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Structure Strategy Use in Children's Comprehension of Expository Texts.

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Abstract

This study reviewed a body of literature largely written between the mid 1970s and 1990s that was concerned with the rhetorical structure of written expository text and its relationship to memory and comprehension. This dissertation follows from an argument that the earlier research often confused memory and comprehension and that it was limited in its attempt to clarify the relationship between text structure and reading comprehension. The current study sought to provide a fuller description of the manner in which schoolchildren of different ages and abilities employ rhetorical structure in the comprehension process. In contrast to the earlier research this study makes a distinction between the top-level structure of a text and the structure of the reader's meaning. It sought to discover what, if any, was the relationship between the structure of the reader's comprehension and the top-level structure of the text, the educational stage of the reader, and the reading comprehension ability of the reader.

A sample of 229 schoolchildren from Years 5, 7, and 9, and further subdivided by reading ability, was given a task of reading three passages and carrying out an underlining task to identify the seven sentences in each passage that best captured the its overall meaning. The three passages employed were natural passages of text, each approximately 700 words in length, and each with a different top-level structure. Minor adjustments were made in respect of vocabulary and sentence length to match the different age groups within the sample. Each participant's sentence selections were analysed for a collective structure in an effort to discover any structure employed by the reader in constructing the meaning of the respective text. The effectiveness of structure usage was measured by the degree of coherence captured by the sentence selections.

As might be expected, good readers and older children generally performed the task more successfully and effectively than poorer and younger readers. The results indicated, contrary to a common assumption of the earlier research, that the structures employed by the participants reflected two different and distinct categories: content structures which selected information based on association and rhetorical structures based on logical argument. It was subsequently considered that semantic information might be relatively more influential in using content structure whereas syntax might play the more significant role in the use of rhetorical structure.   The more able readers generally maximised coherence by combining rhetorical and content structures in the construction of meaning except where a passage was limited to description only. There was a complex relationship between the structure of the text and the structure of the reader's meaning that reflected a constructivist explanation of reading comprehension. It was found that whilst many children of all ages and ability had a capacity to recognise the various content and rhetorical structures regardless of their relative complexity, that effective use was related to practice. Other factors that might complicate structure strategy use in reading comprehension were identified.

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I certify that this thesis does not, to the best of my knowledge and belief:

(i)   incorporate without acknowledgment any material previously submitted for a

degree or diploma in any institution of higher education;

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where due reference is made in the text of this thesis; or,

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Acknowledgements

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Structure strategy use in children's comprehension of expository texts.

1. Introduction

In a period commencing in the mid 1970s there developed a distinctive body of research concerned with the part that the organisational structure of expository text might play in its subsequent recall. The research revealed that a competent reader or listener employed the organisational structure of the text to identify the important elements and that these elements were more likely to be remembered. This finding complemented and contrasted with traditional research on memory for words and phrases that had focused on such factors as serial position, i.e., recency and primacy, and association by common theme or topic. Arising from this important finding, subsequent related research explored the ability of children at different ages to identify the organisational structure of expository text, the merits of instructing children in the use of organisational structure, and the relative effects of age and reading ability on the capacity to employ structure. On the basis of findings predominantly based on the ability to recall important information in text along with the ability to recognise such structure, many of these studies concluded that there was a relationship between the identification and employment of organisational structure and reading comprehension skill. This study questions the justification for such a conclusion or inference from the earlier research and attempts to find new evidence of a relationship between the comprehension of expository text and the use of organisational structure among middle-school children.

The body of research previously referred to, whilst innovative at the time, can nevertheless find its origins in the early psychological research of Henderson (1903), Thorndike (1917) and Bartlett (1932). It also borrowed ideas on prose structure emanating from the later developing field of linguistics (Chomsky, 1966; Fillmore,

1968; Grimes, 1975; Halliday, 1967; van Dijk, 1972).   A number of other important theoretical influences played a role in the emergence of research on text structure including epistemological theories embracing structuralism and post-structural theories of meaning construction. Schema theory was an important thread within mainstream psychological theory connecting early research about reading to later research concerned with the manner in which structure plays a role in text comprehension. These combined influences emphasised the importance of coherence to the comprehension of text. Coherence might be considered to be the important common concept linking the various disciplinary influences and it will be a key concept in this study.

Researchers in the fields of linguistics and discourse processing generated sophisticated methods of analysing the structure of written text. These methods of analysis provided the tools for psychologists interested in the part that text structure plays in comprehension. They resulted in a significant corpus of material being produced during the 1970s and 1980s by Bonnie Meyer and her various associates (Meyer, 1975, 1977, 1985; Meyer, Brandt, & Bluth, 1980; Meyer & Freedle, 1984; Meyer & McConkie, 1973) and others (Bartlett, 1978; Englert & Hiebert, 1984; Englert, Stewart, & Hiebert, 1988; Horowitz, 1982; Slater, Graves, & Piche, 1985; Taylor, 1980; Taylor & Beach, 1982, 1984; Taylor & Samuels, 1983) that merged with the available knowledge about text structure in related disciplines and focused on the implications of the organisational structure of expository texts for recall and reading comprehension. This research generally focused in the first instance on the influence of text structure on a reader's recall and from these data drew conclusions about comprehension in a similar way to the early researchers such as Bartlett (1932). This study explores the reliability and validity of some of these conclusions. One of

the main reasons to question conclusions about comprehension skill is that there was no explanation in any of these studies as to how comprehension ought to be assessed. There were other significant limitations in this body of research including failure to distinguish the organisation of the text from the organisation of the reader's understanding, inconsistency and confusion in the conceptual terminology, and inconsistent methodology. All of these difficulties limited its ability to shed light on processes of reading comprehension.

The current study will address some of these limitations in order to gain a better impression of the manner by which school children develop awareness of text structure and how they apply it in the process of comprehension in order to achieve a coherent understanding of natural expository texts. It will be necessary, in the first instance, to address some of the key theoretical questions surrounding the topic. To what extent is the employment of structure strategy in reading comprehension an example of schema theory in action? Is there a difference between the structure of a text and the structure of the reader's understanding of the text? Should the latter be considered to be a cognitive structure? Should we distinguish, and how do we distinguish, between the cohesive characteristics of written text and the coherence of the reader's meaning? What is the relationship between them? How should they be observed? The answers to these questions will provide the epistemological and theoretical context for the current study.

Chapter 2 Summary

This chapter explores the theoretical and epistemological background to the field of research into structure strategy. Two important aspects of the very early reading research are emphasised, viz, the active role of the reader in constructing meaning and the recognition that the relationships between parts of the text facilitate the construction of meaning. The emergence of structuralism and its application in the emerging field of linguistics provided the essential epistemology for later research into the reader's active role in comprehension and paved the way for post structural epistemologies such as constructivism emphasised in the current study. The chapter explores the need for a balance between the positivist extremes of behaviourism and radical constructivism in the form of a phenomenological approach. Schema theory is explored as a means of understanding the comprehension process. The chapter explores the nature of structural schemata and how they are constructed and challenges the traditional use of recall data as a link between structural schemata and comprehension. Finally, the chapter explores the relationship between structure and coherence and considers how mental models have been established as a method of construction of text macrostructure. It is argued that structure strategy is a type of mental modelling used to establish a macrostructure which is synonymous with coherence.

2. The Theoretical Context

The Reading Process

It is arguable that the most significant and challenging subject of research for psychologists has been, and continues to be, that of the reading process and how humans learn to read, read to learn, and learn to read to learn. The processes involved in reading a passage of printed text are numerous and complex, not simply complex in their individuality but complex in their interconnectedness. Consider that the reader first needs to perceive the visual stimuli, encode the stimuli and demonstrate phonological skills to match the visual stimuli with oral language, apply syntactic rules and semantic understanding, relate the surface level text information to existing knowledge of both subject and text structure in long-term memory, and generate inferences to integrate the text into a coherent whole, before finally arriving at a global representation of the meaning of the text. These processes do not include the complicating influences on the reader's task of reading purpose, the reader's level of domain knowledge, and the social context within which the reading takes place. All of these processes must be carried out more-or-less concurrently. It is not surprising therefore that LaBerge and Samuels (1974) considered any attempt to develop a complete theory of reading as equivalent to attempting to come up with a theory of how people think. The present study is consequently limited and concerns itself only with the final aspect of the process described, i.e., the construction of a coherent understanding of extended passages of expository text.

Not surprisingly, over the years there has been concern about the need to control so many variables in addition to the one being observed when studying any one aspect of the reading process. External validity has been largely sacrificed in the name of internal validity. Attempts to impose tight controls tended to result in

difficulties relating to the generalisability of any conclusions. It will be argued that a less tightly controlled study can produce results that have greater external validity and are, consequently, potentially more useful. This is not to dismiss the importance of internal validity. However, it is considered that research into the role of structure strategy in reading comprehension is still in the exploratory stages. Consequently, the primary research task is one of observation and inductive reasoning. The time to be more intensely concerned with internal validity is later when a clearer theoretical picture has emerged.

Early Reading Research in the Field of Psychology

The history of research in reading has been inconsistent and fragmented and has crossed several disciplinary borders including linguistics, anthropology, computer science, educational research and practice, discourse theory, and psychology. The earliest research with implications for reading within the field of psychology is almost as old as the discipline itself. It was generally focused on the physiological psychology of the reading process and, in particular, the role of perception (Cattell, 1886). The first half of the 20th century saw the rise in pre-eminence and the eventual dominance of a behaviourist epistemology across the field of psychology with an exclusive focus on the observable world external to the individual. This reflected the dominance of positivism among western scientists in the early twentieth century. During these years the processes of the human mind, including the cognitive processes involved in reading comprehension, were condemned as mentalism and considered to be an inappropriate topic of research. Consequently, there was limited research activity into the psychology of reading comprehension in the first half of the 20th century.

During those early years there was, nevertheless, some limited but important research that provided a foundation for subsequent research in reading comprehension to be carried out in the latter half of the twentieth century. Thorndike (1917) conducted several studies that examined the processes involved in arriving at meaning from sentences and paragraphs of written text. An important conclusion from his research was that the role of the reader is not a passive one, simply recording the knowledge contained exclusively in the text, but that of an active participator or problem solver. Thorndike concluded that:

> In educational theory, then, we should not consider the reading of a text-book or reference as a mechanical or passive, undiscriminating task, on a totally different level from the task of evaluating or using what is read. While the work of judging and applying doubtless demands a more elaborate and inventive organisation and control of mental connections, the demands of mere reading are also for the active selection which is typical of thought. It is not a small or unworthy task to learn "what the book says". (Thorndike, 1917a, p.332)

This was an early indicator of the potential importance of distinguishing between the informational structure of the text and the cognitive structure of the reader's understanding. It is of particular relevance for the current study that Thorndike referred specifically to the reading of expository texts to the exclusion of alternative forms of text including narrative.

Henderson (1903) and Bartlett (1932) were interested in the role of the organisation of memory and prior knowledge of narrative and expository written texts. Henderson was an educational psychologist with an interest in assessment. He

believed that a student's recall was the best indication of learning and carried out research into the individual's ability to recall written text. He conducted a number of experiments with students ranging from primary school to university students, studying their capacity to recall short passages of text, both narrative and expository. He employed texts of between 125 and 180 words in length and allowed students a limited amount of time to read and re-read them before having them write a free recall. He subsequently assessed delayed recall. Henderson adopted a scoring protocol that recognised the reader's recall of topics, subtopics, details and words from the original text. Henderson found that related elements in the text increased the likelihood of their recall, that such recall was a reduced or simplified form of the original, and that the recall reflected a reconstruction of the original text base influenced by the reader's previous knowledge and experience. This method came to be used extensively in contemporary research in relation to the role of text organisation in reading comprehension. The use of recall data was to become the dominant method in the study of text structure and text comprehension. This study raises questions about the validity of conclusions about comprehension skill arising from such methods and consequent data.

Bartlett (1932) was the first to coin the term 'schema' to reflect the idea that the reader imposes structure on text that captures the relationships between the ideas contained in the text. Such structure was found to improve memory for the ideas contained in the text. This paved the way for the development of schema theory which, years later, was to carry important implications for the understanding of reading comprehension.

The current study has its origins in these two important ideas resulting from this early research, i.e., that the reader is active in constructing meaning and that the

structure or pattern of relations between the ideas in the text facilitates the construction of meaning.

Early structuralist theories

A renewed emphasis on the active role of the reader and the role of structure in the comprehension of text in recent decades was related to a change in the dominant epistemology adopted by researchers within the field of psychology. The epistemology of late 20th century reading comprehension research that looked at the role of text structure can be traced back to the structuralist ideas of the late 19th century. Ferdinand de Saussure is considered to be the founding father of structuralism and shared with contemporaries, such as Freud, a desire for structural explanation. De Saussure was interested in developing a structural explanation of language in contrast to the historical approach that had been the traditional approach of the time. De Saussure emphasised the study of the language system as opposed to particular examples of speech and sought to identify 'deep structures' within language. He believed that the whole, i.e., language, is more than the sum of its parts, i.e., words, and so the spoken word relied on the underlying rules or 'deep structure' of language. However, De Saussure was interested only in the internal linguistic system and its infrastructure to the exclusion of meaning.

De Saussure's ideas about structure were embraced by Chomsky (1957, 1967, 1968) in the rapidly emerging discipline of linguistics. Chomsky dragged linguistics out of the behaviourist paradigm that dominated his discipline and at the same time brought a change of focus to linguistics from grammar to spoken language. He brought linguistics closer to dealing with the meaning of text which previously had not been the case. For Chomsky the most important reason for being interested in the scientific study of language was its contribution to our understanding of mental

processes (Lyons, 1971). Chomsky believed that language is determined by the structure of the human mind – that people have an innate capacity for grammar and that this is an innate capacity of the human mind. Evident in his thesis were the philosophical ideas of Kant that would have been unacceptable within a behaviourist paradigm. Whilst this might suggest an exclusively rationalist orientation, it was not the case that research in the area of reading comprehension had abandoned empirical enquiry, and in this respect reflected Kant's philosophical reconciliation of European rationalism and British empiricism.

Theoretical relationships to the current study

The early research emphasised some important aspects of reading comprehension that are particularly relevant to the current study. The idea of the reader's active role in constructing meaning has a long history going back to Thorndike. The part that structure plays in this process of meaning construction was also documented from an early stage and the foundations laid for schema theory. However, in common with the research conducted later in the century, memory studies were the typical vehicle for such research. This may, at least to some extent, have been due to psychology's difficulties with the idea of observing thinking processes during the years dominated by behaviourism. At the same time, the strong influence of linguistics may explain why so much of the research in the 1970s and 1980s was focused on the structure of the text and generally failed to distinguish the structure of the reader's understanding, treating them as synonymous.

This study is concerned with the employment of structure in the process of reading comprehension and how strategies utilising structure develop and are employed by young readers. In doing so, the study emphasises a distinction between the writer's structure contained within the written text and the cognitive structure

constructed in the mind of the reader. It addresses differences between memory based theories of comprehension and constructionist accounts of comprehension. In adopting a constructionist approach it explores the influence of schema theory on our understanding of text comprehension and it ultimately focuses on the role of rhetorical structure in reading comprehension.

Structure and Comprehension

Thorndike's (1971a) argument in relation to the active role of the reader in the reading comprehension process foreshadowed a key point of debate across a number of disciplines in the latter half of the 20th century in relation to the interpretation of texts. Even before the rise in popularity of the post-structural constructivist epistemology, the notion of the reader (or learner, or observer) as an active participant in the construction of knowledge was challenging the dominant behaviourist epistemology. Piaget held a dynamic view of learning whereby the child constructs his or her experience into knowledge structures or cognitive schemas that capture the relations between one thing and another. These structures are subsequently employed by the child to interpret new experiences which may lead to adjustment to such structures. Piaget believed that the earlier research confirmed the belief that knowledge does not result from a mere recording of observations but includes a structuring activity on the part of the child/ person. Piaget, in contrast to the behaviourists, considered that humans do not merely act as passive receptors of external experience but are cognitively active in interpreting their experience and in so doing develop internal cognitive structures that subsequently facilitate the construction of meaning.

Phillips (1995) described a polemical contrast between the behaviourist conception of reading and that of the radical constructivist as a distinction between

'nature the instructor' and 'humans the creator'. The distinction here relates to whether meaning derives entirely from the external stimuli, e.g., the text, with the reader in a passive role, or from the mind of the reader actively imposing meaning on the text. Chandler (1995) identified the same distinction in less polemical terms. He presented a continuum anchored at one end as 'objectivist' where the meaning is considered to reside entirely in the text and the reader as entirely, or almost entirely, passive; and the other end of the continuum as 'subjectivist' where the meaning is considered to reside entirely in the re-created, active interpretation of the reader. Somewhere in between lies the 'constructivist' for whom the meaning of the text rests in an interplay between the text (as intended by the writer) and the reader (interpretation) resulting from a 'negotiation'. This study is carried out from the latter perspective and explores the nature of the negotiation. One way of understanding this negotiation is through the application of schema theory.

Constructivism and schema theory

Sir Frederick Bartlett (1932) conducted a similar study to Henderson's (1903) using the same method and reached the same conclusions. Bartlett coined the term 'schema' to describe the persistent structure of recall which he defined as "an active organisation of past reactions, or of past experiences" (p.201). Bartlett emphasised the construction process involved in recall and the important part played by the reader's schemata. This suggested a top-down approach to recall described by Bartlett in relation to a reader in the following terms: "In all ordinary instances he has an overmastering tendency simply to get a general impression of the whole; and, on the basis of this, he constructs the probable detail" (1932, p.206).

Although Bartlett has been credited with introducing us to the concept of a schema, the idea had its origins in the earlier work of the Gestalt psychologists. In

contrast to the dominant behaviourist paradigm, the Gestalt psychologists believed that learning involves responding to meanings in the form of intellectual connections in the mind of the reader, thereby putting insight at the heart of learning rather than reinforcement. The Gestalt psychologist was concerned with the observation and recognition of pattern. The present study is similarly concerned with how the reader learns and constructs patterns.

Rumelhart (1980) described two different processes whereby schemata can be activated that he referred to as conceptual-driven processing and data-driven processing. Conceptual-driven processing he described as a top-down activity whereby the schema facilitates comprehension through the expectations it creates revealing sub schemata. Data-driven processing, on the other hand, is a bottom-up activity whereby sub schemata activate a higher order schema. This top-down versus bottom-up distinction in relation to schemata could be put more simply by distinguishing between the extent to which a schema facilitates comprehension of the text topic in a top-down process through expectation as described, and the extent to which information contained in the text assists in the identification and construction of the schema in the first place.

The radical constructivist approach to reading comprehension assumes that the reader is active and analytic, and that the process of construction is a top-down effortful process made easier by the use of schemata which reduce the cognitive demands of comprehension (Graesser, Singer, & Trabasso, 1994). At the same time there is a well respected alternative approach called memory-based processing that views reading comprehension as a relatively passive, bottom-up process (McKoon & Ratcliff, 1998). However, these two approaches may not be mutually exclusive. van

den Boek, Rapp and Kendeou (2005) argued that both approaches are essential to reading comprehension:

> …memory-based processes provide the input to the constructionist processes, and the product from the constructionist processes determines whether the memory-based input is sufficient for comprehension. The standards of coherence that a reader has in a particular reading situation provide constraints, in addition to those provided by textual information and background knowledge. (p.304).

Definition of 'schema'

The field of information technology and the search to write programmes for computers that might replicate human thought processes led later researchers to take a renewed interest in Bartlett's (1932) original conception of a 'schema'. A number of different terms were employed with the same concept in mind e.g., Minsky (1975) employed the term 'frames'. Schemata have been described as ways of storing facts that cohere together in a higher-order categorical unit (Anderson, 2000). Such a definition of a schema focused on the structure of memory in a manner consistent with that of Bartlett (1932). Anderson described the process whereby a schema might be applied to reading: "schemas represent categorical knowledge according to a *slot* structure, where slots specify values that members of a category have on various attributes" (2000, p.155) (author's own italics). This popular, if simplistic, description of the application of a schema implies a simple process of correspondence between the 'slot' structure generated in the mind of the reader by the schema and the information contained in the text. It is an idea drawn from the field of information technology (Minsky, 1975).

Rumelhart (1980) developed a psychological theory of the mental representation of complex knowledge from the work of Minsky. His definition of a schema went beyond the foregoing with its popular emphasis on encoding and storage and included the productive function of a schema. Rumelhart likened a schema to a theory of knowledge, both in "how knowledge is represented and about the *use* (author's italics) of the knowledge in particular ways" (1980, p.34). He postulated that "the central function of schemata is in the construction of an interpretation of an event, object, or situation – that is, in the process of comprehension" (Rumelhart, 1980, p.37).

Theoretical origins of schema theory

Although, within the field of psychology, the theoretical notion of a schema has its origins in Gestalt psychology, the notion that there exist such psychological constructs whereby humans hold categorising impressions for the purpose of understanding a class of phenomena goes back to Kant. In the 18th century Kant argued that the mind imposes form or order on sensory information and that we cannot know 'things-in-themselves'. Kant proposed that the human mind imposes principles and categories on the objects of experience and this begged the question as to what it is in the human mind that provides the templates for such organisation. An intense debate between Piaget and Chomsky had the former arguing that cognitive structures originated from a developmental learning process and the latter arguing for an innate quality to basic cognitive structures. In the latter regard, Chomsky's argument was more consistent with that of Kant. The literature in relation to the use of structure in reading comprehension strongly suggests a developmental and/or learning process and is an expectation of this study.

In the early years of psychological research, Henderson (1903) and Bartlett (1932) reflected the Kantian epistemology in their work on memory. Bartlett adopted the word 'schema' to describe the "active organisation of past reactions, or past experience" (1932, p.201). However, Bartlett never offered an explanation of how this process occurs. Gestalt psychology was premised on the wider application of the idea of human psychological ability to impose structure on human experience. Gestalt psychologists took the view that the function of the human mind is to recognise or project structures. Arguably the greatest contemporary psychologist to adopt such an idea of the use of cognitive structure at the heart of his theoretical orientation was Piaget. He held that all human experience is mediated by categories learned through interaction with the environment.

In his analysis of Piaget's views on structure, Phillips (1987) pointed out the need to discriminate between the structure of some part of the world, which for the purposes of this study could be a written text, and the structure of the psychological entity with which it is understood.   The logical implication of this distinction is that such structures (physical and psychological) may not be the same thing, but in fact may be significantly different. In this respect Phillips' distinction between the structure of the text and the structure of the reader's mental representation reflected a similar distinction implied earlier by Bartlett (1932).

Graesser, Singer and Trabasso (1994) went beyond this dichotomous distinction between the material and psychological and distinguished between three aspects of comprehension that they argued needed to be in harmony for good comprehension: the author's intended meaning; the explicit text; and, the constructed meaning in the mind of the reader. Much of the research examining the role of text structure in reading comprehension has failed to distinguish between these three

aspects. This has been evident in the use of free recall data to assess the reader's skill since it implies that the acid test of comprehension is the ability to reproduce the written text itself. However, it has been discovered that some children with a good capacity for decoding written text nevertheless have little competency in comprehending the text (Leach, Scarborough, & Rescorla, 2003). Arguably, such children would, potentially, be capable of recalling a text despite the lack of comprehension, in which case the quality of the recall tells us nothing of the child's comprehension. This provides justification for Phillips' (1987) caution against confusing the individual's memory with the content structure of the text.

The present study rests on the assumption that structural schemata when utilised by a reader are cognitive constructs and ought to be distinguished from text structure. Consequently, it adopts a critical view of previous studies that have explored meaning construction on the basis of data obtained using pure memory tasks.

Schema theory and reading comprehension

Following its popular resurgence in the field of information technology, schema theory was subsequently embraced by reading researchers (Adams & Collins, 1977; Anderson 1977, 1978; Mandler & Johnson 1977; Rumelhart 1975). The opening paragraph of the current dissertation described the range of lower and higher order processes required to read and understand a passage of text. Schema theory offers a useful tool at any level of processing. Adams and Collins (1977) argued that schemata are flexible enough to "provide a structure powerful enough to support the interactions among different levels of processing in reading" but added that, "The goal of schema theory is to specify how the reader's knowledge interacts and shapes the information on the page and to specify how that knowledge must be organized to support the interaction " (p.4-5), emphasising the interaction between the structure of

the text and the structuring process going on in the mind of the reader as well as the difference between the two.

Adams and Collins (1977) acknowledged that no single schema can embrace all of the elements in the majority of texts. They described a text as prompting a number of schemata that are connected in a hierarchical manner starting with a top-level or super ordinate schema that embraces the topic of the text at its most general level before giving way to subordinate schemata. In this respect it is worth reflecting on Henderson's (1903) scoring protocol that implicitly acknowledged such a hierarchy of ideas within a text. At the same time, Adams and Collins (1977) proposed that the reader would work in both directions in the hierarchy simultaneously, from subordinate upwards and from superordinate downwards. It is important in this respect to recognise an assumption specified by Adams and Collins that schemata "exist at all levels of abstraction" (1979, p13). In other words schema theory operates at the level of decoding as well as comprehension. From this perspective a schema driven constructionist account of the reading process need not be restricted to a top-down process as held by the radical constructivist.

Rumelhart and Ortony (1977) considered schemata to be fundamental to reading comprehension. The manner in which they described the application of schemata to the comprehension process in the following paragraph appears to emphasise the conceptually driven aspect:

> Comprehension can be considered to consist of selecting schemata and variable bindings that will account for the material to be comprehended, and then verifying that those schemata do indeed account for it …

The process of comprehension can be regarded rather like the process a

scientist goes through in testing a theory; evidence is sought which either

tends to confirm it, or which leads to its rejection. (1977, p. 111-112).

Rumelhart and Ortony (1977) recognised the imperative for multiple schemata

when reading a text and described such schemata as embedded one within the other,

labelling them as sub-schemata and dominating schemata respectively. The advantage

of the embedded organisation of schemata is that it affords an explanation as to how

the text content can be understood at different levels.

There are two categories of schema that carry implications for the ways in

which schema theory might be applied to reading comprehension. The most common

type of schema explored in the literature on schema theory relates to topic knowledge

and will be referred to as content schemata. Although the literature on schema theory

generally focuses on the reader's knowledge of a topic and how it contributes to

content schemata, schemata can equally be based on the reader's discourse knowledge

about particular forms or organisational structures of a text, i.e., structural or

rhetorical schemata (Ohlhausen & Roller, 1988). Such rhetorical schemata have been

identified in fairy tales (Mandler, 1984; Stein & Glenn, 1979) and narratives (Bower

& Morrow, 1990).

Distinguishing cognitive schemata and text structure

Whilst it is argued that content schemata can only exist as cognitive entities

insofar as they are memory structures representing related groups of generic concepts,

the question is less clear in relation to structural schemata. The primary role of

structural schemata is to assist in achieving a coherent representation of the meaning

of the text as a whole.   Such coherence will clearly be much more easily achieved

when the text itself has a distinctive structure. This begs the question to what extent structural schemata are aspects of the text or aspects of the reader's interpretation.

There has been considerable debate within the literature regarding the cognitive status of coherence relations depicted by structural schemata. Some argued that such structural schemata are simply tools and are not cognitive entities (Grosz & Sidner, 1986) whereas others argued that they are more than mere tools and that these relations are indeed cognitive entities (Hobbs, 1985; Mann & Thompson, 1986; Sanders, Spooren & Noordman, 1992).

If a schema theoretical approach to reading comprehension is accepted then there needs to be a clear distinction, as previously indicated and emphasised by Phillips (1987), between the structure of the text and the structure of the representation in the mind of the reader. However, the reader needs to select an initial schema and presumably does this on the basis of information contained in the text. In this respect a radical constructivist position of totally subjective interpretation is avoided and the moderate constructivist view of a negotiated meaning achieved. This position also embraces and validates the simultaneous bottom-up and top-down process described by Adams and Collins (1977).

Among the criticisms of Piaget is one highlighting Piaget's tendency to confuse different orders of relationships, such as spatial, conceptual, and psychological (Phillips, 1987, p.154). In relation to the use of schemata in reading comprehension, a similar mistake could lead to confusion between the structure of the text and the cognitive structure representing the reader's interpretation of the text. To treat the two automatically as the same would lead to the assumption that the reader is a passive recipient, in the same manner as the behaviourists, of the information contained in the text. If it is accepted, and it is an assumption of this study, that the

reader is indeed an active participant in the construction of meaning, then it must equally be assumed that the structure of the text and the structure of the reader's interpretation are not necessarily the same. Phillips (1987) saw this distinction as one between the subjective world of the mind and the objective world of knowledge.

It has been argued that an individual's recall reflects the individual's internal subjective cognitive structure, however, the way such internal structure is organised and how it is expressed. e.g., as a written recall, are not necessarily identical. As Phillips (1987) pointed out:

> How these individuals structure or organise their
>
> public…pronouncements is altogether a different kettle of fish –
>
> it is determined by contemporary literary tastes, by the rules and
>
> standards of their peers in the scientific community… and by the
>
> level of understanding they regard their intended audience as
>
> possessing. (p.140)

This has implications for those studies that sought to reach conclusions about reading comprehension from written recall (Horowitz, 1982; Taylor, 1982; Taylor & Samuels, 1983).

Implications for recall

In the context of reading comprehension, the important point being made by Phillips is that any invitation to readers to recall what they have read will introduce new variables qualifying the response and not guarantee that readers will convey their subjective interpretation at all. This has implications for the use of recall which has become a favoured method in research involving reading comprehension.

Memory has played a central part in the research into both schema theory and reading comprehension. Anderson and Pearson (1984) emphasised the part that a

schema plays in establishing what might be considered the important ideas in a text. They argued that the application of a schema ought to result in more attention being placed on what is considered by the reader to be the most important information within the text as defined by the schema employed and, consequently, better recalled. If then a researcher is interested to discover what sort of schema has been employed by the reader, then the particular choice of information selected by the reader ought to reflect that schema, and by a process of extrapolation, such a schema might be reconstituted. The current study intends to demonstrate how this might be carried out. However, it would be essential for such a process to be based not on the reader's recall and the unjustifiable assumption that it is necessarily the most important simply because it has been recalled. Would it not be much simpler to ask the reader to select the most important information from the text? This was the approach taken by Ohlhausen and Roller (1988).

The one thing shared consistently by Gestalt psychologists, psychologists in the tradition of Piaget, schema theorists, and contemporary reading researchers is that the reader is actively involved in the discovery of relationships within the text. There is also broad agreement within the literature about the sorts of conceptual relationships that exist in texts and how they might be identified. The challenging question is how one discovers the cognitive schemata employed by the reader, i.e., the psychological process whereby the reader converts the conceptual relationships in the text into a coherent understanding of the text. What should be clear is that methods premised on recall are an unreliable guide to the way in which the reader constructs meaning. The primary purpose of structure in text is not to aid memory, although this may occur, but rather to facilitate coherence in the mind of the reader.

Structure and Coherence

The purpose of the reader in seeking to discover relationships between the various parts of a text is to achieve coherence. The meaning of an extended piece of written text, whilst embracing semantics, necessarily goes beyond semantics if it is accepted that the meaning of a text is much more than the sum of the meaning of individual words and sentences. Coherence is concerned with the meaningful relationships between the parts of the text that give it its meaning as a whole and these parts may be quite separate from each other within the text.

The nature of coherence

There is much confusion in the terminology used to explore and apply the concept of 'coherence' (Knott & Dale, 1994). Much of the literature attempting to make sense of the concept of coherence refers to the classic text by Halliday and Hasan (1976) that treated coherence as synonymous with cohesion.   Halliday and Hasan focused exclusively on the text as opposed to the reader and paid particular attention to cohesion at the local level. Given that they were writing in the field of linguistics this should be no surprise. However, Hellman (1995) considered that Halliday and Hasan (1976) were guilty of contributing to the confusion in the terminology by failing to distinguish cohesion and coherence. The confusion between these two concepts is apparent across much of the literature (Hellman, 1995; Sanders, Spooren, & Noordman, 1992). Other areas of confusion relate to the distinction between coherence relations and coherence structure (Hellman 1995; Hobbs 1985), ontological concerns, i.e., whether coherence is a property of a text or a psychological property of the reader (Knott & Dale, 1994; Sanders et al., 1992), and whether coherence emanates from a bottom-up approach to comprehension or

facilitates a top-down approach to comprehension.   Some of these points have been addressed to some extent already.

As stated already, Halliday and Hasan (1976) referred only to cohesion and treated it as embracing what subsequent writers have distinguished as coherence. They described cohesion as a semantic relation, "expressed partly through grammar and partly through vocabulary" (p.5) and considered it to be the *sine qua non* of a text, since without cohesion, i.e., dependencies between different parts of the text, a text would likely be unintelligible. Sanders et al. (1992) were satisfied with the idea of cohesion as referring to semantic relations but saw cohesion as having limited local application though not extending to the underlying conceptual relations within the text as a whole. Halliday and Hasan (1976) tended to use the term cohesion in the general manner of linguistics, i.e., in reference to surface indicators of relations between sentences, in contrast to coherence referring to "the degree to which text propositions are interconnected in the reader's mental representation of the text" (McNamara *&* Kintsch, 1996, p.255). This latter definition clearly recognises coherence as a psychological property in the mind of the reader as opposed to a property of the text itself. In the view of McNamara and Kintsch (1996), cohesion becomes unnecessary for coherence.

Sanders et al. (1992) considered that there is an essential cognitive quality to coherence relations that is absent in cohesion. This distinction between cohesion as understood by those such as Halliday and Hasan (1976) and coherence as it was understood by those such as Sanders et al. (1992) was summarised by Kamalski, Sanders and Lentz (2009) who equated cohesion with the "overt linguistic elements and structures" of the text and coherence as "a characteristic of the mental

representation of the text rather than of the text itself" (p.324). The same distinction was acknowledged by Graesser, Singer and Trabasso (1994).

Nevertheless, whether the literature employs the concept of cohesion or coherence, writers are invariably concerned with issues of relationships or connectedness in relation to a text which they believe plays a significant role in the intended meaning of the writer or the constructed meaning by the reader. To the extent that the focus is on the intended meaning of the writer, the emphasis will be on the structural organisation of the text and cohesion may be flagged by linguistic clues in the text. When the focus is on the constructed meaning of the reader, the goal will be coherence and there is an implication of a cognitive aspect. Perhaps the confusion has arisen due to linguistics and discourse theory having been primarily concerned with spoken language involving a speaker and a listener. There is a more dynamic quality to live oral discourse within which meaning is negotiated in ways that may not apply to written discourse.

Hobbs (1985) described such a dynamic perspective. He identified coherence as a property of a text but by the same token recognised coherence as a text building strategy employed by a speaker thereby giving it an implicit psychological quality. Whilst this approach was in reference to spoken discourse, this description could still apply to some extent in the situation of a writer and reader where written text is concerned. However, there has been a strong tendency in the research literature towards a unidirectional examination of coherence in written texts, which sought to discover whether the reader identifies the coherence structure contained within the text. This implies an assumption that coherence only exists when the reader recognises the writer's intention as expressed in a specific text structure. It begs the question whether the reader might also establish a coherent understanding through the

application of a different cognitive structure altogether, even though it may or may not produce the precise or full meaning intended by the writer. Would such a meaning be any less valid?

The foregoing discussion implies that there is an obvious dynamic in spoken discourse that is not as easily recognised in written discourse. This might suggest that in the case of the former, coherence can be viewed as a process, whilst in the latter it might be more easily seen to be a product. Brown and Yule (1983) made just such a distinction between 'discourse-as-process' and 'discourse-as-product'. Discourse-as-process emphasises the communicative function of language as its primary area of investigation and consequently seeks to describe a discourse, not as a static object, but as "a dynamic means of expressing intended meaning" (Brown & Yule, 1983, p.24). If one is inclined to accept that there is a dynamic quality to written discourse communication, then one has to look beyond the text itself and embrace the reader to identify coherence.

Implications of textbase and mental models for coherence

It is generally acknowledged and accepted that within a written text there exists a hierarchy of ideas according to their relative importance. The identification and structure of the hierarchy of ideas in a text has been formalised (van Dijk & Kintsch, 1983) and, subsequently, utilised by researchers of text structure. Such hierarchical structures of ideas in texts assist with the construction of coherent understanding. However, there are different types of hierarchy by which such coherence can be manifested. These might relate to either the physical proximity of the ideas in the text or the hierarchical proximity of the ideas based on their relative importance.

The literature identifies different levels of coherence that relate to the scope and character of the relations established between parts of the text. The constructionist distinguishes between local coherence consisting of connections between short sequences of clauses which are referentially based, and global coherence consisting of connections based on one or more overarching themes (Long & Lea, 2005). Lehman (2002) added a little more specificity to the distinction between local and global coherence, local coherence being restricted to relations between a segment of text and those segments that immediately precede and follow it, and global coherence reflecting "the extent to which the reader is able to construct text wide inferences and integrate broad text ideas into a situation model" (p.739). Lehman's reference to 'situation model' places global coherence in a category which differentiates it from local coherence on more than quantitative terms and which embraces the nature of the metacognitive strategies employed by the reader in addition to factors arising from the difficulty of the text.

