CHAPTER FIVE

DISCUSSION OF THE FINDINGS

5.0 Introduction

This chapter interprets the findings of the study in the light of systemic-semantic theory. It begins with an evaluation of the application of the theoretical construct in analysing the texts for their cohesive properties and in capturing chemistry concepts in system networks. The discussion proceeds to give a general comparative observation of how each chapter achieves lexical cohesion and what their respective system networks reveal. This is followed by a discussion of the coding problems encountered with reference to specific examples. The discussion also covers the problems faced in constructing system networks using a restrictive corpus which is the content words of the two chemistry chapters analysed. This chapter also highlights similarities and contrasts of the salient features of my research with those of other researchers. The chapter finally concludes by reviewing the concepts of lexical cohesion and lexical coherence in the light of my exploration.

5.1 Review of theoretical construct

In this present study, I have attempted to explore the questions of whether the lexis of a text may be discernible in terms of the semantic fields they espouse, whether they may be seen to make connections with each other independent of structural relations, whether the semantic relationships occurring between them may be identified and whether their contrastive features may be captured in system networks.

The findings of my study, presented in chapter four, suggest that the application of the theoretical construct using the methodology outlined in chapter three is well substantiated.

The lexis of the texts have been studied for their role in creating a sense of unity in the text. The findings reveal that the texts stay on topic, do not digress, employ consistent use of register and thus display a unified development. The lexis studied for their cohesive potential in the text were distributed across the text for their paradigmatic grouping and distributed within the confines of the sentence for their syntagmatic grouping. Although cohesion within the sentence which is above structural relations may also be explored, it is the cohesion between sentences or in Halliday and Hasan's (1976) term "intersentential cohesion" which is the focus of this study. Lexis is studied in terms of its semantic continuity across the text which is

how one lexical item depends on another for the recovery of its meaning thereby creating a semantic bond between them. The lexical items which are semantically related are distributed in adjacent sentences or distanced by many mediating sentences.

Lexical items that cohere along the paradigmatic dimension participate in lexical string formation. A semantic field may organise one string or several strings in one stretch of text under examination. Lexical strings expounding the same concept are subsumed under one semantic field. Only the paradigmatically related lexical items are analysed for the type of meaning relation they establish. The syntagmatically related lexical items which are consistent with Halliday's category of a collocational spread or lexical set are not analysed any further for their cohesive relations but are examined for their use as entries or features in system networks.

There are three reasons why cohesion along the paradigmatic dimension is given prominence in this study. The first reason is to show that there is a semantic relationship between one part of the text and the next and the findings of my study substantiate the theory that text is a semantic unit. The lexical items in one part of the text are linked to the lexical items in another part of the text through a relationship which is not structural but semantic. Lexical items distributed along the syntagmatic dimension are not distinguished any

further either for their collocability or for their meaning relations as this distinction does not contribute to the idea of intersentential cohesion and cannot be used to substantiate Halliday and Hasan's (1976 : 2) view of "text as a semantic unit."

The second reason is that only lexical items distributed along the paradigmatic dimension give any meaningful answers when we want to differentiate one text from another in terms of what kinds of meaning relations have been established and how cohesion has been achieved. The findings of my study indicate that since a syntagmatic analysis of cohesion is confined to the sentence level, it cannot reveal how one part of the text is semantically related to another which only a paradigmatic analysis can. Moreover, since the concept of collocation, which involves structural relations, does not involve the lexical items' contextual meaning but is restricted to meaning derived from co-occurrences tendencies among lexical items, a further exploration along the syntagmatic dimension cannot fulfill the objectives of intersentential cohesion.

The third reason is that in order to realise more delicate options in the extensions of system networks, it is crucial that the distribution of substitutional lexical items needs to be retrieved. My findings indicate that a syntagmatic analysis of lexical items does not provide the substitutional alternatives available in the language of chemistry.

A systemic analysis displays these substitutional alternatives to create more delicate choices in system networks.

Another aspect of the analysis is that lexical items are not arbitrarily present in the text. In this thesis, I have attempted to show how the textual metafunction (Halliday & Hasan 1976) expresses the ideational metafunction (Halliday & Hasan 1976) of language. The ideational meanings of the lexical items tell us what the text is about or what the text means. In order to find the text coherent we have to be able to relate the experiences of the real world to the content of the text. The textual metafunction tells us how the text creates meanings by the use of lexical cohesive strategies. These are viewed as cohesive devices and are given taxonomic relational labels in this thesis following Martin's (1981,1989 & 1992) framework.

