Missing the Point: The effect of punctuation on reading performance

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Abstract

Any coherent theory of language comprehension must account for the ways in which different informational sources are combined in the analysis and interpretation of language input. Until recently, punctuation has received very little attention in psycholinguistics, even though punctuation marks are perhaps among the most important structural elements in written language. The major aim of the current project was to examine whether punctuation, in the form of commas, provides a dependable and effective cue for facilitating reading performance—as measured by reading speed and comprehension. Further, the relationship between the reading-ability of participants and the effectiveness of punctuation was explored. The notion of redundancy in punctuation, and whether the comma exerts a similar influence on both simple- and difficult-to-process sentences was also considered.

Both the plausibility of potential attachments and the length of ambiguous regions in sentences have been shown to influence the severity of misanalysis experienced by readers. The way in which appropriate punctuation affects the impact of these factors in processing and comprehension of ambiguous sentences was investigated. An additional aim of the research was to determine whether the previously observed disambiguating effects of commas could be simply credited to clausal segmentation. The findings indicated that commas do more than simply physically segmenting text. Commas were observed to have a strong and structurally dependent influence on sentence processing—particularly with skilled readers—successfully averting the need for major reanalysis, either by eliminating misanalysis altogether or activating rapid repair.

A variety of syntactically relevant constraints are likely to be accessible, which could be used to inform parsing commitments. What the constraints are, and how and when they are used, remains an important and largely unresolved question. The current findings clearly suggest that punctuation is one such constraint. Moreover, the effectiveness of punctuation as a syntactic constraint appears strongly tied to reading-ability. The results suggest that models of sentence parsing and comprehension that do not include a role for punctuation are incomplete.
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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference is made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being available for loan and photocopying.

Benjamin Grindlay

July 2002.
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For Bruce and Gaynor Grindlay
Chapter 1: Introduction to Dissertation

Many writers profess great exactness in punctuation, who never yet made a point.

—George Prentice

1.1 PREAMBLE

Psycholinguistics is a hybrid discipline that has evolved out of the psychologist’s interest in language and the linguist’s interest in psychology. The mutual relevance of psychology and linguistics has been recognised for a long time, yet it is only relatively recently that psycholinguistics has achieved the level of an accepted discipline, with its own assumptions, theories and research methodologies. Language, in many respects, is the subjective veil through which we view the existence and nature of our thoughts; accordingly, the discipline of psycholinguistics is both purposeful and interesting.

Sentence processing is a sub-domain of psycholinguistics that attempts to account for how people compose the meanings from sentences they read or hear. In order to understand a sentence, it is necessary for the listener or reader to determine the syntactic structure of the sentence. The assignment of the words in a sentence to their relevant linguistic categories is referred to as parsing (Gleason & Ratner, 1993). Sentence parsing involves the rapid integration of numerous types of information, for example lexical, structural and discourse (Mitchell, 1994), and research in this area is inevitably interdisciplinary, drawing on work in such areas as theoretical linguistics, experimental psychology and computer science (Fodor, 1995).

This dissertation focuses on the syntactic aspects of parsing and, in particular, how graphic, non-lexical features, which we call ‘punctuation marks’, can guide the structural composition of a sentence. Given that punctuation marks are perhaps among the most
important structural elements in written language, the apparent rarity with which the role of punctuation marks has been systematically examined, their effect on reading speed and comprehension explored, and their adequacy questioned, appears mystifying.

1.1.1 Punctuation: A Neglected Topic.

Three distinct but interdependent written language systems have been suggested as available for indicating the structure of discourse: lexical markers, including cue words and phrases; punctuation markers, including periods, commas, colons, semi-colons, dashes and parentheses; and graphical markers, including the use of paragraph breaks and itemised or enumerated lists (Dale, 1990). The first of these is clearly uncontrovertial and well researched; however, it is only relatively recently that researchers have begun to seriously contemplate the others. Perhaps it is the pervasive bias towards the spoken language as the primary object of linguistic study that has resulted in language researchers all but ignoring the value of the second and third classifications (Nunberg, 1990).

This lack of research into the role of punctuation in reading has been acknowledged by researchers both from a linguistic perspective (e.g., Baron, 2001; Bruthiaux, 1993; Levinson, 1985; Meyer, 1987; Nunberg, 1990; Parkes, 1992) and a psycholinguistic viewpoint (e.g., Baldwin & Coady, 1978; Chafe, 1988; Chapman, 1993; Cordeiro, Giacobbe, & Cazden, 1983; Hill & Murray, 2000b; Murray, 2000; Scholes & Willis, 1990; Shapero, 1999). Moreover, at present there are few natural language analysis or generation systems that make full use of punctuation, and those that do make a limited use of it are considered the exception rather than the rule (Bayraktar, Say, & Akman, 1998; Briscoe & Carroll, 1994; Dale, 1991; Dorán, 1996; Jones, 1994). Commonly, punctuation is removed from the text before analysis is carried out, or else the computational systems are designed to ignore punctuation occurring in the text. In the same way, the generation framework tends to produce a text without punctuation (Beeferman, Berger, & Lafferty, 1998).
Other disciplines of research have dealt, at least to some extent, with punctuation—most notably in palaeographic studies of ancient scripts and manuscripts, and in literary studies. Investigations into punctuation have been used in such disciplines to ascertain the origins of texts, establish uncorrupted versions of important use, and on occasion explore the stylistic use of punctuation (Levinson, 1985). Aside from a prescriptive standpoint observed in stylistic guides (commonly, these reviews employ a prescriptive treatment of punctuation, in which long lists of rules are given, but the actual practice is not considered), punctuation marks had not been studied much by linguists until the nineteen-eighties. Pedagogically, punctuation has also endured neglect (Hall, 1996; Robinson, 1996). Mordaunt (1993, p. 68) mentions five fallacies from which punctuation teaching has suffered:

1. *Since the teaching of grammar is out, punctuation should not be taught;*

2. *Punctuation is a matter of personal taste, and so cannot be taught;*

3. *Concentration on mechanical aspects of language inhibits creativity, and therefore punctuation should not be taught;*

4. *For the less able it should be 'first things first', and any consideration of punctuation is an excessive burden for such pupils; and*

5. *Punctuation is unnecessary in any case.*

The limited empirical research that has dealt with punctuation has been largely conducted in recent times—perhaps due to the absence of a concise formal background for the abstract problem (Jones, 1996). Interest in the subject has risen within the last decade-and-a-half due to the realisation that a fuller understanding of the processing associated with written language is quite impossible without taking punctuation into account. Of the recent valuable inquiries that have been undertaken, those on the synthesis side have focused on ways of formalizing the discourse functions of punctuation, whereas
those on the analysis side have emphasized how punctuation can improve robust parsing (White, 1995). Once it is accepted that punctuation is an orthographic component that is inseparable from written language, continued research into punctuation can only be viewed as sensible (Bayraktar et al., 1998).

While it is readily assumed that punctuation plays a crucial role in skilled reading, the amount of direct empirical investigation of its effects is, to say the least, very limited. When encountering written language, the shapes, positions and sequences give us cues to understanding, and these need to be accommodated into habits in order to respond easily and accurately. These habits have been formed in us by encounters with conventional devices for the efficient transcribing of language, which have evolved over the centuries (Spradley, 1971). Conventions of reading and writing, based on visual signals, such as spaces, reading from left to right, and punctuation have been established over time, according to their degree of usefulness. Intuitively, the fact that there has been inadequate attention paid to the role of punctuation in sentence parsing appears amiss; as punctuation is such an integral part of written language it is difficult to envision producing any substantial body of unpunctuated text, or being easily able to understand such a body of text (Dale, 1991; Jones, 1996; Jones, 1994; Meyer, 1987). Indeed, as illustrated in 1.1, the reader has become to rely on punctuation marks rather heavily.

(1.1) conventionsbasedonvisualsignalssuchasspacesreadingfromlefttorightandpunctuationhavebeenestablishedovertheimposedaccordingtotheirdegreeofusefulnessintuitivelythefactthattherehasbeenina
deguateattentionpaidtotheroleofpunctuationinsentenceparsing
appearsamissaspunctuationissuchanintegralpartofwrittenlanguagethatisdifficulttoenvisionproducinganysubstantialbodyofunpunctuatedtextortoensureasayabletounderstandsuchabodyoftext

This dissertation will principally address the role of punctuation in written language, taking into account the constraints imposed and the opportunities offered by the structure of text in which punctuation markers appear. Punctuation has become an essential
component of written language, functioning to resolve structural uncertainties in text, and signal nuances of semantic significance which otherwise might not be conveyed (Parkes, 1992). The study of punctuation marks as functioning linguistic units, however, has largely been neglected; this has been combined with a 'less is best' punctuation policy (Chapman, 1993), which has been endorsed by many of the major stylistic pundits. This research is intended to rectify the former and examine the latter.

1.1.1.1 Definition of Punctuation

Punctuation is a phenomenon of written language—its history bound with that of the written medium (Parkes, 1992). After the invention of the alphabet, the creation of punctuation is considered as the primary development in the history of writing (Foley, 1993). Although small and unassuming, punctuation marks aim to serve the vital functions of separating clusters of alphabetic symbols into manageable pieces, and bringing order to clarify meaning, or at least prevent the wrong meaning being extracted. In relation to the timeframe in which the expansion of the written language took place, the arrival of punctuation was quite delayed. The term ‘punctuation’ itself did not appear in the sense in which we comprehend it today until the mid-seventeenth-century, deriving from the Latin word punctus (to point). Prior to this time it was called pointing, while punctuation referred instead to the insertion in Hebrew texts of points near consonants to indicate vowels. During a period around 1650, the two terms exchanged meaning.

As suggested by Dale (1991), punctuation occupies an interesting middle ground between overtly linguistic phenomena (like cue words and phrases) and overtly layout-oriented phenomena (such as indentation and spacing). In line with Nunberg’s (1990, p. 17) influential monograph The Linguistics of Punctuation, the term punctuation is defined here as “a set of non-alphanumeric characters that are used to provide information about structural relations among elements of a text, including commas, semicolons, periods, parentheses, quotation marks and so forth.” Viewed as such, punctuation marks function to signify the
grammatical structure and meaning of written text, and are all segmental units of writing, as they fully occupy a position in the linear sequence of written symbols. Various non-segmental features, however, can serve the same kind of purpose as punctuation marks. In 1.2, for example, the beginning sentence of the sentence is indicated non-segmentally by the capitalisation of the first letter, the title of the literary work is italicised (non-segmentally), and the end of the sentence is indicated segmentally by a full stop punctuation mark.

(1.2) I consider *Lord of the Rings* to be the catalyst for books in this genre.

Therefore, punctuation is regarded as not only encompassing the use of punctuation marks, but also of such features as italics, capital letters, bold face, and small capitals. One other aspect that falls under the rubric of punctuation is the use of space—notably to separate one word from the next. Spaces between words, like punctuation marks, are segmental units, as they occupy a whole position in the linear sequence. The term punctuation, therefore, is used to denote punctuation marks, spaces, and non-segmental modifications (Nunberg, Briscoe, & Huddleston, 2002). Moreover, punctuation could also be said to include ultra-sentence entities such as headings, sectioning, size and style of characters, justification and positional properties of titles (Pascual & Virbel, 1996). Examining these types of text-structural indications in the function of punctuation can be worthwhile, as they play a double role of textual segmentation and signposting the textual function of the segment, which, at a generic level, is also the case for intra-sentence punctuation.

For a limited set of apparently minor graphical features, therefore, punctuation offers a sizeable pool of structural information (Hill & Murray, 1997a). A useful way of structuring the mechanisms necessary to produce organised and readable text is to employ three marking systems (Dale, 1991). The first of these, the primary marking system,
includes marks of the alphabet and syllabary used to represent the words (usually called writing); the secondary marking system uses graphic devices like commas and periods to organise words (usually called punctuation); the tertiary marking system includes lay-out properties within a page (such as sections, divisions and footnotes) as well as groupings of pages (such as chapters and indexes) to organise sets of clauses and sentences.

1.1.1.2 Punctuation Use

The use of punctuation marks can be divided into three categories: those situations where punctuation marks are mandatory, such as at the end of a sentence; those situations where use of punctuation is unacceptable; and those situations where punctuation is possible, but not compulsory. In the latter, valuable information can be extracted from the existence and type of a punctuation mark, but if the mark is absent the analysis can proceed correctly anyway (Jones, 1996). With this in mind, the present research focuses on the first and last categories of punctuation use.

The rules of punctuation are created and maintained by writers to help make their prose more effective, and their exact meaning changes over time. At any point in time, a particular punctuation mark means what writers agree it means; as consensus shifts, so will its meaning. The argument for some amount of determinism in the use of punctuation is reinforced through the many style guides that take the view that there are correct and incorrect ways to use punctuation (Jones, 1996). It is important to appreciate, however, that there is a hazy middle region where idiosyncrasy and disagreement reign supreme.

1.1.2 The Relationship between Speech, Writing and Punctuation

Historically, linguists have invariably approached the study of writing contrastively, as a mode of linguistic expression alternative to speech. Until recently, the contrast was drawn in order to disparage the view of writing as an object of theoretical concern. As the American linguist Leonard Bloomfield (1887 – 1949) famously framed it, “Writing is not
language, but merely a means of recording language by means of visual marks” (cited in Nunberg, 1990, p. 1). In more recent years, however, the tendency has been to view writing and speech as two distinct linguistic systems (Coulmas, 1989; Scribner & Coe, 1981). Speech has been characterised as interpersonal, ephemeral, spontaneous, loosely structured and informal; whereas writing has been described as planned, highly structured, durable, monologic, and formal (Chafe & Danielewicz, 1987). Even so, the written language is still very much defined and legitimated by reference to the properties of the spoken language. In the same way, the discipline of psycholinguistics has been dedicated almost exclusively to language as embodied speech.

Ethnographically oriented studies have argued that the relationship between writing and speech is not dichotomous—but spectral. Influenced by social circumstances, a written text may be more prototypically speech-like than normal conversation, or vice versa (Baron, 2001). One intention of this dissertation is to chart the evolution of English punctuation against the changing character of writing. Well into the seventeenth-century, the central functions of vernacular writing were to document official transactions or to enable readers to re-create speech at a future time. During the seventeenth-century, the written (and printed) word began to realise greater independence from speech, reaching full flower in the eighteenth-, nineteenth-, and early twentieth-centuries. Since the Second World War, however, written English—perhaps more notably in America—has once again increasingly become a handmaiden to speech (Baron, 2001). Rather than a medium supporting formal rhetoric, much of the late-twentieth-century writing serves as a direct mirror of informal discourse and is, on the whole, interchangeable with it.

Notably, tracing the evolution of punctuation assists in monitoring the changing symmetry between speech and writing in the history of written English. The extent to which the literate community views speech and writing as independent or interdependent modes of language is, on some level, reflected in the rhetorical or syntactic nature and character of punctuation featured in writing of a given period (Baron, 2001). Recent
research by Jones (1996) and Baron (2001), examining the history of punctuation, suggests that the tangible marks of punctuation can be used to gain a window on the historical interplay in the relationship between speech and writing. This dissertation, through providing a relatively detailed history of the development of punctuation and examining current accounts of the function of punctuation, discusses the shifting relationship between writing and speech.

1.1.3 Reading Research: Parsing and Ambiguity

1.1.3.1 Introduction to Parsing Research

For a skilled adult reader, reading typically appears to be an instantaneous and cohesive process. Under the scrutiny of research, however, this assessment is far from accurate. Reading is not a distinct mental operation; rather, theorists differentiate component processes of reading at the word, sentence, and text level (Haberlandt, 1994). While recognising that any comprehensive commentary on the human processing of written language must account for the successful recognition of all the words and visible features of an individual sentence, this dissertation is concerned with the journey that begins immediately after these preceding recognition stages—sentence parsing.

Concentrating on the psycholinguistic field of parsing which, in a linguistic sense, emphasises the interaction between words in order to generate sentences, allows the meaning of sentences to be far greater than the simple sum of their parts.

In order to comprehend a sentence, an individual must compute the structural relationship between the constituent words, phrases and clauses. In most natural languages this task is complicated, as practically all sentences contain strings of words that are, or at least appear, structurally ambiguous when first encountered (Mitchell, 1986). Sentence-level processes include syntactic parsing processes. Using surface markers, word class, word position and punctuation, these processes organise the words of sentence into syntactic
structure (Crystal, 1987; Haberlandt, 1994) An efficient processing system must somehow be capable of making the correct parsing decisions most of the time; minimising, or perhaps even avoiding, obstacles introduced by backtracking or dealing with misleading starts.

Parsing operations are extremely rapid, and for this reason it has proved almost impossible to develop experimental measures that can convincingly be demonstrated to quantify the full range of parsing operations at the point in processing when they actually occur. Nevertheless, it is possible to use indirect procedures to obtain much of the information needed for tackling the complex issue of human parsing (Mitchell, 1994). Many of these indirect methods exploit the fact that natural languages can be highly ambiguous. On the basis of how readers handle ambiguous material, inferences can be drawn about operations that are difficult to observe directly. Consequently, much of the empirical work on parsing centres on how people contend with structurally ambiguous sentences (see Harley, 1995; Kennedy, Radach, Heller, & Pynte, 2000; Whitney, 1998).

1.1.3.2 Ambiguity in Parsing Research

A large amount of the current work on parsing, then, focuses how readers cope with syntactic ambiguity: how they choose alternatives, what determines parsing preferences, and how they deal with temporary structural ambiguity. Structural ambiguity arises when a sentence has more than one syntactic analysis, which often happens transiently at least. The extreme case of transient syntactical ambiguity is the ‘garden path’ sentence, where the reader has a clear sense of having selected an incorrect structural analysis (Harley, 1995). These sentences are so called because they lead the reader or listener up the garden path to an incorrect parse. For most people, sentences such as 1.3 and 1.4 look as though they are incorrect when, in fact, each is grammatically correct, and each has a clear meaning (Pinker, 1994).
The man who hunts ducks out on weekends.

Fat people eat accumulates.

Such indirect methods, therefore, can exploit the fact that natural languages are capable of being highly ambiguous. Readers are deliberately presented with ambiguous material and, depending on how they cope with the ambiguity, inferences can be drawn about the operations that are difficult to observe directly (Mitchell, 1994). Investigations of syntactically ambiguous sentences are primarily concerned with the basis on which readers commit to parsing the sentence in a particular way (Whitney, 1998).

Many people consider that garden path sentences are rather odd, as often there would be pauses in normal speech, and commas in written language, which, although strictly optional, are usually there to prevent ambiguity in the first place (Harley, 1995). A substantial body of recent work has studied the prosodic pattern in which a sentence is spoken, and findings indicate that prosody can be used to resolve local or temporary ambiguity (e.g., Beach, 1991; Cohen, Douaire, & Mayada, 2001; Schafer, Speer, Warren, & White, 2000). When spoken aloud, natural stress can easily resolve such temporary ambiguity—in principle, the idea of ambiguity might not even occur to a listener in the first place. Indeed, there is some evidence to suggest that prosodic cues can operate effectively at the earliest stages of parsing and interpretation in sentence comprehension (e.g., Marslen-Wilson, Tyler, Warren, Grenier, & Lee, 1992).

Although there some is evidence that punctuation, primarily commas, can influence the course of on-line parsing (e.g., Hill & Murray, 2000a; Mitchell & Holmes, 1985), most researchers studying sentence processing have either deleted sentence internal punctuation with casual abandon (e.g., Ferreira & Henderson, 1991; Frazier & Rayner, 1982), or have assumed that they necessarily understand the role it will play (e.g., Pickering & Traxler, 1998). In such cases it is possible that these atypical sentences are not telling us as much about normal parsing as previously thought (Harley, 1995; Murray, 2000).
1.2 NATURE OF DISSERTATION

Broadly speaking, research questions can be divided into two basic types: descriptive and predictive. Descriptive research questions focus on ‘what is happening?’; predictive questions contain specific ideas which can be tested through research. In the case of a predictive research question, the goal of the research is to test the accuracy of the prediction rather than to provide a picture of what is going on (Keeble, 1994). Although the current project is, by definition, experimental—thus largely predictive—perhaps its overall character might nevertheless be expressed as descriptive and pragmatic. Descriptive research is concerned with conditions or relationships that exist; practices that prevail; beliefs and attitudes that are held; processes that are going on; and trends that are developing (Best, 1993). In an area where there is such a clear lack of previous work, having descriptive and explorative elements in the research is quite reasonable.

Applied or pragmatic research is descriptive in the sense that it primarily describes general facts about the world, seeking to establish hypotheses that express true and law-like connections between properties or types of events. A typical result of applied research is a deterministic or probabilistic causal law of the form of 1.5 and 1.6, which can also be used for prediction (Niiniluoto, 1993, p. 7):

\[ X \text{ causes } A \text{ in situation } B \]

or (more appropriately for social sciences)

\[ X \text{ tends to cause (with probability } p) A \text{ in situation } B \]

Existing between basic science and technology, applied science aims to produce new knowledge that is intended to be useful for the purpose of increasing the effectiveness of some human activity (for example reading). Consequently, the results of pragmatic research
can be evaluated both in terms of their epistemic and practical utilities (Leary, 1995; Niiniluoto, 1993).

The lack of previous empirical work on punctuation makes it a fertile area for investigation, and much of the current project is aimed at exploring the impact of punctuation on reading, and encouraging further research into the subject. A major assumption embedded in the current work is that readers desire to read efficiently and extract meaning, and on this assumption the research questions were based. The project is concerned with the 'technological utility' of punctuation in reading, rather than developing or testing any theory of punctuation. In this sense, technological utility refers to the effectiveness relative to the intended use (see Niiniluoto, 1993).

In many cases no general theory is available from which a technical norm can be deduced. In these situations technical norms are developed by 'building up' a simplified model of the situation, which is usually achieved by using trial-and-error procedures and experimental tests to investigate the dependencies between the most important variables, and trying to find the optimal methods of producing the desired effects. When the result is expressed as a general rule, a technical norm with some empirical support is obtained (Niiniluoto, 1993), and from this exploration theoretical approaches can arise.

Figure 1.1, depicts the research domains that the current project included. Owing to the paucity of investigation into punctuation, the dissertation has descriptive and explorative elements; yet, when an appropriate theoretical basis exists, it is predictive. At the core of the research is the pragmatic question of 'does punctuation make reading more efficient?' Notably, the planning constituent is limited to the specific subgroup (undergraduates) involved in the research. However, it would be surprising if what was true of this subpopulation were to prove irrelevant to most other subpopulations.
Figure 1.1. Research domains used in the current project

The methods that are adopted in research must be at least partly determined by the desired end point (Keeble, 1994). The specific method adopted by a researcher in conducting a particular investigation depends a good deal on the type of question he or she is trying to answer. Accordingly, the main interest of this research was in evaluating practical outcomes, in seeing which manipulations were associated with more positive outcomes and, to a lesser extent, in trying to spot any clues about what was going on when different subgroups of participants obtained different outcomes. This interest in explanation was, in a sense, secondary to interest in what circumstances gave the best and worst outcomes and, to a degree, was still pragmatic, since the only kinds of explanations of interest to the current study were ones relevant to improving reading outcomes.

However, the findings and inferences are not (similar to purely descriptive modelling) generalized to other related data sets, as that would require additional assumptions of the similarity of the data sets, by assuming that they are generated somehow by the same underlying phenomenon. One would expect that different subpopulations would be quite heterogenous in terms of reading behaviour, and what may be the case for undergraduate students is not necessarily accurate for other populations. Nevertheless, the current findings undoubtedly provide a sound basis from which other subpopulations can be investigated.
1.2.1 Overview of Dissertation

1.2.1.1 Introductory Chapters

With the intention of providing a theoretical platform upon which the project can be based, the dissertation begins with an examination of the historical development of punctuation, and surveys its current status by means of reviewing modern approaches to the issue of punctuation practice. It is valuable to have an insight into the development of punctuation, since so much of the diversity and functional characteristics of punctuation marks can be traced to their origins in historical practices (Jones, 1996; Levinson, 1985; Parkes, 1992). Moreover, in addition to giving usage examples for the individual marks, the discussion of the historical progression of punctuation provided in Chapter 2 also reveals the operation and reasons for the punctuation system as a whole. Developing from the historical analysis, Chapter 3 surveys modern text marking conventions and provides a synopsis of the functions and roles performed (or at least suggested to be performed) by punctuation, and discusses current practices and perspectives in relation to these orthographic devices.

Psycholinguists, as well as many other language researchers, have often claimed the beneficial uses of punctuation without giving concrete empirical justification. There is little empirical evidence to support, or disprove, this conjecture of punctuation facilitation, and most researchers have either evaded the consideration of punctuation or have merely assumed that it serves a disambiguating role (Hill, 1996; Murray, 2000). Chapter 4 discusses in detail some past studies that have examined punctuation, either incidentally or as a focus of research. Lamentably, representations of the former category are scarce, and of the latter, scarcer still; and, in many cases, the research is unpublished.
1.2.1.2 Experimental Chapters

The first experimental chapter describes a number of pilot studies that dealt with issues concerning subject recruitment, stimulus selection, and measures used—as these were not only relevant to the first experiment, but to those following as well. The purpose of Experiment 1 was to establish if punctuation is able to act as a mechanism for disambiguation in an otherwise temporarily ambiguous sentence. Whether punctuation exerts a similar influence on the reading speed of both simple- and difficult-to-process ambiguous sentences was also investigated. Further, the relationship between the reading-ability of participants and the effectiveness of punctuation in facilitating reading was explored.

There has been little, if any, research on, or discussion of, the mechanisms by which punctuation disambiguates or, importantly, whether it is equally effective across different sentence structures. Experiment 2 examined whether punctuation, in the form of commas, provides a dependable and effective cue for the disambiguation of an array of garden path type sentences—as measured by reading speed and comprehension. The factor of reading-ability was further investigated in the Experiment 2 by means of dividing participants into skilled and less-skilled reading-ability groups. This permitted a comparison in terms of how each group responds to the introduction (or, alternatively, the omission) of commas in a range of ambiguous sentences, as well as in their unambiguous counterparts. Additionally, Experiment 2 used a cumulative design, to provide information regarding whether there is a critical zone in the sentence that is facilitated by the inclusion of punctuation.

The purpose of Experiment 3a was to investigate the idea that punctuation cues reside on a continuum, with critical and redundant marks existing at polar opposites (Baldwin & Coady, 1978). Both the plausibility of potential attachments and the length of ambiguous regions in sentences have been shown to influence the severity of misanalysis experienced by readers. The way in which appropriate punctuation affects the impact of
these factors in processing and comprehension of ambiguous sentences was investigated. Moreover, the experiment allowed further examination of the issue of whether punctuation provides complete disambiguation or merely facilitates reanalysis. The relationship between reading-ability and the effect of punctuation was also further considered—primarily the observed inconsistency in punctuational influence on skilled and less-skilled readers.

One possible objection to many of the conclusions drawn in the experiments might be that the observed facilitatory effect of punctuation on garden path sentences could have been merely an artefact of segmentation. If this were the case, it would limit the generality of the finding that commas can influence the course of syntactic processing. The purpose of Experiment 3b, therefore, was to determine whether the previously observed disambiguating effects of commas could be simply credited to clausal segmentation. Extra-spacing was examined in order to ensure that any punctuation effects are not simply attributable to an extended break between words. Further, we were interested in whether the same pattern of greater magnitude of punctuation facilitation in skilled readers would manifest for extra-spacing.

The combined findings from Experiments 1 – 3b suggest that commas have a strong and structurally dependent influence on sentence processing—particularly with skilled readers—as they can successfully avert the need for major reanalysis, either by eliminating garden path effects altogether or by activating rapid repair. Moreover, commas are doing more than simply physically segmenting text. Increased spacing was observed to have a minor effect on processing under certain circumstances, but this may perhaps be due to clausal-segmentation rather than any guiding of sentence parsing.

Compounding the uncertainty surrounding punctuation are the unexamined assumptions about the fundamental aspects of contemporary punctuation, in particular the failure to distinguish between obligatory punctuation and the vast area of optional punctuation. The purpose of Experiment 4 was to explore whether optional punctuation has any effect on reading speed, comprehension and comprehension-confidence when
used in a minimalist compared to a traditional manner. The overall confidence participants felt in their own ability to punctuate, and whether this was related to reading-ability was also investigated.

1.2.1.3 General Discussion and Conclusions

The final chapter discusses methodological issues and details how the findings relate to previous research on punctuation. The dissertation does not aim to provide a unified theory of the use of punctuation. Any comprehensive account must be based on a much broader set of corpora, various genres, and both micro- and macro-typographies must be investigated. Nevertheless, by identifying a smaller set of instances where punctuation is not open to choice, as well as investigating possible factors that influence the effectiveness of punctuation, the current project plainly suggests that these areas deserve further and independent investigation.
Chapter 2: The History of Punctuation

I sometimes think that writing is like driving sheep down a road. If there is any gate to the left or right, the readers will most certainly go into it.

—C.S. Lewis

2.1 PREAMBLE

Having achieved a working definition of what constitutes punctuation in contemporary orthography (see Section 1.1.1.1), an examination of the history of English punctuation is important, as it provides insights into the variety, composition, and use of modern punctuation marks. This chapter provides a comprehensive description of the origins and development of punctuation, beginning with a brief account of the evolution of writing, which produced the conditions required for the creation of punctuation. The historical overview deals with the classical Greek and Latin periods, and continues through Medieval Latin to ascertain what, if any, were the punctuation practices that could have been inherited by old English. Aspects of earlier and later Middle English periods up to and just after the invention of printing are also examined. Vernaculars other than English are not directly dealt with.

It would be gratifying to uncover a continuous line of development in English punctuation, from its earliest conception to present practice. In reality this is not the case, and conceivably this is one explanation as to why so many myths about punctuation prevail (Levinson, 1985), and perhaps why punctuation has been overlooked as a subject for scholarly research. Nevertheless, punctuation does have a past, and that past is intimately connected with developments in writing, particularly with the development of books and the emergence of silent reading.
The line of descent, however, is not easily traced, and widely varying practices in marking appeared and disappeared in Europe from classical Greek all the way to the century after the invention of printing. As shall be discussed in this chapter, the presence or absence of the different adaptations of punctuation was influenced more by social and historical conditions than by linguistic factors.

2.2 STARTING POINTS

Appearing around 200 BC (Parkes, 1992), punctuation can be viewed as a relatively new facet of orthography, particularly given that the genesis of graphical writing itself can be traced as far back as the Upper Palaeolithic era, from 35,000 to 15,000 BC (Schmandt-Besserat, 1991). Writing of this period predominately consisted of rock paintings and carvings, which included concrete imagery, such as pictures of a hunt, or ceremony; abstract work; and symbolic images where, for example, a circle with eight rays was used to symbolise the sun. While perhaps best viewed as a form of prewriting, these images and symbols illustrated the need of their producers to communicate with their contemporaries; however, they did not yet demonstrate those intentional facets of conscious writing as a system of human intercommunication by means of conventional visible marks (Senner, 1989).

Nevertheless, even graphical systems that we do recognise as writing predate punctuation by a considerable margin (Jones, 1996). The advent of a writing system seems to coincide with the transition from hunter-gatherer societies to more permanent agrarian encampments, where it became necessary to count property, perhaps to record ownership of parcels of land, animals or measures of grain, or as part of the process of transferring property to another individual or another settlement. In the Middle East, throughout 8000 – 3400 BC, plain and complex tokens were fashioned and used for accounting purposes (Schmandt-Besserat, 1991). Tokens were small three-dimensional geometric counters made in simple shapes such as cones, discs, and spheres. The more complex tokens, while
often consisting of similar shapes, used more complicated forms, such as triangles, ovoids, bent coils, and representations of tools and animals. Moreover, they additionally bore markings on their surfaces, which typically involved linear patterns, notches and dots that were marked with a stylus or, more rarely, represented in raised clay (Jones, 1996).

These tokens not only acted to denote what was being measured (e.g., sheep, grain), but also indicated numbers and quantities. Notably, such tokens existed not simply as physical entities that could, for example, be strung together or kept in a box as a permanent representative record, but they could also be used to mark soft-clay tablets, leaving an impression of the token behind, and thereby signifying the same as the token itself (Schmandt-Besserat, 1989). By around 3200 BC, the expansion of the imprints of the plain tokens in clay tablets, and the wedge-shaped impressions made with a stylus to represent the complex tokens, enabled the starkly utilitarian accounting-based symbolism to broaden, which led directly to the development of Cuneiform script used by the Sumerians of Mesopotamia (Schmandt-Besserat, 1991). The imprints became stylised and, although pictures began as representing what they were (pictographs), eventually certain pictures represented an idea or concept (ideographs) until finally they were used to represent sounds.

Sumerian was an agglutinative monosyllabic language and, as the language developed, each ideogram became a symbol for a concrete or abstract reality. In combination they could communicate and codify the spoken language as well as abstract notions of mathematics and naming, unrelated to pictographs. As the script became more powerful and flexible in transcribing, its scope branched into the narrative and creative realms. Each ideogram had a spoken word, a palabra, associated with it—this is called analytic writing. The recognition that, by recording with writing, information could be passed on over distance and to future generations led to a rapid expansion of written languages. Furthermore, those who could read and write took on important and powerful positions in their communities. As writing developed, it became more and more important to the
community in order to preserve its culture and its history, to conduct its affairs, and run its economy. When the Assyrians conquered the Sumerians in 1720 BC, they adopted cuneiform, and reduced the number of symbols from approximately 2000 to 600 or so. They used this updated cuneiform to record religion, history, law, science, mathematics, astronomy, and medicine. The Assyrians then conquered the Babylonians and spread the use of cuneiform throughout the Middle East (Jackson, 1987; Schmandt-Besserat, 1989).