There is a relationship between coherence, either local or global, and the quality of the meaning constructed by the reader. The choice and application of comprehension strategy will influence and be influenced by the way understanding is structured by the reader.   van Dijk and Kintsch (1983) identified three different levels of construction at which text might be understood. At the surface level the reader is primarily concerned with decoding and consequently the processing skills are largely phonological and syntactic, along with a limited degree of semantic processing (Tunmer & Hoover, 1992). At this level the meaning the reader extracts from the text is very limited unless the text is particularly elementary or the topic very familiar. The focus tends to be intra sentential and consequently any degree of coherence

achieved will be very limited. This study is not concerned with this level of understanding as it will be argued that it does not demand structure strategy use.

The other two levels, text base and situation or mental model, are concerned with inter sentential meanings and present the potential for the construction of global coherence. Here the reader is endeavouring to gain an understanding of the complete text, or at least significant portions of the text that can be organised in the reader's mind into a coherent whole.   According to van Dijk and Kintsch (1983), at these levels of understanding the reader seeks to generate a macrostructure from micro propositions through the application of transitional rules to be explained below.

It is important to understand the relation between text base construction and mental model construction (Kintsch, 1988; van Dijk &Kintsch, 1983). Beyond the surface level it has been widely theorised that the reader constructs a hierarchically structured list of the propositions contained in the text that expresses the relations between the propositions. This is referred to as the text base. Both the microstructure and macrostructure can be derived from this text base. The microstructure facilitates local coherence and the macrostructure facilitates global coherence. The construction of the text macrostructure is based on transitional rules or macro-operators that help to reduce the information in the text base to its gist, and these operators are in turn controlled by the reader's schema (Kintsch & van Dijk, 1978). An important characteristic of the text base is its restriction to the elements and relations that can be directly derived from the text itself. However, the reader might subsequently add other knowledge or information to the text base from the reader's own long-term memory. When the text base derived knowledge is linked with the memory nodes of the reader's existing knowledge then a situation model emerges. According to van Dijk and Kintsch (1983), the distinction between textbase and mental model is based

on the relative degree to which a coherent meaning from the text adheres to the limits of information actually expressed in the text or embraces and integrates related ideas held by the reader in long term memory.

Whilst this distinction might be perceived as providing mutually exclusive types of meaning construction that differ in quality and utility, in practice it would be extremely difficult, if not impossible, to make such a distinction.   The text base is not an alternative to the mental model but, rather, precedes it. A continuum might be imagined in which at one end coherence draws solely on information contained within the text and at the other is dominated by the reader's existing knowledge. However, this raises the question of what sort of process leads to the transition from restriction to text base to inclusion of existing knowledge. This transition implies a shift in the cognitive processes being employed to construct meaning. This point was highlighted by McNamara and Kintsch (1996) who stated, "a text's macrostructure can be cued directly in the text via topic leaders and topic sentences, but it is often left up to the reader to construct the macrostructure, for example by using some sort of schema to organise the text" (p.252).

Cote, Goldman and Saul (1998), reflecting on the alternative models of coherence presented by van Dijk and Kintsch (1983), claimed that we go beyond textbase towards the creation of a mental model when we "draw on multiple types of prior knowledge such as knowledge of the topic, general world knowledge, and discourse knowledge" (p.2). It would be relatively easy to establish if the reader's constructed meaning embraced knowledge of the topic or general world knowledge not explicit in the text, but much more difficult to establish whether the reader had used discourse knowledge from the reader's long term memory to integrate the text. According to Cote et al. (1998), discourse knowledge includes the rhetorical structure

of the text. Consequently, the meaning presented by the reader, whilst not including any apparent domain knowledge left out of the text, may nevertheless employ knowledge of text structure from long term memory in order to integrate the text. If Cote et al.'s (1998) argument is accepted then the consequent meaning construction could and ought to be considered a mental model.

Perhaps the important conclusion to be drawn from Cote et al. (1998) is that the meaning achieved by the reader is inevitably influenced both by the information presented in the text and by all sorts of knowledge in the reader's long-term memory. It begs the question, particularly in the case of rhetorical structure, of the relative contributions of the text as opposed to the reader's knowledge. Cote et al. (1998) presented a two dimensional model of comprehension relating the influence of the text and the reader's use of existing knowledge. Assuming a high quality textbase, it distinguished between a coherent integrated representation in the event of high knowledge use, and a coherent encapsulated representation in the event of low knowledge use. The distinction between the two was purported to be based on the extent to which the representation does or does not "impact on readers' knowledge structures for the domain" (Cote et al., 1998, p.4).   This would appear to suggest that there are two potential mental models but of different quality: one which is integrated with existing domain knowledge in long term memory and another which is not, but that both have in common a high level of coherence.

Chapter 3 Summary

The chapter opens with a discussion of structure strategy and its origins in the literature on Rhetorical Structure Theory and more particularly the work of B.J.Meyer and others in relation to top-level structure. Structure strategy is described as an inference driven activity. Inferences in relation to structure are distinguished from 'gap-filling' inferences on the basis that their primary role is to establish connections. There is a thorough review of the literature relating to top-level structure carried out largely between the mid 1970s and the late 1980s that explores structure strategy use in the comprehension of expository texts. The relationship between rhetorical structure- , top-level structure and coherence is explored and clarified. The chapter highlights the limitations of the research into top-level structure and reading comprehension and the need to explore more clearly the relationship between text structure and comprehension that acknowledges the active role of the reader. It is argued that this cannot be achieved with recall tasks, the favoured approach of the earlier research. The underlining method designed and employed by Ohlhausen and Roller (1988) is a data collection method specifically designed for identifying what the reader thinks is important in a text and thus offers a useful device for exploring the relationship between structure and comprehension whilst embracing the reader's active role. The chapter concludes with the research questions posed in this study.

3. Structure Strategy in Reading Comprehension

Rhetorical structure lies at the heart of a descriptive theory or framework for text that applies specifically to the organisation of a text and has been considered a useful tool for the study of text coherence. It has its origins in Rhetorical Structure Theory. Mann and Thompson (1988) summarised the main features of Rhetorical Structure Theory:

> It identifies hierarchic structure in text. It describes the relations between text parts in functional terms, identifying both the transition point of a relation and the extent of the items related. (p.243).

Mann and Thompson (1988) attempted to distinguish these relations from schemata: "based on the relations, the schemas define patterns in which a particular span of text can be analysed in terms of other spans." (p.245).   This appears to emphasise the more generic nature of schemata as opposed to specific rhetorical relations and the potential for schemata to reduce the potentially large number of possible rhetorical relations to a much smaller one. The top-level structures referred to by Meyer (1975) appear to be more like schemata than the rhetorical structures referred to by Mann and Thompson. In this way the detailed relations embraced by Rhetorical Structure Theory are the building bricks out of which structural schemata can be constructed.

A common criticism that has been applied to both schema theory and rhetorical structure theory is in relation to the criteria by which examples are defined. In both cases the literature has demonstrated the tendency, through a process of reductionism, for researchers to discover and describe increasingly greater numbers of increasingly fine grained schemata and rhetorical structures with subsequent

questions about common criteria and the impracticality of knowing and applying such an immense number of possibilities. A rhetorical structure might on first sight simply be considered to represent a miniature schema. However, another possibility is to utilise the idea of a schema to organise and reduce the potential number of rhetorical structures.

The notion of a hierarchy of such structures with a top-level structure lends itself to this. The top-level structure is not one of numerous rhetorical structures employed by the writer to organise local relations within the text, but embraces other structures further down the hierarchy like a set of Russian dolls. In this way it makes sense to infer a broad rhetorical structure in the comprehension process despite the potential for discovering various more finely tuned rhetorical structures as a mental model develops. The number of readers who might be aware of and willing to utilise such finely tuned versions can be expected to be much smaller than the number with a general or top-level schema which will be familiar to most, if not all, experienced readers.

The more fundamental question, whether one is concerned with content schemata or structural schemata, relates to the process whereby the reader arrives at a particular schema and applies it. As has been indicated already, one possibility is that it is already in the text, placed there by the writer and simply awaiting recognition by the reader. The other alternative, based on the argument that the reader will necessarily impose structure on the text whether the author's intended structure is recognised or not, is that the reader will make an inference based on interpretation of semantic and syntactic clues contained in the text leading to a generic structure or schema. An inference has been defined as, "any piece of information that is not explicitly stated in the text" (McKoon & Ratcliff, 1992, p.2). At no time does a writer

explicitly state an organising schema in a text. Consequently, any such organisation has to be imposed by the reader, and so the notion of schema being accessed by simple recognition needs to be dismissed and more credit given to the reader for actively imposing some degree of organisation on the text.

Inference making and structure identification

Anderson and Pearson (1984) identified four types of inference related to schemata, two of which are inferences identifying a particular schema to be employed as a whole and those inferences required to fill 'slots' in the schema respectively. The other two types of inference include those involved when a slot cannot be filled and those where the reader lacks the necessary knowledge, and they are, arguably, not pertinent to the current discussion. The focus of this study requires attention to the first type of inference which might result in the reader's text organisation schema.

Inferences can be distinguished according to whether they elaborate beyond the text itself or seek to create coherence within the limits of the explicit information contained in the text.   This distinction could correspond both to the distinction between mental models and textbase and also that between structural schemata and content schemata (Ohlhausen & Roller 1988). It has been argued that inferences for the purpose of achieving coherence are generally more common than elaborative inferences (Barnes, Dennis, & Haefele-Kalvaitis, 1996).

It seems evident that the extent to which the reader does or does not relate text information to existing knowledge carries implications for the type of inference that will be made. Cain and Oakhill (1999) in a study of the relationship between inference-making and comprehension distinguished text-connecting and gap-filling inferences. They defined the former in terms of "integrating information explicitly provided by the text to establish cohesion", and the latter as "incorporating

information outside of the text with information in the text to fill in missing details"
(1999, p.489-490). In the case of expository text, inferences aimed at coherence but
excluding domain knowledge are much more likely.

Cain and Oakhill (1999) concluded that poor comprehension was partly due to
insufficient inferences, but only in relation to inferences aimed at establishing
coherence. On this basis topic knowledge is secondary in the basic task of
comprehension. They argued that gap-filling inferences requiring additional topic
knowledge might be late-emerging and be related to cognitive development.

The identification of a structural schema belongs in the category of
'connecting' inferences aimed at achieving coherence and ought not to be considered
a gap-filling inference.   The use of structural schemata does not lead to elaboration
beyond the text and such schemata have as their purpose the construction of
connections between the various ideas contained in the text. On the other hand, the
use of structural schemata necessarily calls on the reader's general knowledge of
discourse as opposed to content. There have been some studies solely concerned with
inferences targeted at coherence relations (Sanders & Noordman, 2000). In order to
distinguish between the ways different types of structural schema affect
comprehension, Sanders and Noordman manipulated the coherence structure of the
text and observed the effect on comprehension.   This approach was quite different to
traditional studies of inference making that tended to manipulate the number and type
of inferences contained within the text.

It is generally accepted that the cognitive dynamic involved in the use of
structural schemata is an inference-making process. The constructionist adopts a
distinctly different view of the inferences involved in the comprehension process from
some others, most notably those theorists generally identified as 'minimalists'. The

minimalist view is that in the first instance the reader merely employs two types of inference, namely, those quickly available perhaps due to familiarity with the topic and those required to establish local coherence. On this basis the reader constructs the textbase. Strategic inferences do not come until afterwards (McKoon & Ratcliff, 1992). The constructivist account assumes that the reader makes three sets of inferences: those that address the reader's goals; those that establish coherence in the form of a situation model; and those that explain events, actions and states (Graesser, Singer, & Trabasso, 1994). However, the last of these three seems tailored to the task of comprehending narrative text and in the case of expository text might be replaced by inferences that explain relations between ideas.

It might be argued that the demands of these three sets of inferences would make excessive cognitive demands on the reader. In relation to expository text, however, it has been shown that the number of inferences demanded by expository text is significantly less than that required in comprehending narratives, particularly since the reader generally has less background knowledge of the text topic (Britton, Graesser, Glynn, Hamilton, & Pentland, 1983; Britton & Gulgoz, 1991; Graesser, 1981). To the extent that the reader of expository text on unfamiliar topics will make minimal inferences from content it is argued that the reader will be more inclined to make inferences aimed at the organising structure of the text. There is certainly evidence to support the converse of this argument, i.e., that where the topic is very familiar to the reader, the reader will be less inclined to make inferences about structure (Ohlhausen & Roller, 1988).

The opposing views of inference making afforded by constructionists and minimalists respectively were mirrored in a study about reasoning processes conducted by Favrel and Barrouillet (2000) which was concerned with the respective

cognitive demands of linear ordered tasks and set-inclusion tasks. The authors

pointed out that inferences in the case of a mental model are made on the basis of

simple extraction from a single representation, whereas the traditional mental logic

approach views inferences as deductions, from a propositional representation that

sounds like a textbase, based on a set of rules. They concluded from this that "the

structure of the representation resulting from comprehension processes is a central

problem for text comprehension theories as well as for the psychology of reasoning"

(Favrel & Barrouillet, 2000, p.3). The existing evidence, they said, suggests that

linear ordered tasks are usually resolved on the basis of a construction of a mental

model, but whether a mental model is required to resolve a set inclusion task is

disputable. The results of their experiments led them to conclude that linear ordering

is indeed best resolved with a mental model, but not so the set inclusion task where

the information is stored in an atomic way in a similar manner to a textbase. They

believed that the explanation for this is that set inclusion tasks cannot be ordered

along a single dimension unlike a linear ordering task. The potential implications of

this proposed relationship between types of reasoning task and comprehension

processes will become clear when the constraining dimensions of alternative forms of

top-level rhetorical structure are discussed.

The Organisational Structure of Expository Text and its Comprehension

There is a degree of consensus among students of coherence that the attempted

construction of a coherence structure in respect of a text by the reader (or listener) is

an inevitable behaviour (Brown & Yule, 1983; Hannon & Daneman, 2004). It has

further been argued that organising structure is the *sine qua non* of a text (Hobbs,

1985). This view is shared by Halliday and Hasan (1976) who in the opening

paragraphs of their book made the bold statement that "the word TEXT is used in

linguistics to refer to any passage, spoken or written, of whatever length, that does form a unified whole" (p. 1) and *ipso facto* that in the absence of coherence it cannot be considered to be a text. If this assumption is accepted then the reader begins reading a text with the belief that the ideas contained within the text are organised in a manner that connects the various ideas contained within it. This raises several questions around when and how the reader begins to employ the structural organisation of a text. Does the text's organisational structure direct the comprehension process in a top-down approach or does it result from a bottom-up approach? How does the reader select or identify the particular structure being employed to organise the text? And, perhaps most important in the context of the current study, is comprehension achieved when the reader recognises the writer's intended structure, or, is comprehension the result of the reader's organisation of the ideas in the text even though it may be different?

Rhetorical structures

As in many aspects of reading comprehension research, there are inconsistencies in terminology that can cause a degree of confusion. The structural relations in text that form the subject of this study have been labelled in a variety of different ways. Grimes (1975) and Meyer (1975) referred to the organisational or coherence relations in texts as rhetorical predicates; Mann and Thompson (1988) to relational propositions; Grosz and Sidner (1986) to rhetorical relations; and Hobbs (1979) and Sanders (2000) to coherence relations. All of these writers were referring to the same type of relations. These relations are not linguistic ones, but are concerned with the logical or rational relations that connect different parts of the text and provide the text with its overall structure. Such relations organise the ideas in a text in a way that is essential to its meaning.

Whilst the expression 'coherence relations' has a simple appeal to it, it fails to discriminate the various types of relations that might contribute to coherence. 'Relational propositions', by its focus on propositions, tends to suggest focus at the micro level of text whereas the focus here is on global coherence. For the purposes of this study the expression 'rhetorical structure' will be adopted to express those relations that give an expository text its top-level organisational structure or global coherence, and 'structure strategy' will embrace the utilisation of rhetorical structure in the process of reading comprehension. The rhetorical structure in relation to text comprehension will be presented as a generic schema of the coherence contained or established in respect of a text. However, since this dissertation has specifically differentiated text structure from the structure of a reader's understanding, the organisational structure of the text as it applies in linguistics will be referred to simply as 'text structure' or 'top-level structure', and other expressions related to structure, unless expressly stated otherwise, will refer to the reader's understanding, even though they both may share the characteristics of rhetorical structure.

Rhetorical structure as it is used in the current study has its origins in Rhetorical Structure Theory (RST). RST proposed that the relational propositions within a text can be reconstructed into a hierarchy of relative importance based on the degree of coherence brought to the text as a whole. However, rhetorical relations apply at every level of the text and, consequently, there is a vast number of readily identified such relationships. RST "provides a framework for investigating relational propositions, which are unstated but inferred propositions that arise from the text structure in the process of interpreting texts" (Mann & Thompson, 1988, p.244). This appears to imply a predominantly bottom-up or minimalist approach to comprehension.

One way of identifying the global coherence of a text, or a significant portion of the text, is by recognition of its top-level structure. The top-level structure would be the top-level of a hierarchy of rhetorical relationships. The top-level structure of a text "corresponds to its overall organising principle" (Meyer, 1985, p.20) and is expressed by the particular rhetorical structure which governs the dominant meaning relations between the various parts of the text. The top-level structure, put in these terms, might be thought of as a description of the text macrostructure. If such top-level rhetorical structures can be generalised they would then assume the character of schemata.

According to RST the related propositions in a text can be arranged into schemata that specify how they are related to the collection of such relations within a portion of a text. Mann and Thompson (1988) managed to reduce the great number of identified rhetorical relations to five potential schemas described as 'circumstance', 'contrast', 'joint', 'motivation/enablement', and 'sequence/sequence'. However, one of the major criticisms that have been levelled at RST goes to the fundamental need for common and practical criteria for rhetorical relations (Knott & Dale, 1994). Despite Knott and Dale's efforts to achieve this it still remains an area without consensus and consequent confusion.

Perhaps the best known and most commonly used classification of top-level structures in the research literature looking at text structure and reading comprehension belongs to Meyer. Meyer (1985) placed top-level structures on a continuum according to the degree of constraint or redundancy that any particular top-level structure brings to the meaning or comprehension of the text. She meant by this that the arguments or information to be related to a particular top-level relation will vary. Britton and Black (1985), in the same volume, put it another way: they claimed

that higher level text structures "constrain the possible inferences because they represent information about what can follow what in texts" (p.5).

Meyer (1982) identified and labelled five alternative rhetorical structures that might serve as top-level structures for expository text: description, collection, causation, problem-solution, and compare-contrast, in order from least constraining to most constraining. However, she expressed some doubts as to where 'compare-contrast' belonged on this continuum and it appears last because it appeared to be the most difficult to employ rather than being the most constraining.   These alternative rhetorical structures were all explained by Meyer and Freedle (1984) despite the fact that the authors only included four forms of rhetorical structure in their study. Meyer and Freedle acknowledged the five forms articulated by Meyer (1982) but elected to combine 'collection' and 'description' in a single category. The criteria for each of the five rhetorical structures are described in Table 1 below.

Table 1

Description of Meyer's top-level structures (from Meyer & Freedle, 1984, p.122-123)

Collection	Grouping by association
Description	Only distinguished from Collection by the amount of information provided. One element of the association is subordinate to another.
Causation	The elements of the text are grouped, come before and after in time, and are causally related.
Problem-Solution	Has the same criteria as Causation but also includes the requirement that "at least one aspect of the solution matches in content and stops an antecedent of the problem".
Compare-contrast	Organises the main elements of the text on the basis of contrast or their similarities and differences.

In other studies 'causation' has been labelled as 'antecedent-consequent' (Bartlett, 1978; Meyer, Brandt, & Bluth, 1980); 'collection' as 'list' (Sanders & Noordman, 2000), 'attribution' (Bartlett, 1978; Slater, Graves, & Piche, 1985) or 'enumeration' (Englert & Hiebert, 1984); 'problem-solution' as 'response' (Meyer, 1982); and 'compare-contrast' as 'adversative' (Slater, et al., 1985) or 'covariance' (Slater et al.,1985). For the purposes of this study, the four forms defined and labelled by Meyer and Freedle (1984), i.e., collection (through the combination of 'collection' and description'), cause-effect, problem-solution, and compare-contrast, will be adopted in the first instance. It is intended that the method of analysis of the data in this study will test the validity of these forms of organisation and their capacity to describe comprehensively the rhetorical structures identified by the participants in this study in relation to the texts in question, and also test Meyer's idea of a constraint continuum.

There has been a high level of inconsistency in the use of the collection and description organisational schemata. As stated already, Meyer and Freedle (1984) combined the two schemata into one. In contrast other studies generated three schemata from the single one employed by Meyer and Freedle (Englert & Hiebert, 1984). Englert and Hiebert (1984) distinguished three different rhetorical structures from Meyer and Freedle's (1984) single collection structure. Description was a list of descriptive attributes; enumeration was a list of information associated with a specific topic; and sequence referred to a series of temporally related events.

 In order to be consistent, this study seeks to employ a schema that is characterised by the level of constraint it imposes and consequently by the number of factors that constrain the interpretation according to the logical structure of the text. On this basis this study will not differentiate between description, collection, and

enumeration, and will treat them all as collection in a manner consistent with Meyer and Freedle (1984). However, it will not exclude the possibility that the reader might organise the meaning of a text in quite different though equally constraining ways depending on whether the text lends itself to temporal sequence as opposed to a simple listing of associated ideas. An additional reason why young readers might make differential use of a hierarchical listing and a serial listing is that the temporal sequence of the latter seems to be a simplified version of narrative structure with which the child will already be very familiar.   Consequently, this distinction i.e., between collection (sequence) and collection (list), will be recognised in the analysis.

If the validity of the continuum proposed by Meyer (1982) is accepted then Knott and Dale's (1994) critique may not pose such a significant obstacle since the focus will become the relative degrees of constraint as opposed to the sort of elaborate typology developed by RST.   It may be important, if not imperative, for the purposes of computational linguistics to have the capacity to analyse a discourse in its smallest details. However, it is highly unlikely that a reader, no matter how sophisticated and skilled, would apply such detailed rhetorical relations as proposed by RST to the task of constructing a coherent representation of a text, or for that matter that the writer would require such detailed grasp of rhetorical relations. On the other hand, there can be no doubt that both writer and reader are required to impose some organisational structure on the text for it even to be considered a text, apart from which the reader will, even in the absence of such organisation, seek to impose structure regardless. It then becomes useful to be able to classify and identify the relative places of such top-level structures on Meyer's continuum. The particular top-level rhetorical structures selected by Meyer for this purpose are in no way controversial and there would be a common understanding of them shared by researchers in the field of reading research.

The interest in this study relates to how and when such understanding and its application emerges and what sort of contribution it makes to reading comprehension.

Expository text structure

The top-level rhetorical structures featuring in Meyer's work are not intended to apply to all written texts but only to a restricted category classified by Meyer as expository text. There is a degree of confusion in the literature as to what constitutes expository text, however, there is broad support for a dichotomous distinction between narrative structure and expository structure implying that expository structure embraces all non narratives (Black, 1985; Cote et al., 1998; Gillam, Fargo & Robertson, 2009). Whereas narrative structure is a common structure applying to all narrative texts, expository structure represents a class of structures that are broadly described as intended to "convey new information and explain new topics" (Black, 1985, p.249). The narrative structure follows a temporal sequence with a consistent arrangement consisting of agents with problems to solve, consequent goal directed actions, and eventual solutions (Bower & Morrow, 1990). Since narratives reflect real life experience, it is argued that children are generally familiar with this structure even before learning to read. The same familiarity with text structure is not apparent in the case of expository text and such structures by necessity have to be learned. This becomes a more complex affair with the recognition that there are several alternative organising structures available for any particular expository text and these might be used in a variety of combinations.

Whilst Meyer (1985) identified five such top-level structures for expository text; collection, causation, problem-solution (labelled as "response"), compare-contrast, and description, and Meyer and Freedle (1984) reduced these to four, Gillam et al. (2009) further reduced this list of expository structures by arguing for three

structures, namely, descriptive, sequential, and comparative. This proposal would seem to combine Meyer's (1985) causation and response structures, as well as combining her collection and description structures in the manner of Meyer and Freedle (1984). Meyer found the 'compare-contrast' relation hard to plot in her constraints continuum. It lacks the time and causality factors that characterise highly constraining structures such as causation and response, but is clearly more complex than the less constraining collection and description structures. Meyer considered that it imposed a comparatively high level of constraint but it is hard on first impression to see how such constraint applies. It is probably fairer to say that it is a grouping structure but one which places greater cognitive demands on the reader without necessarily placing constraints on the meaning of a text. Consequently, one might assume that it might demand a more cognitively able or more experienced reader than one barely able to cope with collection.

Research employing Meyer's top-level structures

The pertinent literature relating to the influence of top-level rhetorical structure on reading comprehension has embraced a number of related questions. These have included the effect of structure on recall; the effect of signalling on the identification of structure and consequently, for comprehension; and the effect of age and development on the use of structure strategy. 'Signalling' refers to linguistic cues to specific rhetorical relations. A summary of the research is presented in Table 2 below. Whilst the areas of interest in relation to rhetorical structure are fairly consistent, there has been considerable variation in the combination of variables of interest and more particularly in the methods utilised by researchers. There has also been some confusion between the variables observed and the conclusions reached.

Table 2

Experimental research carried out in relation to structure strategy 1973-2005

Study	Rhetorical Structures	Text Description	Participants	Purpose/Findings
Meyer & McConkie (1973)	Collection Problem Solution	481 & 502 word natural texts	Undergraduate students N=69	Listen and recall. Hierarchical structure of ideas influences recall with higher ideas being remembered more often.
Meyer (1975)	Problem-Solution Collection	575 words (x12) and 125 words (x3) Natural expository prose	University undergraduates N=105	Information high in the content structure is recalled more often than information low in the content structure
Meyer, Brandt, & Bluth (1980)	Problem-Solution Compare-contrast	169-242 words With and without signalling	9th grade students (N=102) Grouped by reading ability	Read and recall. Delayed recognition task. <50% used top-level structure; Most high ability readers used text TLS; Use of text TLS improved recall. Concluded a strong relationship between comprehension and use of top-level structure. No clear indication of effects of signalling

Study	Rhetorical Structures	Text Description	Participants	Purpose/Findings
Bartlett (1978)	Collection Compare-contrast	240 words taken or paraphrased from unfamiliar classroom texts.	9th grade students	Read and identify top-level structure followed by recall task after training in structure recognition on all four structures. A few high ability students did well in recall but did not use or identify the top-level structure.
Taylor (1980)	Collection	225 word textoids	6th grade good readers (N=17) 6th grade poor readers (N=17) 4th grade good readers (N=17) Graduate students (N=17)	Read and oral recall task. Effects for age and reading ability. Results suggest memory enhanced if child follows text structure.
Horowitz (1982)	Collection Cause-Effect Problem-Solution Compare-contrast	Short passages approx 140 words in length. Same topic rewritten in each different structure.	9th grade students N=120 University undergraduates N=99	Read (to remember) and written recall task. Compare relative effects of each structure. No difference between structures on recall. Age brought improvement. Main effect for topic.

Study	Rhetorical Structures	Text Description	Participants	Purpose/Findings
Taylor (1982)	Unspecified but probably Collection. Emphasis on hierarchical organisation of texts.	Experiment 1: 2 texts - 861 word and 953 word natural texts. Experiment 2: 2 texts – 819 word and 906 word natural texts.	Experiment 1: 5th grade students (N=48) grouped by reading ability Experiment 2: 5th grade students (N=42)	Instruction programme in hierarchical summarisation of ideas in text. Read and write hierarchical summary followed by delayed recall task. Even though instruction on text structure enhances memory students need to be able to use strategy well before significant difference in recall.
Schnotz (1982)	Compare-contrast	1079 word comparative text in two forms: compare-contrast by object and compare-contrast by aspect.	University students N=20	Read and Recall task. Respond to questions re true/false statements arising from compare-contrasts in text. Interactive effect between prior knowledge and text organisation with respect to recall and reading time. Texts organised by aspect integrative plus comparative processing required. Text organised by object only require integrative processing.

Study	Rhetorical Structures	Text Description	Participants	Purpose/Findings
Hiebert, Englert, & Brennan (1983)	Description Sequence Enumeration Compare-contrast	A test item for each structure consisting of : 2 stimulus sentences indicating topic and structure; 2 target sentences extended ideas and consistent with structure; 2 distracter sentences of inconsistent structure.	52 Undergraduate students	Students read two stimulus sentences and identify sentences that are consistent in structure with stimulus sentences Use of structure related to reading comprehension. Compare-contrast more difficult to use than others. Higher ability readers showed more skilful use.
Taylor & Samuels (1983)	Not specified	3 x 100 word descriptive passages and 2 x 400 word descriptive passages that could also be understood with cause-effect. Scrambled organisation and unscrambled versions of texts.	5th grade students (N=14) and 6th grade students (N=36)	Read and delayed (very short delay involving distraction– 3 mins) written recall. Students identified as unaware of text structure scored equally on scrambled and unscrambled passages. 72% of subjects unaware of structure. Sig difference for those aware of structure where it improved recall.

Study	Rhetorical Structures	Text Description	Participants	Purpose/ Findings
Taylor & Beach (1984)	unspecified	Approx. 1500 word natural expository texts	7th grade students N=114	Studied effects of instruction on hierarchical text structure. Read, summarise, and delayed recall task. Structure instruction enhanced recall for unfamiliar but not familiar topic material.
Meyer & Freedle (1984)	Collection Cause-Effect Problem-Solution Compare-contrast	141-184 word constructed textoids	44 teachers	Listen to passage followed by written free recall task and delayed recall task. Differences in discourse type affect learning and memory. Collection least effective. Problem-solution effects disappointing. Most likely to provoke alternative structure for recall protocol.

Study	Rhetorical Structures	Text Description	Participants	Purpose/ Findings
Englert & Hiebert (1984)	Collection (description) Collection (enumeration) Collection (sequence) Compare-contrast	A test item for each structure consisting of : 2 stimulus sentences indicating topic and structure; 2 target sentences extended ideas and consistent with structure; 2 distracter sentences of inconsistent structure.	3rd grade (N=76) and 6th grade (N=70) students graded by ability	Items read aloud and children required to indicate the degree of fit of target and distracter sentences. Significant effects for age and ability. Results better for sequence and enumeration than description and compare-contrast.
Slater, Graves, & Piche (1985)	Description (collection) Cause-Effect Problem-Solution Compare-contrast	670 word natural passages of text on unfamiliar topic.	9th grade students N=224 Graded by reading ability.	Effects of structural organisers. Organisers with outline grid significantly improved comprehension and recall. Without outline grid improvement limited to comprehension. However, no direct test of comprehension was employed. Conclusion based on results from multiple choice test that was designed to assess recall.

Study	Rhetorical Structures	Text Description	Participants	Purpose/ Findings
Englert & Thomas (1987)	Description (collection) Enumeration (collection) Sequence (collection) Compare-contrast	A test item for each structure consisting of : 2 stimulus sentences indicating topic and structure; 2 target sentences extended ideas and consistent with structure; 2 distracter sentences of inconsistent structure	3rd/4th grade students 6th/7th grade students	Compared sensitivity to text structure between learning disabled and non-learning disabled children. Items read aloud and children required to indicate the degree of fit of target and distracter sentences. Disabled students had limited understanding of text structure. Concluded that knowledge of structure types underlies effective comprehension. Compare-contrast most difficult.
Richgels, McGee, Lomax, & Sheard (1987)	Collection Cause-Effect Problem-Solution Compare-contrast	Ave 133 word textoids (range of 98-184 words)	6th grade students N=56	Match passages for structure. Read and written recall task. Recall (structure) significantly poorer for cause-effect; no difference between others. Recall (total) better for unscrambled vs scrambled (except cause-effect) and interaction with hierarchical level of ideas.

Study	Rhetorical Structures	Text Description	Participants	Purpose/ Findings
Ohlhausen & Roller (1988)	Collection	Approx. 700 words	5th, 7th, and 9th grade students N=231	How to decide which information in a text is important? Relative contributions of content schemata and structure schemata. Underling task and strategic awareness tasks. Developmental trend in awareness; Influence of structure not as emphatic when content knowledge high. Complex interactions between prior knowledge, schooling, and text.
Sanders & Noordman (2000)	Collection Problem-Solution	144-151 words with embedded sentence to manipulate structure	University students N=68	What if any is the effect of structural relations markers? Online reading of text followed by free recall and verification tasks. Problem-solution produced faster processing, better verification, and superior recall. Signalling improved processing speed but not recall.

Study	Rhetorical Structures	Text Description	Participants	Purpose/ Findings
Meyer & Poon (2001)	Problem-Solution Compare-contrast	Approx 240 – 520 words	56 young adults and 65 older adults	Structure strategy training. Read and Recall task. Training improved recall, both in amount and in importance. Few consistently used structure strategy on all passages. No significant differences between passages (structures). Improved use of signalling.
Meyer et al (2002)	Problem-Solution Compare-contrast	563 words (compare-contrast) 355 words (problem solution)	5th grade students N=60	Structure strategy instruction via internet followed by Read and written recall task, plus Question/answer task for problem-solution text. Children in structure strategy programme showed increased strategy use, total and main idea recall, and self-efficacy.

Study	Rhetorical Structures	Text Description	Participants	Purpose/ Findings
Williams, Hall, Lauer, Stafford, DeSisto, & deCani (2005)	Compare-contrast	19-82 word textoids.	2nd grade students N=128	Does instruction in text structure aid comprehension? Instruction improved comprehension. Based on oral summary and content knowledge. Instruction feasible and effective as early as 2nd grade.

The early research into the organisation of expository text was focused on implications for memory. It was concerned in particular with the hierarchical position of ideas and their relative importance (Meyer, 1971; Meyer & McConkie, 1973). Meyer's approach to the analysis of expository text structure was based on Fillmore's (1968) case grammar, and Grimes (1975) semantic grammar of propositions. Fillmore (1968) focused on propositions and their arguments rather than subjects and predicates. Fillmore (1968) and Grimes (1975) changed the traditional focus of prose analysis on subjects and verbs to the role of ideas in the construction of meaning. Meyer (1975) constructed hierarchical tree-type structures of the organisational content of prose that revealed the relative importance of ideas contained in the text. A text was seen as a complex of related propositions composed of predicates (typically verbs but including adjectives, adverbs, and sentence connectives) and their arguments (people or objects related to the action in the predicate). Predicates came in two types, lexical and rhetorical: lexical predicates were governed by lexical meanings whereas rhetorical predicates classified relationships, either between sentences or between paragraphs.   Such predicates constrained the meaning of their associated arguments.

Rhetorical predicates more frequently occurred at higher levels in the text hierarchy (Meyer 1975). If readers first concerned themselves with main ideas in text as predicted by Ausubel (1963), then Meyer argued that readers ought to recall information that was relatively higher in the hierarchy than detailed information that was lower in the hierarchy. This became a prime focus of the early research investigating top-level, structure in expository prose and was a consistent finding

(Meyer, 1975; Meyer & Freedle, 1984; Taylor, 1982; Taylor & Beach, 1984).

However, it did not illuminate our understanding of the comprehension process.

The research into expository text organisation then made a slight shift away

from its focus on the hierarchical position of ideas and their recall and became more

concerned with the manner in which 'structure strategy' was used by the reader.   It

began to explore the reader's ability to discriminate between different types of

rhetorical structure and the relative effect on recall and comprehension (Englert &

Hiebert, 1984; Meyer, Brandt, & Bluth, 1980). Englert and Hiebert (1984) posed the

question as to how knowledge of various text structures affected successful reading

comprehension. Meyer, Brandt and Bluth (1980) highlighted the need to observe the

interaction between the reader and the text when attempting to predict comprehension

skill and recall from text structure. They introduced the term 'structure strategy'

when referring to "the search for major text-based relationships among propositions"

(p.78).

Meyer et al. (1980) embraced the assumption that the reader automatically

seeks patterns within the text that tie propositions together. They explored the extent

to which linguistic cues signalling different rhetorical structures played a part in this

process. They required 9th grade students to read passages embracing two different

top-level structures, problem-solution and compare-contrast, and then respond to a

recognition test and free-recall task (both immediate and delayed). They found that

good readers were more likely to reflect the same top-level structure as the author in

their recall and more likely to do so with the problem-solution passage than the

compare-contrast passage. However, the authors played down the last point on the

basis that it could be "attributed to the uncontrolled factors of passage topic and

amount of signalling" (Meyer et al, 1980, p.98).   It is important to note that the two

rhetorical structures highlighted in the study are both considered by Meyer to be high on the continuum of constraint and consequently, may not have been the best choices with which to identify differences. Whilst not recording a main effect for signalling, the authors nevertheless pointed to indications that whilst good readers did not appear to benefit from signalling, this may not have been true of poor readers. The subject of signalling will be discussed presently.

The full range of Meyer's continuum of top-level structures was embraced in a study by Meyer and Freedle (1984). This study was conducted with adult participants, used the same content in each of the rhetorical structures, and used recall and structure recognition tasks. The authors concluded that the more constraining the top-level structure, the better it proved for recall. However, they failed to discover any differences between the more constraining structures and merely distinguished them from description. It was also apparent that there was a tendency for the participants to substitute an alternative structure for problem-solution.

In a contrast with Meyer, et al., (1980), a study by Slater, Graves, and Piche (1985) examined the relative influence of alternative top-level structures on recall and found no significant differences between any of the range of alternative rhetorical structures. Richgels, McGee, Lomax, and Sheard (1987) studied the same top-level structures in 6th grade students and found poorer recall with causation but no significant difference between the other three structures. Other studies involving younger students, i.e., 3rd grade and 6th grade students provided limited support for Meyer's original hypothesis that the more highly constraining structures would assist recall but tended to focus on low constraining structures (Englert & Hiebert, 1984; Englert, Stewart, & Hiebert, 1988).