5.2 Comparative study

This section compares the two chapters analysed for their general features pertaining to the taxonomic analysis and system networks. Tables 5.2.1 and 5.2.2 shown on pages 145 and 146 display overall frequency counts obtained from a survey of the simple and complex relations of the lexical strings. Table 5.2.3 on page 147 displays a summary of the frequency counts obtained for both chapters.

Table 5.2.1

Subtopics of Chapter Two : Atoms and The Atomic Theory

Lexical relations

Simple		2.1	2.2	2.3	2.4	2.5	2.6	2.7	Number of Strings
1	rep	6	1	3	8	2	3	3	26
2	hyp	-	1	-	2	-	-	1	4
3	cohyp	-	-	-	-	-	-	2	2
4	syn	-	1	1	-	-	-	-	2
5	ant	-	2	-	-	-	-	-	2
6	mer	-	-	1	-	1	-	-	2
					Total number of simple strings :				38
Complex									
1	hyp/rep	2	5	1	2	1	2	1	14
2	hyp/cohyp	-	-	-	-	-	1	-	1
3	rep/syn	1	1	-	1	-	-	-	3
4	mer/comer	2	-	-	-	-	-	-	2
5	rep/ant	-	1	-	-	-	-	-	1
6	hyp/ant	-	-	1	-	-	-	-	1
7	syn/mer	-	-	1	-	-	-	-	1
8	cohyp/mer	-	-	-	1	-	-	-	1
9	rep/mer	-	-	-	-	-	-	1	1
10	hyp/cohyp/rep	2	-	-	2	-	-	-	4
11	cohyp/rep/syn	-	1	-	-	-	-	-	1
12	cohyp/rep/mer	-	1	-	-	-	-	-	1
13	rep/syn/mer	-	1	-	-	-	-	-	1
14	hyp/rep/ant	-	-	1	-	-	-	-	1
15	hyp/rep/mer	-	-	-	-	1	-	-	1
16	hyp/rep/syn/ant	-	1	-	-	-	-	-	1
17	hyp/rep/ant/mer	-	1	-	-	-	-	-	1
18	hyp/rep/syn/mer	-	1	-	-	-	-	-	1
19	hyp/cohyp/rep/syn	-	-	1	-	1	-	-	2
20	hyp/cohyp/rep/mer	-	-	-	1	-	-	-	1
					Total number of complex strings :				38

Table 5.2.2

Subtopics of Chapter Ten : Gases

Lexical relations

Simple		10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	10.10	Number of strings
1	rep	5	13	8	4	5	2	4	8	6	2	57
2	hyp	2	-	-	3	1	-	-	1	1	1	9
3	cohyp	-	-	-	-	-	-	1	-	3	1	5
4	syn	-	2	1	2	-	-	-	-	1	-	6
5	ant	2	-	-	-	1	-	1	1	2	-	7
6	comer	-	-	-	1	-	-	-	-	-	-	1
								Total number of simple strings :				85
Complex												
1	hyp/rep	3	3	2	5	1	-	1	4	3	1	23
2	syn/mer	-	-	1	-	-	-	-	-	-	-	1
3	rep/ant	-	-	1	-	-	-	-	-	1	-	2
4	rep/syn	-	-	-	1	1	-	-	-	-	1	3
5	hyp/syn	-	-	-	-	-	1	-	-	-	-	1
6	mer/comer	-	-	-	-	-	1	-	-	-	-	1
7	cohyp/ant	-	-	-	-	-	-	-	1	-	1	2
8	cohyp/rep	-	-	-	-	-	-	-	1	1	-	2
9	hyp/mer	-	-	-	-	-	-	1	-	-	-	1
10	syn/ant	-	-	-	-	-	-	-	-	-	1	1
11	hyp/cohyp/rep	-	-	1	1	-	-	-	-	-	-	2
12	hyp/rep/syn	-	-	1	1	-	-	-	1	1	2	6
13	hyp/cohyp/syn	-	-	1	-	-	-	-	-	-	-	1
14	hyp/rep/mer	1	-	-	-	1	-	-	1	-	-	3
15	rep/ant/syn	-	-	-	-	-	-	-	1	1	1	3
16	cohyp/rep/ant	-	-	-	-	-	-	-	-	-	1	1
17	syn/mer/comer	-	-	-	-	-	-	-	-	-	1	1
18	hyp/rep/mer/comer	-	-	-	1	-	-	-	-	-	-	1
19	rep/cohyp/ant/syn	-	-	-	-	-	-	-	1	-	-	1
20	hyp/cohyp/rep/syn	-	-	-	-	-	-	-	-	1	1	2
21	hyp/rep/syn/mer	-	-	-	-	-	-	-	-	1	-	1
22	rep/syn/mer/comer	-	-	-	-	-	-	-	-	-	1	1
23	hyp/cohyp/rep/syn/mer /comer		-	-	-	-	-	-	-	-	1	1
								Total number of complex strings :				61