At the same time the as Sumerians were developing cuneiform, the Egyptians were creating their own collection of symbols; it was named hieroglyphics (sacred engraved writing) by the Greeks 2000 years later. It consisted of many symbols that recorded such things as estate boundaries, the rise and fall of the Nile’s flood, the fertility of plants, and the distribution and payment of taxes. Like many of the logographic/phonetic scripts developed in the Near East, hieroglyphics was extremely complicated—consisting of several hundred signs. Not surprisingly, it was a formidable task to learn and apply the signs, which in effect made writing the monopoly of royal and religious courts (Jackson, 1987). These conditions provided a suitable background for the establishment of the Old Canaanite (the first alphabet), around 1800 BC. All subsequent alphabetic writing systems, such as Latin, Hebrew, Arabic and Greek, derived from this original Old Canaanite system (Jones, 1996). It was a structure of simplicity, which consisted of only 27 or 28 symbols, with each symbol representing a consonantal phoneme (vocalic phonemes were not represented in the early alphabet). The Aramean culture was where the first rudimentary system for representing certain vowels was developed; however, the creation of the first complete system of symbols for vowels is attributed to the Greeks around 900-800 BC. The Greek system was the foundation from which Latin writing originated, in approximately 700 BC. Importantly, it is the Latin writing system in which the use of rudimentary punctuation can initially be observed (Jones, 1996).
2.3 THE DEVELOPMENT OF PUNCTUATION

In the earliest Greek inscriptions, all letters were written in majuscules or capitals, and they ran continuously, ONE AFTER ANOTHER (Foley, 1993). Furthermore, even the concept of using a blank space for a word separation boundary was unknown, with authors (or, more accurately, their amanuenses and scribes) rarely inserting any symbols into the text, other than the letters that comprised the words (Jones, 1996). Count your blessings, readers of today. If you were living during the years of Greece’s glory or Rome’s grandeur, that last sentence would have looked like this (Casson, 1988):

COUNT YOUR BLESSINGS READERS OF TODAY

Further, if it had been an inscription on a public monument in, for example, Athens, where the focus was on balance and symmetry above all, it may have looked like this:

COUNT YOU R B L E S S I N G S RE A D E R SOFTODAY

As Parks (1992) explains, the culture of the ancient world was one dominated by the ideal of the eloquent orator. Text was invariably read out aloud, either in a murmur, if the reader was alone or, preferably, as an open declamation in public. The capacity to make a high-quality speech in public was considered vital, and this encouraged the emphasis on a

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1 It should be noted that, even today, the demarcation of word-separation is not used in all writing systems. For instance, in modern Japanese writing, spaces are not used, although when writing in the Katakana syllabary, word divisions are sometimes signalled by a small circle (○).
verbal response to the written word. However, as text inscriptions were written continuously, with no spacing even between the words, the framework was plagued with potential for ambiguities and misinterpretation. This long string of letters was labelled *scriptio continua* in Latin; and the text, as it appeared on the page, had significantly less information than would have been required to enable a reader to read aloud at first sight. The potential for uncertainty is highlighted in 2.1.

\[
\begin{align*}
(2.1) & \quad \text{CONSPICITURSUS} & \text{(ambiguous scriptio continua)} \\
& \quad \text{CONSPICTURSUS} & \text{(a bear espies)} \\
& \quad \text{CONSPICITURSUS} & \text{(a sow is espied)}
\end{align*}
\]

The first acknowledged punctuation symbol, the *paragraphos*, appeared in the fourth-century BC, and was devised by the philosopher Aristotle (384 – 322 BC) to denote a break in sense. The *paragraphos* (literally a ‘mark written alongside’) was merely a short horizontal stroke under the beginning of a line, extended into the left-hand margin, to signify that a change of topic was occurring. Whether the change actually came at the beginning of the line, or at the end, or somewhere in the middle was a conundrum the reader had to solve. Around 200 BC the first rudimentary instances of punctuation can be observed, with scribes employing layout features that indicated major divisions or sections of a text (Jones, 1996).

The Romans, in the first-century AD, began separating words by points, and soon after introduced a more definite form of paragraphing by projecting the first few letters of

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2 Alternatively, many ancient Greek inscriptions were written in ‘boustrophedon’ (as the ox ploughs) in which the line ran from left to right, bent around, and then continued from right to left with individual letters also drawn backwards.

3 This example is taken from Jones (1996).

4 Some evidence, however, suggests that a number of Greek writers were already using individual marks by the 5th century BC. For example, the playwright Euripides (c. 480 – 406 BC) marked changes of speaker with a wedge (\(<\)), and the philosopher Plato (c. 428 – 348 BC) sometimes ended a section with a double point (\(\cdot\)) (Foley, 1993).
each new section into the margin (litterae notabiles). In late medieval times, the use of a 'C' mark representing capitulum (chapter) became visible in some manuscripts and books. It was not until the seventeenth-century that the modern practice of indicating paragraphs by the use of a space (indentation) was adopted (Foley, 1993; Hanks & Fish, 1997). By 50 AD spaces were used by some scribes to denote major pauses within paragraphs, and by 100 AD Latin manuscripts had the words separated by *interpunctus* (2.2), a practice the Romans had derived from the Etruscans (Jones, 1996).

(2.2) *LUCEAT* LUX VESTRA  (let your light shine onward)

However, at the conclusion of the first-century, the use of *interpunctus* in Latin text ended, due to scribes imitating the Greek practice of writing without word separation or indication of pauses within a key section of text. The perceived value of *scriptio continua*, according to the ancient Romans, was that it presented the reader with a 'neutral' text. The introduction of graded pauses into the text was seen to involve an act of interpretation, and it was believed that this role more properly ought to be reserved for the reader.

Interestingly, this concept has experienced a semi-renaissance in play writing, where a number of writers are removing all punctuation (apart from spacing) in order to present actors with a raw basic material, which they must interpret for themselves. The translation of Seneca’s *Oedipus* by Ted Hughes, and the plays of the great Viennese dramatist Thomas Bernhard, are two possible forerunners to this revival. More recently, Australian playwright Michael Gow has used this approach with the texts of *Women of Troy*, *Titus Andronicus* and *Sweet Phoebe*. Gow believes that often unconscious patterns are already dictated by commas,

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5 Literally, the term translates to "more noticeable letters".

6 An argument and practice echoed in the much later determination by legists that legal documents should not be punctuated.
full stops and so on; the eradication of punctuation allowed the actors to re-discover the value of every sound for themselves, making the work richer and more powerful.

Attempting to read a text written in scriptio continua, therefore, involved thorough preparation, as well as identification of the elements of the text (such as letters, syllables, words, and phrases). The capacity to perform this analysis was not easily gained, and the principle interpretation method used during secondary education was praelectio, which was taught by the grammatici, who were the teachers that provided secondary education in the ancient world. Parks (1992) describes praelectio as an exposition of the text intended to make pupils follow the written word with ease and accuracy. The method involved either the teacher or pupil inserting marks or symbols to link and separate words (hyphen or diastole) and to indicate position and duration of pauses (positurae). These marks are considered the first actual symbols of punctuation and, importantly, served a both disambiguating and prosodic function (Parkes, 1992). Scribes would enter some of the major marks, such as the kaput (§), which marked the beginning of a new head in the argument, whilst readers would insert the minor ones such as oblique strokes (/) to indicate minor pauses, or the simplex ductus (\) to separate some preceding material from subsequent material which, although unconnected, had been run together (Jones, 1996).

The grammarian and lexicographer Aristophanes of Byzantium (head of the library at Alexandria around 200 BC) is usually credited with the invention of the critical signs, marks of quantity, accents, breathings and so forth associated with the beginnings of the Greek system of punctuation\(^7\). Aristophanes devised a three-point system that divided text into short, medium, and long sections according to rhetorical theory. The paragraphos, Aristophanes reasoned, was all to the good, but a few signposts here and there at the edge of a trackless forest seemed far from adequate. Aristophanes, through a system of dots,
attempted to add some trail markers along the way. The end of a long section was marked by a high point ('). called *periodos*, meaning 'a going around', derived from *peri* (round, about) and *hodos* (a way). The meaning is clear: the end of a sentence, which most often requires a period, marks a cycle, a circumference, of thought and expression (Shaw, 1963). The *kolon* (;), a middle point, marked the end of a shorter section; and the *komma* (,), which came from koptein (to cut off), marked the end of the shortest section (Scholes & Willis, 1990). Since writing was still in majuscule letters, the three positions were easily distinguishable. They were, in effect, breath marks. Significantly, here in the fourth-century is the expression of a tradition of punctuation that permeated writing for centuries—punctuation as a guide to 'breathings'—and shaped the discussion of all unrelated forms of punctuation that followed (Levinson, 1985).

Even in the present day, when punctuation is based on more abstract linguistic concepts, authorities are still writing with reference to pauses and breathing points. It is important to keep in mind that current terms, such as ‘comma’ and ‘colon’, are nothing like what they were in writing of this time. Conceivably, it is because there are so many different features that shape intonation, which while discernible are not easily distinguishable, that distinct elements such as rhythmic patterns, tonal contrasts, and contour sequences have been, though the centuries, simplified into 'pauses' (Levinson, 1985). Nevertheless, these breath points did gradually evolve into the modern comma, colon and period, described by Brightland (1711, cited in Baldwin and Coady, 1978, p. 364) as follows:

> The Use of these points, Pauses, or Stops, is not only to give a proper Time for Breathing: but to avoid Obscurity, and Confusion of the Sense in Joining Words together in a sentence (p. 149).

7 Not only did Aristophanes earn himself the right to be called the father of punctuation, and run the world's greatest library, he also put out a definitive edition of Homer's Iliad and Odyssey, and even found time to write a book about courtesans.
Although Aristophanes' system was never widely adopted, he is also believed to have devised a number of other signs such as the hyphen (⁻), used to denote compound words; and the virgule (/), which was inserted between words where the meaning might appear ambiguous (Foley, 1993). Roman scholars, including fourth-century grammarian Donatus and sixth-century patron of monastic learning Cassiodorus, advocated the Aristophanic system. The three-point breathing pauses system was perfectly workable with the majuscule Latin scripts then in use (remembering that scribes had reverted to *scriptio continua* and the point between words had been abandoned). Consequently, the concept of punctuation marks began to shift from their being a secondary device to help inexperienced readers, to their being a legitimate addition to the text, acting to ensure that it was correctly understood.

As these standardised systems of punctuation developed, favourite texts began to be annotated by scholars so that others could clearly understand them (Jones, 1996). One of the first Latin books to be written with punctuation included for the readers, rather than those marked up after they had been written, was the version of the Vulgate Bible translated by St. Jerome in approximately 400 AD. St. Jerome devised punctuation *per cola et commata* (by phrases), which was a rhetorical classification especially intended for reading aloud (2.3). Each phrase began with a letter projecting into the margin (*litterae notabiliores*), which was treated as a minute paragraph, before which the reader was expected to take a new breath. The reasons for the preparation of texts in this manner, according to Parks (1992), were St. Jerome’s dissatisfaction with the need for so much correction in earlier manuscripts, and the need for accurate interpretations of the book that is so vital to the Christian religion.
Blessed is the man who hath not walked in the counsel of the ungodly
and hath not stood in the way of sinners
and hath not sat in the seat of the scornful
but his will is the law of the Lord
and in His law shall he mediate day and night
and he shall be like a tree transplanted close by the streams of water
that will bring forth its fruit in due season⁸ (cited in Jones, 1996, p. 15).

Although St. Jerome’s arrangement established a precedent, and became increasingly
popular, by 600 AD the ideal of the eloquent orator ceased to be so dominant in literary
culture. Moreover, forms of spoken language began to deviate progressively from that
represented by the Latin text, making it increasingly necessary to indicate meaning in
manuscripts in what was becoming, to many readers, a foreign language. Additionally, at
that point in time, silent reading began to increase in popularity, which led directly to the
recognition of writing as existing as a linguistic medium in its own right, rather than merely
being a transcription of spoken word (Saenger, 1997). Isidore of Seville (560-636 AD),
writing for the Christian Visigothic community, was the first grammarian to seriously argue
that writing was an independent mode of representation intended to be read silently.

Isidore stated that (Libri sent. III, xiv, 8, cited in Parks, 1993, p. 21):

...the understanding is instructed more fully when the voice of the reader is silent...one can read
without effort, and by reflecting upon those things which one has read, they escape from memory less easily.

Isidore’s solution was to reconceptualize the role of punctuation in written text;
punctuation, he argued, should not only mark sentence boundaries, but also demarcate
sentence-internal clause structure (Baron, 2001).

⁸ In the original, the longer lines would have been split and the wrapped lines indented from the margin.
Moreover, around this point in time, the use of ancient scripts began to decline, and new scripts, based on cursive and calligraphic writing styles, began to be employed (Jones, 1996). These more contemporary manuscripts were written by scribes, especially Irish, Anglo-Saxon and German scribes, to whom Latin was a foreign language. Consequently, the writings of Isidore of Seville had a considerable impact on the thinking of these scribes, who approached the Latin corpus as a written language whose structure they needed to decode (Baron, 2001). Additionally, other languages besides Latin began to be written down, which employed minuscule writing (these scripts were usually smaller than majuscule and had projections above and below the body of letters, as in modern lowercase letters). The separation of words, therefore, became critical to the development of silent reading.

The scribes of Ireland were particularly influential in the development both of writing and punctuation, inventing new symbols for abbreviations and, importantly, subdividing Latin sentences more clearly by separating words with spaces. Further, the Irish fashioned new punctuation marks that were better suited to the new scripts than were the marks used with the ancient ones. Moreover, they began the practice of grouping a number of punctuation marks together to create new symbols and denote new meanings, such as three comma-shaped marks indicating the end of a section, and double or single marks indicating subdivisions inside the section (Lowe, 1971).

A prominent feature of Irish manuscripts is the conceptual linkage between punctuation and decoration within the text, as scribes viewed these as two characteristics of the same entity: the presentation component of a text that acts to facilitate its use. Elaborate, decorated *litterae notabiliores*, ‘carpet pages’, that contained only ornate decorations, and the use of different colours in writing (specific punctuation marks were rendered in colour for distinguishing and decorative reasons) all developed from Irish practices (Baron, 2001; Jones, 1994). These scribal practices, which placed additional emphasis on producing greater clarity through a focus on the visual impact of layout and
punctuation, made a sizeable contribution to the expansion of punctuation and, indeed, the concept of punctuation.

Learning from the Irish, Anglo-Saxon scribes sought to improve these practices further. Legibility and clarity were still poor in many Irish manuscripts, owing to their tendency to compress as much text as possible onto the one page (Jones, 1996). Through restricting the number of variant forms of letters, and producing new, better standardised and legible calligraphic forms, the Anglo-Saxons attempted to emend these failings. Furthermore, word-separation intended to improve clarity and comprehension was implemented in the transcription of existing manuscripts that were written in *scriptio continua*. The Anglo-Saxons also developed a more sophisticated notion of page design, in part by curbing the decorative innovations of the Irish, but also by the establishment of rigid conventions for producing text. Anglo-Saxons also began to use different scripts to discriminate passages of the text; where, for example, two different script styles might be used in a commentary to distinguish the original text from the passage discussing it.

Ironically, the inquiry of the Anglo-Saxons into ancient texts caused some scribes to reintroduce ancient punctuation marks into their own texts, such as the kaput (ᚼ) to mark a new chapter, the diple (ᚼ) to indicate questions, and the ivy-leaf (ᚱ) to separate two sections or distinguish normal text from commentary. When it came to prosodic aspects of the text, however, most scribes merely modified the Irish system of multiple punctuation marks for indicating the significance of pause (Parkes, 1992).

These new practices (*insular scripti*) shaped by the Irish and Anglo-Saxons began to be exported back to the continent by scribes and in books around 800 AD. One such scribe was the English scholar Alcuin (735 – 804 AD), who in the 780s assisted Charlemagne (king of the Franks and Holy Roman emperor) in promoting liturgical, educational, and administrative reforms throughout the Holy Roman Empire. The primary reform Alcuin was occupied with was the revival of ancient Latin—as distinct from *lingua romana* that was
used every day—for use in the business of State and Church (Foley, 1993). The standards required for a revisit to 'Latinity' necessitated wide reading, and consequently, copious reproduction of ancient books. Subsequently, there was a certain amount of confusion between the ancient scripts and conventions and the newer insular ones (Jones, 1996). As a result, scribes started to insert punctuation marks on their own initiative, using both insular punctuation marks and the more ancient ones.

At the same time, however, further reforms were carried out which simplified letter-forms to *litterae absolutae* (invariable letters) so that there was only a single form of each letter, and that form included the minimum number of distinguishing graphical features to enable differentiation from other letter forms. Thus, while the letters of text had come to be standardised, punctuation had not yet attained this, since the marks had not yet acquired sufficiently clear identities in relation to each other or to the scripts in which they were used. The scribes of Charlemagne had succeeded in assembling a variety of punctuation marks from different sources, but had also created the potential for hyper-characterisation through increasing the possible number of variants (Jones, 1996). The number of variants needed to be reduced, and their visual characteristics and position relative to one another refined and defined to facilitate their interpretation and the establishment of their identity (Parkes, 1992).

Alcuin directed the palace school at Aachen from 782 to 796, and was an important element in the educational revival that led to the improvement of spelling and punctuation in biblical and liturgical manuscripts. Alcuin recognised the need for steps to be taken to improve scribes’ knowledge of punctuation, as illustrated in his letter to Charlemagne:

> ...yet it is the employment of those points that has almost entirely disappeared among scribes because of their lack of culture. But just as the dignity of all wisdom and the embellishment of beneficial learning begin to be revived through the diligence of your noble self, so it seems best that the use of these things [punctuation] be restored to the handwriting of those copying... (cited in Parks, 1992, p. 32).
Alcuin is considered to be the first person to bring order to the subject of punctuation, by reshaping the Aristophanic system and creating a number of important additions. The system was primarily fashioned for liturgical use, where the need for adequate and clear punctuation was considered crucial (Foley, 1993). This classification of symbols continued to use interior stops in the form of points; but these were joined by new marks (*puncturae*), which consisted of four marks: *punctus versus* ($) to indicate the end of a declarative sentence, *punctus interrogatius* (?) to end a questioning sentence, *punctus elevatus* (:) to indicate a major medial pause, and *punctus flexus* (.) to denote a minor medial pause (Bohn, 1887 cited by Jones, 1996). These new marks derived from neumes, a system of musical notation known to have been used for Gregorian chant, and indicated not only pauses and syntactical breaks, but also an appropriate inflection of the voice. In a civilisation where, prior to the rise of universities, all education was under monastic command, liturgical practice was bound to influence other forms of writing—particularly since the majority of texts were intended to be read aloud both in public and in private (Bruthiaux, 1993).

Liturgical manuscripts (particularly between the tenth- and thirteenth-centuries) made full use of this inflectional and prosodic system, and this is the source of the colon still used to divide verses of the Psalms in breviaries and prayer books. In the later Middle Ages it was especially the Cistercian, Dominican, and Carthusian orders, and the members of religious communities such as the Brethren of the Common Life, who endeavoured to preserve a mode of punctuation admirably tailored to the continual reading aloud, in church and refectory, that typified the religious life (Parkes, 1992). The *hyphen*, used to mark words divided at the ends of lines, also derived from liturgical uses, and appeared late in the tenth-century. Although single at first, it was often doubled in the period between the fourteenth and eighteenth centuries.
Alcuin’s amendments, though, did not even begin to spread through England until the tenth-century (Foley, 1993), as the volume of material using the older systems of punctuation was simply too large to enable the newer method to take over, particularly since the punctuation system was generally diffused through copying the original text. The *positurae* did become progressively popular beyond liturgical uses, however, particularly those symbols (such as the question mark) that did not have parallels under the old systems. *Positurae* had the advantage of clarity and ease of recognition, as well as a structure that integrated easily with the newer cursive and calligraphic scripts.

However, most late medieval punctuation was irregular by comparison with twelfth-century work, with numerous local variations surfacing—more through the personal inclination of a scribe than on any basis of authority. Although the basic conventions of orthography were well established, there was still no general standardisation of particular marks used, so that while the position in which a mark would appear would be a standard one, the nature of the mark would not necessarily be standard (Jones, 1996). As handwriting became more compressed, and hence the space available for punctuation marks diminished, scribes began to favour simpler marks, most notably the *punctus*, or point. *Punctus* was used to indicate all kinds of pauses, to separate, introduce quotations, and mark abbreviations and titles. Needless to say, this led to an enormous amount of ambiguity, and this dilemma was resolved by attaching other symbols (such as other points and comma-like marks) to distinguish between the various uses of *punctus*. Combined with these symbols, the placement, or ‘height’, of the point ceased to be central, and as a result it was the graphical shape of the punctuation mark that determined meaning, rather than its vertical location (Hector, 1980).

It is perhaps tempting to provide a list of marks that appeared during the late middle English writing period and then propose the variety of uses to which they were put (as several investigators have), but this is problematic. Such an analysis suggests that there was a ‘repertoire’ of punctuation marks from which scribes could choose; yet this was not the
case. There were a small number of signs that appeared in writing, and, undoubtedly, some
marks became quite common, but each manuscript must be considered in its own terms—
this copy of this text by this scribe at this time and place—for there was no common
system in use (Levinson, 1985).

The standardisation of punctuation continued, both in use and function, until the
advent of the humanists (between the 1400s and 1500s). Humanists considered
punctuation to be essential in order for their texts to be read widely and easily. However,
since they regarded eloquence as a process in which their own expression was fashioned,
each writer had to attend to his own punctuation rather that merely following a specified
technique or model. Humanist writers attempted to convey both the logical relationship
between the subordinate constituents of their sentences and the periodic structure of their
discourse, while drawing on the widest possible range of symbols available (Jones, 1996).
New and varied symbols were established (among these were the question mark, the
exclamation point, and the double punctus), in addition to the reintroduction of some of the
ancient Roman symbols, to signify pauses within the sentence, indicating such new
functions as parenthesis (indicated by / or :).

“Ben:Jonson” (1572 – 1637) 9, seen as the most distinctive authorial signature in the
English Renaissance, is noted as having played a large part in the shaping of current
punctuation practice. Van den Berg (1995), conducting a review of historical scholarship,
and in the process, surveying representative passages from Jonson’s work, concludes that
his editorial style conformed to continental Humanist theory. Jonson saw the text as an
organic whole, and not just as a set of autonomous sign systems (such as font, spelling,

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9 Jonson indulged his own preferences when it came to his writing, as most clearly illustrated in his name.
Jonson dropped the h from his surname, thereby making it stand out from the mass of common “Johnsons”
and especially his own family. He inserted a colon (or double punctus) between his first and last name, which
was a common practice among bishops, archbishops, and college masters at Oxford and Cambridge when
‘Latinising’ their first names and signatures. Van den Berg (1995) suggests that by adopting this usage Jonson
may have sought to identify himself with men in authority, or with learned men who shared his interest in
books and language. Importantly, the symbol also identifies Johnson as an adherent of Humanism, eager to
introduce the new punctuation marks developed by continental Humanist writers (Van den Berg, 1995).
capitalisation, punctuation). Advocating the Humanist mode of punctuation, Jonson considered the text to be a body in its own right, its materiality replacing that of the orator’s physical presence (Van den Berg, 1995). Humanist writers replaced the Scholastic practice of equiparative punctuation, which marked the logical propositions of a text, with a new balance of logical marking to clarify the elements of a text, and rhetorical marking to indicate its real or imagined oral delivery (Parkes, 1992). In the seventeenth-century debate about English punctuation largely focused on the competing importance of these two functions. Importantly, the Humanists also established a third function of punctuation: hermeneutic analysis. Hermeneutic punctuation guides interpretation, indicating relationships and nuances in a text (Van den Berg, 1995).

On account of these three different functions in a written text, Jonson and other Humanists marked texts heavily, and developed the semi-colon, the exclamation point, the question mark, and parentheses. Although these symbols began to pass into the general repertoire of punctuation, the contribution of the Humanists to modern punctuation was not just these new marks of punctuation, but also their attitudes to punctuation use. Humanists demanded an exact disambiguation of the meaning and function of each punctuation mark, leading to a dictatorial system (which exerted a powerful influence on later writers) of punctuation use, where only particular marks could be used in particular, constrained circumstances to achieve a particular effect (Parkes, 1992).

Whilst the Humanist mode of writing was growing in influence, the punctuation system was simultaneously undergoing another major change, resulting from the most radical development in the history of orthography—the invention of printing presses and movable metal types, in the 1430s. The growing standardisation of punctuation is attributed to particular type foundries and typefaces gaining dominance, coupled with the desire for the reuse of a small number of metal punctuation mark types. Simple marks were preferred, as these were more easily set into metal type and print. By 1600, marks in
common circulation included the period, comma, colon, semi-colon, question mark, exclamation mark, and parentheses (Jones, 1996; Levinson, 1985).

The form and layout of text was also constrained by the development of print, as it necessitated restrictions as to the vertical displacement of the symbols it contained, consequently fixing the position of punctuation marks as aligned with text. New conventions also had to be fashioned to perform such functions as alignment or reference in commentaries, which meant new symbols. The apostrophe was used, initially to mark elision (omission of a syllable or vowel from a word), and was retained later even when the vowel no longer appeared in the spoken form of the word. A sign of suspension was also developed, which functioned to indicate a point where a speech in a dramatic text had been interrupted. Furthermore, certain other old marks (which could easily be replicated in metal type), such as * and †, were employed for specialised uses, such as marking deliberately omitted letters and referencing footnotes. However, as the number of such notes increased, standard practice of referencing began to use letters or numbers (Jones, 1996).

As the printing trade expanded and the rate of literacy increased, punctuation, in terms of both the structure of marks and their use, was standardised, largely in accordance with Humanist practices (Van den Berg, 1995). Credit for printing the first standardised punctuation marks, as we identify them today, is given to the Italian Aldus Manutius (1450 – 1515), founder of Aldine Press. Manutius recognised the need for a more uniform system, his work paving the way for much of the punctuation used today such as the comma, semi-colon, and colon signs. Some sixty years later, his grandson (also named Aldus) began to define the role of punctuation in sentence structure. Espousing a similar system to that of his Venetian editor and printer grandfather, the younger Aldus stated

10 The mark used for this was a series of dashes or points, which has developed into the modern dash interpolation (suspension of current argument or discourse to begin digression) and the modern ellipsis, which can now be used outside the context of speech (Jones, 1996; Patridge, 1964).
plainly, in his book *Orthographiae Ratio* (System of Orthography), that the main objective of punctuation is clarification of syntax. However, the first person to recommend this syntactical role was the dramatist Ben Jonson in his book *English Drama*.

All the parts of the Syntaxe have already beene declared. There resteth one

generall affection of the whole, disposed thorow every member thereof, as the bloud is

thorow the body; and consisteth in breathing, we pronounce any Sentence; For, whereas

our breath is by nature so short, that we cannot continue without a stay to speake long
together; it was thought necessarie, as well for the speakers ease, as for the plainer
deliverance of the things spoken, to invent this meanes, whereby men, pausing a pretty
while, the whole speech might never the worse be understood.

Jonson, using the analogy of the text being a body, considered logical punctuation marks as its skeletal structure and rhetorical punctuation as indicating its breath. Johnson insisted on the importance of rhetorical punctuation only after completing his survey of logical punctuation, in which he analysed the use of period, comma, semi-colon, and colon marks to convey complete and imperfectly completed sentences. The hermeneutic function of punctuation is implicit in his image of the text as a body. Punctuation conveys the life of a text, ‘blood and breath’, and its symbols (paradoxically referred to as stops) create a sense of its motion as utterance and image (Van den Berg, 1995).

By the end of the sixteenth-century, writers of English were employing most of the marks described by the younger Aldus in 1566; but their purpose was seen as purely elocutionary, and not syntactical as suggested by Jonson. In an attempt to bring order to a basically confused and unsatisfactory situation, ‘breath units’ were used. Language pundits specified a pause of one unit for a comma, of two units for a semi-colon, and of three for a colon11 (Foley, 1993; Parkes, 1992).

11 Most notably George Puttenham, in his treatise *The Arte of English Poesie* (1589), and Simon Daines, in *Orthogopia Anglicana* (1640).
By the early seventeenth-century most modern punctuation signs were already established (Foley, 1993), and the notion of the orthographic sentence was tightly embedded in writing practice. The orthographic sentence is defined as the graphical notion of the sentence, which contains a single line of argument, and is delimited with capitalisation and final-stopping punctuation features (Allerton, 1969; Crystal, 1987; Jones, 1996; Nunberg, 1990). The term orthographic sentence is therefore applied to the unit of text that is defined by punctuation: writing that begins with a capital letter and ends with a full stop, question mark or exclamation mark. This definition appears circular, however, because if one attempts to establish rules to account for the distribution of punctuation, the rules require the prior notion of a sentence, yet the clearest identification of a sentence hinges on the proper placement of capital letters and full stops (Levinson, 1985). The term orthographic sentence embodies no commitment as to whether or not the unit concerned is syntactically a sentence, a question that may have no determinate answer (Nunberg et al., 2002). Nevertheless, as they are mutually defining, an analysis of punctuation takes one into the realm of the sentence, and to examine the sentence involves an examination of punctuation.

The prevalence of the orthographic sentence at this time is clearly illustrated in the influential treatises on syntactical punctuation written by Robert Monteith in 1704 and Joseph Robertson in 1795. Previously, the situation had been far less clear, with whole paragraphs sometimes being punctuated with marks less significant than the full-stop or, conversely, full-stops occurring in the middle of what would today be considered a sentence, since the punctuation related to elocutionary pauses to be made in reading (both silent and aloud). Importantly, at the same time, quotation marks began to be used to signify quoted speech, rather than the diple marks that had been used since antiquity (Jones, 1996). Therefore, in many ways, it was not until well after the invention of movable type created a population of readers that marks of punctuation began to reflect anything
other than the spoken language, or attempts at the spoken language (Levinson, 1985; Saenger, 1997).

Excessive punctuation was common in the eighteenth-century, and at its most extreme used commas with every subordinate clause and separable phrase. It was the lexicographers Henry Watson Fowler and Francis George Fowler, in *The King's English*, published in 1906, who established the current British practice of lighter punctuation. American punctuation has followed the same general path as in Britain, although it is generally acknowledged that the American authorities have been stricter in the development of prescriptive rules (Meyer, 1987).

It was the mechanical nature of movable type and the mass products of the printing press that led to the eventual standardisation of punctuation, disseminated related systems widely, and halted any further substantial changes (Levinson, 1985). Printers, who had ultimate control over the layout properties of published works, were not only influential in facilitating the standardisation of punctuation conventions, but also in promoting the grammatical-punctuation agenda advocated by a number of eighteenth- and nineteenth-century grammarians (Little, 1983). Though Manutius had intended his marks to specify grammatical relationships within a sentence, later printers commonly used the pointing system to indicate rhetorical pauses. This schizoid mix of professed function and actual usage has endured to this present day (Baron, 2001).

**2.4 SUMMARY**

The initial advancement of English punctuation is the product of four developmental strands: punctuation of Latin texts, punctuating of vernacular texts, the growth of silent reading, and the founding of printing. There is no direct line of decent that can be traced for English punctuation. Early texts were essentially transcriptions, which became intelligible only when read aloud. Word spacing, along with syntactically significant critical marks, became necessary only after the formation of texts intended to be read silently,
where the meaning-bearing units of language could no longer be derived from segmental and prosodic information provided by speech (Scholes & Willis, 1990). While there was a practice of marking some written texts during much of the Middle Ages, there was no common system of punctuation until sometime in the eighteenth-century, well after the arrival of printing. Although some symbols in current use resemble—or are even identical to—past markings, current practices do not directly derive from any practice prior to the establishment of standard rules by the early printers. This situation transpired because, until movable type and the influx of the printed book itself developed a large population of silent readers, writing was viewed as merely a guide to, or transcription of, speaking—most commonly to an audience or to ones ‘inner ear’ (Levinson, 1985). Consequently, punctuation to aid the silent reader (syntactic and stylistic) was not necessary until writing began to diverge from spoken language. The homogeny of punctuation practice was the product of the intersection of humanist attitudes and practices with the development of printing.
Chapter 3: Contemporary Punctuation Practice

Punctuation is ubiquitous and invisible. It exercises a powerful influence over the interpretation of a text, but is rarely discussed (O'Donnell, 1994).

3.1 PREAMBLE

In some languages, including English, it is possible to define a sentence by referring to the punctuation used. Commonly, an English sentence begins with a capital letter and is completed with a full stop (or another ‘final’ mark of punctuation such as an exclamation mark or a question mark). However, defining a sentence via the punctuation used is problematic due to the fact that many languages (the most obvious being Asiatic languages) do not make use of such features; and even in those, such as English, which do, punctuation is not always an instantly recognisable guide (Crystal, 1994). It is notoriously problematic to prescribe rules of best practice when in governing punctuation. Punctuation is, and perhaps always will be, a personal matter and, in being so, tends to show a great diversity. Where, for example, spelling is (generally) either right or wrong regardless of the level of formality at which it is used, punctuation and layout features of an informal communication are likely to differ markedly from those of a formal communication by the same person (Nunberg et al., 2002; Squires, 1994). This uncertainty has led some specialists, particularly lawyers, often omitting punctuation altogether. The claim (by some lawyers) has always been that the variability of punctuation rules leads to possible difficulties of interpretation, so their omission clarifies matters. This is of course highly debatable, and it has been suggested (not always light-heartedly) that the lack of clarity caused by the absence of punctuation creates work for the lawyers.
It would, in fact, be easy, on the basis of the similarity among the prescriptive rulebooks, to wrongly assume that punctuation has become standardised. However, punctuation is far from being standardised, and no one system is in general use (Halverson & Crole, 1966). The differences among writers and between genres (e.g., fiction and technical writing), and the absence of consensus on the application of rules by even experienced copy editors clearly indicate the lack of homogeneity in punctuation usage (Cordeiro, 1988; Cronnell, 1980).

As discussed in Chapter 2, familiar marks in modern English writing (such as periods and commas) have often served other demarcation functions. For example, the modern period was previously used to mark extended pauses, not necessarily at the end of a sentence. In the same way, the functions served by modern marks were sometimes indicated by symbols that have fallen into disuse or have evolved into a noticeably different-looking mark. For instance, the brief pause associated in the present day with the comma was indicated in the Middle Ages by *punctus elavatus* or a *virgule*, which was, ultimately, graphically transformed into the modern comma (Baron, 2001). Not surprisingly, punctuation exhibits a considerable amount of variation cross-linguistically also. Practices in layout and in the use of capitalisation, in the forms of punctuation symbols, and rules governing punctuation usage all have their own histories, language by language. These histories and practices, although interesting in their own right, will not be dealt with directly in this dissertation.

