is the result of the accumulated grammatical selection, it is important, in relation to GLIMPSE, to take an experiential view as a first step in understanding what kind of information building is occurring. Halliday's "double point of view" (1995:162-175) on the experiential function interprets a clause from a transitivity perspective and an ergativity perspective. Ergative structure becomes relevant as one tries to clarify the clause as a model of agency or causality, and the transitive structure becomes the focus of interpretation when one tries to clarify the clause as an extension¹ (A more

¹ 'Ergative pattern' interprets a clause as containing Medium + Process +/- Agent. In this case, the Process is brought about by the participant (Medium) or external agency (Agent). 'Transitive pattern'

detailed description of how the ergative and transitive interpretation relate to one another is provided in the discussion of BRIDGING in 3.6.3). For that reason, I will here utilise Halliday’s view on ergative/transitive distinction to tease out the semantic design of GLIMPSE.

Table 3.5 presents an ergative analysis of GLIMPSE in the three texts. It shows how Medium is dominant in the three GLIMPSEs. It can be inferred that the focus of the meaning in GLIMPSEs here is on causality, that is, what is happening, rather than on who is causing it (Agency). To identify what it is that occurs, I categorised the participants (both Medium and Agent) into four groups below:

Natural world entity: a material entity or a simple natural entity that ordinary people can feel and observe, for example, cloud, gas, water, sea level, snow etc.

Natural world process: part of the natural order, but having a stronger process-orientation with which ordinary people are not normally involved. In other words, they are not a part of everyday experiences and not commonly observed or contemplated by ordinary people. Such processes are usually turned into a nominal group and thus involves a sense of abstraction, for example, *regular injections of nitrogen bearing compounds*, *the effect of CO₂*, and *solar radiation* etc.

interprets a clause as containing Actor + Process + Goal (or other process type patterns). In this case, the Process extends beyond the Actor or other entity. (See chapter 5 in *An Introduction to Functional Grammar*. M.A.K. Halliday 1994. Edward Arnold, London)

Example

A warmer climate	has brought	thicker ice.
Agent	Process: Material	Medium
Actor		Goal

Abstract entity: an intellectual abstract activity involved in research work, for instance, prediction, findings, study, explanation, factors, the global warming trend, idea, and reasons etc. This category also includes people’s mental and emotional state such as perception and fear.

Human participants: any human beings that can be readers, writers, scientists, politicians etc.

Text	Cl.no	Medium	Agent
Parasol	1.	sunlight and heat	a hazy umbrella of sulfur particles
	2.	you	
	3.	that (a hazy umbrella of sulfur particles is reflecting enough sunlight and heat back into space to offset global warming)	
	4.	(you)	
Icy	1.	thicker ice	a warmer climate
	2.	this (a warmer climate has brought thicker ice)	
	3.	sea levels	
	4.	(sea levels)	
Heat	1.	the earth’s climate	chemical wastes spewed into the air

Table 3. 5 Summary of Ergative Analysis of GLIMPSE in Three Texts.

N.B. This table summarises data from Appendix 3 which provides a comprehensive ergative analysis of GLIMPSE in the articles under discussion.

The participants in the three GLIMPSEs are categorised as shown in Table 3.6 and 3.7. The tables show that the semantic pattern found in the three GLIMPSEs concerns ‘Natural world processes’ and ‘Natural world entities’. The reason for GLIMPSEs being predominantly about ‘Natural world processes’ and ‘Natural world entities’ may be that the writers want to tell the reader about what is happening to the environment, not about human beings. Human participants appear as ‘Sensors’ to reflect what people feel or think about the environment, and not what they do to the environment.

Text	Cl. no	Natural world entity	Natural world process	Abstract entity	Human participant
Parasol	1.	sunlight and heat			
	2.				you
	3.		that (a hazy umbrella of sulfur particles ...)		
	4.				(you)
Icy	1.	thicker ice			
	2.		this (a warmer climate has brought thicker ice)		
	3.	sea levels			
	4.	(sea levels)			

Table 3.6 Categories of Medium in GLIMPSE

Text	Cl. no	Natural world entity	Natural world process	Abstract entity	Human participant
Parasol	1.		a hazy umbrella of sulfur particles		
Icy	1.		a warmer climate		
Heat	1.	chemical wastes			

Table 3.7 Categories of Agent in GLIMPSE

The role of participants in the GLIMPSEs is conflated with Subject role in the Mood analysis. This means the ‘Natural world processes’ and ‘Natural world entities’ are being debated. Moreover, they are the usual selection for topical Themes. It can be argued that the ‘Natural world processes’ and ‘Natural world entities’ are constantly foregrounded and thus become a focus of the GLIMPSEs. Table 3.8 sets out the selection of Medium in Mood and Theme.

Text	Cl.no	Medium	Subject	Theme	
				Textual	Topical
Parasol	1.	sunlight and heat	--	--	--
	2.	you	+	--	+
	3.	that (a hazy umbrella of sulfur particles is reflecting enough sunlight and heat back into space to offset global warming)	+	--	+
	4.	(you)	(+)	--	(+)
Icy	1.	thicker ice	+	--	+
	2.	this (a warmer climate has brought thicker ice)	+	--	+
	3.	sea levels	+	--	+
	4.	(sea levels)	(+)	--	(+)
Heat	1.	the earth's climate	--	--	--

Table 3.8 The Role of Medium in Mood and Theme

It is helpful to review the options for Finite² for the same clauses in the three GLIMPSEs. Table 3.9 shows how the three temporal aspects are distributed. The GLIMPSEs show the usual selection of modality: modalization which indicates probability, not usuality or necessity. It is also noticeable that ‘futurism’ is the main semantic focus in these GLIMPSEs. This ‘futurism’ aspect can be detected in ‘Parasol’ from the expressions *is reflecting*, *might think*, and *think*, in ‘Icy’ from *would fall*, and in ‘Heat’, from which modality is absent because a sense of futurism is inherent in the word *threaten*. Thus, each of these GLIMPSEs deals mainly with futurism.

² Mood element.

Examples:

A hazy umbrella of sulfur particles	is	reflecting	enough sunlight.
Subject	Finite	Predicator	Complement
MOOD		RESIDUE	

Chemical wastes spewed into the air	threaten		the earth's climate.
Subject	Finite	Predicator	Complement
MOOD		RESIDUE	

Text	Present	Non-present	Modality
Parasol	Cl.1 is reflecting		Cl.2 might think
	Cl. 3 might think		
	Cl. 4 is		
	Cl.5 think		
Icy	Cl.1 has brought	Cl.2 happened	Cl.3 would fall
			Cl.4 (would) not rise
Heat	Cl.1 threaten		

Table 3.9 Tense Selection in the Three GLIMPSEs.

TITLE and GLIMPSE both act as advertising elements for the article by promoting issues that can catch the reader's attention and at the same time provide the reader with a degree of scientific information. One finds that the experiential, the interpersonal, and textual function are part of a congruent semantic design in GLIMPSEs. That is, GLIMPSEs provide experiential meaning by trying to interpret the scenario of global warming. The interpersonal meaning in GLIMPSEs has an emotional impact on the readers because it tends to deal with negative consequences of global warming. Finally, GLIMPSE, in the three texts provides information on the direction of the articles, giving the reader have a general idea about what will be discussed in the remainder of the article.

Once writers have drawn the reader's attention to the texts through the medium of GLIMPSEs, they begin to introduce the main issues. Bearing in mind that they have to write for a wide range of readers with different degrees of scientific background, the writers employ different strategies. According to my analysis, two strategies in the introduction of scientific problems were discovered: the main issue being dealt with is introduced in the element SETTING (in 'Parasol' and 'Heat') and then stands out as a discrete element, called PROBLEM ('Icy').

3.5.3 SETTING (SET) AND PROBLEM (PRB)

It is appropriate to discuss SETTING and PROBLEM together because they are interrelated. SETTING is one of the elements subsumed within TUNING and the main purpose of TUNING is to maintain the reader's attention. TITLE is the first

element within TUNING that is designed to catch the reader's attention. The function of GLIMPSE is to stimulate the reader's curiosity to read further. SETTING is the third element employed to hold the reader's attention and at the same time provide the reader with a clear indication of what the article is about. It is sometimes possible for the writer to establish his/her angle while SETTING is being provided. In such cases, PROBLEM is embedded in SETTING (for example in 'Parasol'). When the writer introduces the central issue in a separate section, PROBLEM is presented as a discrete element (for example in 'Icy' and 'Heat').

Due to the fact that the majority of the target readers are 'non-scientists', the writer faces a challenge in establishing the angle in an interesting way. One way to make the article worth pursuing, is to introduce the subject matter in the context of day-to-day situations. These day-to-day situations appear designed to help the non-scientist reader to understand scientific issues and concepts more clearly. Analysis of the first three texts revealed that only two, 'Parasol' and 'Heat' have the element SETTING while, 'Icy' does not. In 'Parasol', the writer introduces the issue through a scientist's life experience (Robert Charlson). Therefore, the element SETTING has another element embedded in it, that is PROBLEM. In 'Heat', the writer first describes a scene to stimulate the reader's interest in SETTING, and then introduces the main issue separately in the element PROBLEM. In 'Icy', however, the writer begins by introducing the main issue in PROBLEM.

The author of 'Parasol' begins SETTING in Parasol by giving a detailed description of how a certain physical location appears on the surface, that is, apparently unpolluted. Through the scientist Robert Charlson's eyes, however, it is polluted. In other words, Charlson is evaluating what he sees for the readers. The main issue that the writer of the article wanted to present to the reader is the discovery of the parasol effect by Charlson. The issue is presented with a contradiction between what can be seen with the naked eye and what cannot. Paragraphs two to four of the text begins to shape where the main issue more clearly in PROBLEM. PROBLEM is considered as an embedded element in SETTING because the main issue is introduced, while at the same time an account of Charlson's experience is continuing.

The contrasting images between what we perceive and what is reality are given in a positive manner through the SETTING in a way that reassures the reader. The use of expressions such as *This air looks pretty clean*, *A cold scent of fresh water is blowing off the lake*, and *Sparrows are cheeping all around as they flit among the red and gold leaves of trees in full autumn display*. *There's a constant scritch-scratch sound coming from the lawn, where a flock of Canadageese, each approximately the size of a well-fed third grader, is munching grass* create the feeling that nature is intoxicated by its own abundance. The contrasting view is presented, however by a gradual shift in meaning, from being positive to negative.

Use of the 'contrasting view' is a strategy that is quite common in the popular texts under study, and may be common to popular scientific writing in general. The text, in these cases, usually begins with a common misconception or popular wisdom and then presents (scientific) facts because the writer wants to ensure that the writer and the reader are starting from the same premise (Hennessy 1997:137).

The writer of 'Parasol' relies on the scientist to explain all the scientific facts to establish his credibility in the subject matter. For this reason, the 'Parasol' article contains a high proportion of reported speech. The article is then followed by an explanation based on the scenario. As we read further we notice that the writer begins to provide some scientific facts concerning the properties of an aerosol (clauses 22-32) to enable the reader to understand the notion of the "parasol effect" which is discussed later in the article. The following extract demonstrates the strategy in the presentation of SETTING and PROBLEM. (The clauses are numbered for the purpose of discussion below).

Parasol

SETTING

(1) ¹ Robert Charlson glances at a stand of dark pines a few hundred yards away, across the flat gray waters of Lake Washington. ² "This air looks pretty clean, ³he says. ⁴It sure does. ⁵A cold scent of fresh water is blowing off the lake behind the parking lot of the National Oceanic and Atmospheric Administration's Pacific Marine Environmental Laboratory in Seattle. ⁶Sparrows are cheeping all

around ⁷as they flit among the red and gold leaves of trees in full autumn display. ⁸There's a constant *scritch-scratch* sound coming from the lawn, ⁹where a flock of Canadageese, each approximately the size of a well-fed third grader, is munching grass. ¹⁰The sensible compacts in the parking lot aren't belching exhaust, ¹¹and even the smoke coming from one of NOAA's boxy white buildings looks like harmless water vapor. ¹²It's hard to imagine how the atmosphere could be any cleaner and still have any modern, car-driving industry-dependent people in it.

[[PROBLEM]]

(2) ¹³“Well, let me tell you, ¹⁴it's not clean,” ¹⁵Charlson says ¹⁶“See the trees on the other side of the lake?” ¹⁷He points east. ¹⁸“If it were really clear, ¹⁹you'd be able to see every branch over there.” ²⁰Instead, some of the details are lost ²¹because some of the light reflected from the trees isn't reaching us. ²²On its trip across the lake, the light is slogging through a thin haze of solid specks and liquid globules, most of which are sulfur compounds. ²³Some of these particles are as small as viruses; ²⁴some are no bigger than a handful of molecules. ²⁵Belched forth from smokestacks and car exhausts, ²⁶these airborne particles, or aerosols, don't absorb much light, ²⁷so they don't appear dark. ²⁸But light that strikes an aerosol doesn't pass through it, either-- ²⁹it just bounces off at a new angle. ³⁰The more haze, ³¹Charlson says, ³²the more this “optical scattering” degrades the view.

(3) ³³Charlson, a professor of both atmospheric sciences and chemistry at the University of Washington in Seattle, has been studying aerosols since the 1960s, ³⁴when standard textbooks said optical scattering would never be measured accurately (³⁵among the first of Charlson's half-dozen patents is for a device that does just that). ³⁶Like a nineteenth-century explorer painstakingly drawing hills and streams on the blank spots that were once labeled HERE THERE BE TIGERS, he has spent 30 years creating an almanac of details about what he calls “this peculiar state of material floating around in the atmosphere.”

(4) ³⁷As a result of his work, one feature of haze is now very clear: ³⁸there's much more at stake than the view. ³⁹Our whole climate is in jeopardy. ⁴⁰Just as aerosols scatter light traveling from one side of a lake to another, ⁴¹they also interfere with light coming in to Earth from the sun. ⁴²“Some of it's being reflected back,” ⁴³Charlson says. ⁴⁴“It goes right out into the blackness of space.”]]

SETTING in ‘Heat’, unlike that in ‘Parasol’, does not dramatise a character, but rather orientates the reader by foregrounding the event related to the issue raised in the element PROBLEM. To make the article interesting to the reader, SETTING in ‘Heat’ is presented in an anecdotal style in which the writer relates a story about scientific expedition to Antarctica to ascertain the causes of ozone depletion. The account of the expedition is suspended in quite a long stretch of text for the purpose of creating a

degree of tension in the reader's mind as to exactly why these scientists were doing in the tourist resort of Cabo de Hornos Hotel in Puntas Arenas. Information on the scientists aims is provided, little by little. In paragraph (2) the reader discovers that the scientists are carrying out research because the text mentions the preparation of *the plane and its research instruments*. The text is more like an informal report on a particular (NASA) project as it gives information about what has happened, who is involved in the project, what are the results etc.

PROBLEM in 'Heat' is given after the writer sets the scene for the reader in the element SETTING. To write an article about greenhouse effect and ozone depletion for a popular audience, a necessary strategy may be to attract the reader's attention first by providing him/her with a human interest perspective rather than going straight to the subject matter. After curiosity is created in the reader's mind (What were the scientists doing at the tourist resort, if not holidaying?), the main issue can then be presented. The main issue of this text is announced in the element PROBLEM which is presented discretely and precisely (in only two clauses, 15-16). The fact that the information in PROBLEM is not as detailed as that in 'Parasol' may be because the writer assumes that the reader has some knowledge about ozone depletion and greenhouse effect since they are high-profile issues, particularly in mass media (Bell 1994: 33). In contrast, the 'parasol effect' is new to lay people. The following extract from 'Heat' shows its SETTING and PROBLEM.

Heat

SETTING

- (1) ¹At this time of year, the Cabo de Hornos Hotel in Puntas Arenas (pop.100,000) is ordinarily filled with tourists who spend their days browsing in the local tax-free shops or mounting expeditions into the rugged mountainous countryside just out of town. ²But the 120 mostly American scientists and technicians who converged on Chile's southernmost city for most of August and September ignored advertisements for hunting, hiking and ski tours. ³Instead each day they scanned the bulletin board in the hotel lobby for the latest information on a different sort of venture.
- (2) ⁴Thirteen times during their eight-week stay, a specially outfitted DC-8 took off from the President Ibañez Airport, twelve miles northeast of Puntas Arenas. ⁵Often the 40-odd scientists and support crew listed for a given flight had to leave the hotel soon after midnight to prepare the plane and its research instruments. ⁶Once airborne, the DC-8 would bank south toward Antarctica,

1000 miles away, ⁷fighting vicious winds before settling into a twelve-hour round-trip flight at altitudes of up to 40,000 ft. ⁸Along the way, the instruments continuously collected data on atmospheric gases, airborne particles and solar radiation high above the frozen continent. ⁹Meantime, parallel flights took off from Ibañez to gather additional atmospheric data at nearly twice the altitude. ¹⁰Manned by a lone pilot, a Lockheed ER-2, the research version of the high-altitude U-2 spy plane, made twelve sorties into the lower stratosphere, ¹¹cruising at nearly 70,000 ft., or more than 13 miles, for six hours at a time.

PROBLEM

(3)¹²Both aircraft were part of an unprecedented, \$10 million scientific mission carried out under the combined sponsorship of NASA, the National Oceanic and Atmospheric Administration, the National Science Foundation and the Chemical Manufacturers Association. ¹³The purpose: to find out why the layer of ozone gas in the upper atmosphere, which protects the earth from lethal solar ultraviolet radiation was badly depleted over Antarctica. ¹⁴The scale of the mission reflected an intensifying push to understand the detailed dynamics of potentially disastrous changes in the climate.||¹⁵The danger of ozone depletion is only part of the problem; ¹⁶scientists are also concerned about the “greenhouse effect,” a long-term warming of the planet caused by chemical changes in the atmosphere.