The various studies into the relative influence on the reader of alternative top-level structures provided no clear indication beyond the earlier findings that superordinate ideas are more easily recalled than subordinate ideas, that older students tended to perform better than younger students, and that more able readers tended to outperform less able readers. However, there had generally been a lack of consistency in the choice of structures to be studied, the ages of the participants, and the methodology employed, despite the overwhelming consistency of focus on memory tasks. No clear picture emerged of the relative effects of alternative top-level structures. Nor does the literature enlighten us any further about the relationship between structure and comprehension.

One of the most consistent features of the research in this area has been the focus on recall and how it is affected by the organisational structure of text (Bartlett, 1978; Meyer et al., 1980; Meyer & Freedle, 1984; Richgels et al., 1987; Sanders & Noordman, 2000; Slater et al., 1984). This body of research has generally required participants to read various passages of text defined by their differences in top-level rhetorical structure and then undertake some form of recall or recognition task. It begs the question of what, if anything, such data have to say about reading comprehension skill? Graesser, Millis, and Zwaan (1997) cautioned that "comprehension cannot be reduced to problems of accessing and constructing memory representations" (p.163).

There have been some notable and important exceptions to the heavy emphasis on memory tasks, important because they placed a greater focus on the comprehension task involved in reading as opposed to what the reader may recall. Englert and Hiebert (1984) were concerned with how knowledge of various text structures might develop and relate to successful reading. Consequently, they shifted

away from the preoccupation with the relative recall of superordinate and subordinate ideas characteristic of earlier research and instead concentrated on the students' ability to identify main ideas, recognise related details, and organise information into topical groupings. They set up an experimental task in which the child either listened to (in the case of 3rd grade students) or read (in the case of 6th grade students) a pair of sentences that reflected a main idea and rhetorical structure. The child's task was to select a third sentence to complete the set from two distracter sentences and two target sentences (one more appropriate for overall meaning than the other). In comparison to the traditional recall task the students were required to anticipate what came next in a short passage. It was anticipated that the student's choice would reflect whether the child was employing a structure schema and the character of that schema. The results could only discriminate between the two age groups on the basis of the distracter items and not the target items, but produced significant results for structure on both targets and distracters. However, the selection of four alternative rhetorical structures included three that are closely related and low on constraint, namely, sequence, enumeration, and description. Not surprisingly, the fourth structure, compare/contrast, proved to be the most difficult for the students to grasp and there was no difference between sequence and enumeration which Meyer would see as both belonging to the 'collection' rhetorical structure. However, the study did provide some basis for the idea that structural awareness has a developmental component and that this may be different for different rhetorical structures. The authors also claimed evidence that text structure aids comprehension, perhaps with more justification than studies employing recall tasks, but nevertheless without real conviction.

Englert, Stewart, and Hiebert (1988) conducted a similar study to Englert and Hiebert (1984) except that this study was concerned with the use of text structure in

writing. They employed a similar task but in this instance the students (3rd grade and 6th grade) had to write either two sentences to complete the paragraph or a topic sentence to introduce the main idea. There were main effects for grade, ability, and structure type. In this instance the students proved to be more able in applying structure strategy to enumeration and compare/contrast than sequence which was quite inconsistent from the earlier reading/listening study results. It would suggest that the mode of response can significantly affect the outcomes of a study exploring children's use of test structure. This again has implications for the employment of written recall protocols as a measure of comprehension.

An important relationship has been demonstrated between the type of text model constructed by the reader and the subsequent quality of recall. It has been shown that memory for text is best achieved with recall tasks premised on the textbase, whereas understanding a text will be better achieved with tasks premised on a situation model (McNamara & Kintsch, 1996). McNamara and Kintsch go so far as to claim that "it is possible to access and reproduce separate segments of text without understanding or reproducing the relations between them" (1996, p.254) once again casting doubt on studies seeking to draw conclusions about comprehension from data based on recall.

There is also evidence of a relationship between the quality of organisational structure of a text and learning and recall respectively. A well organised and highly structured text lends itself better to recall, whereas a less well organised and poorly structured text lends itself better to learning (McNamara, Kintsch, Soyer, & Kintsch, 1996). If this is accepted then the free recall of a text may be a reflection of the text's organising structure but fails to take full account of the underlying comprehension skills of the reader and the part played by structure strategy.

Another notable area of difference across the body of research into the use of top-level structure in reading comprehension has been in relation to what constitutes a text. Passages of text used in research of this type have varied on a number of dimensions, most notably length, topic, and the extent to which it is a naturalistic text as opposed to one contrived for the purpose. It is generally accepted in the field of discourse processing that there is no minimal size to what constitutes a text. However, from the point of view of the reader's use of the text structure for comprehension, it is likely that longer passages will demand more in terms of global coherence than short texts. Accordingly, the question of the use of text structure may well be related to some extent to the length of the passage in question. Studies employing very short passages of text might allow students to remember all the details in addition to the main ideas simply on account of the brevity of the text. Consequently, shorter and less complex texts may make the search for top-level rhetorical schemata unnecessary (Carter, 1977). The implication here is that texts have to be a certain length before the global coherence demands will require the reader to apply structure strategy.

A related concern about the texts employed in this body of research is the manner of their construction. Much of the research has been concerned with controlling the top-level structure to minimise the intrusion of other text structures or to exclude them entirely. This was particularly so in studies that employed very short passages. As pointed out by Richgels et al. (1987) in relation to short unnatural passages, "very few such passages reflecting only one text structure can be found in texts that students are likely to encounter" (p.191). The problem with using artificially constructed texts that minimise the likelihood of the reader utilising an alternative structure is that it will increase the likelihood of a competent reader

identifying the criterion structure against which the reader's ability is being assessed, thereby putting the results in doubt and raising questions about their generalisability. There is a strong case to be made for the use of naturalistic texts of sufficient length and complexity to engage the reader's high level comprehension strategies including structure strategy (Graesser, Millis, & Zwaan, 1997).

As indicated already, a major concern in relation to the research has been the relationship between text structure, reading comprehension, and memory. The logic of much of the research, particularly that of Meyer and her associates, was that the text structure highlights the important information in the text, and if the reader can identify the important ideas in a text then it is demonstrated that the reader has comprehended the text. Consequently, recall of the important ideas is inferred to be evidence of comprehension. What Meyer and her fellow researchers contributed was the role of text structure in facilitating the identification of the important ideas in text (Bartlett, 1978; Meyer, 1977; Meyer et al., 1980; Meyer & Freedle, 1984; Richgels et al., 1987; Slater et al., 1985). In other words the rhetorical structure mediates the relationship between the text comprehension and its recall. The text communicates itself to the reader by reading (or listening) to it, consequently, it is inferred that the quality of the recall tells us something about the comprehension skills of the reader. In many ways this methodology and reasoning have not changed much since the early work of Henderson. However, in order to be confident of such a conclusion the text would have to be of such a length and complexity to challenge the capacity of the reader to remember some but not all of the text. In other words the text needs to be a suitable length, on a relatively unfamiliar topic, and be sufficiently challenging in its organisation before the use of structure strategy is likely. At the same time, if the

relative merits of alternative rhetorical structures are to be compared then they must all be assessed simultaneously.

The body of research investigating the relation between structure strategy and recall tended to assess the reader's recall against a criterion, usually the top-level rhetorical structure formally identified for the passage. Often the passage had been deliberately constructed for this purpose. The test thus became the reader's ability to identify the writer's top-level structure. However, in doing so it assumed that there was only one correct (or best) way to comprehend a passage and that was by using the writer's top-level structure and, conversely, that failure to identify the text structure implied a failure in comprehension. This may or may not be the case for the accomplished reader, but it tells us nothing of the process whereby younger readers develop this expertise, despite this having been a key focus of much of the research (Englert & Hiebert, 1984; Englert, Stewart, & Hiebert, 1988; Meyer, Brandt, & Bluth, 1980; Richgels et al., 1987; Slater, Graves, & Piche, 1985).   Such an approach excludes consideration of the use of alternative structures and their relative effectiveness despite such a possibility being acknowledged. In the latter respect an unexpected result of Bartlett's (1978) study into the capacity of 9th grade students to learn and apply structure strategy, was that some very high ability readers did not use the intended top-level structure.   All this begs the important question asked by Ohlhausen and Roller (1988), not simply whether text structure assists in the identification of important information, but how text structure assists young readers make the decision about which information in a text is important. If the focus is placed on the information selected, and the assumption made that this information is what the reader considers to be most important, then the relations among the selected information ought to tell us something about the reading comprehension process as

opposed to simply matching its accuracy with the overall structure of the text as in a recall task.

Ohlhausen and Roller (1988) attempted to solve some of these problems in their study of 5th, 7th, and 9th grade students' relative use of content and structure schemata. Ohlhausen and Roller employed texts of approximately 650 words in length and a data collection method specifically designed to identify what information was considered important by the reader. This method required the reader to read the passage and underline those sentences considered by the reader to be the most important in the passage. However, in their attempt to control the relative contributions of two different types of schema, i.e., content and structure, they sacrificed the naturalistic quality of the passages. The authors themselves acknowledged that it is, "possible that…identifying important information in deformed text is more difficult than unmanipulated text" (Ohlhausen & Roller, 1988, p.83). They also restricted the passages to a single rhetorical structure, namely, descriptive, thereby affording no insight into the relative use of alternative structures that would be anticipated in a natural passage of text. However, they generated structural awareness scores for each participant related to each one's important sentence selection, which seems to be a significant step in respect of exploring reading comprehension strategy use. Nonetheless, the process of identifying the reader's awareness was limited on two counts: firstly, it is likely that there is a developmental limitation in the metacognitive ability that was required for the tasks; and, secondly, it relied on reader's reference to signalling contained in the text as evidence of structural awareness despite the fact that such signalling has been shown not to be a reliable indicator of structure strategy employment by more able readers (McNamara & Kintsch, 1996).

Signalling

There is research evidence both to support the hypothesis that signalling improves text comprehension (Degand & Sanders, 2002) and conversely, that it does not improve text comprehension (Spyridakis & Standal, 1987). There have also been studies that have suggested a differential effect of signalling related to the reading ability of the reader (McNamara & Kintsch, 1996). The latter result might be explained by the authors' assumption that signalling cues are a manifestation of cohesion as opposed to coherence so that their manipulation may not be expected to impact on coherence at all. Consequently, more able readers' ability to achieve coherence will make signalling less important. Other studies have suggested a differential effect of signalling related to the degree of existing content knowledge held by the reader (Kamalski, Sanders, & Lentz, 2008). The effects of signalling on comprehension are thus far from clear.

Knott and Dale (1994) argued that:

If people actually use a particular set of relations when constructing and interpreting text, it is likely that the language they speak contains the resources to signal those particular relations explicitly. (p.44)

If this is accepted then a degree of signalling is inevitable in any meaningful text and attempts to generate texts without such signalling not possible without loss of meaning. Knott and Dale (1994) went on to argue that:

A given linguistic strategy can be taken as evidence for the existence of some structuring mechanism that corresponds to it, even before we have a way of defining it in theoretical terms at all (p. 44-45)

The argument here appears to be for a necessary relationship between structure and language which will be evident in text comprehension. The choice of what the reader

considers to be the important information contained in the text provides clues to the structure involved in the selection. Ohlhausen and Roller's (2000) method provides the potential to discover any structural strategy employed by the reader.

Sanders and Noordman (2000) were concerned not just with the substance of the relation in the text but with how that relation was, or was not, made explicit. They recorded the processing time on two texts with different top-level rhetorical structures and on versions with and without signalling. They also collected recall data. Their findings indicated no relationship between signalling, recall, and text structure but that texts were processed more quickly in the versions with signalling. This tended to suggest that the presence of signalling carries implications for comprehension but may not distinguish between the implications for different top-level rhetorical structures. On the other hand Meyer et al. (1980) argued that such signalling does influence recall.

Other researchers have concluded that any effect of signalling is dependent on the prior content knowledge about the text held by the reader and that it is only readers with low content knowledge who benefited from such signalling (McNamara & Kintsch, 1996; Roller, 1990).   However, this has not been a consistent finding either (Boscolo & Mason, 2003).

Among the many studies exploring the effects of signalling on comprehension there are many differences and debates about the methods used. Such research has tended to manipulate the presence of signalling. Consequently, studies tended to look for effects of two extreme conditions, namely, abundant signalling cues or no signalling cues. On the basis of the argument put by Knott and Dale (1994) this is a virtually impossible task. Given the latter, along with the fact that the effects of signalling cues are still contentious, this study does not plan to manipulate the

intended natural texts to control for the presence or absence of signalling although there is some degree of signalling in all three passages.

The Role of Prior Knowledge

van Dijk (1979) distinguished textual relevance and contextual relevance. Textual relevance is concerned with the rhetorical structure of the text whereas contextual relevance is concerned with the reader's background knowledge of the topic. Despite this distinction they have an interactive influence on text comprehension (Ohlhausen & Roller, 1988; Schnotz, 1982; Taylor & Beach, 1984). The degree of prior topic knowledge held by the reader has implications for the nature and extent of the comprehension strategies employed by the reader. It has been demonstrated that when readers have good prior knowledge of a text topic they appear to have less reliance on such comprehension strategies. However, since school students, as they progress through school, will increasingly be faced with material on relatively unfamiliar topics, it can be argued that explicit teaching of comprehension strategies is essential.

The principal distinction between the two higher level models of text comprehension, i.e., textbase and mental model, as described by Kintsch (1978), lies in the relative extent to which meaning is restricted to information contained in the text or the extent to which it establishes coherence in the context of the reader's existing knowledge of the subject matter. Kintsch distinguished text base comprehension from mental modelling on the basis of the relative degree to which existing knowledge plays a part in the construction of meaning. Text base comprehension is generally restricted to the text itself, whereas mental models draw extensively on existing knowledge. However, this distinction arguably oversimplified the relative role of existing knowledge in comprehension.

There is a need to distinguish the various sorts of existing knowledge that might be employed by the reader in the process of text comprehension. The most obvious form of knowledge is domain knowledge, i.e., the reader has existing knowledge in long-term memory about the topic being addressed in the text. The reader might also have knowledge of related topics that assist in comprehending the topic contained in the text. It has been well documented in the literature that such knowledge improves the reader's comprehension and reduces the cognitive effort in grasping the gist of a text.   However, the reader will also, to a greater or lesser degree, have existing knowledge about the structure of written language which is not topic related and can range from syntactical knowledge to knowledge of rhetorical structure. Wiley, Griffin, and Thiede, (2005) argued that mental modelling involves both "explicit and implicit relations between ideas" (p.412) and regarded the critical component of theories of mental modelling as the reader's ability to establish "causal, logical, and explanatory relations" (p. 412).   In this broader definition of mental modelling, a mental model and global coherence can be achieved without domain knowledge.

The Current Study

It should be clear from this examination of the relevant literature and the foregoing discussion that, despite extensive efforts to understand the relationship between text structure and reading comprehension, there is still little clarity as to how children develop awareness of text structure and apply it as a comprehension strategy. The research has also tended to be plagued with conceptual and methodological concerns. Conceptual confusions have been found in the definition of coherence, the nature of a text and expository text in particular, the philosophical validity of constructivism, the classification of different rhetorical structures, differentiation of

the text structure from the reader's cognitive structure, and debate about schema theoretical approaches to reading comprehension in general. Methodological concerns have included the impact of different text transmission modes and experimental response methods including both receptive language, i.e., listening and reading, and expressive language, i.e. oral and written; a lack of consistency in the selection of participants; questionable conclusions about reading comprehension based on recall data; a lack of naturalistic texts of sufficient length to test a child's range of comprehension strategies; criterion-referenced assessment based on the structure of the text to make statements about the reader's cognitive structure; and inconsistency in the selection of top-level structures being observed.

The results of the various research studies in this area have provided no clear conclusions on the questions as to when and how children learn and begin to employ structure strategy in reading comprehension. There has been a tendency to rely on absolute results based on the absence or presence of structural strategy use to the exclusion of the graduated employment of structure strategy that seems more likely. Siegler (1996) has challenged 'stage' type approaches to strategy use and argued that alternative strategies emerge in a more complex manner similar to 'overlapping waves'(Siegler, 1996). For all the reasons summarised above it is perhaps not surprising that research in this area has tended in more recent years to move its focus away from such big questions to more specific questions such as the effects of strategy training and signalling (Meyer & Poon, 2001; Williams et al., 2005). This seems akin to making a diagnosis on the basis of the success of the treatment. This ignores the possibility of other reasons that might explain such success. In the absence of answers to the broader questions about the development and influence of structure strategy on reading comprehension there is little, if any, theoretical

justification for the implementation of instruction programmes in structure strategy. The tendency has been to justify such implementation on the basis of results demonstrating that the child has learned what has been taught, but this begs the question as to the value and justification of what has been taught. Consequently this study seeks to return to some of the earlier more fundamental questions.

It is considered that there is currently insufficient evidence to reach any clear conclusions about the part structure strategy plays in the reading comprehension process, and although there is evidence that alternative top-level structures make different cognitive demands on the child it is not yet clear how this develops and affects comprehension. Whilst there is some evidence to conclude that general reading ability has a bearing on the relative development and use of different rhetorical structures, it is less clear how such structural awareness develops during the years of 'learning to read to learn' which seems to occur in the middle school years between 'learning to read' and 'reading to learn'. This is the focus of the present study.

Whilst the literature in discourse processing presents a consensus that embraces a very broad view of what constitutes text, this study is concerned with a particular comprehension strategy that it has been argued will only be necessary in relation to expository texts of sufficient length and complexity to require such a strategy by the young reader. It has been made equally clear that the strategy is more likely to apply when domain knowledge of the text topics is minimal. There will be no attempt to eliminate domain knowledge since this is not considered possible without losing the natural character of the text. However, texts with relatively obscure topics have been chosen deliberately for this reason. A major justification for

the texts selected is that they are just the sorts of texts that students in these years are confronted with in school.

This study will purposely avoid reliance on any form of recall data. Studies of comprehension that have avoided using recall data have typically sought ways to observe on-line processing such as think-aloud strategies (Cote, Goldman, & Saul, 1998; Magliano, Trabasso, & Graesser, 1999). However, there are significant problems associated with 'think-aloud' protocols. Think-aloud strategies are metacognitive strategies adding a significant additional variable to be controlled since a child may well employ a strategy without necessarily being aware of it. Children in particular may not have the necessary metacognitive skills to respond adequately to think-aloud demands and, consequently, it would be hard to assess the extent to which results reflect the child's comprehension skills as opposed to the child's metacognitive skills. Although a child may lack the necessary metacognitive ability this does not preclude good cognitive ability. Think-aloud strategies may alter the reading process by inducing more extensive processing by children who have good metacognitive skills, thereby becoming a contributing factor in improving the child's comprehension. Think-aloud strategies by virtue of their on-line character are more likely to focus on local coherence when in fact the comprehension task is ultimately to achieve global coherence, and so may offer little insight into how global coherence is achieved. Following on from the last point, and most importantly for this study, a think-aloud strategy will not test the relationship between the comprehension strategy employed by the reader and the nature of the representation constructed by the reader.

The method of underlining the important ideas contained in the text developed by Ohlhausen and Roller (1988) solves the metacognitive demand associated with think-aloud protocols. It is argued that the important ideas identified by the reader are

a genuine reflection of the reader's understanding of the text, and provide data which might facilitate a reconstruction of the reader's schema. However, Ohlhausen and Roller did not attempt any such reconstruction from the data, instead preferring to conduct a simple comparison between the reader's selection and a preferred selection previously identified by the authors of the study. If the two matched then it was considered that the organisational structure of the text had been employed in its comprehension. If the same initial data were examined for any structure implied by the particular selections of important information for any single individual then we might have some insight into what structure strategy had been employed. It is believed that such data collected with such a reconstruction method in mind could be a rich source of information about the reader's comprehension strategy when analysed in a qualitative manner.

Attempts to place strict time limits on reading, which would almost inevitably apply when using computer transmission, would detract from the reader's ability to use structure strategy. This study is not concerned with how quickly the student reads but how the student arrives at meaning. Consequently, it will be considered important that all students have reasonable and sufficient time to read and re-read as much as necessary to understand the text. Consequently, texts will be supplied in conventional hard copy.

Assumptions of the study

Arguments have been put forward to support the following assumptions that underpin this study:

- The reader plays an active part in the construction of meaning from text;

- A moderate constructivist epistemology applies to reading comprehension;

- The structure of the reader's understanding of the text is not necessarily synonymous with structure of the text;

- The ultimate goal of reading comprehension is to achieve global coherence;

- The process of achieving global coherence from expository text involves the construction of a structure that reflects the relationships between significant parts of the text;

- Such a meaning construction by the reader can be facilitated by structural schemata;

- These structural schemata reflect rhetorical top-level structure and there are a limited number of such schemata;

- An invitation to a reader to identify the most important ideas in the text will reflect the reader's understanding of the text;

- The relations between those important ideas in the text identified by the reader will reflect the reader's organising schema and the nature of the representation constructed by the reader.

Focus of the study

This study will be concerned with the structure of text and the use of structure strategy. It will compare the top-level structure of a text with the structure of those elements of the text considered by the reader to be important. The inherent assumption is that the structure of the text will signal what is objectively important and the reader's identified elements of importance will express the reader's understanding of the text. The extent to which the relations between the reader's

selected important elements reflect particular rhetorical structures will permit some comparison with the text structure itself and allow some conclusions about the efficiency of the reader's comprehension skills. A particular advantage of this process will be the inclusion of all the reader's responses as opposed to simple comparison with a strict criterion; in particular the different types of text structure reflected in the reader's responses will permit reflection on the implications for comprehension arising from individual differences. At the same time it will assume that the reading of a text is not fundamentally different from an oral dialogue insofar as it is still concerned with a communication between two parties, a writer and a reader. There is necessarily a phenomenological quality to the process whereby the reader arrives at an understanding of the writer's intended meaning and consequently, that it is unlikely that the reader's understanding will precisely match the writer's intended meaning. Nevertheless one should expect a reasonably high degree of correspondence or else one has to wonder whether meaningful communication has taken place at all. The difficulty in the case of written discourse is that the writer is not present to provide feedback to the reader. This begs the question as to how the quality of the reader's interpretation can be assessed.

Many researchers have employed methods of discourse analysis to identify the rhetorical structure of written text and used this as a standard against which to assess the reader's comprehension. However, if coherence stands apart from the text, this begs the question of whether a reader might employ an alternative top-level structure or complex combinations of rhetorical structures to achieve some degree of coherence. If this is accepted then any understanding of the process of text comprehension must look not only at the structure intended by the writer (i.e. the text structure) but also the structure of the meaning or understanding achieved by the

reader in respect of the text. Whilst it may be impossible to know the writer's intention (unless the researcher wrote the text for the purpose), it is possible to compare the structure identified by the researcher and compare it with that of the reader.   This study will be concerned with the nature of the difference between the structure of the text and the structure of the reader's constructed meaning as opposed to simply recognising and acknowledging that a difference exists.

Given that skills in making coherence inferences are developing at age 8 years, and given the importance of such development for learning, it would be useful to understand the relative comprehension difficulty associated with different types of coherence relations during the years when the child is in school reading to learn. The results of such a study would contribute to a developmental model of text comprehension with implications for reading instruction. It would also provide a clearer standard for the assessment of children's reading skills at different stages of schooling.

Research questions

This study will address the following research questions:

1. How do school children employ structure strategy when reading expository text?

2. What degree of coherence do school children achieve when using structure strategy?

3. What is the nature of any relationship between general reading ability and use of structure strategy?

4. To what extent, if any, is there a relationship between the use of structure strategy and the organisational structure of expository text in the reading comprehension skills of school children?

5. Is there any evidence of a developmental pattern to the use of structure

    strategy by school children?

Chapter 4 Summary

This chapter describes the selection of the participants in the study and the consent process as approved by the ECU Human Research Ethics Committee. The process of subdividing the sample into year groups and ability groups is outlined. There is a detailed description of the passages of expository text used to test the use of structure strategy highlighting their respective top-level structures and the application of the Dale-Chall readability formula to make the passages age appropriate in respect of vocabulary and syntax. A sentence underlining task is the tool used to gather data and its construction and administration is described. Finally, the chapter addresses the scoring process with particular emphasis on the complex coding undertaken and this process is described in detail and a number of examples provided.

4. Method

Participants

This study is concerned with school students who have reached that stage in their education when they have a reasonable mastery of the decoding processes and are applying, to a greater or lesser extent, the higher order cognitive processes involved in reading comprehension necessary for 'reading to learn'. There is widespread acceptance that this process begins to occur at about the age of 8 years, (i.e., Year 3). Consequently this study concerns itself with school children who have completed a minimum of four years of education. The study seeks to discover the manner in which children utilise rhetorical structure for the purpose of reading comprehension between Year 5 and Year 9.

Participants were generally selected on the basis of chronological age. However, because of an intention to test participants on the basis of classroom membership, individual participants in this study were identified by their school year level with the proviso that participants selected for any particular year group would turn the same chronological age in the same year. In support of the decision to identify students by their year level, the identification of participants by their school year level has been the established practice across the relevant literature. In view of the fact that corresponding age and year level might not be consistent across the literature the ages of the children have been provided for purposes of comparison with other studies. Participants were selected on the basis that they were in either Year 5, or Year 7, or Year 9 and turned age 10, 12 or 14 years respectively in the year the data were collected. Consequently, the study focused on students between 10 and 14 years of age and their respective year groups are the same years when the children were

administered the state bench-mark tests in reading comprehension (Western Australian Literacy and Numeracy Assessment/ WALNA).

Participants were selected from two schools for each year group. The two schools comprised a public school and an independent school (i.e., Catholic school). Since Years 5 and 7 are primary school grades and Year 9 a secondary school grade, this resulted in four schools being selected, i.e., two primary and two secondary schools. As a matter of convenience these schools were selected on the basis of proximity to the university. Consequently, the two primary schools and two secondary schools selected are situated in Perth's northern suburbs. The area is neither notably affluent nor poor and could be considered a good reflection of middle Australia. The suburbs are typical 'mortgage belt' suburbs and the only significant migrant population in the area is from English speaking countries, mainly the United Kingdom and Ireland, and a small proportion from South Africa. None of the schools have any demand for specialised ESL programmes.

Two classrooms of students within each year group were selected in each school, resulting in four classrooms of students for each of the three year groups. ECU Human Research Ethics Committee approval was given to conduct the data collection activity on the basis of each school's consent as opposed to the individual student's consent, but that each school would only release a student's results on receipt of a completed parental consent form following the data collection activity. For this reason the exact number of prospective students in the initial sample was unknown. Three out of four schools were happy with this process, but one secondary school expressed a preference to distribute consent forms on behalf of the investigator prior to conducting the data collection activity resulting in a smaller initial sample.

Otherwise, the selection process resulted in four classes of approximately 30 students within each year group.

A major weakness of the consent process was that it relied on the respective classroom teachers to collate and look after the data until individual consent had been provided. The teacher was also relied upon to follow up the consent form returns as the investigator did not have any details relating to the identities of the students within the respective classrooms. Whilst the consent form returns appeared to have been followed up quite well, although better in some classes than others, it became obvious that the same care had not always been extended to looking after the data. The investigator subsequently found that data returns following consent were often incomplete despite the student's full participation. On some occasions this was due to the fact that the data collection activity was carried out on two separate occasions and the student may have been absent on one of those days. However, there were a significant number of cases where data had simply been mislaid by the teacher leading to incomplete responses from students who had participated fully. A further weakness lay in the dependence on the students themselves to transmit information and documentation between school and home. The final consenting sample numbers are presented in Table 3 below:

Table 3
Composition of the Sample Group

Gender	Year 5	Year 7	Year 9	Total
Male	42	32	27	101
Female	42	45	41	128
Total	84	77	68	229

There was a fairly even gender balance in the original classes and it is apparent that, beyond Year 5, boys were less likely to submit a completed consent form. This may have been because the parents of boys are less likely to respond, but

it is more probable that, having used the students to transfer documentation between schools and home, boys were both less reliable, and that by age 12 their parents less likely to check up on school communications.

Reading Comprehension Ability

At the time of data collection Western Australian school students in Years 5 and 7 were required to sit the WALNA. Students in Year 9 were similarly assessed with the Monitoring Standards in Education (MSE9). These were curriculum-based assessments that were criterion-referenced and were employed by the Department of Education and Training in Western Australia for the purpose of monitoring skills in numeracy and literacy and included an assessment of reading comprehension. Raw scores in these tests were converted to a standardised Rasch type scale known as the WAMSE scale (Western Australian Monitoring Standards in Education) which provided for cross-year compare-contrasts within the skill domain. Consequently these scores provided a measure of achievement within a specific domain that did not depend upon age or year of testing.

The tests produced a raw reading comprehension score which was converted using the WAMSE conversion scale which provided scores up to a maximum score of 800. These scores permitted both comparison between students and comparison of an individual student's scores across different test administrations. For the purpose of this study it was necessary to reduce the number of different scores to a smaller set of nominal categories for the purposes of comparison with the organisational structure data which was also nominal in character.

It was decided to identify what might be considered an average ability group along with a below average and an above average group. This was done using the mean score ($X = 460$) and standard deviation ($sd = 70$)) for the whole sample, since

all reading ability scores are on the same scale. The average group was deemed to consist of those participants with a score within one standard deviation of the group mean score (390 – 530). Those more than one standard deviation below the mean constituted the below average group (<390), and those more than one standard above the mean constituted the above average group (>530).   Table 4 below provides a breakdown of the complete sample into reading ability groups.

Table 4
Reading ability group frequencies for the complete sample

Ability group	Frequency	Percent
Below average	38	19.2
Average	120	60.6
Above average	40	20.2
Total	198	100
Missing	31	

However, there was variation between year groups in the proportions of the respective ability groups (Table 5). It can be seen from Table 5 that the number of below average readers drops consistently beyond Year 5 and correspondingly, the number of above average readers increases consistently as might be expected. However, the overall effect is that the proportion of readers in the average range remains much the same regardless of year group.

Table 5
Percentage (and number) of participants within ability groups by year group

Year group	Below average	Average	Above average
Year 5	38.5 (29)	60.0 (45)	1.3 (1)
Year 7	10.6 (7)	63.6 (42)	25.8 (17)
Year 9	3.5 (2)	57.9 (33)	38.6 (22)

The figures might suggest that the older each sample year group the more able a sample it appears to be. However, it needs to be borne in mind that the number of participants within each year group diminishes as the group gets older and that the

number of missing cases varies considerably. It is also worth noting the year group

mean scores and standard deviations presented in Table 6 below.

Table 6
Mean reading scores and standard deviations for the overall sample and year groups

Sample Group	Mean	SD
Year 5	413	58.5
Year 7	474	61.0
Year 9	507	53.0
Total sample	460	70.0

These figures suggest that there is greater overall improvement in reading ability

between Year 5 and Year 7, than between the latter and Year 9**.**

Materials

The aim of the study was to explore the relative use made of the various

rhetorical structures for reading comprehension at different stages of the child's

education. It is through the use of such structures that the reader establishes good

coherence of a text. One important way in which this study differed from many

previous similar studies was the avoidance of textoids i.e., short unnatural passages

designed to provide good experimental control of the rhetorical structure of the text,

and instead, the use of natural classroom texts that are longer than the textoids

typically used in many of the earlier studies.

The selected texts were differentiated by top-level organising structure.

However, natural texts, as opposed to textoids, are generally not restricted to any

particular rhetorical structure and instead are composed of structures within structures.

Thus it is not a question of the reader recognising *the* structure but of recognising and

employing various rhetorical structures that might support coherence. Although the

three passages differed by top-level structure they also shared other common

rhetorical structures. For this reason it was intended to analyse not only differences

between responses to the three texts but also differences between individual approaches to the same text.

The three top-level structures characterising the different passages used in this study are collection, cause-effect, and problem-solution. These three top-level structures reflect varying degrees of constraint on the text meaning, with collection representing the least constraint and problem solution the greatest constraint. It subsequently became apparent that in relation to children's comprehension, the collection rhetorical structure embraced two quite different schemata, i.e., listing and temporal sequence.

Some time was spent finding suitable texts of equal length that suited the criteria for the study. Not only did the texts have to reflect the designated top-level structures, but had to be expository in character, on topics not likely to be familiar to the participants, and of approximately equal length. Time was spent looking at texts that had been previously employed for testing children's reading comprehension within the age range. Two redundant texts from an earlier edition of the Tests of Reading Comprehension (TORCH) (Mossenson, Hill, & Masters, 1987) satisfied the requirements and provided top-level structures reflecting cause-effect and problem-solution. The third text, a descriptive passage with a collection top-level structure, was taken from a book designed to assist children develop their reading comprehension skills (Foster, 1985).

The first of the two texts taken from TORCH is entitled 'Iceberg Towing' and has a problem-solution top-level structure. The passage is concerned with water shortage and the problems associated with the proposed solution, i.e., towing icebergs. The second passage is entitled 'Killer Smog' and has a cause-effect top-level structure. This passage is concerned with the causes and effects of a famous London

fog that occurred in 1952. The third passage, from Foster's book, is a descriptive passage about weddings in the Sikh religion and is appropriately entitled, 'Sikh Wedding'.

Whilst it is acknowledged that the only sure way to eliminate content schemata is to construct passages with no meaningful content whatsoever as in Ohlhausen and Roller's (1988) study, it was considered unlikely that the participants in the current study would have much if any knowledge about the topics of these three passages. However, on later consideration it is possible that some students might have employed their schema for conventional Australian weddings in the course of reading 'Sikh Wedding'. Otherwise the impact of content schema on comprehension is assumed to have been minimal.

It is self evident that some degree of understanding and recognition of the organisation of vocabulary is necessary though not sufficient to achieve comprehension. This organisational awareness can occur at the level of the sentence i.e., syntactical level, or at the rhetorical level if any degree of wider coherence beyond the individual sentence is to be achieved. It is hard to see how knowledge of a particular topic can substitute for a rhetorical structure within which the information can be organised into a coherent whole unless the reader merely listed information that the reader already knew to be associated, i.e., through a content schema. This might be seen as a situation where there are minimal structural constraints on meaning, and no more constraining than a list. Consequently, if there is any effect felt from knowledge of the topic it would only occur when a collection structure was imposed on a text and this would be most likely to occur with Sikh Wedding, selected with this structure in mind.

Minor amendments to the three texts were carried out to ensure they accommodated the differences in decoding ability due to age of participants and equality of text length. Readability has traditionally been concerned with grading texts based on the assessment of vocabulary and syntactical complexity. Chall (1995) generated a readability formula based on the difficulty of the vocabulary and sentence length to grade texts for different aged readers. The process involved enumerating the number of difficult words in the passage and the average sentence length. Chall provided a list of 3000 words generally known by children in grade 4 as a basis for identifying 'difficult' words. She provided tables of cloze comprehension scores derived from these two parameters along with tables indicating the grade level that might be considered appropriate in terms of difficulty for the various grade levels. Such a classic approach to readability was overshadowed by research coming out of cognitive psychology into the influence of text structure and organisation on reading comprehension, but they are not mutually exclusive. The application of the New Dale Chall readability formula allowed for a greater degree of control over the traditional factors considered central to reading comprehension and, consequently, assisted the observation of the influence of organisational/ structural factors.

The application of the Dale-Chall readability formula was used to produce versions of the three passages at Grades (US) 4, 7/8, and 9/10 for participants in Years 5, 7, and 9 respectively. At the same time care was taken to ensure that the readability modifications did not significantly alter the relative length of passages. Consequently, all passages were approximately 700 words long. It was not possible, due to characteristics of the texts themselves, to ensure that the different grade levels were similar across both vocabulary and sentence length independently, only that the two factors in combination were at an appropriate level of readability for each of the age

groups of participants taking part in the study. All versions of each of the three texts are in the appendices.

Procedure

As indicated above, it was agreed with three out of four participating schools to conduct the data collection activity with two complete classes. In the case of the fourth school the reading exercise was only administered to those students in two classes who had previously consented to participate. In the case of the two primary schools this process resulted in classes with the full range of abilities that one might expect in a mainstream primary classroom. In the case of the two secondary schools, where English classes were streamed for ability, care had been taken to avoid classes specifically tailored to the needs of limited ability students. Neither school provided specialist classes for advanced ability students in Year 9.

The reading comprehension task required each participant to read each of the passages in turn and to underline the seven sentences that the reader considered to be the most important.   This method of studying the operation of text structure in reading comprehension had previously been employed by Ohlhausen and Roller (1988). Ohlhausen and Roller were concerned with the extent to which children of the same ages as the children in this study used either structural or content schema or their combination. They generated a passage of expository descriptive text of a similar length to the passages in the current study that was deliberately contrived to reflect a strictly limited structure. Their participants were invited to underline the seven most important sentences in the passage on the argument that the selection strategy would be dictated by recognition of the writer's organisational structure. The results confirmed this expectation. However, the success of the child in selecting sentences was premised on the researchers having written the text with target

sentences in mind reflecting the organisational structure. The children in their study did not have to tease out alternative organisational structures from the text since none existed, the passage having been deliberately constructed to emphasise the top level structure to the exclusion of alternatives. The other limitation of Ohlhausen and Roller's study was that it was limited to the simplest or least constraining of all possible rhetorical structures, i.e., collection.