Writing manuals have typically adopted an encyclopaedic approach to English punctuation rather than a didactic one. Thus, there is an extensive list of what the range of punctuation does, but the literature is unrepresentative of what specific communities of writers actually do with it (Bruthiaux, 1995). Parks (1992) notes that the essential principle for interpreting punctuation is the value and function of each symbol in relation to context and other symbols, rather than in relation to a supposed value and function for that symbol when considered in isolation. It is the aim of this chapter to provide an overview of the
functions and roles performed (or at least suggested to be performed) by punctuation, and
in doing so to discuss current practices and perspectives in relation to these orthographic
devices.

3.2 FUNCTIONS OF ENGLISH PUNCTUATION: PROSODY AND SYNTAX

Punctuation, in effect, has been assigned two simultaneous, and not always
compatible, functions—those being prosodic (elocutionary) and syntactic (Bruthiaux, 1995;
Nunberg, 1990). Prosodic punctuation acts as a guide to pausing, whilst the purpose of
syntactic punctuation is to guide grammatical construction. It is useful to sketch the
functions of modern punctuation by contrasting them with the old functions—the latter
tended to be oratorical, based on the needs of the speaker reading the text aloud, indicating
the pauses in the sentence more than they did the relations of the parts; and, therefore,
abundant. In contrast, modern use of punctuation is (or strives to be) logical, caring little
about speech pauses, and minimalist in its application, with modern writers “forever
striving to avoid punctuating at all” (Barzun, 1975, p. 189). Consequently, prosodic effects
have been marginalised, although not totally abandoned, to the extent that they are seldom
pedagogically emphasised.

Five models of the function of punctuation have, at various times, been prevalent.
These five models (breathing, pause, cadence, grammatical and expository) are neither
mutually exclusive, nor are they especially clear (Levinson, 1985). The first three models fall
under the heading of prosody or elocution, while the forth and fifth models fit loosely into
the syntactic or structural grouping.

The breathing hypothesis derives from the oldest medieval manuscripts in Latin, and
holds that the marks of punctuation point the reader to where in the string of reading to
take a breath (obviously, such a reader is an oral reader). The pause model has been far
more persistent, and holds that there are systematic pauses of differing and measurable
length, whose quantitative time-relationships can be fixed. The cadence model maintains
that punctuation marks indeed indicate pauses, but that these pauses come at the end of certain intonational contours, and therefore reflect the rhythm in reading.

Opposed to these elocutionary approaches are those that view the marks as a way of indicating structure or meaning. The grammatical model describes punctuation in terms of its relationship to syntactic structures such as sentences, clauses and phrases, and is seen as reflecting the structure of the language. The fifth and final model, the expository, suggests that the marks of punctuation are used to make clear the meaning of the text—this is often referred to as the logical or semantic function of punctuation (Levinson, 1985).

It is argued here that the use of the terminology above has hindered progress in the understanding of punctuation, due to the difficulty in deciding what a particular mark in a particular position is doing. Moreover, the functions are not mutually exclusive. Thus, does only an expository punctuation mark make meaning clear, given that an oratorical approach, which divides the passage into intonational phrases, also serves a logical function? An additional problem is that these terms are not even used in the few serious works on punctuation with any consistency (Levinson, 1985). Punctuation is probably best understood if its purposes are divided into two clearly specified categories: prosodic and syntactic. This dichotomy provides a simpler framework and can be made far more precise in its application to actual practice. In its prosodic function, punctuation serves as a set of directives for reading text aloud. In its syntactic function, punctuation serves, like other aspects of orthography, to convey sense. This is achieved by identifying lexical elements and clausal, phrasal, and sentential structure (Scholes & Willis, 1990).

As discussed in the previous chapter, the original function of punctuation was elocutionary; oral reading, after all, was the channel for imparting written discourse. After the development of printing and the expansion of silent reading, however, a syntactic purpose evolved. By the eighteenth-century the latter purpose was dominant, perhaps reflecting a reaction against the confusion created by attempts to map punctuation marks
onto every prosodic detail (Bruthiaux, 1993)—even so, prosodic purposes were always evident (Lupton, 1988).

Not surprisingly, there is a less than perfect consensus between analysts on the specific importance of these two functions for a punctuation mark in any given text. Bruthiaux (1993) shows that, over a period of five centuries, views of the matter have shifted from an almost exclusive emphasis on the prosodic function, to stressing the syntactic function, and finally to attempts by modern pundits to integrate the two. Thus, within a particular historical period, there may have been contradictory messages regarding the relationship between speech and writing. The ways in which punctuation was used indicate that relationship. However, rather than conclude that past or present punctuation is ‘lawless’, it is necessary to be alert to the possibility that it often marks both written and spoken functions in the same text (Baron, 2001).

As written language shares the same core grammar as spoken language (even though the two mediums differ in very fundamental respects), there will always be an association between grammatical units and prosodic ones. In English there is the pattern whereby the clause (grammatical unit) is related to the tone group (a phonological unit, which is categorised by intonation), and, other things being equal, each clause is spoken as a tone group. By this rationale, when writing discourse in English, the punctuation can be thought of indifferently as marking off grammatical units or as marking off prosodic units (Halliday, 1985). Things are frequently not equal, however, and the primary reason why the association between tone group and clause is significant is precisely because it is not static. Tone group, generally, expresses a piece of information; what the speaker chooses to encode as a single message block. The relation of this to the clause is merely the baseline to which all other alignments can be related as a point of reference. Therefore, a speaker is able to organise a particular clause as two or more information units, or combine two clauses into one—each alternative has its own particular meaning in the context.
This dissimilarity between grammatical units and tone groups has critical
consequences for punctuation. If a writer is composing a passage in the written mode, the
punctuation will purely follow the grammar, as there is no necessary implication of
utterance, hence no prosody, or any alternative pattern of organization. Conversely, if a
writer is composing with ‘their ear’, which is essentially spoken discourse, there is the
implication of an utterance. Therefore, the writer is shaping the text prosodically, and
conflict may arise, since it is unclear whether the writer should be using the clause or the
tone group (or some other division) as the basic unit with which to work (Halliday, 1985).
It is this confusion that forms the basis for the many instances of uncertainty that we feel
when attempting to punctuate, or when reading something we believe should have been
punctuated differently.

To a large extent it doesn’t matter to which principle one adheres (punctuation
according to grammar or according to phonology), as much of the time there will be
minimal or no difference between clauses and tone groups. When they do differ, however,
two possibilities arise: shifting between one and the other, or combining both. Additionally,
there are some writers who enthusiastically prefer one or the other type—who are at heart
either grammatical punctuators, or phonological punctuators (Halliday, 1985). The choices
a writer makes regarding how to punctuate are often seen as part of his or her individual
style.

3.2.1 Prosodic

Punctuation practice is rooted in oral language, and oral face-to-face speech is a
multi-modal, multi-channel occurrence that encodes a lot of surplus information (Edlund,
1999). Concurrent with speaking words embedded in grammatical structures, we vary the
intensity of speech; pause for effect; modulate the intonation; and use body language and
facial expressions. However, the needs of the eye are quite different from those of the
voice and ear. Written language leaves only words and grammatical structures to carry the
message, excluding visual and auditory channels. Rather than a broad array of often-redundant channels to rely on, the writer is left with only the aforementioned two. Or, perhaps, more accurately, two and a quarter, suggests Edlund (1999), as we also have punctuation.

When talking, an individual does not depend solely upon words to communicate meaning. A raise of an eyebrow can be quite telling, as may a shrug or a wink—facial and bodily gestures can, and often do, add much to the spoken words themselves. Moreover, tone and stress of the speaker's voice may influence the meaning of the spoken words: a yell or whisper; speaking calmly or angrily; or lowering and raising the voice at the end of statement or question (Nagle, 1993; Shaw, 1963). Similarly, when writing one cannot expect words alone to make the meaning known and clear to the reader. The pauses, stresses, and inflections that occur in speech often need to be represented by various marks of punctuation, if meaning is to be unambiguous.

As a result, punctuation marks have been considered as simply cues to the possible prosodic and pausal features of a text, and thus firmly tied to intonation (Dawkins, 1992b; Edlund, 1999; Jones, 1996). Punctuation, viewed in this way, functions to mark some of the intonational contours that a writer may perceive as accompanying the text or may believe might surface if texts were to be read aloud (Bruthiaux, 1995). At the very least, punctuation marks are an imperfect reflection of those pauses and stresses in spoken language known as prosodic cues (Nunberg et al., 2002; Van de Water & O'Connell, 1985).

Even with correct punctuation, which perhaps partly makes up for the missing indications of the voice and face in speech, the chances of misunderstanding remain great, as the art of writing differs on numerous points from the practice of speaking words (Barzun, 1975; Hopkins, 1982). In conversation, people rarely organise their thoughts and words into fully intelligible remarks—relying on a sort of oral shorthand where the listener 'jumps' to the right conclusion. Context cues and the ability of the listener to ask questions often settle uncertainty. In contrast, with a written text there is no opportunity to ask
questions; all the reader has is words and punctuation marks (Barzun, 1975). It follows that these must be set out right in order to foster a correct understanding by the reader.

Physiology reveals that speech organs are stimulated during reading—something that has been termed the inner ear (the nerves and muscles of gesticulation). Science has demonstrated what literary scholars have long believed: readers inwardly turn writing into speech, so far as they are able (McMullen, 2001). This statement could be interpreted as a claim about how most writers initially learn the use of punctuation, yet it is not clear what relevance that would have to the description of what it is exactly that competent writers consult when using punctuation. Nor is it necessary that every learner proceed in this way. After all, a congenitally deaf person can learn to punctuate.

Although the evidence is largely anecdotal and based on self-report, it does appear that readers tend to associate a form of acoustic image with the presence of certain types of punctuation marks. Perhaps this is what language researchers have in mind when they advocate the transcriptional perspective of punctuation, and what writers label 'a good ear' or 'a rhythmic sense' (Nunberg, 1990). Yet whatever the psychological mechanism related to the concept of an inner ear, it is far from clear what explanatory purpose would be served by claiming that punctuation transcribes it, particularly when many parts of it (such as colons or parentheses) have no actual correlates in ordinary speech.

When reading aloud, the general understanding is that a pause is taken at the boundaries marked by punctuation, yet this pause is not a structural feature. In spontaneous spoken discourse there are often pauses, but not only are these fewer and shorter than those that are characteristic of reading aloud, they also appear at different places. In natural speech, pauses are not, in the main, associated with grammatical boundaries; rather, the speaker tends to pause in the middle of a structure when he or she arrives to a low-frequency word, or a word not predictable from context (Halliday, 1985). For this reason, punctuation (whether grammatical or phonological) is not actually representing pauses—if one pauses when reading aloud then this is a special feature linked
to that activity, where the written text is being consciously reprocessed and translated into a spoken medium.

Therefore, although intonation in spoken language and punctuation in written language share similar roles, this does not mean that one is simply a transcription of the other into another modality. In questioning this claim Nunberg (1990) not only points out that the correlation between punctuation and intonation is not very large, but also that such a transcriptional account of punctuation is, theoretically, rather uninteresting. Moreover, the correlation is not universal, as there are no spoken manifestations of quotation marks, capitalisations or word divisions. In fact, particularly in relation to quotation marks, it has become common for speakers to signal their awareness of this deficiency by indicating them with gestures.

3.2.2 Syntactical

By the mid-eighteen-hundreds, language analysts began to argue that it is the grammatical form of the construction of a passage, and not the rhetorical mode of delivery, which is the underlying rule by which the act of punctuation should be regulated. The syntactic approach to punctuation had completely emerged and, theoretically at least, replaced the elocutionary point of view. Remnants of this former divergence still existed, however, with the dictum that ‘commas equal pauses’ often being taught, even in an otherwise completely grammatical account (Baldwin & Coady, 1978). Syntactic punctuation acts to guide grammatical construction of text, in order to clarify relationships between sentences or between independent and dependent clauses (Bruthiaux, 1995). Through this style of punctuation, then, the reader is able to see the hierarchical structure of sentences, as various marks indicate the status of text boundaries—in essence acting as units of sense (Waller, 1988).

As English dropped most of its case endings, the decoding of textual relationships became heavily dependent on logical word order. The grammatical aspect of punctuation
came to be seen as more significant, therefore, since punctuation helps to make word order comprehensible (Bruthiaux, 1993). Clear punctuation may well allow the writer to retain control and direction of the communication, pacifying the comprehension process of the reader; thereby effectively steering them in the correct or desired direction (Hill, 1996). Perhaps it is not stretching the argument too far to suggest that the elocutionary/grammatical distinction reflects the writer-control/reader-control dichotomy.

As the number of writing manuals multiplied at the beginning of the last century, numerous language authorities began to adopt the view that, since the system is grounded in reason, it can be understood and, by extension, taught. The problem about the sentence for schooling purposes, however, is that it is not a unit of speech—it is a unit of written language. In spoken language, the nearest equivalent is a speech-unit, which, grammatically or semantically, does not have to be a complete unit. The speech-unit does not have to be a clause, does not have to be an explicit grammatical link to neighbouring units (as intonation can provide these links instead); and does not even have to include all there is to be said about its topic, since the following units can add, expand, revert and so forth (Pearce, 1983).

Although later twentieth century writing manuals note the duality of prosody and syntax, they opt to concentrate on the structural dimension on the grounds that punctuation marks do not transcribe spontaneous speech even when they indicate some form of pause (Gibbs, 1982; Paxon, 1986; Raskin & Weiser, 1987). Furthermore, some guides warn that punctuating by ear can be a misleading approach (Meyer & Smith, 1987), and that effective punctuation can come only from learning the meaning and use of each mark (McCuen & Winkler, 1986; O'Hare & Memering, 1990). Quirk, Greenbaum and Syartvik (1985) see no systematic link between punctuation and prosody, Nunberg (1990) claims there is not a very good correlation, and Lakoff (1982, cited in Bruthiaux, 1995) writes that the reliance on aberrant punctuation in some modern narrative prose shows that punctuation must be essentially syntactic if rules must be broken to imitate oral style.
3.2.3 Summary

These two representations of punctuation—to indicate pauses for breathing and for rhetorical effect, and to delineate the grammatical boundaries of text—are to a certain extent contradictory, opposing the creative, living and breathing individual voice with an analytical, logical and rule-driven structure (Edlund, 1999). Historically, written English shows a continuous change in its relationship to speech, from a heavy dependency to significant independence, and then returning to a greater dependency on speech once again. Some commentators have argued that the functional development of punctuation has mirrored that of written English (Baron, 2001; Bruthiaux, 1993; Casson, 1988; Foley, 1993; Jones, 1996; Lupton, 1988), as it has progressed from a mainly oral basis, to becoming a highly rule-bound and systematic grammatical system, and lastly to our modern-day practice which is a blend of the two. However, this seems to be something of an oversimplification. Such commentators tend to refer to the way in which only one punctuation mark (the comma) is described. Most other punctuation marks are interpreted in similar ways by all schools of thought. For example, even the most grammar-bound of punctuators admits that the exclamation mark connotes a tone of voice. Conversely, elocutionary punctuators have always reserved the full stop to indicate the end of sentences, even when there may be a case for an equally long pause mid-sentence (Waller, 1988).

This section has shown that views of the nature and function of punctuation did not shift smoothly from prosody to syntax (and, perhaps, back again), nor has there been any clear resolution. Language analysts tend to emphasise the structural dimensions of punctuation, yet interest in the prosodic dimension is rarely entirely absent from writings on the subject. Moreover, despite the development of prescriptive rules, the exact nature of punctuation has remained hazy and there has been no indication of a clear resolution (Bruthiaux, 1995). One issue is clear, however: while we may choose to separate syntax and
prosody for the purpose of analysis, these aspects are largely inseparable in use (Meyer, 1987).

3.3 SYNTACTIC ROLES OF ENGLISH PUNCTUATION

The most obvious field to consult for an account of the function and use of punctuation is that of linguistics. However, if one delves into the subject, it is quickly apparent that there has been a marked lack of empirical investigation in this area. As Nunberg (1990, p. 9) states:

*With few exceptions, the extensive literature on written language and writing systems has almost nothing to say about punctuation, from either a historical or theoretical point of view. There is little reason to revise the observation that Gleason (1965) made more than twenty years ago, to the effect that "no appreciable amount of research has ever been devoted to [questions of punctuation]... Indeed, there is available very little descriptive data on how English, or any other, punctuation system is actually used. The large volume of published material which is available is predominantly normative..."

As discussed in Chapter 2, it was not until well after the introduction of print that there emerges anything like the standardised, sophisticated and autonomous system of punctuation marks that is used in intellectualised languages such as English. For this reason, the study of punctuation has been irrelevant to current discussions of the genesis of writing, or about the changes that the development of writing works had on individual cognition. Nonetheless, punctuation is of basic importance to writing; truly organic, and a genuine part of written language (Shaw, 1963).

While accepting that punctuation occupies a linguistic role of its own, what such a role would be is not clearly evident. As there is still no succinct account of the formal function of punctuation, one is expected to rely mainly on personal intuitions (Jones, 1994). While there may be agreement on core situations when the use of a given
punctuation mark is desirable, or even necessary, there are many conditions where their use is less apparent. Thus, there is vast range of idiosyncrasy associated with punctuation (Jones, 1994), as punctuation has always been considered a personal matter (Aronoff, 1994). Hence, punctuation is not always uniformly subject to precise and unwavering rules; it is often illogical, with commonsense not offering salvation—certain punctuation marks are matters of convention, nothing else.

The majority of languages formally define the circumstances when punctuation is mandatory (Crystal, 1987; Parkes, 1992); however, the number of such circumstances differs depending on the language (Jones, 1994). While it is acknowledged that there is no all-encompassing theory of punctuation; this does not mean that there are no interpretations of the subject at all. Consequently, one does not have to look askance at punctuation as, fortunately, an individual does not have to depend totally on personal intuitions.

The grammar of language is organised through a small hierarchy of units of different size: in English, sentences, clauses, phrases, words and morphemes (Halliday, 1985). Collectively the symbols of punctuation act to provide boundary markings for these units. The two most distinctive units, words and sentences, were the first to be associated with punctuation—words were marked off by spaces and sentences by full stops. Subsequently, minor boundaries for intermediate units were provided, such as the comma for weaker boundaries and the colon for stronger ones. Both can be used to separate clauses, and the comma is also used to mark off phrases, and even words. One of the most recent distinctions was that made between a colon and a semicolon, the colon having a special cataphoric (forward-referencing) implication. Figure 3.1, adapted from Jones (1996), provides an indication of the position of punctuation in orthography, as well as providing a taxonomy of roles (and respective symbols) associated with punctuation.
Figure 3.1. Taxonomical hierarchy for punctuation

Viewed in these terms, punctuation is observed as the primary element of the range of non-lexical orthography; within this definition it has been suggested that there are three broad functions that the punctuation mark can perform: delimiting, separating and disambiguating (Nunberg, 1990). Each category is distinct from the others, as it performs a different linguistic function. Some punctuation marks, however, fall into multiple categories, as they can have different roles—the comma is the most notable in this regard. However, in each given instance a multi-category punctuation marker can only perform one given role, and hence only occur in a single category (Jones, 1994).

3.3.1 Delimiting

Delimiters (such as commas, parentheses and dashes) occur immediately before and after a particular expression, effectively removing that expression from the immediate syntactic context of the surrounding sentence. The delimited phrase then acts as a modifier to adjacent phrases in the original sentence instead (Jones, 1994). In example 3.1 my supervisor acts to modify Peter.
(3.1) Peter, my supervisor, is running for the new position of President.

3.3.2 Separating

Punctuation marks serving the function of separating (e.g., commas, semicolons) occur between similar grammatical items and indicate that the items form a list, as illustrated in example 3.2. For this reason, there is a great deal of similarity in behaviour between separators and conjunctions (such as and)—the former seem to abbreviate the latter (Jones, 1994).

(3.2) The brands of beer Adrian likes to drink are Coopers, Victoria Bitter, Fosters and Carlton Cold.

3.3.3 Disambiguating

Disambiguating marks perhaps illustrate best the importance of punctuation in written language. These marks, usually commas, occur in positions where an unintentional ambiguity could result if the marks were not there (Squires, 1994). A universal justification for the distribution of punctuation is that it prevents the incorrect parsing of the constituent structure of a sentence\(^\text{12}\). In example 3.3 a simple comma takes all the savageness out of the expression.

(3.3) Let’s eat Scott! / Let’s eat, Scott!

\(^{12}\) Although the distribution of commas is said to have this effect, it does not appear evident that such use of punctuation is obligatory.
Some particular languages, such as English, have a minimal level of formal definition, with the only necessary punctuation being a full stop or a similar value (e.g., question mark) at the completion of a sentence. Other languages, however, have rather more conventional systems of punctuation, so that in German, for example, a comma is mandatory before all finite and subordinate clauses.

3.4 THE CURRENT STATUS OF ENGLISH PUNCTUATION

A strong dependence on punctuation marks by readers can only be the result of encounters with them that are largely consistent. Long before students are taught the intricacies of punctuation, they have become conditioned to respond to the uniformity of the marks, and possibly to have a greater unconscious mastery of what the marks signify than they are likely consciously to grasp. In contrast, a writer, if aiming to facilitate reading, needs to have an awareness of the responses to punctuation. Such a responsibility involves mastery of a relatively small number of situations where punctuation practices are consistent, as well as an appreciation that certain marks create specific expectations, and that failure to satisfy such expectations gives rise to unclear writing (Spradley, 1971). A great deal of written material, such as books, newspapers and journals, has text edited by people whose profession is precisely to prepare text for publication (although, recently, this seems to have been less consistently the case). To a large extent this process involves the conscious application of codified rules, set out in manuals specific to a particular publishing house or accepted more widely as authoritative guides (Nunberg et al., 2002). Yet in spite of this codification, punctuation practice is by no means entirely uniform.

If one looks at writing manuals and guides, it is clear that there are correct and incorrect ways of using punctuation, and each suggests that punctuation should be used to make clear certain relationships in the text. There are certainly conventions for the use of punctuation, but they are rarely learned in the way in which rules of grammar are learned. Given that punctuation marks reside only in the world of written language, we have
considerable less practice at using them than the rules of grammar proper, which are
exercised in both writing and speaking (Dale, 1991). It is perhaps because of this limited
use that rules of punctuation appear more like a set of artificial conventions than do the
rules of syntax; and it is possible that it is in response to this perception that people feel
uncomfortable with the notion that punctuation marks obey rules.

Introductory, intermediate and advanced handbooks on punctuation usually are
pedagogical approaches, and typically contain lengthy authoritarian passages on the
individual marks. Commonly, these reviews employ a prescriptive treatment of
punctuation, in which long lists of rules are given, but the actual practice is not considered
(Bayraktar et al., 1998). Moreover, such handbooks generally provide rules for the use of
punctuation based totally on the structural aspects of sentences, and it is only on rare
occasions that manuals refer to speech. The elocutionary purpose of punctuation is
maintained largely in the field of linguistics—due no doubt to the structuralist position that
writing is merely a visual representation of speech (Scholes & Willis, 1990).

While numerous manuals that provide detailed descriptions of the English
punctuation system by stressing the specific properties of each mark, they rarely deal with
the relative frequency of each mark. On the contrary, they are inclined to give equal status
to all the marks in the system—possibly overemphasising the role of intermediate marks,
such as colon, semicolon, and dash (Bruthiaux, 1995; Bruthiaux, 1993). Consequently,
student and adult writers may well labour under the misapprehension that all marks in the
punctuation system warrant equal effort and attention.

The work by Meyer (1987) is the first example of a purely descriptive study of
punctuation, and he makes the observation that the functions of marks and their
realisations are distinct concepts. Concentrating on American practice and using examples
from the Brown Corpus (Francis & Kucera, 1982), he puts forward three functions of
punctuation: to help the reader understand the text easily, to emphasise a concept, and to
vary the rhythm of the text (Meyer, 1987). The realisation of these functions, on the other
hand, falls into two main categories, marks that separate, and marks that enclose (Bayraktar et al., 1998). Meyer’s work, however, suffers from a limitation that affects many types of statistical surveys, as he considers only what does occur, and neglects to ask about the constraints that account for the non-occurrence of various sequences.

Nunberg’s (1990) valuable examination of the linguistics of punctuation was a catalyst for much of the research in the past decade. Nunberg argues that the punctuation system is, firstly, systematic and linguistic, in the sense that it obeys principles and constraints of a type familiar from work in other linguistic subsystems such as phonology or syntax, and secondly, it is a separate linguistic subsystem not reducible to principles of (prosodic) phonology or syntax (Briscoe, 1996). Further, he attacks the general opinion that punctuation is prescriptive, and only a device for reflecting intonation, arguing that, after the divergence of written and spoken languages, punctuation has become a linguistic system in its own right. He puts forward two separate grammars to analyse text: a lexical grammar, which accounts for text-categories occurring between the punctuation marks, and a text grammar, which deals with the structure of punctuation and the relation of punctuation marks to the text-categories they separate (Nunberg, 1990).

Textbooks that venture to give advice about punctuation are becoming very uncommon, and those that endure are increasingly ready to play Canute, as time and again they lay down the rules, while writers, publishers and printers behave quite otherwise. Pearce (1983) even suggests that in many cases the teacher’s best policy is to be positively antinomian and do the opposite of what the textbooks say. Punctuation is more complicated and more subtle than the broad range of manuals suggest, and the teacher is not to know which textbook rules to reject, which to invert, and which to adopt (Pearce, 1983).

Yet what is the appropriate measure of punctuation? Typically, effective punctuation goes unnoticed—the marks reinforce the logic of the sentence and remain quite unobtrusive (O’Donnell, 1994). One measure, then, could be the degree of success in
unobtrusively aiding the reader in recognising and anticipating the grammatical and logical structures likely to be encountered. By this rationale, the only punctuation that is incorrect is that which clashes with what the text is in fact intended to express (Spradley, 1971). Such a reader-oriented analysis of punctuation promotes acquisition of the ability to judge the appropriateness of a mark, rather than the memorisation of the multitude of subtle rules. According to Dawkins (1992a) two propositions suggest themselves: firstly, punctuation practice varies from genre to genre, and, secondly, skilled writers punctuate according to needs, not according to the rules.

Quirk et al. (1985), in what has been called the most comprehensive examination of modern English, examine the statistical data on commas with and and but between coordinate clauses and conclude that it is likely that the general notion that punctuation conforms to grammatical rather than rhetorical considerations is, in reality, overridden. Moreover, the data suggested that writers are dealing with tendencies, which although quite comprehensible, are by no means rules (Quirk et al., 1985). Many of the best non-fiction writers violate punctuation rules frequently enough to indicate that the rules neither indicate precisely what to do nor inform very accurately about what is done (Chapman, 1993; Dale, 1991; Edlund, 1999; Jones, 1996; Levinson, 1985). In an examination of the use of the entire hierarchy of punctuation marks by 18 prominent nonfiction authors, Dawkins (1992a) found disagreement and inconsistency among all of them concerning application of punctuation rules.

Simpler systemisation of punctuation, which downplays the importance of rules and emphasises, in their place, principles, has been proposed as an approach that offers more promise—both theoretically and pedagogically (Dawkins, 1992a; Limaye, 1983). One assumption of such an approach is that writers have an intuitive sense of the hierarchy of marks. Dawkins (1992a) suggests that it is semantic intent, not the rules, that governs the punctuation practices of top writers. If punctuation is looked at as a process based on what writers intend, only two principles are needed: firstly, punctuate only to achieve clarity
and/or effectiveness; and secondly, use the hierarchy of marks to show the nature and degree of separation (Dawkins, 1992b). Dawkins (1992b) introduces the concept of raising or lowering a mark on the hierarchy, depending on the desired effect. The higher up the hierarchy one goes, the greater the separation, and the greater the emphasis for the added material. Thus, in sentences 3.4 – 3.7 the likelihood of Benjamin writing the journal article diminishes, and the irony of the tone increases, as the punctuation marks get stronger.

(3.4) Benjamin promised to write the article when he had the time.
(3.5) Benjamin promised to write the article, when he had the time.
(3.6) Benjamin promised to write the article—when he had the time.
(3.7) Benjamin promised to write the article. When he had the time.

Dawkins’ central argument is that good writers use punctuation; not to indicate breathing points; not to satisfy grammatical rules; but to create rhetorical effects. Sentence 3.7, for example, violates a basic handbook rule, and Dawkins’s system explains why this rule is so often broken (Edlund, 1999).

A benefit of systematising punctuation rules, and emphasising the principles, is that it appeals to reason, semantic intentions and sense of rhetorical effectiveness, rather than the need to be ‘correct’ according to a set of confusing rules. Similarly, it has the potential to make punctuation easier to learn (perhaps avoiding the difficulty associated with rote learning of unrelated rules) as well as increasing confidence when punctuating.

For the most part, however, modern authors of writing manuals still continue to emphasise internal logic over prosodic factors, and to grant each mark in the punctuation system equal emphasis, not as a indication of its usage or frequency in naturally-occurring texts, but merely because it exists as a resource (Bruthiaux, 1995). Consequently, writing guides do not have a large role to play in the prioritisation of education needs for writers. It is perhaps advantageous, therefore, for instructors to encourage their students to adopt an
approach based on contemporary practice, and that writing manuals should be viewed as merely theoretically interesting inventories of the potential of punctuation, not as learning or teaching tools, which their promoters consider them to be. On the other hand, this point may be more reflective of the inadequacy of such manuals to date, rather than a point 'in principle'.

3.4.1 Punctuating in Contemporary Orthography

At the beginning of this century we are witnessing, perhaps, the culmination of a progression from 'heavy' to 'light' punctuation (Dawkins, 1992a). There seem to be two general philosophies guiding the use of punctuation (particularly commas): the open style, where marks are used only where they are absolutely necessary; and the closed style, where punctuation is used wherever permitted. The second stance is now considered old fashioned, while the first is not exactly user-friendly (Hay-Roe, 1997). Quirk et al. (1985), discussing the current punctuation style, suggest that, in preference to heavily punctuating sentences, writers often move in the opposite direction, towards light punctuation, just sufficiently to make their sentences quickly and easily understood. The distinction is to do with optional punctuation, especially commas: a light style puts in relatively few commas in those places where they are optional rather than obligatory (Commonwealth Department of Finance and Administration, 2002; Nunberg et al., 2002; The University of Chicago Press, 1993).

Stylistic handbooks tend to suggest that “a useful rule of thumb is to punctuate a lightly as possible without holding up or misleading the readers” (Hughes, Drury, & Barrett, 1993, p. 432), that the use of a comma is mainly a matter of good judgement, with ease of reading as the end in view (The University of Chicago Press, 1993), and that “some writers use more punctuation marks than others, but the modern tendency is to use them sparingly” (Australian Government Printing Services, 1988, p. 63). One objection to systematic under-punctuating is that it inevitably leads to the occasional inadvertent
omission of commas which are ‘absolutely necessary’ for the prevention of a momentary misreading (Patridge, 1964). Moreover, the possible facilitating functions of optional punctuation are rarely discussed (Chapter 8 deals with these questions in detail).

The tendency towards less punctuation is likely to be associated with the modern preference for shorter sentence lengths. Shorter sentences need less punctuation—whether grammatically or rhetorically based—than longer ones (Baron, 2001). This inclination towards shorter sentences was analysed by Haussamen (1994), who examined English sentence length in texts at one hundred year intervals from 1600 to 1900, together with a collection of works from the 1980s. In the early periods sampled (1600th and 1700th centuries), written sentences range from 40–70 words in length. In selections from the 1800th and 1900th centuries, sentence length had reduced to 30–40 words; and in the 1980s findings indicated that sentence length was rarely more than 20 words (Haussamen, 1994). These results are not unexpected, yet they are extremely useful in indicating the changing relationship between spoken and written English. Except for infrequent occasions, such as a chain of clauses linked with conjunctive ‘ands’ or a loss of sequence, few people speak 40–70 word sentences in everyday discourse. Moreover, as there is no evidence to suggest that the conversational style in the 1600th and 1700th centuries would have included lengthy sentences, the data suggests that there was a greater mismatch in earlier centuries between everyday spoken communication and written text, as compared to more recent times.

Since the mid-nineteenth century, a series of technological inventions have drastically altered the ways in which people communicate. Communication-technologies such as the telegraph, telephone, radio, television and, more recently, the Internet, have made it possible to separate transportation from communication—removing the need for face-to-face interaction or for written messages to be physically carried from sender to recipient (Carey, 1983). As Baron (2001) suggests, all of these technologies help to reshape the relationship between speech and writing, typically by blurring the distinctions between the two. Carey (1983) argues that these technologies (most specifically the telegraph) were
responsible for the creation of the new, crisper writing, due to the limits on the amount of text that could be transmitted.

Writing has progressively developed into a reflection of informal speech, and nowhere is this more clearly illustrated than in e-mail (Baron, 1998). As a form of writing, e-mail is durable and its syntax commonly includes complex clause structures; however, e-mail also shares numerous features with face-to-face spoken language, such as informality, and the prevalence of present tenses, and is often unedited (see Baron 1998 for a detailed analysis of the linguistics of e-mail). More and more, writing is seen as an interchangeable alternative to speech rather than as a distinct entity with its own functions and conventions (Baron, 2001). As a result, punctuation is increasingly being used (and perhaps taught) as a tool for recording pauses in the speech which writing mirrors.