This element is narrative-like in that the writer describes the physical location as background for the reader. It is not uncommon to find that scientific articles in a popular magazine contain a narrative-like orientation. Writers for the mass media seek to report past events as well as to interpret and explain them in order to help the reader to comprehend issues and (possibly) act on them. Further, readers are also entertained by reading a narrative or story-like account (Fairclough 1995: 91) and this appears to be acknowledged by writers on popular science who take advantage of the way readers have been naturalised (through detective story, or other motifs) into reading with the expectation of finding drama.

‘Icy’ has a different orientation in how the main issue is presented. ‘Icy’ does not have SETTING; at the beginning of the text, it directly introduces the main issue to be followed up in the element PROBLEM. To address the main issue, the writer of ‘Icy’ orientates the reader with a very brief introduction (clauses 1-3) concerning global warming. The strategy employed in this text is a dialectic one; that is to say, the

contrast between popular belief (ice sheets should melt in warmer temperature and therefore cause sea levels to rise, which can be inferred from clauses 4-5) and a scientific fact (scientific evidence shows an opposite fact, as indicated in clauses 6-7). The following extract from 'Icy' shows how the main issue is addressed in PROBLEM.

Icy

PROBLEM ¹An abiding concern of climatologists faced with the prospect of global warming has been the behaviour of the great ice sheets of Greenland and the Arctic. ²The world has become warmer over the past hundred years or so ³and many scientists ascribe this to the increase in carbon dioxide and other greenhouse gases in the atmosphere. ⁴At first glance, it seems likely ⁵that a warmer world would bring smaller ice sheets and rising sea levels. ⁶But while there is evidence of ice sheets melting at the lowest latitude margins, ⁷the ice in the interiors of the sheets is growing. ⁸Researchers interested in the interplay of ice sheets and sea level are now discovering a similar pattern in the past.

The three extracts above show how 'Parasol', 'Heat', and 'Icy' differ from each other in relation to their method of development. SETTING in 'Parasol' is foregrounded in the first clause by a 'Human participant' (Charlson). The foregrounding of the character, assures us that the text is developed through a scientist's experience. This involves the text containing a degree of reported speech which will be discussed in detail in chapter four. Deeper into the 'Parasol' text, we encounter 'Abstract entities' (*optical scattering, the physics and chemistry of cloud formation and the aerosol umbrella etc.*) and 'Natural world entities' (*this air, the atmosphere, the light, our whole climate and sunlight on our planet etc.*) that are thematised because the scientist wants to tell the reader about the environment or about an occurrence. To establish the feeling that something is happening currently, present tense is employed in this element. On the contrary SETTING in Heat is organised in terms of a time frame that relates to the here and now, using marked Themes as a hyper-theme to construct the text (*At this time of the year*). The development of the text is later constructed around the 'Human participants' (*the 120 mostly American scientists and technicians, the 40-odd scientists and support crew listed for a given flight, scientists, and scientists with the British Survey*), 'Natural world processes' (*the danger of ozone depletion, the threat to the ozone, the phenomenon, and the culprit*) and 'Natural world entities'

(winds and a group of man-made chemical called chlorofluorocarbons). In 'Icy', the 'Abstract entity' (an abiding concern of climatologists faced with the prospect of global warming) is thematised.

A conclusion about the similarities and differences among the three texts can be drawn here. To illustrate these similarities and differences, Table 3.10 outlines the strategies which the writer of each article uses to address the main issue.

Characteristic	Parasol	Icy	Heat
Human interest features	SETTING [PROBLEM]	---	SETTING
Contrasting views (standard assumption as against scientific facts)		PROBLEM	---
Statements of fact	---	---	PROBLEM

Table 3.10 A Comparison of Strategies used to Introduce the Main Issue in the Three Texts.

It is obvious from an examination of the opening sections of the three texts that the assumed knowledge is different. This may be illustrated by the manner of introduction of the term “global warming” in the three texts; the term is first introduced in paragraph 5 in ‘Parasol’, paragraph 3 in ‘Heat’, and paragraph 1 in ‘Icy’. It may be argued that ‘Icy’ has a higher degree of technicality than the other two texts. It may also be concluded here that the three sample texts differ from each other with regard to their degrees of popular appeal. ‘Parasol’ and ‘Heat’ both appear to be pitched more directly to a popular readership by the fact that they both contain detailed human interest elements which include an appropriate amount of scientific background information.

How is the element PROBLEM realised? The analysis of the three texts reveals two ways in which PROBLEM can be recognised semantically. Firstly, it can be realised by the dialectic relationship between ‘standard assumption’ or popular conventional wisdom, and scientific facts. For example, in ‘Parasol’ the writer compares the actual scenario with scientific fact. The scenario is that *This air looks pretty clean...* and the

scientific fact is *Well, let me tell you, it's not clean, Charlson says*. The key semantic characteristic is the use of adversative statement *Well, let me tell you, it's not clean, Charlson says*. In 'Icy', a similar dialectic relation is found in which a clause is thematised by Adjunct: 'while', with the conjunction: 'but' (*At first glance, it seems likely that a warmer world would bring smaller ice sheets and rising sea levels. But while there is evidence of ice sheets melting at the lowest latitude margins, the ice in the interiors of the sheets is growing*). We can sense a semantic move from *well* and *but*. Following Halliday (1994:53), the use of Continuative such as *well, oh, and now*, shows that a move is beginning. Because the writer of 'Icy' wants to explain to the reader why commonly held beliefs or ideas are in fact contrary to scientific evidence, it needs to begin a new move.

The second means by which to recognise PROBLEM is shown in 'Heat'. The realisation of PROBLEM in 'Heat' is made explicit by the word *problem*. In 'Parasol' and 'Icy', the meaning of PROBLEM is indicated in an adversative statement, but the PROBLEM in 'Heat' is presented in an affirmative statement. The semantic property is concerned with the confirmation of scientific assumptions or facts that are held. On the basis of the analysis, the affirmative statement presents a negative aspect of the situation, which attempts to convince the reader that the situation gives cause for concern. The reader has general knowledge that the phenomena (that is ozone depletion and greenhouse effect) are by themselves alarming. Moreover, the author uses lexis containing negative aspects, for example, *danger, problem, and long-term warming*.

3.5.4 TECHNICAL LEAD-IN (TLI)

The TECHNICAL LEAD-IN refers to that part of the text which contains essential technical information as a basis for the reader to be able to understand the main argument in the body of the text. The information can be basic scientific knowledge, or it can be the motivation behind the research, or research methods and findings. The analysis of the first three texts shows that only 'Icy' contains TECHNICAL LEAD-IN which provides information about processes which occurred on the Earth in the past when it warmed. TLI here is the key to understanding the relationship between the growth of ice sheets and the rise of sea levels in a greenhouse world of the future.

Hence, the writer provides this technical information before the reader goes further. The relevant extract reads:

Icy

TECHNICAL LEAD-IN

(2) ¹By looking into the past, scientists hope to understand the effects of the threatened runaway greenhouse effect. ²Turning to the rocks and sediments of the Earth's most recent ice age, in the Pleistocene epoch that stretches back 1.6 million years, they are searching for an example of how the Earth behaved ³as it warmed then. ⁴During Pleistocene times the Earth switched from a glacial to a milder interglacial climate and back again nine times. ⁵These cycles are subdivided into cooler and warmer periods known as stadials and interstadials respectively. ⁶The timing and duration of these minor cycles closely match fluctuations in the distribution of the energy the Earth receives from the Sun, which are caused by periodic changes, in the shape of the Earth's orbit and by variations in the tilt and precession of its axis, together known as Milankovitch cycles.

(3) ⁷At least two periods in the Pleistocene epoch had very mild climates, milder than today. ⁸The first, termed the Hypsithermal interstadial, was between 7000 and 3000 years ago, ⁹ when the world was, on average, about 2°C warmer than now. ¹⁰The second was the most recent major interglacial, between 132 000 and 120 000 years ago, ¹¹when the world basked in a climate 2 to 3°C warmer, on average.

The discussion above has demonstrated that TUNING, the first global move, subsumes four possible elements. These elements suggest different strategies employed by writers in order to orientate the reader whose background knowledge of the subject matter is different. It is apparent that the three texts have different presentation techniques although they have similar generic form. It will become apparent also, as we analyse further, that the three texts contain different writing styles overall. This is reflected partly by the use of different strategies to catch the reader's attention. Both 'Parasol' and 'Heat' took the form of a narrative to present a scientific issue. 'Parasol' is an account of a scientific discovery by a scientist, Robert Charlson: the account is given by relating Charlson's own experience. This is done through the frequent use of Sayer + Verbiage pattern as in "*Charlson says*". By contrast, 'Heat' is an account of an event, the gathering of a group of scientists at a hotel in Chile. This is shown by the selection of location: temporal as topical marked Themes (*At this time of the year, thirteen times during their eight weeks stay, once airborne and meantime*). 'Icy' differs from 'Parasol' and 'Heat' in that it does not take the form of a narrative. Instead 'Icy' simply raises the issue of the warming of the Earth, and follows with a scientific explanation. Table 3.11 shows the structural elements of the three texts.

Obligatory and optional elements, and the sequencing of these elements, will be discussed later in chapter six.

Parasol	TTL	GLM	SET	[PRB]
Icy	TTL	GLM	PRB	TLI
Heat	TTL	GLM	SET	PRB

Table 3.11 Actual Semantic Elements Within TUNING of the Three Texts.

3.6 SEMANTIC ELEMENTS IN FOCUSSING : DEFINITION AND REALIZATION

In FOCUSSING, the main argument in each of the three texts cites a number of supportive studies related to the issue under discussion. FOCUSSING encompasses several elements which appear in repetitive cycles. The semantic elements identified are SPECIFIC CLAIM, GENERAL CLAIM, BRIDGING, EVALUATION, ONGOING PROJECT, SOLUTION, CONCERNS, and PREDICTION which are explained below.

3.6.1 SPECIFIC CLAIM (SPC)

The SPECIFIC CLAIM is the part of a text which the writer uses to support his/her argument. It includes information such as researcher’s name and other personal information, such as expertise, workplace and nationality, what he/she has studied, the purposes of research, where the investigation takes place, what the methods of the investigation are, and what the results and their significance are.

The writer of popular articles aims at communicating new and interesting scientific discoveries to general audiences. Scientists’ work and opinions are vital in media discourse because they endow a voice with authority, and also with credibility and reliability (Anderson 1997:128; Waugh 1995:129-173 Zelizer 1989:369-388). Consequently, it is always the case that scientists referred to in popular articles are fully introduced and their qualifications and backgrounds are well detailed. This is

not the case in research articles in which only the researcher’s name is provided below the title of the articles and their personal information is provided in a footnote. The semantic attributes of SPECIFIC CLAIM, and their realisations found in the three texts are illustrated below in Table 3.12.

SPECIFIC CLAIM		
Semantic attribute	Realisation	Example
Statement of aim (s)	x did y (time)	(Last year) Charlson , together with six of his fellow atmospheric researchers published the first reliable calculations of just how much heat is getting bounced away from Earth. ('Parasol') Eugene Domack of Hamilton College in New York, Timothy Jull of the University of Arizona and Seizo Nakao of the Geological Survey of Japan have been looking for <i>an answer in the sediments on the sea floor around the Antarctic.</i> ('Icy')
Materials and methods	x uses y To do x, y does z	They have used <i>cores drilled in 1987 and 1988...</i> ('Icy') To get a complete measure of optical scattering , Charlson explains, " <u>you make a measurement with a nephelometer.....</u> " ('Parasol')
Findings	x found z, it was found that	He (Domack) found that the Antarctic ice sheets grew significantly between 3000 and 7000 years ago- -at the same time as a period of global warming. ('Icy')
Statement (s) evaluating findings	x confirms y	The computer model confirmed his rough calculation. ('Parasol')
Conclusion	x concludes that... x announces the conclusion	The team concluded that the Antarctic ice sheets were expanding at a time when the world was, on average, 2°C warmer than today. ('Icy') In 1974 Rowland and Molina announced their conclusion: CFCs were weakening the ozone layer... ('Heat')

Table 3.12 Semantic Attributes and their Realisation

Before discussing further, I shall provide some examples of extract that contain SPECIFIC CLAIM. It would take too much space to provide all extracts as there are far too many of them. Some extracts are very long therefore the rest of the extracts are not included. Only the beginning of the extracts where the semantic attributes appear are bolded.

Parasol

SPECIFIC CLAIM 1

(5) ¹And sunlight, on our planet, means heat. ²Last year Charlson, together with six of his fellow atmospheric researchers published the first reliable calculations of just how much heat is getting bounced away from Earth. ³Some regions, ⁴they found, are so blanketed by haze that they are undergoing an aerosol cooling, a cooling great enough that what might be called the parasol effect is neutralizing the better-known greenhouse effect. ⁵In other words, the explorer is back with news. ⁶Here be tigers, indeed.

(6) ⁷When Charlson and his colleagues made this announcement, ⁸they noted ⁹that their finding might explain why even the best models of global warming have predicted hotter temperatures than those that have actually been measured. ¹⁰They also pointed out ¹¹that their assessment of aerosol effects may in fact be too conservative. ¹²Charlson says it includes only the direct effect of aerosols; ¹³there's even more cooling going on indirectly.

Icy

SPECIFIC CLAIM 1

Back to the future

(4) ¹Evidence for the Hypsithermal warming comes from sediment below the Southern Ocean around Antarctica. ²Just the idea of Antarctica in a hotter world provokes alarming images of ice cubes disappearing in bubbling hot water; ³many vision of a greenhouse future have included the melting of this huge ice sheet and a consequent rise in sea level of 5 metres or so. ⁴But this simple assumption can be tested by looking at how the Antarctic ice has responded to warming in the past.

(5) ⁵Eugene Domack of Hamilton College in New York, Timothy Jull of the University of Arizona and Seizo Nakao of the Geological Survey of Japan have been looking for an answer in the sediments on the sea floor around the Antarctic. ⁶They have used cores drilled in 1987 and 1988 by the Ocean Drilling Program, together with other cores from geological expeditions in Antarctica over the past decade. ⁷The sites were carefully chosen to provide a continuous record of the sediment accumulating at places that were sensitive to the amount of ice in Antarctica over the past 10 000 years. ⁸Cores contain a wealth of information—⁹the types of sediment found near ice-covered continents change with the climate.

....

(10) ³⁷Domack matched the record of larger ice shelves between 4000 and 7000 years ago with the record of average world temperatures over the same period. ³⁸To his surprise he found ³⁹that the Antarctic ice sheets grew significantly between 3000 and 7000 years ago—at the same time as a period of global warming. ⁴⁰“At first we thought that the Antarctic ice-sheet outlets were simply lagging behind the retreat of

northern hemisphere ice sheets,” ⁴¹says Domack. ⁴²(These ice sheets mainly disappeared 10 000 years ago.) ⁴³“But the Lambert Glacier drill-core clearly records the end of a major Antarctic ice-expansion episode at the same time as the great ice sheets of the northern hemisphere disappeared,” ⁴⁴he notes. ⁴⁵**The team concluded** 19that the Antarctic ice sheets were expanding at a time when the world was, on average, 2°C warmer than today.

Heat

SPECIFIC CLAIM 1

[BRIDGING]

(16) ¹They were. ²In 1972 Rowland heard a report that trace amounts of CFCs had been found in the atmosphere in both the northern and southern hemispheres. ³What were they doing there? ⁴**The answer,** ⁵**as Rowland and his colleague, Mario Molina, soon found,** was that there was nowhere else for them to go but into the atmosphere. ⁶CFCs in aerosol cans are sprayed directly into the air, ⁷they escape from refrigerator coils, ⁸and they evaporate quickly from liquid cleaners and slowly from plastic foams.

(17) ⁹[[In the troposphere, CFCs are immune to destruction. ¹⁰But in the stratosphere, they break apart easily under the glare of ultraviolet light. ¹¹The result: free chlorine atoms, which attack ozone to form chlorine monoxide (ClO) and O₂. ¹²The ClO then combines with a free oxygen atom to form O₂ and a chlorine atom. ¹³The chain then repeats itself. ¹⁴“For every chlorine atom you release,” ¹⁵says Rowland, “100,000 molecules of ozone are removed from the atmosphere.”]]

(18) ¹⁶In 1974, **Rowland and Molina announced their conclusion:** ¹⁷CFCs were weakening the ozone layer enough to cause a marked increase in skin cancers, perhaps enough to perturb the planet’s climate by rejuggling the stratosphere’s temperature profile....

The extracts above demonstrate how the number of semantic structure within SPECIFIC CLAIM varies from one article to another. However, some typical semantic characteristics may still be found. Hasan’s idea of unfolding linear structure can be applied to present the semantic characteristics of SPECIFIC CLAIM below:

(Statement of aim)^(Materials & methods)^Finding^(Explanation)^(Evaluation)^(Conclusion) ³

³ The key to symbols.

() elements are optional.

^ fixed order of elements.

From the above presentation, it means that one can find a complete set of semantic attributes that characterise SPECIFIC CLAIM or any one of them with Finding or only Finding.

As far as the analysis of the three texts is concerned, one key factor that motivates different semantic attributes within SPECIFIC CLAIM is the use of Charlson's profile and his own research. Consequently, the writer devotes a large amount of text to the introduction of Charlson and his qualifications.

SPECIFIC CLAIM in 'Heat' differs from that in 'Parasol' and 'Icy' in that 'Heat' incorporates a number of research outcomes to make the writer's point. The writer gives only the information of a scientist and the result of his study, followed by a short comment on such result. There are no other details such as where the study took place and how the data were collected. Then the writer goes on to give other results from the mission mentioned early in the article.