Table 5.2.3

Summary of frequency counts

	Chapter two: Atoms and The Atomic Theory	Chapter ten : Gases
Total number of strings : (simple & complex)	76	146
Percentage of strings formed of simple relations :	50.00%	58.22%
Percentage of strings formed of complex relations :	50.00%	41.78%
Percentage of some significant relations :		
a. rep relations	34.21%	39.04%
b. hyp relations	5.26%	6.16%
c. syn relations	2.63%	4.11%
d. hyp/rep relations	18.42%	15.75%
e. hyp/cohyp/rep relations	5.26%	1.37%
f. hyp/rep/syn relations	1.32%	4.11%

Both the chapters show a similar trend of having lexical strings constructed of both simple and complex relations. 50.00% of the strings can be conceived to be of only simple relations in the chapter on "Atoms and The Atomic Theory" and 58.22% of the strings can be conceived to be of only simple relations in the chapter on "Gases." Generally, the chapter on "Atoms and The Atomic Theory" has an equal number of simple and complex strings whereas the chapter on "Gases" has a higher number of simple strings compared to complex strings.

The use of repetition, hyponymy and hyponymy/repetition relations is significant for both chapters analysed with repetition relations being the most favoured cohesive device of all. The number of strings constructed of repetition relations accounts for 34.21% of the total number of strings for the chapter on "Atoms and The Atomic Theory" and 39.04% of the total number of strings for the chapter on "Gases." The study implies that the repetition of a lexical item is favoured over the use of a synonym.

Strings constructed purely out of synonymy relations account for only 2.63% of the total number strings for the chapter on "Atoms and The Atomic Theory" and 4.11% of the total number of strings for the chapter on "Gases." However, the lexical items related cohesively

through a synonymy relation are in combination with other kinds of taxonomic relations for both the chemistry chapters.

The complex strings of both chapters are constructed of two, three or four kinds of taxonomic relations. The subtopic 10.10 of the chapter on "Gases" which discusses the concept of "Departures from the Ideal Gas Equation" utilises the most complex string which is constructed of six kinds of taxonomic relations which are hyponymy, cohyponymy, repetition, synonymy, meronymy and comeronymy. In short, the chapter on "Gases" reveal an additional five more permutations of taxonomic relations.

The complex strings of both chapters are found to be formed of permutations of semblance, inclusion and compositonal relations though not all complex strings have all three types of relations occurring at the same time. Since there are five relations categorised as superordination relations (of which semblance and inclusion are parts of) and only two relations categorised as compositional relations, there are a significantly higher number of strings constructed of superordination relations compared to compositional relations in both chapters.

The significantly higher permutations of complex relations and the significantly higher number of hierarchically ordered system networks for the chapter on "Gases" can be attributed to it being an

exposition of advanced concepts in comparison to the chapter on "Atoms and The Atomic Theory" which is an introduction to fundamental concepts.

The analyses indicate that the strings founded on lexical items related through antonymy, cohyponymy and meronymy relations provide the delicate options needed in the extension of system networks. These cohering lexical items are used to conceptualise chemistry phenomena. Wherever possible the cohering lexical items are retained in the original form to act as entry conditions, features or options in the system networks. However, linguistic items are also used to label the concepts in order that the system networks are elegantly displayed. This was found to be a necessary condition as a restricted corpus pertaining to the cohering lexical items within the chapters was used for the creation of networks.

5.3 Coding problems

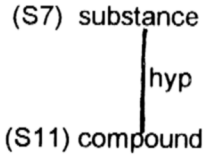
Several coding problems were encountered when textually provided clues point to either one possibility and whichever was chosen depended very much on the construal of my experiential meaning of the lexical items in question. The sections were inspected again many times in order to be more precise in ascribing a taxonomic relation. Neither answer may be termed right or wrong and the

relationships denoted are not conclusive. The following sectional analyses of the lexical strings illustrate the kinds of problems encountered.