The underlining task was initially trialled with several teachers who completed the task individually at a time of their own convenience. The teachers provided positive feedback on the suitability of the task and the readability of the passages for the target groups. Some feedback was provided about how the task should be presented to the students and the wording of instructions. The task was then refined and trialled with a Year 7 student who had no apparent difficulty following the instructions and did not seek any clarification. The student's responses seemed appropriate and satisfactory for the purposes of the study. The length of time required by this student for each passage was noted and influenced the organisation of delivery to the participants.

Following trials of the experimental task it was estimated that it would take participants on average between 30 and 40 minutes, depending on the age of the child, to carry out the underlining task in respect of any one passage. Whilst, ideally, the task in respect of all three passages would have been best carried out in a single session in a random order, it was considered that the total time required would have been too long, particularly for the younger children, and would have allowed fatigue and/or loss of interest to contaminate some responses. Also, the time requirements had to be balanced against the constraints of school timetables and it was not going to be possible to get the block of time that would be required to carry out all the data

collection in one go. Consequently, the three underling tasks were carried out over two sessions. It was anticipated, and subsequently confirmed, that the underlining task on the first passage administered would take more time than the two to follow regardless of which passage came first.   This was probably due to the initial unfamiliarity with the process. For this reason only one passage was addressed in the first session and the other two passages in the second session. The order of presentation of the passages was deliberately varied from school to school and class to class.

Classroom procedure

At the beginning of the first session the researcher explained to the children the nature and purpose of the activity they were about to engage in. It was described as an exercise in reading comprehension and the purpose as being to provide important information about how school children go about constructing meaning from what they read in school. They were told that the information would later be requested for a university study into children's reading comprehension skills. It was then explained that, although all present would attempt the reading exercise, their responses would only be handed over to the university by the school with the written consent of their parents and that they would be receiving an explanatory letter and consent form to take home to their parents at the end of the session.

As a further measure to reduce the effect of any decoding difficulties that might be experienced by some students the passage was read to the students by their classroom teacher while the students followed the text visually. Following this the students were prompted to read the passage again themselves. Once this was done the students were asked to identify seven sentences from the passage that the student considered to be most important. The students were required to underline these

sentences in pencil. The 'importance' of sentences was explained as the sentences that together might be considered best expressed or summarised the meaning of the passage. The students were given the opportunity to ask questions of clarification if they were in any way unclear about what was required. In the very few cases of individuals who required further clarification the researcher adopted a similar explanation to that given by Ohlhausen and Roller (1988): "if you had to tell an absent student what the passage was about, what seven sentences would you pick?"

On completing the task students tended to hold up their papers to indicate they were finished. This appeared to be the standard practice within the classrooms. The class teacher collected responses as they were completed and instructed students who completed the exercise quicker than others to read quietly until all had finished. All the completed responses were retained by the class teacher until such time as he/she had received consent forms from parents for release of the responses to the researcher. Subsequently, it became evident that some teachers stored the responses more carefully than others as the responses from some students whose parents had consented to the release of the information were incomplete despite their attendance when the task had been carried out.

Scoring

Ohlhausen and Roller (1988) scored responses to the underlining task as right or wrong based on whether or not participants correctly identified the designated target sentences. They were interested in whether the child recognised the anticipated structure built into the text by the writer. However, in the current study there were no target sentences and the challenge was to identify whether the individual participants' collective selections of what was considered important reflected any degree of coherence that might indicate some rhetorical structure which may or may not be

identical to the text structure. It sought to identify any organisational schemata that might reflect the use of structure strategy by the child. Identification of target sentences was a common practice of some earlier similar studies and assumed that the task of comprehension involves, among other things, the ability to identify the writer's organisational structure. However, this tends to imply that there is a single definitive approach to the comprehension of a text whereas this study assumes that a reader might use structure in a variety of different ways to comprehend the text and still arrive at a coherent understanding, not necessarily different from that intended by the writer but possibly different in quality from that of other readers. Consequently, the task of analysing the responses involved the identification of individual patterns of responses with recognised rhetorical structures in an attempt to discover whether there was evidence, not only of top-level structure, but, of any other rhetorical structure. Secondly, it was concerned with any degree of reciprocity between the reader's rhetorical structure and the text's organisational structure.

In respect of the latter goal the researcher imitated the practice of previous researchers in this field by attempting to identify the top-level structure characterising each text. It was initially considered that, as in previous research, it ought to be possible to construct a hierarchical table indicating the various structural components of each passage. However, this was discovered subsequently to be a very difficult task. The creation of such a hierarchical schema assumes that each structural component is largely independent of the others, and although this might be the case in short passages written for such a research purpose, other writers are not generally so obliging. The reality is that structures not only overlap but may also replace one another, the latter depending on the significance attached to each component of the text by the writer.

The 'Killer Smog' passage describes and explains the causes of smog and its potential effects and in particular the causes and effects of one particularly bad event that occurred in London in 1952. It is easy to attribute a cause-effect top level structure to this passage. However, it is equally possible, and plausible, to read a large part of the passage like a narrative structure, i.e., collection (sequence) or with a problem-solution schema. Alternatively, the reader might simply apply a collection (list) schema to the passage by listing the consequences of the natural event. Equally, in reading 'Iceberg Towing', the problem-solution top-level structure is readily apparent, yet large parts of the text could be usefully interpreted using cause-effect or collection (list) schemas. The question that arises from this is whether it matters. The argument is that the degree of constraint imposed by the selected organisational schema has consequences for the degree of cognitive energy required for the comprehension task and consequently tells us something about the efficiency of the reader's comprehension skills.

It was, consequently, not considered practical or useful to attempt to generate a single structure to explain any particular set of sentence selections by an individual. Instead, it became necessary to look at each participant's individual responses for each passage and attempt to extrapolate from the participant's unique set of responses what organisational schemata or rhetorical structures were reflected by the particular set of choices. The experience of doing this was to initially identify short strings of sentences, as little as a pair, that could potentially enjoy a rhetorical relationship, and gradually refine the process to identify larger groups of sentences that might enjoy a rhetorical relationship and which afforded the highest level of coherence given the selections. This resulted in several false starts when a particular group of selected sentences prompted an organising structure that had not been thought of until that

point in the analysis, thus prompting the researcher to begin again.   In addition, two sentences seemed grossly insufficient to base a conclusion regarding the reader's use of a structural strategy. Through this process it gradually became possible to recognise some consistency across responses and develop a set of criteria for the attribution of organisational structure use by a reader.

These criteria were established along two parameters: the minimum number of sentences and their relationship considered necessary and sufficient to establish a rhetorical structure and the proportion of the passage encapsulated by it, i.e., the degree of coherence established by a combination of sentences constituting a rhetorical structure.

Two final points need to be made before outlining the data coding criteria. It has been the generally accepted practice in studies of top-level rhetorical structure to view narrative structure as applying to a particular genre and quite separate from the list of rhetorical structures employed in writing expository texts. However, it quickly became apparent that, even though the passages are essentially expository in character, there were nevertheless opportunities for the reader to employ one significant aspect of the narrative schema, i.e., temporal sequence, when reading a couple of these passages. There was thus some overlap between the manner in which organisational structure is employed to comprehend both narrative and expository texts. It also became apparent in analysing responses that a small but significant group of readers identified sentences on the basis that they were topic sentences. A topic sentence encapsulates and organises an entire paragraph. It provides a summary of the content of the paragraph. Whilst topic sentences have the potential to contribute to a collection (list) the sentences contributing to a collection (list) will not necessarily be topic sentences. As previously acknowledged, the selection of topic

sentences can offer an alternative method of creating a text macrostructure (McNamara & Kintsch 1996). A group of topic sentences was not considered a rhetorical structure because it is felt that rhetorical structures reflect the connections between the selected sentences, i.e., coherence, which is not necessarily the case with a list of topic sentences. An alternative was to treat a list of topic sentences as akin to a descriptive list; however, it was felt that a group of topic sentences indicated a better grasp of the overall content of the passage than a descriptive list and reflected greater competency on the part of the reader in grasping the general content of the passage. For these reasons it was decided to treat 'topic sentences' as an organising structure *sui generis*.

Data coding criteria

Iceberg Towing – organisational structures

The larger part of the text is concerned with the problems involved in towing icebergs and their solutions and this is the top-level structure. Alternatively, the reader might simply list a series of either problems or solutions without indicating the problem-solution relationship. The early part of the text is concerned with the problem of supplying water where shortages occur with iceberg towing becoming the solution as opposed to the problem. The final few paragraphs of the text are concerned with the potential effects of iceberg towing and coherence could be established either with a cause effect structure or a compare-contrast structure. In fact it became clear that the latter section of the text did not provoke a cause-effect structure but that a small but significant group of participants employed a compare-contrast structure. Consequently, there were three organisational structures identified as having been employed to a significant extent by participants reading this text: problem-solution, collection (listing), and compare-contrast. It was decided to

differentiate between the limited application of problem-solution to the opening paragraphs and the more extensive use in relation to the problems involved in iceberg towing.

Problem-solution was identified if the participant selected a minimum of three sentences, not adjacent to one another in the text that clearly established the problem-solution link and included the main part of the passage. Collection was identified if the participant selected at least three sentences, not adjacent to one another in the text that captured significant characteristics of a single topic, e.g., a list of three solutions but without reference to problems. Compare-contrast was identified when the participant selected sentences highlighting the question of environmental problems and two sentences highlighting alternative views. In the opening paragraph relating to the water shortage, problem-solution (local) structure use was acknowledged if the participant selected a sentence highlighting the problem and one highlighting that iceberg towing was the preferred solution.

Coding of the participants' sentence selections in relation to structure for Iceberg Towing was completed by one independent trained coder and the resulting inter-rater reliability was 0.75 indicating substantial agreement.

Killer Smog – organisational structures

The text opens with a brief explanation of the causes and potential risks associated with smog before a more detailed account of a specific event involving smog. The text concludes with a brief account of the national response to the event. The top-level structure is cause-effect. However, the larger part of the text could equally be read as a collection (sequence). Alternatively, the reader might merely establish lists of characteristics associated with smog or the event in particular. Some readers considered smog to represent a problem with the closing paragraphs

elaborating on the solution. Consequently, there were four organisational structures identified as having been employed to a significant extent by participants reading this text: cause-effect, problem-solution, collection (listing), and collection (sequence).

Cause-effect was established by a causally linked sequence involving at least three sentences, not adjacent to one another, relating to a central issue or idea within the text. Problem-solution was identified if the participant selected a minimum of three sentences, not adjacent to one another in the text that clearly established the problem solution link and included the main part of the passage. Collection (listing) was identified if the participant selected at least three sentences, not adjacent to one another in the text that captured significant characteristics of a single topic, e.g., a list of the main characteristics of the great smog of 1952. Collection (sequence) use was established by a minimum of three sentences establishing a temporal sequence of events with a beginning, middle and end.

Coding of the participants' sentence selections in relation to structure for Killer Smog was completed by one independent trained coder and the resulting inter-rater reliability was 0.62 indicating substantial agreement.

Sikh Wedding – organisational structures

This text is a descriptive passage about the circumstances and proceedings in a Sikh wedding. However, in addition to collection (listing), there were two other organisational structures employed by participants to understand the text: collection (sequence) and topic sentences. It might be considered debatable whether the identification of topic sentences ought to be considered an organisational structure, however, it was considered that it should be as it provides an organisational plan no matter how limited for the reader .

Collection (listing) was identified when the participant selected at least three sentences, not adjacent to one another in the text, highlighting different significant features or characteristics of a particular topic. Collection (sequence) use was established by a minimum of three sentences establishing a temporal sequence of events with a beginning, middle and end. Topic sentence use (in all three passages) was based on the participant selecting more than three topic sentences (i.e., more than half the reader's selections were topic sentences in different paragraphs).

Coding of the participants' sentence selections in relation to structure for Sikh Wedding was completed by one independent trained coder and the resulting inter-rater reliability was 0.8 indicating substantial agreement.

Coherence level

Each passage can be subdivided into three parts, each with a slightly different focus that would add to the complexity of establishing global coherence. One of these parts is identified as the main or central part of the passage. Iceberg Towing can be divided into a short section concerned with the water shortage problem and solution, followed by an extended section (main part) concerned with the problems associated with towing icebergs and their solution, and finishes with several paragraphs about the potential environmental problems generated by removing icebergs from their natural origin. Killer Smog commences with a brief section about smog in general before moving on to an extended passage about the problems generated by the 1952 smog in particular (main part), and concludes with the preventative measures taken to address the problem of smog in general. Sikh Wedding commences with comments about partner choice in marriage, moves on to the circumstances and events preceding a Sikh marriage, and finishes with an extended description of the Sikh marriage ceremony (main part).

The coherence level coding is intended to convey an idea of the proportion of the overall text connected by the organisational structures employed by a reader. There were generally five alternatives; firstly, where there is no apparent coherence established by the sentence selections; secondly, topic sentence use (as previously discussed); thirdly, structure use restricted to one of the two minor sections of each passage or a significant part of the main section and referred to as 'minimal coherence; fourthly, a structural application that captures two sections within the text or the vast majority of the main section in the text, referred to as 'moderate coherence'; and finally, use of structure that captures the majority and at least two sections including the main section of the text, referred to as 'majority coherence'.

Coding of the participants' sentence selections in relation to the amount of coherence achieved for all three passages was completed by one independent trained coder and the resulting inter-rater reliability was found to be Kappa = 0.766, p < .000 (unweighted) indicating substantial agreement..

Examples of Application of Coding Criteria

The following are the sentence selections for 'Iceberg Towing' from a Year 9 student of average reading ability:

1. *"A great amount of money and resources are being poured into studies aimed at overcoming these technical difficulties."*

2. *'One important question is where to locate suitable icebergs."*

3. *"Research is being carried out to calculate the rate that icebergs deteriorate in certain types of weather and at certain temperatures."*

4. *"Even so, the amount of iceberg surviving at the end of the journey, experts say, would contain enough water on arrival to supply a medium density city such as Perth or Adelaide, for about two years."*

5. *"However, those interested in the idea of transporting icebergs still have to overcome other environmental problems."*

6. *"Some people are worried about the effect of the removal of the iceberg from their natural home regions."*

7. *"On the other hand, those who support the iceberg towing idea say that the upwelling of the water caused by the removal of the icebergs may improve the water by bringing more nutrients to the surface."*

This student identifies the core set of problems with which the passage is concerned in her first sentence choice. The 'problems' are developed in sentence choices 2, 3 and 5. Sentence choice number 4 implies solutions to the problems described in sentence choices 2 and 3. Sentence choices 1 to 4 (and 5 could be counted as well) are seen as indicative of the use of a problem-solution organising structure. Sentence choices 6 and 7 pose alternative scenarios in response to the set of problems posed by sentence choice number 5 including a suggestion that there may not be a problem to solve here. Sentence choices 5 to 7 may also indicate the employment of a compare-contrast organising structure in the latter part of the passage.

This student was adjudged as having achieved majority coherence, although not embracing the opening context about water shortages in her sentence selections.

The following are the sentence selections for 'Iceberg Towing' from a Year 7 student of average reading ability:

1. *"Scientists believe that Australia's best hunting ground for the icebergs would be north of the Amery ice shelf, near Australia's Davis Antarctic base."*

2. *"The scientists seem to agree that such an iceberg would need to be 200-280 metres thick, with a top surface of about five square metres."*

3. *"A typical towing speed would be around a kilometre per hour, rising to over three kilometres per hour near the end of the journey."*

4. *Scientists say that the total Antarctic iceberg production per year is about 1200 cubic kilometres."*

5. *"On the other hand, those who support the iceberg towing idea say that the upwelling of the water caused by the removal of icebergs may improve the water by bringing more nutrients to the surface."*

6. *"Although water is a source of life, it has a low value in most places."*

7. *"However, iceberg water could be extremely cheap for some countries when compared with desalination, a process which needs much more fuel and much more money."*

This student failed to select any sentences referring to either the problem of water shortage or the technical problems associated with, or arising from, iceberg towing. Sentence choices 1 to 4, and arguably including 5 and 7, provide a list of descriptive information about iceberg towing. Selection 6 appears to relate to, and provide additional justification for, selection 7. It was adjudged that the student had employed a collection (listing) organising structure. The student was considered to have employed a structural application that captured two sections within the text or

the vast majority of the main section in the text and classified as 'moderate coherence'.

The following are the sentence selections for 'Iceberg Towing' from a Year 5 student that exemplify the absence of structure strategy:

1. *"He put forward the idea of moving icebergs from the South Pole to very dry parts of the world."*

2. *Engineers believe that Australia's best place to find icebergs would be north of the Amery ice shelf, near Australia's Antarctic base."*

3. *"An iceberg would need to be big enough to last several months."*

4. *"The iceberg would have to be big enough to give enough time to move the iceberg the two to three thousand kilometres to Australia."*

5. *"Engineers seem to agree that the icebergs would need to be 200-280 metres thick, with a top surface of about five square kilometres."*

6. *"This can cause the numbers of fish to grow as well as the number of animals that feed off the fish."*

7. *"At the end of the day the question of iceberg towing will depend on how much it will cost."*

The following are the sentence selections for 'Killer Smog' from a Year 9 student of average reading ability:

1. *"It is currently well known that smoke and other pollutants in the atmosphere can be dangerous to our health."*

2. *"On one occasion, in early December 1952, due to the stability of the atmosphere over London, a wind did not come and the smoke pouring into the air just stayed over the city."*

3. *"For old people, babies under one year and anyone suffering from heart or lung complaints it was a time of extreme risk."*

4. *"Four thousand people died from an attack of bronchitis."*

5. *"The sulphur dioxide came from the burning coal and oil and when combined with water it produced sulphuric acid."*

6. *"Therefore, in 1956 the Clean Air Act was made a law by Parliament."*

7. *"It was the 1952 event, the worst of a whole series of such smogs, which prompted Londoners to support legislation which otherwise would not have been very popular."*

The first selection states a general causal link between pollution (i.e. smog) and ill health. The second selection states a causal link between a specific event concerning pollution and the reason it occurred. These two selections complement one another in establishing the top-level organising structure. Selections 3 and 4 are treated as one, due to their being adjacent sentences, and describe the ill health effects of the event. Selection 6 could at first be thought to be a solution to pollution, but selection 7 complements 6 to clearly state a causal relationship between the event and clean air legislation. There is adjudged to have been a clear and consistent application of a cause-effect organising structure by the student, and one that satisfies the criteria for a high level of coherence classified as 'majority coherence'.

The following are the sentence selections for 'Killer Smog' from a Year 7 student of average reading ability:

1. *"However, a rare instance occurred in the city of London in December, 1952, when, due to the stability of the atmosphere over London, a wind did not come."*

2. *"Soon people could not see more than a few metres in front of them."*

3. *"Soon there were major disruptions to ambulance, fire-brigade and bus services and people were afraid to go out in case they lost their way."*

4. *"For old people, babies under one year and anyone suffering from heart or lung complaints it was a time of extreme risk."*

5. *"An official committee set up to investigate the disaster confirmed this combination of pollutants was one of the main causes of deaths."*

6. *"After four days of the terrifying smog, a wind slowly began to clear the air over London."*

7. *"Those Londoners who had suffered through the four days were determined that such an event should not happen again."*

There is some evidence to suggest a degree of collection (listing) of features or effects of the Great Smog in selections 2, 3, and 4. However, there is a temporal sequence embracing a clear beginning, middle and ending that leads the researcher to conclude that in this case the dominant organising schema is collection (sequence), and that it is this organising schema that generates the greatest level of coherence. The coherence level was deemed to reflect a structural application that was limited to the vast majority of the main section in the text and classified as 'moderate coherence'.

The following are the sentence selections for 'Sikh Wedding' from a Year 5 student of average reading ability:

1. *"In Australia, people decide for themselves whom they will marry."*

2. *"Arranged marriages can sometimes take place in other religions but this is not the case in the Sikh religion."*

3. *"It may be 9.00 am on the flat roof top of a house in the Punjab with all the guests squeezed together around the holy book of the Sikh religion, and with onlookers standing on the roofs of neighbouring houses."*

4. *"The person sitting behind the holy book is a respected member of one of the families, who leads the prayers and directs the wedding."*

5. *The high spot of the wedding service is the singing of the Lavan."*

6. *"Many of the men in the bride's family will stand round, putting their hands on the bride's shoulders and helping her on her way."*

7. *"The bride and groom and their guests listen to a reading from the holy book and the service ends with the sharing of a popular Indian sweet."*

Selections 1 and 2 generate local coherence around the topic of partner choice in marriages. Two sentences do not qualify as evidence of the use of an organising schema. Selection 3 sets the scene of a typical Sikh wedding and the remaining four selections can be viewed as a collection (listing) of characteristics or features of a Sikh wedding. There is no evidence in this set of selections of either collection (sequence) or topic sentence identification being used by the student. This reader was adjudged to have established a limited degree of coherence over two sections of the passage but short of the majority and classified as 'moderate coherence'.

The following are the sentence selections for 'Sikh Wedding' from a Year 5 student of average reading ability:

1. *"In Australia, people decide for themselves whom they will marry."*

2. *"The wedding service begins with the singing of the morning hymn Asa di Var followed by prayers."*

3. *"He will be wearing a golden coloured turban on his head."*

4. *"The bride, dressed in red, then joins the guests and, along with a friend, sits on the left side of the groom."*

5. *"The bride and groom show that they agree to the marriage by bowing towards the holy book."*

6. *"During the singing the couple walks around the holy book, the bride following the groom."*

7. *The service finishes with a hymn, followed by a prayer and some food is shared."*

Selection 1 picks up the opening topic in the passage but there is no obvious organisational connection to later selections. Selections 2, 5, 6, and 7 describe actions that occur at the wedding being described in the passage. Selections 3 and 4 describe the attire of the bride and groom and may have been selected on account of the student having an existing wedding schema which in Australia places a lot of focus on dressing up for weddings. However, within the actions there is a collection (sequence) structure from the wedding service starting to the key events occurring during the wedding, and culminating in the finish to the wedding service. It was adjudged that a collection (sequence) organising structure was the dominant strategy of the student despite evidence of collection (listing). This reader was adjudged to

have established 'moderate coherence' over two sections of the passage but short of the majority of the passage.

The following are the sentence selections for 'Sikh Wedding' from a Year 7 student of average reading ability:

1. *"In some countries the parents choose a partner for their son or daughter and such a marriage is called an 'arranged' marriage."*

2. *"A Sikh wedding is one of consent."*

3. *"The wedding normally takes place in the village where the bride's family lives, and may be celebrated in any convenient place."*

4. *"The wedding service begins with the singing of the morning hymn Asa di Var followed by prayers."*

5. *"The bride and groom show their assent to the marriage by bowing towards the Guru Granth Sahib."*

6. *"The main feature of the wedding service is the singing of the Lavan."*

7. *"The service concludes with a hymn, followed by a prayer and the sharing of food."*

This is an example of a student selecting topic sentences, in this case the topic sentence from six of the nine paragraphs composing the passage. The only selection not qualifying as a topic sentence was the first one. This happens also to be the only paragraph where the topic sentence is not the opening sentence in the paragraph. The final paragraph consists of only a single sentence and was not selected.

Chapter 5 Summary

Each part of the presentation of results focuses on four points of comparison: the types of structures employed by participants, the number of structures employed by participants, the dominant structure strategies employed by participants, and the levels of coherence achieved by participants. The results are divided into three sections. Firstly, there is an examination of the frequencies of use of the various organising structures by year group and passage. Secondly, there is an examination of the frequencies of use of the various organising structures by ability group and passage followed by an ability group comparison. Thirdly, there is a comparison of results across passages.

5. Results

The order of presentation of the results will, firstly, examine participants' frequencies of responses according to their year group followed by a comparison between year groups. Secondly, it will examine the frequencies of responses by reading ability group followed by comparison between reading ability groups. Thirdly, there will be a comparison of responses across the three passages. Each part of the presentation of results will focus on four points of comparison: the types of structures employed by individuals, the number of structures employed by individuals, the dominant structure strategies employed by individuals, and, finally, the levels of coherence achieved by individuals.

Some clarification may be useful in relation to the distinction between the frequencies of all structures employed by individual participants and the frequencies of the dominant structures employed by those same individuals. The former acknowledges any structures that might be construed as being constituted by any combination of the sentences selected by the individual and consequently may show an individual participant using multiple structures. The latter refers to the single structure that makes the greatest contribution to the participant's coherence and parallels the top-level structure of the passage.

It is anticipated that the examination of the various frequency tables will answer the first two research questions relating to how children employ structure strategy and the degree of coherence subsequently achieved. The third research question relating to the influence of reading ability on structure strategy ought to be answered by the section comparing ability groups. A comparison between the results of year group and ability group should elucidate the question of developmental influence. The final section of the chapter will address the question as to the

relationship between the structure employed by the reader and the top-level structure of the passage.

The participants' responses were recoded several times in a lengthy process of refinement that resulted in a limited number of structural strategies for each passage across all three year levels. The various organising structures identified as having been employed by participants in respect of each passage are presented in Table 7.

The recognition of 'problem-solution (local)' in the Killer Smog passage is exceptional insofar as it is the only passage where such limited apparent use of structure is recognised by the researcher. The decision to do so was based on the fact that this passage was the only one which so clearly flagged the top level structure of the text and by acknowledging the local use it provided some insight into those who recognised this structure as opposed to those who used it effectively.

Apart from rhetorical structures it was also observed that some participants selected sentences that highlighted the various topics contained within the passage as opposed to a conventional rhetorical structure. The selection of topic sentences represented a fundamentally different approach to the research task that could not be ignored. Consequently, the selection of topic sentences is identified in the results and addressed in the discussion section. It needs also to be acknowledged that there was considerable overlap between topic sentences and collection (list). It transpired, particularly in relation to the descriptive passage Sikh Wedding that a participant selecting topic sentences frequently also satisfied the criteria for collection (list) and this has to be borne in mind when considering the results.

Table 7
Organising structures employed by participants in respect of each text

	Iceberg Towing	Killer Smog	Sikh Wedding
Collection (list)	X	X	X
Collection (sequence)		X	X
Cause-effect		X	
Problem-solution (local)	X		
Problem-solution	X	X	
Compare-contrast	X		
Topic Sentences	X	X	X

Year 5 Results

This section will present the range of rhetorical structures employed by Year 5 participants and identify the dominant schema choices of each individual participant. It will also present the levels of coherence achieved by Year 5 participants. In doing so it will distinguish between responses to each of the three passages since each passage presents the reader with a different type of stimuli identified by its top-level structure. Out of a total of 84 Year 5 participants, 79 responded to 'Iceberg Towing', 69 responded to 'Killer Smog', and 80 responded to 'Sikh Wedding'. Given the difference in numbers responding to each of the passages, for ease of comparison the frequencies of response will also be presented in percentages.

Iceberg Towing

The following table presents the numbers of Year 5 students who employed each of the identified structures to assist in the comprehension of 'Iceberg Towing', a passage with a problem-solution top-level structure. It should be remembered that the 'number of students' column generates a total greater than the number of participants in this table as a participant may have shown evidence of having used multiple organising structures. Consequently, no totals are given. In this respect this table is

different from the later table that shows the frequencies of use of individuals'

dominant structure choice.

Table 8
Numbers of Year 5 Participants Employing Various Organising Structures to Comprehend 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	24	30.4
Collection (list)	41	51.9
Problem-solution	9	11.4
Compare-contrast	4	5.1
Topic sentences	14	17.7
No schema used	20	25.3

Despite the fact that the top-level structure for this text is 'problem-solution', the Year

5 participants most frequently listed a collection of related pieces of information

(collection-list). Almost a third of the participants recognised the problem-solution

structure flagged in the open paragraph but only nine participants succeeded in

developing it through other parts of the text. Almost one in five participants identified

topic sentences. More than a quarter of the participants failed to register any apparent

use of either rhetorical structure or identification of topic sentences.

Table 9
Numbers of Structural Schemata Employed by Individual Year 5 Participants Reading 'Iceberg Towing'

Number of schemata employed by an individual	Frequency	Percentage
None	20	25.3
One	34	43.0
Two	20	25.3
Three	4	5.1
Total	79	100

The information contained in Table 9 recognises the fact that participants may

have made sentence selections reflecting the use of multiple structures in their

structure strategy. The purpose of presenting this information is to provide some

insight into the relative complexity of structure strategy by some individuals relative to different types of top-level text structures. In the case of Year 5 participants reading Iceberg Towing a quarter of the group failed to employ any structure. Among those who employed a structure strategy it was most frequently the case that strategy was restricted to a single schema (43%), and over 30 percent of the participants employed more than one structure. For the purpose of comparison with other groups of participants and other passages the average number of schemata per participant has been calculated. The average number of structures used by each Year 5 participant was 1.08.

Table 10

Dominant Schema Choice of Year 5 Participants Reading 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	4	5.1
Collection (list)	36	45.6
Problem-solution	5	6.3
Compare-contrast	2	2.5
Topic Sentences	12	15.2
No structure used	20	25.3
Total	79	100

Thirty six of the 41 Year 5 participants who used collection (list) employed it as their dominant structure strategy tool to comprehend 'Iceberg Towing'. Twenty four participants identified the problem-solution indicated in the opening paragraph of the passage but only four were limited to its use as their dominant strategy. The small number of participants who made wider use of the problem-solution structure almost halved when it was considered as the dominant structure employed. Among the Year 5 participants very few showed the ability to apply a high constraining structure in the process of comprehension of this passage. The number of participants employing topic sentences as their main tool for comprehension remained fairly constant suggesting that any use of topic sentences was likely to denote the dominant strategy.

The amount of coherence achieved by Year 5 students in respect of Iceberg Towing (Table 11 below) broadly reflected the dominant schema use, i.e., there was a degree of correspondence between numbers using no or low constraining structures and numbers achieving no or minimal coherence. Since the majority of Year 5 participants were inclined to rely on a low constraining schemata it is not surprising that in most cases the dominant schema was insufficient to achieve maximum coherence. It was anticipated that there might be some cases where maximum coherence might be attributed when the dominant schema clearly overlapped a complementary schema. However, only one Year 5 student achieved majority coherence.

Table 11
Levels of Coherence Achieved by Year 5 Participants Reading 'Iceberg Towing'

Level of coherence	Number of students	Percentage of students
No coherence	20	25.3
Minimal coherence	32	40.5
Moderate coherence	14	17.7
Majority coherence	1	1.3
Topic sentences	12	15.2
Total	79	100

Topic sentences are included in Table 11 but they represent a special category, it being very difficult to quantify from a selection of topic sentences how much coherence has been achieved. If it is assumed that the student identifying topic sentences is achieving some degree of coherence then almost three quarters of Year 5 participants found some degree of coherence based on structure use in relation to the 'Iceberg Towing' passage despite the fact that very few of them used the top-level structure of the passage. Having said that, the level of coherence achieved by the average Year 5 participant was typically very low with fewer than one in five achieving moderate coherence and only a single participant achieving majority

coherence. The data indicates that whilst three quarters of the year group employed some degree of structure strategy they did not generally do so very effectively.

Killer Smog

It did not become clear until analysing and coding the responses that, despite the apparent cause-effect top-level structure of this passage, the text could also be very effectively understood using a problem-solution structure with the potential for even greater coherence. It is a moot point, in considering the top-level structure of this passage, whether the enactment of legislation was an effect of the crisis, i.e., precipitated by the Great Smog, or a solution to the problem of smog in general. It is interesting that the top-level structure of the text may not always be a matter of fact but as in this case be subject to the interpretation of the reader. The slightly lower inter-rater reliability in respect of the coding of this passage can be attributed to this very point as the independent coder and the researcher more often differed on this aspect than any other. For the purposes of this study a judgment was made in individual cases based on the particular group of sentences selected and their particular emphasis. However, much of the analyses that follows groups these two rhetorical structures together labelled as 'high constraining' structure.

The following table presents the numbers of Year 5 students who employed the various identified structures to assist in the comprehension of 'Killer Smog'.

Table 12
Numbers of Year 5 Participants Employing Various Organising Structures to Comprehend 'Killer Smog'

Structure	Number of students	Percentage of students
Collection (sequence)	14	20.3
Collection (list)	18	26.1
Cause-effect	42	60.9
Problem-solution	11	15.9
Topic sentences	11	15.9
No schema used	8	11.6

Over 60 percent of Year 5 participants made some use of the same rhetorical structure that characterised the top-level structure of the 'Killer Smog' passage. Problem-solution and topic sentences were each employed by almost 16 percent of the group. Almost half of the participants employed a collection schema and only eight Year 5 participants failed to use any structure strategy with this passage.

The average number of structures used by each Year 5 participant reading 'Killer Smog' was 1.36. The numbers of schemata employed by individual Year 5 participants are presented in Table 13.

Table 13
Numbers of Structural Schemata Employed by Individual Year 5 Participants Reading 'Killer Smog'

Number of schemata employed by an individual	Frequency	Percentage
None	8	11.6
One	34	49.3
Two	21	30.4
Three	5	7.2
Four	1	1.5
Total	69	100

Thirty-nine percent of the Year 5 participants employed more than one organising structure (including topic sentences) in the process of reading 'Killer Smog' and it was a relatively small number (eight) who failed to employ any rhetorical structure. Almost half relied on a single structure.

Table 14
Dominant Schema Choice of Year 5 Participants Reading 'Killer Smog'

Structure	Number of students	Percentage of students
Collection (sequence)	4	5.8
Collection (list)	11	15.9
Cause-effect	31	44.9
Problem-solution	9	13.0
Topic sentences	6	8.7
No schema used	8	11.6
Total	69	100

Almost 45 percent of the Year 5 participants employed an identical rhetorical structure to the passage's top-level structure, i.e., cause-effect. An additional 13 percent employed the more constraining problem-solution structure. Taken together these two high constraining structures were employed by almost 58 percent of the Year 5 participants which is a very high proportion. Very few participants used collection (sequence) or topic sentences despite the greater numbers who used them to a limited extent. Almost 16 percent employed collection (list). In contrast to 'Iceberg Towing' the number of students who used Topic Sentences halved when considering the dominant schema employed by individuals suggesting that more constraining organising schemata were considered a more effective organising device than topic sentences for this group of participants.

Despite the high levels of use of high constraining structures, in many cases the dominant schema was insufficient to achieve maximum coherence. The levels of coherence achieved by Year 5 participants reading 'Killer Smog' are presented in Table 15 below.

Table 15
Levels of Coherence Achieved by Year 5 Participants Reading 'Killer Smog'

Level of coherence	Number of students	Percentage of students
No coherence	8	11.6
Minimal coherence	30	43.5
Moderate coherence	20	29.0
Majority coherence	5	7.2
Topic sentences	6	8.7
Total	69	100

Almost nine out of 10 Year 5 participants found some degree of coherence based on structure use in relation to the 'Killer Smog' passage if topic sentences are

included. Over a third of the participants achieved moderate coherence or better, and this does not include Topic Sentences.

Sikh Wedding

Table 16 presents the numbers of Year 5 students who employed each of the identified structures to assist in the comprehension of 'Sikh Wedding', a passage with a collection (list) top-level structure. Among all the participants in the study only three organising structures were identified as having been employed in reading this passage, i.e., collection (sequence), collection (list), and topic sentences.

Table 16
Numbers of Year 5 Participants Employing Various Organising Structures to Comprehend 'Sikh Wedding'

Structure	Number of students	Percentage of students
Collection (sequence)	5	6.3
Collection (list)	23	27.4
Topic sentences	26	32.5
No schema used	32	40.0

Six out of 10 Year 5 participants showed some evidence of using structure strategy in comprehending this descriptive passage. Of those who did, more than half employed a collection schema. A similar number of participants employed topic sentences. A very high number (40%) failed to employ any apparent organising structure. The number of participants who failed to identify any structure in this passage was greater than in either of the other two passages.

Table 17
Numbers of Structural Schemata Employed by Individual Year 5 Participants Reading 'Sikh Wedding

Number of schemata employed by an individual	Frequency	Percentage
None	32	40.0
One	41	51.3
Two	7	8.8
Total	80	100

The average number of structures used by each Year 5 participant reading 'Sikh Wedding' was 0.7. The numbers of schemata employed by individual Year 5 participants are presented in Table 17. Since only 48 of the Year 5 participants employed any structure strategy it can be deduced that only a handful of the participants used more than one structure in comprehending the passage. Eighty-seven percent of Year 5 participants who used structure strategy restricted themselves to a single structural schema. Consequently, the choices of dominant schemata employed by participants are similar to the total schemata employed. A quarter of the group relied on collection (list) and almost a third preferred topic sentences. More participants employed 'no schema' than any other option.

Table 18
Dominant Schema Choice of Year 5 Participants Reading 'Sikh Wedding'

Structure	Number of students	Percentage of students
Collection (sequence)	3	3.8
Collection (list)	20	25.0
Topic sentences	25	31.3
No schema used	32	40.0
Total	80	100

Since the vast majority of Year 5 participants restricted themselves to a single organising structure the level of coherence tended to reflect the relative limits of the respective structures. The levels of coherence achieved by Year 5 participants reading 'Sikh Wedding' are presented in Table 19 below.

Table 19
Levels of Coherence Achieved by Year 5 Participants Reading 'Sikh Wedding'

Level of coherence	Number of students	Percentage of students
No coherence	32	40.0
Minimal coherence	22	27.5
Moderate coherence	1	1.3
Majority coherence	0	0.0
Topic sentences	25	31.3
Total	80	100

Given that collection is the only rhetorical structure employed with this passage, it can be deduced from Table 19 that the use of a collection schema in all but one case failed to afford the reader more than minimal coherence.