As the articles incorporate more than one research outcome, it can be expected that SPECIFIC CLAIM is presented in a cyclical order. There is a challenge, then, to build in cyclic and recursive potential into the proposals on generic structure (for example, see Hasan on 'The Nursery Tale as a Genre'.)

3.6.2 GENERAL CLAIM (GCL)

GENERAL CLAIM functions to support the writer's claim by referring to the work of other researchers who have been investigating the problem under discussion. Therefore, it has similar semantic properties to those found in SPECIFIC CLAIM. As the label suggests, it is a general reference to scientific findings and gives no credit to specific researchers. Their names and other personal information are not given in this element. Instead of being realised by the full personal attribute of the researcher, it is realised by generic nouns such as *scientists*, *mounting evidence*, and *data*. According to the analysis of the three texts, this element is found only in Heat. By comparison, the information in GENERAL CLAIM is usually not as detailed as that in SPECIFIC

CLAIM. The semantic characteristic is typically realised only by “researchers” (no specific names), and findings. The two extracts below are examples of GENERAL CLAIM in Heat. One (clauses 1-5 in the first extract of GENERAL CLAIM) is close to that in SPECIFIC CLAIM in terms of the amount of information cited. The other (clauses 1-9 in the second extract of GENERAL CLAIM) is the example in which the information is given briefly.

Heat

GENERAL
CLAIM

(9) ¹The relationship between CO₂ emissions and global warming is more than theoretical. ²Two weeks ago, a Soviet-French research team announced impressive evidence ³that CO₂ levels and worldwide average temperatures are intimately related. ⁴By looking at cores of Antarctic ice, the researchers showed ⁵that over the past 160,000 years, ice ages have coincided with reduced CO₂ levels and warmer interglacial periods have been marked by increases in production of the gas.

GENERAL
CLAIM

(24) ¹It is not yet clear whether ozone depletion in the Antarctic is an isolated phenomenon or whether it is an ominous warning signal of more slowly progressing ozone destruction worldwide. ²Data indicate ³that the decline over the past eight years is 4% to 5%. ⁴Scientists estimate ⁵the natural destruction of the ozone could account for 2% of that figure. ⁶The Antarctic hole could explain an additional 1%. ⁷The remaining 1% to 2% could simply be the result of normal fluctuations. ⁸As Albritton's research team reported, ⁹“A depletion of this magnitude would be very difficult to identify against the background of poorly understood natural variation.”

Table 3.13 below compares the realisation of semantic attributes within SPECIFIC CLAIM and GENERAL CLAIM.

		SPECIFIC CLAIM	GENERAL CLAIM
Semantic attribute	Realisation	Example	Example
Statement of aim (s)	x did y (time)	(Last year) Charlson, together with six of his fellow atmospheric researchers published the first reliable calculations of just how much heat is getting bounced away from Earth. ('Parasol')	---
Materials and methods	x uses y To do x, y does z	They have used cores drilled in 1987 and 1988... ('Icy') To get a complete measure of optical scattering, Charlson explains, "you make a measurement with a nephelometer....." ('Parasol')	---
Findings	finds announces x indicates y estimates	He (Domack) found that the Antarctic ice sheets grew significantly between 3000 and 7000 years ago--at the same time as a period of global warming. ('Icy')	A Soviet-French research team announced impressive evidence that CO ₂ levels and worldwide average temperatures are intimately related. ('Heat') Data indicate that the decline over the past eight years is 4% to 5%. ('Heat') Scientists estimate the natural destruction of the ozone could account for 2% of that figure. ('Heat')
Statement (s) evaluating findings	x confirms y	The computer model confirmed his rough calculation. ('Parasol')	---
Conclusion	x concludes that... x announces the conclusion	The team concluded that the Antarctic ice sheets were expanding at a time when the world was, on average, 2°C warmer than today. ('Heat') In 1974, Rowland and Molina announced their conclusion : CFCs were weakening the ozone layer ...('Heat')	---

Table 3.13 Comparison Between Semantic Attributes and their Realisations of SPECIFIC CLAIM and GENERAL CLAIM

3.6.3 BRIDGING (BRG)

BRIDGING is an important semantic element in the Generic Structure by which we may characterise popular scientific writing. It is the element that bears a great deal of responsibility for carrying the reader towards understanding by explaining or reasoning. It contains the possibly adequate amount of technical explanation necessary for the readers to make sense of the entire article. It is very important especially when the knowledge is moving towards a higher degree of technicality: it is difficult for a general audience to comprehend the text of any popular article because there is an implicit connection between two ideas which most numbers of general public would not be able to make. This element helps close the gap between the ongoing text and the level of reader's knowledge. This commonly occurs for ordinary lay readers. Moreover, BRIDGING indicates the degree to which other elements can be successful. PREDICTION, for example, will not make much sense to the readers if the writer fails to give them sufficient information. In other words, it is unlikely that the readers can infer the illocutionary force the writer has in mind. By the same token, BRIDGING and the element EVALUATION are interrelated; if EVALUATION appears in vacuo, the readers cannot fully understand the writer's interpretation of the experiment or argument that he is trying to evaluate. Accepting that some outsiders find science too difficult and too complex, Farago (1976: 14-15) sees that it is important for science writers to bridge the knowledge gap. He says that:

From the journalist's point of view the most important problems are suggested by the interpretation of facts leading to their potential consequences. To consider one example, an assessment of the potential dangers of a nuclear reactor is based on a relatively small number of facts interpreted through a massive statistical analysis. The non-scientist will be concerned only with the final interpretation; without an intimate knowledge of metallurgy, engineering, chemistry, and statistics he cannot sensibly comment on the underlying scientific work. The task of the science writer is to place in perspective the processed used to derive the final interpretation, to bring out any major assumptions made, and to note conflicting results if these exist.

In fact, explanation is crucial in all kinds of texts and it can appear anywhere in the texts because explanation gives further information and clarifies the matter being discussed. It is not only BRIDGING that contains explanation but also TECHNICAL LEAD-IN, an element subsumed under TUNING (as discussed in 3.5.4). There seems

to be a parallel representation between BRIDGING and TECHNICAL LEAD-IN. Both are responsible for presenting essential technical information to the reader. They, are different, however, because they have distinctive semantic motifs. The question at issue is what kind of technical information is recognised as TECHNICAL LEAD-IN and what kind of information is accounted for in BRIDGING.

Semantically, TECHNICAL LEAD-IN prepares the readers with essential technical information so that they can follow the main argument discussed in the body of the text (FOCUSSING). In other words, TECHNICAL LEAD-IN is a prospection; it directs the readers forward. Conversely, BRIDGING connects two elements together (the previous and the following one) within FOCUSSING. TECHNICAL LEAD-IN is responsible for clarifying the key concept of the whole article while BRIDGING gives further information on particular or narrow issues in FOCUSSING. There is a sense here in which the information moves away from the apparent topic. In other words, the writer stops the ongoing argument of the main topic in order to add some minor topics which have to be understood. This is because the minor topics link the previous and the new argument together.

BRIDGING can be recognised by the fact that there is a break with the main line of the argument. The break contains information that is ancillary to the main topic, which assists the reader to understand the main argument better, and thus acts as a dependent part of the discourse. If we look at the main argument and the explanation in BRIDGING in terms of their ideational meaning, we will find that the ideational direction of the main argument (which is presented in other elements such as SPECIFIC CLAIM) may stop or slow down while another line of ideational meaning is developed. Then the reader is returned to the first line of the ideational meaning.

TECHNICAL LEAD-IN and BRIDGING can be distinguished as shown in Diagram 3.1.

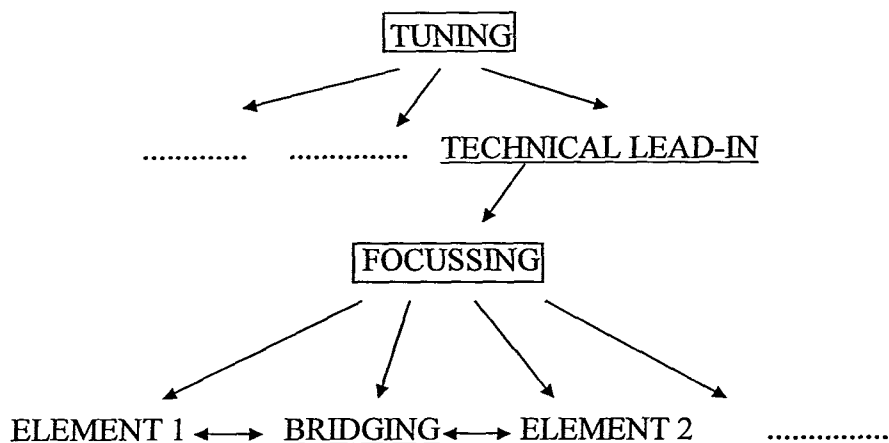


Diagram 3.1 Functions of TECHNICAL LEAD-IN and BRIDGING

The next section examines typical lexicogrammatical strategies found in BRIDGING. We need to consider how lexicogrammar throws light on the semantic characteristics of this element. Ultimately the meaning of an element is constructed through its wording and so the wording is the final reference point to which we might go in order to have the best characterisation of the meaning. We might start from the simple question; Which areas of the lexicogrammatical systems are ‘at risk’ in BRIDGING?

It is most relevant to take up the ideational, or more specifically the experiential, picture in terms of the explanatory genre we are dealing with in popular scientific writing. This is because the task of scientists is to describe the world to us and provide us with a model of the external world. The experiential function of BRIDGING is most directly related to that task of scientists. Another reason for taking up the ideational picture is that when we look at the different meanings we find that the interpersonal meaning is not as dominant as the experiential meaning. Therefore, if the declarative mood is predominant we are not forced to give as much weight to interpersonal meaning in the analysis of BRIDGING. However, the interpersonal perspective remains one of the tools that we must be aware of.

It must be said also that textual function has to be carefully evaluated as a contributor to the meaning, and therefore, at different points in the GSP approach I have attempted to characterise elements and point out differences between them on the

basis of their textual contribution, even when the ideational meanings tend to resemble each other.

Accordingly, I will proceed from the experiential metafunction because at the clausal rank the experiential metafunction construes the world in terms of what is going on, namely happening, doing, sensing, meaning, being, and becoming. These are sets of the Process type in the transitive system that unfold the experiential domain (Halliday 1994:106-107, Matthiessen 1995:205-215). The grammar of transitivity is one in which the process extends to another participant. In other words, the transitivity system helps us to understand “Who does what to whom under what circumstances?” (Butt et al. 1995:40).

Halliday (1995:162-175) notes further that the interpretation of processes can be conducted from more than a transitive point of view. Following developments in the theory of grammar, grammarians have to consider the fact that languages are not all marked for an extension model, that is, a transitive model (involving a movement from one participant through the verb to a second participant). The best way of characterising the alternative perspective is to take up the term proposed earlier in the century around the word ‘*ergative*’. Halliday (1995:162-175) refers to this model as being increasingly agentive as opposed to being a model based on extension. It is a model centred on the notion of ‘*cause*’ and is useful in trying to characterise the meaning of elements such as BRIDGING to see what the two perspectives offer in terms of understanding the processes of ‘world building’ in the explanation.

Consequently, in the following discussion I set out from the ergative perspective and relate it to the transitive function. This is because Medium is perhaps the most general participant in the experiential interpretation of a clause. If we consider Medium+Process to be the sub-stratum of experiential meaning in the clause we then have the option of adding an agent or not. Adopting this approach we can build up a picture of the semantic tendencies which we encounter through the grammar from the ergative perspective as well as the transitive perspective. Table 3.14 summarises transitive and ergative values of participant functions as proposed by Halliday (1994: 166).

Typical preposition	Ergative Function	Transitive Function						
		Material	Behavioural	Mental	Verbal	Attributive	Identifying	Existential
PROCESS	Process							
---	Medium	Actor (mid.), Goal (eff.)	Behaver	Senser	Sayer (mid.), Target (eff.)	Carrier	Identified	Existent
by	Agent	Actor (eff.)		Phenomenon ('please')		Attributor	Identifier/Token	
to, for	Beneficiary	Recipient; client			Receiver	Beneficiary		
at, on etc.	Range	Range	Behaviour	Phenomenon ('like')	Verbiage	Attribute	Identifier/Value	

Table 3. 14 Values of Participant Functions in Transitive and Ergative System

Transitive and Ergative Perspectives of BRIDGING

This section deals with the analysis of the transitive and the ergative view of the element BRIDGING. The steps of the analysis are as follows:

1. Fifteen instances of the text element BRIDGING are divided into clauses following Halliday's notions of clause and clause complex.
2. All clauses (excluding the embedded) are analysed in the light of Participant + Process + Circumstance and Medium + Process (+/- Agent) + Circumstance.
3. The results of fifteen instances of BRIDGING in the three texts are tabulated, compared and discussed.
4. The full scale analysis is shown in Appendix 4.

The results of the ergative analysis are tabulated in Table 3.15. The table shows a remarkable consistency of the semantic choices made by the authors, that is, Medium+Process configurations. The very high incidence of Medium without Agent in the fifteen samples of text shows that the segments are non-agentive. This leads to a further inference: that the main focus of BRIDGING is on middle voice, that is, "things happen". In other words, the information provided in BRIDGING deals with what is happening, rather than "who does it".

Text	Medium only %	Medium and Agent %
Parasol 1	92	8
Parasol 2	82	18
Parasol 3	80	20
Parasol 4	84	16
Icy 1	84	16
Icy 2	88	12
Icy 3	95	5
Heat 1	82	18
Heat 2	60	40
Heat 3	71	29
Heat 4	88	12
Heat 5	60	40
Heat 6	71	29
Heat 7	88	12
Heat 8	78	22
X (mean)	80.2	19.8

Table 3.15 Percentage of Cases in which Mediums and Agents are Present in Fifteen Instances of BRIDGING. (In this and all subsequent tables a decimal place of less than half is rounded down. A decimal of more than half is rounded up, except in X). N.B. This table is derived from Appendix 4.

When considering what form Medium can take from the perspective of Transitivity, we can isolate a yet more specific meaning about “happenings”. At this point the differing transitive and ergative perspectives on a clause play an important role. They are complementary because when we look at clauses from an ergative standpoint, we can come to the notion that BRIDGINGS in the three texts tell us merely that “something is happening or has happened”. If we consider the same clauses from a transitive point of view, we will know more about the information in BRIDGING. Table 3.16 below shows the incidence and distribution of ‘transitive roles’ conflated with Medium in the fifteen studied instances.

Process Participant Text	Material		Beha- vioural	Mental	Verbal		Attributive	Identifying	Existential	Total
	Actor %	Goal %	Behaver %	Senser %	Sayer %	Target %	Carrier %	Identified %	Existent %	
Parasol 1	5	27	0	18	5	0	36	0	9	100
Parasol 2	13	26	5	0	16	0	29	8	3	100
Parasol 3	17	46	0	4	13	0	4	4	12	100
Parasol 4	18	11	0	0	25	0	36	10	0	100
Icy 1	28	25	0	0	3	0	22	13	9	100
Icy 2	31	44	0	6	0	0	13	0	6	100
Icy 3	41	18	0	5	8	0	13	10	5	100
Heat 1	14	29	0	14	7	0	22	7	7	100
Heat 2	22	34	0	0	11	0	11	22	0	100
Heat 3	16	34	0	5	0	0	34	11	0	100
Heat 4	49	17	0	0	17	0	17	0	0	100
Heat 5	0	33	0	0	17	0	33	0	17	100
Heat 6	17	33	0	0	11	0	39	0	0	100
Heat 7	0	14	0	0	14	0	58	14	0	100
Heat 8	7	38	0	10	11	0	27	7	0	100
X (mean)	18.5	28.6	.3	4.2	10.5	0	26.3	7.1	4.5	100

Table 3.16 Transitive Participants Conflated with Medium in BRIDGING.

N.B. This table is derived from Appendix 5.

In Table 3.16, all fifteen instances represent 100% of all the clauses in BRIDGINGS in the three texts. The table reveals that Medium has the role of Goal (28.6%), followed by Carrier (26.3%) and Actor (18.5%).

It was suggested in Table 3.15 that the argument in BRIDGINGS revolves around the middle voice (“things happen”) whereas Table 3.16 provides insight into how the “happening” is discussed. The fact that Goal has the highest incidence among participants types implies that the “things” that happen are being acted upon. The fact that Medium conflated with Carrier is the second most frequently occurring type, in fact it has almost the same frequency as Goal, reflects a logical linguistic pattern because when Goal or the “acted upon” is mentioned, the characteristics of “Goal” might also be followed up. It is worth noting here that four instances (‘Icy 1-3’ and ‘Heat 3’) contain a significantly high number of Actor. When we look closely at those instances, we find that the Actors are such “things” as *ice shelves*, *glaciers*, *winds*, *the drop in temperature*, *CFCs*, and *Chlorine*. This demonstrates that these four instances of BRIDGING put more emphasis on how “things” happen or on these “things” that bring about the “happenings”.

The conceptualisation of the “things” discussed in BRIDGINGS still requires sharper clarification in terms of what the “things” actually are. I therefore grouped the participants into four categories during my discussion of the meaning of GLIMPSE. The four categories are: 1. Natural world entity, 2. Natural world process, 3. Abstract entity, and 4. Human participant. All participants in Table 3.16 have been grouped according to their nature and role into one of these four categories which have in turn been tabulated in Table 3.17.