5.3.1 The choice between two possible relationships

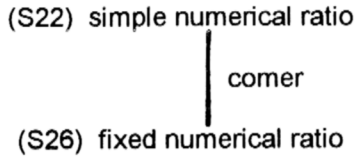
In the following example, a relationship of synonymy and hyponymy are both possible. Subtopics 2.1 to 2.7 are subtopics of the chapter on "Atoms and The Atomic Theory" and subtopics 10.1 to 10.10 are subtopics of the chapter on "Gases."

a. L5-subtopic 2.1



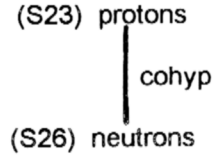
When the term compound is viewed as a subclass of the term substance, a semantic relationship of hyponymy is created between two lexical items. On the other hand, a compound and a substance may be used interchangeably to mean the same thing thereby deserving the semantic relationship of a synonymy. It was found that textually provided clues point to either one meaning. Since the rest of L5 is constructed of a repetition/hyponymy relation I decided to denote this semantic tie a hyponymy relation, for the purpose of not extending its complexity.

b. L10-subtopic 2.1



The lexical items "simple numerical ratio" and "fixed numerical ratio" are in a compositional relationship with lexical item "chemical formula" and therefore are related through a meronymy relation with it. At the same time, "simple numerical ratio" and "fixed numerical ratio" are also subclasses of numerical ratios and may be linked to it through a relationship of hyponymy. I decided to ascribe the semantic bond a relationship of comeronymy as the preceding part of the string is already constructed of a compositional relation of meronymy linking "chemical formula"(S13) with "simple numerical ratio"(S22).

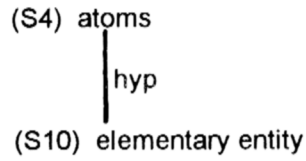
c. L5-subtopic 2.3



When the lexical items "protons" and "neutrons" are viewed as compositions of an atom, the semantic bond between them may be denoted a comeronymy relation. On the other hand, when they are viewed as subclasses of fundamental particles, the semantic bond between them may be denoted a cohyponymy relation. The preceding

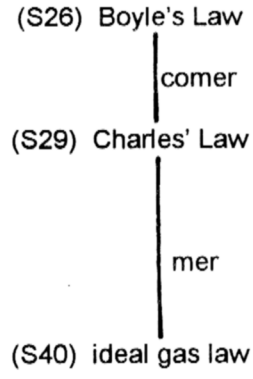
parts of the lexical string is constructed of repetition/cohyponymy relations and therefore I decided to encode a relationship of cohyponymy.

d. L1-subtopic 2.6



The lexical item "atoms" may be realised as a subclass of the general term "elementary entity" and yet "atoms" also appears to be realised as a synonymy of "elementary entity."

e. L1-subtopic 10.4



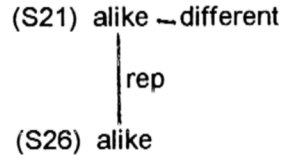
The lexical items "Boyle's Law" and "Charles' Law" are subclasses of the lexical item "general gas laws." From this view, Boyle's Law and Charles' Law are cohyponyms of general gas laws. Boyle's Law in combination with Charles' Law constitute what is known as the ideal gas law. From this view, Boyle's Law and Charles' Law are comeronyms of the ideal gas law. I favoured a comeronymy

relationship over a cohyponymy relationship to denote the bond between Boyle's Law and Charles' Law as a more important concept of ideal gas law is to be explicated from their combination.

5.3.2 The choice between two lexical items

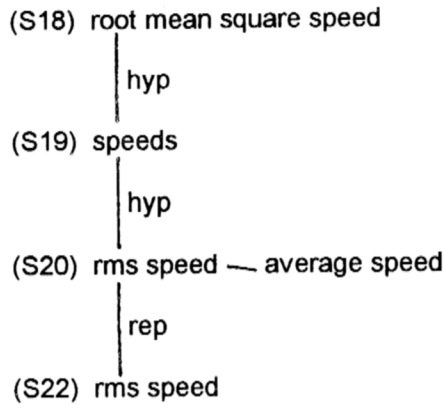
When a choice has to be made between two lexical items which may be coded onto the the lexical string, the decision I have undertaken pertains to what is of greater emphasis in the propositions involved. Although the lexical item which is not chosen is not assigned a meaning relation with any other lexical item, its presence in the text is still acknowledged by attaching it sideways to the coded lexical item. Since only downward explicating of lexical items are assigned semantic bonds, the lexical item attached to the coded lexical item is not considered for its exertion of a cohesive force in the text.