Year 7 Results

Out of a total of 77 Year 7 participants, 72 responded to 'Iceberg Towing', 75 responded to 'Killer Smog', and 63 responded to 'Sikh Wedding'.

Iceberg Towing

Table 20 presents the numbers and percentages of Year 7 students who employed each of the identified structures to assist in the comprehension of 'Iceberg Towing'.

Table 20
Numbers of Year 7 Participants Employing Various Organising Structures to Comprehend 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	29	40.3
Collection (list)	41	56.9
Problem-solution	29	40.3
Compare-contrast	4	5.6
Topic sentences	12	16.7
No schema used	5	6.9

Very few of the Year 7 participants failed to employ some sort of structure strategy when reading 'Iceberg Towing'. The most frequently employed organising structure among Year 7 participants reading 'Iceberg Towing' was collection (list) (56.9%). The same number of students who recognised the problem-solution structure in the first paragraph of the passage developed this rhetorical structure across other parts of the passage. More than 40 percent of the participants made some use of a high constraining rhetorical structure. Twelve participants identified topic structures.

The average number of structures used by Year 7 participants in relation to

'Iceberg Towing was 1.41. The numbers of schemata employed by individual Year 7

participants are presented in Table 21.

Table 21
Numbers of Structural Schemata Employed by Individual Year 7 Participants Reading
'Iceberg Towing'

Number of schemata employed by an individual	Frequency	Percentage
None	5	6.9
One	35	48.6
Two	29	40.3
Three	3	4.2
Total	72	100

Almost nine out of 10 Year 7 participants used one or two schemata when

reading Iceberg Towing with almost one half of the total number of Year 7

respondents limited to a single schema. Very few failed to use any schema and even

fewer employed more than two.

Table 22
Dominant Schema Choice of Year 7 Participants Reading 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	2	2.8
Collection (list)	28	38.9
Problem-solution	28	38.9
Compare-contrast	1	1.4
Topic Sentences	8	11.1
No structure used	5	6.9
Total	72	100

As far as dominant structure is concerned, almost 40 percent of participants

employed a problem-solution rhetorical structure to comprehend this passage. This is

the same rhetorical structure as that characterising the top-level structure of the

passage. Reference back to Table 20 makes it clear that any Year 7 participant who

used a problem-solution structure at all was highly likely to employ it as the dominant

structure strategy. Of the 40 percent who recognised the problem-solution structure in the opening paragraph, less than three percent failed to use a more effective structure. By comparison, more than two thirds of the participants who employed collection (list) employed it as their dominant structure strategy. The conclusion that can be deduced from the data is that a Year 7 participant who employed a dominant problem-solution structure frequently employed an additional structure such as collection (list). Perhaps not surprisingly, given the small proportion of the passage devoted to compare-contrast, only one participant depended on compare-contrast as the dominant structure and in this case not linked to another rhetorical structure.

Table 23

Levels of Coherence Achieved by Year 7 Participants Reading 'Iceberg Towing'

Level of coherence	Number of students	Percentage of students
No coherence	5	6.9
Minimal coherence	30	41.7
Moderate coherence	26	36.1
Majority coherence	4	5.6
Topic sentences	7	9.7
Total	72	100

Despite the fact that around 40 percent of the Year 7 participants employed a high constraining dominant schema only four participants achieved majority coherence. Over three quarters of the Year 7 participants achieved a level of coherence between minimal and moderate. About half the Year 7 cohort achieved minimal or no coherence and the other approximate half achieved moderate coherence or better.

A review of the data in Tables 20-23 suggests that Year 7 readers were fairly evenly divided between those who relied on a low constraining rhetorical structure and those who made use of a high constraining rhetorical structure. It shows that among those who employed any structure strategy there was an almost equal chance

that more than one schema would be employed and it was likely to be a high

constraining structure combined with a low constraining structure. The highest levels

of coherence were achieved by participants who employed a problem-solution

structure most likely in conjunction with some other structure.

Killer Smog

Table 24 presents the numbers of Year 7 students who employed each

of the identified structures to assist in the comprehension of 'Killer Smog'.

Table 24
*Numbers of Year 7 Participants Employing Various Organising Structures to
Comprehend 'Killer Smog'*

Structure	*Number of students*	*Percentage of students*
Collection (sequence)	19	25.3
Collection (list)	15	20.0
Cause-effect	51	68.0
Problem-solution	24	32.0
Topic sentences	14	18.7
No schema used	11	14.7

The number of Year 7 participants employing a high constraining structure to

any extent was more than double the number employing a low constraining structure.

There was extensive use of the top-level structure of this passage with more than two-

thirds of the Year 7 participants making some use of a cause-effect structure. Only 11

students (14.7%) failed to use any structure strategy at all. Almost 19 percent selected

topic sentences.

The numbers of schemata employed by individual Year 7 participants are

presented in Table 25. The average number of structures used by each Year 7

participant reading 'Killer Smog' was 1.6. Almost 58 percent of the Year 7

respondents employed two or more organising structures in the process of

comprehending 'Killer Smog'.   Two structures was the mode and equalled the total

number of Year 7 students who used none and one organising structure combined.

Table 25

*Numbers of Structural Schemata Employed by Individual Year 7 Participants Reading
'Killer Smog'*

Number of schemata employed by an individual	Frequency	Percentage
None	11	14.7
One	21	28.0
Two	32	42.7
Three	9	12.0
Four	2	2.7
Total	75	100

Table 26

Dominant Schema Choice of Year 7 Participants Reading 'Killer Smog'

Structure	Number of students	Percentage of students
Collection (sequence)	5	6.7
Collection (list)	4	5.3
Cause-effect	35	46.7
Problem-solution	17	22.7
Topic sentences	3	4.0
No schema used	11	14.7
Total	75	100

Over 46 percent of the Year 7 participants employed an identical rhetorical
structure to the passage's top-level structure, i.e., cause-effect, as their dominant
structure choice. An additional 17 students (22.7%) employed the more constraining
problem-solution structure. Taken together, high constraining structures were
employed by almost 70 percent of the Year 7 participants. The numbers of
participants who either failed to employ any structure or used a collection structure
accounted for about a quarter of the Year 7 respondents and were almost equally
divided between no structure and low constraint structure. Although the passage
could be interpreted like a story only five students adopted a collection (sequence)
structure.

When the dominant structure choices (Table 26) are compared to total structures employed (Table 24) it can be deduced that whilst many participants used a collection sequence it was as a subsidiary to a more constraining structure, i.e., 34 used it but it was only dominant for nine. The reduced number of participants using a high constraining structure as the dominant strategy (cause-effect in particular) compared to those who used it at all suggests that a large number of students attempted to utilise the structure but not to maximum effect. It appears that Year 7 students reading this passage who used a high constraining structure were much more inclined to maintain it as the dominant structure than those participants who made use of a low constraining structure, perhaps reflecting the limited effectiveness of low constraining structures in the comprehension of this passage. This conclusion is also supported by the relatively high average number of structures employed per participant.

Table 27
Levels of Coherence Achieved by Year 7 Participants Reading 'Killer Smog'

Level of coherence	Number of students	Percentage of students
No coherence	11	14.7
Minimal coherence	13	17.3
Moderate coherence	28	37.3
Majority coherence	20	26.7
Topic sentences	3	4.0
Total	75	100

Almost two thirds of the Year 7 participants achieved at least moderate coherence on 'Killer Smog' and of this group over 40 percent achieved majority coherence. Over 85 percent achieved some degree of coherence using structure strategy if the three participants who selected topic sentences are included.

Sikh Wedding

Over 90 percent of Year 7 participants utilised some form of organisational structure when reading 'Sikh Wedding'. Each of the three structures was used by a large number of students and only six readers failed to employ any apparent structure strategy.

Table 28
Numbers of Year 7 Participants Employing Various Organising Structures to Comprehend 'Sikh Wedding'

Structure	Number of students	Percentage of students
Collection (sequence)	20	31.7
Collection (list)	36	57.1
Topic sentences	29	46.0
No schema used	6	9.5

The average number of structures used by each Year 7 participant reading 'Sikh Wedding' was 1.35. However, it was much easier to satisfy the needs of multiple structures in relation to this text and the average number employed cannot be read as indicating more extensive use of structure strategy. The numbers of schemata employed by individual Year 7 participants are presented in Table 29.

Table 29
Numbers of Structural Schemata Employed by Individual Year 7 Participants Reading 'Killer Smog'

Number of schemata employed by an individual	Frequency	Percentage
None	6	9.5
One	32	50.8
Two	22	34.9
Three	3	4.8
Total	63	100

More than half of the Year 7 participants relied on a single organising structure with only one in three showing evidence of use of two structures. Three students managed to select sentences embracing all three structures. However, any

participant selecting all the topic sentences in this passage was also likely to meet the criteria for collection, and 46 percent of Year 7 participants selected at least four topic sentences. A clearer picture should emerge from the dominant structures selected by participants.

Table 30
Dominant Schema Choice of Year 7 Participants Reading 'Sikh Wedding'

Structure	Number of students	Percentage of students
Collection (sequence)	5	7.9
Collection (list)	30	47.6
Topic sentences	22	34.9
No schema used	6	9.5
Total	63	100

The choices of dominant schema indicate that although there was evidence of almost one in three participants using collection (sequence), that it was only the dominant schema in a small proportion of those cases. Eighty-two percent of participants preferred either collection (list) or topic sentences. Topic sentences could be considered to have been the more difficult option since it required four sentences as opposed to three in the case of collection (list). Consequently, some of those whose dominant choice was topic sentences were likely also to have satisfied the criteria for collection (list).

Table 31
Levels of Coherence Achieved by Year 7 Participants Reading 'Sikh Wedding'

Level of coherence	Number of students	Percentage of students
No coherence	6	9.5
Minimal coherence	23	36.5
Moderate coherence	8	12.7
Majority coherence	4	6.3
Topic sentences	22	34.9
Total	63	100

If topic sentence choice is put aside it can be seen from Table 31 that it was very difficult for a Year 7 participant to achieve more than minimal coherence with fewer than one in five students doing better.

Year 9 Results

Out of a total of 68 Year 9 participants, 66 responded to 'Iceberg Towing', 63 responded to 'Killer Smog', and 64 responded to 'Sikh Wedding'.

Iceberg Towing

Table 32 presents the numbers of Year 9 students who employed each of the identified structures to assist in the comprehension of 'Iceberg Towing', a passage with a problem-solution top-level structure.

Table 32
Numbers of Year 9 Participants Employing Various Organising Structures to Comprehend 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	25	37.9
Collection (list)	37	56.1
Problem-solution	19	28.8
Compare-contrast	12	18.5
Topic sentences	20	30.3
No schema used	2	3.0

Fifty-six percent of all Year 9 respondents employed a collection (list) structure to some extent. Only two students failed to employ any structure. Almost 38 percent of the Year 9 participants identified the problem-solution structure contained in the opening paragraph and almost 29 percent made more extensive use of a problem-solution structure. The use of a higher constraining structure was swelled by the 12 students who used compare-contrast. Almost one third of the respondents selected topic sentences.

The average number of structures used by each Year 9 participant while reading 'Iceberg Towing' was 1.55. The numbers of schemata employed by individual Year 9 participants are presented in Table 33.

Table 33
Numbers of Structural Schemata Employed by Individual Year 9 Participants Reading 'Iceberg Towing'

Number of schemata employed by an individual	Frequency	Percentage
None	2	3.0
One	32	48.5
Two	26	39.4
Three	6	9.1
Total	66	100

About half the group made use of a single structure and the other half employed two structures or more. Nine out of 10 participants offered evidence of the use of either one or two organising structures.

Table 34
Dominant Schema Choice of Year 9 Participants Reading 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	4	6.1
Collection (list)	21	31.8
Problem-solution	13	19.7
Compare-contrast	6	9.1
Topic Sentences	20	30.3
No structure used	2	3.0
Total	66	100

As well as being the most frequently used rhetorical structure (Table 32), collection (list) was also the most extensively applied rhetorical structure (31.8%). Although 25 readers identified the problem-solution structure in the opening paragraph of this passage (Table 32), only four failed to use a more effective structure (Table 34). Of the 19 students who made wider use of the problem-solution structure (Table 32) for 13 of these it was the dominant organising structure. Twenty nine

percent of the group relied upon a higher constraining rhetorical structure as their main structure strategy. A little less than a third of the Year 9 participants selected topic sentences. However, all those Year 9 participants who employed topic sentences relied on it as their dominant structure strategy.

Table 35

Levels of Coherence Achieved by Year 9 Participants Reading 'Iceberg Towing'

Level of coherence	Number of students	Percentage of students
No coherence	2	3.0
Minimal coherence	27	40.9
Moderate coherence	15	22.7
Majority coherence	2	3.0
Topic sentences	20	30.3
Total	66	100

The relative amounts of coherence achieved compared to other year groups was distorted by the high number of Year 9 participants who opted for topic sentences as their dominant strategy. All but two Year 9 students achieved some degree of coherence. However, in 40 percent of cases coherence was minimal and only a quarter of the group managed to achieve better than minimal coherence if coherence associated with topic sentences is disregarded.   The proportion of readers achieving higher than minimal coherence is, not surprisingly, similar to the proportion of readers who utilised a high constraining structure.

Killer Smog

There was evidence of a high level of structure strategy being used by Year 9 students with the Killer Smog passage, a text with a cause-effect top level structure. A substantial number of Year 9 students employed each of the rhetorical structures associated with this passage and only four students failed to employ any structure. Over half of the Year 9 group used each of the higher constraining rhetorical structures.

Table 36
Numbers of Year 9 Participants Employing Various Organising Structures to Comprehend 'Killer Smog'

Structure	Number of students	Percentage of students
Collection (sequence)	18	28.6
Collection (list)	15	23.8
Cause-effect	36	57.1
Problem-solution	33	52.4
Topic sentences	16	25.4
No schema used	4	6.3

The average number of structures used by each Year 9 participant reading

'Killer Smog' was a comparatively high 1.87. The numbers of schemata employed by

individual Year 9 participants are presented in Table 37.

Table 37
Numbers of Structural Schemata Employed by Individual Year 9 Participants Reading 'Killer Smog'

Number of schemata employed by an individual	Frequency	Percentage
None	4	6.3
One	18	28.6
Two	25	39.7
Three	14	22.2
Four	2	3.2
Total	63	100

Almost 65 percent of the Year 9 group used two or more organising structures

when reading 'Killer Smog'. Most of the remaining third employed a single structure.

Table 38
Dominant Schema Choice of Year 9 Participants Reading 'Killer Smog'

Structure	Number of students	Percentage of students
Collection (sequence)	3	4.8
Collection (list)	5	7.9
Cause-effect	16	25.4
Problem-solution	24	38.1
Topic sentences	11	17.5
No schema used	4	6.3
Total	63	100

The most commonly used dominant organising structure was problem-solution used by almost 40 percent of the Year 9 group. When the numbers of Year 9 participants who employed cause-effect as the dominant structure are added to those who used problem-solution structure the total proportion of the group using a high constraining structure reached over 63 percent, almost two thirds of the year 9 group. The higher the level of constraint of a structure the more likely it was to be retained as the dominant structure among those Year 9 participants who used it. In other words it was least likely to be a supporting structure to some other structure; that may say more about the structures than the readers. Less than 13 percent of the group relied on a low constraining structure to interpret the passage.

Given the high proportion of participants in this group using a high constraining structure it was to be expected that coherence levels would generally be quite high as well.

Table 39
Levels of Coherence Achieved by Year 9 Participants Reading 'Killer Smog'

Level of coherence	Number of students	Percentage of students
No coherence	4	6.3
Minimal coherence	12	19.0
Moderate coherence	25	40.3
Majority coherence	11	17.7
Topic sentences	11	17.7
Total	63	100

Fifty eight percent of the Year 9 group achieved moderate or majority coherence with this passage. Fewer than one in five of the students were limited to minimal coherence with only four students failing to register any coherence.

Sikh Wedding

The following table presents the numbers of Year 9 students who employed each of the identified structures to assist in the comprehension of 'Sikh Wedding', a passage with a collection top-level structure.

Table 40
Numbers of Year 9 Participants Employing Various Organising Structures to Comprehend 'Sikh Wedding'

Structure	Number of students	Percentage of students
Collection (sequence)	8	12.5
Collection (list)	33	51.6
Topic sentences	33	51.6
No schema used	13	20.3

Just over half the students in the Year 9 group employed collection (list) and topic sentences respectively. One in eight students identified the pseudo narrative contained in the passage and one in five failed to employ a structure strategy. The average number of structures used by each Year 9 participant reading 'Sikh Wedding' was 1.17. The numbers of schemata employed by individual Year 9 participants are presented in Table 41.

Table 41
Numbers of Structural Schemata Employed by Individual Year 9 Participants Reading 'Sikh Wedding'

Number of schemata employed by an individual	Frequency	Percentage
None	13	20.3
One	29	45.3
Two	20	31.3
Three	2	3.1
Total	64	100

One in five students in the group failed to employ any structure and just over a third of the group used more than a single structure. However, it should be noted again that it was common for readers who identified topic sentences to satisfy the

criteria for collection (list). A single structure was the mode among Year 9

participants for this passage with over 45 percent of the group limited to a single

structure.

Table 42
Dominant Schema Choice of Year 9 Participants Reading 'Sikh Wedding'

Structure	Number of students	Percentage of students
Collection (sequence)	1	1.6
Collection (list)	17	26.6
Topic sentences	33	51.6
No schema used	13	20.3
Total	64	100

Over half the students in the Year 9 group relied primarily on topic sentences

as the key to comprehending 'Sikh Wedding'. A little over a quarter of the group had

collection (list) as their dominant strategy. Only one student in this group focused on

the pseudo narrative sequence contained in the passage and about 20 percent failed to

employ structure strategy.

Table 43
Levels of Coherence Achieved by Year 9 Participants Reading 'Sikh Wedding'

Level of coherence	Number of students	Percentage of students
No coherence	13	20.3
Minimal coherence	17	26.6
Moderate coherence	0	0.0
Majority coherence	1	1.6
Topic sentences	33	51.6
Total	64	100

If the large number of students in the group who selected topic sentences is set

aside then 55 percent of the remaining members of the Year 9 group achieved

minimal coherence using a collection rhetorical structure with only a single student

performing better.

Year Group Comparison

The chi square test of independence is used frequently in the reading ability group comparisons.

Iceberg Towing

Table 44
Year Group Comparison in Respect of Organising Schemata for 'Iceberg Towing'

Structure	Year 5 (%)	Year 7 (%)	Year 9 (%)
Problem-solution (local)	24 (30.4)	29 (40.3)	25 (37.9)
Collection (list)	41 (51.9)	41 (56.9)	37 (56.1)
Problem-solution	9 (11.4)	29 (40.3)	19 (28.8)
Compare-contrast	4 (5.1)	4 (5.6)	12 (18.2)
Topic sentences	14 (17.7)	12 (16.7)	20 (30.3)
No schema	20 (25.3)	4 (5.6)	2 (3.0)

Chi-square tests of independence in relation to the low constraining structures and topic sentences were not significant, however, there was a significant difference between the year group usage of problem-solution, χ^2 (2, N=217) = 16.539, p <.00, and compare-contrast, χ^2 (2, N=217) = 9.382, p <.009. In relation to problem solution the Year 5 group were underrepresented and in compare-contrast the Year 9 were significantly overrepresented. There was also a significant difference between year groups in respect of failure to select a schema, χ^2 (2, N=217) = 21.153, p <.00, where the Year 5 group were overrepresented and the converse was true of the Year 9 group.

A chi-square test of independence performed to examine the relationship between year group and the total schemata employed in reading comprehension for Iceberg Towing was significant; however, there were three cells with very small expected counts raising the possibility that the assumptions of the test were not met. Consequently, the cells relating to multiple schemata use were combined to remove the low expected cell counts (Table 45) which again produced a significant chi square

result, χ^2 (4, N=217) = 20.855, p <.000. The chi square result related to Year 5

readers' higher than expected numbers of students who failed to show any evidence of

structure usage and conversely the Year 9 groups lower than expected numbers.

There was no difference between year groups among those who employed structure

strategy.

Table 45
Year Group Comparison in Respect of Total Schemata employed for 'Iceberg Towing'

Number of schemata	Year 5 (%)	Year 7 (%)	Year 9 (%)
No schema use	20 (25.3)	4 (5.5)	2 (3.0)
Single schema use	36 (45.6)	37 (51.5)	32 (48.5)
Multiple schemata use	23 (29.1)	31 (43.0)	32 (48.5)
Total	79 (100)	72 (100)	66 (100)

In view of the number of cells with low counts in relation to dominant schema

use it was decided to merge some rhetorical structures, excluding topic sentences, into

two groups comprising low constraining schemata (local problem-solution and

collection) and high constraining schemata (problem-solution and compare-contrast)

for the purposes of a chi square test of independence.

Table 47
Year Group Comparison of Dominant Schema Use in Respect of Iceberg Towing

Structure	Year 5 (%)	Year 7 (%)	Year 9 (%)
No structure	20 (25.3)	4 (5.5)	2 (3.0)
Low constraining structures	40 (50.6)	31 (43.1)	25 (37.9)
High constraining structures	7 (8.9)	29 (40.3)	19 (28.8)
Topic Sentences	12 (15.2)	8 (11.1)	20 (30.3)
Total	79 (100)	72 (100)	66 (100)

The subsequent chi square test of independence produced a significant result, χ^2 (6,

N=217) = 36.998, p <.000. Significantly greater numbers of Year 5 participants were

found in the 'no structure' category and significantly lower numbers in the 'high

constraining structures' category. Year 7 participants were significantly

overrepresented in the 'high constraining structures' category and likewise Year 9

participants in the 'topic sentences' category. There were no significant results in

relation to 'low constraining structures'.

Table 48

Year Group Comparison in Respect of Coherence Achieved with 'Iceberg Towing'

Coherence level	Year 5 (%)	Year 7 (%)	Year 9 (%)
No coherence	20 (25.3)	4 (5.5)	2 (3.0)
Minimal	32 (40.5)	32 (44.5)	27 (40.9)
Moderate/majority	15 (19.0)	29 (40.3)	17 (25.8)
Topic sentences	12 (15.2)	7 (9.7)	20 (30.3)
Total	79 (100)	72 (100)	66 (100)

A chi-square test of independence performed to examine the relationship

between year group and coherence in the comprehension of Iceberg Towing was

significant, χ^2 (8, N=217) = 34.574, p <.000.   However, there were three cells with

very small expected counts and it was decided to combine the cells relating to

moderate and majority coherence where there was no indication of a significant result

in order to eliminate small expected cell counts. The resulting chi square test of

independence was again significant, χ^2 (6, N=217) = 30.509, p <.000. Year 5

participants were overrepresented in the 'no coherence' category. Year 9 participants

had significantly higher numbers in 'topic sentences' but significantly lower numbers

in 'no coherence'.

Killer Smog

Table 49
Year Group Comparison in Respect of Organising Schemata for ''Killer Smog'

Structure	Year 5 (%)	Year 7 (%)	Year 9 (%)
Collection (sequence)	14 (20.3)	19 (25.3)	18 (28.6)
Collection (list)	18 (26.1)	15 (20.0)	15 (23.8)
Cause-effect	42 (60.9)	51 (68.0)	36 (57.1)
Problem-solution	11 (15.9)	24 (32.0)	33 (52.4)
Topic sentences	11 (15.9)	14 (18.7)	16 (25.4)
No schema	8 (11.6)	11 (14.6)	4 (6.3)

The only significant difference between year groups in relation to overall use of organising structures was in respect of problem-solution, χ^2 (2, N=207) = 19.861, p <.000, with the Year 5 group underrepresented and the Year 9 group overrepresented. No significant relationship was established between year group and organising schema for any of the other rhetorical schemata, the failure to employ organising schemata, or the selection of topic sentences.

Table 50
Year Group Comparison in Respect of Numbers of Schemata employed for 'Killer Smog'

Number of schemata	Year 5 (%)	Year 7 (%)	Year 9 (%)
None	8 (11.6)	11 (14.7)	4 (6.3)
One	34 (49.3)	21 (28.0)	19 (30.2)
Two	21 (30.4)	32 (42.7)	24 (38.1)
Three	5 (7.2)	9 (12.0)	14 (22.2)
Four	1 (1.5)	2 (2.6)	2 (3.2)
Total	69 (100)	75 (100)	63 (100)

A chi-square test of independence performed to examine the relationship between year group and the total number of schemata employed in reading comprehension for Killer Smog was not significant.

Table 51
Year Group Comparison in Respect of Dominant Schema Employed for 'Killer Smog'

Structure	Year 5 (%)	Year 7 (%)	Year 9 (%)
Problem-solution	9 (13.1)	17 (22.7)	24 (38.1)
Cause-effect	31 (44.9)	35 (46.7)	16 (25.4)
Collection	15 (21.7)	9 (12.0)	8 (12.7)
Topic sentences	6 (8.7)	3 (4.0)	11 (17.5)
No structure	8 (11.6)	11 (14.6)	4 (6.3)
Total	69 (100)	75 (100)	63 (100)

There was a significant difference between year groups in relation to dominant schema choice for Killer Smog, χ^2 (10, N=207) = 26.666, p <.003. However, there were three cells with low cell counts and, consequently, both collection schemata were combined. There remained a significant difference between year groups, χ^2 (8, N=207) = 24.638, p <.002. The Year 9 group was significantly overrepresented in both problem-solution and topic sentences.

Table 52
Year Group Comparison in Respect of Coherence Achieved with 'Killer Smog'

Coherence level	Year 5 (%)	Year 7 (%)	Year 9 (%)
No coherence	8 (11.6)	11 (14.7)	4 (6.3)
Minimal	30 (43.5)	13 (17.3)	12 (19)
Moderate	20 (29.0)	28 (37.3)	25 (40.3)
Majority	5 (7.2)	20 (26.7)	11 (17.7)
Topic sentences	6 (8.7)	3 (4.0)	11 (17.7)
Total	69 (100)	75 (100)	63 (100)

A chi square test of independence indicated a significant difference in relation to the level of coherence achieved between year groups reading Killer Smog, χ^2 (8, N=207) = 28.853, p <.000. The Year 5 group was overrepresented in minimal coherence and underrepresented in majority coherence. The Year 9 group was overrepresented in the selection of topic sentences.

Sikh Wedding

Table 53
Year Group Comparison in Respect of Organising Schemata for 'Sikh Wedding'

Structure	*Year 5 (%)*	*Year 7 (%)*	*Year 9 (%)*
Collection (sequence)	5 (6.3)	20 (31.7)	8 (12.5)
Collection (list)	23 (27.4)	36 (57.1)	33 (51.6)
Topic sentences	26 (32.5)	29 (46.0)	33 (51.6)
No schema	32 (40.0)	6 (9.5)	13 (20.3)

There were significant differences between year group schema choices in relation to collection (sequence), χ^2 (2, N=207) = 17.916, p <.000; collection (list), χ^2 (2, N=207) = 13.408, p <.001; and, the failure to employ any apparent structure, χ^2 (2, N=207) = 18.564, p <.000, but not in relation to topic sentences. The Year 5 group was underrepresented in relation to the two collection rhetorical structures and overrepresented among those who failed to use structure. The Year 7 group was overrepresented in the use of collection (sequence) and underrepresented among those who failed to employ structure.

Table 54
Year Group Comparison in Respect of Total Numbers of Schemata employed for 'Sikh Wedding'

Number of schemata	*Year 5 (%)*	*Year 7 (%)*	*Year 9 (%)*
None	32 (40.0	6 (9.5)	13 (20.3)
One	41 (51.3)	32 (50.8)	29 (45.3)
More than one	7 (8.7)	25 (39.7)	22 (34.4)
Total	80 (100)	63 (100)	64 (100)

In view of low expected cell counts numbers of schemata in excess of a single schema were combined into a single category. There was a significant difference between the year groups, χ^2 (4, N=207) = 29.653, p <.000. The Year 5 group was overrepresented in the 'no structure' category and underrepresented in multiple schemata. The converse applied in respect of the Year 7 group. The modal number

of structures for all year groups was a single structure application. However, whereas fewer than one in 10 Year 5 participants employed more than one structure, the Year 7 and Year 9 groups employed more than one structure in almost 40 and 35 percent of cases respectively.

Table 55
Year Group Comparison in Respect of Dominant Schema Employed for 'Sikh Wedding'

Structure	Year 5 (%)	Year 7 (%)	Year 9 (%)
Collection (combined)	23 (28.7)	35 (55.6)	18 (28.1)
Topic sentences	25 (31.3)	22 (34.9)	33 (51.6))
No structure	32 (40.0)	6 (9.5)	13 (20.3))
Total	80 (100)	63 (100)	64 (100)

There was a significant difference among the dominant schema choices between year groups, χ^2 (6, N=207) = 27.721, p <.000. In view of the small cell counts in respect of collection (sequence) for all three year groups they were combined with collection (list). The results of a subsequent chi square test of independence was still significant, χ^2 (4, N=207) = 28.190, p <.000. Year 5 readers were overrepresented among those failing to use a structure whilst Year 7 readers were underrepresented in the same category but overrepresented in the 'low constraint' category.

Table 56
Year Group Comparison in Respect of Coherence Achieved with 'Sikh Wedding'

Coherence level	Year 5 (%)	Year 7 (%)	Year 9 (%)
No coherence	32 (40.0)	6 (9.5)	13 (20.3)
Minimal	22 (27.5)	23 (36.5)	17 (26.6)
Moderate/ majority	1 (1.3)	12 (19.0)	1 (1.6)
Topic sentences	25 (31.3)	22 (34.9)	33(51.6)
Total	80 (100)	63 (100)	64 (100)

A chi square test of independence established a significant difference between year groups in relation to the amount of coherence achieved using structure strategy, χ^2 (8, N=207) = 40.235, p <.000. In order to reduce the number of the cells that had small counts the small numbers of participants achieving moderate and majority coherence were excluded from a subsequent chi square test of independence that was also significant, χ^2 (4, N=193) = 19.118, p <.001. The significant difference lay in respect of the Year 5 absence of any coherence.

Ability Group Frequencies

Low Ability - Iceberg Towing

There were 37 participants in the low reading ability group who responded to Iceberg Towing; 32 who responded to Killer Smog; and, 36 who responded to Sikh Wedding.

Table 57
Numbers of Low Ability Participants Employing Various Organising Structures to Comprehend 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	11	29.7
Collection (list)	17	45.9
Problem-solution	1	2.7
Compare-contrast	3	8.1
Topic sentences	3	8.1
No schema used	13	35.1

Low ability participants tended not to select a high constraining rhetorical structure or topic sentences to comprehend Iceberg Towing (10.8%). Instead large numbers opted for low constraining structures such as collection (45.9%) or failed to employ any structure (35.1%). Although almost 30 percent of the group identified the problem-solution structure flagged in the opening paragraph only one student

extended the use of a problem-solution rhetorical structure to other parts of the passage.

The average number of organising schemata employed by low ability participants was 0.923. The average for low ability students who used any rhetorical structure was 1.5. The low ability group tended to restrict their usage to a single structure or none at all (Table 58).

Table 58
Numbers of Structural Schemata Employed by Low Ability Participants Reading 'Iceberg Towing'

Number of schemata employed by an individual	Frequency	Percentage
None	13	35.1
One	14	37.8
Two	8	21.6
Three	2	5.4
Total	37	100

Table 59
Dominant Schema Choice of Low Ability Participants Reading 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	3	8.1
Collection (list)	18	48.6
Problem-solution	0	0.0
Compare-contrast	2	5.4
Topic Sentences	1	2.7
No structure used	13	35.1
Total	37	100

Almost half of all the low ability respondents relied on the use of collection (list) to comprehend Iceberg Towing. More than a third of the ability group did not appear to have adopted a structure strategy. There was minimal usage of any other organising structure. Those students who employed more than one structure most

frequently relied on collection along with problem-solution (local) in the opening

paragraph.

Table 60
Levels of Coherence Achieved by Low Ability Participants Reading 'Iceberg Towing'

Level of coherence	Number of students	Percentage of students
No coherence	13	35.1
Minimal coherence	19	51.4
Moderate coherence	4	10.8
Majority coherence	0	0.0
Topic sentences	1	2.7
Total	37	100

Over half of the low ability group managed to achieve minimum coherence

but less than 11 percent achieved better than minimal coherence and more than a third

found no coherence with structure strategy. The typical low ability participant

appears to have employed a collection structure to achieve a minimal level of

coherence.

Low Ability - Killer Smog

Table 61
Numbers of Low Ability Participants Employing Various Organising Structures to Comprehend 'Killer Smog'

Structure	Number of students	Percentage of students
Collection (sequence)	6	18.8
Collection (list)	7	21.9
Cause-effect	12	37.5
Problem-solution	3	9.4
Topic sentences	2	6.3
No schema used	13	40.6

Perhaps surprisingly, well over a third of the low ability readers used a cause-

effect organising structure and almost 10 percent used a problem-solution structure

indicating a good proportion of low ability participants used a high constraining

structure. On the other hand, more than a third of the cohort failed to employ any

organising schema. Only two low ability students relied on the identification of topic sentences with this passage.

Table 62
Numbers of Structural Schemata Employed by Low Ability Participants Reading 'Killer Smog'

Number of schemata employed by an individual	Frequency	Percentage
None	13	40.6
One	9	28.1
Two	9	28.1
Three	1	3.1
Four	0	0.0
Total	32	100

Almost a third of the low ability readers employed more than one schema which seems quite remarkable given that over 40 percent of the low ability participants failed to employ any organising schema. One student showed evidence of three schemata.

Table 63
Dominant Schema Choice of Low Ability Participants Reading 'Killer Smog'

Structure	Number of students	Percentage of students
Collection (sequence)	2	6.3
Collection (list)	4	12.5
Cause-effect	9	28.1
Problem-solution	2	6.3
Topic sentences	2	6.3
No schema used	13	40.6
Total	32	100

Notwithstanding that 40 percent of the low ability participants failed to employ structure, 58 percent of all the low ability readers who employed structure strategy relied primarily on cause-effect. The indications are that the more constraining the schema, the more frequently it was to have been used as the dominant

schema. Problem solution and topic sentences were only employed by two students each.

Table 64
Levels of Coherence Achieved by Low Ability Participants Reading 'Killer Smog'

Level of coherence	Number of students	Percentage of students
No coherence	13	40.6
Minimal coherence	14	43.8
Moderate coherence	2	6.3
Majority coherence	1	3.1
Topic sentences	2	6.3
Total	32	100

Despite the relatively large numbers of low ability readers who used a high constraining structure to comprehend 'Killer Smog', the readers did not generally achieve a high level of coherence. Less than 10 percent of the low ability readers achieved better than minimal coherence.

Low Ability - Sikh Wedding

Table 65
Numbers of Low Ability Participants Employing Various Organising Structures to Comprehend 'Sikh Wedding'

Structure	Number of students	Percentage of students
Collection (sequence)	2	5.6
Collection (list)	7	19.4
Topic sentences	11	30.6
No schema used	18	50

Half of the group failed to employ any organising schema. Of the half who did, over 60 percent selected topic sentences and most of the remainder used a collection (list) structure.

Table 66
Numbers of Structural Schemata Employed by Low Ability Participants Reading 'Sikh Wedding'

Number of schemata employed by an individual	Frequency	Percentage
None	18	50.0
One	15	41.7
Two	3	8.3
Three	0	0.0
Total	36	100

Of the 18 low ability readers who employed a structure strategy, fifteen restricted themselves to a single schema. Only three students used more than a single schema.

Table 67
Dominant Schema Choice of Low Ability Participants Reading 'Sikh Wedding'

Structure	Number of students	Percentage of students
Collection (sequence)	1	2.8
Collection (list)	6	16.7
Topic sentences	11	30.6
No schema used	18	50.0
Total	36	100

Among the 50 percent who employed structure strategy, low ability readers most commonly interpreted this passage by identifying the topic sentences. About a third of those who used structure strategy used a collection (list) structure with only a single student relying on collection (sequence).

Table 68
Levels of Coherence Achieved by Low Ability Participants Reading 'Sikh Wedding'

Level of coherence	Number of students	Percentage of students
No coherence	18	50.0
Minimal coherence	7	19.4
Moderate coherence	0	0.0
Majority coherence	0	0.0
Topic sentences	11	30.6
Total	36	100

Not surprisingly, putting aside the students who used topic sentences, no low ability reader achieved better than minimal coherence in respect of 'Sikh Wedding'. A low ability reader more frequently failed to employ structure strategy with this descriptive passage, but among those who did they more frequently selected topic sentences. In no instances did a low ability reader using a rhetorical structure achieve better than minimal coherence.

Average Ability - Iceberg Towing

There were 114 participants in the average reading ability group who responded to Iceberg Towing; 115 who responded to Killer Smog; and, 111 who responded to Sikh Wedding.

Table 69
Numbers of Average Ability Participants Employing Various Organising Structures to Comprehend 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	44	38.6
Collection (list)	71	62.3
Problem-solution	29	25.4
Compare-contrast	8	7.0
Topic sentences	24	21.1
No schema used	8	7.0

Despite the problem-solution top-level structure of the passage only a quarter of the average ability readers used this rhetorical structure for comprehension with about a half as many again recognising the problem-solution indications in the opening paragraph. The most frequently employed structure was collection (list) (62.3%). More than one in five students selected topic sentences. Only eight students failed to register any structure use.