Text	Natural world entity %	Natural world process %	Abstract entity %	Human participant %	Total %
Parasol 1	67	28	0	5	100
Parasol 2	64	13	3	20	100
Parasol 3	44	19	0	37	100
Parasol 4	30	37	7	26	100
Icy 1	94	3	3	0	100
Icy 2	59	24	12	5	100
Icy 3	49	31	10	10	100
Heat 1	36	36	0	28	100
Heat 2	33	56	0	11	100
Heat 3	90	8	0	2	100
Heat 4	76	12	0	12	100
Heat 5	40	20	20	20	100
Heat 6	43	33	5	19	100
Heat 7	29	43	14	14	100
Heat 8	45	28	3	24	100
X (mean)	53.1	26.1	5.2	15.6	100

Table 3.17 Occurrence of Different Categories of the Role of Medium Expressed as a Percentage.

NB. This table is derived from Appendix 6.

As Table 3.17 shows, the creation of the four conceptual categories enables stricter classification of what constitutes Goal, Carrier, and Actor and therefore provides a more powerful analytical tool. It was revealed that Medium which is conflated with Goal, Carrier, and Actor mostly falls into two main categories: ‘Natural world entity’ and Natural world process, with Natural world entity occurring most commonly.

The following are examples of each of the four conceptual categories identified from the fifteen instances:

Examples of ‘Natural world entity’;

sulfates, the planet, excess aerosols, ozone molecules, the stratosphere, the Earth, the extra heat, sunlight, CO₂ and the greenhouse gases, methane, and the biosphere.

Examples of ‘Natural world process’;

those colorless combinations of oxygen and sulfur, the aerosol concentration, a chemical analysis, global warming veering, the effect of air circulation, the greenhouse effect, and long-term variations in the wobbling of the earth’s axis.

Examples of Abstract entity;

the theory, a complete sediment record for a particular period of Earth history, the key factor in the growth of ice sheets, and other climatic factors.

Examples of Human participants;

Charlson, you, atmospheric scientists, most experts, represenatives of 24 countries, and scientists.

These examples of each category confirm that the meaning in BRIDGING predominantly concerns the representation of ‘Natural world entities’. That is, in BRIDGING, the authors of the three articles deal mainly with entities and move away from complex processes. In addition, the incidences of Abstract entities found are very few. I would therefore argue that a characteristic of this genre is that if the subject of the discussion centres around complex processes or ideas, or abstract concepts, which can become difficult for lay readers to understand, then the subject matter or the direction of the text is manipulated accordingly.

When we examine the Human participant category in Table 3.17 we note that the Human participants category comprises Sayer, Senser and Behaver although the instances of the latter can be considered insignificant. This implies that when Human participants are actively involved in issues in the texts, they either give information (Sayer) concerning “what has been brought about” and “how”, or show their perception and concern (Senser) about the greenhouse effect or related issues. Such concerns are expressed through such lexis as *expect, believe, fear, know*, and *haven’t seen*. The Human participants shown in the studies texts are mostly researchers which accounts for the predominance of Sayers.

Examples of 'Natural world entities' which are acted upon (Goal);

- *Twenty-two million tons of sulfur are emitted every year by minuscule, single-celled algae, giving the sea its faintly musty smell. ('Parasol')*
- *The Amazon rain forest has been slashed by an estimated 10% to 15%. ('Heat')*
- *The climatic cycles can be affected by man. ('Heat')*

Examples of 'Natural world entities' as doers (Actor);

- *Some coastal and interior sites in Antarctica have accumulated ice over the past 80 years, giving a growth rate equivalent to a fall in sea level of 0.75 millimetres per year. ('Icy')*
- *Ozone layer diminishes over populated areas. ('Heat')*
- *Man-made contributions to the greenhouse effect may be hastening a global warming trend. ('Heat')*

Examples of 'Natural world entities' as be-ers (Carrier).

- *...and the sky directly overhead may be blue or bluish, but off at angles it'll be whitish. ('Parasol')*
- *Before about 7500 years ago, the oceans were free of ice again at these sites, with conditions probably much like today. ('Icy')*
- *If the Earth were the size of an orange, the atmosphere would be only as thick as its peel. ('Heat')*

A typical example of BRIDGING is provided below:

Heat 3

BRIDGING (11) ¹The arena in which such projected climatic warming will first be played out is the atmosphere, ²the ocean of gases that blankets the earth. ³It is a remarkably thin membrane: ⁴if the earth were the size of an orange, ⁵the atmosphere would be only as thick as its peel. ⁶The bottom layer of the peel, the troposphere, is essentially where all global weather takes place; ⁷it extends from the earth's surface to a height ten miles. ⁸Because air warmed by the earth's surface rises and colder air rushes down to replace it, ⁹the troposphere is constantly churning. ¹⁰A permanent air flow streams from the poles to the equator at low altitudes and from the equator to the poles at higher levels. ¹¹These swirling air masses, distorted by the rotation of the earth, generate prevailing winds that drive weather across the hemisphere ¹²and aid the spread of pollutants into the troposphere. ¹³Above this turmoil, the stratosphere extends upward to about 3 miles. ¹⁴In the lower stratosphere, however, rising air that has been growing colder at higher and higher altitudes begins to turn warmer. ¹⁵The reason, in a word: ozone.

.....

3.6.4 EVALUATION (EVN)

EVALUATION is another important semantic element which assists our characterisation of popular scientific discourse. This element may have a function similar to that of evaluative components in other genres, yet EVALUATION deserves our attention because of its unique role in popular scientific discourse.

An evaluative component is not at all a new feature in spoken and written discourse. It appears in many genres such as narrative, argumentative texts, or research articles. Labov (1972:365) studied the characteristics of narratives in black vernacular style. He holds that one important element in narrative is *evaluation* by which he means "the means used by the narrator to indicate the point of narrative, its *raison d'être*: why it was told, and what the narrator is getting at." In her study about argumentative texts, Tirkkonen-Condit (1985) categorizes four components constituting the problem-solution structure of an argumentative text: situation, problem, solution and evaluation. She asserts that an evaluation "expresses the writer's view of the desirability, relevance, interest, importance, truth, etc." of a particular issue.

of the argument but it adds an interpersonal aspect to the argument, that is, the whole set of possible expressions of judgment are predominant here.

Given that EVALUATION involves some kind of judgment, the analogy of a court situation with which everybody is familiar may render a clearer picture of two of its features which are illustrated in the sample texts. First, it is the scientist writer who has authority to act as a judge, adjudicating on the issue based on objective criteria. Second, a writer, who is normally a journalist, performs the function of a reporter reporting to the public the judge's voice or opinion. The act of reporting may take two forms: quoting, with or without citing an authority. The first form is exemplified in EVALUATION with direct speech, the latter with indirect speech. Indirect, paraphrased, forms of report will always be situations of multiple interpretations and value judgements.

To increase the credibility and perceived truthfulness of a text, the journalist writer must cite authorities using accepted citing practice (van Dijk 1988). Quotes, moreover, lessen the distance between events and reporters (Zelizer 1989: 374). In direct speech text, there are two voices: the reporter's and the reported speaker's (that is the scientist's). The bringing of the cited authority into the text creates the illusion of a dialogic text. On the contrary, in text containing indirect speech, there is only one voice, which is the reporter's, and therefore the strongest illusion of dialogism is absent (Waugh 1995:137).

The analysis of EVALUATION in the three sample texts reveals two forms of realisation of the element - as a discrete element, and as an embedded element. My treatment of EVALUATION here will focus on the first option only, because an embedded EVALUATION can be expressed through many other elements, most frequently SPECIFIC CLAIM. In such cases its function is encompassed by the main elements and thus EVALUATION would not have the major role. EVALUATION as

an embedded element will be examined during my discussion of the main elements (such as SPECIFIC CLAIM).

In brief, the examination of EVALUATION focusses on two aspects:

- 1. its semantic pattern and motivations,
- 2. its implicitness or explicitness.

Before beginning the analysis, EVALUATION from each text is quoted below in full for ease of reference. This will be followed by a discussion of the texts where EVALUATION is realised discretely.

EVALUATION in ‘Icy 2’

The EVALUATION in the ‘Icy 2⁴’ text will be discussed first as it contains a standard set of semantic criteria (highlighted by bold text). This will be followed by ‘Icy 1’, ‘Parasol 1’, ‘2’, and ‘3’, and ‘Heat 1’, ‘2’ and ‘3’ respectively.

Icy 2

EVALUATION

Falling sea levels

(24) ¹The slowdown 6000 years ago may support Domack’s observation ²that ice sheets were growing in the Hypsithermal, ³but there are also other explanations. ⁴One is that glaciers in the northern hemisphere melted later than was previously thought. ⁵This area needs more research. ⁶But more importantly, Lambeck’s calculations show ⁷that although ice and snow are now accumulating at the poles, ⁸this is not taking in water fast enough to overcome the processes that are raising the sea level.

(25) ⁹Looking back further, sea levels fell while temperatures were mild as the Earth slid into its last great glaciation, which began 120 000 years ago. ¹⁰Miller and de Vernal saw clear signs of ice sheet growth in the steady enrichment of oxygen-18 in fossils, at the same time as average sea levels fell by about 70 metres. ¹¹This led them to forecast ¹²that

⁴ Number after the title of the extract refers to its sequence in the text as an instance of EVALUATION.

Note that ‘Icy 1’ in the discussion concerning EVALUATION is not the same text as ‘Icy 1’ in BRIDGING.

modern ice sheets will grow ¹³and sea level could fall by up to 7 millimetres per year, in the longer term, ¹⁴if greenhouse gases continue to accumulate in the atmosphere. ¹⁵**this is in accord with** predictions made by Mark Meier of the Institute of Arctic and Alpine Research in Colorado, who calculates that the world is not likely to see an increase in the size of floating ice sheets before 2050, ¹⁶because glaciers respond only slowly to changes in the mass of ice feeding them.

EVALUATION in the 'Icy 2' text contains a set of semantic patterns that is quite subtle. First, there is the voice of an authority who steps into the argument to evaluate the topic under discussion based on some objective criteria. In this case, the writer himself is an authority who plays the judge's role, stopping the flow of an argument to articulate his opinion towards *Domack's observation* by referring back to the situation in the past, that is, *the slowdown 6000 years ago*. The recount signals to the reader that the new move is being introduced.

Secondly, the writer's uncertainty about the two research findings is shown by the selection of modality: 'probability', and the adversative idea reflected in Adversative conjunctions (*may* in clause 1 and *but* in clause 3, in paragraph 24). The meaning conveyed in the first three clauses implies that "Yes, it may be true, but..."

Thirdly, the co-occurrence of the nominalization of mental processes (such as observe/observation, calculate/calculation, and predict/prediction) and the harmonisation, or the correlation, of different voices comprise an implicit EVALUATION. In her study on evaluation and ideology in scientific writing, Hunston (1993:68) points out that knowledge claims are evaluated by a certain value constrained by the scientific domain. Ideologically, scientific truth cannot be uncovered individually but communally developed. Thus, certainty of claims can be expressed through modality, mental activity (indicated by either mental processes or nominalization of the mental processes) and citation of other studies. The meaning presented in EVALUATION can be negative or positive, and is often shown by the choice of lexical items that follow.

The meaning conveyed in clauses 1-8 in paragraph (24) of 'Icy 2' is that the writer doubts the results of the two studies (*Domack's observation* and *Lambeck's calculation*). The use of *observation* and *calculation* per se, do not reflect the writer's negative judgment, however, what follows, (*This area needs more research* and *this is not taking in water fast enough to overcome the processes that are raising the sea level*) does. These two judgments contain negativity by implying that the two studies did not produce adequate and unambiguous results. From the meaning implied in clauses 1-8, the experienced reader can anticipate the information that will follow; that is, that he/she is about to be presented with an alternative way of looking at the relationship between rise of sea levels and the increase in global temperatures. The alternative is presented in a positive fashion which is evidenced by the harmonization of a different authority's voice (*Mark Meier*) from clauses 9-16. The harmonization is illustrated by the expression *This is in accord with* in clause 15. As suggested in the previous paragraph, scientific truth is communally developed, and therefore a writer relies on support from other authorities whose work has produced similar results. This type of EVALUATION is an evaluation of *status*.

Fourthly, the degree of uncertainty reflected in the results of the two studies suggests a scientific knowledge gap. The writer is making a judgment on the basis of *status* by pointing out that the result is inadequate and that therefore no fast conclusions can yet be drawn. The implication is that we should take other studies into consideration. Examples of the suggestion of a knowledge gap are in clause 5, and 7-8, in paragraph 24; *This area needs more research* and...*although ice and snow are now accumulating at the poles, this is not taking in water fast enough to overcome the processes that are raising the sea level*.

The fifth semantic attribute of EVALUATION in 'Icy 2' is the thematisation of a judgmental expression in clause 6 in paragraph 24; *But more importantly...* This choice of attitudinal lexis explicitly demonstrates the writer's evaluation of a further (but still probably inadequate) study on the rise of sea levels.

Verbal processes such as “point out”, “show”, “suggest”, “forecast”, “claim”, and “speculate” point to an implicit EVALUATION because they are placed on the ‘certainty-uncertainty’ cline (Hunston 1993:62). For example, “point out” and “show” are closer to the ‘certainty’ end while “claim” and “speculate” are closer to the opposite end. In the case of the ‘Icy 2’, the writer uses *forecast* (clause 11, paragraph 25) when he evaluates the work of Miller and de Vernal. The selection of *forecast* gives the reader the impression that the *status* of the work is close to the certainty cline. This can be inferred from the harmonization in the next proposition; *This is in accord with predictions made by Mark Meier....*

EVALUATION in ‘Icy’

The following section discusses EVALUATION in the ‘Icy 1’ text, another instance of a discrete EVALUATION. One finds semantic characteristics in ‘Icy 1’ similar to those revealed in ‘Icy 2’. A discussion of how this element is realised follows the extract.

Icy 1

EVALUATION (20) ¹Overall, the evidence seems conclusive ²that past ice sheets grew ³when the average temperature was higher. ⁴So what might the future hold in terms of the rise or fall of sea level in response to global warming? ⁵Unfortunately this is a complex area in which **detailed information is lacking**. ⁶Geologists and polar scientists are urgently addressing the **range of factors** that contribute to the sea level we measure.

(21) ⁷First, there is the inevitable and immediate rise in sea level that comes from the thermal expansion of warmer oceans, ⁸giving a rise of about 10 centimetres for every extra 2°C. ⁹Secondly, sea level is affected by the amount of water stored on land as ground water and in lakes and rivers. ¹⁰Thirdly, the influence of gravity is important: ¹¹ice sheets exert a gravitational pull on nearby water, ¹²so the sea level around an ice sheet is higher than that farther away. ¹³Fourthly, there is the effect of the weight of icecaps on the rock beneath. ¹⁴A continent covered with ice sinks beneath the extra weight, and the land at its periphery bulges. ¹⁵The net effect is a rise in sea level as the ice builds up.

(22) ¹⁶Moreover, sea level is both **relative and subjective**. ¹⁷The effects of gravity and loading, for example, are not uniform around the Earth, ¹⁸so **perception** of a rise or fall in sea level will depend on the observer’s location.

The above extract displays an implicit evaluative view at the beginning of the element. This article presents the reader with a series of studies on the interplay of ice sheets and sea levels (the relationship between climatic warming and the growth of polar ice sheets). During the course of providing the account, the writer stops the flow of information given in the previous element, BRIDGING, which calls the reader's attention to this evaluative segment. The strategy used here is thematising whereby in the first clause of paragraph 20, *Overall...* signals an interruption. This reflects that the writer, having considered the two studies, feels that their findings may lead the reader to believe that in the past ice sheets grew when the average temperature was warmer, which can be interpreted as meaning that sea levels are not going to rise even when the world is warmer. The writer informs the reader that such a conclusion is premature as there are many factors involved making it difficult to come to any certain conclusion. Only paragraphs 20 and 22 contain evaluative devices. Paragraph 21 does not because it elaborates on the point made in paragraph 20.

In summary, the semantic attributes of EVALUATION displayed in the 'Icy 1' text are:

1. an expression (*overall, but more importantly*) indicating the suspension of the flow of information.
2. the selection of attitudinal lexis (*conclusive, unfortunately, complex, relative and subjective*).
3. the selection of Modality: probability (*seems* and *might*).
4. the suggestion, in clause 5, paragraph 20 that there is a knowledge gap (*Unfortunately this is a complex area in which detailed information is lacking*).
5. the use of nominalization of a mental process (*perception*) in clause 18, paragraph 22.

Following is the discussion of the three instances of discrete EVALUATION in the 'Parasol' text. The 'Parasol 1' will be dealt with first.

EVALUATION in 'Parasol 1'

Parasol 1

EVALUATION (8) ¹This **might**, of course, seem like good news. ²At first blush, it looks like we've created a type of "good" pollution that is eliminating the effects of "bad" greenhouse-gas pollution. ³Perhaps we should even be congratulating ourselves for polluting our way out of a global disaster.