In a review of modern handbooks, empirical research, and pedagogical manifestos Baron (2001, p. 56) suggests:

_The semi-stable grammatical model of the past century is being abandoned. In its stead, punctuation is increasingly marking the cadences of informal speech or, in the case of email and other contemporary language media, helping the eye make sense of messages that are intended to be viewed quickly._

### 3.4.2 Future of English Punctuation

Throughout history punctuation has served two masters: speech and writing, though this service has not been stable over time. One source of confusion was that no matter how independent English written language became from spoken communication, the role of writing as an aid for formal oratory never disappeared. A second source of confusion is mismatches between professional standards (set by pedagogues or printers) and the punctuation habits of recognised writers, popular media, and learners themselves (Baron, 2001). As reinforced in the previous and present chapter, ‘pointing’ in English began as a rhetorical tool, changed its function to that of marking grammatical constructions, and
now has swung back, perhaps, to reflecting spoken language. However, as has been shown, the account is far more chaotic, and it is not straightforward to foresee the directions in which English punctuation will change in this new millennium.

Baron (2001) proposes three possible directions of development in punctuation in the early decades of the twenty-first century. One possibility is that, following recent trends, punctuation will increasingly become a handmaiden to informal speech. There is a reasonable likelihood that punctuation will become progressively more open or overtly mark the cadences associated with the author's inner ear. A second possibility is that punctuation will be re-established as a marker of grammatical categories (at least in formal writing), regaining its former stature. A final, and perhaps most likely, possibility is that punctuation will continue to play a schizoid role in the minds of learners, readers and writers. For over a millennium literate English-speaking societies have juggled elocutionary and syntactical functions of punctuation, and the essential dilemma remains the same—is there a distinct form of written language intended to be encountered silently, or is writing inextricably linked to speech?

In spite of the overwhelming dissemination of written thoughts and the clear and growing desire to express many vocally produced messages that are part of our real-life system of communication, we have for centuries been using a most limited repertoire of punctuation symbols (Poyatos, 1981). Perhaps due to the rise in communication technologies, we are now facing the need for a revision of the very concept of what written communication should be like. In terms of punctuation, it is perhaps, at the very least, desirable to explore the possibility of improving the effectiveness of punctuation by modifying and adding to the present system. Emoticons, symbols usually made by combining a number of punctuation marks, such as :-) for sarcasm\(^{13}\), are an example of an effort to use punctuation to symbolise speech for better evocation of semantic variations.

\(^{13}\) Viewed on the side, it represents a smiling face with a wink.
3.5 SUMMARY

Descriptions of the English punctuation system may be unrepresentative of current punctuation practice, as writing is tending to advance toward more oral characterisations, more involved, more situated, and less abstract styles (Biber & Finegan, 1989). Yet, while English punctuation has shown clear signs of having undergone a process of simplification, writing guides indicate little awareness of this shift (Bruthiaux, 1995).

Some researchers have suggested that punctuation usage should be guided by principles of style, rather than rules that require strict compliance. The rule-based method is perceived as intimidating for learners, whilst the principle approach could be easier to learn and less threatening. The general lack of confidence in the power of the structural approach to account for all punctuation uses has led some commentators to argue that punctuation practice should be considered in terms of clarity, appropriateness, effectiveness, and taste. Rethinking punctuation practices in these terms may generate solutions to problems that are less arbitrary than traditional rules.
Chapter 4: Psycholinguistic Research on Punctuation

...still the comma gets no respect. It seems just a slip of a thing, a pedant's tick, a blip on the edge of our consciousness, a kind of printer smudge almost. Small, we claim, is beautiful. Yet what is so often used, and so rarely recalled, as the comma—unless it be breath itself? (Iyer, 1988)

4.1 PREAMBLE

In order to investigate the interpretive aspects of punctuation marks and the effect they have on the cognitive task of reading, it is valuable to consider previous study in this area. The amount of empirical research that has dealt with punctuation, however, has been slight, and largely conducted in recent times. This limitation has been identified by researchers both from a linguistic standpoint (e.g., Baron, 2001; Bruthiaux, 1993; Levinson, 1985; Meyer, 1987; Nunberg, 1990; Parkes, 1992) and a psychological perspective (e.g., Baldwin & Coady, 1978; Chafe, 1988; Chapman, 1993; Cordeiro et al., 1983; Hill & Murray, 2000b; Scholes & Willis, 1990; Shapero, 1999). Moreover, researchers in automated natural language processing, where punctuation is typically deleted before parsing is initiated, or simply ignored, have also questioned the lack of investigation into punctuation (e.g., Bayraktar et al., 1998; Dale, 1991; Jones, 1996).

It is suggested that, up until the last decade or so, the study of punctuation suffered from the emphasis placed on the spoken language as well as from a conscious reaction on the part of modern linguists against a tradition of prescriptivism uninformed by observation. Given the widespread view that orthographic forms of language are simply, and often imperfect, transcriptions of speech, it is not remarkable that linguists are inclined
to endeavour to maintain the elocutionary function of punctuation—even, it would seem, when it is apparent it does not work.

In a series of publications, Robert Scholes and Brenda Willis (Scholes & Willis, 1987a, 1987b, 1989, 1990) posit a distinction between extensional and intensional elements in the processing of language, loosely based on the philosophical distinction between external and mental reference. Extensional elements of a language are those forms that map onto the real world, the forms that allow us to communicate about things, while intensional elements map on to the grammar of the language itself and have no reference to anything outside of that grammar (Scholes & Willis, 1990). Viewed in this dichotomous way, punctuation marks are extensional in their elocutionary function and intensional in their syntactic function. As extensional elements, they refer to overt properties of utterance, such as pausing and intonation; as intensional elements, they serve as indicators of syntactic structure. Given that linguists have previously dealt with punctuation as a transcriptional device (hence extensionally), it is interesting to note that most experimental research on the topic of punctuation has considered the syntactic (intensional) function of punctuation marks.

Psycholinguists, as well as many other language researchers, have often claimed the beneficial intensional uses of punctuation without giving concrete empirical justification. There is little empirical evidence to support, or disprove, this conjecture of punctuation facilitation, and most researchers have either evaded the consideration of punctuation or have merely assumed that it serves a disambiguating role (Hill, 1996). A number of articles examining sentence parsing are relevant to this observation. In an study by Ferriera and Henderson (1991), the authors, describing research by Warner and Glass (1987) list a number of early- and late-closure sentences such as 4.1 – 4.4, yet a short, and perhaps, as suggested by Hill (1996), humble, parenthesised statement accompanies the list, which declares: “Sentences did not appear with commas in their study; they are included here for ease of exposition” (Ferreira & Henderson, 1991, p. 28). Frazier and Rayner (1982, p. 563)
reason that commas would be used to disambiguate sentences in normal prose, hence “emphasise that none of the sentences used on the experiment contained commas.” Similarly, Frazier (1987, p. 563) states, “if a string is locally disambiguated (e.g., by punctuation or prosodic effects) then by definition there will be only one permissible analysis of the input and we would expect perceivers to construct that analysis.” More recently, Pickering and Traxler (1998, p. 943) used commas as a means of creating unambiguous controls in a study of plausibility and garden paths stating “sentences… are disambiguated by the comma, so no misanalysis should take place.” Undoubtedly these quotes are bold statements about the disambiguating potential of punctuation, even though, with the exception of Pickering and Traxler (1998), the possible effects of punctuation are ignored in these studies.

Early-closure sentences:

(4.1) When the boys strike (,) the dog kills
(4.2) Before the boy kills (,) the man the dog bites strikes

Late-closure sentences:

(4.3) After the dog bites the man (,) the cat kills
(4.4) When the horse kicks the boy (,) the dog bites the man

Many researchers have investigated syntactic structures and ambiguous sentences without sentence-internal punctuation, even though, in most cases, standard practice would have required it. Arguably, the view of punctuation as a facilitator for disambiguation is intuitively driven, rather than a notion based on research. However, not all researchers have made such blanket assumptions concerning the ability of punctuation to provide clarification, although often this consideration of the influence of punctuation has been an incidental and minor line of investigation.
This chapter will discuss in detail some past studies that have examined punctuation, either incidentally or as a focus of research. Representations of the former category are scarce, and in the latter, scarcer still; and often the research is unpublished. It is not certain whether this situation is due to the common perception of punctuation as elocutionary, and hence as theoretically uninteresting, since it is viewed as a simple written transcription of pauses in speech (Nunberg, 1990); or to punctuation occupying a blurred middle ground between overtly linguistic phenomena (like cue words and phrases) and overtly layout-oriented phenomena (such as indentation and spacing) (Dale, 1991); or to a combination of both. Nevertheless, acquiring a true understanding of written language will be impossible if punctuation marks are not taken into account (Bayraktar et al., 1998).

4.2 PREVIOUS EMPIRICAL RESEARCH ON ENGLISH PUNCTUATION

4.2.1 Sentence-level Parsing Processes

For a competent mature reader, reading ordinarily appears to be an instantaneous and unified process. Under the scrutiny of research, however, this perception is inaccurate. Reading is not a single mental operation; rather, theorists distinguish among component processes of reading at the word, sentence, and text level (Haberlandt, 1994). Without doubt, most research on syntax has focused on sentence structure, as this is considered to be where the critical grammatical relationships are expressed. Typically, grammars have defined a sentence as 'the complete expression of a single thought' (Crystal, 1987). For the most part, however, research has attempted to avoid direct application of this definition because of the difficulties in identifying what a 'thought' is. For example, an egg can express a thought, but it would not be considered a complete sentence. Moreover, although Ben closed the door, as it was freezing is one sentence, it could without doubt be analysed as two distinct thoughts.
Sentence-level processes include syntactic parsing processes. Syntactic parsing requires applying the lexical categories in order to calculate the relationships between words, to group them into units (such as phases and clauses), and, ultimately, to describe the structure of a sentence (Hill, 1996). Simply put, therefore, parsing is concerned with how words combine to construct sentences. Hence, if a sentence is generated successfully, its meaning becomes far greater than the straightforward sum of its parts (words). Using surface markers, word class, word position, and punctuation, these processes organise the words of sentence into syntactic structure (Crystal, 1987; Haberlandt, 1994). An efficient processing system must somehow be capable of making the correct parsing decisions most of the time (Mitchell, 1986); minimising, or perhaps even avoiding, obstacles introduced by backtracking or dealing with misleading starts. This process is performed word-by-word; hence, as the reader comes across each word in a sentence, it is necessary that he or she determine its syntactic category. Stated as such, this sounds like a simple process, as the reader will realise what syntactic category a word is likely to be assigned and what syntactic categories have already been assigned to the preceding words in the sentence. Language, however, is indeterminate, and making a decision regarding the correct syntactic category of a word can be quite complex and taxing.

For example, on encountering the word man in the following sentence, the reader must decide if it is a noun (as in an old man) or if it is a verb (as in man the lifeboat).

(4.5) The old man the boats

Patterson (1998) proposes that the reader can implement two strategies. The first option involves using some rule or guideline (or guesswork), while the second involves putting off the decision-making until later in the sentence, when other information acquired may make the decision less demanding. However, as the reader must retain the two alternative analyses, this latter strategy naturally involves a memory load. Studies have
shown that readers do not do this; rather, they have a tendency to decide on a syntactic category for each word in the sentence as it is encountered (Patterson, 1998). The cognitive process of reading is apparently based on two related assumptions, application of the immediacy and the eye-mind principles. According to the immediacy principle, the reader attempts to comprehend a unit of text (usually a word) as soon as possible, instead of delaying until the end of a clause or sentence. Similarly, according to the eye-mind principle, the mental processing of a unit of text takes place concurrently with the eye-fixations on that unit; hence there is no delay between the word being fixated upon and the mental processes attached to that word (Haberlandt, 1994).

As a result, readers sometimes make the wrong parsing decision, and subsequently have to correct that error and reanalyse the sentence. It is not surprising, then, that previous investigations into the influence of punctuation on reading have generally focused on the effects of the segments of text that are either on the point of being analysed structurally, or have already been analysed at some earlier stage in the process of interpreting the sentence (e.g., Chapman, 1993; Hill, 1996; Hill & Murray, 2000b; Mitchell, 1986).

4.2.2 The Comma

Punctuation rules concern all the marks. However, statistical studies indicate that over ninety percent of the marks are periods and commas, with commas being the more frequently occurring (Dawkins, 1992a). Meyer (1987) observed that commas and periods each constituted around forty-five percent of all marks in the Brown Corpus (Francis & Kucera, 1982), with the next most frequent mark having a frequency of only two percent—a very sharp drop. It may be argued that, other marks aside, the period may be at least as important as the comma, since its frequency is almost the same. However, the comma is far more versatile (Jones, 1996) and is involved in almost three-quarters of all punctuation patterns (Bayraktar et al., 1998). Hence, as the comma requires more rules, it leads to more
problems for the writer, and consequently is considered the most controversial of the punctuation marks (Hay-Roe, 1997; LaRoque, 1996; Meyer, 1989; Quirk et al., 1985) As suggested by Hill (1996), the comma has flexible qualities that range from signifying strong structural significance to being, effectively, arbitrary and uninformative. It is for these reasons that most of the research on punctuation marks has focused on the comma—specifically on its disambiguating role.

4.2.3 Punctuation and Syntactic Parsing: Avoiding the Garden Path

4.2.3.1 The Garden Path Model

One of the most significant theories of syntactic parsing is the garden path model. The model derives from strictly systematic principles of parsing (Kimball, 1973) and the architecture involved in the ‘Sausage Machine’ (Frazier & Fodor, 1978). With the combination of simplicity and power incorporated into its framework, it has withstood the test of time, and remains highly influential (for a review of studies that have supported the garden path model see Mitchell, 1994). The model suggests that readers make decisions about the structure of phrases using a small set of heuristics based on knowledge about syntactic structure. The garden path view of parsing maintains that decisions are initially made on syntactic considerations alone, without reference to semantic or pragmatic information or to certain kinds of lexical information (e.g., Ferreira & Henderson, 1990; Mitchell, 1989; Rayner, Carlson, & Frazier, 1983). Accounts of this kind can be referred to as syntax-first models of parsing (Mitchell, Corley, & Garnham, 1992); consequently, the theory posits that readers do not either use knowledge about the meaning of words and sentences, or about the surrounding context in initial parsing decisions.

One of the two, very general, parsing strategies used in garden path theory, minimal attachment, essentially entails that the reader builds the least complex of the possible syntactic analyses that can be assigned to a phrase. Minimal attachment proposes that when
building a new lexical item the reader should only use the smallest number of syntactic nodes (branching points) as possible, while remaining consistent to the grammar. Consequently, garden path theory maintains that the reader initially pursues a simple active analysis of a sentence and selects the least marked interpretation, deriving only one representation. If the reader realises they are wrong, it is necessary to backtrack and recompute.

The second heuristic, *late-closure*, presumes that the reader attempts to process new information as part of the current phrase structure. Late-closure holds that, wherever possible, a new lexical item is attached to the clause or phrase currently being processed; so if the reader is currently processing a verb-phrase, then incoming information would be processed as part of that verb-phrase for as long as possible. This bias is evident when the new information is temporarily ambiguous, and the reader initially thinks that the new information can be processed as part of the current phrase, but subsequently it is disambiguated as part of a new phrase structure. Sentence 4.6 is an example of a sentence in which the application of late-closure results in a problem. Readers initially attempt to interpret the directly following noun phrase (the actors) as the direct object of the first verb (applauded), but this is subsequently disambiguated at the beginning of a new verb-phrase (took a break).

(4.6) After the audience had applauded the actors took a break.

Similarly, in sentence 4.7 readers appear to encounter difficulty because late-closure leads them to incorrectly analyse the noun-phrase (a mile) as the direct object argument of the verb (jogs), when in fact it is the subject noun-phrase of a new clause.

(4.7) Since Jay always jogs a mile seems a short distance to him.
The parser builds an initial analysis on the basis of purely structural information following these two general principles. The obvious advantage of the garden path theory is that it is quick and easy to make decisions on the basis of a simple set of heuristics derived from one source of knowledge. This is an important requirement, as readers must compute the syntactic structure of sentences extremely quickly. The garden path theory provides a simple and reasonably efficient account of how this can be done (although it is by no means the only account).

Under garden path theory, the temporarily ambiguous nature of language is delivered in a serial manner and is managed by only pursuing a single analysis of a sentence at a time. There is no guarantee, of course, that the simplest and first analysis will be the correct one, as a variety of possible analyses exist. Consequently, by employing these two heuristics the parser can be led up and down 'the garden path' of analysis—initially developing an incorrect structural analysis and having to retrace its steps when a mistake is revealed (Hill, 1996). Misanalysis is typically non-fatal to the parse, but the discovery of the error, along with the resulting confusion and reanalysis, is presumed to be a time-consuming activity for the reader. Sentences 4.8 and 4.9 are a useful means of illustrating this point:

(4.8) The Head of Department argued the student's position convincingly

(4.9) The Head of Department argued the student's position was mistaken

The temporarily ambiguous noun phrase the student's position can be interpreted as the simple direct object of the verb or as the subject of a complement cause. Minimal attachment will favour constructing the former interpretation, as it requires a smaller number of nodes and avoids building a new constituent (Figure 4.1). However, while this is a correct interpretation for sentence 4.8, it is not correct for sentence 4.9, which requires
the alternative phrase marker. Therefore, the minimal attachment approach would predict a garden path effect in 4.9 but not 4.8.

![Diagram of sentence structure]

**Figure 4.1. Phrase markers for sentences 4.8 and 4.9**

The major attraction of the garden path model is that late-closure and minimal attachment are clear and general principles, and easily testable. Moreover, they also appeal to the notion of cognitive economy, by keeping mental processes as simple and efficient as possible (Hill, 1996). Having only two guiding principles lessens the burden on working memory during parsing and keeps structures as undemanding as they can be.

However, while garden path theory is an appealing model, there are findings that indicate readers make use of other sources of information when working out the structure of sentences. An area of contention is lexical information—specifically, whether detailed information about the verb can guide parsing (see Holmes, 1987; Holmes, Kennedy, & Murray, 1987; Kennedy, Murray, Jennings, & Reid, 1989). For example, there is evidence to suggest that the initial analysis of a sentence is made in accordance with the strongest preferred lexical form of the verb (Ford, Bresnan, & Kaplan, 1982). Additionally, the principle of late-closure does not necessarily extend cross-linguistically (Cuntos &
Mitchell, 1988). A further threat to the simple and straightforward garden path principles comes from informational-rich semantic sources, as readers have been found to use information about the meaning of words (e.g., Trueswell, Tanenhaus, & Garnsey, 1994) or information about the context in which the temporarily ambiguous sentence appears (e.g., Altmann & Steedman, 1988; Altmann, Garnham, & Dennis, 1992). It is therefore possible to prevent, or at least reduce, any processing difficulties (even when garden path theory states that there must be a problem) given the right prior context (Hill, 1996).

These findings are a serious challenge to the garden path theory, and there seems little doubt that a variety of factors can influence sentence comprehension. However, evidence for strategies other than minimal attachment and late-closure is not conclusive (Ferreira & Clifton, 1986; Frazier, 1987; Hill, 1996; Mitchell, 1989). Moreover, the important empirical question is when sources other than minimal attachment and late-closure are brought into play. Mitchell (1989), for example, claims that specific lexical information is only used to verify that the structures proposed are valid. There is room, then, to suggest that other sources of information may only be employed during reanalysis, after the parser encounters a difficulty in its primary analysis.

4.2.3.2 Punctuation and the Garden Path

Beverly Adams, Don Mitchell and colleagues have examined punctuation (albeit slightly), looking at the question of whether the course of parsing (how words combine and generate sentences) is influenced by punctuation—or, more specifically, commas (Adams, Clifton, & Mitchell, 1992; Adams, Clifton, & Mitchell, 1998; Mitchell, 1986; Mitchell & Holmes, 1985). Nevertheless, even Mitchell appears to regard punctuation as playing a lesser role than the potential influence of guiding information stemming from the lexicon, and consequently his consideration of punctuation appears a secondary matter.

In order to comprehend a sentence, an individual must compute the structural relationship between the constituent words, phrases and clauses. This task is complicated,
as in most natural languages virtually all sentences contain strings of words that are, or at least appear, structurally ambiguous when first encountered (Mitchell, 1986). Mitchell and Holmes (1985) were the first to document the influence of punctuation or any other surface structural cues on parsing, exploring the effect of a comma on a sample of garden path sentence structures.

The findings from the experiment by Mitchell and Holmes (1985) suggested, though tentatively, due to a small stimulus and sample-size, that commas might have caused a human parser to interpret ambiguous phrases in a way dissimilar to that normally selected in the absence of punctuation. When commas were inserted immediately before the ambiguous phrases, viewing times for the indicator display were notably reduced. Hence, the insertion of a comma facilitated the comprehension of a previously ambiguous sentence.

Mitchell’s (1986) subsequent and unpublished study predicted that the presence of a comma would make it possible to avoid the misanalysis that normally occurs with the following types of ambiguous sentences:

(4.10) After the audience had applauded/gone, the actors sat down for a well-earned drink.

(4.11) As soon as he had phoned/arrived, his wife started to prepare for the journey.

Sentences 4.10 and 4.11 are ambiguous because the noun phrase *the actors or his wife* can function as either the direct object of the verb or as the subject of the second clause. As can be inferred from the sample sentences, the commas act as a disambiguating

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14In Mitchell and Holmes’s (1985) study, only a quarter of the experimental items used in the study were constructed in a suitable form to allow any conclusions on punctuation to be arrived at, and the sample was not large enough to warrant a strict statistical analysis.
mechanism by indicating the end of the clause. Mitchell (1986) stated that the introduction of a comma at the end of the preposed clause nullified the dominant tendency to interpret the directly following noun phrase as a direct object of the first verb. Consequently, punctuation, in the form of the comma, was observed to exert a strong influence on the parsing process. Mitchell (1986) concluded that the human parser, in addition to contextual information, has access to punctuation, which can be used to guide its operations more effectively.

Although providing significant support for the facilitation effect of punctuation, the strength of the findings should perhaps not be overstated, due to the required switching from optionally transitive (e.g., phoned, applauded) to intransitive (e.g., arrived, gone) in the two conditions. Intransitive verbs are unable to take a direct object (e.g., his wife, the actors); consequently, the non-attachment of the second noun phrase to the main verb is lexically unambiguous. Mitchell (1986), in fact, reported substantial lexical influences, with intransitive verbs resulting in smaller garden path effects than transitive. However, the nature of the interaction of verb type with punctuation, and which—if either—is more dominant, was not determined.

More recently Christianson et al. (2001) found similar results with sentences involving reflexive absolute transitive (RAT) verbs such as 4.12. The 36 participants were slower to read sentences in the comma absent condition than in the comma present condition. In addition there was a main effect of comma presence for comprehension, with subjects performing significantly better in the comma-present condition (Christianson, Hollingworth, Halliwell, & Ferreira, 2001).

(4.12) While Jim bathed the child that was blond and podgy giggled with delight
Mitchell (1987) deemed the evidence for punctuational facilitation to be strong enough to require him to assign a temporary memory store dedicated to punctuation in his outline of a two-phase parser. This theoretical model (Figure 4.2) is rare, if not unique, in that it specifically integrates the processing of punctuation. Mitchell believes that the view that initial parsing decisions are based wholly on tree structure considerations is problematic, given that early parsing preferences seem to be influenced by the presence or absence of punctuation (Mitchell, 1994). The completeness of tree-driven accounts is, then, questioned by the findings of Mitchell and Holmes (1985), and Mitchell (1986), given that something other than a parsing tree must be consulted prior to a decision being made (Adams et al., 1998).

![Diagram](image)

**Figure 4.2. Mitchell’s (1986) outline of a two-phase parser model.**

The conventions employed in the diagram are the same as those used by Mitchell in his general description of reading (Mitchell, 1982, p. 141-142). Circles represent cognitive operations and rectangles represent temporary (or working) memories. A double-headed arrow between an operation and store indicates that the procedure is capable of drawing upon the contents of that particular store in the course of performing its function. A bold arrow signifies that the end products of an operation are placed in the working memory specified in the diagram. According to the framework, the Parser is made up of two distinct sub-components (the Director and the Monitor). Certain sources of information

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are known to influence parsing as a whole and they are marked as doing so by ending at the outer circle. Given the conventions of the diagram, these stores must in fact be consulted by either (or both) of the sub-processes. The other connections are left unspecified, as which of them are operational was considered unknown by Mitchell. Finally, the access route marked with a dashed line was the subject of the study (Mitchell, 1982).

It is only very recently, however, that there has been anything other than a piecemeal approach to the study of punctuation and its relation to the cognitive process of reading. Robin Hill and Wayne Murray from the University of Dundee have embarked on a systematic approach to evaluating the power and application of punctuation to the human parser, and this has recently culminated in a chapter in *Reading as a Perceptual Process* (Kennedy et al., 2000), where a number of important experiments on the effect of punctuation on parsing are reported (Hill & Murray, 2000b). Their research is primarily based on Hill’s (1996) unpublished Masters thesis, and concentrates on the disambiguation properties of commas during self-paced reading. Whereas other previous work (Christianson et al., 2001; Mitchell, 1986; Mitchell & Holmes, 1985) has been restricted to locally ambiguous early-closure sentences, such as 4.13, Hill and Murray’s research extended the number of types of sentences from the ‘garden path family’ to include prepositional phrase attachment (4.14) and reduced relative (4.15) ambiguities (Hill, 1996; Hill & Murray, 1997a, 1997b; Hill & Murray, 1998).

(4.13) While the cleaner was dusting the wooden clock chimed loudly

(4.14) The boy attacked the girl with the smile because he was mad

(4.15) The foreigner told the joke did not understand

These categories of garden path sentence structures have consistently been shown to be problematic for readers, and the researchers investigated the influence of inserting...
commas at relevant locations in the sentence. Findings indicated that garden path effects were removed by the insertion of a comma at appropriate points in both early-closure and reduced relative sentences. In sentence 4.13 for example, the problem that arises is an incorrect attachment of the wooden clock as the object of the verb dusting. Commonly, this results in increased reading times and the word chimed along with the need for a re-analysis of the sentence. The inclusion of a comma after dusting successfully eliminated misreading and led to significantly faster reading times. In the case of reduced relative sentences such as 4.15, commas after foreigner and joke also facilitated reading times significantly. Unexpectedly, commas were found to be inconsequential with prepositional phrase ambiguities.

Further, although not significantly lengthening reading time, the researchers found that commas did not facilitate reading time when they merely complimented the preferred initial parse, as in the case of unambiguous late-closure 4.16 and unreduced relative sentences 4.17.

(4.16) While the cleaner was dusting the wooden clock it chimed loudly
(4.17) The foreigner who was told the joke did not understand

Hill (1996) concluded that the intervention and influence of punctuation on parsing is complex, yet potentially very powerful. Moreover, he stated that any suitable model of parsing must be sophisticated enough to incorporate punctuation, and account both for those situations where punctuation has an effect and those where it does not. Subsequent empirical work replicated the findings of his earlier work using eye-tracking methodology (Hill & Murray, 2000b). The data suggested that a punctuation mark is not treated as

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15 These will be discussed in greater detail in Chapter 6
perceptually equivalent to a word, but neither is it simply an invisible entity that stretches spacing between words and clauses (Hill & Murray, 1998).

Perhaps a limitation of these studies, however, has been the lack of replication, particularly given the participant sample-size (though, it should be noted that this is no fault of Hill and Murray, who are currently and systematically researching in this field). Another concern is the fact that most participants were drawn from the postgraduate community at Dundee in the majority of the studies, particularly in the self-paced reading experiments. It would be expected, therefore, that the sample used was above average in term of literacy and knowledge of (and ability with) punctuation. At this point, there has been no attempt by Hill and Murray to deal with this important variable of the reading-ability of an individual and its interaction with punctuation and reading performance. As a result of these limitations, it is suggested that more caution is needed in generalising from their respective findings. Hill and Murray's work will be dealt with in more detail in Chapter 6, where we endeavoured to replicate some of their findings and extend their experimental paradigms to include the variable of reading-ability.

4.2.4 The Strength of Punctuation: Sentence Complexity and Context

Baldwin and Coady (1978) theorised that punctuation cues lie on a continuum, with critical and redundant existing at polar opposites. The position that a given punctuation mark holds on the continuum is determined by the availability of alternative syntactic cues to mark surface structure boundaries, as well as on the availability of semantic cues to confirm or reject syntactic interpretations. The researchers additionally hypothesised that readers generate grammatical expectations that modify the segmentation of written syntax by influencing the reader's attention to or perception of syntactic boundaries (Baldwin & Coady, 1978).

The research involved two participant groups: fifth-grade students (all of whom were judged to be above average readers) and adults (linguistic graduate students). In canonical
sentences (where word order is a primary source of syntactic information) punctuation was found to have no important effect upon comprehension for either age-group. With the non-canonical sentences, comprehension was dramatically lower for both groups when the sentences were presented without punctuation. However, striking differences were found in the extent to which children and adults used punctuation during reading of punctuated non-canonical sentences. The fifth-graders comprehended the non-canonical sentences no better with than without punctuation, this contrasted with the adult participants who comprehended punctuated non-canonical sentences almost as well as punctuated canonical sentences. The results suggested that children tend to ignore punctuation, even when it is syntactically critical, using word order as a primary source of syntactic information.

The authors use these findings as evidence that punctuation, as a cue system in reading, has a remarkably late onset (Baldwin & Coady, 1978). This assertion is perhaps a little bold given the fact that there were only forty participants in total, and the two groups (elementary school students and university linguistic graduate students) are not representative of the continuum of reading skill development; rather they are two very different populations. What the findings do suggest, however, is that punctuation exerts a variable influence upon reading comprehension. When sentences are non-canonical, punctuation appears essential for the adult readers to arrive at an appropriate syntactic analysis. In contrast, when sentences are canonical, punctuation appears merely to reiterate grammatical information already provided by word order. It is uncertain whether a clear dichotomy exists between critical and redundant punctuation cues, although it seems likely that, as suggested by Baldwin and Coady (1978), the major function of punctuation is to serve as a system of visual markers that contradict previously generated false grammatical expectations.

Hill (1996) similarly viewed the influence of punctuation as dependent on syntactic significance. He suggested that the degree of usefulness of a comma is inversely proportional to the amount of structural information that can be derived from other
sources, and that there is a complicated system of redundancy when processing punctuation. In this sense, redundancy is defined as a naturally occurring overlap in language that guarantees that information is delivered accurately from sender to receiver (Horning, 1993). Hill's research showed that critical punctuation marks act to clarify sentences by reducing structural options, and either prevent the initiation of incorrect parsing or minimise the damage caused by the need for re-analysis; while redundant punctuation appears to have no effect at all.

4.2.5 The Interaction between Punctuation and Individual Differences

A possible reason for the difference in comprehension capacity between good and poor readers may lie in the way in which they organise what they read. Students who fail to code the words they read into meaningful phrases or 'chunks' have been shown to have difficulty comprehending even when they can attach meaning to individual words (Brozo, Schmelzer, & Spires, 1983). It seems that readers find texts that are organised in ways consistent with their underlying clause structure easier to read and comprehend. Moreover, studies into the metacognitive aspects of reading (where readers monitors their degree of understanding or its lack) in children have found that good readers are significantly more able to recognise text organization (e.g., McGee, 1982; Sanacore, 1984) Although obviously not simply chunking, punctuation marks in normal text clearly provide some form of organization. Punctuation may well be a linguistic tool that enables readers to assign text into meaningful units—an organisational skill perhaps allied with factors such as reading-ability or individual experience with punctuation. This raises the issue of whether the individual characteristics of the reader are of paramount importance to the effectiveness of punctuation, as it is well established that writers differ with respect to their punctuation habits (Baldwin & Coady, 1978; Bruthiaux, 1993; Chafe, 1988).

A recent study by Steinhaur and Friederici (2001), which used both behavioural and event-related brain potentials (ERPs) data, found that comma-processing varied
significantly with the readers’ idiosyncratic punctuation habits. Readers accustomed to strict punctuation habits were more susceptible to commas during reading. Moreover, participants who could be viewed as light punctuators (rarely inserting punctuation even in disambiguating positions) seemed not to pay great attention to commas during reading, assessing sentences with or without commas equally in terms of easy/difficult-to-read judgements.

A study by Chapman (1993) that looked at the effect of punctuation errors on good and poor readers provided some support for error/complexity differences in the two populations. Good readers were significantly affected by punctuation errors in test sentences, experiencing degraded reading speeds and comprehension scores. In contrast, poor readers were not affected by punctuation errors; rather it was the complexity of a text structure that negatively influenced their speed and comprehension—an effect to which good readers were immune. The study provided evidence that good readers have mastered the idiosyncrasies unique to written language, whereas poor readers continue to attempt to deal with written language as if it were spoken, and consequently stumble on the imperfect synchrony of punctuation with spoken prosody (Chapman, 1993).

However, a major limitation of Chapman’s study is that it did not control for type of text. Readers more easily comprehend narrative rather than expository text, and will read the former faster than the latter—indeed, Guthrie (1981) found that 70 percent of the predictable variance in reading times was due to the ‘narrativity’ of the piece (Guthrie, 1981b). The underlying assumption of the method—that the sentences of any one type were all more-or-less equivalent in readability—therefore seems flawed, as narrativity is a clear candidate as the source for the large amount of the variation observed in the participants’ responses to the test sentences. Another methodological problem in the study was the oversimplified reading test used to measure reading ability (24 single sentences with

16 The language used was German, and it is worth noting that German punctuation rules are stricter than
true/false responses required). An individual’s reading-ability is multifaceted, and a single crude measure to assess this complex construct is not adequate.

Despite these limitations, however, there is no justification to further neglect research into the influence of reading-ability on the effect of punctuation on reading performance. In fact, the findings would suggest that it is an area ripe for research. Thus, Chapman’s (1993) results should not be treated lightly, particularly given that Steinhaur and Friederici (2001) found such clear individual differences in the effectiveness of punctuation. It may well be that punctuation is a tool, and like most tools it is likely to be most effective in the hands of those who know how to use it.