Table 70
Numbers of Structural Schemata Employed by Average Ability Participants Reading 'Iceberg Towing'

Number of schemata employed by an individual	Frequency	Percentage
None	8	7.0
One	58	50.9
Two	41	36.0
Three	7	6.1
Total	114	100

Half of the average ability group restricted themselves to the use of a single structure. Eighty seven percent used either one or two structures. The average number of structures employed by an individual from the average ability group was 1.32.

Table 71
Dominant Schema Choice of Average Ability Participants Reading 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	5	4.4
Collection (list)	54	47.4
Problem-solution	22	19.3
Compare-contrast	4	3.5
Topic Sentences	21	18.4
No structure used	8	7.0
Total	114	100

Three quarters of all those students who made some use of collection (list) employed it as their dominant structure strategy and accounted for almost half of the average ability group of participants. Only three of those students who selected topic sentences used some other rhetorical structure more effectively. The number of average ability students who made effective use of a high constraining rhetorical structure in respect of Iceberg Towing amounted to a little over a fifth of the group.

Table 72
Levels of Coherence Achieved by Average Ability Participants Reading 'Iceberg Towing'

Level of coherence	Number of students	Percentage of students
No coherence	8	7.0
Minimal coherence	54	47.4
Moderate coherence	29	25.4
Majority coherence	2	1.8
Topic sentences	21	18.4
Total	114	100

Given that the majority of average ability readers relied on low constraining rhetorical structures it is not surprising that, topic sentences aside, only 27 percent of the group achieved better than minimal coherence. Only two students achieved majority coherence.

Average Ability - Killer Smog

Table 73
Numbers of Average Ability Participants Employing Various Organising Structures to Comprehend 'Killer Smog'

Structure	Number of students	Percentage of students
Collection (sequence)	28	24.3
Collection (list)	31	27.0
Cause-effect	73	63.5
Problem-solution	32	27.8
Topic sentences	26	22.6
No schema used	7	6.1

The most frequently used structure by average ability readers in respect of 'Killer Smog' was cause-effect which is also the top-level structure of the passage. Problem-solution was employed almost as frequently as cause-effect. All structures were used by large numbers of average ability readers with only seven students failing to employ any structural schema. Almost a quarter of the group employed collection (sequence) and a similar number used collection (list).

Table 74
Numbers of Structural Schemata Employed by Average Ability Participants Reading 'Killer Smog'

Number of schemata employed by an individual	Frequency	Percentage
None	7	6.1
One	48	41.7
Two	44	38.3
Three	15	13.0
Four	1	0.9
Total	115	100

Almost 80 percent of average ability readers used either one or two schemata in reading this passage. A further 14 percent employed more than two organising structures. The average number of structural schemata employed by an average ability reader in respect of Killer Smog was 1.6.

Table 75
Dominant Schema Choice of Average Ability Participants Reading 'Killer Smog'

Structure	Number of students	Percentage of students
Collection (sequence)	8	7.0
Collection (list)	15	13.0
Cause-effect	48	41.7
Problem-solution	24	20.9
Topic sentences	13	11.3
No schema used	7	6.1
Total	115	100

The most frequently used dominant schema among average ability readers was cause-effect (41.7%). Problem-solution was the dominant schema for half that number. Almost two thirds of all average ability readers employed a high constraining structure when reading Killer Smog. In contrast, only 20 percent relied primarily on a low constraining structure. The number who relied on topic sentence identification was relatively small (11.3%).

Table 76
Levels of Coherence Achieved by Average Ability Participants Reading 'Killer Smog'

Level of coherence	Number of students	Percentage of students
No coherence	7	6.1
Minimal coherence	32	27.8
Moderate coherence	51	44.3
Majority coherence	12	10.4
Topic sentences	13	11.3
Total	115	100

The coherence achieved by average ability readers in respect of Killer Smog was relatively high. More than half the group achieved moderate coherence or better. A third of the group achieved a lower level of coherence of which only 6.1 percent achieved no coherence on account of having failed to employ any structure strategy.

Average Ability - Sikh Wedding

Table 77
Numbers of Average Ability Participants Employing Various Organising Structures to Comprehend 'Sikh Wedding'

Structure	Number of students	Percentage of students
Collection (sequence)	17	15.3
Collection (list)	50	45.0
Topic sentences	50	45.0
No schema used	24	21.6

Three times as many students used collection (list) and topic sentences as used collection (sequence). However, many of those who were considered to have satisfied the criteria for use of topic sentences would have also qualified as having used collection (list). More than one in five average ability readers failed to record any structure use.

Table 78
Numbers of Structural Schemata Employed by Average Ability Participants Reading 'Sikh Wedding'

Number of schemata employed by an individual	Frequency	Percentage
None	24	21.6
One	57	51.4
Two	29	26.1
Three	1	0.9
Total	111	100

More than half of the average ability group was restricted to a single structure with a little over a quarter employing two structures. A little over one in five used no schemata at all. The average number of structures employed by an average ability reader was 1.06.

Table 79
Dominant Schema Choice of Average Ability Participants Reading 'Sikh Wedding'

Structure	Number of students	Percentage of students
Collection (sequence)	3	2.7
Collection (list)	38	34.2
Topic sentences	46	41.4
No schema used	24	21.6
Total	111	100

Over 90 percent of those students who identified the topic sentences had this as their dominant strategy and this was the most frequently employed strategy by average ability participants reading Sikh Wedding. Over one third of the group relied primarily on collection (list) with only three students using collection (sequence) as their dominant structure.

Table 80

Levels of Coherence Achieved by Average Ability Participants Reading 'Sikh Wedding'

Level of coherence	Number of students	Percentage of students
No coherence	24	21.6
Minimal coherence	37	33.3
Moderate coherence	3	2.7
Majority coherence	1	0.9
Topic sentences	46	41.4
Total	111	100

Only four of the average ability readers achieved more than minimal

coherence regardless of structure employed. A third of the group achieved minimal

coherence but this constituted 57 percent if the 46 participants who used topic

sentences are excluded.

High Ability - Iceberg Towing

There were 41 participants in the high ability reading group who responded to

Iceberg Towing; 40 who responded to Killer Smog; and, 37 who responded to Sikh

Wedding.

Table 81

Numbers of High Ability Participants Employing Various Organising Structures to Comprehend 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	16	39
Collection (list)	21	51.2
Problem-solution	22	53.7
Compare-contrast	6	14.6
Topic sentences	11	26.8
No schema used	1	2.4

The collection (list) and problem-solution rhetorical structures were each

employed to some extent by over half the high ability cohort. A further 14.6 percent

used compare-contrast to add to the overall use of high constraining structures. More

than a quarter of the group identified topic sentences and only one student failed to

employ any apparent structure.

Table 82
Numbers of Structural Schemata Employed by High Ability Participants Reading
'Iceberg Towing'

Number of schemata employed by an individual	Frequency	Percentage
None	1	2.4
One	20	48.8
Two	16	39
Three	4	9.8
Total	41	100

Slightly less than half the group employed a single structure and the other half

used two or more structures. Only one high ability participant failed to employ at

least one schema while reading Iceberg Towing. The average number of structures

used by a high ability reader was 1.6.

Table 83
Dominant Schema Choice of High Ability Participants Reading 'Iceberg Towing'

Structure	Number of students	Percentage of students
Problem-solution (local)	0	0.0
Collection (list)	9	22.0
Problem-solution	19	46.3
Compare-contrast	2	4.9
Topic Sentences	10	24.4
No structure used	1	2.4
Total	41	100

If a high ability reader used either problem-solution or topic sentences at all

then this was frequently the reader's dominant choice. The implication is that these

two choices tended to be mutually exclusive. None of the students who identified the

problem-solution structure at the local level failed to use a more effective rhetorical

structure.

The most frequently employed dominant structure was the top-level structure of the passage, i.e., problem-solution (46.3%). The number of high ability students showing preferential use for this structure was more than double each of the next most used structures, i.e., topic sentences (24.4%) and collection (list) (22%).

Table 84
Levels of Coherence Achieved by High Ability Participants Reading 'Iceberg Towing'

Level of coherence	Number of students	Percentage of students
No coherence	1	2.4
Minimal coherence	6	14.6
Moderate coherence	20	48.8
Majority coherence	5	12.2
Topic sentences	9	22.0
Total	41	100

Sixty-one percent of the high ability readers achieved moderate coherence or better. Only 17 percent achieved less than moderate coherence with only a single student failing to get any coherence.

High Ability - Killer Smog

Table 85
Numbers of High Ability Participants Employing Various Organising Structures to Comprehend 'Killer Smog'

Structure	Number of students	Percentage of students
Collection (sequence)	14	35.0
Collection (list)	8	20.0
Cause-effect	30	75.0
Problem-solution	24	60.0
Topic sentences	9	22.5
No schema used	1	2.5

The high ability participants used high constraining structures extensively with the Killer Smog passage. Three quarters of the high ability readers used a cause-effect rhetorical structure to some extent and 60 percent employed a problem-solution structure. Some high ability participants satisfied the criteria for both problem-

solution and cause-effect with their sentence selections. By comparison, the number

of students using low constraining structures or topic sentences was relatively small.

Table 86
Numbers of Structural Schemata Employed by High Ability Participants Reading 'Killer Smog'

Number of schemata employed by an individual	Frequency	Percentage
None	1	2.5
One	9	22.5
Two	18	45.0
Three	9	22.5
Four	3	7.5
Total	40	100

Three quarters of the high ability readers used more than one structure to

comprehend Killer Smog. Apart from the single student who failed to employ a

structure the remaining members of the group used a single structure. The average

number of structures employed by a high ability reader in respect of Killer Smog was

2.0.

Table 87
Dominant Schema Choice of High Ability Participants Reading 'Killer Smog'

Structure	Number of students	Percentage of students
Collection (sequence)	2	5.0
Collection (list)	0	0.0
Cause-effect	15	37.5
Problem-solution	19	47.5
Topic sentences	3	7.5
No schema used	1	2.5
Total	40	100

Eighty five percent of the high ability readers used a high constraining

rhetorical structure as their dominant structure strategy when reading Killer Smog.

The most frequently employed dominant structure was problem-solution where the

number of users exceeded cause-effect by 10 percent. Only two students in the group

relied on a low constraining structure as their dominant strategy and three relied on

topic sentences. It can be deduced that low constraining structures were generally

used to supplement high constraining structures.

Table 88
Levels of Coherence Achieved by High Ability Participants Reading 'Killer Smog'

Level of coherence	Number of students	Percentage of students
No coherence	1	2.5
Minimal coherence	3	7.5
Moderate coherence	15	37.5
Majority coherence	18	45.0
Topic sentences	3	7.5
Total	40	100

The levels of coherence are relatively high for this group of readers in respect

of this passage with more than four out of five students getting at least moderate

coherence and 45 percent achieving majority coherence. Only four students achieved

less than moderate coherence.

High Ability - Sikh Wedding

Table 89
*Numbers of High Ability Participants Employing Various Organising Structures to
Comprehend 'Sikh Wedding'*

Structure	Number of students	Percentage of students
Collection (sequence)	10	27.0
Collection (list)	24	64.9
Topic sentences	18	48.6
No schema used	2	5.4

Only two students in the high ability group failed to employ a structure

strategy while large numbers of students employed each of the three structures used in

respect of this passage. The greatest number of students (65%) used collection (list),

almost half the group selected topic sentences, and more than a quarter of the group

used collection (sequence).

Table 90
*Numbers of Structural Schemata Employed by High Ability Participants Reading
'Sikh Wedding'*

Number of schemata employed by an individual	Frequency	Percentage
None	2	5.4
One	19	51.4
Two	14	37.8
Three	2	5.4
Total	37	100

More than half of the high ability group was restricted to a single structure in respect of Sikh Wedding. Forty-three percent used more than one structure. The average number of structures employed by a high ability reader in respect of Sikh wedding was 1.4.

Table 91
Dominant Schema Choice of High Ability Participants Reading 'Sikh Wedding'

Structure	Number of students	Percentage of students
Collection (sequence)	3	8.1
Collection (list)	16	43.2
Topic sentences	16	43.2
No schema used	2	5.4
Total	37	100

An equal number of high ability readers employed collection (list) and topic sentences as a dominant strategy and between them they accounted for 86.4 percent of the group. Three students relied on collection (sequence) and two used no schema.

Table 92
Levels of Coherence Achieved by High Ability Participants Reading 'Sikh Wedding'

Level of coherence	Number of students	Percentage of students
No coherence	2	5.4
Minimal coherence	12	32.4
Moderate coherence	4	10.8
Majority coherence	3	8.1
Topic sentences	16	43.2
Total	37	100

Apart from the 43.2 percent of high ability readers who selected topic sentences most of the other high ability readers were limited to minimal coherence in respect of Sikh Wedding. Fewer than one in five of this group managed better than minimal coherence.

Ability Group Comparison

Iceberg Towing

Table 93
Ability Group Comparison in Respect of Organising Schemata for 'Iceberg Towing'

Structure	Low ability (%)	Average ability (%)	High ability (%)
Problem-solution (local)	11 (29.7)	44 (38.6)	16 (39.0)
Collection (list)	17 (45.5)	71 (62.3)	21 (51.2)
Problem-solution	1 (2.7)	29 (25.4)	22 (53.7)
Compare-contrast	3 (8.1)	8 (7.0)	6 (14.6)
Topic sentences	3 (8.1)	24 (21.1)	11 (26.8)
No schema	13 (35.1)	8 (7.0)	1 (2.4)

Chi square tests of independence produced significant results in relation to use of problem-solution, χ^2 (2, N=192) = 25.956, p <.000, where the low ability group were underrepresented and the high ability group overrepresented; and, failure to employ any organising schemata, χ^2 (2, N=192) = 25.948, p <.000, where the converse applied, i.e., the low ability group were overrepresented and the high ability group underrepresented. There were no other significant differences.

Table 94
Ability Group Comparison in Respect of Total Number of Schemata employed for 'Iceberg Towing'

Number of schemata	Low ability %	Average ability %	High ability %
None	13 (35.1)	8 (7.0)	1 (2.4)
One	14 (37.8)	59 (51.8)	20 (48.8)
Multiple	10 (27.1)	47 (41.2)	20 (48.8)
Total	37 (100)	114 (100)	41 (100)

There were significant differences between the reading ability groups in relation to the numbers of schemata employed in the reading process, χ^2 (6, N=192) = 26.792, p <.000. However, multiple schemata were combined into a single category to reduce the number of cells with small expected counts to two. The resultant chi square test of independence was significant χ^2 (4, N=192) = 26.476, p <.000. The low ability group was significantly overrepresented among those who failed to use any schema. This result reflected the relative failure of low ability participants to employ structure strategy as already indicated.

Table 95

Ability Group Comparison in Respect of Dominant Schema Employed for 'Iceberg Towing'

Structure	Low ability (%)	Average ability (%)	High ability (%)p
No structure	13 (35.1)	8(7.0)	1 (2.4)
Low constraining structures	21 (56.8)	59 (51.8)	9 (22.0)
High constraining structures	2 (5.4)	26 (22.8)	21 (51.2)
Topic sentences	1 (2.7)	21 (18.4)	10 (24.4)
Total	37 (100)	114 (100)	41 (100)

The reading ability groups had some significant differences in relation to choice of dominant schema, χ^2 (10, N=192) = 57.573, p <.000. However, there were a large number of cells with low expected counts. Consequently, the rhetorical structures were combined into two categories of low constraining structures and high constraining structures in addition to topic sentences and the absence of structure strategy. The subsequent chi square test of independence was significant, χ^2 (6, N=192) = 54.043, p <.000. Apart from the low ability group having significantly greater numbers in the 'no structure' category, they were significantly underrepresented in both the high constraint and topic sentence categories. The high ability group had significantly lower numbers using low constraint structures and was overrepresented in the high constraining structures.

Table 96

Ability Group Comparison in Respect of Coherence Achieved with 'Iceberg Towing'

Coherence level	Low ability (%)	Average ability (%)	High ability (%)
No coherence	13 (35.1)	8 (7.0)	1 (2.4)
Minimal	19 (51.4)	55 (48.3)	6 (14.6)
Moderate/majority	4 (10.8)	30 (26.3)	25 (61.0)
Topic sentences	1 (2.7)	21 (18.4)	9 (22.0)
Total	37 (100)	114 (100)	41 (100)

It was necessary to combine some cells for the purpose of a chi square test of independence. The subsequent test confirmed a relationship between the variables, χ^2 (6, N=192) = 53.174, p <.000. The low ability group was significantly overrepresented among those achieving no coherence and underrepresented among those gaining moderate/majority coherence and using topic sentences. The high ability group was significantly underrepresented in the no coherence category but overrepresented in the group achieving moderate/majority coherence.

Killer Smog

Table 97

Ability Group Comparison in Respect of Organising Schemata for ''Killer Smog'

Structure	Percentage of Low ability group	Percentage of Average ability group	Percentage of High ability
Collection (sequence)	6 (18.8)	28 (24.3)	14 (35.0)
Collection (list)	7 (21.9)	31 (27)	8 (20.0)
Cause-effect	12 (37.5)	73 (63.5)	30 (75.0)
Problem-solution	3 (9.4)	32 (27.8)	24 (60.0)
Topic sentences	2 (6.3)	26 (22.6)	9 (22.5)
No schema	13 (38.3)	7 (6.1)	1 (2.5)

The only significant differences between reading ability groups in relation to the general use of rhetorical structures were cause-effect, χ^2 (8, N=192) = 58.672, p <.000, and problem-solution, χ^2 (2, N=187) = 23.016, p <.000. There was a further significant difference in relation to the absence of any evidence of structure strategy,

χ^2 (2, N=187) = 29.441, p <.000.   The difference in relation to cause-effect

emphasised the relatively lower use of the schema by the below average ability group.

The relative absence of structure by the below average group was highlighted in the

'no structure' comparison where the below average ability group were represented in

much higher numbers than ought to have been expected. In relation to the use of a

problem-solution rhetorical structure the below average ability group were

underrepresented and the above average ability group were overrepresented.

Table 98
Ability Group Comparison in Respect of Total Schemata employed for 'Killer Smog'

Number of schemata	Low ability group (%)	Average ability group (%)	High ability group (%)
None or single schema	22 (68.8)	55 (47.8)	10 (25.0)
Two schemata	9 (28.1)	44 (38.3)	18 (45.0)
More than two schemata	1 (3.1)	16 (13.9)	12 (30.0)
Total	32 (100)	115 (100)	40 (100)

In view of a number of low expected cell counts, the cells relating to more

than a single schema were combined into a single category and none or single schema

cells also combined. A chi square test of independence was significant, χ^2 (4,

N=187) = 17.533, p <.002. The high ability group had significantly lower numbers

using a single or no schema and significantly higher numbers using multiple

schemata.

Table 99
Ability Group Comparison in Respect of Dominant Schema Employed for 'Killer Smog'

Structure	Low ability (%)	Average ability (%)	High ability (%)
None / low constraint	19 (63.3)	30 (29.4)	3 (8.1)
High constraint	11 (36.7)	72 (70.6)	34 (91.9)
Total	30 (100)	102 (100)	37 (100)

Due to a number of cells with low expected counts the rhetorical structures were combined into two categories with topic sentences left out. One category consisted of no structure or a low constraint structure (collection) and the other category consisted of the remaining high constraining structures (cause-effect and problem-solution). A chi square test of independence was significant, χ^2 (2, N=169) = 23.942, p <.000. The low ability group was significantly overrepresented in the none/low constraint category and the high ability group was underrepresented in the none/low constraint group.

Table 100
Ability Group Comparison in Respect of Coherence Achieved with 'Killer Smog'

Coherence level	Low ability (%)	Average ability (%)	High ability (%)
No coherence	13 (40.6)	7 (6.1)	1 (2.5)
Minimal	14 (43.7)	32 (27.8)	3 (7.5)
Moderate	2 (6.3)	51 (44.3)	15 (37.5)
Majority	1 (3.1)	12 (10.4)	18 (45.0)
Topic sentences	2 (6.3)	13 (11.3)	3 (7.5)
Total	32 (100)	115 (100)	40 (100)

On account of some low expected cell counts the chi square test was calculated excluding cases of no coherence or topic selection and it again proved to be significant, χ^2 (4, N=148) = 44.325, p <.000. The low ability group was overrepresented among those who achieved only minimal coherence and underrepresented among those who achieved moderate coherence. The expected number of low ability readers achieving majority coherence was fewer than five. The high ability group were underrepresented in the minimal coherence group and over represented in the majority coherence group.

Sikh Wedding

Table 101
Ability Group Comparison in Respect of Organising Schemata for 'Sikh Wedding'

Structure	Low ability (%)	Average ability (%)	High ability (%)
Collection (sequence)	2 (5.6)	17 (15.3)	10 (27.0)
Collection (list)	7 (19.4)	50 (45.0)	24 (64.9)
Topic sentences	11 (30.6)	50 (45.0)	18 (48.6)
No schema	18 (50.0)	24 (21.6)	2 (5.4)

A chi square test of independence confirmed a relationship between collection (list) and reading ability, χ^2 (2, N=184) = 15.394, p <.000, and the absence of structure use and reading ability, χ^2 (2, N=184) = 20.751, p <.000. The numbers using collection (list) increased with increased reading ability and the numbers not using any structural schemata reduced with increased reading ability.

Table 102
Ability Group Comparison in Respect of Total Schemata employed for 'Sikh Wedding'

Number of schemata	Low ability (%)	Average ability (%)	High ability (%)
No schema	18 (50.0)	24 (21.6)	2 (5.4)
One schema	15 (41.7)	57 (51.4)	19 (51.4)
Multiple schemata	3 (8.3)	30 (27.0)	16 (43.2)
total	36 (100)	111 (100)	37 (100)

Low expected cell counts resulted in cells relating to multiple schemata use being combined for a subsequent significant chi square test of independence, χ^2 (4, N=184) = 24.705, p <.000. The low ability group was significantly overrepresented among those making no use of structure and underrepresented among those using multiple structures. The converse applied in respect of the high ability group.

Table 103

Ability Group Comparison in Respect of Dominant Schema Employed for 'Sikh Wedding'

Structure	Percentage of Low ability group	Percentage of Average ability group	Percentage of High ability group
Collection (sequence)	2.8	2.7	8.1
Collection (list)	16.7	34.2	43.2
Topic sentences	30.6	41.4	43.2
No structure	50.0	21.6	5.4

The two collection structures were combined in to a single 'collection' category to eliminate the low expected cell counts. A chi square test of independence was significant, χ^2 (4, N=184) = 22.534, p <.000, with the low ability group overrepresented in the 'no structure' category and the high ability group underrepresented in the same category.

Table 104

Ability Group Comparison in Respect of Coherence Achieved with 'Sikh Wedding'

Coherence level	Low ability (%)	Average ability (%)	High ability (%)
No coherence	18 (50.0)	24 (22.4)	2 (6.7)
Minimal coherence	7 (19.4)	37 (34.6)	11 (36.7)
Topic sentences	11 (30.6)	46 (43.0)	17 (56.6)
Total	36 (100)	107 (100)	30 (100)

Once again some low cell counts were evident and these were reduced by excluding the small numbers of participants who achieved moderate/ majority coherence. This produced a significant chi square test of independence, χ^2 (4, N=173) = 17.900, p <.001. The low ability group was significantly overrepresented among those achieving no coherence and the opposite was true of the high ability group.

Inter Text Comparisons

Allowing for the fact that each passage resulted in different schema choices and different numbers of schemata the comparisons made related to the extent to which the readers selected a dominant structure that matched the top-level structure of the relevant text, the extent to which topic sentences were selected, the extent to which participants failed to employ any structure strategy, the most frequently used structure, and the degree of coherence achieved.

In comparing the number of schemata used by the respective passages it needs to be borne in mind that Sikh Wedding afforded only three structural schemata whereas the other two passages afforded five options each. The average number of structures used by all participants in Iceberg Towing was 1.34; in Killer Smog it was 1.6; and in Sikh Wedding it was 1.05. This gives the general impression that there might be a real difference in the general use of structural schemata depending on the passage. However when the average number of schemata is recalculated as a ratio of the number of schemata and the number of schemata available the indications are that the top-level structure of the passage makes no difference: the respective scores were 0.27 for Iceberg Towing, 0.3 for Killer Smog, and 0.35 for Sikh Wedding. It has to be borne in mind, as emphasised already, that Sikh Wedding afforded greater opportunity for participants to embrace two alternative schemata insofar as a participant selecting topic sentences frequently satisfied the criteria for collection (list). It is therefore quite likely that the descriptive passage tended to be less amenable to multiple structures.

In considering the use of a rhetorical structure akin to the top-level structure of the passage special consideration needs to be given to Killer Smog previously identified as having a cause-effect top-level structure. As indicated previously this

passage was equally if not more effectively interpreted with a problem-solution

rhetorical structure. Consequently, in respect of Killer Smog the comparison will

embrace both cause-effect and problem-solution.

Table 105

Inter Text Comparison of Dominant Structure Use and Top-level Structure

Dominant structure Strategy used	*Iceberg Towing (problem-solution) %*	*Killer Smog (cause-effect or problem-solution) %*	*Sikh Wedding (collection-list) %*
Top-level structure match	21.3	39.6 (cause-effect) 24.2 (problem-sol)	32.4
Topic sentences	18.4	9.7	38.6
No structure strategy	12.4	11.1	24.6
Most frequently used structure	Collection (list)	Cause-effect	Topic sentences

The indications are that a minority of all participants effectively employed the

same rhetorical structure as the passage top-levels structure for each passage.

However, in relation to Killer Smog the combination of the two high constraining

structures and the fact that cause-effect was the most frequently used structure suggest

that readers were much more consistent in mirroring the top-level structure of the

passage. There was a large discrepancy between texts in relation to the selection of

topic sentences with less than 10 percent for Killer Smog almost doubling in relation

to Iceberg Towing, and doubling again in relation to Sikh Wedding. The top-level

structure was not the most frequently employed rhetorical structure in relation to

either Iceberg Towing or Sikh Wedding. However, in respect of Sikh Wedding topic

sentences was used only marginally more often that collection (list).

It is worth looking at the same comparison when only the high ability readers

are considered. The data are presented in Table 106 below.

Table 106
Inter Text Comparison of Dominant Structure Use and Top-level Structure Among
High Ability Readers

Dominant structure Strategy used	Iceberg Towing (problem-solution) %	Killer Smog (cause-effect or problem-solution) %	Sikh Wedding (collection-list) %
Top-level structure match	46.3	37.5 (cause-effect) 47.5 (problem-sol)	43.2
Topic sentences	24.4	7.5	43.2
No structure strategy	2.4	2.5	5.4
Most frequently used structure	Problem-solution	Problem-solution	Collection (list) & Topic sentences

It becomes apparent that improved reading ability increased the frequency of

the reader employing a dominant structure consistent with the top-level structure of

the passage. It is also apparent that more high ability readers made dominant use of

the most constraining rhetorical structure that lent itself to each of the passages.

The next table examines the relative degrees of coherence achieved with each

of the passages.

Table 107
Inter Text Comparison of Coherence Levels

Level of coherence	Iceberg Towing (%)	Killer Smog (%)	Sikh Wedding (%)
No coherence	27 (12.4)	23(11.1)	51 (24.6)
Minimal coherence	89 (41.0)	55 (26.6)	62 (30.0)
Moderate coherence	55 (25.3)	73 (35.3)	9 (4.3)
Majority coherence	7 (3.2)	36 (17.4)	5 (2.4)
Topic sentences	39 (18.0)	20 (9.7)	80 (38.6)

Double the participants failed to achieve any coherence in relation to Sikh

Wedding, the descriptive passage with the collection (list) top-level structure. High

coherence levels tended to be most frequent in relation to Killer Smog, the passage

with the cause-effect top-level structure but which also lent itself equally to problem-

solution. Iceberg Towing with its problem-solution top-level structure was

somewhere in between.   More participants applied the highest levels of structure

strategy and with the greatest degree of success to Killer Smog. If one excludes

problem-solution (local) from the count of structures used in respect of each passage,

then the employment of structure strategy and relative degree of coherence achieved

increases in relation to the overall number of rhetorical structures that lent themselves

to the comprehension of the passage.

Chapter 6 Summary

The chapter opens with a series of discussions of each of the five research questions. There is important emphasis given to the division of organisational structures into two separate and distinct categories, i.e., content structures and rhetorical structures. These two categories of structures are explained in terms of their respective non-linear and linear characters and it is observed that comprehending expository text may not be as different from comprehending narrative text as would have been expected. The discussion reflects on the limited ability of children to apply structure strategy despite their apparent potential to do so. Consideration is given to the part played by practice and the need to develop skill in using multiple schemata if good levels of coherence are to be achieved. The manner in which children develop and apply structure strategy is explained in terms of Siegler's moderate experience hypothesis and his 'overlapping waves' model. It is hypothesised that semantics may play the greater role in content structure use whereas syntax may play a greater role in the case of rhetorical structure use. The role of the logical complexity of text, first raised in the literature review, is revisited and its implications for memory capacity considered. Also considered are the implications arising from computer generated texts with hyperlinks. Further implications of the study for various aspects of education including reading assessment, structural aids, textbook selection, and classroom instruction are discussed. The chapter concludes with a brief comment on some of the limitations of the study and future research directions.

6. Discussion

Previous research into the use of structure strategy suggested that some schoolchildren appeared to be aware of or employ the organisational structure of a text relative to their age and general reading ability, however, in contrast to adults, the proportion of children doing so tended to be a minority. A simple focus on whether children in the current study reflected the organising top-level structure in the experimental activity would have produced results that are generally consistent with the earlier research. However, in contrast to previous studies, and premised on the distinction made between the organisational structure of the text and the structure characterising the reader's understanding of the text, the current study suggests a more complex process at work in relation to structure strategy and the way it develops. This more elaborate description provides some insight into the way in which some children employed multiple structures concurrently to achieve comprehension. This study takes us beyond the simple question of whether the child appears to recognise the top-level structure of the text to the more complex ways in which the child might sift the material through a variety of structural schemata to achieve maximum coherence. It emphasises the fact that the primary purpose of structure strategy is coherence and not recall, although improved coherence may well contribute to more effective recall. The indications are that the more experienced and able the reader, the more frequently he or she used combinations of structures in the comprehension process, to consequently achieve greater levels of coherence.

Although this study has emphasised the difference between the organisational structure of the text and the structure of the reader's interpretation of the text, it was not intended to suggest that no relationship exists between the two. It is acknowledged that a writer's organisation is an important and essential part of the

communication and intended to have communicative purpose. What is argued in this study is that the reader's understanding cannot simply be measured by the reader's recognition of the writer's structure and that the influence of text structure might be much more complex or subtle than is evident from earlier research. The results of this study help to illuminate the complexities and subtleties of this relationship.

How do children employ structure strategy when reading expository text?

The purpose of much of the earlier research on structure strategy was concerned with the individual's recall relative to the top-level structure of the text. As a consequence of the methods generally employed, the focus was restricted to the manner in which an individual reader was seen to recognise a single structure and even then, only if the structure was the top-level structure of the text. Most of these studies failed to provide information about alternative structures employed or the combined use of multiple structures. The present study deliberately sought to identify any and all apparent uses of structure and distinguished the dominant preferred structure on the basis of its relatively greater contribution to the overall coherence achieved from other contributing structure use. Whilst it was apparent from the results that the failure to employ structure strategy was a significant differentiating feature, among participants who used structure strategy multiple structure use was common regardless of year level or reading ability. The indication from this is that the participants who employed structure strategy were generally making connections between different parts of the text on more than one level and that structure strategy is a more complex process than might have appeared to be the case from earlier research.

It is interesting that Siegler (1996), in his research into the use of counting strategies amongst young children, concluded that the ability to use a variety of

strategies was a better predictor of mathematical ability than skill in the use of a single strategy regardless of its sophistication or complexity. Siegler emphasised not only the cognitive variability between individuals, but also the variability in a single child's strategy choices which might change from one problem to the next regardless of the similarity of the problems. He concluded that "memory, learning, and understanding all seem likely to benefit from being able to reach the same conclusion via several different lines of reasoning, or from knowing multiple strategies that generate the same answer" (Siegler, 1996, p.31). Siegler believed his conclusion applied not only to mathematics but also to other skills such as reading. The results of the current study are consistent with such a view of reading comprehension. Readers can reach an understanding of the meaning of a text using alternative structures and although individuals may not be consistent in their use from one text to another the important thing is the mastery of the alternative structures.

There was, as predicted by the earlier research, a relationship between structure strategy use and text top-level structure which will be discussed in more detail presently. At this point it is important to point out that, with the exception of the Killer Smog passage, collection (list) was the most frequently, although not generally the most effectively, used structure. In the case of Killer Smog the most frequently employed structure was cause-effect. This begs the question why collection should have been the most frequently employed structure by readers of two texts with such disparate top-level structures but not the case in relation to Killer Smog. There is one obvious potential factor that could explain such differences, namely, that a passage of text must potentially lend itself to a particular organisational structure for it to be used appropriately and that Killer Smog either did not lend itself to the use of collection or more easily lent itself to other structures. The use of a

collection structure in relation to Killer Smog could not be ruled out and prompts the question why a more constraining rhetorical structure was not the most frequently employed structure in the case of Iceberg Towing. The reasons for the difference in structure strategy in relation to the Killer Smog passage will also be explored presently. In the meantime it is acknowledged that these results shed a little doubt on the notions that there might be a simple relationship between the level of complexity of the structure and the likelihood of its being employed assuming its suitability and any consistency of top-level structure influence on structure strategy.

As indicated above, a complete failure to employ structure strategy was a significant differentiating feature between groups and individuals from the results of this study. Such differentiation was more easily achieved on the basis of the presence or absence of structure strategy than the relative use of such strategy. It was clear from examination of the results that fewer low ability readers and fewer Year 5 readers employed structure strategy than more able or older participants and it was this absence of structure strategy rather than differences in the application of structure strategy that resulted in the most obvious distinction between younger, less able readers and the rest.

An unanticipated result from this study was the extensive use of topic sentences and the way that topic sentence selection appeared to be used as an alternative to the recognised organisational structures identified for the purposes of the study. Nevertheless, McNamara and Kintsch (1996) believed that the macrostructure of a text could be cued directly via topic sentences, but that it "is often left up to the reader to construct … .by using some type of schema to organise the text" (p.252). It is implied in this statement that topic sentences and organisational schemata represent alternative routes to generating the macrostructure of a text.

One of the most important discoveries arising from the results of this study was that the various structures identified by Meyer may not represent a single continuum but in fact may be divided into two groups of structures that complement one another and thus generated the highest levels of coherence. It is suggested at this point that an important distinction ought to be made between what will be referred to henceforth as **rhetorical structure** and **content structure**. Rhetorical structure should be seen as limited to the logical structure or argument contained within the text and capable of identification without any knowledge of the topic or content of the text. The selection of topic sentences or collection (list) on the other hand generally depends on semantic understanding of the subject matter contained within the text. Topic sentence selection has some resemblance to collection in that they both rely on relationships based on the content as opposed to the logic of the passage. They both relate information in a text by their association. Another way of highlighting this distinction is that rhetorical structure demands linear reasoning whereas collection and topic sentences are non-linear and reflect relationships based on association. Association might be thought of as a categorisation task as opposed to logical reasoning and the child's ability to categorise is a reasoning skill that generally precedes the development of logic.

Topic sentences and collections (list) are based on association rather than rhetorical argument but are considered to vary from one another on the quality of the association or breadth of category involved. Topic sentences suggest a way to sample the content as a whole whereas collection is restricted to information associated with a single idea or topic and likely to convey a more limited account of the overall content of a passage of text. The only linear rhetorical structures are cause-effect and problem-solution and they share a large degree of overlap. Whilst compare-contrast

has characteristics of a rhetorical structure it also shares characteristics of collection (list). Perhaps this is why Meyer found it so difficult to place this structure within her continuum.

This distinction between content structures and rhetorical structures sheds some doubt on Meyer's original continuum by suggesting that it can be divided into two qualitatively different sets of structures with cause-effect and problem-solution in one and topic sentences and collection (list) in the other. Compare-contrast would straddle both. The remainder of this discussion will recognise the foregoing distinction by referring to topic sentences and collection (sequence) as content structures as opposed to rhetorical structures. This leaves the collection (sequence) structure in need of some explanation as to where it fits in this model.

The connections between the pieces of information brought together by collection (list) can be articulated by the use of the word 'and' between any pairing of the items. The list comprises added items based on a common association. However, can the same be said about collection (sequence)? The sequential character of this organisational structure on first impression appears to have more in common with the rhetorical structures and the appropriate connective would appear to be 'then'. The relationship between pieces of information in a collection (sequence) is based on actions associated in time. However, although cause-effect and problem-solution have a necessary sequential character, unlike collection (sequence) the sequence is not a sufficient although being a necessary characteristic of the relationship. What collection (list) and collection (sequence) have in common is their additive character. Whilst any piece of information can be removed from a collection structure without damaging the integrity of the schema, this is not true in the case of a rhetorical structure. Finally, the items bound together by collection (sequence) could be

considered still to be based on association or category but in this case the category being an event. Content structures such as topic sentences, collection (list) and collection (sequence) are solely descriptive in contrast to the rhetorical structures which are essentially explanatory.