(9) ⁴Indeed, ⁵says Charlson, just this type of reasoning has been used by politicians to justify going slowly on problems associated with global warming. ⁶"Since the days of the Nixon administration," ⁷he says, "there have been people **suggesting** that aerosol pollution **might** counteract global warming. ⁸Some people have actually **suggested** that ⁹if we learn how to pollute just right, ¹⁰everything will be **fine**." (Enlarged text in original)

In this text EVALUATION follows a SPECIFIC CLAIM in which Charlson is informing the reader about the chemical process of the cooling effect caused by aerosols in the air. This EVALUATION differs from other examples in that it has two voices of judgment. One is that of the writer (paragraph 8) and the other is that of the authority (Charlson) mostly using quotation (paragraph 9). The authority's voice makes the writer's voice more convincing. As with other instances of EVALUATION displayed in this analysis, 'Parasol 1' reveals the same evaluative signalling device, namely, the suspension of the flow of the content. This is indicated by the distinctive large type *This might* in the first clause. *This might* turns the reader's attention to the content in the current paragraph. Knowing that for the public any information about reducing the global temperature is welcome, the writer anticipates that from the reader and therefore, believes his judgment that such beliefs are opposite to the fact. The degree of certainty that the 'cooling effect' brings us good news, because it can counteract the warmer global temperature, is decreased by the use of double modality: probability (*might* and *seem*) in clause 1. His opinion about 'goodness' and 'badness' is further elaborated in clauses 2-3. In paragraph 9, the use of verbal process (*suggesting* and *suggested*), and Modality: probability (*might*) in the quotation gives

greater credibility to the writer's opinion in paragraph 8: the degree of uncertainty is strengthened in paragraph 8. This negative EVALUATION, however, has to be considered in conjunction with what follows. The idea in the next paragraph, which contains BRIDGING, contradicts the uncertainty in this EVALUATION by the introduction of greater certainty with *But as Charlson points out, there are a number of subtleties to the parasol effect suggesting that aerosols, far from preventing a greenhouse world...*

EVALUATION in 'Parasol 2'

The second instance of EVALUATION in this text is 'Parasol 2'. It follows BRIDGING in which the writer provides detailed scientific information concerning the properties and the effects of aerosols.

Parasol 2

EVALUATION (14) ¹Hence, for many years aerosols were considered a "local" problem for industrial areas and their neighbours a few hundred miles downwind. ²In fact, for most of the time that Charlson pursued his research, the government agencies that paid his bills were concerned about the view rather than far-flung effects on the climate. ³Among the customers for his instruments was the U.S. Defense Department, which wanted to understand haze so weapons guidance systems could pierce its veil.

(15) ⁴Indeed, Charlson himself, with his longtime collaborator Bert Bolin of Stockholm University, wrote a paper in the mid-1970s that said aerosols could not have much impact on global climate. ⁵"We had made a mistake," ⁶Charlson says now. ⁷"We didn't have the global chemical model. ⁸We were guessing as to numbers. ⁹We didn't get the geographical extent of sulfates right."

In this portion of text, an evaluative proposition is given in clause 1, paragraph 14. The selection for conjunctive adjunct: 'causal' is *Hence*, because the theme of the paragraph calls the reader's attention from technical information to judgmental activity. Mental process (*were considered*) and the words (*local problem*) combine to show the American government's attitude towards the effects of aerosols in the atmosphere. The other semantic strategy found in this extract is the suggestion of a

gap in knowledge, expressed in clauses 5-9 by: *We had made a mistake... We didn't have the global chemical model... We were guessing as to numbers... We didn't get the geographical extent of sulfates right.* In this case, the authority evaluates his past research in terms of its *status*.

EVALUATION in 'Parasol 3'

The last instance of EVALUATION in the 'Parasol' text (Parasol 3) is long compared to other instances in the sample texts. To omit parts of the element however would hamper understanding of how the element is realised.

Parasol 3

EVALUATION [CONCERNS]

(25)¹**And that,** ²says James Hansen, director of NASA's Goddard Institute for Space Studies in New York, could explain ³why models of global warming have predicted that Earth should be warmer than it actually is. ⁴Hansen gained some unwanted notoriety in 1989 ⁵when he charged that officials in the Bush administration made him lower his own estimates of the power of the greenhouse effect. ⁶His latest simulation of climate change over the past 150 years now takes aerosols into account as a global cooling force and incorporates Charlson's model of aerosol distribution over the Northern Hemisphere.⁷**The result,** ⁸Hansen says, **"is quite consistent with the amount of warming that has been observed" in the real world.** ⁹**"For the best estimates we can make, the aerosols are second in importance only to the greenhouse gases."**

(26)¹⁰But opposite in effect. ¹¹Is the aerosol umbrella, then, a mandate to do nothing about global warming? ¹²Or to do nothing about reducing sulfur emissions? ¹³In a word, Charlson says, no. ¹⁴**To him,** the notion that humanity could fine-tune a system as **big and complex** as the climate is **laughable.** ¹⁵**"There's always this temptation to tell ourselves we can handle it, that we're bigger than it is,"** ¹⁶he says. ¹⁷**"Personally, I find that attitude very arrogant.** ¹⁸**It assumes that we understand climate well enough to engineer it,** ¹⁹**and we don't."**

(27)²⁰Some of **Charlson's findings** about the parasol effect **suggest** ²¹that it won't help at all with some serious aspects of the global warming problem, such as rising sea levels. ²²Sulfate aerosols **may even make some warming effects worse,** ²³Charlson says. ²⁴**The reasons** lie in the fundamental difference between greenhouse gases-- which rise to the stratosphere and cover the globe--and sulfates, which travel only a few hundred miles.

(28)²⁵Because sulfates have such a limited range, ²⁶almost all man-made aerosols are floating above the Northern Hemisphere, where 90 percent of industrial activity is still concentrated. ²⁷By contrast, the Southern Hemisphere gets almost no such "protection" from man-made sulfates. ²⁸Even in the relatively clean air of Seattle, ²⁹Charlson says, "the amount of light

scattered by haze is probably 10 to 100 times higher than it is in the Southern Hemisphere.”³⁰ With one hemisphere bearing the full brunt of global warming while the other is protected by an umbrella of pollution,³¹ he says, seas would still rise uniformly all over the globe,³² as the warmer southern waters expand.³³ In other words, sulfates can’t save the Maldives, the low-lying island nation in the Indian Ocean.

(29) ¶³⁴ But a rise in sea levels, ³⁵ Charlson says, **might not be the biggest effect to worry about.** ³⁶ **Much more important,** ³⁷ **he points out, could be the increased difference in temperature between the two hemispheres.** ³⁸ **That’s likely to affect the large-scale weather systems on which people depend.**

(30)³⁹ “More frequent occurrence of drought is a **possibility**” ⁴⁰ Charlson says. ⁴¹ “Or of violent storms. ⁴² Or the opposite—less frequent storms. ⁴³ **I’d give either chance equal billing.** ⁴⁴ The thing people need to understand is that a slight regional shift in any direction is a big concern. ⁴⁵ Last year in the mountains around Seattle we had more precipitation as rain and less as snow than normal. ⁴⁶ And the snowpack is our reserve of water that fills the reservoirs in late spring. ⁴⁷ So just because the balance of snow to rain changed, ⁴⁸ we had a drought here.” ¶

(31)⁴⁹ Charlson is a neatly trimmed man who comes to work in a tie knotted tightly at the neck. ⁵⁰ The fuzzy carelessness of most public talk about world climate **seems to offend him personally.** ⁵¹ **To his mind, the aerosol results are a perfect illustration of the extent to which we don’t know what we’re doing.** ⁵² “**The biggest problem the public has is that it perceives that we should do research in order to solve problems but after those problems occur.** ⁵³ **It’s wrong.** ⁵⁴ **It can’t work that way.** ⁵⁵ **You have to have the fundamental knowledge ahead of time** ⁵⁶ **so you can apply it** ⁵⁷ **when the problem shows up.”**

(32)⁵⁸ Charlson recalls the time in the 1960s ⁵⁹ when some researchers, extrapolating from measurements that showed some cooling in the globes average temperatures, **predicted that mother ice age was already starting.** ⁶⁰ “**They were wrong,**” ⁶¹ Charlson says. ⁶² “**That’s the problem we’ve always had in this field—this kind of lurching off and making grandstand statements without a good scientific foundation.** ⁶⁴ **We need a decades-long intensive scientific inquiry,** ⁶⁵ **because in reality these things are not going to submit to quick answers.”**

(33)⁶⁶ **With that in mind,** Charlson is very quick to insist on what his discovery is not. ⁶⁷ **He says** ⁶⁸ **that so much remains to be understood about aerosols—especially with regard to their indirect influence as the seeds of clouds—** ⁶⁹ **that any estimates about their effects could be off by an order of magnitude.** ⁷⁰ “**There are substantial uncertainties,**” ⁷¹ he says. ⁷² “**Perhaps as much as a factor of 2 up or down,**” ⁷³ **which would mean, statistically, that a calculation of, say, .6 watts per square meter could represent a reality of maybe .3 or maybe 1.2.** ⁷⁴ **We can’t say yet where it would fall in that range.** ⁷⁵ **But the key point is that even using the lowest estimates doesn’t make this effect go away.** ⁷⁶ **It’s definitely there.”**

This long EVALUATION is highly evaluative, containing nearly all of the semantic characteristics found in the 'Icy 2' EVALUATION. However, the EVALUATION in 'Icy 2' and 'Parasol 3' is presented differently. Firstly, the writer in 'Icy 2' acts as an authority who passes judgment, but in the 'Parasol 3' EVALUATION, it is the authorities who express their opinion about the situation. Secondly, EVALUATION in 'Icy 2' is made in declarative statements, whereas that in 'Parasol 3' is mainly in reported speech (direct and indirect).

The text quoted above follows a SPECIFIC CLAIM in which the information about Charlson's discovery is given. It is intended to evaluate Charlson's study. The semantic attributes that can account for EVALUATION in 'Parasol 3' are illustrated in turn.

Firstly, the ongoing discussion was brought to a halt, and authorities moved in to make judgment. This suspension is indicated by the introduction of *And that, says James Hansen,* which interrupts the flow of the long episode about Charlson's discovery of a computer model to measure sulfates in the air. There are two authoritative voices presented in this paragraph; those of Hansen supports Charlson's computer model findings in that they gave results consistent with conditions observed in the real world. The writer uses Hansen's remark as a lead to the key authority's (Charlson's) opinion; namely, that it is inconclusive to claim that aerosol cooling can help reduce global warming for there are many factors involved in global warming and that the "parasol effect" (or aerosol cooling) may even make the situation worse. Unlike EVALUATION in 'Icy 1' and 'Icy 2' which is made in declarative statements, EVALUATION in 'Parasol 3' is formed by direct quotations from the two authorities (James Hansen and Robert Charlson).

The degree of certainty of Charlson's and Hansen's studies is indicated several times throughout the extract through the suggestion of a knowledge gap (see clauses 14-19

in paragraph 26, 51-57 in paragraph 31, 60-64 in paragraph 32, and 67 and 76 in paragraph 33).

The fourth semantic characteristic is the harmonisation of voices/ideas. The use of *now* in clause 6, paragraph 25, suggests that Charlson's model has been proved reliable because Hansen's latest simulation, which incorporates Charlson's model, shows results consistent with conditions in the real world.

The use of lexis referring to mental activity, such as *Charlson's findings* in clause 20, paragraph 27, and verbal processes, such as *suggest* in the same paragraph, projects the authority's judgment, with a degree of certainty, that rising sea levels will not be affected by the "parasol effect"; namely, that sea levels will still rise. To support his own opinion, the author devotes paragraph 28 to an explanation by Charlson of why the "parasol effect" cannot solve the rising sea level problem. Another word relating to mental activity (*estimate*) is also used in clause 9 paragraph 25.

Finally, we note the existence of a significant number of instances of attitudinal lexis across the entire extract, for example, *biggest, complex, laughable, personally, very arrogant, worst, perfect, wrong, and that's likely.*

As stated above, EVALUATION in the 'Icy 1 and 2' extracts is presented in declarative clauses, while in 'Parasol 3', it is presented in reported speech. A further distinction between them lies in the presence of "filler" or human interest in the 'Parasol 3' extract concerning Hansen's personal background (clause 4, paragraph 25) and concerning Charlson's personal characteristics (clauses 49-50, paragraph 31). Both "fillers" could be omitted as they are irrelevant to the studies, however, they create a sense of entertainment and a tone of informality in the article and thus result in the reader's perception that the article is not overly technical. This feature is absent in the 'Icy 1 and 2' extracts.

EVALUATION IN 'Heat 1'

The last sample text, "Heat", contains three instances of discrete EVALUATION. The following extract is from 'Heat 1':

Heat 1

EVALUATION (5) ¹The precise chemical process is still **uncertain**; ²but the central role of CFCs is **undeniable**. ³Last month Barney Farmer an atmospheric physicist at the Jet Propulsion Laboratory in Pasadena, Calif., **announced** ⁴that his ground-based observations as a member of the 1986 Antarctic National Ozone Expedition pointed directly to a CFC-ozone link. ⁵"**The evidence isn't final**," ⁶he said, ⁷"**but it's strong enough**." ⁸Earlier this month, results from NASA's Punta Arenas project **confirmed** the bad news. ⁹Not only was the ozone hole more severely depleted than ever before--¹⁰fully 50% of the gas had disappeared during the polar thaw, compared with the previous high of 40% in 1985--¹¹but the CFC connection was more evident. ¹²Notes Sherwood Rowland, a chemist at the University of California at Irvine. ¹³"**The measurements are cleaner this time, more detailed**." ¹⁴"**They're seeing the chemical chain more clearly**."

The previous element (GENERAL CLAIM) concerns the discovery of the Antarctic ozone depletion and its causes. In the present element, the writer tells the reader that there is uncertainty as to the chemical processes causing the depletion of the ozone layer, but that it is quite possible to draw some conclusions because more recently researchers have made more detailed measurements. The judgment is expressed through the assertions of one expert which are strengthened by those of another. The opening clause reveals (through the word *uncertain*) that the writer is presenting an evaluation on the *status* of the previous research finding (mentioned in GENERAL CLAIM in paragraph 4). This occurs without the use of a semantic signal to show the interruption, which was used in other extracts analysed above. The use of verbal processes (*announced*) in clause 3, *confirmed* in clause 8, and *notes* in clause 12) deals with the *status* of the study in terms of its scientific certainty. The *status* of the study is also reflected in clause 5 (*The evidence isn't final*), clause 7 (*but it's strong enough*), clause 13 (*The measurements are cleaner this time, more detailed.*), and clause 14 (*They're seeing the chemical chain more clearly.*).

EVALUATION in 'Heat 2'

Heat 2

EVALUATION (19) ¹For several years NASA's scientists failed to accept data on the Antarctic ozone hole that was before their eyes. ²The reason: computers prescreening data from monitoring satellites had been programmed to dismiss as suspicious presumably wild data showing a 30% or greater drop in ozone levels. ³After British scientists reported the deficit in 1985, ⁴NASA went back to its computer records, ⁵finally recognizing ⁶the satellite data had been showing the hole all along.

The EVALUATION in this short extract is identifiable through implied meaning rather than directly by the frequent use of attitudinal lexis or modality. The move is gestured by the thematisation of time. *For several years* switches the reader's attention to a judgmental section, interrupting the flow of the recount in the previous element in which the study of Rowland and Molina is cited. The reader's impression from the recount and this element could be expressed as "In 1972, somebody found this. In 1974, someone else found that. Now, look at what happened as a result of those findings". It is this semantic signpost that indicates to the reader that the writer is making judgment. The main aim of this article is to report NASA's mission to ascertain why the depletion of the ozone layer over Antarctica is so severe. What is evaluated in this is the failure of NASA's scientists in those "*several years*". The evaluative sense gestured by the harmonization of a different voice is very subtle in this extract. The voice referred to here is *British scientists* in clause 4; NASA has to reconsider its own overlooked result which is later reconciled with that of the *British scientists*.

EVALUATION in 'Heat 3'

Heat 3

EVALUATION (38) ¹Some experts do not believe ²the projected cutback is good enough. ³Says Rowland: ⁴"The Montreal agreement simply isn't sufficient to protect the ozone. ⁵We should have signed a treaty that reduced CFC production, by 95%—not 50%". ⁶Nonetheless, the Environmental Protection Agency has calculated that without the accord, ⁷a staggering 131 million additional cases

of skin cancer would occur among people born before 2075.

(39) ⁸Any similar attempt to ease the greenhouse effect by imposing limits on CO₂ and other emissions is **unlikely**. ⁹John Topping, president of the Washington-based Climate Research Institute, **argue** ¹⁰that adjustments in agricultural production, like limiting the use of nitrogen-based fertilisers, **would** have only a slight effect. ¹¹A more important step **would** be to protect the tropical rain forests, ¹²a move that **would certainly** be resisted by developers. ¹³**Obviously**, the most far-reaching step **would** be to cut back on the use of fossil fuels, ¹⁴a measure that **would be hard to accomplish** in industrialized countries without a wholesale turn to energy conservation or alternative forms of power. ¹⁵In developing countries, such reductions **might** be technologically feasible ¹⁶but **would** be all but **impossible** to carry out politically and economically.

The element prior to this extract is SOLUTION which outlines the means of reducing problems caused by the greenhouse effect and the depletion of the world's ozone, which were agreed upon in the Montreal Accord. It is part of human nature to criticize or evaluate solutions in terms of their effectiveness. When the author, with that assumption in mind, tells the reader about the Montreal agreement, he is providing such evaluative information after the SOLUTION is presented. While aware that he is not one of the authorities who should make a value judgment, the writer relies on authorities (Rowland and John Topping) to judge on the issue for him.

EVALUATION in 'Heat 3' can be realised by merely looking at lexicogrammatical devices alone. The reader knows immediately that this segment comprises an evaluation of the Montreal Accord because the meaning in this segment corresponds to what s/he is expecting after the information about the solution is offered. Secondly, the first clause of paragraph 38 contains an explicit judgmental statement in the words *do not believe* and *not good enough*. This value judgment is expressed through a series of attitudinal lexis and metaphors of Mood or modality: 'probability' such as *simply isn't sufficient*, *impossible*, *hard to accomplish*, *unlikely*, *certainly*, and *might*.

Table 3.18 summarises and compares the strategies which the writers of the three texts employ when making judgment in EVALUATIONS.