4.2.6 Punctuation and Prosody

The extent that typographical cues (notably punctuation) in text contribute to pause distribution remains largely unexplored. The near-universal occurrence and perceptual salience of punctuation in written language suggests the hypothesis that readers use punctuation to segment text: “In contrast with speech, segmentation of the message into words and sentences is correctly indicated in written text and is not a task that must be performed by the reader” (Rubin, 1980, p. 415). Although the limited group of punctuation marks does not reflect all the nuances possible with speech, it frequently indicates, among other things, pauses (,), elocutionary force (?!), lists (,) and related statements (;). However, as outlined in Chapter 3, the relationship between punctuation and prosody cannot be a simple one-to-one mapping. Grammatical rules prevent the inclusion of punctuation at all points where a speaker might pause, and the set of punctuation marks is not extensive or rich enough to transcribe all the spoken features classed as prosody (Hill & Murray, 2000a). Intuitively, there seems to be a functional overlap between punctuation and prosody, although the relationship is far from perfect. Consider 4.18, while a pause

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those in most other languages—including English.
might seem natural in the sentence, a comma cannot be inserted between a subject and a predicate (Chafe, 1988).

(4.18) The man over there in the corner, is obviously drunk.

Research interest in the use of punctuation for pausing, while presently minimal, was reasonably strong at the turn of the twentieth-century (for a review see O'Connell and Kowal, 1984, 1986). The collective findings suggested that punctuation is the best predictor of pause occurrence and durations. However, the only common element in the research was that pauses at periods were longer than pauses at commas; otherwise there was not much agreement, either across languages or within a given language (O'Connell & Kowal, 1986).

More recent work by Hill and Murray (2000a) has shown that commas have a direct effect on reading aloud, resulting in the lengthening of words preceding the comma and increasing pauses in speech. Additionally, there was slightly faster reading in the region following commas; which is consistent with eye-movement and self-pace reading experiments (Hill, 1996; Hill & Murray, 2000b). Steinhaur and Friederici (2001) make a strong case that comma perception during reading seems to involve processes comparable to the perception of prosodic boundaries in spoken language and is possibly mediated by the same brain structures.

A number of late-twentieth-century language researchers tried to generate the empirical foundation for modern arguments that written punctuation should be further reflective of spoken intonation. In a comparison of syntactic boundaries for comma-insertion with intonation-group boundaries, Cruttenden (1990) examined twenty-two places within the sentence where either a syntactically proscribed comma or an intonational-group boundary can occur. While the vast majority of these (seventeen out of the twenty-two) were identical, there were five discrepancies, each of which was an
intonational-group boundary for which grammatically based punctuation principles prohibit the insertion of a comma (Cruttenden, 1990). For example, consider the junction between a subject and verb in 4.19, and, similarly, sentence 4.20 in which an indirect object precedes a direct object.

(4.19) The small office second on the right / is Dr Delin’s
(4.20) The policeman gave the young thief / a severe talking-to.

Syntactical punctuation does not permit a comma between the last work of a subject (“the small office second on the right”) and the verb (ii), or between young thief and a—spoken intonation does (Baron, 2001).

Orthography denotes writing systems that are intended to be read silently, and in which the visual graphs can be directly mapped onto lexical and syntactic components of language. In written speech, however, the graphics are intended to be pronounced, and meaning is access by pronunciation, not directly from the visual representation (Scholes & Willis, 1990). It is clear that both orthography and written speech are present among English readers and writers; although Scholes and Willis (1990) take this line of reasoning further, proposing that there are two different kinds of people who can read or write. The first type are people to whom reading and writing “is a visual representation of speech, writing in which elements and symbols are derived from an inspection of the segmentation and contours of speech, and reading in which meaning is accessed only after an (overt or covert) transposition of the visual representation into an acoustic one” (Scholes & Willis, 1990, p. 18). The second type are people who read and write orthography, “whose reading is a comprehension of the visual representation of the meaning-signalling aspects of the ‘standard’ written form of the language and whose writing is based on expressions of content quite independent of the form (or even existence) of any corresponding utterance” (Scholes & Willis, 1990, p. 18).
Whether there actually are categories of readers is uncertain, although Scholes and Willis's (1990) findings do, albeit loosely, point to the transition (if indeed it is a developmental transition) from written speech to orthography as linked to education. In their study, there were twenty-three university students and two English teachers, all of which were in the two top groups in terms of fewest errors. Nonetheless, the otherwise educated writers remained relatively ignorant of the orthographic function of punctuation. The authors conclude that groupings such as 'literate' and 'illiterate' are in need of expansion and revision. They suggest that the acquisition and use of orthography is remarkably independent of the acquisition and use of written speech, and that one may be literate or illiterate with respect to either form of writing. Terms such as 'orthographically literate', 'orthographically illiterate', 'writing literate' and 'writing illiterate' are given as suggestions.

Chafe (1988) further investigated prosody and punctuation, centering on the notion of a writer's inner voice and the extent to which contemporary punctuation of written texts signals "auditory images of specific intonations, accents, pauses, rhythms, and voice qualities" (Chafe, 1988, p. 397). It is necessary to note, however, that Chafe assumes that the primary purpose of punctuation is "to tell us something about a writer's intentions with regard to the prosody of that inner voice" (Chafe, 1988, p. 397). The first series of studies compared the average length of a punctuation unit, the term used for the number of words occurring prior to a punctuation mark, in a published text with participants' normal length of intonation when reading the same extract aloud. The texts used were diverse, ranging from local advertisements to the writings of Ernest Hemingway, and the participants were college students and members of an adult educational class. The two participant groups were given separate but comparable written samples, with the mean number of words per punctuation unit (as marked in the written text) at 8.9 for college students and 9.4 for the older participants. When asked to read their respective texts aloud, however, both groups
separated the texts into significantly smaller intonation units, 5.7 mean words for college students and 5.2 for the members of the adult education class.

In the subsequent set of studies, participants were given the original texts, without punctuation markings, and instructed to repunctuate the printed passages by providing their own punctuation markings. Both populations differed from the originals, generating mean punctuation unit lengths of 9.4 (college) and 10.6 (adult education class) words, respectively. From these findings, it was concluded that contemporary readers and writers encounter and produce texts using an inner voice that is apt in incorporating, but also go beyond, conventional grammar-based (or syntactic) rules for punctuating written material (Chafe, 1988).

A study by Danielewicz and Chafe (1985) compared written punctuation practices of a group of college freshmen with the analogous use of intonation and pauses by educated speakers. It was suggested that what might perhaps appear to be errors of punctuation in freshman compositions could be viewed instead as attempts to capture prosodic features of speech in writing. Thus, the freshmen appeared to be punctuating their writing in a manner which reflected the intonation they would have used had their words been spoken. Their use of commas and periods reflected in many cases an accurate appreciation of how these marks are used to capture prosodic features in normal speech; thus, the ‘errors’ came from assuming that the uses of spoken language can be transferred, without amendment, to written language (Danielewicz & Chafe, 1985). The researchers then went on to compare the written punctuation produced by the students with the intonation patterns in a separate corpus of spoken language. In speech 4.21, for example, the relative clause is not syntactically separated from its head noun by a comma; yet, an intonation boundary would be typically inserted in speech. Following the spoken-language model, a freshman writer in the study placed a comma (shown in 4.22) in the same grammatical spot (Danielewicz and Chafe, 1985, p. 219-220).
(4.21) And the letters are supposed to represent the noise / that the informant made

(4.22) One of these categories, that I can be classified in is that of an only child

Danielewicz and Chafe (1985) propose that teachers should be able to use learners’ knowledge of intonation boundaries in spoken language to guide their writing skills. In this light, learners’ non-standard punctuation markings can been viewed as inappropriate extensions of a spoken language into a different medium, not as random errors, enabling teachers to concentrate on pointing out the particular ways in which the requirements of writing differ from those of speaking. The study has been replicated more recently with adult learners (Ivanic, 1996). Although the study had quite a limited sample, the findings similarly indicated that non-standard punctuation was frequently based on the prosody involved in reading the sentence aloud.

Recently, there have been appeals for punctuation reform at a college level, with many writing instructors advocating teaching students to follow the punctuation style of practicing writers, not the prescriptive rules laid out in grammar books (Baron, 2001; Calkins, 1980). John Dawkins has published heavily on this issue, and suggests that skilled writers “punctuate according to their intended meaning, and their intended emphasis”, as, “depending on the amount of emphasis the writer wishes to give, the same sentence might be punctuated multiple ways” (Dawkins, 1995, p. 534). However, it must be said that novelists and short story writers are much more likely to punctuate in the manner Dawkins describes than writers of correspondence or scientific reports, and punctuation cannot be reduced to simple rules of breath, counting or grammar (Edlund, 1999).
4.2.7 Learning Punctuation: Developmental Research

There has been some limited research into the acquisition of punctuation knowledge by young children, the object of which is to obtain some background on the context in which punctuation is taught to, and learned by, children in their first years of school\(^\text{17}\). There are many views about how punctuation should be taught, yet a primary concern should be to understand more about how beginning learners make sense of a complex subject like punctuation (Hall, 1996). A study by Shapero (1999), which examined how much young children knew about the function of punctuation, discovered that most of the five to seven year-olds understood far less about the marks than was expected. Comprehension of short texts with and without punctuation was also tested, with findings indicating that children, on the whole, were unable to heed the marks. However, there were exceptions amongst the students, and this, the author argued, is evidence that knowledge about punctuation is achievable in young children (Shapero, 1999).

Developmental data on the acquisition of rules of punctuation appears to support a hypothesis of maturation from writing literate to orthographically literate. Codeiro and colleagues (1983, 1988) provide evidence that the punctuation errors of children are attempts to express their implicit awareness of linguistic segmenting, textual division and meaningful units. The errors made by the children reflected spoken clausal complexes, which were intended to be meaningful within the context and often contradicted the sentence unit—which, although existing in writing, does not exist in speech or thought (Cordeiro, 1988).

However, explaining the concept of a ‘sentence’ to children is not a simple task, as it relies on formal syntactic explanations. Further, explanations that rely on non-syntactic criteria inevitably produce errors (Cordeiro et al., 1983), and the semantic concept of a
‘complete thought’ is meaningless, as it does not reflect speech or thought. Cordeiro et al. (1983) suggests that the speech production criterion (elocutionary function) may be the most useful first approximation for young writers. The fact that young writers are first instructed on the subject of punctuation in terms of the elocutionary function and then later taught that the role of punctuation is primarily syntactic may perhaps explain why punctuation is regarded as so troublesome by so many.

A study by Calkins (1980) compared third-grade ‘writers’ who had been taught punctuation formally and mechanically (though drills and workbooks) with those who had learnt through trial and error whilst doing their own writing (using punctuation for their own purposes). The students who had not received formal instruction in punctuation could explain or define an average of 8.66 kinds of punctuation marks, while the children who had studied punctuation through class-work, drills and tests (but had rarely written) were only able to describe an average of 3.85 kinds of punctuation (Calkins, 1980). This study has two important implications: firstly, the data suggests that punctuation taught in the context of writing, rather than in isolation, is preferable; and secondly, that, as children want to give ‘voice’ to their stories, an elocutionary approach to the early instruction of punctuation is advantageous.

Research by Edelsky (1983) that looked at developmental data of segmentation and punctuation by first-, second-, and third-grade children of migrant farm workers, found that unconventional punctuation used by the children honoured, with very few exceptions, phonological boundaries (Edelsky, 1983). Moreover, it has been suggested that children compensate for the lack of paralanguage and prosody in writing by employing graphic means: heavy and dramatic punctuation, the free mixing of pictures and words, and the unconstrained use of space and writing direction (Cook-Gumperz & Cook-Gumperz, 1977). The Punctuation Project, set up in 1993 in the Didsbury School of Education at the Manchester Metropolitan University under the directorship of Nigel Hall and Anne Robinson, has set about reversing the neglect of punctuation in literacy. Learning About Punctuation (Hall & Robinson, 1996) is an excellent resource for information regarding the learning and teaching of punctuation to children.
Typographical and spatial features may, it seems, be more natural than we think (Waller, 1988).

As outlined in the previous chapter, a growing number of language theorists are advocating a shift in punctuation standards, moving away from syntactical or grammatical marking to a more informal rhetoric. Such an approach may help children deal with the observed mismatch between punctuation they are traditionally taught and the punctuation that they actually encounter in everyday texts (Little, 1983). Moreover, there is something of a problem about grammatical explanations: they are often more complex than the phenomena they are attempting to define (Hall, 1996). Obviously, few starting writers begin with an explicit grammatical knowledge of written language; hence, successful use of punctuation does not indicate the ability to deconstruct language intellectually. It is only through continually being supported in their exploration and invention of written language as readers; recognising punctuation in literature, the environment, and the writing of others; and as authors creating, organising, and controlling their own writing, that children will refine and strengthen their understanding and control of these meaningful language conventions (Martens & Goodman, 1996).

4.2.8 Beliefs about Punctuation

Scholes and Willis (1990), when asking university students (people one would expect to be at a high level of literacy) to indicate the main purpose of punctuation, found that 63 percent of the 82 participants saw elocution as the primary function of punctuation. Six years later, Hill (1996) found similar results, with 22 of his 42 participants favouring the rhetorical over the structural functioning of punctuation. Although this finding cannot completely support Scholes and Willis's (1990) claim for a prosodic preference, it does strengthen the contention that the rules of modern grammar—which advocate the purely syntactic use—are not consistently the rules commonly applied (of course, this could be interpreted as further evidence that people do not learn to punctuate properly).
Fourteen percent of Hill's (1996) participants failed to notice, after reading 112 sentences, that some had included commas while others had not—this is particularly surprising given that half of the sentences did contain commas. Further, over a third of the participants did not have the confidence to judge what percentage of sentences contained commas, and those that did gave quite varied responses (although the mean over all evaluations was accurate). In view of the fact that there were strong punctuation effects found in the processing of sentences in the experiment, this finding suggests that perhaps the attentional requirement for commas is low and they are automatically or unconsciously interpreted.

Interestingly, 42 percent of Hill's (1996) participants were content that all the sentences had been adequately punctuated, which is surprising as, if commas are generally felt to be necessary in the disambiguation of garden path sentences, one would have expected this figure to be a great deal lower. Similarly, although the experiment only included correct or necessary punctuation, 42 percent of respondents believed that there had been an overuse of punctuation that was unnecessary or confusing. Hill (1996) concluded that although there is a strong overriding and consistent influence exerted by commas in at least some structural environments, individuals tend to pay very little attention to punctuation and have widely differing views towards it. People may not have a clear idea of when, where or why to place commas, but if included in appropriate places they appear to work in a regular and highly efficient manner (Hill, 1996).

4.3 SUMMARY

The study of punctuation, although customarily dismissed by modern analysts as being of only marginal interest to understanding language structure or use, has come a long way (Bruthiaux, 1995). Undoubtedly, psycholinguistic interest in the subject of punctuation has risen within the last decade, due to the realisation that a complete understanding of the processing of written language is quite impossible without taking punctuation into account.
Yet empirical research has been notable by its absence, particularly in terms of published work. Where punctuation has been included in experimental conditions, psycholinguists have generally assumed that punctuation (most notably commas) effectively disambiguated a range of garden path sentences. With the exception of the recent research of Hill and Murray (e.g., Hill, 1996; Hill & Murray, 2000b), there has been no consideration of how 'disambiguation' might occur or whether punctuation is uniformly effective in differing sentence structures. The limited work on the relationship between individual differences, such as idiosyncratic habits (Steinhauer & Friederici, 2001) and reading-ability (Chapman, 1993), and punctuation suggests further research into this area may well prove quite fruitful.

Developmental research proposes that a simpler systemisation of punctuation, which downplays the importance of rules, and emphasises, in their place, punctuating by 'ear', is an approach that offers promise—both theoretically and pedagogically. However, there is a need to be suspicious of this conclusion, as, on the whole, the evidence suggests little more than that the current methods and milieux for teaching punctuation are not particularly good.
Chapter 5: Pilot Studies and Experiment 1

5.1 PREAMBLE

The present study is a first component in researching the effect of punctuation upon reading speed and comprehension. As discussed in the previous chapter, the limited research on punctuation marks suggests that they offer a great deal of structural information in spite of being apparently minor graphical features in text. The purpose of the following experiment was to establish whether the most contentious and common punctuation mark—the comma—is able to act as a mechanism for disambiguation in an otherwise momentarily ambiguous sentence. We were also interested in whether punctuation exerts a similar influence on both simple- and difficult-to-process ambiguous sentences. Further, we wanted to explore the relationship between the reading-ability of participants and the effectiveness of punctuation in facilitating reading. To begin with, however, this chapter describes a number of pilot studies, which dealt with issues concerning subject recruitment, stimulus selection, and measures used—as these were not only relevant for the current experiment, but for those following as well.

5.1.1 Pilot Work

Quality research entails trial and error, and it would be unusual for all facets of any study to function precisely as planned, no matter how well it may have been devised. To ensure the strength of a study, all procedures, materials, and instrumentation should be thoroughly refined prior to being put to use in a formal research setting. There is no question that the methodology of an investigation can be enhanced to a large extent by the
undertaking of pilot studies (Henk, 1987). Pilot studies allow the researcher to observe how well measures, procedures and stimuli function in a situation that mirrors the formal research setting. Further, piloting identifies factors that could limit the potential efficacy of a study.

5.1.1.1 Pilot Study 1: Measure of Reading-ability

One of the most useful purposes of a pilot study is to examine and establish the validity and reliability of any test instruments through standard verification techniques (Henk, 1987). A measure of reading-ability was needed—in the current as well as subsequent experiments—as a means to achieving, within a single experimental session, an approximate matching of participants to others with similar reading. Experiments later in the project would employ a measure of reading-ability as a means of categorising participants into categories of reading skill, thus providing a way to use a quasi-matched-subject-design (Graesser, Hoffman, & Clark, 1980). Since a reading-ability test would provide the measurement of a dependent variable, its quality would dictate the relative merit of many of the findings. If the instrument was insensitive, many valuable effects might be masked. Moreover, if the instrument was not reliable, the results could not confidently be generalised to the larger population.

The objective of this pilot study was to compare the Computerised (Reading) Placement Appraisal (CPA), an on-line reading-ability assessment tool, with the established Woodcock Reading Mastery Test – Revised (WRMT-R) in order to assess the validity of the CPA. The CPA is an appealing measure, as it reflects the on-line nature of the reading task involved in the research. Moreover, it is a more relevant and contemporary tool for measuring reading-ability than many of the conventional psychological reading-ability tests.

18 This experiment was presented at the 27th Australian Experimental Psychology Conference (Grindlay & Delin, 2001).
Designed by Stanford E. Taylor in collaboration with George and Evelyn Spache, the CPA (a public domain test) is typically used to place individuals in suitable reading development programs. The CPA, in addition to determining a person's independent reading level (a high reading level implies successful comprehension and few vocabulary recognition difficulties), provides a general measure of reading efficiency in the form of reading rates, while reading various levels of text content.

Although the principal function of the CPA is to allocate individuals to appropriate instructional content, it ought to be noted that CPA also reflects the effectiveness with which an individual processes information, uses short-term memory, and achieves literal comprehension. The CPA is an attractive instrument to use because it is computerised, convenient, and free. It is important to note, however, that the CPA is not a norm referenced standardised reading-ability test, nor a diagnostic reading test; it is a 'placement' vehicle that is quick and easy to administer.

The revised edition of the Woodcock Reading Mastery Test (WRMT-R) is a comprehensive battery of off-line tests, which measure several important aspects of reading-ability. The WRMT-R is standardised, has demonstrated excellent reliability and validity, and is probably the most widely used test of its kind in the psychology field—both in research and as a clinical and educational appraisal instrument (Woodcock, 1987). The Total Reading – Short Scale cluster of the WRMT-R provides an estimate of global reading-ability with the administration of only two tests: word identification and passage comprehension. The WRMT-R is particularly appropriate for use with late secondary-school and adult participants. The word identification test requires the subject to read and pronounce a list of words, and, although some words are phonetically regular, the test is primarily a measure of sight-word vocabulary. The passage comprehension task requires a subject to identify words that are missing from a text. The process, considered a modified cloze procedure, requires simultaneous understanding of both the semantic and syntactic clues in the written text (Woodcock, 1987).
5.1.1.1 Method

Participants

Sixty-one first-year psychology students (25 males and 36 females) from The University of Adelaide participated in this experiment. The age range of participants was 17 to 53 years, with a mean of 21.92 years ($SD = 8.24$) for males and 21.44 ($SD = 7.77$) for females. Participants were drawn from a wider pool of respondents ($N = 97$) who had previously filled in a ‘reading behaviour’ questionnaire (Appendix A). The 61 participants were those who indicated interest in partaking in the current study after completing the questionnaire, the remaining 36 respondents indicating they did not want to participate in the current experiment. Although the reading behaviour questionnaire was primarily a method of recruiting interested participants, it also allowed a comparison between people who were inclined to volunteer to participate in reading research and those who were not.

One criticism of research resembling that of the current project is that it will inevitably attract volunteers who are seeking to obtain reinforcement of already existing ability (Coye, 1985) or interest (in the current study, for example, skilled or ardent readers)—this has been labelled “approval need” (Crowne & Marlowe, 1964). Rosenthal (1975) investigated the relationship between volunteering by subjects and need for approval, and found that, in twelve of the twenty studies he looked at, there was significantly greater volunteering by subjects higher in need for approval. However, it is unlikely that the variable of need for approval is solely responsible; rather, joint effects of two or more moderator variables (such as type of task, incentives offered, instruments employed and gender) may account for the obtained difference in outcomes (Rosenthal & Rosnow, 1975).

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19A power analysis was conducted, which indicated that 60 participants were needed to achieve 80% power at $\alpha = 0.05$. 

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In comparing respondents who participated in the current study and those that did not, it is important to note that we are not contrasting the reading behaviour of non-volunteers and volunteers, rather first-level volunteers and second-level volunteers (Rosenthal & Rosnow, 1975). Therefore, it is possible that non-volunteers may differ in reading behaviour from all respondents—although this is almost impossible to address unless non-volunteers are ‘forced’ to provide such information. Nevertheless, the present study does allow a comparison of those people who were willing volunteer for a second, and time-consuming, reading study and those that were only willing (or able) to fill in a five- to ten-minute reading behaviour questionnaire.

Analysis on responses to the reading behaviour questionnaire revealed no significant differences between the first-level and second-level volunteers with regard to age, gender or vocabulary level. Moreover, the self-reported manner, category, amount, and genres of reading did not differ between the two groups. For the purpose of this and subsequent experiments, these findings are encouraging, as they suggest that participants volunteering for reading research may not be unrepresentative of first-year psychology students as a whole with regard to reading behaviour.

Materials

Computerised (Reading) Placement Appraisal (CPA):

The CPA determines four components of reading-ability: independent reading level, usual reading rate, comprehension competence, and vocabulary level. The appraisal format has three parts, the first of which involves a series of 100-word texts and literal comprehension questions. The number of texts that a participant encounters varies (from 3 – 7) according to subject accuracy. This first part is used to determine a tentative independent reading level and usual reading speed on various levels of content. The second component of the CPA requires participants to read a 300-word selection, based on
their tentative independent reading level, and to answer a range of comprehension questions aimed at testing their depth of understanding. This final reading is a confirmation of the participant’s reading level and reading rate. Finally, so as to determine vocabulary level, participants are required to complete a series of word meaning and use exercises, starting with items based on their independent reading level, and proceeding to items determined by the accuracy of earlier responses. The CPA can be completed individually in 20 to 30 minutes, and the results of each participant’s performance are available in either display or printout form.

*The Woodcock Reading Mastery Test – Revised (WRMT-R) Total Reading – Short Scale:*

The WRMT-R Short Scale comprises two parts. The first, word identification, requires the participant to identify isolated words that appear in large type letters in the test book. The term *identification* implies that a participant may respond correctly to a stimulus word even though they may have had no previous experience with that word. As participants proceed through the test items, they encounter words that appear less and less frequently in written English language. For an answer to be scored correct the participant must produce a natural reading of the word within approximately five seconds—it is not assumed that the participant ‘knows’ the meaning of any word correctly identified. The second part of the WRMT-R is the passage comprehension test, which measures a participant’s ability to study a short text passage (usually two to three sentences long) and to identify a key word missing from the passage, which is represented with a blank line. The items selected ensure that it will not be possible for a participant to provide an acceptable response based on reading a few words on either side of the blank. A correct response demonstrates that the participant has comprehended the entire passage (Woodcock, 1987). The Short Scale can be administered in approximately 15 minutes and requires interaction with the experimenter.
Procedure

Upon arrival at the session, participants were presented with an information sheet and standard consent form. Once participants had completed the latter, any questions or concerns were addressed, and they were then asked to undertake either the CPA or the WRMT-R—which were counterbalanced in order to control for practice effects. Following a five-minute break, participants completed the remaining test. Upon the completion of both tests, participants were asked about their preferred means of receiving feedback (e.g., phone, e-mail, letter) and whether they would be interested in participating in subsequent experiments. Participants were then provided with a debriefing sheet that outlined the aims of the pilot study, offered an opportunity to ask any questions regarding the study and, lastly, thanked for volunteering their time. All sessions were completed within forty minutes to an hour.

5.1.1.1.2 Results

Results indicated that the CPA correlated highly in all domains with the well-validated and commonly used WRMT-R (Table 5.1). What is significant for the current project is that there was a positive and large correlation between the CPA reading level and WRMT-R passage comprehension \( r(59) = .84, p < .01 \), as well as a between the CPA vocabulary level and WRMT-R word identification \( r(59) = .73, p < .01 \).

Table 5.1. Correlation Matrix for CPA (italicised) and WRMT-R items

<table>
<thead>
<tr>
<th></th>
<th>Reading Level</th>
<th>Reading Rate</th>
<th>Vocabulary Level</th>
<th>Word Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Rate</td>
<td>.346**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vocabulary Level</td>
<td>.711**</td>
<td>.289*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Word Identification</td>
<td>.652**</td>
<td>.179</td>
<td>.731**</td>
<td></td>
</tr>
<tr>
<td>Passage Comprehension</td>
<td>.838**</td>
<td>.334**</td>
<td>.776**</td>
<td>.768**</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
The results of the validation study provide good justification for the decision to use the CPA as a tool for rating participants on reading-ability. The current findings suggest that the CPA may be a suitable on-line assessment tool of reading-ability and, therefore, may be an appropriate measure to be used in on-line reading research, where similarity between tests of reading-ability and experimental tasks is desired. Moreover, the CPA has the added benefit of providing a measure of usual-reading-rates, a feature not afforded by the standard off-line reading skill measures.

5.1.1.2 Reading Time as a Measure of Reading Processes

Self-paced reading time methods are based on the assumption that people read at a pace that consistent with their internal comprehension processes and that, therefore, measures of reading rates make known the comprehension processes themselves (Just & Carpenter, 1980). The usual interpretation of reading times is based on two additional assumptions, the immediacy and the eye-mind hypotheses. According to the immediacy hypothesis, the reader attempts to comprehend a unit of text instantly rather than delaying until the end of a clause or sentence. Similarly, the eye-mind hypothesis implies that the mental processing of a unit of text takes place parallel with the eye-fixations on that unit; and hence that there is no delay between the word being fixated and the mental processes attached to that word (Haberlandt, 1994).

More extensive use of on-line methodologies, such as self-paced reading (including eye-tracking, key-press, and pointing methods), has provided detailed information about the real-time properties of comprehension, which is, after all, a real-time process (Carpenter, Miyake, & Just, 1995). Although critics of reading-time methods accept that reading times reflect changes in the processing load, they observe that reading times do not reveal the source of the changes in processing (Altmann & Steedman, 1988).

20 Upon request, findings were forwarded to the CPA designers.
Without question these on-line methods have produced interesting data; however, there are uncertainties accompanying each technique. Predominant among such issues is the artificiality of procedures, as they involve unnatural reading for participants. Consequently, the reading rate that emerges from such paradigms, when compared to normal reading, is frequently atypical (Rayner & Sereno, 1994). Moreover, some of the procedures suspend the flow of reading, while others (such as completion responses) involve a secondary task.

A technique that overcomes many of the issues, particularly the artificiality aspect, is a simple variation of the word-by-word reading paradigm, in which the unit of presentation is expanded to include a number of words. What this paradigm gains in naturalness of reading, it loses in terms of its ability to register the precise time needed for processing individual words and, therefore, supplies a poor reflection of moment-to-moment processes (Rayner & Sereno, 1994). Extending this method to whole sentences or paragraphs would have the beneficial effect of greatly reducing the artificiality of the testing procedures. However, the increased naturalness of the task would come at a cost of the sensitivity of reading time as a measure of reading processes.

5.1.1.2.1 Display system and software used

A Toshiba Satellite 2520CDT laptop computer with an AMD-K6(tm) 3D processor (300 MHz) was used in the current project to present sentences, as well as to record participants' reading times, yes/no responses and, in the final experiment, comprehension-confidence. All experiments were run using the DMDX software developed at Monash University (Melbourne) and at the University of Arizona, by K.I. Forster and J.C. Forster. DMDX is a Win 32-based display system used in psychological laboratories around the world to measure reaction times to visual and auditory stimuli. The accurate timing of events and reaction times has led to DMDX being currently used in a wide range of
experimental paradigms. DMDX is a member of the DMASTR family, and represents an extension of the original DOS programs (DM and DMTG) to a Windows 95/98 environment. The experimenter wrote the program code for the testing, with the aid of suggestions from the DMDX-user newsgroup.

5.1.1.3 Pilot Study 2: Selecting Sentence Stimuli

For the purpose of the Experiment 1, sentence-stimuli were selected according to ‘difficulty’ ratings (given by independent judges) of various simple sentences. These ratings were used to determine which 32 sentences, selected from a pool of 90, would become test sentences in the experiments. The 16 sentences that were considered the simplest to read in the absence of sentence-internal punctuation and the 16 sentences that were considered the most difficult were selected, thereby providing two clear stimulus groups.

5.1.1.3.1 Method

Raters

The ten participants were six female and four male acquaintances of the experimenter, ranging in age from 19 – 34 years, with a mean age of 24.5 (SD = 4.88).

Materials

A numbered list of the ninety sentences that contained no sentence-internal punctuation (two versions in reverse order), and a rating sheet with a seven-point visual analogue scale marked from 1 (not at all confusing) to 7 (extremely confusing) were the only materials used.

21 Since the DMDX has generously been placed in the public domain, use of the software is freely available.
22 Although these are not reported in detail here, some minor pilot studies were conducted which, among other things, dealt with instructions to participants, time limits, displays and apparatus calibration.
Procedure

Once participants had read the information sheet and signed the consent form, they were asked to rate each of the sentences according to the seven-point scale provided. Participants were then thanked and asked for verbal feedback regarding the nature of the rating task—specifically whether it was a straightforward or difficult undertaking. The rating phase took no more than fifteen minutes to complete.

5.1.1.3.2 Results

The 16 sentences with the highest readability rating means and the 16 with the lowest were selected, creating two clear sentence stimulus groups: ‘simple’ and ‘difficult’. In terms of inter-rater reliability, analysis indicated that there was a significant concordance between the judges’ ratings of the sentences, with Kendall’s $W = 0.88$ and Kendall’s $\chi^2 (31, N = 10) = 272.12, p < .001$. Furthermore, verbal feedback provided by the participants reinforced the method of rating sentences, as all judges agreed that it was a relatively simple task.

5.2 EXPERIMENT 1

The works of Hill (1996, 2000b), Christianson et al. (2001), Cohen et al. (2001) and, to a lesser extent, Mitchell (1986) and Mitchell and Holmes (1985) provide evidence that commas may cause a reader to interpret an ambiguous phrase in a different way from that normally selected in the absence of punctuation. Essentially, their collective findings imply that commas can play a role in guiding the course of parsing and comprehension, although this effect is not necessarily universal. These findings have, to a slight extent, confirmed the claims made by language researchers concerning the facilitation effects of punctuation, which are intuitively logical, yet largely empirically uncorroborated.

The study by Chapman (1993) pointed toward an error/complexity bias in the effect of punctuation, with skilled readers being significantly more affected in terms of reading speed and comprehension by errors in punctuation. Baldwin and Coady (1978) argued that
a dichotomy exists between critical and redundant punctuation cues, suggesting that punctuation exerts a variable influence on reading comprehension proportional to the amount of structural information that can be derived from other sources. Similarly, Hill (1996) found the influence of punctuation to be dependent on its syntactical significance.

5.2.1 Experimental Aims and Hypotheses

The aim of the present study was three-fold. Primarily, the study provided an opportunity to consider the influence of punctuation on participants' reading speed when faced with both simple- and difficult-to-process ambiguous sentences. Secondly, the impact of punctuation on the reading speed of skilled readers compared to that of less-skilled readers was also examined. Finally, the experiment supplied information on whether or not a less artificial paragraph-testing format is sensitive enough to measure any detriments to reading time caused by punctuation omissions. An additional, less formal, aim was to determine whether the procedure, software, and experimental design envisaged were effective, and what modifications—if any—were needed for future experiments.

Based on the assumptions made by language researchers and the limited previous research, the following general hypotheses were formed: firstly, that the inclusion of punctuation decreases reading time for ambiguous sentences; secondly, that decreases in reading time initiated by punctuation are larger for more difficult-to-process sentences compared to simple-to-process sentences; and thirdly, that the degree of facilitation owing to punctuation depends on the reading skill of the participant, and therefore reading-ability influences the magnitude of punctuation facilitation—assisting skilled readers to a greater extent.
5.3 METHOD

5.3.1 Participants

The majority of participants were drawn from first-year students attending The University of Adelaide, with the greater part of this sample being students studying first-year Psychology. Forty adult readers (14 male and 26 female) participated in the study. It is unlikely that the overrepresentation of women, observed throughout the current project, was due to a greater willingness of women to participate, as it reflected the predominance of females studying psychology. The mean age of participants was 21.28 (SD 5.33), with a range of 17 to 41 years. The incentive of being put in a draw for a voucher at a local music store was used as an aid in recruiting participants.

5.3.2 Materials

5.3.2.1 Measures

The present study employed the 'Window Method' for testing reading speed (Haberlandt, 1994), where the reader is exposed to successive segments of text (the windows) by pressing a key. The intervals between presses are defined as the reading times for the window. It is acknowledged that such global measures are limited in that they do not reveal the location of critical processes within a passage. However, this is not a concern in the present study, as a singular reading time per window is all that is required.