The distinction between content structure and rhetorical structure might also help to explain the previously identified relationship between structure and recall. It is generally accepted that the principle means of assisting the encoding of information in memory are association and understanding. In this sense the distinction between content and rhetorical schemata could be seen to parallel this distinction. The notion that content schemata reflect association and perhaps some shallow grasp of the material, whilst rhetorical structures support deep understanding, might afford some enlightenment on their reported relative effect on recall. There were suggestions in the literature that the more constraining structures were more effective in aiding recall. Given the results from this study showing the tendency of participants who use a rhetorical structure to complement it with a content structure, any such conclusion would shed little light on a comparison between recall and low constraining and high constraining organising structures respectively.

As stated previously, the results showed that readers who employed multiple structures generally combined a rhetorical structure with a content structure. This of course could not have applied in the case of Sikh Wedding where there were no rhetorical structures employed. However, as pointed out already, the criteria for topic sentences and collection (list) were such that it was highly likely that a participant who selected topic sentences frequently satisfied the criteria for collection (list) as well. Consequently, it was frequently the case that a participant reading Sikh Wedding and employing structure was generally using only a single structure strategy

approach and that this was a content structure. In the case of the other two passages which lent themselves to rhetorical structure strategy it was commonly accompanied by a secondary collection (list) strategy.

The fact that the dominant structure used for each passage was not always the most effective is indicative that, among the school children in the sample, whilst there were students who showed a degree of competency in applying each of the structures and combinations of structure, the general tendency was to use structures that limited the degree of coherence achieved. It was clear that the majority of the participants were still in the process of developing expertise in the use of structure strategy.

What degree of coherence do school children achieve when using structure strategy?

The nature of the methods used in this study guaranteed that any participant who satisfied the criteria for any of the structures specified would satisfy the requirements for achieving minimal coherence. Consequently, if it transpired that participants generally achieved no more than minimal coherence, this would do no more than reiterate the numbers of participants who used structure strategy and tell us nothing of the relative effectiveness with which structure was used. Thus, the important information in these results lay in distinguishing the numbers of participants who not only used structure but also achieved better than minimal coherence. For the purpose of outlining the broad picture of coherence achieved, the following discussion is based on coherence relating to reading ability groups. The reason for selecting reading ability groups, as opposed to year groups, is that they provided a clearer picture of differences between participants than year groups, a point that will later be discussed in more detail.

A further consideration in exploring the results in relation to coherence is the need to account for topic sentences. As previously stated, it was not possible to gauge in any simple way the amount of coherence achieved by a participant who selected topic sentences. Consequently, given that the selection of topic sentences was not uniform either across texts or across ability/ year groups, the best way to gauge the level of coherence generally being achieved was to look at the relative degree of coherence achieved proportionate to the number of participants who employed structure excluding topic sentences.

On this basis the proportion of low ability readers achieving greater than minimal coherence was greatest in Killer Smog but nevertheless only embraced about 18% of the low ability group. A slightly smaller proportion of this group achieved greater than minimal coherence in respect of Iceberg Towing with none achieving majority coherence, and no students at all achieving better than minimal coherence in respect of Sikh Wedding. The proportions of average ability participants achieving better than minimal coherence in respect of Iceberg Towing and Killer Smog was very much greater than the low ability group but not much better in respect of Sikh Wedding. In the case of average ability readers much higher levels of coherence were achieved in respect of Killer Smog than Iceberg Towing. The high ability group of readers produced an even higher level of coherence on all three passages but although the vast majority of these students achieved better than minimal coherence in respect of Iceberg Towing and Killer Smog, only about a third of the group achieved this in respect of Sikh Wedding.

It is clear from the foregoing that the level of coherence achieved in respect of the three texts must have been affected by characteristics of the texts themselves in addition to the ability level of the participant. The subjects of reading ability and text

differences will be discussed in greater detail at a later stage of this discussion.

Equally important to the discussion of the results in relation to coherence was the high

number of participants who failed to achieve better than minimal coherence despite

having employed structure strategy regardless of text characteristics or reading ability.

It appears that whilst the number of students using any degree of structure strategy

was relatively high, the ability to use structure strategy effectively was considerably

smaller. There appears from this sample to be a period when the participant has

limited ability to apply structure strategy but has not achieved the level of mastery

that would be manifested through high levels of coherence, although the high ability

reading group appeared to be making good progress towards that goal in relation to

Killer Smog if not the other two texts. This could be seen to mirror the development

of strategy described by Siegler in relation to arithmetical skills. Siegler (1996)

referred to the "moderate experience hypothesis" whereby "use of multiple strategies

is most likely when people have moderate amounts of experience with the problems

being studied" (p.59). Siegler identified a trade off between speed and accuracy in the

adoption and learning of new strategies. He asserted that strategy use depends on

three factors: the effectiveness of the strategy, the effectiveness of alternative

strategies, and children's tendency to use the fastest strategy that provides accuracy

(Siegler, 1996). If the first couple of years of reading instruction are focused on

decoding with the task of comprehension only becoming the primary goal beyond

those years, then the child is starting to experiment with structure strategy at the same

time as fluency is being achieved. Since the use of multiple schemata with unfamiliar

topics is likely to increase processing time it is equally possible that it will reduce

reading fluency. Consequently, the child may be reluctant to do so, instead sticking to

the single schemata that is easiest to apply.

Siegler's ideas raise the question of whether there might be trade-offs for the reader learning a new comprehension strategy and the nature of any trade-off? As suggested above, a potential implication of Siegler's findings is that the adoption of structure strategy could potentially affect fluency and, consequently, comprehension. If this is the case then it carries implications for teaching children to read to understand. In the early years of learning to read the emphasis is on fluency, i.e., rate and accuracy. The move to reading to learn might, in the short term, adversely affect fluency. Consequently, the assessment of reading ability would need to take this into consideration. The question of whether such a trade-off takes place requires further research.

As indicated already, the text needs to provide the opportunity for alternative structures if they are to be used effectively. Many of the participants who achieved majority coherence in respect of a text did so based on multiple structure use, which as we have seen already, invariably consisted of a rhetorical structure along with a content structure. This could only be achieved with Iceberg Towing and Killer Smog which would go a long way to explaining the differences between passages in the amount of coherence achieved, particularly the low levels of coherence achieved by all groups in respect of Sikh Wedding.

What is the nature of any relationship between general reading ability and use of structure strategy?

There were a significant number of low ability readers who generally failed to employ structure strategy effectively and when they did it tended to be content schemata and not rhetorical schemata. Nevertheless, a significant number of low ability readers still managed to demonstrate limited use of cause-effect when reading Killer Smog. Given their tendency to rely on content schemata, it is not surprising

that low ability readers generally failed to establish levels of coherence beyond minimal. The indication from the results of the low ability sample was that they were learning to recognise but had not reached the stage of effectively utilising structure strategy. This would be consistent with the moderate experience hypothesis.

The earlier research tended to suggest that the younger (and relatively less able) readers applied low constraining structures before high constraining structures in a learning progression that appeared to reflect Meyer's continuum of constraint. The results from this study showed a more complex situation occurring whereby low ability readers appeared to be quite competent in identifying cause-effect even if they could not necessarily achieve high levels of coherence using it. There is certainly evidence to support the belief that children learn the cause-effect relationship at a relatively young age. Consequently, rather than the learning of structure being a linear progression from the least to the most constraining, the child may in fact learn content and rhetorical structure simultaneously but achieve mastery at different time intervals. Siegler's (1996) 'overlapping waves' model has the potential to account for this process of strategy use. In this model Siegler described strategy development as shaped like waves with the use of one strategy overlapping and being overlapped by others. He acknowledged that children's early use of a strategy was generally carried out ineffectively and demanded greater cognitive resources than once they had become more experienced.

Even though large numbers of low ability participants managed to meet the criteria for both collection (list) and cause-effect, the low ability group was characterised by the large number who failed to employ any structure strategy, from 35 percent in the case of Iceberg Towing to 50 percent in the case of Sikh Wedding.

This was consistent with the earlier literature in which most studies failed to show results for much younger students although a few contradicted the broad consensus.

On first impression the low ability readers managed to employ collection (list) more frequently on the more complex Iceberg Towing passage than the structurally less sophisticated Sikh Wedding. However, when the numbers of low ability participants selecting topic sentences in the case of Sikh Wedding are added to the numbers employing collection (list) the proportion of low ability participants using a content schema as the dominant one was about the same as in Iceberg Towing. The top-level structure of the text appeared to make no difference to the number of low ability readers using content schemata allowing for the fact that than in the case of Sikh Wedding there was greater use of topic sentences as opposed to collection (list).

The greatest contrast in this study lay between the low ability and high ability groups. Nevertheless, among the average ability group of readers, only about a third managed to show some use of a rhetorical structure in respect of Iceberg Towing and only one in five used it as their dominant strategy. The average ability readers showed a clear preference for a content schema when reading this passage and this was reflected in the relatively poor coherence levels achieved. This performance of average ability readers was in stark contrast when reading Killer Smog where 60 percent of the group had a rhetorical structure as the dominant structure and there was more extensive use of multiple structures leading to higher levels of coherence.

Three quarters of the average ability readers used a content schema as the dominant strategy when reading Sikh Wedding and slightly more used topic sentences than collection (list). A fifth of the group failed to employ structure strategy. Consequently, the level of coherence achieved was quite poor with only a few achieving better than minimal coherence.

In contrast to the low and average ability groups, the high ability group succeeded in having significantly more participants than expected utilise both a rhetorical structure (problem-solution) and a content structure (topic sentences) and better than expected performance in achieving coherence. The latter was achieved by effective use of multiple schemata. The high ability group achieved the highest level of rhetorical structure use when reading Killer Smog where 85 percent had a dominant rhetorical structure with 45 percent achieving majority coherence. Although this group showed 86 percent using content schemata for Sikh Wedding they only managed modest levels of coherence.

It was clear from the results of this study, that providing we use coherence as the criterion of success as opposed to frequency of use, there was a relationship between reading ability and the effective use of structure strategy. Having said that, it was equally clear that there were significant differences between the performances of some individuals within ability groups.

One of the issues arising from these results is not only differences arising from ability but also from differences of response to the respective texts. All ability groups showed more extensive and effective use of structure strategy in respect of the Killer Smog passage than either of the other two passages.

Is there any evidence of a developmental pattern to the use of structure strategy by school children?

One of the questions posed in this study was whether there is a developmental factor involved in the learning and use of structure strategy. Most of the earlier research on the subject focused on children by their year or grade level in school and the focus was typically on the odd years from Year 3 to Year 9.   Despite a tendency by some researchers to comment on reading ability on the basis of their results,

researchers tended not to treat reading ability as an independent variable. In contrast, the current study has treated both year level and reading ability as separate independent variables. This contrasts with much of the earlier research and affords a clearer picture of any relationship between structure strategy use and reading ability. A comparison of year-based and ability-based performance also has the potential to provide an indication of the presence of a developmental factor. If it is assumed that, and it is considered reasonable to do so, children in the same school year and of the same age are at a similar stage of development, then if development is a factor it ought to show up more strongly in a year-based comparison than an ability-based one.

While the broad pattern of results across year groups was very similar to that across ability groups in relation to non-use of structure strategy as well as the relative use of both content and rhetorical schemata, the ability group comparison showed a more consistent pattern of differences in relation to the coherence achieved with structure strategy than was apparent from the year group results. Both the year group and ability group results indicated that the frequency of schema employment increased with age and ability respectively but the increasing effectiveness of such use was clearer from the ability group comparison. If it is accepted, and the results tend to support the claim, that recognition of both content and rhetorical structure occur quite early in a child's learning but that effective use requires considerable practice, then an absence of difference in relation to coherence fails to shed light on the development of such skills. Thus, it was the ability-based results that provided the clearer picture of change in relation to structure strategy employment in the reading comprehension process. Whilst there can be little doubt that the relative amount of relevant education a child receives will have an influence on the development of a learning strategy, the fact that ability offers a clearer picture of effectiveness suggests

that this is a more significant factor than year level and consequently ability would appear to be a greater influence than development. However, while these results suggest that ability may be a relatively more important influence on the effective use of structure strategy than development, the results also support the view that the initial recognition of structure strategy is developmental. Ability seems to determine the subsequent success of structure strategy use.

To what extent, if any, is there a relationship between the use of structure and the organisational structure of expository text in the reading comprehension skills of school children?

This study has been very deliberate in discriminating between the structure applied to text by the reader for the purpose of assisting comprehension and the top-level structure of the text built in by the text's author. This was not to argue that the top-level structure of the text plays no part in the reader's comprehension process, rather, that an ability to recognise the top-level structure in itself need not be an adequate reflection of the way in which the reader employs structure in the organisation of meaning or a true reflection of the reading skills of the reader. Indeed, the results of this study have tended to support this distinction between text structure and structure strategy by illustrating the manner in which the highest levels of coherence have generally depended on the combination of content and rhetorical structures. However, it was also very apparent that the participants' performance in respect of the three texts varied significantly suggesting that aspects of the texts played no small part in the quality of the comprehension and level of coherence achieved. The difference in response to the three texts was quite consistent, being apparent regardless of age or ability. It is important to try and establish the nature of

the part played by the text in this process as opposed to the part played by the reader's skills in using structure strategy.

The most obvious potential explanation for these differences is that the performance of the participants reflected the degree of difficulty imposed by the respective passages, but begs the question whether and to what extent top-level structure was the variable generating relative difficulty. Whilst this question is difficult to answer it is nevertheless possible to eliminate some of the other variables that could contribute to the level of difficulty of a text, i.e., topic, vocabulary, syntax, and passage length.

Great care was taken at the outset to ensure that the topics embraced by each of the passages were likely to be unfamiliar to the participants. However, it is very difficult to be completely sure that none of the participants had any such knowledge and no steps were taken to assess whether such knowledge existed. The fact that Iceberg Towing and Killer Smog had been utilised for many years in a standardised test of comprehension in Western Australian schools was taken as a reasonable indication of relative unfamiliarity since familiarity would have undermined the reliability of the original test and no such challenge was, as far as the writer knows, ever made. Certainly, the removal of these passages from the test some years ago was not due to any such concerns. The third passage, Sikh Wedding, was also used as a tool for teaching comprehension, and to some extent the same argument applies. Also, given the predominately Anglo-Australian demographic of the group of participants it seemed a reasonable assumption that a wedding in the relatively obscure Sikh religion would be novel for this group of students. Having said that, with hindsight most if not all of the participants would have had knowledge of weddings and, whether we are talking about conventional Australian weddings or

Sikh weddings, they all appear to share some common characteristics. From this point of view it might be argued that the participants could have had more topic knowledge of this passage than either of the other two. If this was the case then one would have expected the comprehension task in respect of Sikh Wedding to have produced relatively better results and since the converse appears to have been the case it is more likely that a less familiar topic would have exaggerated the differences lending more weight to the results rather than less.

As stated already, vocabulary and syntax are the two traditional measures of text difficulty. Measures were taken to neutralise their influence before arriving at the final versions of the texts used in this study insofar as the passages were matched on a combination of vocabulary and syntax for each year group. However, it has to be acknowledged that the passages were not matched on vocabulary and syntax independently of one another. Such a procedure was considered but rejected on account of the difficulty that would have been involved in doing so and the effect it would have had on the natural quality of the texts. However, if the texts varied in their relative difficulty of vocabulary versus syntax, then it might be argued that one would outweigh the other. On the other hand it leaves open the hypothesis that vocabulary and syntax impose quite different complexities relative to top-level structure.

There is an important question that arises from the relative role of semantics and syntax in relation to the relative influence of different structures. It can be argued that descriptive passages are more likely to be dominated by semantics insofar as the categorical organisation of ideas is related by content rather than logic. On the other hand, the more constraining rhetorical structures are dominated by a linear organising principle and this linear ordering may be more influenced by syntax, although not to

the exclusion of semantics. This suggestion might appear to be disproved by common evidence that young readers have less difficulty with understanding narratives than expository text and narratives have a linear organising principle. However, linear organisation can be distinguished according to whether the linear organisation reflects temporal description or temporal explanation. The former can be treated in an additive fashion linked by 'then', like hierarchical ideas linked by 'and', but temporal explanation cannot be organised in the same simple way. Narratives are characterised by temporal description whereas rhetorical structure is characterised by temporal explanation.

An examination of the respective totals of unfamiliar vocabulary and numbers of sentences for each of the texts in each age bracket indicates that the Year 5 texts were undifferentiated in terms of vocabulary and differentiated on syntax, whereas the Year 9 texts were largely undifferentiated in terms of both vocabulary and syntax. The Year 7 texts tended to be differentiated on both vocabulary and syntax with Iceberg Towing being the most difficult syntactically but with the simplest vocabulary and Killer Smog relatively easier to read than both of the other two. Consequently, any difference between texts related to syntax should have been most evident across Year 5 participants, and a comparison of Year 9 responses across texts should have produced no differences due to syntax.

In fact the responses of the Year 5 and Year 9 groups both showed similar changes from high use of content structures in the cases of Iceberg Towing and Sikh Wedding to a high rate of rhetorical structures in relation to Killer Smog. The Year 9 group showed much higher use of rhetorical structures in relation to Killer Smog than Iceberg Towing. These are indications that syntax did not appear to play a significant role in differentiating the passages. Consequently, we can have a degree of

confidence that topic, vocabulary and syntax were not major factors in generating different levels of response, and since the passages were all of similar length, it seems reasonable to conclude that structure was a significant factor influencing their relative difficulty.

The three passages were selected in the first instance on the basis that their respective top-level structures were different and reflected different levels of constraint on Meyer's continuum. However, the results of the study have challenged the continuum and also to some extent the notion that the structure of a passage can always be analysed into a single definitive structure. The results of this study point to a distinction between rhetorical structure characterised by linear logical relationships and content structure characterised by connections based on association. It has found differing levels of complexity within each of these two sets of structures: collection (list) and topic sentences can be differentiated by their relative scope, and cause-effect and problem-solution by the fact that the effect is an essential condition for recognising a cause whereas a problem can be self defining. Problems also lend themselves to organisation by collection (list) to a much more significant extent than causes where, given that effects must also be recognised, the cause-effect structure is much more likely to be utilised. It has also been discovered that a cause-effect relationship also might lend itself to recognition as a problem offering an alternative and more constraining structure strategy.

If the foregoing is accepted then it becomes clear that the most challenging passage of the three used in this study was Iceberg Towing, not simply because it had the most constraining top-level structure, but also because organising structures required to some extent to be applied consecutively rather than concurrently as it switched focus from a discussion of problems and solutions associated with towing to

the pros and cons of the environmental impact, and consequently, that it did not have the structural flexibility of Killer Smog. For those readers who were unable to effectively apply a problem-solution structure, the passage nevertheless lent itself to use of a collection (list) structure. It is difficult to compare the Sikh Wedding passage with the other two since any structure strategy required to be restricted to a content structure which it has been argued is of a different order entirely from rhetorical structure. For all the reasons stated above, Killer Smog ought to have been the easiest passage to comprehend using structure strategy: it had a cause-effect top-level structure familiar to most children even at a young age, and the cause-effect structure facilitated recognition of a co-existing problem-solution structure. These characteristics and portrayal of the levels of difficulty of the respective passages were borne out by the results of this study.

The process of encoding the responses of the participants brought out the fact that the Killer Smog passage appeared to be more easily reorganised by alternative structures than Iceberg Towing. i.e., that it was more structurally flexible. Both passages afforded the use of two rhetorical structures along with two content schemata. However, the use of the two rhetorical structures in the case of Iceberg Towing had to be applied consecutively, whereas in the case of Killer Smog they could be applied concurrently. At the same time the two rhetorical structures used for Killer Smog are structurally very similar, whereas the two used for Iceberg Towing are quite dissimilar, and in the case of compare-contrast somewhat complex for reasons already mentioned.

There is also good reason to believe that cause-effect is much more widely grasped by younger children than the earlier researchers in this area generally gave them credit for, and problem-solution could be thought of as a more complicated form

of cause-effect. The co-existence of cause-effect and problem-solution in the Killer Smog passage might have facilitated the employment of problem-solution by some readers, whereas in Iceberg Towing there was no such assistance, the reader having to recognise immediately the underlying problem-solution structure.

A cause is only so defined by the existence of its effect. Without the effect it is simply a piece of neutral information, e.g., if we say, 'the boy kicked the ball and it broke a window', the kicking of the ball is only a cause once we know the window was broken immediately following. However, a problem will exist as a problem whether the solution is specified or not, e.g., "the boy kicked the ball and it broke the window" could be recognised as a problem even though there is no mention of a solution. The example offered also shows how the combined cause and effect could be taken to constitute a single problem and this explains how the two rhetorical structures were intertwined in Killer Smog. Consequently, we can have a collection of problems without any solutions but we cannot have a collection of causes without knowledge of their effects. From this point of view the reader utilising a cause-effect will be looking for both pieces of information and this would not be necessary in the case of problem-solution. Thus problem-solution, although not significantly different from a logical perspective, could be much more difficult to recognise in a text in the reading process insofar as its existence can be masked by a structure such as collection (list).

The indications from this study are that global coherence is more difficult to achieve with a descriptive passage of text unless it is relatively brief, which was a common feature of much of the earlier research. Research on structure strategy using short passages or textoids might thus be considered to produce results biased in favour of descriptive top-level structure. Consequently, any apparent weakness in

application of a descriptive rhetorical structure may result from the characteristics of the text relative to other rhetorical organising structures as opposed to lack of skill by the reader. If this is the case then it begs the question as to how global coherence can be achieved when reading a descriptive text. It might be the case that descriptive texts tend to be fairly limited in their potential length and readers tend to use additional organisational structures for longer texts. This offers a potential explanation as to why good readers employ combined structures. The descriptive rhetorical structure has limited application and needs to supplement another. This other is going to embrace some degree of linear structure.

If a descriptive rhetorical structure is potentially less efficient for achieving a coherent mental model then why might it be mastered and utilised before cause/effect or problem solution? Bishop and Donlan (2005) have suggested that causality between events demands syntactic understanding. Whilst they acknowledge uncertainty as to whether syntax precedes the concept of causality or vice versa, they nevertheless put forward a strong argument for the former. It has been argued in this study that descriptive text makes less demand on syntactic ability and more on semantic understanding. It has been recognised that good and poor comprehenders can be distinguished in relation to the strength of their syntactical processing as opposed to phonological ability, i.e., good readers tend to have greater syntactical skill. The fact that good readers in this study more frequently achieved high levels of coherence using rhetorical structures embracing a causal component may reflect more effective syntactical skills.

The effect of the logical complexity of the text

A distinction has been made between two different types of structure that can be employed by the reader, i.e., content and rhetorical. Another way, apart from top-

level structure, in which the text might influence the efficacy with which the reader exercises structure strategy is in the logical complexity of the text and the implications arising from cognitive load theory. Favrel and Barrouillet (2000), in their examination of the set inclusion task, pointed out the relative difficulty of drawing inferences from a passage of text with a set inclusion content given its transitive and anti-symmetrical character. The passage used as an example by Favrel and Barrouillet was descriptive with a collection (list) top-level structure. However, the set inclusion presentation would have required considerably more cognitive effort to master than the descriptive information presented in the passages used in the current study. Inclusion relations in sets have two properties. Firstly, a relation is transitive, i.e., all As are Bs, all Bs are Cs, therefore all As are Cs. Secondly, the relation is asymmetrical, i.e., one cannot conclude that 'all Bs are As'. This asymmetrical property lends itself to false inferences like the example described in the previous sentence. The associated relationships captured by the set inclusion task in Favrel and Barrouillet's (2000) descriptive passage generated a level of logical complexity not found in Sikh Wedding where the relationships do not assume the properties of set inclusion and, consequently, are unlikely to lead to such false inferences. Whether young readers could use a collection (list) structure as effectively with Favrel and Barrouillet's passage as they did in the case of Sikh Wedding is thought to be unlikely. Consequently, in considering the ability of the reader to employ structure strategy with a passage it would not be sufficient to consider the ability of the reader and the top-level structure of the passage, but also the logical complexity of the passage. Siegler (1996) argued that limited cognitive resources force people to select approaches that meet their key goals without imposing excessive processing demands.

The ability of the child to comprehend logical complexity of a passage such as that used by Favrel and Barrouillet (2000) would almost certainly be affected by the quality of the child's working memory capacity. The logical complexity may have more relevance to the relationship between text and recall than top-level structure. However, the question would become the effect of working memory on comprehension as opposed to the relationship between comprehension and structure. The logical complexity of the text, which should not be taken as synonymous with what Meyer and others have referred to as rhetorical structure, has implications for cognitive load which in turn has a bearing on the working memory capacity of the reader. It is this aspect that might explain the inconsistency in the reading research literature as to the relationship between working memory and reading comprehension. Future research into the use of structure strategy needs to look beyond top-level structure and examine how logical complexity as opposed to top-level structure affects the child's ability to employ structure strategy.

Linear versus non-linear text structures

Bush (1945), in a seminal paper that predicted the hyperlink of the modern internet, reflected that human memory storage and recall was not structured like a filing system (linear relationships) and that human recall was generally based on association (non-linear relationships). This idea underpins the hyperlink which facilitates the rapid search facility necessary for the speed and efficiency of the modern computer database search facilities. However, it is questionable whether someone learns in this manner or whether learning is more of a linear pursuit. A distinction has to be made between learning restricted to memory and recall and learning as deep understanding. It is on account of this distinction that the computer may not entirely replace the book as a learning tool, for were this to happen it could

be foreseen to presage fundamental changes in the way that children learn. This distinction between the associative nature of recall and the linear nature of deep learning, i.e., understanding, can be seen to hold parallels for the distinction made in this study between content structure based on association and rhetorical structure based on logical linear relationships. If this parallel distinction is valid then it carries implications for the relationships between the structure of text, the structure strategy employed by the reader, and the type and quality of learning the reader is experiencing.

It has been argued that reading hypertext involves greater intrinsic cognitive demand with negative consequences if the reader is concerned with more than mere fact finding (Zumbach, 2006). However, Zumbach went on to argue that the effect on learning can be balanced out by a competent reader who is encouraged by the difficulty of the task to adopt strategies that switch to extrinsic cognitive load i.e., higher order thinking skills, and germane cognitive load i.e., curiosity and problem solving. This is consistent with Siegler's explanation of how people choose between strategies. However, Zumback argued that extraneous cognitive load requires readers to activate prior knowledge, i.e., learning with hypertext requires of the reader, "a more thorough reflection of available information than learning with linear texts" (Zumback, 2006, p 417). This would be difficult task for school students faced with novel material.

The foregoing could explain the results from earlier research on structure strategy showing that children's recall of descriptive passages improved with recognition of a collection (list) structure given its associative character. It also reinforces the argument contained in this study that the reader's recall should not be considered a good indicator of anything other than surface comprehension. The use

of rhetorical structure, given its linear character, ought to lead to deeper understanding
of the content of a text.

Implications of the Study for Various Aspects of School Education

   Implications for assessing comprehension

      Previous research in the field of structure strategy use appears to have
confused recall and comprehension. Whilst it is acknowledged that familiarity and
understanding contribute to memory, it does not automatically follow that good
memory equates with good comprehension. An autistic child may achieve perfect
recall of a text but have no comprehension of the text whatsoever. Consequently,
exercises in recall ought not to be the primary means of assessing a student's
comprehension skills. This is not to say that the child's memory capacity will play no
part in comprehension, but, as argued above, this will be determined by a range of
variables, including the length of the text and its logical complexity, apart from any
effect of top-level structure. The inconclusive results within the literature regarding
the relationship between memory and reading bear testament to this point.

      It might be argued that reading a textbook in school has two broad purposes:
firstly, it may be employed as a means of conveying factual information and,
secondly, it may promote understanding of the subject matter being addressed in the
classroom curriculum. In reading to learn the child seeks to identify and reinforce
important factual information, make connections between the factual information
addressed in the text, and make connections with information already held in long-
term memory. It is the connections, and the quality of the connections, that lead to a
deeper understanding of the subject matter. A student who merely accumulates the
factual information without the connections may be able to reproduce the information
in the form of a list of associated facts but would show little understanding of the

topic. Any test of the child's understanding of the subject matter on the other hand would seek to discover if the child has grasped the relationships between the facts. The quality of the connections made by the child would reflect the structure imposed on the information by the child and the degree of coherence achieved.

This study has demonstrated that the structure a child imposes on expository text is not unitary but has two distinctly different but related aspects or components. These two components, referred to in this study as rhetorical and content structures, can also be characterised as linear and non-linear respectively. The linear structure captures the temporal sequential structure that embraces the logical argument contained in the text and the non-linear structure provides contextual depth. Although this study has focused exclusively on expository texts and distinguished them from narrative texts, this reconstruction of structure strategy into a linear function and a non-linear function has much in common with the comprehension of narrative texts in contrast to Meyer's original continuum. In narrative texts the reader is faced with non-linear construction of descriptive information relating to characters and physical settings and linear construction of the characters' actions which have a temporal sequential nature as the character(s) pursue plans and goals.

This distinction between the linear and non-linear aspects of structure strategy has potential as useful for analysing the quality of a child's reading comprehension processes. If we consider that texts restricted to descriptive material will invariably be brief in length and restricted in their subject matter, then we should consider that children reading expository texts will invariably be required to utilise both linear and non-linear approaches to structure strategy. Consider one without the other in relation to a narrative. An inability to capture the linear structure would leave the story devoid of action and the child would likely lose interest very quickly. An inability to capture

a non-linear structure would render the story more like an instruction manual than a rich narrative, stripped of all important context and descriptive information about the characters in the story. In a similar manner the reader of an expository text who fails to construct both linear and non-linear structure will find him/herself with an inadequate understanding of the text. The reader who constructs the linear structure alone will capture the gist of the argument contained in the text but it will lack contextual depth. Consequently the text will be much less interesting and may also make it more difficult to integrate with existing information in long-term memory or to generalise to other circumstances or situations. The reader who constructs the non-linear structure alone might be temporarily amused by descriptive portions of the text but will entirely miss the relevance of the material and will likely lose interest very quickly.

The reader restricted to non-linear construction will arguably get even less from the text than the reader restricted to linear construction. Reflect back on a time when you have been reading a very complex expository text. The writer recalls in particular trying to comprehend a passage written by the French structuralist philosopher, Jacques Lacan. Failing to make any sense of the passage, the reader slowly and very deliberately re-read the text with a view to identifying the essential logical thread of the argument and trying to disregard the contextual information until this had been achieved. The current study makes sense of this strategy and highlights the primary essential nature of the linear structure in expository text comprehension.

In evaluating a child's comprehension of expository text it is therefore important to be able to distinguish whether any weakness can be attributable to the relative absence of either the linear or non-linear components. Much emphasis has been given to inference-making in reading comprehension and to a great extent this

has been a major focus of instruction and assessment in reading comprehension skills. However, explicitly teaching the child how to make inferences will not resolve a relative inability to apply one or other aspect of structure strategy but such inability may go a long way to explaining why a child appears unsuccessful and unmotivated about reading to learn. It may be that some, if not all, children need to be explicitly taught these two distinct aspects of structure strategy rather than the various structures identified by Meyer.

Implications arising from the increasing replacement of books with computers

The movement away from hard copy to computer generated texts is accelerating, not just in schools and universities, but also for those reading for leisure. Increasingly, students are being required to have lap-top computers or iPads as part of their essential equipment in school, and more and more people are using similar technology to acquire and access books in their private lives. The school and university libraries now have a quite different physical appearance to the libraries a couple of decades ago. Book shelves have given way to banks of computers and wireless technology has become an essential part of the infrastructure.   However, not only is technology being used more frequently as the medium for transmitting written texts but its potential is leading to changes in the organisation and presentation of text itself. In particular, the effectiveness of the computer as a search tool has resulted in changes to text designed to facilitate connections to related matter in other parts of the information web in the form of hyperlinks. Hyperlinks are highlighted within the text and invite the reader to leave the text and jump to another text that is topically related. The effect of this is to encourage greater non-linear processing and begs the question whether the increasing non-linear material will adversely affect the child's ability to

construct the linear structure of the initial or subsequent text if one acknowledges and accepts the implications of cognitive load theory.

There is an emerging literature on the relative merits of various types of structural and conceptual user interfaces that has emerged out of concerns about potential cognitive overload among readers of hypertext (McDonald & Stevenson, 1998; 1999; Passig & Nadler, 2010). Passig and Nadler identified that a common problem of readers of hypertext was the construction of the text macrostructure. The increasing use of hypertexts demanding non-linear movements through the text based on association of ideas has been considered to increase the risk of cognitive overload in contrast to a text book that progresses in a linear manner. Consequently, there has been research conducted to discover whether and which sort of navigational device would be best suited to assist the reader. This begs the question whether the sorts of structural organisers recommended for navigating the associated topics in hypertext would be equally well suited to facilitating the reading of linear structured text books?

Implications for structural aids in text books

It is generally accepted that there is a number of strategies that can be employed by a writer to improve the child's ability to recognise and understand the construction of a text including topic headings, highlighting and margin notes. These mirror strategies employed by a reader taking notes in respect of an unsupported text. One of the possibilities arising from this study is that different structural aids may need to be employed depending on whether one wants to promote the descriptive content of the passage or the rhetorical structure of the passage. Topic headings and various forms of highlighting may be ideal for supporting the recognition of information held together by association but probably would have little benefit to the comprehension of a causal or problem-solution sequence due to their linear logical

character. Margin notes highlighting linear structure might be a better strategy for assisting the reader to understand cause-effect, problem-solution and compare-contrast.

Implications for the selection of textbooks in classrooms

Throughout Australia secondary education embraces Year 7 and Year 9 with the single exception of Western Australia where Year 7 is part of secondary education in independent schools but remains part of the primary school system in the government sector. Year 5 students are in primary school across all sectors in Australia. Primary school students do not generally make use of text books.

Within the secondary school system it is customary for teachers to generate an annual booklist. The books for any particular course of study are generally selected on their match with the curriculum rather than their match to individual student needs. Consequently, books will usually be approved if suitable for the 'average' student. At the same time, in the lower school years it is relatively unusual for students to be streamed according to ability. There was a time when students were streamed by ability prior to commencing secondary school but streaming by ability has generally become a thing of the past, at least until the more advanced years of secondary school, as the move to inclusive education has increasingly dominated educational philosophy since the 1970s. Consequently, the intellectual potential and academic skills composition of the typical lower secondary school classroom is quite heterogeneous and reflects a wide span. The results of this study suggest that to rely on a single text for all members of the class may not be appropriate unless an exceptional text can be discovered that might cater to students from a very wide range of ability, accommodating the students of limited ability and challenging students of high ability.

It has been demonstrated in earlier studies that better than average readers learn best with texts which tax their abilities whereas low ability readers require texts that are comfortably within their range of skills. One of the indications arising from this study is that the degree of organisational complexity of a text provides relative degrees of opportunity for the reader to employ a range of structure strategies. However, since it is generally only the more able reader who can employ multiple structures effectively, an organisationally complex text will be to the potential advantage of the more able reader but the disadvantage of the less able reader.

The results of this study point to a number of important considerations, other than match to the curriculum, that ought to be considered by teachers when selecting textbooks for inclusive classrooms where students have not been selected on the basis of ability:

- Select books that are well structured with no unnecessary logical complexity;

- Select books that have effective structural aids that address both the linear and non-linear characteristics of the text;

- Select books that contain effective pictorial and diagrammatic content that support the text;

- Select books that generally match the purpose to the structure, i.e., they have a clear linear structure when seeking to explain or persuade and good non-linear structure when providing descriptive context.

Whilst curriculum differentiation is quite common in the primary school classroom, it is less common and generally resisted in the secondary school classroom where the curriculum is dominated by content and the teacher. The results of this

study contribute to the argument for alternative texts to be used in mainstream classrooms.

Implications for classroom instruction

The results of this study support the hypothesis that whilst children may have the underlying ability to apply both content and rhetorical structures from a surprisingly early stage of their education, they nevertheless require considerable practice to do so effectively. The fact that children have this early ability might suggest that it derives as much from oral language as written. Teaching programmes designed to promote structure awareness of Meyer's various rhetorical structures may have merit in generating metacognitive awareness of these structures but not necessarily improve on the child's effective use of structure strategy. Consequently, the results of this study suggest that any such programmes devote maximum time and attention to the practice of structure strategy rather than unduly lengthy explanation. The explanatory aspect of such programmes ought to provide explicit instruction in the complementary aspects of content and rhetorical structures.

Limitations of the Current Study

Whilst the decision to use extended natural texts for the purposes of this study was deliberate for the reasons already argued, it nevertheless undermined the internal validity of the results. Consequently, the value of the results primarily lie in the way they have challenged the broad consensus arising from earlier research in this field of study and generated new questions that should reinvigorate this useful field of enquiry.

One other limitation of this study, in hindsight, was the size of some sub-groups within the overall sample. Whilst the overall sample size appeared quite adequate in the first instance, by using natural classroom groups in addition to a single

Rasch scale to differentiate by ability, it was with hindsight inevitable that there would be some relatively small ability groups of participants who were either below or above the average range of ability within particular year groups. The results might have been much clearer had a bigger sample been used.

Future Research Directions

It has been hypothesised above that the use of structure strategy may not be as dissimilar between expository and narrative text comprehension as previously expected in the context of the earlier literature on structure strategy. It may be informative to review the literature on mental modelling in the comprehension of narrative texts to see whether it has relevance to expository text in the light of this study's findings on structure strategy postulating two categories of structure, i.e., linear and non-linear.

It has been shown in this study that the most effective users of structure strategy used a combination of content and rhetorical structures to achieve the greatest coherence while reading an expository text other than the purely descriptive passage. Further study ought to be given to how this process of combined application occurs. It is surmised that the reader switches between content and rhetorical structures according to the immediate demands of the text but how does the dynamic unfold? It is also hypothesised that the demand on working memory may vary depending on the relative balance and frequency of change between the two types of structure.