Semantic characteristics	Icy 1	Icy 2	Parasol 1	Parasol 2	Parasol 3	Heat 1	Heat 2	Heat 3
Expressions showing suspension of the flow of information	+	+	+	+	+		+	
Co-occurrence of Modality and adversative conjunction		+						
Coupling of mental activity and the harmonization of different voices or ideas or only lexis relating to mental activity	+	+			+		+	
Indication of knowledge gap	+	+		+	+			
Thematisation of judgmental expression	+	+			+			+
Use of verbal processes to show the degree of certainty		+	+	+	+	+		
Use of attitudinal lexis and Modality	+		+	+	+	+	+	+

Table 3.18 Semantic Characteristics of Eight Instances of EVALUATION in the Three Texts.

3.6.5 ONGOING PROJECT (ONP)

As the label suggests, ONGOING PROJECT is an element that refers to the part of an article in which the writer informs the reader about ongoing research related to the issue being discussed in the article. My analysis has only identified this element in ‘Parasol’. Since the information in this element deals with a research project, some of the semantic characteristics found in SPECIFIC CLAIM and GENERAL CLAIM could also be expected, namely, statement of aim(s) and materials and methods. Because the project is not yet completed, it is logical that findings, statement(s) evaluating findings, and conclusions are absent, however, it is possible to find a statement of expected outcomes in this element. Table 3.19 below compares the semantic characteristics of SPECIFIC CLAIM and ONGOING PROJECT.

Semantic characteristics	SPECIFIC CLAIM	ONGOING PROJECT
Statement of aim (s)	+	+
Materials and methods	+	+
Findings	+	--
Statement (s) evaluating findings	+	--
Conclusion	+	--
Statement of expected outcomes	--	+

Table 3.19 Comparison of the Semantic Characteristics of SPECIFIC CLAIM and ONGOING PROJECT.

In the following extract from ‘Parasol’, semantic realisation of ONGOING PROJECT is shown in bold type.

Parasol

ONGOING PROJECT

(34) ¹ So **Charlson is continuing to chip away at the aerosol mysteries** with a network of colleagues, students, and former students scattered throughout the world. ²One graduate student, for instance, has been dispatched to **Antarctica to examine sulfate deposits trapped in ancient ice.** ³Because the same ice that collects sulfate particles also traps carbon dioxide in bubbles, ⁴it’s possible to track the relationship between levels of sulfate and levels of the gas, which is more abundant when the climate is warmer. ⁵Not surprisingly, ⁶says Charlson, higher amounts of sulfate do seem to correlate well with lower levels of carbon dioxide. ⁷**The main purpose of the work** is to build a record of preindustrial sulfate levels and temperatures. ⁸**A historical standard of comparison will give researchers a much better handle on the extent to which sulfates can drive the climate.**

(35)⁹Charlson is also working with several colleagues at the National Oceanic and Atmospheric Administration lab who are assembling a shipborne expedition **to get a more complete picture of the boundary between the sulfate-laden Northern Hemisphere and the more pristine southern half of the planet, to learn more about any possible aerosol carryover.** ¹⁰As the research vessel goes steaming up north of Tanin, ¹¹Charlson says, ¹²“they will see the westerly winds flowing out of Asia carrying a load of sulfate pollution from China, Japan, and Korea, ¹³so they’ll be getting measurements of the transition from clean Southern Hemisphere air to more polluted Northern Hemisphere air ¹⁴and quantifying the amounts of it ¹⁵and defining the optical properties of it.” ¹⁶Meanwhile, airplanes will be taking measurements of aerosol and cloud properties, ¹⁷and an NOAA satellite will measure the amounts and wavelengths of light bouncing off the atmosphere and out into space over the ship.

3.6.6 SOLUTION (SLN)

SOLUTION is the term given to the element in which the writer reports solutions to the problems discussed, informed about, or summarised in the article. The 'solutions' suggested in this element are forms of behavioural modification that have already been implemented or taken place. The information in this element can also refer to any agreements made to overcome the problem and which are to be implemented or effective in the future. This element has only been found in 'Heat' in which the writer reports the solutions proposed by the Montreal Accord (See the text of the element extracted below). In this text, the element is realised by the insertion of a rhetorical question (clause 1) initiating that the writer is about to discuss solutions to overcome the greenhouse effect and ozone depletion. This element is also characterised by words related to the act of problem solving, such as, *way* (clause 1), and *negotiations* (clause 2), and to expressions showing behavioural modification and expected outcomes (clauses 3-6). In short, the meaning of SOLUTION concerns "what was agreed to be done (by whom) and when was it done or will it be done".

Heat

SOLUTION (37) ¹Is there any way to slow either the greenhouse effect or the depletion of the world's ozone? ²The Montreal accord, agreed to last month after nearly five years of on-and-off negotiations, is a good start on ozone. ³It calls on most signatory countries to reduce production and consumption of CFCs by 50% by 1999. ⁴Developing nations, however, will be allowed to increase their use of the chemicals for a decade ⁵so they can catch up in basic technologies like refrigeration. ⁶The net effect, ⁷insist the treaty' advocates, will be a 35% reduction in total CFCs by the turn of the century.

3.6.7 CONCERNS (CNS) and PREDICTION (PRE)

CONCERNS and PREDICTION are the final elements found in the FOCUSING section of the three texts. They are presented together because both terms contain a sense of futurism. CONCERNS is found in 'Parasol' and 'Heat': that in 'Parasol' is embedded in BRIDGING while in 'Heat' is a discrete element. PREDICTION is

found only in 'Heat'. The text containing CONCERNS in 'Parasol' and 'Heat' are extracted below, as is the PREDICTION from 'Heat'.

CONCERNS refers to the element in which the writer's anxieties or concern about particular circumstances that may have a negative impact on mankind and/or the environment are expressed. The semantic motivation for the presence of this element can be considered to be due at least partly to the fact that the impact of global warming is something that even scientists are not in agreement on. However, no one wants to experience it and we ought not wait for its certainty to be proven because of the serious negative impact it may have on the planet. It is quite common that authors show their concern about such a situation. One notices a sense of futurism inherent in the word CONCERNS because normally people are most apprehensive about situations with unknown consequences. A negative emotion is also inherent in the element because if a situation is expected to be pleasant, people look forward to it excitedly.

When discussing futurism, it is useful to adopt notions of 'realis' and 'irrealis' because the further the analysis progresses, the more it reveals how future-oriented the texts are. Halliday (1995: 241, 278) uses 'realis' and 'irrealis' as a system of 'aspect: imperfective/perfective'. "The imperfective represents the real, or actual, mode of non-finiteness ('realis'), while the perfective represents the potential, or virtual ('irrealis')" (ibid). The distinctions between them come in any number of contrasts, for example, "as future to present, appearance to reality, starting off to going on, goals to means, intention to action, or proposal to propositions" (ibid).

Since there is a sense of futurism or the 'irrealis' in this section of the text, and since futurism gives some sense of prediction, the element could be simply labelled PREDICTION. However, due to the nature of my analysis, I felt a strong need to distinguish CONCERNS from PREDICTION even though both terms contain a futuristic sense. PREDICTION can be any statement made about the future. It can be

either a positive or negative proposition about the future. CONCERNS is restricted to a predictive statement about a possible negative impact in the future. Accordingly, the key semantic characteristic of CONCERNS revolves around “**what dire consequences** are going to happen” while that of PREDICTION is centred around “**when** something is going to happen”. Lexicogrammatically, futurism can be explicitly realised by modality: ‘probability’ such as “will”, “would”, “might”. This is illustrated in the example of CONCERNS in ‘Parasol’ and ‘Heat’ provided below.

Parasol

[CONCERNS] (29) [¹But a rise in sea levels, ²Charlson says, **might** not be the biggest effect to **worry** about. ³Much more important, ⁴he points out, **could** be the increased difference in temperature between the two hemispheres. ⁵**That’s likely to affect** the large-scale weather systems on which people depend.

(30) ⁶“More frequent occurrence of drought is a **possibility**,” ⁷Charlson says. ⁸“Or of violent storms. ⁹Or the opposite—less frequent storms. ¹⁰I’d give either chance equal billing. ¹¹The thing people need to understand is that a slight regional shift in any direction is a big concern. ¹²Last year in the mountains around Seattle we had more precipitation as rain and less as snow than normal. ¹³And the snowpack is our reserve of water that fills the reservoirs in late spring. ¹⁴So just because the balance of snow to rain changed, ¹⁵we had a drought here.”]

Heat

CONCERNS (27) ¹The **consequences could** be **daunting**. ²Says National Center for Atmospheric Research’s Francis Bretherton: ³“Suppose it’s August in New York City. ⁴The temperature is 95°; ⁵the humidity is 95%. ⁶The heat wave started on July 4 ⁷and **will** continue through Labor Day.” ⁸While warmer temperatures **might** boost the fish catch in Alaska and lumber harvests in the Pacific Northwest, ⁹he says, ¹⁰**the Great Plains could become a dust bowl**; ¹¹people **would** move north in search of food and jobs, ¹²and Canada **might** rival the Soviet Union as the world’s most powerful nation.

The fact that the extracts of CONCERNS are thematised by *a rise in sea level* and *The consequences...* indicate that the emphasis on the future stressed by “**what will happen**”. By comparison, the emphasis in PREDICTION is on the notion of “**when** it will happen”, indicated by the thematisation of the ‘Circumstance: temporal’ *In the*

next half of the century. It is noticeable that in PREDICTION there is no modality: ‘probability’ to indicate a sense of futurism, however, futurism can be detected by words containing a futuristic sense, such as *trend*.

Heat

PREDICTION (10)¹Although the region-by-region effects of rapid atmospheric warming are far from clear, ²scientists are confident of **the overall trend**. ³**In the next half-century**, they fear dramatically altered weather patterns, major shifts of deserts and fertile regions, intensification of tropical storm and a rise in sea level, caused mainly by the expansion of sea water ⁴as it warms up.

All actual semantic elements within FOCUSSING of the three texts are presented in Table 3.20.

Parasol	Icy	Heat
SPC 1	SPC 1	GCL
[EVN]	[BRG]	EVN
[BRG]	SPC 2	BRG
EVN	[BRG]	CNS
[BRG]	BRG	SLN
EVN	EVN	BRG
SPC 2	SPC 3	GCL
[BRG]	EVN	PRE
BRG		BRG
[CNS]		[EVN]
EVN		SPC 1
ONP		[BRG]
		[EVN]
		EVN
		BRG
		EVN
		BRG
		GCL
		BRG
		SPC 2
		[EVN]
		[PRE]
		[CNS]
		[EVN]
		BRG
		CNS
		[EVN]
		SPC 3
		[PRE]
		SLN
		EVN

Table 3. 20 Actual Semantic Elements within FOCUSSING in the Three Texts.

So far I have discussed the elements subsumed within the first two global stages of TUNING and FOCUSING. Next, I shall focus on the final stage of the articles, CLOSING.

3.7 SEMANTIC ELEMENTS IN CLOSING : DEFINITION AND REALIZATION

CLOSING is an important part of a text in which writers deliver their final conclusion, leaving the reader with the specific message that the writers wish to impart. It is normally the part of the text where the writer directs the reader's attention to the text's main point. Within CLOSING, we ought to be able to find the deepest underlying purpose of the texts, for example, to move the reader emotionally, to create an atmosphere, to stimulate the reader intellectually, or to argue a case in order to persuade or provoke action (Hennessy 1997:143). To this point, analysis of the three sample texts has identified three different semantic elements within CLOSING; CONCERNS, PREDICTION, and SUMMARY.

Although the terms CONCERNS and PREDICTION have been used in FOCUSING, they are used again in CLOSING for a specific purpose. One of the purposes of the present study is to characterise the texts, which demands teasing out the semantic characteristics of the texts and in this exercise parts of the texts look similar because they have similar lexicogrammatical patterns. That applies here in the case of CONCERNS and PREDICTION. This is relevant to the theoretical discussion in chapter two which argues the advantage of shuttling between the three strata and is a practical demonstration of the analytical benefit of this approach. However, the issue related to why the two terms are used again will be dealt with below in 3.8 after all semantic elements are proposed. It is beneficial to keep the two terms at this stage of analysis so as to confront the problem of labelling elements with similar semantic and

lexicogrammatical consistencies which may be encountered by others who undertake the same line of research.

3.7.1 CONCERNS (CNS)

As stated above, CONCERNS is one of the semantic terms whose characteristics are present in both FOCUSSING and in CLOSING. The motivation for using the same label is due to the similarity of their ideational meaning in that they express the writer's concerns or worries about particular circumstances that may have a negative impact on mankind and/or the environment. (The difference in their interpersonal and textual meaning will be discussed in 3.8 as will the issue of whether two elements, that are given the same label, and appear in different stages, should have the same label).

Like CONCERNS in FOCUSSING, CONCERNS in CLOSING contains affectual negative meaning that tends to leave the reader with a negative feeling such as fear or apprehension. To create a sense of fear or threat, the rhetorical strategy used here, is the invocation to everyone to share in such apprehension as it is the future of our world at stake; this is realised by the inclusive *we* or *our*. Therefore, the interpersonal charge in CONCERNS here is quite high. In addition, the interpersonal charge of CONCERNS in CLOSING is elevated because the writer, having already made his point by utilising words which convey a sense of threat, fear, or nervousness in TUNING and FOCUSSING, then avails of CONCERNS in CLOSING to reinforce the message. In concluding the text, the author seeks the most memorable message from the text.

The major semantic characteristics of CONCERNS are realised by a combination of expressions or words containing negative meaning, associated lexis indicating futurism, and inclusive use of "we" or "our". The following two extracts show how CONCERNS in CLOSING is realised.

Parasol

CONCERNS (36) ¹The effort is very much needed. ²If it took this long for atmospheric scientists to get the drop on an effect as important as that of sulfate aerosols, ³Charlson says, ⁴who knows ⁵what other **consequences of our** monkeying with the climate are drifting through the air, ⁶**waiting to be noticed?** ⁷Most of what **we** do know about aerosols comes from observing **our** own haphazard release of the particles into **our** air. ⁸“In a kind of **sinister** way **we**’ re doing a giant worldwide meteorological experiment,” ⁹Charlson says. ¹⁰“And **we** don’t know ¹¹**what’s going to happen**”.

Heat

CONCERNS (40)...¹The irony is that just as **we** have begun to decipher the climatic rhythms that have gone on for hundreds of millions of years, ²**we** may have begun to change them **irrevocably**. ³And as the **unforeseen discovery** of the **ozone hole** demonstrates, ⁴**still more unexpected changes may be on the way**.

The negative meaning in the ‘Parasol’ extract is powerful enough to trigger apprehension or fear in the reader’s mind even though employing only one lexis indicating negative view *sinister* (clause 8). It may be that the semantic pressure on the reader, which mounts over the course of the entire article, is so great that there is no need to bombard the reader with many more lexical items pointing to the unwanted consequences. The very last proposition about why we should be worried is a direct quote from Charlson, the central authority who *has been studying aerosols since 1960s* (see appendix 1.2 clause 1, paragraph 3).

The inclusive “we” and “our” appears to be used to invoke in the reader a sentiment or opinion to be shared with the writer (Dowdy 1987:279) and/or the quoted authority. The meanings of *we* and *our* are strategically mixed together. For example, *our* in clause 5, and *we* in clause 7, refer to the quoted authorities and experts on atmospheric science, whereas *our* in clause 7, (*our own haphazard release of the particles into our air*), and *we* in clauses 8 and 10 refer to both experts and the reader. The overall semantic attributes of this element are thus signalled by words conveying negative meanings or consequences and uncertainties, such as *haphazard* and *sinister*, and in

the last clause *And we don't know what's going to happen* which leaves the reader the feeling of apprehension. This negative meaning is combined with the use of inclusive lexis (*we* and *our*) to make this meaning inescapable.

The most striking negative view in CONCERNS in 'Heat', and one that arouses the reader's fear is *ozone hole*. Public understanding about the *ozone hole*, in combination with the form of media coverage of scientific information on climate change means that concepts of the *ozone hole* issue are linked to "skin cancer", "greenhouse effect", "disaster" etc. (Bell 1994). When *ozone hole* co-occurs with *irrevocably, unforeseen discovery* and *unexpected changes* (clauses 2-4) in this short final message in 'Heat', the impression given to the reader is that we humans may be facing a catastrophic situation.

3.7.2 PREDICTION (PRE)

PREDICTION is the second element found within both CLOSING and FOCUSING, and for the same reasons as CONCERNS, that is, that the lexicogrammatical patterns are very similar. PREDICTION in 'Icy' is extracted below. PREDICTION in climate change deals with forecasting the future, in particular, whether the world will be warmer or cooler. The semantic motivation for this element is that it is urgent that we all know about the possible future scenarios resulting from climate change and that we cannot risk waiting until we are certain of the consequences before acting. Lay readers are not in a position to predict our future in terms of the impact of global warming. The act of predicting must be based substantially on scientific grounds rather than intuition. My analysis has found that PREDICTION always follows BRIDGING or EVALUATION. I have already suggested that this is because the writer must ensure that the reader is sufficiently informed to be able to understand the information in PREDICTION and, eventually, to share the author's conclusions. So explanation is a rhetorical strategy for the PREDICTION.

Given that a sense of futurism is inherent in PREDICTION, one can expect explicit lexical items such as modality: 'probability'. In fact modality: 'probability' is also

found in EVALUATION and in other elements, however as mentioned in the discussion on the semantic characteristics of EVALUATION (3.6.4), Modality: ‘probability’ or metaphors of modality per se cannot characterise EVALUATION; other meanings also have to be taken into consideration. In the same vein, one has to examine the semantics as well as the lexicogrammatical pattern in order to characterise PREDICTION. Consider the following extract containing PREDICTION which is characterised by the combined textual evidence of thematisation, lexical items, modality: ‘probability’, and metaphors of probability. The text expressing these characteristics appears in bold type.