The Computerised (Reading) Placement Appraisal (CPA) assessment tool was used to grade participants on reading-ability (see Section 5.1.1.1). The software and displays systems used were those outlined in section 5.1.1.2.

5.3.2.2 Stimuli

The 16 simple and 16 difficult sentences appeared in two formats: either standing alone or embedded in a paragraph with a relevant context. In each of these formats,
sentences appeared either without punctuation or with appropriate punctuation, thereby creating four conditions (see Appendix B for example items). As described in section 5.1.1.3, the sentences were selected from a pool of 90 ambiguous sentences according to 'reading difficulty' ratings given by ten independent judges in the Pilot Study 2. These ratings were used to determine which sentences would become test sentences in the present study. The 16 most readable sentences and the 16 sentences that attracted the lowest readability ratings were selected, thereby providing two clear stimulus groups.

Participants encountered all 32 experimental items, with each appearing only once in one of the four aforementioned categories. These conditions were varied for each participant using a Latin-square design so as to get an equal distribution of each stimuli sentence in each condition. There were also nine filler sentences and nine filler paragraphs, bringing the total number of stimuli to 50, which were presented in random order.

5.3.3 Procedure

Once participants had arrived for the experimental session, they were provided with a written general description of the experiment as well as a set of instructions. The description outlined to the participants that they would be asked to complete a reading-ability test, and then undertake a reading experiment where they would be required to read a number of sentences and paragraphs on a computer. Participants, although told about the nature of the task, were not told of the focus of the experimental task (i.e., punctuation) in order to avoid priming effects. Upon completing the consent form, participants were placed in front of the computer, which had colour-coded response keys, and a message appeared on the screen asking the participant to follow the instructions and press a button to initiate either the experiment or the reading-ability test (which were counterbalanced). Participants were asked to finish the tasks as rapidly as possible, but instructed not to increase speed to the detriment of accuracy. Following a five-minute break, participants were asked to complete the remaining task.
In the experimental phase, brief instructions and diagrammatic information were presented on the screen, and there was a practice phase in order to familiarise participants with the type of stimulus and response tasks. Participants were invited to ask questions before and immediately after the practice trials. During the experiment, pressing the ‘Ready’ button brought up a fixation marker (X) on the left middle of the screen. Pressing ‘Yes’ replaced this with the complete sentence or paragraph. Before continuing to the next sentence or paragraph, the ‘Ready’ button had to be pressed, which insured that there was occasion available for the participant to rest, as there was no time limit during the ‘ready’ phase. All participants took part in six practice trials: four sentences and two paragraphs, both punctuated and unpunctuated. The participants then moved to the experimental phase, where the presentation order of the 50 sentences and paragraphs (32 test stimuli, 18 fillers) was determined randomly for each of the participants.

Participants were then thanked, told about the focus of the study (and provided with a debriefing sheet), and placed in the draw for the music voucher. Generally, the experiment took between 30 to 50 minutes to complete.

5.4 RESULTS

Figure 5.1 shows the mean differences between punctuated and unpunctuated conditions, for both simple- and difficult-to-process sentences. The inclusion of punctuation reduced reading time in the vast majority of sentences. The apparent difference in central tendency was confirmed by a Wilcoxon Signed Ranks Test, across all sentences \((z = -4.15, p < .001)\), as well as difficult \((z = -3.26, p < .001)\) and simple \((z = -2.48, p = .013)\) sentences separately.
Figure 5.1. Mean difference in reading time between punctuated and unpunctuated sentence conditions for each of the 32 stimuli (punctuated condition minus unpunctuated condition). The darker bars indicate the difficult sentences.

Given that sentences and paragraphs were not matched for length or structure, any sensible overall account of the data needs to consider the effect of variance. It was apparent from the data that the variances in reading times for the individual sentences were quite heterogenous, which was indicated by an analysis where the differences between the restricted log likelihood ratio of an initial constant variance model was compared to the variance components model using the SPSS procedure mixed23. Chi-square analyses revealed significant differences between the two models, for both sentence, ($\chi^2 (1, N = 32) = 292, p < .05$) and paragraph ($\chi^2 (1, N = 32) = 210.1, p < .05$) conditions. Consequently,

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23Mixed Model Analysis of Variance (SPSS Version 11)
a mixed model analysis of variance (random coefficient model) was used which enabled an estimation of the separate variance for each sentence (see Jennrich & Schluchter, 1986).

The results for the sentence-testing condition revealed that punctuation had a significant and beneficial effect on reading time across all the sentences combined, $F(1,293) = 115.84, p < .001$. Although the effectiveness of punctuation tended to be greater for difficult-to-process sentences compared to simple-to-process sentences (Table 5.2), the difference between types of sentences was not significant. There was, however, a significant interaction effect between punctuation and reading-ability ($F(1,293) = 149.67, p < .001$), where the magnitude facilitation caused by the inclusion of punctuation was greater for skilled readers.

Table 5.2. Means and standard deviations (ms) of the simple and complex sentences for both punctuated and unpunctuated conditions.

<table>
<thead>
<tr>
<th></th>
<th>Unpunctuated</th>
<th>Punctuated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Simple</td>
<td>2991.60</td>
<td>724.51</td>
</tr>
<tr>
<td>Complex</td>
<td>3115.21</td>
<td>654.50</td>
</tr>
<tr>
<td>Total</td>
<td>3053.40</td>
<td>692.10</td>
</tr>
</tbody>
</table>

Although the pattern of mean differences in the paragraph-testing condition was not discordant with the sentence-testing condition, analysis revealed it was not sensitive enough to detect any differences between the punctuated and unpunctuated conditions—owing to high levels of inter-subject variability.

5.5 DISCUSSION

The reading of simple- and difficult-to-process ambiguous sentences was significantly reduced by the introduction of commas, which strengthens the notion that the parsing process is influenced by punctuation. It was expected that participants would find misanalysis hard to avoid in the difficult unpunctuated sentences, such as 5.1, because both the verb used in the sentence and the lack of punctuation caused them to be biased...
towards the inappropriate structure (e.g., Hill, 1996; Mitchell, 1986; Mitchell & Holmes, 1985).

(5.1) While the warrior fought the enemy retreated to camp.

In the case of simple-to-process ambiguous sentences, it was expected that the correct parsing decisions would be made even in the absence of punctuation, and therefore it was predicted that these types of sentences would be essentially unaffected by the presence of the commas. The current findings, however, do not support the view of a continuum of critical to redundant punctuation held by Baldwin and Coady (1978), nor do the findings corroborate Hill's (1996) belief that the degree of usefulness of a comma is inversely proportional to the amount of structural information that can be derived from other sources. Overall, the results provide no confirmation for the notion of syntactic redundancy in parsing with punctuation. While there was a trend for comma effects to be maximised in difficult ambiguities, the fact that there were strong facilitation effects in most simple ambiguous sentences as well suggest that the facilitatory power of the comma remains, even when it acts only to support the existing lexically chosen structure.

One explanation as to why the present findings contradict the concept of punctuation redundancy established in previous research may be found in the fact that the present study used only ambiguous sentences, whereas Baldwin and Coady (1978) used easily parsed canonical sentences, and Hill (1996) made use of non-ambiguous controls. Even though the simple-to-process ambiguous sentences employed in the current study had been rated as "not confusing at all" without punctuation, their overarching structure is still an ambiguous one. Nevertheless, if indeed there were a continuum of punctuation effectiveness from critical to redundant, one would have expected to find a clearer disparity in facilitation between the two sentence stimulus groups in the present experiment, as punctuation was judged to be syntactically critical in the difficult-to-process sentences,
while word order was considered to be the primary (and sufficient) source of the syntactic information in the simple-to-process sentences. It would be sensible, therefore, to employ matched non-ambiguous controls in further research if attempting to address this issue of syntactic significance of punctuation. If, as found in the present study and contrary to the two previous relevant studies, punctuation was shown to have a facilitating effect (even when overlapping with syntactic cues) while guiding parsing of non-ambiguous sentences, then this would have important consequences to punctuation practice— In essence, opposing the redundancy viewpoint of punctuation.

Perhaps another explanation for punctuation facilitation in simple-to-process ambiguous sentences is slower reading times being caused by the omission of a comma (which participants may have been expecting), rather than a processing benefit caused by comma inclusion. Adams et al. (1998) when attempting to reconcile their study’s findings with a previous unpublished experiment (Adams et al., 1992) suggested that the observed slower reading times could be viewed as being caused for no deeper reason than that of a comma being expected at a clause break, such as in 5.2 between an initial subordinate clause (After the dog scratched) and a main clause (the veterinarian took off the muzzle).

(5.2) After the dog scratched the veterinarian took off the muzzle.

Whether the notion of slower reading times caused by unfulfilled punctuational expectations can be extended to include simple ambiguities, however, is perhaps doubtful, as readers are less likely to be offended by the lack of punctuation if comprehension is effortlessly achieved.

The strong interaction effect found in the present experiment between the magnitude of punctuation facilitation and reading-ability suggests that the effectiveness of punctuation is dependent on reading skill. This finding supports Chapman’s (1993) contention that punctuation is a tool best used in the hands of skilled readers. Just and
Carpenter (1992) have proposed that, in selecting one parsing interpretation over another, a reader's use of certain types of information (such as discourse context information) may well depend on his or her individual capacity for comprehension. Thus, high-capacity readers may have resources that permit them to profit from an expansive range of potential constraints, while low-capacity readers are forced to restrict themselves to more immediate syntactic concerns (Just & Carpenter, 1992). In extreme cases, an individual's capacity may determine whether a selection needs to be made at all, or whether the alternative readings can be pursued in parallel (Mitchell, 1994). The current findings indicate that one of the constraints that high-capacity readers are perhaps able to take account of is punctuation. Therefore, depending on the individual's capacity, parsing decisions appear to be influenced differently by the absence or presence of punctuations.

Thus, one possible reason as to why the magnitude of facilitation was found to be larger with skilled readers could be the mismatch between the mode of responding to punctuation employed by less-skilled readers and the pattern of responding assumed necessary for successful comprehension to occur. Skilled readers have been shown to be able to organise sentences into meaningful 'chunks', whereas less-skilled readers often struggle to organise material in a manner that is required for reading comprehension (Stevens, 1981). Punctuation may well be a linguistic tool that enables skilled readers to apportion text into meaningful units—an organisational skill which less-skilled readers are not proficient in using. Studies into the metacognitive aspects of reading (where readers monitor their degree of understanding or its lack) in children provide additional support for this speculation, as good readers have been found to be significantly more able to recognise text organization (e.g., McGee, 1982; Sanacore, 1984).

Similarly, adult readers have been found to have a greater repertoire of strategies for building a 'scaffold' (a structure of meaning) within the text (Smith, 1985) and to draw more inferences regarding the structure of text (Wilson & Hammill, 1982). Moreover, less-skilled readers have been shown to know less about such print-related concepts as word...
order in sentences and, importantly, the function of punctuation marks (Stewart & Tei, 1983). Presumably, readers who failed to code the words they read into meaningful phrases or chunks may have had difficulty comprehending even when they were able to attach meaning to individual words, thereby incurring a time-consuming reanalysis. Skilled readers, on the other hand, presumably used punctuation to organise input into meaningful units, implying that they are using effective coding strategies that involve punctuation.

5.5.1 Conclusion

Comma facilitation effects were clearly present, suggesting that the parser can use commas to resolve local structural ambiguities. The insertion of a comma, therefore, seems to affect the parser in a way that leads it to decipher an ambiguous phrase differently from that usually selected in the absence of a comma. Moreover, the magnitude of these effects established that the materials used in the study were capable of producing extremely strong garden path effects.

Commas appear to be a valuable tool in written language, acting as immediate effective guides to parsing. The present findings empirically illustrate the potential of punctuation to disambiguate ambiguous sentences, both difficult- and simple-to-process. These data are problematic for the view that initial parsing decisions are based (exclusively) on tree-structural considerations, as something other than a parsing tree must be consulted before a decision is made. Similarly, purely lexical or discourse accounts of parsing do not offer any explanation for observed comma effects either, and would have to be supplemented before they could process punctuational influences (Mitchell, 1994).

Exposure-based explanations, which propose that readers’ choices are determined by their past encounters with the ambiguous forms in question, might offer an account. The different outcomes for high- and low-skilled readers could be indicative of previous differing encounters in comparable circumstances in their past experiences with language. Developmental data, which suggests that as children get older their ability to use
punctuation as a structural guide is improved (e.g., Cordeiro, 1988; Edelsky, 1983) and that an increased experience with punctuation leads to greater knowledge about the marks (Calkins, 1980), provides direct support for the exposure hypothesis. These findings suggest that as a reader gains linguistic experience, he or she systematically adapts to biases imposed by contact with language—in this case, punctuation. The current results provide preliminary support for the view that there is a relationship between people’s parsing resources (in this case, punctuation) when dealing with ambiguous structures and the prevalence of these forms in their prior exposure to language.

These current results are not particularly surprising—most writers would use a comma to aid the interpretation of sentences of the kind used in this experiment. However, theories of parsing rarely incorporate formal procedures for managing punctuation, and these findings serve to re-emphasise that such facilities ought to be included in any complete model of parsing.
Chapter 6: Experiment 2

6.1 PREAMBLE

There has been little, if any, research or discussion of the mechanisms by which punctuation disambiguates or, importantly, whether it is equally effective across different sentence structures. Previous experiments have illustrated that punctuation (in these cases the comma) can have powerful disambiguating effects in some ambiguous structures (Adams et al., 1992; Grindlay & Delin, 2001; Mitchell, 1986), yet these studies provide no clear evidence for the universality of disambiguation by punctuation across sentence types. The experiment reported in this chapter examines whether punctuation, in the form of a comma, can provide a dependable and effective cue for the disambiguation of an array of garden path sentences.

As discussed in Chapter 4, many language researchers have assumed, without any empirical justification, that punctuation can alleviate the processing difficulties associated with certain types of ambiguous sentence structures. The results from Experiment 1 provide persuasive support for this assumption. These findings, coupled with the limited previous research, certainly point toward processing benefits as a result of punctuation, yet whether the insertion of a comma simply facilitates processing or provides complete disambiguation is not known. To address this question of the syntactic significance of punctuation to parsing, Experiment 2 made use of matched unambiguous control sentences. This enabled a comparison between sentences that are unambiguous (due to word order providing the necessary syntactic information) and sentences where punctuation is syntactically critical, and as a result the human parser cannot rely on word order as an effective guide.

24This experiment was presented at the annual APS Conference (Grindlay, 2001).
The factors influencing the potency of punctuation, as well as its manner of
disambiguation, remain largely undetermined. The magnitude of the relationship between
reading-ability and punctuation facilitation found in Experiment 1 was considerably greater
than had been expected. This finding suggested that the effectiveness of punctuation is heavily
dependent on reading skill. This factor was further investigated in the Experiment 2 by means
of dividing participants into skilled and less-skilled reading-ability groups. This permitted a
comparison in terms of how each group responds to the introduction (or, alternatively, the
omission) of a comma in a range of ambiguous sentences, as well as their unambiguous
counterparts.

6.1.1 The Contribution of Robin Hill and The Importance of Replication

The experiment reported in this chapter is essentially a replication of Robin Hill’s (1996)
Masters thesis research, as well as his and Wayne Murray’s subsequent research (Hill &
Murray, 2000b). In addition to the scarcity of piloting in reading research, Henk (1987)
suggested that there is an apparent reluctance to pursue or insist upon the replication of
findings. In an area where participants are known for their erratic performance, it is important
that all phenomena be demonstrated repeatedly before results can be considered reliable
(Gravetter & Wallnau, 1992). One criticism of Hill’s (1996) experiment was that he used
largely postgraduate students (a sample, one would have assumed, which is well above average
in terms of literacy). It was hoped that the present study might overcome this problem not
simply by using a more varied population in terms of literacy, but also by taking into
consideration the factor of a individual’s reading-ability.

Hill (1996) can be credited with being first to systematically consider the effect of
punctuation marks on a range of sentence ambiguities, as well as investigating the ‘critical
zone’ in the sentence where facilitation may take place. Moreover, Hill and Murray were also
the first to include unambiguous matched alternatives for comparison. Their findings showed
strong punctuation effects on the processing of early-closure and reduced relative-clause
constructions, but not in the non-ambiguous versions of either of these, and not in sentences containing prepositional phrase ambiguities, using both self-paced reading (Hill, 1996) and eye-tracking methods (Hill & Murray, 2000b). The addition of punctuation was shown to increase processing time on sections of a sentence immediately preceding the comma, while facilitating the processing that followed. This could be viewed as short-term cost (increased processing time caused by the insertion of a comma) for long-term gain (decreased overall processing time caused by successful parsing with little or no need for reanalysis).

The highly-regarded work of Hill and Murray provides strong grounds for supposing that punctuation can alleviate the processing difficulties associated with certain garden path sentence structures. Nonetheless, there is a need not only to attempt to replicate some of these findings with a different sample, but to investigate further the contribution of reading-ability to the influence of punctuation on parsing.

6.1.2 Ambiguous Sentence Structures: the empirical value of parsing failure

When reading, it is not unusual for readers to misinterpret some section or sections of a sentence. Comprehending sentences involves computing the structural relationships between the constituent words, phrases and clauses (Mitchell, 1986). This is complicated, in most natural languages, by the fact that effectively all sentences contain strings of words that are structurally ambiguous (or, at least appear to be so when first encountered).

Psycholinguists are interested in how readers reach conclusions about the syntactic structure of sentences, and often this involves the study of temporarily ambiguous sentences. Generally, ambiguous sentences contain a section of text that initially appears indefinite as between two syntactic analyses, but is subsequently disambiguated in favour of one analysis (Patterson, 1998). Normally, the first issue considered is whether readers decide upon the correct analysis when first encountering the ambiguous section of text. Often they do not, and these sentences in which readers primarily opt for the wrong analysis, and are subsequently forced to reanalyse the sentence, are labelled garden path sentences. They are labelled garden
path sentences for the reason that the reader initially pursues an erroneous route when parsing the sentence.

Descriptively, garden path sentences produce a misanalysis in the initial syntactic analysis or parse. When the misanalysis is recognised by the parser—characteristically due to the breakdown in the ongoing analysis—reanalysis is necessary. Often, the reader may be conscious of the effort required to perform reanalysis in the case of an ambiguous garden path sentence. It is precisely these failures in parsing that make garden path sentences a fertile area of research (Christianson et al., 2001). By probing how garden path sentences are initially parsed, reanalysed, and ultimately comprehended, one can gain insight into the principal mechanisms that more typically operate accurately.

As people have been shown to make similar patterns of errors when reading garden path ambiguities, it is reasonable to assume that people analyse these types of sentences in similar ways. Logically, then, it must be possible to define the rules a human parser follows, or at least state what sources of information they use when making initial decisions about the structure of sentences. The sources of knowledge that could be used have been shown to include knowledge about the possible syntactic structure of sentences, knowledge about the meanings of words and sentences, and knowledge about the context in which the sentence appears. Perhaps an additional source of knowledge could be knowledge of punctuation.

6.1.3 Types of Garden Path Sentences

Sentence processing is almost always an effortless task. This seemingly trite observation about human linguistic capability becomes considerably more puzzling when juxtaposed to the somewhat less apparent fact that human language exhibits extensive (local) ambiguity. That is to say, in the processing of a particular sentence there are likely to be numerous points at which there are multiple analyses compatible with the input processed thus far, only one of which will turn out to be consistent with the remainder of the utterance. Many sentences are temporarily ambiguous, and because of processing immediacy, a single structural
interpretation must be selected. Generally, the simpler interpretation is preferred, and if the preferred interpretation turns out to be incorrect when disambiguation information is encountered, readers must recover. The time to recover constitutes the garden path effect (Figure 6.1).

![Diagram](image)

*Figure 6.1. Reanalysis by selection from parallel alternatives (Lewis, 1998).*

The dashed lines indicate the path the parser pursues. The heavy dashed lines indicate the reanalysis that takes place when some paths are dropped from consideration (garden path effect). S indicates the starting state; G indicates the goals state (a well-formed syntactic representation).

Three types of structures that have been shown to produce strong garden path effects are early-closure, prepositional phrase and reduced relative sentences. Typically, in previous studies on these types of ambiguous sentence, the punctuation marks that would identify a clausal reading are elided.

### 6.1.3.1 Closure Ambiguities

Reading problems linked with closure sentences, such as 6.1, are well documented and notoriously difficult to prevent.

(6.1) Because Bruce drinks *wine*…

(6.1)a. Because Bruce drinks *wine* beer is never kept in the house

(6.1)b. Because Bruce drinks *wine* is never kept in the house
The word *wine* in sentence 6.1 is syntactically ambiguous, because it could function as either the direct object of the verb in the first clause (as in 6.1a), or as the subject of the second clause (as in 6.1b). According to the principle of late-closure, the parser prefers to attach new material to the phrase or clause currently open rather than create new constituents. Thus, in sentence 6.1 the analysis in which *wine* is the direct object would initially be chosen and sentence 6.1a would be easily parsed. In contrast, sentences such as 6.1b cause parsing to be much more difficult. The disambiguating word *is* signals that *wine* cannot be the direct object of *drinks*—consequently syntactically reanalysis of the ambiguous phrase is required (Ferreira & Henderson, 1991). Sentences such as 6.1a are consistent with late-closure and are termed *late-closure sentences*; sentences such as 6.1b, which require that the first clause be closed early, are termed *early-closure sentences* (as they require reanalysis they are classed as 'garden path').

Intervention in sentence processing associated with the comma has discredited, to some extent, the basic two-principle-driven garden path model as a sole explanation of human parsing. In line with the main assumption of the constraint-satisfaction view—that information from a variety of sources may confine the emerging analysis—language researchers have reasoned that commas provide effective disambiguation in the early-closure construction (e.g., Adams et al., 1998; Clifton, 1993; Mitchell, 1986; Pickering & Traxler, 1998). Until quite recently, however, no studies had included a preferred late-closure (non-ambiguous) alternative for comparison. Thus, while the results certainly provided evidence for facilitation related to the inclusion of punctuation in the processing of early-closure items, uncertainty remained about whether commas provided complete disambiguation or simply aided in correct analysis. This gap has been rectified by a considerable extent by the comprehensive research of Robin Hill and Wayne Murray at the University of Dundee (Hill, 1996; Hill &

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25 Disambiguating in this context is a standard psycholinguistic usage. Nevertheless, it is important to acknowledge that such usage is perhaps misleading, as the word *is* does not disambiguate except incidentally. Rather the word acts as a ‘dead-end’ signal or syntactic ‘blocker’, indicating that the original parsing was wrong, and pointing to an alternative parsing, which *may* lead to the correct parsing decisions.
Murray, 2000b). Their research has shown that punctuation assists in the parsing of early-closure items and neither facilitates nor inhibits a correct ‘default’ attachment preference associated with late-closure items.

6.1.3.2 Prepositional Phrase Ambiguities

Another traditionally problematic sentence structure considered in Experiment 2 involved prepositional phrase ambiguities such as 6.2.

(6.2) Siobhan saw the man with the telescope

The garden path model is able to account for the ambiguity in attachment of prepositional phrases exhibited in this sentence type. The principle of minimal attachment implies that the prepositional phrase with the telescope will be attached to the verb phrase as describing the instrument used for observation. While the telescope could reasonably belong to the man rather than to Siobhan, this is argued to create a more complex phrase structure involving the insertion of an additional node in the second noun phrase. Minimal attachment dictates that the initial structural preference will always favour the verb phrase attachment and that this preference should prevail even when plausibility or other factors ought to provide an advantage26 (Hill & Murray, 2000b), for instance if the prepositional phrase was with the umbrella. Despite these local ambiguities, people have little difficulty in parsing these sentences, and prepositional phrase ambiguities are generally construed to be soft or easily resolved ambiguities.

The limited empirical consideration of punctuation on prepositional phrase ambiguities has found no comma influences on self-paced reading (Hill, 1996). Further, eye-movement data has suggested that punctuation does little more than prompt earlier identification of the problem, and does not allow it to be avoided (Hill & Murray, 2000b).
6.1.3.3 Reduced Relative Ambiguities

The most famous formulation of a reduced relative garden path sentence is given in 6.3 and belongs to Bever (1970):

(6.3) The horse raced past the barn fell

The expression *raced past the barn* is ambiguous between two syntactic analyses. The first of these is the simple active analysis, where the phrase *raced past the barn* provides information about what the horse did—it raced past the barn. The second analysis is called the relative clause analysis, and on this analysis the phrase *raced past the barn* provides modifying information. Specifically, it further describes a property of the horse that conceivably differentiates this horse from other horses. Additional forms of modifying clause that could be used to distinguish one of a group of horses in a field are such things as *with a black nose*, or *near the paddock’s gate*. The sentence in 6.3 is disambiguated in favour of the relative clause analysis by the word *fell*. This type of sentence is labelled a reduced relative clause sentence, and has exactly the same meaning as the unreduced relative clause sentence in 6.4. These types of sentences are termed reduced relative sentences for the reason that they lack the explicit words *which was* or *that was*. In English these are considered optional, and reduced relatives are still considered grammatically correct, and should ultimately result in the same interpretation as their unreduced versions.

(6.4) The horse that was raced past the barn fell.

Past investigations (e.g., Binder, Duffy, & Rayner, 2001; Britt, Perfetti, Garrod, & Rayner, 1992; Clifton, Bock, & Rado, 2000; Ferreira & Clifton, 1986; Rayner, Garrod, &

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26 However, this default attachment is by no means uncontested, as is discussed in the next chapter.
Perfetti, 1992) into reduced relative ambiguities have shown that readers find temporarily ambiguous sentences like 6.3 difficult to read compared to unambiguous sentences like 6.4. Consequently, it can be presumed that readers initially prefer the simple active analysis of the ambiguous segment of the sentence, and subsequently are required to spend time reanalysing the structure of the sentence when they arrive at the disambiguating word fell. Garden path theory asserts that sentence 6.3 will always be initially interpreted as a simple active sentence, with processing problems only arising when fell is encountered. The first verb, raced, is assumed to be the main verb, and directly attached to the subject, the horse (Hill, 1996).

Unlike early-closure ambiguities, however, it is not immediately and intuitively obvious that punctuation would necessary help with such a robust garden path. If delineating the clausal boundaries with commas can alleviate this kind of processing difficulty, then punctuation must be acknowledged as having a rapid and dominant influence on parsing. The limited previous research has found strong facilitation effects caused by commas were found in both self-paced (Hill, 1996) and eye-movement studies (Hill & Murray, 2000b), in the ambiguous reduced relative condition (although no punctuation effect was found in the unambiguous unreduced relative condition).

6.1.4 Experimental Aims and Hypotheses

It seems uncontroversial to suggest that, in the absence of at least very strong cues, everyone is garden-pathed in early-closure, reduced relative and, to some extent, prepositional phrase ambiguities, and practically everyone assumes that appropriately placed commas would facilitate parsing (Hill & Murray, 2000b). Moreover, certain points in early-closure, reduced relative and prepositional phrase items seem to be suitable and expected positions to mark with a comma. If this premise is correct, and it can be demonstrated that commas reduce or remove processing difficulties in a garden path, then this clearly gives persuasive support for the claim that punctuation can convey critical syntactic information. In order to test this,
however, the processing of not only of punctuated and unpunctuated ambiguous sentences but also of their unambiguous counterparts need to be considered.

The major aim of this experiment was to examine whether punctuation, in the form of commas, provides a dependable and effective cue for the disambiguation of an array of garden path type sentences—as measured by reading speed and comprehension. Moreover, we were interested in whether the magnitude or nature of the effect of punctuation on reading speed and comprehension differs according to reading ability. Additionally, it was hoped that the cumulative design would provide information regarding the critical zone for facilitation caused by the inclusion of punctuation.

It was expected, based primarily on the findings of Hill (1996), that the insertion of punctuation would disambiguate the three types of garden path sentences—decreasing reading time and increasing comprehension. It was also expected that punctuation would have minimal or no influence on non-garden-path control sentences. Finally, in light of the Experiment 1 finding, the degree of facilitation due to punctuation was expected to depend on the reading skill of the participant—assisting skilled readers to a greater extent than less-skilled readers.

6.2 METHOD

6.2.1 Participants

The forty participants were male (N = 7) and female (N = 33) adult readers, drawn from first-year psychology students attending The University of Adelaide—all received course credit for participation. The mean age of participants was 19.45 (SD 4.47) with a range of 17 to 39 years. Participants were native speakers of English, and all had normal or corrected-to-normal eyesight. Students involved with the pilot studies or with Experiment 1 were not eligible to take part, ensuring that all participants were naïve with regard to the nature of the hypotheses under investigation.
6.2.2 Materials

6.2.2.1 Measures

The computer, software and display system used in the current experiment were identical to those used in Experiment 1 (see Section 5.1.1.2.1) and, similarly, the experimenter wrote the code for the testing phase. The design was cumulative, however, with three zones being used, rather than the presentation of whole sentences. Although increasing the artificiality of procedures, zoning provides information as to the critical region in the sentence where facilitation may take place. Additionally, comprehension was also tested, and not simply reading speed.

The study employed a modified Window Method of presentation where three distinct zones of the full sentence were cumulatively presented, which required the participant to press the response key once they had read each zone. The preceding zone still stayed on the screen, and the zones were aligned appropriately. After the whole sentence had been presented and the participant had responded, there was a delay of 500ms before a comprehension question appeared, in full, on the screen. The question remained on the screen until the participant pressed either the 'Yes' or 'No' response button. No feedback was given to the subject, and there was a short delay before the next trial began.

While in the past there has been some disapproval of the use of cumulative presentations (e.g., Just, Carpenter & Wooley, 1982; Ferreira & Henderson, 1990), regressions are a common occurrence in the reading of garden path sentences; therefore, having all the words up to the current one being processed available for reinspection is a relatively natural reading situation (Hill, 1996).

As in Experiment 1, the Computerised (Reading) Placement Appraisal (CPA), an on-line reading-ability assessment tool, was used to grade participants on reading-ability (see Section 5.1.1.1).
6.2.2.2 Sentence Stimuli

Three categories of ambiguous sentences were examined: closure (early and late), prepositional phases (noun phrase and verb phrase), and reduced relatives (reduced and unreduced relatives). Examples of these sentence types are given in Table 6.1. These sentences were largely drawn from Hill (1996) and Hill and Murray (2000b), where the sentences had been specifically constructed to lead to a garden-path-type misanalysis. Generally, although their descriptions of the underlying mechanisms may disagree, all models of sentence processing foretell garden path effects with these sentence structures.

Table 6.1. Examples of the categories of ambiguous sentences used and sample questions

<table>
<thead>
<tr>
<th>ZONE</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC)</td>
<td>While the audience applauded (.) the actors</td>
<td>took a well-earned break.</td>
<td></td>
</tr>
<tr>
<td>LC)</td>
<td>While the audience applauded the actors (.)</td>
<td>they took a well-earned break.</td>
<td></td>
</tr>
<tr>
<td><strong>Question:</strong></td>
<td>Did the audience applaud the actors?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VP)</td>
<td>The cop blasted the thief (.) with the shotgun (.) but the other escaped</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NP)</td>
<td>The cop blasted the thief (.) with the diamond (.) but the other escaped</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Question:</strong></td>
<td>Did the all the thieves escape?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RR)</td>
<td>The foreigner (.) told a joke (.) did not understand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UR)</td>
<td>The foreigner (.) who was told a joke (.) did not understand</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Question:</strong></td>
<td>Did the foreigner tell a joke?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.2.2.2.1 Closure Sentences

The difference between early- and late-closure sentence structures centres on whether there is a structural break after the first verb (e.g., applauded). The late-closure parsing principle asserts that the current clause is kept open whenever possible; consequently, it is expected that the initial preference will be for late-closure in early-closure items and a delay will occur when parse error is realised. Late-closure items, however, should pose no difficulty
when parsing, as primary clause breaks are consistent with the late-closure parsing principle. As with Hill and Murray (2000b) punctuated versions only have a single comma at the point matching the correct primary clausal break. The analysis is expected to determine whether the inclusion of a comma facilitates accurate parsing—specifically, whether it assists in the preferred late-closure items and whether it reduces (or eliminates) the parsing difficulty associated with the early-closure items.

6.2.2.2 Prepositional Phrase Sentences

Following the experimental paradigm of Hill (1996) and Hill and Murray (2000b), there were two types of prepositional phrase target sentences: verb phrase and noun phrase attachments of the prepositional phrase. The additional node required in the noun phrase attachment identifies it as a more complicated and non-minimally attached structure (Figure 6.2). The key words that discriminate between opposing prepositional attachments (e.g., shotgun/diamond) were matched exactly for word length. Word frequency (Francis & Kucera, 1982) was identical whenever possible, and never differed by more than ten percent (Hill, 1996). The punctuated versions contained two commas delimiting the prepositional phrase. Garden path theory predicts slower reading times in noun phrase conditions, and the important question is whether differences in reading times of unpunctuated noun phrase and verb phrase attached sentences are improved by the insertion of commas.
The cop blasted the thief with the shotgun but the other escaped.

The cop blasted the thief with the diamond but the other escaped.

Figure 6.2. Phrase Markers for VP and NP prepositional phrase examples (Hill, 1996)

6.2.2.2.3 Reduced Relative Sentences

The reduced relative is the version of an unreduced relative that is missing the relative pronoun. In the reduced relative conditions, minimal attachment implies that a simple active sentence construction will be initially adopted, as this requires fewer nodes than the structure pertaining to what is actually the correct interpretation. Thus, a first attempt at parsing should present the foreigner as telling the joke, rather than being told the joke. In line with Hill (1996) and Hill and Murray (2000b), punctuated versions contained a pair of commas that effectively parenthesised the relative phrase. It was expected that this might disrupt the simple attachment construction process and reduce (if not eliminate) any garden path effect.