This study has raised the issue of the trend towards e-books and the increasing availability of hyperlinks within computer generated text. It has been hypothesised that the non-linear nature of hyperlinks carries implications for the effective use of structure strategy. This is an area that requires further exploration.

A further concern raised in this dissertation is the part that logical complexity plays in reading comprehension and it has been argued that the use of structure strategy will be more or less difficult depending on the complexity or simplicity of the underlying logic contained within the text. This would be a further interesting avenue of research.

Summary and Conclusions

This study was prompted by an earlier body of research that focused on the part that text structure played in its comprehension and recall. This body of research led to studies investigating the effects of explicit instruction in the recognition of text structure on school children's reading and recall performance based on a general acceptance that there is a positive relationship between the top-level structure of text and a reader's recall, and the inference that such performance is indicative of improved reading comprehension. This study has challenged some of the assumptions and conclusions arising from the earlier research.

The most significant assumption in much of the earlier research was that the structure of text and the structure of the reader's constructed meaning ought to match in order to conclude that satisfactory comprehension had taken place. This led to the conclusions about the reader's reading ability by his or her recall of the information contained in the top-level structure. It has been argued in this study that whilst there is likely to be a relationship between the text structure and the structure constructed by the successful reader, they are not necessarily the same. It has been argued that the reader actively imposes a structure on the text but that this structure will be limited by the reader's general reading ability and experience in using structure strategy over and above the ability to recognise top-level structure. The important question becomes how effectively the reader uses structure strategy, as even very young and relatively

inexperienced readers can recognise the top-level structure of the text. It was for this reason that this study focused on the structure generated by the reader rather than the reader's recognition of the text top-level structure, and the extent to which the reader succeeded in achieving coherence with structure strategy.

A further assumption in much of the earlier research was that recall of a text was evidence of comprehension of a text. This assumption has been challenged on the grounds of a distinction between surface comprehension and deep level understanding. It has been argued that deep level understanding of a text is not necessarily reflected in recall. This study has treated reading ability as a separate independent variable in the study of structure strategy use rather than draw an inference about comprehension from data reflecting the child's recall of the text.

In examining how the participants utilised structure strategy it became apparent that Meyer's single continuum of top-level structures based on relative constraint more likely consisted of two independent continua, although the concept of constraint is nevertheless relevant. One of these continua embraced structures that organised information in text on the basis of association and the other on the basis of the logical linear relationship. These were subsequently labelled as content and rhetorical structures respectively. On the basis of this distinction between content and rhetorical structures it has been argued that content structure identification and use is more likely to be influenced by semantic understanding whereas rhetorical structure recognition and application is more likely to be influenced by syntactic skill. It was also apparent that a significant number of participants in all age and ability groups relied on the identification of topic sentences to reflect the gist of the text rather than the popular structures identified by Meyer.

There was a number of levels at which a distinction could be made between individuals in relation to the effective use of structure strategy, most notably whether or not structure strategy was employed at all, but also the age and ability of the student. It was observed that among the participants, the most effective use of structure strategy combined a rhetorical structure and a content structure providing the passage lent itself to both, which was not the case in relation to the descriptive "Sikh Wedding" passage. It was noted that the development and use of structure strategy to some extent reflected Siegler's (1996) model of strategy use. In particular there was evidence of Siegler's Moderate Experience Hypothesis at work: that even younger and less able readers could have the ability to recognise and attempt to apply the apparently more demanding rhetorical structures but to do so effectively appeared to require experience. This last finding carries implications for instructional programmes directed at developing children's skills in the use of structure strategy.

Where the earlier research in structure strategy focused almost exclusively on that characteristic of a text referred to as its 'top-level structure', this study found that the structural flexibility of the text and the level of complexity of its underlying logic could also be important in assessing a reader's ability to use structure strategy and construct the meaning of the text. The reader's effective use of structure strategy would appear to be a complex interaction of these characteristics of the text and the reader's ability, background knowledge, and relative experience in the use of particular comprehension strategies, structure strategy in particular. It was clear from the results that for structure strategy to be used effectively the reader must ultimately apply a combination of rhetorical and content structures unless the passage is short and limited to description, and that this takes time and experience.

It was evident from the results that ability was more relevant than age for successful use of structure strategy in the construction of meaning from written text, but at the same time there were also high levels of both inter-and intra- individual differences. The apparent inconsistency among readers of a similar age and ability in the effective use of structure strategy could be explained by Siegler's 'overlapping waves' theory (Siegler 1996).

This study began with a broad question about how children construct meaning from text and was inspired by a couple of seminal books on mental models (Johnson-Laird, 1983; van Dijk & Kintsch 1983). However, it became clear that, whilst research into the construction of mental models was well developed in respect of narrative texts, research in relation to expository texts was hard to find. The earlier body of research into top-level structure, which subsequently became the focus of this study, seemed closely related to the challenge of constructing a macrostructure from expository text. However, whereas theories of mental models approached the question from the perspective of the role of the reader in constructing the macrostructure, the top-level structure research was focused on the structure contained in the text and its impact on the reader. This focus on the text rather than the reader reflected the strong influence of linguistics. This study opens up the possibility that the manner in which children construct mental models in the case of narratives may have relevance for understanding expository text in a way not previously appreciated.

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Appendix A

Letter to Parents via School Principal

Dear Parent/Guardian,

Reading Research Project

I am a doctoral candidate at Edith Cowan University and I am engaged in research into the thinking processes that school children employ to understand school texts. As you are probably aware there is a current ongoing debate regarding the most effective methods of teaching children to read. I am interested in children who have achieved basic reading skills and who have reached a stage in their education where they are reading to learn. Printed school texts vary in the way in which the information is organised. There are a variety of different ways in which such texts can be organised and this organisation can make a difference to the child's ability to comprehend and learn from the text. I hope to clarify the capacity of children of different ages to recognize and utilize these alternative structures.

I have recently attended your child's school with the permission of the Principal, where I administered reading comprehension and recall tests to a number of classes. The completed tests are now in the hands of the Principal and I would like your permission for me to obtain your child's results for the purposes of my research.

No reference will be made at any time to individual students participating in this research and individual results will be confidential. The results of the study will be beneficial in planning teaching methods and strategies in the future, in addition to the selection of suitable texts for different ages.

In addition to the results of the tests referred to above I would also appreciate your permission to access your child's reading scores from the WALNA/MSE9 results for comparison purposes. WALNA and MSE9 are the statewide achievement tests all school students are assessed with in years 5, 7 and 9.

For these purposes I would be grateful if you would complete and return the enclosed form at your earliest convenience. If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:

Research Ethics Officer
Edith Cowan University
100 Joondalup Drive
JOONDALUP WA 6027
Phone: 6304 2170
Email: research.ethics@ecu.edu.au

Yours sincerely,

John V. Holsgrove

PARENT/GUARDIAN CONSENT FORM

Project Title: The Effect of Text Structure on Reading and Learning in School

Children.

I _____ (the parent/guardian of the participant) have read and

understood information provided in the letter accompanying this consent form. Any

questions I have asked have been answered to my satisfaction.

I agree to allow data collected by (name of school) for the purposes of this study in

respect of my child _____ (name) to be available for the purposes of the

study being conducted by John Holsgrove at Edith Cowan University.

I agree that the research data in this study may be published provided my child and

my child's school are not identifiable in any way.

_____   _____

Parent/Guardian's signature   Date

I agree to the release of WALNA / MSE9 scores in respect of my child's reading

comprehension for the purposes of the research project.

_____   _____

Parent/Guardian's signature   Date

Letter to parents via school Principal

Follow-up letter to Parents

Dear Parent/Guardian,

Reading Research Project

I am a doctoral candidate at Edith Cowan University and I am engaged in research into the thinking processes that school children employ to understand school texts. As you are probably aware there is a current ongoing debate regarding the most effective methods of teaching children to read. I am interested in children who have achieved basic reading skills and who have reached a stage in their education where they are reading to learn. Printed school texts vary in the way in which the information is organised. There are a variety of different ways in which such texts can be organised and this organisation can make a difference to the child's ability to comprehend and learn from the text. I hope to clarify the capacity of children of different ages to recognize and utilize these alternative structures.

I have recently attended your child's school with the permission of the Principal, where I administered reading comprehension, vocabulary and retention tests to a number of classes. The completed tests are now in the hands of the Principal and I would like your permission for me to obtain your child's results for the purposes of my research.

No reference will be made at any time to individual students participating in this research and individual results will be confidential. The results of the study will be beneficial in planning teaching methods and strategies in the future, in addition to the selection of suitable texts for different ages.

In addition to the results of the tests referred to above I would also appreciate your permission to access your child's reading scores from the WALNA/MSE9 results for comparison purposes. WALNA and MSE9 are the statewide achievement tests all school students are assessed with in years 5, 7 and 9.

For these purposes I would be grateful if you would complete and return the enclosed form at your earliest convenience. If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:

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Email: research.ethics@ecu.edu.au

Yours sincerely,

John V. Holsgrove

Appendix B

Year 5 Texts

Iceberg Towing – Year 5

More than 20 years ago a clever American, John Isaacs, brought forward the idea of moving icebergs from the South Pole to dry parts of the world. Isaacs first put forward the idea of iceberg towing when they were very short of water in southern California in America. He had been asked to look at the possible ways of moving huge amounts of water to California from other places. As Isaacs began to study ways of bringing in water by ship, he soon thought that the bigger the ship the cheaper the cost of moving it would be. It was then that he hit upon the idea of towing a whole iceberg to America.

Today, it seems quite possible that iceberg towing could become a reality in the future. Engineers, as well as businessmen with an eye to making money, are studying the idea. A great amount of money is being poured into finding ways to solve the technical difficulties. Some very rich countries in the world, as well as rich people, are interested.

Engineers believe that Australia's best place to find icebergs would be north of the Amery ice shelf, near Australia's Antarctic base. This would be the closest area from which to bring icebergs to Australia.

Scientists seem to agree that the icebergs would need to be 200-280 metres thick, with a top surface of about five square kilometres. An iceberg of this size would last several months. This would give enough time to move the iceberg the two to three thousand kilometres to Australia.

It has been worked out that a force of about 6000 tonnes would be needed to move such an iceberg. This would take about 10 to 15 large tugs. The boats pulling the iceberg could travel at a speed of around a kilometre per hour, rising to over three kilometres per hour near the end of the journey.

Such a journey would take about two months, during which about half the iceberg would have melted by the time it reached Australia. Even so, the piece of iceberg remaining at the end of the journey should hold enough water on arrival to meet the needs of a medium size city, such as Perth or Adelaide, for about two years.

Though the cost of moving an iceberg would be huge, many believe that bringing icebergs to Australia would be less costly in the long run than removing salt from sea water.

Though some people believe that moving icebergs would damage the natural environment, others believe that it would only be making good use of the natural drift of ice from the South Pole to warmer countries.

However, those interested in the idea of moving icebergs still have to solve many problems. Special studies are being made on the rate that icebergs melt in certain types of weather, and at certain temperatures.

One of the big questions being asked is what would the removal of icebergs do to the South Pole? Scientists say that the total Antarctic iceberg production per year is

about 1200 cubic kilometres. Huge icebergs break from ice shelves around the edge of the Antarctic and float north with the tides and winds, melting on the way.

   Some people are worried about the effect of moving icebergs from their natural home areas. They say that moving them may cause parts of the Antarctic areas to warm up. This could start a chain reaction in the South Pole that nobody yet has enough experience to understand.

   On the other hand, those who agree with moving icebergs say that moving an iceberg will stir up the water. This might improve the water by bringing more food to the surface. This can cause the numbers of fish to grow as well as the number of animals that feed off the fish.

   The whole question of iceberg towing will depend on how much it will cost. Although life depends on water it has low value in most places. Also, for the most part, water from icebergs would probably have to be used quite close to its landing place. Although it would cost less than taking the salt out of sea water, it might cost too much to carry it more than a few hundred kilometres overland. However, iceberg water could be very cheap for some countries when compared with the cost of taking the salt out of sea water, a process which needs much more fuel and much more money.

The Killer Smog - Year 5

It is now well known that smoke and other dirty things in the air called pollutants can be dangerous to our health. It is very rare for the air to be so polluted that it badly harms or kills people.

One of these rare times happened in London in December, 1952. London was noted for its pea-soup fogs. It had felt these a few times since the mid-nineteenth century. As the city grew with the industrial revolution there was a lot more coal burned in factories and houses and the coal smoke mixed with tiny drops of water in the winter air and sometimes made thick smog. Londoners were used to the smog in winter but the wind usually cleared the smog fast.

One day, in early December 1952, due to the still weather over London, a wind did not come. The smoke pouring into the air just stayed over the city. During December 5 the smog became thicker and thicker until it became hard to see in it. Soon people could not see more than a few metres in front of them. Even in cinemas it was hard to see the screen from the back seats.

At first the smog was just a pest, causing traffic problems and causing people to be late for work. However, soon there were major delays for ambulance, fire-brigade and bus services. It soon became impossible to answer emergency services in time.

Crime increased during the Great Smog. It was lucky that the smog, which gave cover to criminals, also made escaping difficult. By the third day stock in shops was becoming short. Dockers could not find their way to work to unload the ships, and truck drivers could not find their way to the shops. People were afraid to go to shops in case they lost their way.

The worst effect of the great smog was on human life. For old people, babies under one year and anyone suffering from heart or lung problems it was a time of great danger. Four thousand people died from an attack of very bad bronchitis.

The reason for the deaths was the mixture of the soot and other nasty pollutants in the air. The other pollutants were caused by the burning of coal and oil. When mixed together with water they create acid. People were breathing a mixture of acid and soot! A group of smart people brought together to investigate the great smog agreed that this mixing of soot and acid was one of the main causes of deaths.

There were plans put up by some people and organizations to move people with weak hearts and lungs out of London. One member of Parliament said that 10,000 people should be moved out of the city for four or five days, but these plans were not acted on by the Government.

After four days of the frightening smog, a wind slowly began to clear the air over London. It became easier to see, people were able to go out of their houses and find their way about, and business resumed.

Those Londoners who had suffered through the four days were determined that this should not happen again. In studying the great smog and its causes, they realized that the great smog of December, 1952 was only the last link in a long chain of events leading towards such a disaster. In 1956 the Clean Air Act was made a law by the Government. This permitted local governments to control the burning of coal and production of smoke in their areas. In London these new laws were used to create smoke-free areas. This happened during the same period that natural gas was being

used by more and more people. Because of these steps it is impossible for a smog as bad as the one in 1952 to happen again.

It is interesting to note that most other cities of the world did not have laws governing air pollution until the 1960's. It was the 1952 great smog, the worst of a whole series of such smogs, which caused Londoners to agree to laws which at another time would not have been liked. In a climate of long winters, stopping people from having coal fires would not have been agreeable, except for the people now knew about the greater evil of effects on health. The 1952 smog is another example of the way that important and good laws can be introduced because of a major disaster.

A Sikh Wedding - Year 5

In Australia, people decide for themselves whom they will marry. In some other countries the parents choose a partner for their son or daughter and such a marriage is called an 'arranged' marriage. Arranged marriages can sometimes take place in other religions but this is not the case in the Sikh religion.

A Sikh marriage is one where each wants to marry the other. The bride and the groom have the right to either agree or disagree to the marriage. They are becoming more involved in choosing their own partner, so that the term 'assisted marriage' rather than 'arranged marriage' is now used more often. Nowadays, the couple is expected to meet a number of times before deciding to marry each other. Going out together without someone to keep an eye on them is frowned on.

The wedding takes place in the bride's village but may be celebrated in many different places. It may be 9.00 a.m. on the flat rooftop of a house in the Punjab with all the guests squeezed together around the holy book of the Sikh religion, and with onlookers standing on the roofs of neighbouring houses. In colder and wetter climates indoor weddings are customary. The only thing needed, other than the two people being married, is the holy book which may be carried from the Sikh church to the house. In Australia, the wedding is often part of a normal church service.

On the wedding day or the evening before, the groom's party travels to the bride's home town or village. They are greeted at a special party called *milani*. A few older male members of each family exchange gifts with each other, the father of the bride with the father of the groom, elder brother of the bride with elder brother of the groom. The gift is often a length of cloth for making a turban which is worn on the head.

The wedding service begins with the singing of the morning hymn *Asa di Var*. When it has ended the bridegroom comes forward to sit in front of the holy book. He will be wearing a golden coloured turban on his head. The bride, dressed in red, then joins the guests and, along with a friend, sits on the left-hand side of the groom. The person sitting behind the holy book is a respected member of one of the families, who leads the prayers and directs the wedding. He or she will pray that God will bless the marriage. During the prayer the couple and their parents will stand; the rest of the guests remain seated.

The bride and groom show that they agree to the marriage by bowing towards the holy book. When they sit down the bride's father comes forward, puts flower petals on the holy book, and over the shoulders of his daughter and the groom. He then ties the end of his daughters head-covering to the end of a silk scarf which hangs from the groom's shoulders.

The high spot of the wedding service is the singing of the *Lavan*. This is a marriage hymn which was written by a well known religious leader for his daughter's wedding. The hymn has four verses. Each is read and then sung. During the singing the couple walks round the holy book, the bride following the groom. Many of the men in the bride's family will stand round, putting their hands on the bride's shoulders and helping her on her way. This is how they show their love and support for the bride and groom. The service finishes with the first five and the final verse of the *Anand* which is a hymn, followed by the prayer called *Ardas*. The bride and

groom and their guests listen to a reading from the holy book and the service ends with the distribution of *Karah parshad*. This is a cooked mixture of flour, sugar, water and butter. It is a popular Indian sweet. It is distributed to the seated guests who receive it in their right hand. The word *parshad* means a gift or present. The reason for this small sharing of food is symbolic. No one must leave the service hungry. By eating together the guests show that they are one united family of equals. After the service their will be a wedding reception and later in the day the married couple will leave for the groom's home.

Adapted from *Thinking about Sikhism* by W. Owen Cole.

Year 7 Texts

Iceberg Towing - Year 7

More than 20 years ago an American oceanographer, John Isaacs, brought forward the idea of towing icebergs from the Antarctic regions to the drier centres of the world. Isaacs first put forward the idea of iceberg towing during a serious water shortage in southern California in America. He had been asked to look at the possible ways of moving huge amounts of water to California from other places. As Isaacs began to study ways of bringing in water by ship, he soon realized that the bigger the ship the cheaper the transport costs would be. It was then that he hit upon the idea of towing a whole iceberg to America.

Today, it seems possible that iceberg towing could become a reality in the future. Scientists, as well as businessmen with an eye to profits, are looking at the idea very closely, and a great deal of money is being poured into studies aimed at overcoming the technical difficulties. Some very wealthy countries in the world, as well as individuals, are interested.

Scientists believe that Australia's best hunting ground for the icebergs would be north of the Amery ice shelf, near Australia's Davis Antarctic base. This would be the most convenient area from which to bring icebergs to Australia.

Scientists seem to agree that the icebergs would need to be 200-280 metres thick, with a top surface of about five square kilometres. An iceberg of this size would last several months. This would give enough time to move the iceberg the two to three thousand kilometres to Australia.

It has been estimated that a force of about 6000 tonnes would be needed to move such an iceberg. This would require about 10 to 15 large tugs to carry out this task. A typical towing speed would be around a kilometre per hour, rising to over three kilometres per hour near the end of the journey.

Such a journey would take about two months. During the journey about half the iceberg would have melted by the time it reached Australia. Even so, an iceberg of the size mentioned, experts say, would contain enough water on arrival to supply a medium size city, such as Perth or Adelaide, for about two years.

Though the cost of the venture would be huge, both in labour and power, many believe that iceberg towing would prove less costly in the long run than the desalination of sea water which is the alternative.

Though some people believe that moving icebergs would have the effect of tampering with the environment, others believe that it would only be taking advantage of the natural drift of ice from the Antarctic shelf to warmer areas.

However, those interested in the idea of towing icebergs still have to solve many problems. Special studies are being made on the rate that icebergs melt in certain types of weather, and at certain temperatures.

One of the big questions being asked is what effect would the removal of icebergs have on the ice-cap? Scientists say that the total Antarctic iceberg production per year is about 1200 cubic kilometres. Huge icebergs break from ice shelves and glaciers

around the edge of the Antarctic continent. They drift north with the tides and winds, gradually melting on the way.

Some people are worried about the effect of moving icebergs from their natural home areas. They say that their removal may cause parts of the Antarctic areas to warm up, possibly beginning a chain reaction in the environment that nobody yet has enough experience to fully understand.

On the other hand, those who support the iceberg towing idea say that the upwelling of the water caused by the removal of icebergs may improve the water by bringing more nutrients to the surface. Also, that it may, in turn, increase the fish population and the number of animals that feed off the fish.

The whole question of iceberg transportation will depend in the end on how much it will cost. Although water is a source of life, it has a low value in most places. Also, for the most part, water from icebergs would probably have to be used close to its landing place. Although it would be less costly than desalinated sea water, it might be too costly to carry it more than a few hundred kilometres overland. However, iceberg water could be extremely cheap for some countries when compared with desalination, a process which needs much more fuel and much more money.

The Killer Smog - Year 7

It is now well known that smoke and other pollutants in the atmosphere can be dangerous to our health and that breathing air, which has become polluted, over a long period can have a very bad effect on a person's lungs. Fortunately it is very rare for the pollution of the atmosphere to be so bad that it causes chaos and death within a short time.

However, one of these rare instances occurred in the city of London in December, 1952. London was noted for its pea-soup fogs, so called because of how thick they were. It had experienced these periodically since the middle of the nineteenth century. As the city grew with the industrial revolution, the amount of coal burned in factories and houses increased, and the coal smoke mixed with the water particles in the winter atmosphere often creating thick smog. Londoners were accustomed to the smog in winter but usually wind would clear the smog fairly quickly.

However, in early December 1952, due to the stability of the atmosphere over London, a wind did not come. The smoke pouring into the air just stayed over the city. Throughout December 5 the smog became thicker and visibility decreased. Soon people could not see more than a few metres in front of them. Even in cinemas the view of the screen from the back seats was obscured.

At first the smog was just an inconvenience, causing traffic chaos and personal delays, but soon there were major disruptions to ambulance, fire-brigade and bus services. It soon became impossible to answer emergency services in time.

Crime increased during the Great Smog, particularly violent crime. Fortunately, the smog, which gave cover to criminals, also made escaping difficult. By the third day supplies to shops became short. Dockers could not find their way to work to unload ships, and truck drivers could not find their destinations. People were afraid to go to shops in case they lost their way.

However, the most disastrous effect of the great smog was on human life. For old people, babies under one year and anyone suffering from heart or lung complaints it was a time of extreme risk. Four thousand people died from an attack of acute bronchitis.

The reason for the fatalities was the combination of the soot particles and sulphur dioxide in the air. The sulphur dioxide came from the burning coal and oil, which when combined with water it becomes sulphuric acid. People were breathing a mixture of acid and soot! An official committee set up to investigate the disaster confirmed this combination of pollutants was one of the main causes of deaths.

There were proposals from various people and organizations to evacuate people with weak hearts and lungs out of London. One member of Parliament proposed that 10,000 people should be moved out of the city for four or five days. However, these plans were not acted on by the Government.

After four days of the terrifying smog, a wind slowly began to clear the air over London. The visibility increased, people were able to go out of their houses and find their way about, and business resumed.

Those Londoners who had suffered through the four days were determined that such an event should not happen again. In analysing the event and its causes, they realized that December, 1952 was only the last step in a long progression towards

such a disaster. Therefore, in 1956 the Clean Air Act was made a law by Parliament. This allowed local governments to control the burning of coal and production of smoke within their local areas. In London these new laws were very quickly used to create smoke-free areas. Because this happened during the same period that natural gas was being used more widely, it is impossible for such a disaster as the 1952 smog to happen again.

It is interesting to note that most other cities of the world did not have laws governing air pollution until the 1960's. It was the 1952 event, the worst of a whole series of such smogs, which prompted Londoners to support legislation which otherwise would not have been very popular. In a climate of long winters, restrictions on the burning of coal would not have been supported, except for the knowledge of the greater evil of effects on health. The 1952 smog is another example of the way that important and beneficial laws can be introduced as a result of a major disaster.

A Sikh Wedding – Year 7

In Australia, people decide for themselves who they will marry. In some other countries the parents choose a partner for their son or daughter. Such a marriage is called an 'arranged' marriage. Arranged marriages sometimes take place in other religions and in other countries. This is not the case in the Sikh religion. The Sikh religion is based in India.

A Sikh marriage is one of consent. The bride and the groom have the right to accept or reject the proposed partner and to an increasing extent they are becoming involved in choosing their partner, so that the term 'assisted' rather than 'arranged' might seem appropriate. Nowadays, the couple are likely to meet a number of times before any decision is taken, though going out together unaccompanied is unlikely.

The wedding normally takes place in the village where the bride's family lives, and may be celebrated in any convenient place. It may be 9.00 a.m. on the flat rooftop of a house in the Punjab with all the guests squeezed together around the holy book called the *Guru Granth Sahib,* and with onlookers standing on neighbouring rooftops. In colder and less reliable climates indoor weddings, often in the gurdwara, are customary. However, the only essential item, other than the couple, is the *Guru Granth Sahib* which may be carried from the gurdwara to the house. In Britain, the wedding is often part of a normal gurdwara service.

On the wedding day or the previous evening, the groom's party travels to the bride's home town or village and are formally received at a ceremony called *milani*. A few senior male members of the families exchange gifts with their opposite members; the father with the father, elder brother with elder brother, the usual token gift is a turban length.

The wedding service begins with the singing of the morning hymn *Asa di Var*. When it has ended the bridegroom comes forward to sit in front of the *Guru Granth Sahib*. He will usually be wearing a saffron or golden coloured turban. The bride, dressed in red, then joins the congregation and, accompanied by a friend, sits on the left-hand side of the groom. The person sitting behind the *Guru Granth Sahib* is a respected member of one of the families, who leads the prayers and conducts the wedding. He or she will pray that God will bless the marriage. During the prayer the couple and their parents will stand; the rest of the congregation remain seated.

The bride and groom show their assent to the marriage by bowing towards the *Guru Granth Sahib*. When they sit down the bride's father comes forward, puts a garland on the *Guru Granth Sahib*, over the shoulders of his daughter and the groom and then ties the end of his daughters head-covering to the end of a muslin scarf which hangs from the groom's shoulders.

The main feature of the wedding service is the singing of the *Lavan*, a marriage hymn composed by Guru Ram Das for his daughter's wedding. The hymn has four verses. Each is read and then sung. During the singing the couple walks round the *Guru Granth Sahib* in a clockwise direction, the bride following the groom. Many of the bride's male relatives will stand round, putting their hands on the bride's shoulders and helping her on her way, thus showing their love and protectiveness and their own support for the marriage. The service concludes with the first five and the final verse of the *Anand*, the Hymn of Bliss, followed by the prayer, *Ardas*, a formal prayer of petition. A random reading of a passage from the *Guru Granth Sahib* is

taken and the service ends with the distribution of *Karah parshad*. This is a cooked mixture of flour or semolina, sugar, water and ghee (clarified butter). It is merely a popular Indian sweet pudding normally called a *halwa*, which is distributed to the seated congregation who receive it in their right hand. The word *parshad* or *prasad* means a gift or present. *Karah* is the Punjabi name for this kind of sweet. The purpose of this small sharing of food is symbolic. No one must leave the Guru's presence hungry and by eating together the worshipers show that they are one united family of equals. After the service their will be a wedding reception and later in the day the married couple will leave for the groom's home.

Adapted from *Thinking about Sikhism* by W. Owen Cole.

Year 9 Texts

Iceberg Towing – Year 9

More than 20 years ago an American oceanographer, John Isaacs, brought forward the idea of towing icebergs from the Antarctic regions to the drier centres of the world. Isaacs first put forward the idea of iceberg towing during a serious water shortage in southern California in the United States of America. He had been asked to look at the possible ways of transporting huge quantities of water to California from other places. As Isaacs began to study ways of bringing in water by ship, he soon realized that the bigger the ship the cheaper the transport costs would be. It was then that he hit upon the idea of towing an entire iceberg to America.

Today, it seems quite possible that iceberg towing could become a reality in the future; for scientists, as well as businessmen with an eye to profits, are looking at the idea very closely, and a great deal of money is being poured into studies aimed at overcoming the technical difficulties. Some very wealthy countries in the world, as well as individuals, are interested.

Scientists believe that Australia's likely hunting ground for the icebergs would be north of the Amery ice shelf, near Australia's Davis Antarctic base. This would be the most convenient area from which to tow icebergs to Australia.

Scientists seem to agree that the icebergs would need to be 200-280 metres thick, with a top surface of about five square kilometres. An iceberg of this size would last several months. This would give enough time to tow the iceberg the two to three thousand kilometres to Australia.

It has been estimated that a force of about 6000 tonnes would be needed to move such an iceberg. This would require about 10 to 15 large tugs. A typical towing speed would be around a kilometre per hour, rising to over three kilometres per hour near the end of the journey.

Such a journey would take about two months, during which about half the iceberg would have melted by the time it reached Australia. Even so, an iceberg of the size mentioned, experts say, would contain enough water on arrival to supply a medium density city, such as Perth or Adelaide, for about two years.

Though the cost of the venture would be immense, both in labour and power, many

believe that iceberg towing would prove less costly in the long run than the alternative

of desalination of sea water.

Though some people believe that the transportation of icebergs would have the effect of tampering with the environment, others believe that it would only be taking advantage of the natural drift of ice from the Antarctic to warmer regions.

However, those interested in the idea of towing icebergs still have to overcome many

problems. Special studies are being made on the rate that icebergs deteriorate in

certain types of weather, and at certain temperatures.

One of the big questions being asked is what effect would the removal of icebergs have on the polar ice-cap? Scientists say that the total Antarctic iceberg production per year is about 1200 cubic kilometres. Huge icebergs break from ice shelves and glaciers around the margin of the Antarctic continent and drift north with the tides and winds, gradually melting on the way.

Some people are worried about the effect of the removal of the icebergs from their natural home regions. They say that their removal may cause parts of the Antarctic areas to warm up, possibly beginning a chain reaction in the environment that nobody yet has sufficient experience to fully understand.

On the other hand, those who support the iceberg towing idea say that the upwelling of the water caused by the removal of icebergs may improve the water by bringing more nutrients to the surface. Also, that it may, in turn, increase the fish population and the number of animals that feed off the fish.

The whole question of iceberg transportation will depend finally on how much it will cost. Although water is a source of life, it is a low value commodity in most places. Also, for the most part, water from icebergs would probably have to be used reasonably close to its landing position. Although it would be less costly than desalinated sea water, it might be too costly to carry it more than a few hundred kilometres overland. However, iceberg water could be extremely cheap for some countries when compared with desalination, a process which requires much more fuel and much more money.

The Killer Smog - Year 9

It is currently well known that smoke and other pollutants in the atmosphere can be dangerous to our health and that breathing air that has become polluted can, over a long period of time, affect the lungs. Fortunately it is extremely rare for the pollution of the atmosphere to be sufficiently bad that it causes chaos and death within a short time.

However, one of these rare instances occurred in December, 1952 in London, a city famous for its pea-soup fogs, so called because of how dense they are. It had experienced these periodically since the middle of the nineteenth century when the city began to expand with the industrial revolution and the amount of coal burned in factories and houses increased. The coal smoke mixed with the water particles in the winter atmosphere and often created thick smog. Londoners were accustomed to the smog in winter but usually wind would clear the smog fairly quickly.

However, in early December 1952, due to the stability of the atmosphere over London, a wind did not come and the smoke pouring into the air just stayed over the city. Throughout December 5 the smog became thicker, visibility decreased, and soon people could not see more than a few metres in front of them. Even in cinemas the view of the screen from the back seats was obscured.

Initially the smog was just an inconvenience, causing traffic chaos and personal delays but soon there were significant disruptions to ambulance, fire-brigade and bus services. It soon became impossible to respond to emergency services in time.

Crime increased during the Great Smog, in particular, violent crime, but fortunately, the smog, which gave cover to criminals, also made escaping difficult. By the third day supplies to shops became short. Dockers could not find their way to work to unload ships, truck drivers could not find their destinations and people were afraid to go to shops in case they became disoriented and lost their way.

However, the most disastrous effect of the great smog was on human life as for old people, babies under one year and anyone suffering from heart or lung complaints it was a time of extreme risk. Four thousand people died from an attack of acute bronchitis.

The reason for the fatalities was the combination of the soot particles and sulphur dioxide in the air. The sulphur dioxide came from the burning coal and oil and when combined with water it produced sulphuric acid. People were breathing a mixture of acid and soot! An official committee set up to investigate the disaster confirmed this combination of pollutants was one of the main causes of deaths.

There were proposals from various people and organizations to evacuate people with weak hearts and lungs out of London. One member of Parliament proposed that 10,000 people should be evacuated out of the city for four or five days, however, such proposals plans were not acted on by the Government.

After four days of the terrifying smog, a wind slowly began to clear the air over London. The visibility increased, people were able to go out of their houses and find their way about, and business resumed.

Those Londoners who had suffered through the four days were determined that such an event should not happen again. In analysing the event and its causes, they realized that December, 1952 was only the last step in a long progression towards

such a disaster. Therefore, in 1956 the Clean Air Act was made a law by Parliament. This allowed local governments to control the burning of coal and production of smoke within their local areas. In London these new laws were very quickly used to create smoke-free areas. Because this occurred during the same period that natural gas was being used more widely, it is impossible for such a disaster as the 1952 smog to happen again.

It is particularly interesting to note that most other cities of the world did not have laws governing air pollution until the 1960's. It was the 1952 event, the worst of a whole series of such smogs, which prompted Londoners to support legislation which otherwise would not have been very popular. In a climate of long winters, restrictions on the burning of coal would not have been supported, except for the knowledge of the greater evil of effects on health. The 1952 smog is another example of the way that important and beneficial laws can be enacted as a result of a major disaster.

A Sikh Wedding – Year 9

In Australia, people decide for themselves who they will marry, whereas in some other countries the parents choose a partner for their son or daughter. Such a marriage is called an 'arranged' marriage. Arranged marriages sometimes take place in other religions. This is not the case in the Sikh religion which originates in India.

A Sikh marriage is one of consent. The bride and the groom have the right to accept or reject the proposed partner and to an increasing extent they are becoming involved in choosing their partner, so that the term 'assisted' rather than 'arranged' might seem appropriate. Nowadays, the couple are likely to meet a number of times before any decision is taken, though going out together unaccompanied is unlikely.

The wedding normally takes place in the village where the bride's family lives, and may be celebrated at any convenient place. It could, for instance, be conducted at 9.00 a.m. on the flat rooftop of a house in the Punjab with all the guests squeezed together around a holy book called the *Guru Granth Sahib* and with onlookers standing on neighbouring rooftops. In colder and less reliable climates indoor weddings, often in the gurdwara, are customary. However, the only essential item, other than the couple, is the *Guru Granth Sahib* which may be carried from the gurdwara to the house. In Britain, the wedding is usually part of a normal gurdwara service.

On the wedding day or the previous evening, the groom's party travels to the bride's home town or village and are formally received at a ceremony called *milani*. A few senior male members of the families exchange gifts with their opposite members; the father with the father, elder brother with elder brother, and the usual token gift is a turban length.

The wedding service begins with the singing of the morning hymn *Asa di Var,* during which the bridegroom comes forward to sit in front of the *Guru Granth Sahib* usually wearing a saffron or golden coloured turban. The bride, dressed in red, then joins the congregation and, accompanied by a friend, sits on the left-hand side of the groom. The person sitting behind the *Guru Granth Sahib* is a respected member of one of the families. This person leads the prayers and conducts the wedding and will pray that God will bless the marriage. During the prayer the couple and their parents will stand; the rest of the congregation remain seated.

The bride and groom display their assent to the marriage by bowing towards the *Guru Granth Sahib*. When they sit down the bride's father approaches the couple, puts a garland on the *Guru Granth Sahib* over the shoulders of his daughter and the groom and then ties the end of his daughters head-covering to the end of a muslin scarf which hangs from the groom's shoulders.

The main feature of the wedding service is the singing of the *Lavan*. This is a marriage hymn consisting of four verses composed by Guru Ram Das for his daughter's wedding. Each verse is read and then sung during which the couple walks round the *Guru Granth Sahib* in a clockwise direction, the bride following the groom. Many of the bride's male relatives will stand close to the couple, putting their hands on the bride's shoulders and helping her on her way, thus displaying their love and protectiveness and their own support for the marriage. The service concludes with the first five and the final verse of the *Anand*, the Hymn of Bliss, followed by the prayer, *Ardas*, a formal prayer of petition. A random reading of a passage from the *Guru*

Granth Sahib is taken and the service ends with the distribution of *Karah parshad*. This is a cooked mixture of flour or semolina, sugar, water and ghee (clarified butter). It is merely a popular Indian sweet pudding, normally called a *halwa*, which is distributed to the seated congregation who receive it in their right hand. The word *parshad* or *prasad* means a gift or present. *Karah* is the Punjabi name for this kind of sweet. The purpose of this small sharing of food is symbolic as no one must leave the Guru's presence hungry and by eating together the worshipers show that they are one united family of equals. After the service their will be a wedding reception and later in the day the married couple will leave for the groom's home.

Adapted from *Thinking about Sikhism* by W. Owen Cole.

Appendix C

Data disk