a. L14-subtopic 2.1



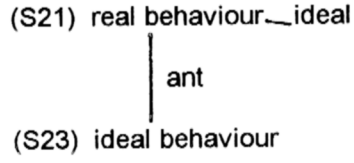
If the lexical item "different" had been coded, the semantic tie would have been one of antonymy. Since the emphasis is on the lexical item "alike" in the proposition, it was preferred to be coded onto the lexical string.

b. L14-subtopic 10.8



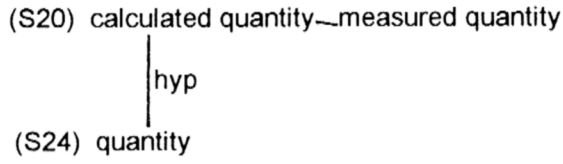
Both lexical items "rms speed" and "average speed" are subclasses of lexical item "speeds." "rms speed" is chosen to be coded over "average speed" so as to avoid the creation of a new lexical relation that of a cohyponymy relation between "average speed" and "rms speed." The complexity of the string is maintained at only two types of lexical relations that of repetition and hyponymy.

c. L17-subtopic 10.4



The lexical iterm "real behaviour" is coded onto the string forming an antonymy relation with "ideal behaviour" as the emphasis in the proposition is to distinguish between the two kinds of gas behaviours. Incidentally, the lexical item "ideal"(S21) is an instance of cohesion through ellipsis.

d. L9-subtopic 10.4



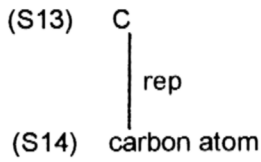
The lexical items "calculated quantity" and "measured quantity" are both subclasses of quantity. Either lexical item can be coded onto the lexical string and the relationship of hyponymy with lexical item "quantity" can still be maintained.

5.3.3 The lexical relationship between a symbol and a lexical item

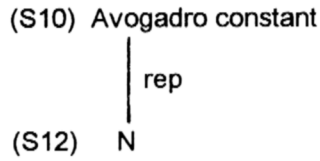
Symbols figure very much in the expression of content in chemistry texts in general and the chapters analysed are no exception. Symbols are of equal status as any of the lexical items in expressing meaning. When the symbol is used interchangeably with a lexical item giving the impression that it represents the lexical item, I decided to assign a repetition relation for the semantic bond formed. When the symbol is used with identical connotations with the lexical item, I decided to assign a synonymy relationship for the semantic bond formed.

Here are some examples to illustrate.