6.2.2.2.4 Stimulus Presentation

Each participant encountered 36 experimental items, with 12 sentence stimuli in each of the aforementioned categories: closure, reduced relatives and propositional phrases. Each sentence appeared in one of four conditions: garden path punctuated; garden path unpunctuated; non-garden-path punctuated; and non-garden-path unpunctuated. These
conditions were varied for each new participant using a Latin-Square design; as a result, across participants each item appeared in each condition an equal number of times. A participant was presented with each sentence only once, yet was given an equal number of sentences in each condition. The same question was presented for all four conditions, and was explicit in nature. In a text-explicit relationship, both the question and answer can be derived from the text, and the answer is explicitly cued, either logically or grammatically (Crowell, Au, & Blake, 1983). Also, there were 44 unambiguous filler sentences that, as was the case for the test sentences, were randomly presented. The filler sentences were included in order to diminish the likelihood of the participant recognising any patterns or consistent structures in the sentences, and to prevent any heuristic strategies that might shield the natural reading process under examination. An equal number of correct ‘Yes’ and ‘No’ responses were required for the comprehension questions, both for experimental and filler items.

6.2.2.3 Questionnaire

A brief off-line questionnaire was used, consisting of five questions designed to gauge participants’ perceptions of the primary purpose of punctuation and the appropriateness of the punctuation (commas) in test items (Appendix C). The questionnaire was based on previous work by Scholes and Wills (1990) and Hill (1996), with the first four questions examining the participants’ conscious awareness of commas as they appeared in the experimental material, and checking whether participants regarded any sentence as having too little or too much punctuation. The final question asked whether the participant considered elocutionary or syntactic function to be the primary role of punctuation.

6.2.3 Procedure

When arriving for the experimental session, participants were provided with a written general description of the experiment, as well as a set of instructions. The information sheet explained to the participants that they would undertake a brief reading-ability assessment,
participate in a reading experiment where they would see a series of sentences on a computer, and answer a question about each sentence; and, finally, that they would be given a very short questionnaire. Upon completing the consent form, participants were seated in front of the computer and commenced either the CPA or experiment, which were counterbalanced. Participants were encouraged to complete the tasks as quickly as possible, but asked not to increase speed to the detriment of accuracy.

In the experimental phase, the computer had colour-coded response keys, and a message appeared on the screen asking the participant to follow the instructions and press a button to initiate the trial. Participants were instructed to read sentences at a normal pace for comprehension and to press the appropriate button to proceed to the question. After the brief instructions and diagrammatic information on the screen, there was a practice phase in order to familiarise participants with the types of stimuli and response tasks. Participants were invited to ask questions before and immediately after the practice trials.

Throughout the experiment, pressing the 'Ready' button brought up a fixation marker (X) on the left middle of the screen. Pressing 'Yes' replaced this with the first zone of the sentence. Subsequent pressing brought up the following zones one at a time, in a cumulative way. Participants were required to read each zone independently prior to revealing the next one. Any punctuation was attached to the word preceding it in the zone and presented concurrently. Upon the finishing of reading the final zone, pushing the 'Yes' button cleared the screen and the question, in full, appeared. A 'Yes' or 'No' response was required, and the participants had six seconds to respond or the trial continued automatically.

The reaction times taken for each zone, as well as the total sentence reading time, were recorded. Moreover, as well as recording comprehension errors, the computer also recorded time taken to respond to comprehension questions. Before continuing to the next sentence, the 'Ready' button had to be pressed, which insured that there was an opportunity for the participant to rest, as there was no time limit during the 'ready' phase. The participant took part in 10 practice trials: six filler sentences and one sentence in each of the experimental
conditions. The participants then moved to the experimental phase, where the presentation order of the 80 sentences was determined randomly for each of the participants.

Finally, the questionnaire, which took no more than a few minutes to complete, was given to participants, after which they were thanked, told about the nature of the task (and provided with a debriefing sheet), given opportunity to ask any questions, and were able to request feedback on the experiment once it was completed. The experimental phase usually lasted no longer than 30 minutes, and the entire experiment generally did not exceed 60 minutes.

6.3 RESULTS

6.3.1 Reading Time

Although the cumulative design undoubtedly impacted upon the accuracy of reading times (Ferreira & Henderson, 1990; Just, Carpenter, & Woolley, 1982), a significant interaction effect ($F(1,38) = 4.57, p = .039$) for speed in garden path sentences was found, where punctuation facilitated skilled readers and appeared to hamper less-skilled readers. This effect was also evident in the non-garden-path conditions, although it was not significant ($F(1,38) = 2.94, p = .094$). This is clearly illustrated in Figure 6.3 where, although less-skilled readers read faster than skilled readers across all conditions (with the exception of non-garden-path punctuated sentences), the inclusion of punctuation appears to have assisted reading speed for skilled readers and impeded reading speed for less-skilled readers.

\[\text{A median-split was used to classify participants into reading-ability groups.}\]
Figure 6.3. Reading times across conditions for both skilled and less-skilled readers (gp = garden path, n-gp = non-garden-path, (p) = punctuation).

6.3.2 Comprehension

Comprehension measures revealed robust garden path effects, with non-garden-path sentences producing significantly fewer comprehension errors than their garden path complements, $F(1,38) = 12.13, p = .001$. There was also a main effect for punctuation ($F(1,38) = 5.73, p = .022$), with punctuation aiding comprehension in garden path sentences for both skilled and less-skilled readers (although the magnitude was much larger for skilled readers). However, there was no significant main effect for non-garden-path sentences. Interestingly, in non-garden-path conditions, punctuation appeared to aid skilled readers, while having a negative impact on less-skilled readers—although the interaction was not significant ($F(1,38) = 2.49, p = .123$). Comparing the two groups of participants (Figure 6.4), skilled readers performed significantly better in the punctuated conditions (garden path, $F(1,38) = 4.425, p = .042$; non-garden-path, $F(1,38) = 4.931, p = .032$), while the difference between the groups on the unpunctuated conditions was not significant.
6.3.3 Types of Sentence Ambiguities

For each of the potentially ambiguous sentence structures, a table presenting the mean reading times for participants across the four conditions is given. Figures are also presented in which the zones are graphically shown in a cumulative fashion in order to give a clearer indication of tendencies. For convenience, example sentence items are also listed.

6.3.3.1 Closure Ambiguities

The example sentence given is presented in each of the two sentence formats: garden path (early-closure) and non-garden-path (late-closure), as well as appropriately punctuated versions of these.

GP: As the dog scratched / the nice vet / laughed out loud
GP(p): As the dog scratched, / the nice vet / laughed out loud
N-GP: As the dog scratched / the nice vet / he laughed out loud
N-GP(p): As the dog scratched / the nice vet, / he laughed out loud
Table 6.2. Mean reading times (ms) across early (GP) and late (N-GP) closure sentences.

<table>
<thead>
<tr>
<th>Zone</th>
<th>GP Mean</th>
<th>Std. Deviation</th>
<th>GP(p) Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone1</td>
<td>491.51</td>
<td>106.61</td>
<td>457.52</td>
<td>109.32</td>
</tr>
<tr>
<td></td>
<td>450.01</td>
<td>126.31</td>
<td>472.60</td>
<td>166.89</td>
</tr>
<tr>
<td>Total</td>
<td>467.91</td>
<td>126.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zone2</td>
<td>348.28</td>
<td>124.29</td>
<td>339.89</td>
<td>84.79</td>
</tr>
<tr>
<td></td>
<td>381.04</td>
<td>155.43</td>
<td>355.05</td>
<td>93.46</td>
</tr>
<tr>
<td>Total</td>
<td>356.06</td>
<td>115.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zone3</td>
<td>1147.75</td>
<td>273.77</td>
<td>785.40</td>
<td>278.92</td>
</tr>
<tr>
<td></td>
<td>931.23</td>
<td>257.38</td>
<td>856.83</td>
<td>322.10</td>
</tr>
<tr>
<td>Total</td>
<td>930.30</td>
<td>307.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total RT</td>
<td>1987.54</td>
<td>358.60</td>
<td>1582.82</td>
<td>294.37</td>
</tr>
<tr>
<td></td>
<td>1762.27</td>
<td>433.09</td>
<td>1684.48</td>
<td>430.31</td>
</tr>
<tr>
<td>Total</td>
<td>1754.28</td>
<td>400.34</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There were no significant differences between any conditions in either Zone1 ($F (3, 44) = .240, p = .868$) or Zone2 ($F (3, 44) = .273, p = .845$). This is not surprising given that there were no structural differences across sentence conditions in these zones in terms of words. Nevertheless, past research (Hill, 1996) has found strong comma inclusion effects, and one would have expected the garden path punctuated condition to have an increased reading time in Zone1 and the non-garden-path punctuated condition to have increased reading times in Zone2—yet this was not found.

The final zone, Zone3, is typically the region where previous studies have found the garden path phenomena to occur. The results clearly endorse this, with significant differences in reading times across conditions ($F (3, 44) = 3.653, p = .019$). The difference between garden path and non-garden-path sentences (i.e., early and late-closure sentence structures).
centres on whether there is a structural break after the first verb (e.g., laughed). The late-closure parsing principle holds that the current clause is kept open whenever possible; accordingly, it was expected that the initial preference would be for late-closure in early-closure items and a delay would occur when parsing error was realised. Post-hoc analyses indicated that this had taken place, as there were significantly longer reading times for unpunctuated garden path versus non-garden-path sentences. Notably, the post-hoc analyses also indicated that inclusion of a comma significantly reduced reading times in Zone3 for garden path sentences.

It was expected that non-garden-path late-closure items should pose no difficulty when parsing, as primary clause breaks are consistent with the late-closure parsing principle. The results supported this notion and, moreover, there were no significant comma effects. The slightly (although non-significantly) longer reading times in the non-garden-path conditions compared to the punctuated garden path condition could be perhaps explained by the extra word (he) in the sentence structure.

As is evident from Figure 6.5, the unpunctuated garden path condition appeared to cause significantly lengthier ($F(3, 44) = 3.270, p = .030$) total reading times perhaps, due to complete parsing failure at worst, or time-consuming reanalysis at best. In sum, the results showed robust garden path effects, which were ameliorated by the inclusion of punctuation.
Figure 6.5. Cumulative reading times for each zone across each sentence condition for garden path and non-garden-path closure ambiguities.

6.3.3.2 Prepositional Phrase Ambiguities

The example sentence given is presented in each of the two sentence formats: garden path (noun phrase) and non-garden-path (verb phrase), as well as appropriately punctuated versions of these.

GP: The cop blasted at the thief / with the diamond / but he escaped

GP(p): The cop blasted at the thief, / with the diamond, / but he escaped

N-GP: The cop blasted at the thief / with the shotgun / but he escaped

N-GP(p): The cop blasted at the thief, / with the shotgun, / but he escaped
Table 6.3. Mean reading times (ms) across noun phrase (GP) and verb phrase (N-GP) prepositional phrase sentences.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone1</td>
<td>GP</td>
<td>636.51</td>
</tr>
<tr>
<td></td>
<td>GP(p)</td>
<td>558.03</td>
</tr>
<tr>
<td></td>
<td>N-GP</td>
<td>489.89</td>
</tr>
<tr>
<td></td>
<td>N-GP(p)</td>
<td>485.02</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>542.36</td>
</tr>
<tr>
<td>Zone2</td>
<td>GP</td>
<td>469.90</td>
</tr>
<tr>
<td></td>
<td>GP(p)</td>
<td>436.21</td>
</tr>
<tr>
<td></td>
<td>N-GP</td>
<td>409.01</td>
</tr>
<tr>
<td></td>
<td>N-GP(p)</td>
<td>340.95</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>414.02</td>
</tr>
<tr>
<td>Zone3</td>
<td>GP</td>
<td>771.07</td>
</tr>
<tr>
<td></td>
<td>GP(p)</td>
<td>680.16</td>
</tr>
<tr>
<td></td>
<td>N-GP</td>
<td>646.70</td>
</tr>
<tr>
<td></td>
<td>N-GP(p)</td>
<td>733.03</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>707.74</td>
</tr>
<tr>
<td>Total RT</td>
<td>GP</td>
<td>1877.48</td>
</tr>
<tr>
<td></td>
<td>GP(p)</td>
<td>1674.40</td>
</tr>
<tr>
<td></td>
<td>N-GP</td>
<td>1545.60</td>
</tr>
<tr>
<td></td>
<td>N-GP(p)</td>
<td>1559.00</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1664.12</td>
</tr>
</tbody>
</table>

Predictably, as the sentences did not vary physically, there were no differences across versions of the sentence in Zone1 ($F(3,44) = 1.432, p = .246$). Further, despite the punctuated versions having a comma attached to the last word in the zone, there was no indication of comma effects. Similarly, there were no significant differences in reading time for Zone 2 ($F(3,44) = 1.740, p = .173$), which was the prepositional phrase itself. The mean reading times in the punctuated versions appeared to be slightly shorter compared to their unpunctuated counterparts—although there statistically significant differences supporting the presence of any type of comma effect.

Zone3 is perhaps the most critical region, yet although the unpunctuated garden path sentences appeared associated with longer reading times, there were no significant differences
between conditions \( (F(3,44) = 1.676, p = .186) \). However, if the total reading time is considered, a clear structure effect is found (Figure 6.6) with significantly slower total reading times on the unpunctuated garden path (noun phrase) attached items \( (F(3,44) = 2.895, p = .046) \) compared to their verb phrase non-garden-path counterparts. Hence, a significantly longer time was spent on the non-minimally attached sentences overall, which is consistent with the minimal attachment principle of parsing and suggests that a garden path phenomenon has emerged. The reading-time differences between punctuated and non-punctuated prepositional phrases that were compliant to minimal attachment were negligible, with the inclusion of punctuation seeming not to alter time spent reading, either by zone or overall. In the garden path structures, however, the consequence of the inclusion of punctuation is far less clear. In each of the zones, and in overall reading time, the punctuated condition produced faster reading times than the unpunctuated condition (although perhaps did not eliminate 'garden pathing')—yet this tendency was not statistically significant.

![Figure 6.6. Cumulative reading times for each zone across each sentence condition for garden path and non-garden-path prepositional phrase ambiguities.](image)
6.3.3.3 Reduced Relative Ambiguities

The example sentence given is presented in each of the two sentence formats: garden path (reduced relative) and non-garden-path (unreduced relative), as well as appropriately punctuated versions of these.

GP: The child / read the story / laughed hysterically

GP(p): The child, / read the story, / laughed hysterically

N-GP: The child / who was read the story / laughed hysterically

N-GP(p): The child, / who was read the story, / laughed hysterically

<table>
<thead>
<tr>
<th>Zone</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone1</td>
<td>GP</td>
<td>274.00</td>
</tr>
<tr>
<td></td>
<td>GP(p)</td>
<td>288.52</td>
</tr>
<tr>
<td></td>
<td>N-GP</td>
<td>292.09</td>
</tr>
<tr>
<td></td>
<td>N-GP(p)</td>
<td>269.86</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>281.12</td>
</tr>
<tr>
<td>Zone2</td>
<td>GP</td>
<td>286.32</td>
</tr>
<tr>
<td></td>
<td>GP(p)</td>
<td>308.34</td>
</tr>
<tr>
<td></td>
<td>N-GP</td>
<td>512.00</td>
</tr>
<tr>
<td></td>
<td>N-GP(p)</td>
<td>525.18</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>407.96</td>
</tr>
<tr>
<td>Zone3</td>
<td>GP</td>
<td>842.04</td>
</tr>
<tr>
<td></td>
<td>GP(p)</td>
<td>602.22</td>
</tr>
<tr>
<td></td>
<td>N-GP</td>
<td>574.38</td>
</tr>
<tr>
<td></td>
<td>N-GP(p)</td>
<td>540.56</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>639.80</td>
</tr>
<tr>
<td>Total RT</td>
<td>GP</td>
<td>1402.36</td>
</tr>
<tr>
<td></td>
<td>GP(p)</td>
<td>1199.07</td>
</tr>
<tr>
<td></td>
<td>N-GP</td>
<td>1378.47</td>
</tr>
<tr>
<td></td>
<td>N-GP(p)</td>
<td>1335.60</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1328.88</td>
</tr>
</tbody>
</table>

Once again, there was no significant difference across sentence types in Zone1, and there was no suggestion of any impact on reading time caused by the inclusion of a comma in
the punctuated conditions \( F(3, 44) = .173, p = .914 \). As one would have expected, due to
the addition of the explicit words who was (and therefore a greater syntactic processing
complexity), reading times for unreduced relatives (non-garden-path) were significantly longer
in this region \( F(3, 44) = 13.807, p < .001 \) compared to their reduced counterparts. Again,
there was no indication of comma effects in either of the sentence types.

The differences in reading times in the final zone indicated a strong garden path
phenomenon, with significant sentence type effects \( F(3, 44) = 9.802, p < .001 \).
Unpunctuated garden path sentences led to significantly longer reading times compared to
their non-garden-path counterparts, suggesting that erroneous attachments had occurred. In
the reduced relative conditions, the principle of minimal attachment assumes that a simple
active sentence construction would have been initially adopted, as this requires fewer nodes
than the structure pertaining to what is actually the correct interpretation. Consequently, when
the parsing error is realised (typically in Zone3) reanalysis is necessary. Post-hoc analysis also
indicated significant punctuation effects for garden path sentences in Zone3, with an average
reduction in reading time of 240ms caused by the inclusion of punctuation. There was no
apparent influence of punctuation on non-garden-path (unreduced relative) sentences.

On the whole, these results show that the predicted garden path phenomena occurred,
as indicated by the significantly longer reading times for reduced relatives in Zone3.
Punctuation exerted a strong influence on reading time in the garden path condition, although
it failed to have an affect on the non-garden-path control condition (Figure 6.7). These results
suggest that commas can have a powerful effect when they are the primary indicator of
structural information, which could otherwise not be established at that stage in the sentence.
6.3.4 Questionnaire

Not surprisingly, all but one of the participants had noticed that some sentences had contained commas, whilst others had not. Similarly, all participants felt that many of the sentences were under-punctuated and would have been easier to read if commas had been inserted. Although this may seem like a rather obvious finding, it is in stark contrast to the responses given in Hill's (1996) study, where there was an almost equal number 'Yes' and 'No' responses by the 43 participants to the question of under-punctuation. In terms of over-punctuation, 65% of the participants felt that there had been at least one sentence that contained unnecessary or confusing commas (74% of skilled, 53% of less-skilled). This is a little unexpected as, if commas are commonly felt to be crucial in the disambiguation of garden path sentences, this question ought to have been answered in the negative.
When asked to give an approximate percentage of the sentences that contained commas (50%), participants (although varying to some extent) were reasonably accurate—less-skilled readers had a mean response of 55%, whilst skilled readers tended to overestimate, responding 60% (although there was no statistical difference between the two groups). When asked about the primary purpose of punctuation, 57.5% of participants considered the syntax role to be dominant. However, if the two reading-ability groups are examined separately (Table 6.5), it is evident that there is a clear and significant ($\chi^2 (1, 40) = 5.97, p = .015$) difference in their views on role of punctuation.

Table 6.5. Responses (number and percentage) regarding the purpose of punctuation.

<table>
<thead>
<tr>
<th>Reading Ability</th>
<th>Skilled</th>
<th>Less-Skilled</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syntactic</td>
<td>17</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>73.9%</td>
<td>35.3%</td>
<td>57.5%</td>
</tr>
<tr>
<td>Prosodic</td>
<td>6</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>26.1%</td>
<td>64.7%</td>
<td>42.5%</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>17</td>
<td>40</td>
</tr>
</tbody>
</table>

It appears, therefore, that the view of a relatively equal divide in opinion regarding the main use of punctuation, as found by Scholes and Willis (1990) and Hill (1996), is perhaps over-simplistic, as the different reading-ability groups preferred quite dissimilar interpretations. The implications of the questionnaire findings will be discussed later in the General Discussion (see Section 9.5).

6.4 DISCUSSION

6.4.1 Reading Speed

In the present study, a version of the self-paced reading task was used, in which material was presented phrase-by-phrase. Previous studies have shown that the viewing times for individual displays are closely tied to the processing difficulties that are encountered in those
displays (Mitchell & Holmes, 1985). Nevertheless, it is likely that the cumulative, zonal design used increased the artificiality of the experimental procedures, as there is little reason to believe that the current point of attentional focus during the on-line sentence processing will be closely coupled with button pressing (Ferreira & Henderson, 1990). Even if, in the best case scenario, participants are focusing attention on the zone that is on the screen, it is still doubtful that the motor command to press the button is integrated into the reading process as is the motor command to move the eyes in natural reading. There is no guarantee that participants will focus attention on the last word to be revealed; instead, readers often seem first to reveal a number of zones or even the whole sentence once it is entirely available. Furthermore, the more attention becomes decoupled from the zone that is being responded to by the button press, the greater the likelihood that initial and reanalysis processes will be reflected in the same measure (Ferreira & Henderson, 1990; Mitchell & Holmes, 1985). In light of this, care must be taken when considering the reading time results, since this measure could perhaps more accurately be called ‘response time’. It is suggested the cumulative design was a major contributor to the apparent lack of any main effect for ambiguity, which would have manifested in an observable overall garden path effect for total sentence reading time.

Nevertheless, the design did provide critical information on the processing times of each region (see Section 6.4.3), and the reading time measure was sensitive enough to reveal a significant interaction effect, where punctuation was shown to assist the reading speed of skilled readers to a greater extent than less-skilled readers (indeed, in some cases punctuation appeared to slow less-skilled readers). This finding confirms the strong relationship found in Experiment 1 between the magnitude of punctuation facilitation and reading skill, suggesting that skilled readers are more adept in using punctuation to organise textual input into meaningful units. Previous work (e.g., Healy, 1981; Patberg & Yonas, 1978) has presented a coherent set of evidence suggesting that a major difference between skilled and less-skilled readers is the reading unit size they employ. This has been labelled the reading unit size hypothesis, and is indicated by the interaction between segment size and reading-ability (Chen & Healy,
1995). If, as has been suggested (e.g., Bayraktar et al., 1998; Bestgen, 1998; Dale, 1991; Jones, 1996; Levinson, 1985), punctuation is a primary indicator of appropriate segmentation, then it is not remarkable that a relationship between punctuation facilitation and reading-ability exists. The finding that skilled readers perform better for text presented in larger segments, while in less-skilled readers a reverse pattern emerges (Chen & Healy, 1995), provides a reasonable (although by no means complete) explanation as to why the observed relationship between punctuation facilitation and reading-ability exists in the current study.

6.4.2 Comprehension

A great deal of research has investigated how the individual words of sentences are processed as they are encountered (e.g., through the use of online measures of processing such as eye-movements and reading times); yet measures of comprehension are generally treated as secondary (Christianson et al., 2001). The remarkably clear comprehension results of the experiment reported here support Christianson et al.’s (2001) proposal that much can be learned about the architecture of the language processing system from comprehension measures.

There was a clear and significant facilitation effect for comprehension in garden path sentences caused by punctuation, where appropriately placed punctuation led to a decrease in overall comprehension errors—for both skilled and less-skilled readers. Interestingly, in the case of non-garden-path sentences, where word order is the main (and sufficient) indicator of correct parsing, there was a similar, although not statistically significant, tendency to that observed in reading time measures, where the addition of punctuation appeared to assist the comprehension of skilled readers, yet hinder that of less-skilled readers. The apparent difference in the influence of punctuation on the comprehension of skilled readers and that found with less-skilled readers, suggests that skilled readers have resources that permit them to profit from punctuation—both when it is syntactically critical and when it is merely
appropriate—while less-skilled readers rely mostly on more basic syntactic cues, such as word order.

The comprehension findings, coupled with the reading-time results, support Just and Carpenter’s (1992) ‘capacity theory’ for comprehension, where higher-capacity readers are considered capable of using a broader range of potential constraints while reading. The findings of both the current experiment and those of Experiment 1 strongly suggest that one such possible constraint is punctuation; as, depending on an individual’s reading-ability, parsing outcomes appear to be influenced differently by the presence or absence of appropriately placed commas.

The disparity in comprehension attributable to which of the four version of each ambiguous structure the question followed is contrary to Hill’s (1996) finding of no variability in comprehension. This discrepancy is somewhat troubling given that, largely, the stimuli and procedure were almost identical. It is difficult to explain why in the current study comprehension measures were so successful, while in Hill’s experiment consistent levels of comprehension were achieved, regardless of whether sentences were presented in ambiguous form or punctuated. One possible explanation centres on the participants used. In current study first-year psychology students were the participants, while Hill’s participants were drawn from the postgraduate community at Dundee University. Presumably, the later group would be far more skilled ‘comprehenders’ and, therefore, less likely to ultimately make erroneous attachments. However, given that in the present study both skilled and less-skilled readers’ comprehension was influenced by ambiguousness and punctuation (although in a dissimilar manner) this explanation is perhaps not adequate, as one would have expected, if reading-ability had such an impact, skilled readers to exhibit no disparity in comprehension across sentence types. However, this was not the case; indeed, the magnitude of the effect appeared to be larger with skilled readers.

Another possible explanation could relate to the greater number of zones used in Hill’s study (five) compared to the current study (three). Perhaps the former encouraged a greater
focus on comprehending the sentence due to increased artificiality, as it has been suggested that when a reading task becomes less like natural reading, there will be a much greater chance that participant strategies will influence the results of an experiment (Ferreira & Henderson, 1990). Additionally, Hill (1996) only used comprehension questions in a quarter of experimental items. It is probable that this is one reason why the comprehension measure was more successful in the current study, where each experimental item was followed by a question. It is likely, in fact, that the discrepancy is a result of a combination of the aforementioned (and perhaps other) methodological differences.

6.4.3 Types of sentence ambiguities: processing summary

This study tackled the problem of studying the immediate processing of text by using garden path effects to make inferences about the structural choices made at earlier points in the sentence. For example, if, in a particular sentence, participants were inclined to settle for one interpretation of an ambiguous phrase rather than another, and the ambiguous phrase was then followed by an additional phrase (one that was incompatible with the preferred reading of the ambiguous portion of the sentence) participants generally took longer than usual to process the final phrase—hence, they were led up the garden path. Conversely, if the sentence was biased in favour of the alternative reading of the ambiguous segment, then there were no sign of any garden path effects. Thus it was possible to use the presence or absence of garden path effects as an index of relatively subtle biases that may have operated in the course of sentence processing (Mitchell & Holmes, 1985).

The application of this technique to examine punctuational influences on parsing is extremely useful, as the viewing time for the final zone can be used as an indicator of the effect of the insertion of punctuation on the structural choices previously made in the first part of the sentence. In line with Mitchell and Holmes (1985), such phrases will henceforth be referred to as indicator phrases. For example, in sentence 6.5, if the participant treats the man as the ‘sender’ rather than the ‘recipient’, then the indicator phrase (was very pleased) should be
anomalous, because it contradicts the initial inference of the man *sending* the flowers. The current findings suggested that, in many cases, the absence of punctuation led to prolonged reading times on the final zone, most likely due to attempts to resolve the anomaly. This reanalysis would involve evoking the alternative structure for the earlier part of the sentence, through re-reading and hence increasing the number of regressions (Everatt & Underwood, 1994).

(6.5) The man / sent the flowers / was very pleased

On the whole, the results in the current study replicate those of Hill (1996) with one apparent difference. Hill found significant comma-effects in closure and reduced relative ambiguity sentences, where a comma increased the average processing time for the zone in which it was located. It was suggested by Hill that this indicated that the comma required some form of detection and processing. However, findings in the current study did not support this assertion, as there was no suggestion of any comma effects. A possible reason as to why comma effects were not observed in the present study is the use of fewer, and therefore, longer zones. It is probable that the lengthier zones in the present study reduced sensitivity enough to engulf any comma effects, because of an increased processing load, and thus greater possible interference.

### 6.4.3.1 Closure Ambiguities

Findings indicated strong garden path effects, which were revealed by the significantly longer reading times for indicator phrases in the unpunctuated ambiguous early-closure condition. As was the case with previous studies (Hill, 1996; Hill & Murray, 2000b), in the absence of a comma, participants appeared to exhibit a late-closure preference and subsequently had to engage in a costly reanalysis. The considerably lengthier reading time observed in the unpunctuated garden path condition for the final zone is consistent with
parsing failure, as it is suggestive of pronounced closure effects caused by the need for second pass reading (reinspections) (Kennedy & Murray, 1984). There were notable reductions in reading times in indicator phrases linked to the inclusion of punctuation (approximately 360ms) in the garden path condition, signifying that the insertion of a comma at the clausal break negated the tendency for erroneous late-closure attachments. There were no clear effects produced by the inclusion of punctuation in the non-garden-path condition, however, with commas appearing to be ‘transparent’—neither facilitating or inhibiting.

6.4.3.2 Prepositional Phrase Ambiguities

The total reading time data was consistent with a garden path effect; owing to significantly longer reading times on non-minimally attached unpunctuated noun phrase sentences compared to their minimally attached verb phrase counterparts. The zonal analysis proved far less clear, however, with no observed differences across any of the three zones. Overall, commas seemed to be ineffective in sentences containing prepositional phrase attachments, failing to exhibit any clear influence over parsing. The current findings relating to prepositional phrase ambiguities are largely consistent with Hill’s (1996) finding of no disambiguating properties of commas in these structures. It should be mentioned, however, that in the current experiment participants consistently read faster in each of the three zones in the punctuated version of the garden path condition (although this tendency was not significant). Thus, the notion that commas might readily provide a means for guiding the parser towards the correct attachment in this sort of sentence ought not be completely overlooked. Indeed, although the eye movement data of Hill and Murray (2000b) does not, in the main, conflict with the current findings (with no clear facilitation effects), it did provide evidence that punctuation reduced second pass reading time in non-minimally attached sentences.
6.4.3.3 Reduced Relative Ambiguities

The predicted garden path effect was again discernible, with parsing difficulties evident for the indicator phrase in unpunctuated garden path conditions. On average, participants took approximately 270ms longer when reading the final zone of the unpunctuated reduced compared to the unreduced relative condition. Importantly, sufficiently punctuated reduced relative sentences failed to show any garden pathing, which is consistent with previous findings (Hill, 1996; Hill & Murray, 2000b). Furthermore, the insertion of the commas had no effect on the non-garden-path (unreduced relative) sentences, which is once more in agreement with past research—suggesting that the effect of punctuation is largely reliant on its degree of syntactic significance at the relevant point in a given sentence.

6.4.3.4 Conclusions

While all three of the potentially ambiguous sentence structures have been shown to cause garden path effects understandable in terms of the two principles of the garden path model, some of these effects are more robust and perhaps more widely accepted (Hill, 1996). This study strengthens the substantial body of evidence describing garden path type effects in the three locally ambiguous sentence formations employed, although the magnitude of the effect differed across sentence structures, with early-closure and reduced relative conditions producing the largest effects.

The present findings empirically illustrate the potential of punctuation to disambiguate a range of ambiguous sentences. Commas exercised a considerable influence on processing when they were syntactically critical, appearing to be a powerful resource in the delivery of structural information, primarily used as evidence against default structures. When the addition of commas coincided with boundaries in the default structures, they were seen to be relatively redundant from a processing view, which was consistent with previous research (Hill, 1996; Hill & Murray, 2000b). Moreover, similar patterns to that of previous research were observed in the current study across sentence types, where it was only in early-closure
and reduced relative garden path conditions that the addition of punctuation had any
significant (and quite striking) effect. In all other conditions (propositional phrase and non-
garden-path sentences), commas appeared to be transparent.

Hill (1996) concluded that, given such a pattern in the results, commas, as well as being
essential in some structures, could be informationally vacuous in others. The present findings,
however, coupled with those from Experiment 1, caution against such blanket statements.
Rather, the distinct influence exhibited over skilled and less-skilled readers by punctuation
strongly suggests that, although their role may be marginalised in non-critical structures,
punctuation marks do potentially influence structural decision making in these sentence
types—assisting skilled readers and possibly hampering less-skilled readers.
Chapter 7: Experiments 3a & 3b

7.1 EXPERIMENT 3A: PREAMBLE

Essentially, Experiment 2 replicated Hill’s (1996) and Hill and Murray’s (2000b) main findings, demonstrating that when commas are the sole sequential indicator of structural information there is no redundancy, and comma effects are maximised—with later lexical disambiguating material instead becoming redundant. Further, when there is coexisting lexical information, the strength of the comma in disambiguating was observed to diminish, although it continued to confirm and support the lexically chosen structure. Hill (1996) suggests that the usefulness of punctuation does have limits, with truly redundant commas having little effect or no effect at all. Hill views the issue as one of *syntactic clarity*, where structural simplification and parsing information are gathered from a variety of sources that complement each other. Thus, the extent of ‘value’ of a comma is considered as inversely proportional to the amount of structural information that can be obtained from other sources, suggesting that there is a complex system of redundancy (particularly syntactic redundancy) in processing (Hill, 1996; Hill & Murray, 2000b).

The current project has provided evidence that commas are more effective when critical—both in Experiment 1, where the magnitude of facilitation was greater in difficult—, as compared to simple-to-process, ambiguous sentences (although the effect was not large enough to be statistically significant), and Experiment 2, where punctuation was shown to be relatively redundant in non-garden-path control sentences. However, the dissimilar influence of punctuation found for skilled and less-skilled readers suggests that, although their role may be lesser in non-critical structures, it is likely that commas shape, or at the very least have some bearing on, structural decision making in non-garden-path sentence
types—seeming to assist skilled readers, and to have little impact on (perhaps even obstructing) less-skilled readers.

The purpose of Experiment 3a was to further test the notion that punctuation cues reside on a continuum, with critical and redundant marks existing at polar opposites (see Baldwin & Coady, 1978). Under this hypothesis, the position that a given punctuation mark holds on the continuum would be determined by the availability of alternative syntactic cues to mark surface structure boundaries, as well as the availability of semantic cues to confirm or reject syntactic interpretations. If this were indeed the case, one would expect punctuation to exert a variable influence on reading, depending on features which are known to affect parsing, such as plausibility (e.g., Pickering & Traxler, 1998; Speer & Clifton, 1998) and length of ambiguous region (e.g., Ferreira & Henderson, 1991; Frazier & Rayner, 1982). Moreover, Experiment 3a also allowed examination of the issue of whether punctuation provides complete disambiguation, as, if this is were the case, one would imagine the factors of plausibility and length of ambiguity to wield little or no influence on parsing once disambiguation caused by punctuation had taken place. The relationship between reading-ability and the effect of punctuation was further considered—primarily the observed inconsistency in punctuational influence on skilled and less-skilled readers.