Icy

PREDICTION (26) ¹So the **future** of the ice at least **looks** less bleak ²than some early estimates of the impact of global warming have suggested. ³The ice sheets **look likely** to grow, ⁴not melt, **in the next few decades**, ⁵and the seas **should** eventually fall, ⁶not rise. ⁷If anything, ⁸the early stages of global warming **seem** to be pushing the world towards a climate closer to the one in which the last glacial period began. ⁹But two qualifications arise.

(27) ¹⁰First, studying mild climates of the past may not produce accurate models of the effects of very rapid warming. ¹¹The hotter intervals of the past 150, 000 years developed because of slow processes such as changes in the Earth’s orbit and axis and not from a leap in carbon dioxide levels that is virtually instantaneous in geological terms. ¹²Secondly, the temperature in these warm intervals was on average less than 3°C warmer than today. ¹³If temperatures increase by more than 5°C, ¹⁴as some models predict, ¹⁵the balance of polar ice **would** tip towards melting, ¹⁶and a rapid and inexorable rise in sea level **would** follow.

The above extract represents the writer’s efforts to formulate a concluding remark, by critiquing all of the cited authorities, to end the article. The thematisation of *so* is employed to call the reader’s attention to the next ‘move’. Lexical items, *future* and *in the next few decades*, in conjunction with modality: ‘probability’ and metaphors of modality such as *looks*, *look likely*, *seem*, and *would*, are indicators of futurism. The future, in this extract, is considered unable to be predicted with any certainty. Here the writer, while clearly wanting to make some kind of prediction, acknowledges that any

such attempts may be far from correct given the ‘unpredictability’ of climate change issues. To make the prediction, and the overall impact of the article more convincing, he incorporates a hypothetical explanation to support the possibility that sea levels could rise.

It is worth noting that the experiential and the interpersonal meanings encapsulated in ‘Parasol’s CONCERNS and ‘Icy’s PREDICTION (both subsumed in CLOSING) are in a sense extended versions of those meanings which are initially presented in the GLIMPSE. This means that the experiential meaning in the two GLIMPSEs is less informative than the experiential meanings provided in CONCERNS and PREDICTION because GLIMPSE is constrained by its textual function. The word length for GLIMPSE does not allow for any elaboration. The purpose of GLIMPSE is to be brief and attention grabbing. GLIMPSE is a herald for the article.

It can be seen from the previous discussion that there are varying degrees of interpersonal meaning in the three GLIMPSEs. The GLIMPSEs in ‘Parasol’ and in ‘Heat’ both arouse a stronger sense of fear than does GLIMPSE in ‘Icy’. In a similar vein, interpersonal meaning is also expressed in CONCERNS and PREDICTION in CLOSING. In this way, the analysis reveals that futurism, or the ‘irrealis’ aspect, has a dominant presence in the semantic structure of most elements in the texts. The remaining stages of my analysis will confirm that futurism determines the form of the elements which constitute this genre. This underlines the advantages of my multilayered analysis.

3.7.3 SUMMARY (SUM)

SUMMARY is the element in which the writer restates the main idea behind the text, that is most likely to be supported by the most recent research. SUMMARY pulls together all of the threads of argument discussed in the article and presents the author’s version of what s/he considers to be the most authoritative evidence, or the most accurate description of current knowledge in the field. It brings the reader’s attention back to the important aspects mentioned earlier in the text. Here, in a sense also, the author restores (assumedly) their own creditability by downplaying or

ignoring any ‘alarmist’ references cited and arriving at a balanced and logical conclusion to reinforce, for one last time, the main points s/he is trying to make. Accordingly, the experiential role in this element is dominant. Consider the following extract:

Heat

SUMMARY (40) ¹Until now, the earth’s climate has been a remarkably stable, self-correcting machine, ²letting in just the right amount and type of solar energy ³and providing just the right balance of temperature and moisture to sustain life. ⁴Alternating cycles of cold and warmth, as well as greater and lesser concentrations of different gases, have forced some species into extinction. ⁵The same changes have helped others evolve.

SUMMARY in ‘Heat’, the only occurrence of this element in all three articles, provides a succinct summary of the global climate system and its impacts on earth over the previous hundreds of million of years. *Until now* in clause 1 of the above extract signals a new move to the reader because prior to SUMMARY the content of the text is provided chronologically. The text outlines what has occurred in the past and also forecasts future ‘happenings’. *Until now* brings the reader back to the reality of what is currently happening.

Having considered CLOSINGS in the three articles, we are able to identify similarities and differences among them as to their original classification as popular articles. Although all three texts contain CLOSING, but, as we have seen above they are expressed differently. Even so, the key message common to all of the three different types of CLOSING is one centred around the issue of “uncertainty”, and “fear or anxiety” about the future.

Thus far, the three texts have been analysed in order to identify their semantic elements. Three general stages (TUNING, FOCUSSING and CLOSING) and generic elements subsumed within these three stages have been proposed. As two elements within CLOSING (PREDICTION and CONCERNS) have also been found in FOCUSSING, their semantic elements require distinguishing from each other by analysing the remaining seven texts on the climate change issue. More importantly,

the purpose of the analysis of the second set of texts is to confirm the initial results. A complete table of the actual semantic elements of the three texts is set out below (Table 3.21).

The complete set of actual semantic elements of the three texts facilitates discussion as to whether semantic elements can bear the same label regardless of their position in the text, that is, in what stage they appear.

	Parasol	Icy	Heat
TUNING	TTL GLM SET [PRB]	TTL GLM PRB TLI	TTL GLM SET PRB
FOCUSSING	SPC 1 [EVN] [BRG] EVN [BRG] EVN SPC 2 [BRG] EVN [CNS] ONP	SPC 1 [BRG] SPC 2 [BRG] BRG EVN SPC 3 EVN	GCL EVN BRG CNS SLN BRG GCL PRE BRG [EVN] SPC 1 [BRG] [EVN] EVN BRG EVN BRG GCL BRG SPC 2 [EVN] [PRE] [CNS] [EVN] BRG CNS [EVN] SPC 3 [PRE] SLN EVN
CLOSING	CNS	PRE	SUM CNS

Table 3.21 Actual Structure of the Three Texts and Their Semantic Elements.

N.B. [.....] denotes an embedded element.

Table 3.21 shows the three broad sections or stages into which the texts have been divided; TUNING, FOCUSSING, and CLOSING. Each section subsumes a number of semantic elements. The internal structure within TUNING is quite uniform and

straightforward in that the texts orient the reader towards understanding the issue being discussed. TUNING comprises at least three semantic elements, namely, TITLE, GLIMPSE, and PROBLEM. However, there is a possibility that a text may consist of more than three semantic elements. 'Parasol', for instance, has four elements: TITLE, GLIMPSE, and SETTING [PROBLEM].

When we look at the internal structure of FOCUSSING, we note that a certain set of elements keep re-appearing in the three texts, although not necessarily in a uniform sequence. For example, FOCUSSING, in each of the three texts contains many varied elements, however SPECIFIC CLAIM, EVALUATION, and BRIDGING are common to all three texts. These three elements, however, do not always appear in a specific sequence. Regardless of the sequencing of the elements my proposal for analysis of the three texts provides a comprehensive description of the internal structure of FOCUSSING.

The final section, CLOSING, is problematic due to the diversity of its semantic elements. That is, 'Parasol' contains the element CONCERNS, 'Icy' contains PREDICTION, and 'Heat' contains both SUMMARY and CONCERNS. Accordingly, I sought to confirm my overall findings by analysing the remaining seven texts on climate change. I expected that this further analysis would confirm my proposals concerning the semantic elements and, in turn, support the postulation of a statement on GSP in the three environmental sub-issues.

The analysis of the ten texts (see full results tabulated in Table 3.23 below) reveals two major findings that affect the internal structure of the three main sections. Firstly, a variety of elements were found in all three sections, but particularly in CLOSING. Secondly, some elements that appear in one section also appear in others. For example, CONCERNS and PREDICTION are found in TUNING, FOCUSSING, and CLOSING. The findings suggest that it is worth examining the following issues:

1. What new semantic elements might be identified during the analysis of the remaining seven texts?

2. Should CONCERNS and PREDICTION be given those labels wherever their characteristics appear?

This section deals with the new semantic elements found in CLOSING. The initial analysis revealed that only three semantic elements are subsumed under CLOSING, namely CONCERNS, PREDICTION, and SUMMARY. The analysis of the remaining seven texts in the data identified three more elements in the CLOSING stage: CONCLUSION, RECOMMENDATION, and CALL FOR COLLABORATION.

3.7.4 CONCLUSION (CON)

CONCLUSION covers the device which the writer adopts to end an article. It is the part of the text in which the writer expresses his/her general impression of the main issue in the article. CONCLUSION must be, and can be distinguished from SUMMARY because they perform different functions. CONCLUSION neither summarises nor evaluates the issue in the text, but rather presents the writer's opinion on the main issue and/or reflects on the situation. We note that the chain of reasoning is extended in CONCLUSION while in SUMMARY we find only a brief recapitulation of ideas, too brief to summarise all of the important points raised in the article; SUMMARY does not add further information. In the SUMMARY, the writer returns to the start of the article, but in the CONCLUSION s/he provides some new information which nevertheless has been deduced from information or ideas provided earlier in the text. The extract below from the 'Algae' text, which exhibits the element CONCLUSION, demonstrates these points.

Algae

CONCLUSION (24)¹Meanwhile, Liss's team will monitor the impact of iron fertilisation on DMS emissions. ²They hope ³that such studies will help them ⁴to predict what might happen to the climate ⁵if the marine ecosystem is affected by global warming. ⁶Until the dynamics of algae are well understood, ⁷any attempt to predict their effect on climate will, ⁸it seems, remain elusive.

This element follows the element ONGOING PROJECT in which the writer informed the reader about a project which three scientists, Johnson, Liss, and Watson were to conduct approximately two months after the article was to be published. In this element, the writer switches from the discussion about the future project to the present state of affairs. The CONCLUSION in ‘Algae’ contains the writer’s reflections on the significance of the project being reported. The semantic motif of this element is suggested by a significant shift, in this case, from the ‘irrealis’ state of ‘what is going to happen’ in the experiment (which Johnson, Liss and Watson were about to start) to the ‘realis’ state of ‘what is actually happening’ in the present (the activity which the same research team is currently pursuing). The opposition of *meanwhile* (clause 1) and *until* (clause 6), both of which are Textual Themes, is also crucial for announcing to the reader that there is a phase shift. Moreover, the meaning is switched from a sense of future, that is, a prediction of the results of the experiment, to concluding or reflecting. Another example of CONCLUSION is from ‘Ozone vanishes’.

Ozone vanishes

CONCLUSION	<p>(28)¹The ozone story is a tragic saga of doubt and delay. ²Rowland recalls ³that for several months after his original paper was published in 1974, ⁴“the reaction was zilch.” ⁵It was not until 1978 that the U.S., but not most other countries, banned the use of CFCs in hair sprays and other aerosols.</p> <p>(29)⁶Not until the Antarctic ozone hole was confirmed in 1985 ⁷did nations get serious about CFCs. ⁸By now as many as 20 million tons of these potent chemicals have been pumped into atmosphere.</p>
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In ‘Ozone vanishes’, the element PREDICTION, which precedes the CONCLUSION, forecasts increased danger from CFC emissions. Then in CONCLUSION the ‘irrealis’ meaning which has been presented in PREDICTION becomes that of ‘realis’ by referring to what has precipitated the current situation. This represents a look backwards to why the current situation is as it is. This look backwards in the CONCLUSION differs from SUMMARY which briefly reviews information provided from the beginning of the text. In this way CONCLUSION adds a specific kind of

information, a perspective not specifically dealt with in the text to this point. It stresses past delays and the inappropriate responses which have caused the current dilemma and stresses where these past actions have brought us to date; *By now as many as 20 million tons of these potent chemicals have been pumped into atmosphere.* A look at each clause in CONCLUSION reveals that the semantics of this element revolve around an addition to the picture that emerges from the past. Lexicogrammatically, the grammar is one of actuality such as the use of past and present tense in the extract.

In the following section the remaining two new elements, CALL FOR COLLABORATION and RECOMMENDATION will be discussed. Since these two elements resemble each other in terms of the selection of lexicogrammar, a comparison of other characteristics of the two elements will give a clearer picture as to why they need to be distinguished from each other as elements.

3.7.5 CALL FOR COLLABORATION (COL) and RECOMMENDATION (REC)

Both CALL FOR COLLABORATION and RECOMMENDATION refer to the part of the text in which the writer takes the step of attempting to convince the reader that action needs to be taken in light of the issues discussed. These two elements reflect a distinct characteristic of a discourse in environmental issues in that these issues are presented as a social problem which requires action at all levels, action if we are to save the planet (Cracknell 1993:3-21).

Both elements shift the focus from the main issue, namely, from what has happened to what should happen in the near and/or far future. Like PREDICTION and CONCERNS, the semantics of these two elements deals with the 'irrealis'--a future state of the world. Given that both elements deal with futurism, we can expect them to display similar lexicogrammatical patterns, such as, an accumulation of modality: 'obligation' evident in *should*, *must*, *need*, or metaphorical representation of modality

seen in *it is vital that ...*, and *it would be wise to ...* . The key semantic feature that distinguishes CALL FOR COLLABORATION from RECOMMENDATION is the ‘actor’ of “something should be done”. In CALL FOR COLLABORATION, the message is directed to a collective group of people by saying “This is something we should do”, whereas that in RECOMMENDATION is to a particular group tells the reader that “This is something somebody should do”. This distinction implies different sites of responsibility from which action ought to be taken in order to save the environment. The semantic differences here reflect a different degree/type of environmental problem. For example, should the problem of how to reduce greenhouse gas emission be solved at the individual, community, or international level. The inclusive *we*, *our*, or *us* gives an impression of solidarity, “we” have to act for “our” environment. By comparison, the use of third person nouns or pronouns distances the actor from the reader. The meaning conveyed in RECOMMENDATION is “You have to act (for us)”. Below is the extract from ‘Drying’ in which the element CALL FOR COLLABORATION is found.

Drying

CALL
FOR
COLLABORATION

(22) ... ¹Neither day-to-day experience, nor the prehistoric climate record, nor even **our** best climate models can tell **us** what the outcome would be. ²So it is **vital** ³that **we** keep track of tropical temperatures ⁴and watch how they change. ⁵Surface temperatures are being monitored around the world, ⁶and satellites can now provide a global picture of temperature change at different levels in the atmosphere. ⁷The planet is likely to be slow to warm, ⁸but once warmed is likely to be difficult to cool. ⁹**It would be wise** to bear this in mind ¹⁰when deciding ¹¹**how we should** curb our emissions of greenhouse gases.

The element preceding this extract is PREDICTION in which the writer tells the reader that an increase in global temperatures would bring about dire consequences such as food shortages in developing countries, severe storms and hurricanes in tropical zones, and a chaotic global climate. Such consequences sound disastrous enough to invoke action to avoid the consequences. This is the writer’s motivation for giving some advice on what should be done in the element CALL FOR COLLABORATION.

It is interesting to consider how the writer uses *we* and *our* strategically in this element. It is a rhetorical strategy the writer uses to make popular science readers feel that they are insiders or belong to a community, and thus feel that they have a responsibility to join in or to take action because other ordinary readers do not appreciate the implications. It is as if the readers are told "You have read this article. You have now been informed. You know what the consequences would be and therefore you are in the position to take action, which is very important for our planet and our future. Our future is in your hands." Phrases such as, *our best climate models, we keep track of tropical temperatures and watch how they change* and *when deciding how we should curb our emissions of greenhouse gas* all bring the popular science readers into the inner circle of informed people where they assume the status of quasi-specialists because they know enough to appreciate that action is required. A closer look at those phrases tell us that *we* and *our* are so well intertwined in one short paragraph that the readers feel that they are part of the community. That is, a link is made which unites the entire community of scientists, decision-makers, and ordinary people.

On the other hand, even though RECOMMENDATION is an element which proposes action, only a certain group of people, such as world leaders and authorities, not the whole community, are deemed responsible for taking it. In the case of 'Ozone vanishes' (see text extract below), the writer is a journalist who cannot take part in the decision-making process. He knows, however, that action is urgently needed, and so all he can do is voice his opinion to whoever can make it happen. Lexicogrammatically, there is only one word suggesting the demanding of service, that is, modality: 'obligation' in *should* (clause 1). Yet this element is semantically motivated in that the rest of the paragraph provides reasons for why it is vital to take "ozone" into account. The reasons are strengthened by the introduction of a threatening tone which spreads through the paragraph, for instance, *serious damage is occurring, it may be much too late to halt the damage, No one knows that anything terrible will happen* and *the possible consequences are too frightening to contemplate*.

The purpose appears to be to say to world leaders or any other decision-makers that it is their responsibility to act in order to avoid a global disaster.

Ozone vanishes

RECOMMENDATION (30)¹**World leaders should remember ozone** ²**when they think about other threats to the planet.** ³**If they always wait** ⁴**until there is indisputable evidence** ⁵**that serious damage is occurring,** ⁶**it may be much too late to halt the damage.** ⁷**Consider the widespread scientific predictions of global warming from the greenhouse effect.** ⁸**No one knows** ⁹**that anything terrible will happen.** ¹⁰**But humanity has boosted the amount of carbon dioxide in the atmosphere by at least 25%.** ¹¹**It is reckless to subject nature to such giant experiments** ¹²**when the outcome is unknown** ¹³**and the possible consequences are too frightening to contemplate.**

To conclude, the analysis of all ten texts revealed that CLOSING subsumes six semantic elements: SUMMARY, CONCLUSION, PREDICTION, CONCERNS, RECOMMENDATION, and CALL FOR COLLABORATION. Table 3. 22 reveals the instances of each in the ten texts on climate change.