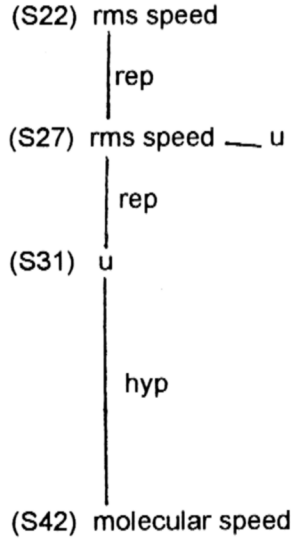
a. L4-subtopic 2.5



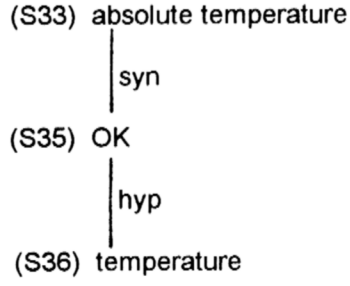
b. L6-subtopic 2.6



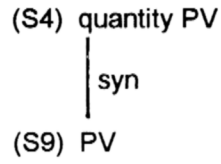
c. L14-subtopic 10.8



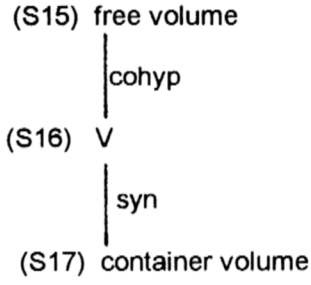
d. L8-subtopic 10.4



e. L11-subtopic 10.10



f. L4-subtopic 10.10



5.4 Similarities and contrasts of findings with those of other researchers

The present study of a systemic-semantic analysis of lexical items cannot achieve its desired objectives if it is based on an already established lexical profile. Roe's (1977) study is an example of an early attempt at generating lexical profiles of common vocabulary items used in particular areas of scientific inquiry. These specialised lexis which have been sorted out with the aid of a computer are presented in alphabetical order, are assigned frequency counts and are categorised according to their sources. One of the possible applications of the study Roe gives is in familiarising teachers and learners with typical vocabulary of their subject specialisation. However, Roe cautions us that in the absence of a context in the listing of lexical items, problems of ambiguity may result.

Should such a lexical profile be available for chemistry, its use would be greatly limited to the recognition of familiar vocabulary items or the introduction of new ones and at most project their contextual range. The lexical items do not reveal how a cohesive force is exerted in a piece of written discourse and also do not reveal whether their distribution are along the syntagmatic or paradigmatic dimension.

In my study, I explicated the text for its lexical organisation and discovered that lexical items may be discernible in terms of the semantic fields they espouse. These semantic fields convey a very different meaning from a lexical profile. While a lexical profile is a listing of lexical items found in a particular subject area such as electricity or magneticism, a semantic field is an embodiment of a certain concept or idea in chemistry such as "the mole concept" or the "kinetic-molecular theory concept."

Phillips (1989) studied lexical patterns within the chapter and presents some of his analyses as dendograms. Dendograms are clusters of lexical items which reflect the conceptual content of the text. They are networks which have one common nuclear node and several other nodes which relate to their corresponding lemma of the text. While Phillips acknowledges Halliday's ideas of the need to view lexis as a level distinct from grammar, his study appears to be independent of a Hallidayan model of language. He has approached lexis in terms

of eliminating all closed class items in the text and lemmatising whatever remaining lexical items. Lemmatising here carries the meaning of considering only the base form of the lexical item. Our approaches differ in the establishment of what would constitute a lexical item in the analysis of the text for its lexical organisation. As I was primarily concerned with the concept of cohesion and was analysing how units of meaning were related to each other, I didn't restrict myself to only single lexical items but also considered phrases as lexical items. My study was in organising the lexis of the texts based on the semantic interpretations of cohering lexical items whereas Phillips' main thrust seems to be in providing semantic interpretations for lexical patterning discovered in the text.

Parson (1990) shares a similar concept using a Hallidayan linguistic model in the study of cohesion. Our point of difference lies in the theoretical construct used, methodology followed and objectives of the research. I used the construct outline by Martin (1981, 1989 & 1992) in analysing the cohesive properties of the texts whereas Parson used Hasan's (1980 & 1984) analytical framework in his research in linking overall writing quality to the quantity of cohesive devices. The texts were judged for their degree of organisation based on the degree of coherence displayed. Hasan's analytical framework involved lexical rendering and chain interaction whereas Martin's

framework involved taxonomic analyses and downward branching in the creation of lexical strings.

5.5 Lexical cohesion and lexical coherence

I chose a Hallidayan theoretical construct for its well established practice as an analytical tool in the study of the cohesive properties of texts. My findings substantiate Halliday and Hasan's (1976 : 23) position that

> "A text is a passage of discourse which is coherent in these two regards: it is coherent with respect to the context of situation, and therefore consistent in register; and it is coherent with respect to itself, and therefore cohesive."

and Hasan's (1984 p192) position that

> "... the interpretation of the cohesive device is not accessible to those who lack information regarding the immediate context of situation ... a cohesive device lacking endophoric source of explication is as opaque in the absence of the knowledge of the text's environment as is an ambiguous cohesive tie whose ambiguity cannot be resolved by reference to the co-text."

We cannot recognise a cohesive device if we don't find the text coherent or lack domain knowledge (knowledge of the subject) in making inferences about word meanings. There may not always be instances of overtly explict cohesive signals suggesting the presence of a tie. The very nature of an exploration into the contextually-bound lexical items' meaning relations and the retrieval of the paradigmatic distribution of lexical items requires the labour and personalised involvement of a human being and at this point in time lacks a computer software which could possibly take over the task of looking

at the text this way. How two lexical items cohere and what meaning relation is conjured is very much dependent on our construal of what ideational meanings they express.

5.6 Conclusion

This chapter has summed up the findings of the study of lexical cohesion in the light of systemic-semantic theory.