Text	Elements Within CLOSING and Sequence in Text		
Cold	PRE	CNS	
Parasol	CNS		
Ozone hole	PRE		
Methane	--		
Icy	PRE		
Algae	CON		
Drying	COL	CNS	
Heat	SUM	CNS	
Ozone vanishes	CON	REC	CNS
Ozone thins	CNS	[PRE]	[CON]

Table 3. 22 Actual Elements Subsumed under CLOSING in Ten Texts.

The table demonstrates that CLOSING can comprise one or more elements, and that CONCERNS, when it occurs, was always the last element in sequence in the texts. These six semantic elements can be divided into two main categories: one that characterised by returns to the start of the text, and another that moves forward from the text. The latter can be further divided into two groups, one which contains providing a general comment, and one with elements providing a comment about the future.

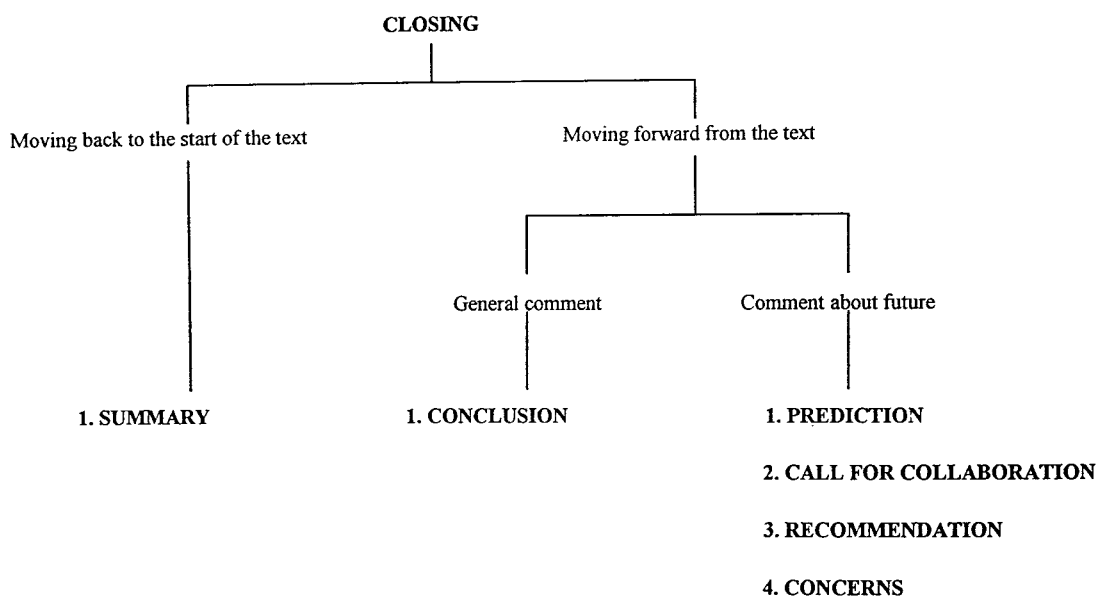


Diagram 3. 2 Taxonomy of CLOSING

As Diagram 3.2 shows, CLOSING is dominated by elements which emphasise futurism, thus indicating this to be the central semantic characteristic of this genre. The location of four ‘irrealis’ elements (PREDICTION, CALL FOR COLLABORATION, RECOMMENDATION, CONCERNS) in CLOSING suggests strongly that the motif in popular writing on the environment, especially the climate change issues, is predominantly about making predictions.

Thus far, I have identified all actual semantic elements found in the ten texts. The analysis of the remaining seven texts on climate change has shed further light on the characteristics of popular scientific writing on environmental issues. What has emerged from the total picture of semantic elements is that the core characteristic of environmental texts is the special attention which they pay to predictions of the future. This fact became clearer when compiling the results of the analysis of the remaining seven texts with those of the initial analysis of three texts. A richer picture of their generic structure is obtained, particularly that of TUNING and CLOSING. Table 3. 23 shows all actual elements of the ten texts.

TEXT	TUNING			FOCUSSING								CLOSING																
Cold	TTL	GLM	PRB	GCL	SPC1	SPC2	SPC3	SPC4	EVN	PRE	BRG	SPC5	EVN	PRE	CNS													
Parasol	TTL	GLM	SET [PRB]	SPC1 [EVN] [BRG]	EVN [BRG]	SPC2 [BRG]	EVN [CNS]	ONP	CNS																			
Ozone hole	TTL	GLM	PRO	PRB	BRG	SPC1	BRG	GCL [PRE]	PRE																			
Methane	TTL	GLM	SET	PRB [TLI]	GCL [EVN]	BRG	GCL	SPC1	GCL	BRG	EVN	ONP	SPC2	SPC3	BRG [EVN]	BRG [GCL] [CNS]	BRG	SPC4	PRE	SPC5	GCL	SPC6	SPC7	GCL	SPC8	BRG	GCL	SPC9
Icy	TTL	GLM	PRB	TLI	SPC1 [BRG]	SPC2 [BRG] [EVN]	BRG	EVN	SPC3	EVN	PRE																	
Algae	TTL	GLM	SET	PRB	TLI	SPC1 [EVN] [BRG]	SPC2 [EVN] [BRG]	SPC3	ONP	BRG	SPC4 [BRG]	EVN	SPC5 [EVN]	SPC6 [EVN]	ONP	CON												
Drying	TTL	GLM	PRB	PRE	SPC1	GCL [EVN]	BRG	EVN	SPC3 [EVN]	GCL	SPC4	SPC5	SPC6	SPC7	SPC8	SPC9	SPC 10	EVN [CNS]	PRE	COL	CNS							
Heat	TTL	GLM	SET	PRB	GCL	EVN	BRG	CNS	SLN	BRG	GCL	PRE	BGR [EVN]	SPC1 [BRG] [EVN]	EVN	BRG	EVN	BRG	GCL	BRG	SPC2 [EVN] [PRE]	CNS [EVN]	BRG [EVN] [CNS]	SPC3 [PRE]	SLN	EVN	SUM	CNS
Ozone vanishes	TTL	GLM	CNS	PRB	CNS	SPC1	PRE	BRG	SLN [EVN]	SLN	BRG	PRE	SLN	BRG	SPC2 [EVN]	SPC3	BRG	SPC4	SPC5	SPC6	PRE	SPC7 [BRG]	PRE	CON	REC	CNS		
Ozone thins	TTL	SET [PRB]	GCL	SPC1	BRG	SLN [EVN]	PRE	EVN	SLN	BRG	SPC2	BRG	EVN	SLN	BRG	EVN	PRE	BRG	EVN	BRG	EVN	BRG	EVN	PRE	EVN	ONP	EVN	CNS [PRE] [CON]

Table 3. 23 Actual Semantic Elements of the Ten Texts.

Table 3.23 reveals that CONCERNS and PREDICTION are found in TUNING, FOCUSsing, and CLOSING and while CONCLUSION, CALL FOR COLLABORATION, and RECOMMENDATION are additional elements found in CLOSING. This means that it is common to find a combination of semantic elements subsumed within each stage.

Having analysed all ten texts and identified all semantic elements, I am now in a position to deal with the issue of whether PREDICTION and CONCERNS should be and can be so labelled regardless of which stage they appear in. The notion of 'delicacy' is taken into consideration when dealing with this issue.

3.8 DISTINCTIONS BETWEEN SEMANTIC ELEMENTS BASED ON DEGREE OF 'DELICACY'

The fact that PREDICTION and CONCERNS appear across the three phases presents a challenge in labelling the elements. They each have the same experiential value across the three stages. If, however, we approach the text from an interpersonal and textual point of view, we find that their interpersonal and textual values differ.

From a textual perspective PREDICTION and CONCERNS can appear in TUNING, FOCUSsing, and CLOSING but in each case their textual values depend on the part of the text to which they contribute. According to Western writing convention, there is a relationship between the introduction, body, and conclusion of a text; a writer tells the reader what s/he is going to say in the introduction, then says it in the body, and finally, in the conclusion, tells the reader what s/he has just said (Kinneavy 1971). TUNING performs the same function as 'introduction' in most, or all rhetoric, that is, it provides background to the problem being discussed in the article. Therefore, if the writer presents the reader with a hypothetical view in TUNING, s/he should follow it up in FOCUSsing and recapitulate it in CLOSING. In short, the textual function of PREDICTION, when appearing in TUNING, is to capture the reader's attention by prophesising as to **when** a predicted occurrence will occur. However, the textual function of CONCERNS in TUNING is to fix and hold the reader's attention on **what** the dire consequences of the potential environmental crisis will be. PREDICTION and

CONCERNS perform the same textual function in FOCUSSING and in CLOSING, that is, the textual function in FOCUSSING is to convince the readers by presenting evidence which supports the predictive statements, while their function in CLOSING is to reiterate the points the writer has made, reminding the readers about the prediction made earlier in TUNING and FOCUSSING.

On evaluating the role of interpersonal value, it is useful to take the notion of contiguity into consideration, particularly in CLOSING, because it is the writer’s final opportunity to put his/her case. Two certain elements that are contiguous have different emotional charge. For example, PREDICTION, when contiguous to CONCERNS, has a different rhetorical effect from PREDICTION when contiguous to RECOMMENDATION. This analysis has found that when there is a combination of elements in CLOSING, one of which is PREDICTION, PREDICTION always comes first. A PREDICTION^CONCERNS configuration works to raise the reader’s emotions and produce a sense of threat because the writer thereby ends the article by predicting a (usually) negative view of the future and leaves the readers with a feeling of apprehension in CONCERNS. The reader’s perception of the future is, accordingly, less bright. On the other hand, a PREDICTION^RECOMMENDATION configuration encourages readers to act because although the meaning in PREDICTION arouses fear in the reader’s mind, RECOMMENDATION provides a sense of hope, and thus the readers may feel the need to act to solve the problem. Below are the two extracts in which PREDICTION appears in TUNING and in CLOSING in ‘Ozone hole’.

Ozone hole

TUNING	PREDICTION	<p>(1)¹Spring is returning to the Antarctic, and with it the hole in the stratospheric ozone layer. ²Last year’s hole was the deepest ever; ³this year’s is expected to be as bad and possibly worse. ⁴Although 74 nations have committed themselves under the Montreal Protocol to ending the production of chlorofluorocarbons by the end of 1995, ⁵ozone-destroying chlorine from the compounds already in use will continue to accumulate in the atmosphere for another decade after that. ⁶Only then, ⁷researchers believe, will the concentrations of the chemical begin to decline slowly- ⁸so slowly that it will take at least until 2060 for the chlorine concentrations in the Antarctic stratosphere to return to the level it was at in the late 1970s, ⁹when the ozone hole was first noticed.</p>
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CLOSING	PREDICTION	(11) ¹ While the resulting ozone hole would cover a smaller area than the one in the Antarctic, ² it would affect far more people. ³ And Malhlman thinks global warming could also promote ozone destruction in ways the British researchers didn't simulate ⁴ Some circulation models suggest ⁵ that global warming could slow the movement of warm air in the stratosphere toward the Arctic, ⁶ and thus strengthen the Arctic vortex. ⁷ At that point the stratosphere-chilling feedback Malhlman has identified in the Antarctic might kick in, ⁸ helping dig a deep ozone hole that would tend to deepen itself from year to year. "Anything that makes the Northern Hemisphere more Southern Hemisphere-like," Malhman says, "pushes the system toward the edge."
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The ideational meaning in the two PREDICTIONS above is centred around the probability that the ozone hole in the Southern Hemisphere will increase in size with time. However, the interpersonal orientations of the two extracts differ. That in PREDICTION, which is subsumed under TUNING, is more striking, an effect gained through the use of *deepest ever*, *bad*, and *worse* in clauses 2-3. The situation is made to appear worse by the meaning (in clauses 4-5) that even though some preventative action has been taken, the ozone level continues to drop. By comparison, the interpersonal meaning in PREDICTION subsumed within CLOSING is not as intense as that in TUNING because the degree of certainty is reduced by the switch of modality from *will* in TUNING to *would*, *could*, and *might* in CLOSING.

The following are three examples of CONCERNSs in ‘Ozone vanishes’, the first two in TUNING and the last one in CLOSING.

TUNING	TITLE	The Ozone vanishes
	GLIMPSE	¹ And not just over the South Pole. ² A hole in earth's protective shield could soon open above Russia, Scandinavia, Germany, Britain, Canada and northern New England.
	CONCERNS	(1) ¹ What does it mean ² to redefine one's relationship to the sky? ³ What will it do to our children's outlook on life ⁴ if we have to teach them to be afraid to look up? — Senator Al Gore, Earth in the Balance
	PROBLEM	(2) ¹ The world now knows ² that danger is shining through the sky. ³ The evidence is overwhelming ⁴ that the earth's stratospheric ozone layer—our shield against the sun's hazardous ultraviolet rays—is being eaten away by man-made chemicals far

	CONCERNS	<p>faster than any scientist had predicted. ⁵No longer is the threat just to our future; ⁶the threat is here and now. ⁷Ground zero is not just the South Pole anymore; ⁸ozone holes could soon open over heavily populated regions in the northern hemisphere as well as the southern. ⁹This unprecedented assault on the planet's life-support system could have horrendous long-term effects on human health, animal life, the plants that support the food chain and just about every other strand that makes up the delicate web of nature. ¹⁰And it is too late to prevent the damage, which will worsen for years to come. ¹¹The best the world can hope for is to stabilize ozone loss soon after the turn of the century.</p>
CLOSING	CONCLUSION	<p>(27)¹The ozone story is a tragic saga of doubt and delay. ²Rowland recalls that for several months ³after his original paper was published in 1974, ⁴"the reaction was zilch." ⁵It was not until 1978 that the U.S., but not most other countries, banned the use of CFCs in hair sprays and other aerosols. ⁶Not until the Antarctic ozone hole was confirmed in 1985 ⁷did nations get serious about CFCs. ⁸By now as many as 20 million tons of these potent chemicals have been pumped into atmosphere.</p>
	RECOMMENDATION	<p>(28)¹World leaders should remember ozone ²when they think about other threats to the planet. ³If they always wait ⁴until there is indisputable evidence that serious damage is occurring, ⁵it may be much too late to halt the damage. ⁶Consider the widespread scientific predictions of global warming from the greenhouse effect. ⁷No one knows ⁸that anything terrible will happen. ⁹But humanity has boosted the amount of carbon dioxide in the atmosphere by at least 25%. ¹⁰It is reckless to subject nature to such giant experiments ¹¹when the outcome is unknown ¹²and the possible consequences are too frightening to contemplate.</p>
	CONCERNS	<p>(29)¹ At least nations now seem to agree on a crash effort to save the ozone. ²But the cure will not be instantaneous. ³The world may not know for decades how costly the years of recklessness will be. ⁴And whether children should be afraid to look up.</p>

We can see from the above examples that the ideational meanings in all three CONCERNS deal with the threat that past environmental damage will develop into a catastrophic situation for all life forms on the earth. The interpersonal roles of CONCERNS in TUNING and in CLOSING differ little from each other. That of CONCERNS in TUNING makes use of the authority's (Senator Al Gore) quote to heighten the reader's emotional engagement of the reader. The second instance of CONCERNS, in TUNING, employs words containing negative affectual meaning to

create apprehension in the reader (note words in bold type). The interpersonal value of **CONCERNS** is amplified in **CLOSING** because of the contiguity of **RECOMMENDATION** and **CONCERNS** and by the repetition of the last line of the authority's quote which had already been used in **CONCERNS** in **TUNING**. The negative meanings contained in **RECOMMENDATION** and **CONCERNS** combine to heighten the interpersonal value of **CONCERNS** considerably.

Unlike the two **PREDICTIONS** in the 'Ozone hole' extracts (one in **TUNING** and the other in **CLOSING**) which have very similar ideational meaning, different textual functions, and different degrees of interpersonal orientation, the three instances of **CONCERNS** in 'Ozone vanishes' have similar ideational and interpersonal meaning, but different textual functions. We could suggest from this that '**PREDICTION**' and '**CONCERNS**' can properly have these labels when they appear in each of the stages of **TUNING**, **FOCUSSING**, and **CLOSING**⁵ because they contain the same ideational values in whatever stage they appear. Despite this however, their interpersonal and textual values vary depending on the stage in which they appear and for this reason I concluded that the labels must change in order to properly reflect the differing interpersonal and textual meanings they contain in the different stages. Accordingly, I proposed the term **PROPHECY** instead of **PREDICTION** when it appears in **TUNING**, I retained the label **PREDICTION** when it appears in **FOCUSSING**, and I proposed the term **SPECULATION** instead of **PREDICTION** when it appears in **CLOSING**. In addition, I proposed the term **THREAT** instead of **CONCERNS** when it appears in **TUNING**, retained the label **CONCERNS** in **FOCUSSING**, and proposed **ANXIETY** instead of **CONCERNS** in **CLOSING**.

I have defined and discussed all of the proposed semantic elements identified in my analysis of the ten sample texts. What has emerged from my examination of the semantic elements is that there are several elements that contain a sense of future and their respective inherent qualities are captured in the labels (for example, **THREAT**,

⁵ None of the analysed texts exhibit the extreme case of having **PREDICTION** or **CONCERNS** in all three stages. They are found in only two stages at most.

PREDICTION and CONCERNS). Significantly, this futurism is also relevant to other elements although the aspect of meaning is not always reflected in their labels (for example, GLIMPSE, PROBLEM, and EVALUATION). These findings suggest that the cultivation of a particular view of the future is a key characteristic of popular articles in climate change. To be able to confirm this interpretation and to properly develop the semantic, syntagmatic, and visual dimensions of the genre, an analysis of texts on population growth and deforestation issues was undertaken, the findings of which are presented in the next chapter.