7.1.1 Syntactic Parsing

It is an important empirical question to determine which sources of information are actually used to guide the decision-making process involved in the fluent analysis of sentences (Mitchell, 1986). The garden path view of parsing maintains that decisions are initially made on syntactic considerations alone, without reference to semantic or pragmatic information, or to certain kinds of lexical information (e.g., Ferreira & Henderson, 1990; Mitchell, 1989; Rayner et al., 1983). Accounts of this kind can be referred to as syntax-first models of parsing (Mitchell et al., 1992). In contrast, some accounts (most notably the constraint-satisfaction model) give syntax no privileged status; instead, these models
maintain that parsing decisions are made by drawing on all types of information without restriction (e.g., Tanenhaus, Carlson, & Trueswell, 1989; Taraban & McClelland, 1988).

The garden path model predicts that readers will select the least marked interpretation of the sentence, deriving only one representation. If they realize they are wrong, such as when dealing with a sentence like 7.1 below, it is necessary to backtrack and recompute. The late-closure hypothesis (readers build as large a constituent as they can and wait to impose a boundary until they have to) provides an account of how *the lecture notes* is initially erroneously attached. This principle prohibits *the lecture notes* from being attached outside the subordinate clause, as it would result in closing off the presence of an apparently compatible object in the input string (Christianson et al., 2001). After the attachment of *lecture notes* as the direct object of *read*, the verb *burned* signals an initial parse error (English requires that verbs have an overt subject). The subordinate verb *read* must be reanalysed as intransitive in order for *the lecture notes* to no longer be structurally attached or thematically related to the verb. Thus, the locus of interpretation under the garden path model is purely syntactic—misinterpretation stems from syntactic misanalysis (Christianson et al., 2001).

(7.1) While the student read the lecture notes burned in the fireplace.

In contrast, the constraint-satisfaction model maintains that, when coping with sentences like 7.1, readers compute both possible interpretations (e.g., MacDonald, Pearlmutter, & Seidenberg, 1994; Trueswell, Tanenhaus, & Kello, 1993). If the first parsing attempt turns out to be wrong, the second is reactivated. In 7.1, several sources of information point to a direct object interpretation: the transitive bias of the verb *read*, the pragmatic appropriateness of *the lecture notes* as a readable object and the absence of a comma, all of which then must be negated when the error signal from *burned* is encountered (Christianson et al., 2001; Ferreira & Henderson, 1991). Much of the
evidence for a constraint-satisfaction model is centred on the discovery that factors such as context and plausibility seem to act as heuristics during analysis—the human parser ‘sets up’ preferred readings. Frequency of meaning, therefore, has an impact of processing and factors such as contextual information can result in activation of only a single meaning of an ambiguous word (MacDonald et al., 1994).

The strongest contextual position holds that inter-sentential information has a direct and immediate influence on parsing. Whereas stringent structural strategies such as minimal attachment and late-closure operate consistently on all sentences irrespective of non-syntactic conditions, the constraint-satisfaction view allows other sources of information to guide initial structural preferences (Hill, 1996). For example, the decision on whether to adopt either an early- or late-closure analysis at a temporarily ambiguous point in a sentence may depend on relevant information extracted from earlier sentences. From a constraint-satisfaction viewpoint, therefore, it should be possible to prevent processing difficulties (even when garden path theory states there must be a problem) in circumstances under which the weight of contextual evidence precludes garden pathing—yet to date there appears to be no study showing this in the absence of appropriate punctuation (Hill & Murray, 2000b).

7.1.1.1 Plausibility

Investigating the influence of semantic aspects, such as plausibility, on analysis and reanalysis of sentences provides an opportunity to explore whether people perform semantic interpretations during sentence processing, and whether such processing influences the degree of commitment to a particular analysis. Ferreira and Stacey (submitted) recently conducted studies designed to examine the conditions under which listeners wrongly analyse sentences, based on their syntactic form and semantic content. Participants listened to sentences such as those shown in 7.2 – 7.5:
(7.2) The dog bit the man
(7.3) The man bit the dog
(7.4) The man was bitten by the dog
(7.5) The dog was bitten by the man

A number of tasks were used to assess the participants’ interpretations of these sentences and, as a whole, they indicated that people tend to misinterpret sentences that are syntactically more demanding and describe an implausible event (such as in 7.5). Participants tended to normalise these sentence types in order to make them conform to the more expected, or plausible, meaning (Ferreira & Stacey, submitted).

A number of studies (e.g., De-Vincenzi & Job, 1993; Ferreira & Clifton, 1986; Pickering & Traxler, 1998; Rayner et al., 1992; Speer & Clifton, 1998) have investigated how the plausibility of initial interpretations might influence the ultimate comprehension of garden path sentences whilst reading. Findings suggest that plausibility influences the extent of commitment to late-closure analysis and affects the ease of recovery when analysis turns out to be incorrect (i.e., the less plausible the attachment, the weaker the level of commitment and the quicker the recovery), but does not prevent an incorrect structural analysis in the first place. A particular analysis will be favoured if it is highly plausibly and has specific lexical support (Speer & Clifton, 1998).

Recently, Christianson et al. (2001) found that the initial, incorrect parses by readers were not only quite persistent and confidently held, but also significantly affected by the non-syntactic factor of plausibility, which caused initial interpretations to be retained. Their results showed that the tendency to make an incorrect parsing decision is due to a combination of the syntactic misanalysis and the pragmatic plausibility of the inference.

The fact that the human parser contends with sentences in an incremental manner, allows certain predictions to be made about semantic influence on syntactic processing. Based on their comprehensive study into plausibility and recovery for garden paths,
Pickering and Traxler (1998) proposed that readers experience greater difficulty during the initial processing of syntactically ambiguous fragments when the analysis they adopt is semantically implausible than when it is semantically plausible. However, their findings also clearly showed that people experience greater difficulty during processing of syntactically disambiguating information (after misanalysis) when the initial analysis had a plausible rather than an implausible interpretation. Readers were shown to commit more strongly to sentences such as 7.6 during initial analysis than implausible sentences such as 7.7. This greater magnitude of commitment to plausible structures was clearly observed in the reanalysis of garden path sentences, where implausibility activated reanalysis (although it was far from clear whether implausibility could eliminate disambiguation difficulty) as readers found it easier to abandon an incorrect implausible interpretation compared to a plausible one (Pickering & Traxler, 1998).

(7.6) As the woman edited the magazine about fishing amused all the reporters
(7.7) As the woman sailed the magazine about fishing amused all the reporters

Thus, in sentence 7.6, readers are likely to strongly commit to the object analysis of the fragment as the woman edited the magazine because it is plausible. Hence, abandoning this analysis is relatively hard as, when semantically processed, this fragment integrates with general knowledge without difficulty. In contrast, the corresponding fragment in 7.7 would initiate a less committed analysis, and semantic processing would be more difficult given that the magazine is, in itself, a ‘dead-end’ signal. Alternatively, readers might accept the object analysis for the time being, but perform less semantic processing based on that analysis, in which case sentence 7.7 should produce some difficulty at amused, though far less than would 7.6 (Pickering & Traxler, 1998).
7.1.1.2 Length of Ambiguous Region

Frazier and Rayner (1982) using eye-movement techniques, compared early- and late-closure sentences with long and short ambiguous regions, and found that fixation times were longer on the disambiguating words of early-closure sentences, compared to late-closure sentences, and, importantly, that times were longer for early-closure sentences when the ambiguous region was long instead of short (Frazier & Rayner, 1982). Warner and Glass (1987) similarly investigated early- and late-closure sentences with short and long ambiguous regions. Using a grammaticality judgment task, the researchers found that long garden path sentences were judged grammatical significantly less often than short garden path sentences (Warner & Glass, 1987).

Ferreira and Henderson (1991), in a series of five experiments in which the number of words in the ambiguous phrase was manipulated, similarly found that reanalysis of garden path sentences was more difficult with a longer ambiguous phrase. Moreover, the researchers established that the effect of phrase length was not attributable to greater syntactic complexity in the longer phrases; rather, it was shown to be attributable to the increasing distance from the head of the ambiguous phrase to the disambiguating word of the garden path sentence. Hence, ambiguous phrases made long by the addition of prenominal adjectives were easier for the parser to reanalyse than phrases made long by the addition of postnominal modifying prepositional phrases or relative clauses (Ferreira & Henderson, 1991). Interestingly, there were significant length effects in not only early-closure garden path sentences, but also in unambiguous late-closure sentences—although the effect was much larger with early-closure items. This finding is consistent with the conclusions of Warner and Glass (1987), who claim that the length effect is qualitatively different for the two closure conditions. In the case of early-closure sentences, length does effect syntactic processing. When encountering the disambiguating word of the sentence, the parser identifies it has misinterpreted the preceding string, and the longer the misinterpreted string, the more difficulty the parser has recovering from this misanalysis.
For the late-closure sentences, it was suggested that length had not affected syntactic processing; rather, due to the sentence being longer overall when critical region is lengthened, there was an increased probability that subjects would miss a word of the sentence and, as a result, more frequently misread the sentence (Ferreira & Henderson, 1991).

7.1.2 Experimental Aims and Hypotheses

If, as has been suggested (e.g., Pickering & Traxler, 1998; Speer & Clifton, 1998), the plausibility of the interpretation that comes from the initial thematic role assignments can influence the extent to which syntactic reanalysis occurs, it would be expected that there would be fewer comprehension errors and faster reading times when interpretations are implausible, as in 7.8, compared to when the interpretation is plausible, such as 7.9.

(7.8) As the lawyer studied the will remained in the safe

(7.9) As the lawyer studied the will lay on the desk

(7.10) As the lawyer studied the will that was complicated lay on the desk

(7.11) As the lawyer studied the deal the will that was complicated lay on the desk

If the longer one is committed to an (ultimately) erroneous thematic assignment, the more difficult reanalysis becomes (Ferreira & Henderson, 1991), the proportion of incorrect responses should be higher, and the time taken to read sentences should be longer, when the length of the ambiguous region is extended. Moreover, the length of the ambiguous region ought to have a greater effect on responses to garden path (7.10) compared to non-garden-path sentences (7.11), as, in the former, the longer region should reduce the chances that full revision will occur, while in the latter, a longer region should not influence thematic role revision (Christianson et al., 2001; Ferreira & Henderson, 1991).
As both the plausibility of potential attachments and the length of ambiguous regions in sentences have been shown to influence the severity of the garden-pathing experienced by readers, Experiment 3a sought to test whether the insertion of appropriate punctuation would eliminate the impact of these factors on the processing and comprehension of garden path sentences. The effect of punctuation on the influence of plausibility or length effects has not been fully explored, which is surprising, given that doing so would enable judgements to be made about the suitability of the ‘redundancy continuum’ view of punctuation (see Baldwin & Coady, 1978; Hill, 1996). Moreover, examination of the effect of punctuation on these factors would provide further data in relation to whether punctuation provides complete disambiguation of ambiguous sentences, or merely aids in the process of reanalysis.

It was expected that the ambiguous sentences would cause clear garden path effects akin to those of Christianson et al. (2001). Further, the pragmatic plausibility of the initial interpretation was expected to influence the ultimate comprehension and reading times of the garden path sentences. It was also anticipated that participants would be more likely to accept an incorrect interpretation the longer they entertained the corresponding syntactic misanalysis. As the effectiveness of punctuation is considered to reside on a continuum from critical to redundant, it was expected that punctuational influences would be more critical in highly plausible garden path sentence-structures, as well as those with a lengthy ambiguous region. Finally, based on the findings of Experiments 1 and 2, it was anticipated that reading skill would again influence the magnitude of facilitation caused by the introduction of punctuation—having a much greater effect on the reading time and comprehension of skilled readers.
7.2 METHOD

7.2.1 Participants

Forty-eight first-year psychology undergraduate students from The University of Adelaide participated in the study, all receiving course credit. The 19 male and 29 female participants had not taken part in either of the previous experiments, and ranged in age from 17 to 40 years, with a mean age of 20.16 years ($SD = 4.75$). All participants were native speakers of English, had normal or corrected-to-normal vision, and were naïve with regard to the nature of the hypotheses under investigation.

7.2.2 Materials

7.2.2.1 Sentence Stimuli

The set of 48 distinct sentence stimuli items were derived from previous related studies that investigated the garden path phenomena, primarily Christianson et al. (2001: Experiments 1a and 1b). Each of the experimental sentences appeared in one of six conditions, with each condition having a punctuated and unpunctuated version. These conditions are presented, each with an example sentence in Table 7.1. For the garden path sentences, the manipulation of two variables created the four conditions: the ambiguous region (the noun phrase (NP) that followed the matrix verb) was either short (the deer) or long (the deer that was brown and graceful); and the syntactically incorrect interpretation of the ambiguous NP as the object of the matrix verb was either plausible (the hunted deer ran into the woods) or implausible (the hunted deer paced in the zoo). Control sentences (non-garden-path) differed from garden path sentences by an additional NP (the rabbit). The two non-garden-path conditions included differed in length of ambiguous region only. Since these sentences provided an alternative object for the matrix verb (hunted), the plausibility of the initial misinterpretation was not varied. The same question was presented for all six conditions.
Table 7.1. Sample item illustrating the six stimuli conditions (all of which had punctuated and unpunctuated versions)

<table>
<thead>
<tr>
<th>Garden Path</th>
<th>Non-garden-path</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Plausible, short ambiguous region:</td>
<td>5. Plausible, short ambiguous region:</td>
</tr>
<tr>
<td><em>While Ben hunted</em> (,) the deer ran into the woods*</td>
<td><em>While Ben hunted</em> (,) the deer ran into the woods*</td>
</tr>
<tr>
<td>2. Plausible, long ambiguous region:</td>
<td>6. Plausible, long ambiguous region:</td>
</tr>
<tr>
<td><em>While Ben hunted</em> (,) the deer that was brown and graceful ran into the woods.*</td>
<td><em>While Ben hunted</em> (,) the deer that was brown and graceful ran into the woods.*</td>
</tr>
<tr>
<td>3. Implausible, short ambiguous region:</td>
<td>4. Implausible, long ambiguous region:</td>
</tr>
<tr>
<td><em>While Ben hunted</em> (,) the deer paced in the zoo.*</td>
<td><em>While Ben hunted</em> (,) the deer that was brown and graceful paced in the zoo.*</td>
</tr>
</tbody>
</table>

Question: Did Ben hunt the deer?

These conditions were balanced across participants using a Latin-square design. Each participant, therefore, was exposed to only one version of each item, but viewed an equivalent number of items in each condition. Across participants, each sentence item appeared in each condition an equal number of times. The 48 experimental items were randomly presented along with 80 filler sentences. As all of the experimental sentences required a “No” response to comprehension questions, the filler sentences, although employing the same clause order (subordinate-matrix), required an even number of “Yes” and “No” responses. None of the filler sentences were syntactically ambiguous.

7.2.2.2 Questionnaire

As in Experiment 2, a short questionnaire was presented, consisting of five questions designed to gauge participants’ perceptions of the primary purpose of punctuation and the appropriateness of the punctuation (commas) in test items (see Section 6.2.2.3).
7.2.2.3 Measures

The computer, software and display system used in the current experiment were identical to those employed in Experiment 1 (see Section 5.1.2.1) and, again, the experimenter wrote the code for the testing phase. As in Experiment 1 and 2, the Computerised (Reading) Placement Appraisal (CPA), an on-line reading-ability assessment tool was used to grade participants on reading-ability (see Section 5.1.1.1).

7.2.3 Procedure

Once participants arrived for the experimental session, they were provided with a written general description of the experiment as well as a set of instructions. The information sheet explained to the participants that they would complete a reading-ability test, and then undertake a reading experiment where they would see a series of sentences on a computer, answer a question about each sentence, and, finally, be given a very brief questionnaire. Upon completing the consent form, participants were seated in front of the computer, which had colour-coded response keys, and a message appeared on the screen asking them to follow the instructions, and press a button to initiate either the experiment or the reading-ability test (which were counterbalanced across participants). Participants were asked to finish the tasks as rapidly as possible, but instructed not to increase speed to the detriment of accuracy.

In the experimental phase, brief instructions, and diagrammatic information, were presented on the screen, and there was a practice phase, in order to facilitate subject familiarity with the type of stimuli and response tasks. Participants were invited to ask questions before and immediately after the practice trials. During the experiment, pressing the 'Ready' button brought up a fixation marker (X) on the left middle of the screen. Pressing 'Yes' replaced this with the complete sentence. Participants were instructed to read sentences at a normal pace for comprehension and press the appropriate button to proceed to the question. Upon reading the sentence, pushing the 'Yes' button cleared the
screen, and there was a delay of 500ms before the question appeared. A ‘Yes’ or ‘No’ response was required, and the participants had six seconds to respond or the trial continued automatically. No feedback was given to the participant, and before continuing to the next sentence, the ‘Ready’ button had to be pressed, which insured that there was opportunity for the participant to rest, as there was no time limit during the ‘ready’ phase.

All participants took part in 16 practice trials: four filler sentences and one sentence in each of the experimental conditions, both punctuated and unpunctuated. The participants then moved to the experimental phase, where the presentation order of the 128 sentences (48 test sentences, 80 fillers) was determined randomly for each of the participants.

Lastly, the questionnaire, which took no more than a few minutes to complete, was given to participants. Once they had completed the questionnaire, participants were thanked, told about the nature of the task (and provided with a detailed debriefing sheet), given opportunity to ask any questions, and told they were able to request feedback on the experiment once it had been completed. The experimental phase usually did not exceed 20 – 30 minutes, and the entire experiment generally did not last longer than 60 minutes.

### 7.3 RESULTS

#### 7.3.1 Reading Time

Initially, the unpunctuated conditions will be considered in isolation, in order to determine whether the current results exhibit the plausibility and length effects previously found. The reading time results for all unpunctuated conditions are presented in Table 7.2. Overall skilled readers read significantly faster than less-skilled readers across all conditions, $F(1,46) = 5.35, p = .025$. In the unpunctuated conditions, however, the reading-ability groups did not differ significantly in reading speed (although there was a tendency for skilled readers to read noticeably faster than less-skilled readers in the long sentence conditions).
Table 7.2. Reading time data (ms) for the six conditions (unpunctuated), for both skilled (N = 24) 
and less-skilled groups (N = 24).

<table>
<thead>
<tr>
<th>Reading Ability</th>
<th>Skilled</th>
<th>Less-skilled</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Short</td>
<td>GP plausible</td>
<td>2438.54</td>
<td>1061.77</td>
</tr>
<tr>
<td></td>
<td>GP implausible</td>
<td>2157.75</td>
<td>967.89</td>
</tr>
<tr>
<td></td>
<td>N-GP</td>
<td>2000.30</td>
<td>829.24</td>
</tr>
<tr>
<td>Long</td>
<td>GP plausible</td>
<td>3308.87</td>
<td>1317.50</td>
</tr>
<tr>
<td></td>
<td>GP implausible</td>
<td>2691.48</td>
<td>972.06</td>
</tr>
<tr>
<td></td>
<td>N-GP</td>
<td>2719.97</td>
<td>947.06</td>
</tr>
</tbody>
</table>

Participants took significantly longer to read sentences in the garden path conditions than in the non-garden-path control condition (F(1,46) = 13.05, p = .001), indicating the presence of a strong garden path effect. Moreover, there was a main effect for plausibility (F(1,46) = 23.30, p < .001), with significantly longer reading times in the plausible condition compared to the implausible condition. There was no interaction effect between plausibility and reading-ability, however, with both groups responding similarly across conditions.

Not surprisingly, given the additional words (and, therefore, the extra processing required) there was a significant main effect for length, F(1,46) = 217.39, p < .001, with participants having considerably longer reading times in the lengthier sentence conditions. Moreover, there was a reliable interaction between plausibility and length, with the length effect for plausible sentences being larger than that for implausible sentences (F(1,46) = 6.94, p = .011), as well as the combined garden path conditions having greater length effects than the non-garden-path controls, although this difference did not quite reach statistical significance (F(1,46) = 3.82, p = .057).
Overall, punctuation was shown to exhibit a significant facilitation effect \( (F(1,46) = 11.29, \ p = .002) \), decreasing reading times by approximately 220ms. Moreover, punctuation exerted a significantly stronger effect on the garden path conditions compared to the non-garden-path control, \( F(1,46) = 12.11, \ p = .001 \). However, the data is much more informative once the factor of reading-ability is included, as there was a significant interaction effect between reading-ability and punctuation \( (F(1,46) = 25.27, \ p < .001) \), where the insertion of a comma was shown to facilitate skilled readers (by approximately 500ms) and have little or no influence on the reading speed of less-skilled readers, across the six conditions combined.

When considering the results for each of the conditions, a disparity in the influence of punctuation between the skilled and less-skilled readers is evident (Figure 7.1). With the exception of the non-garden-path short-ambiguous-region condition, punctuation facilitated the reading times of skilled readers in all conditions. In the case of less-skilled readers, the influence of punctuation is far less clear. Although (with the possible exception of the non-garden-path short-ambiguous-region condition) the insertion of punctuation does not appear to have hindered their reading speed, it did not provide any clear facilitation either.
Figure 7.1. Reading times (ms) for each of the three plausibility conditions by skilled and less-skilled reading-ability groups, both for short and long ambiguous regions.

7.3.2 Comprehension

Not surprisingly, skilled readers made significantly fewer comprehension errors \((F(1,46) = 4.58, p < .001)\) across all sentence conditions. As was the case with reading times, clear effects for ambiguousness were present in the unpunctuated conditions, with participants making significantly more comprehension errors when reading sentences in the garden path conditions than in the non-garden-path control condition \((F(1,46) = 203.91, p < .001)\), a result which indicated the presence of a strong garden path effect. Furthermore, there was a main effect for plausibility \((F(1,46) = 154.57, p < .001)\), with participants
making significantly more comprehension errors in the plausible condition compared to the implausible condition.

Table 7.3. Comprehension data (mean number of errors) for the six unpunctuated conditions, for both skilled and less-skilled groups.

<table>
<thead>
<tr>
<th></th>
<th>Reading Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Skilled</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Short</td>
<td></td>
</tr>
<tr>
<td>GP plausible</td>
<td>1.83</td>
</tr>
<tr>
<td>GP implausible</td>
<td>.79</td>
</tr>
<tr>
<td>N-GP</td>
<td>.25</td>
</tr>
<tr>
<td>Long</td>
<td></td>
</tr>
<tr>
<td>GP plausible</td>
<td>2.21</td>
</tr>
<tr>
<td>GP implausible</td>
<td>1.50</td>
</tr>
<tr>
<td>N-GP</td>
<td>1.25</td>
</tr>
</tbody>
</table>

Although both reading-ability groups showed a relatively linear decline across the three ambiguousness conditions (Table 7.3), an interaction effect indicated that less-skilled readers had significantly higher error rates for both of the garden path conditions compared to skilled readers, whereas in the non-garden-path condition the groups did not differ, $F(1,46) = 7.88, p = .007$—although, given the small error-rate, it is possible that there were floor effects.

There was a significant main effect for length, $F(1,46) = 109.68, p < .001$, with participants making notably more comprehension errors in the lengthier sentence conditions. Moreover, there was an interaction between plausibility and length, with the length effect for the combined garden path conditions being larger than that for the non-garden-path condition, although did not reach statistical significance ($F(1,46) = 3.6, p = .064$). There was no observed interaction between length of sentence and reading-ability.
The introduction of a comma provided significant facilitation effects ($F(1,46) = 85.64, p < .001$), more than halving the mean number of errors made by participants across all six conditions. Punctuation exerted a significantly stronger effect in relation to the plausible sentences than the implausible sentences, $F(1,46) = 32.49, p < .001$. Moreover, compared to the non-garden-path control, punctuation exerted a stronger influence on comprehension within the combined garden path conditions, $F(1,46) = 48.03, p < .001$. There was also a significant interaction effect between punctuation and length, where punctuation facilitated to a greater extent when the ambiguous region in the sentence was long, $F(1,46) = 5.81, p = .020$.

As was the case with the measure of reading time, the data are much more informative once the factor of reading-ability is included. There was a significant interaction effect between reading-ability and punctuation ($F(1,46) = 16.77, p < .001$), where the insertion of a comma was shown to facilitate skilled readers to a much greater extent. When considering the results for each of the conditions, a clear disproportion between skilled and less-skilled readers emerges in terms of the influence of punctuation. As illustrated in Figure 7.2, a linear pattern was observed for ambiguousness (for both short and long ambiguous regions) in the unpunctuated conditions, where the plausible garden path condition produced the most comprehension errors, the implausible garden path condition an intermediate number, and the non-garden-path condition the fewest—for both skilled and less-skilled readers. In the punctuated sentence conditions, the effect of the inclusion of an appropriate comma was quite dramatic—particularly with skilled readers.
Figure 7.2. Mean number of comprehension errors for each of the three plausibility conditions by skilled and less-skilled reading-ability groups, both for short and long ambiguous regions.

In the case of less-skilled readers, the inclusion of punctuation facilitated comprehension for garden path conditions (both long and short ambiguous regions), and appeared to have a negligible negative impact in the non-garden-path conditions. The linear pattern from plausible to non-garden-path was still present, however, suggesting that the factor of plausibility influenced the comprehension of less-skilled readers even when appropriate punctuation was provided. Similarly, it appears that even when an appropriate comma was introduced the length of ambiguous region still affected the comprehension of less-skilled readers for the two garden path conditions, although the mean error rate was substantially lower.
In contrast, the plausibility and length effects observed in skilled readers were eliminated with the introduction of an appropriate comma. As can be seen from Figure 7.2, the rate of comprehension errors of skilled readers dropped dramatically in all conditions (regardless of ambiguousness or length of ambiguous region) with the insertion of punctuation. Given the pattern of results, the data are indicative of complete disambiguation caused by punctuation, for skilled readers, while it appears to be more of a ‘facilitator’ for less-skilled readers, perhaps aiding reanalysis (given that plausibility and length effects were still present).

Finally, there was a significant interaction effect between reading-ability and punctuation facilitation in the longer sentence conditions \( F(1,46) = 4.84, p = .033 \). Punctuation was observed to aid both skilled and less-skilled readers in the garden path conditions, but in the non-garden-path condition facilitated the comprehension of skilled readers only, appearing, if anything, to hamper the comprehension of less-skilled readers.

### 7.3.3 Questionnaire

As with Experiment 2, all but one of the participants noticed that some sentences contained commas, whilst others had not. All 48 participants felt that many of the sentences were under-punctuated and that the insertion of a comma would have made them easier to read. Although identical to what occurred Experiment 2, this finding contrasts notably to the responses given in Hill's (1996) study, where there was a near-equivalent number of 'Yes' and 'No' responses by the 43 participants to the question of under-punctuation. In terms of over-punctuation, 64.7% of the participants felt that there had been at least one sentence that contained unnecessary or confusing commas (75% of skilled, 54.2% of less-skilled). If commas are generally felt to be crucial in the disambiguation of garden path sentences, then this question ought to have been answered in the negative; yet, as in Experiment 2, this was not the case.
When asked to give an approximate percentage of the sentences that contained commas, participants were relatively accurate: less-skilled readers responded with a mean of 56%, whilst skilled readers tended to overestimate, giving a mean response of 60%. Although this difference was not statistically significant, it is interesting to note that this tendency for overestimation by skilled readers was also present in Experiment 2.

When asked about the primary purpose of punctuation, 54.2% of participants viewed syntax as the most important function. At first glance, the data appear to be in accord with previous work (Hill, 1996; Scholes & Willis, 1990), with a relatively equal division of opinion regarding the main use of punctuation. However, when the two reading-ability groups are examined separately (Table 7.4) it is clear that this view is misleading, as the different reading-ability groups differ significantly ($\chi^2 (1, 48) = 8.39, p = .004$) in their views on the role of punctuation. The implications of the questionnaire findings will be discussed, together with those from Experiment 2, in the General Discussion (see Section 9.5).

Table 7.4. Responses (number and percentage) regarding the purpose of punctuation for both reading-ability groups.

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Skilled</th>
<th>Less-Skilled</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syntactic</td>
<td>18</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>75.0%</td>
<td>33.3%</td>
<td>54.2%</td>
</tr>
<tr>
<td>Prosodic</td>
<td>6</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>25.0%</td>
<td>66.7%</td>
<td>45.8%</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>24</td>
<td>48</td>
</tr>
</tbody>
</table>

7.4 DISCUSSION

Readers often misinterpret garden path sentences of the form examined here (e.g., 7.12), which involve a subordinate and main clause together with a noun phrase (NP) that initially attaches to the former but ultimately to the latter. Findings showed strong garden path effects for these types of ambiguous sentences, both measured by reading time and by
comprehension. Ambiguous early-closure sentences were much more likely to lead to
garden-pathing compared to late-closure unambiguous sentences. Furthermore, increased
pragmatic plausibility of erroneous attachments (7.13) and the length of ambiguous region
(7.14) both had an effect on the severity of garden path effects. The results showed that the
tendency to believe that the artist is painting the model is due to a combination of the syntactic
misanalysis, the pragmatic plausibility of the inference, and the length of ambiguous region.

(7.12) While the artist painted the model went out for lunch.
(7.13) While the artist painted the model sat in the chair.
(7.14) While the artist painted the model who was tall and stunning sat in the chair.

Findings supported previous work on the influence of plausibility on parsing (e.g.,
Christianson et al., 2001; De-Vincenzi & Job, 1993; Ferreira & Clifton, 1986; Pickering &
Traxler, 1998; Rayner et al., 1992; Speer & Clifton, 1998), as the degree of commitment to
late-closure analysis, and the subsequent ease of recovery when analysis turned out to be
incorrect, appeared tied to the plausibleness of the attachment. In addition, the current
study replicated previous findings regarding length of ambiguous region (e.g., Christianson
et al., 2001; Ferreira & Henderson, 1991; Frazier & Rayner, 1982; Warner & Glass, 1987),
as the longer the ambiguous region of the early-closure sentences, the more difficult
successful parsing became.

In the current experiment, punctuation was shown to alter the interpretation of the
subordinate clause so as to not include the NP (the model), either by facilitating reanalysis
or by avoiding incorrect analysis all together. Thus, punctuation may help clarify sentences
by indicating the correct path of analysis or by reducing the potential structural options—
either through preventing or by minimising the damage of mistakes. The findings,
particularly those related to comprehension, support the ‘redundancy continuum’ model, as
punctuation was shown to exert a stronger influence in garden path sentences, as compared
to non-garden-path controls. Moreover, punctuation was observed to be more crucial in plausible compared to implausible attachment conditions, as well as in long- compared to short-ambiguous-region conditions. In this respect, the data provide clear support for the notion that the effectiveness of punctuation is inversely related to the number of other relevant cues, for instance syntactic (e.g., word order) and semantic (e.g., plausibility) cues, that are available, as well as the severity of the garden path (Baldwin & Coady, 1978; Hill, 1996).

However, the fact that punctuation was still observed to influence the parsing of non-garden-path sentences is problematic for the redundancy continuum viewpoint, given that a major tenet of this model is that punctuation is merely transparent when non-critical (Hill, 1996). Rather, the dissimilar influence exhibited over skilled and less-skilled readers by punctuation (a pattern that was also present in Experiment 2) strongly suggests that, while their effects may be marginalised in non-critical structures, punctuation marks do potentially influence structural decision-making in unambiguous sentences—appearing to facilitate skilled readers and possibly to slightly impede less-skilled readers.

Another way of looking at the data is in terms of parsing being hindered by unfulfilled punctuational expectations (the omission of suitable, even if non-essential, commas). Adams et al. (1998) suggested that their observed slower reading times in sentences without sentence-internal punctuation could be viewed as being caused by no deeper reason than that of a comma being expected at a clause break. However, although this may explain why skilled readers were facilitated by the inclusion of punctuation, it does not provide an explanation of the apparent obstructiveness of punctuation in non-critical structures for less-skilled readers. Moreover, whether the notion of slower reading times and poorer comprehension caused by the exclusion of a comma can be extended to include unambiguous sentences is uncertain, since one would suppose that readers are less prone to be offended by the lack of appropriate punctuation if understanding is easily accomplished (unless, of course, they are distracted by their ‘annoyance’ at the lack of punctuation).
7.4.1 Reading-ability

Given that the interpretation of a sentence is strongly constrained by its syntactic structure, readers are required to make at least partial syntactic commitments as a sentence unfolds, even when faced with local syntactic indeterminacies. However, a variety of syntactically relevant constraints are likely to be accessible which could be used to inform these commitments (Trueswell et al., 1994). What the constraints are, and how and when they are used, remains an important and largely unresolved question. The current findings provide further support for the view that punctuation is one such constraint. Moreover, the effectiveness of punctuation as a syntactic constraint appears tied to the factor of reading-ability.

The syntactic relations that are established in the initial parse are the most critical; hence, if punctuation has an immediate effect on parsing, ambiguous sentences should be disambiguated as soon as punctuational information becomes available, without waiting for further morphosyntactic or semantic information. The data from skilled readers supports this viewpoint, as the plausibility effects revealed by reading time and comprehension measures, as well as the length effects apparent in the comprehension measure, did not manifest in the skilled group when there was appropriate punctuation. The inclusion of a comma steered skilled readers away from incorrect structural assignments without having to wait for explicit morphosyntactic or semantic cues further downstream—perhaps eliminating the need for any type of backtracking. The fact that punctuation not only removed any temporary attachment ambiguities faced by skilled readers, but also effectively prevented garden paths of the sort typically detected in reading experiments, strongly suggests complete first-pass disambiguation.

The data on less-skilled readers, however, provided evidence that their interpretations often reflected the persistence of initial incorrect thematic role assignments, even once punctuation was introduced. Thus, it appears that punctuation and the semantic influence of ultimate pragmatic plausibility both influenced the extent to which less-skilled
participants were content to leave in place the initial interpretation built from the incorrect parse. Conceivably, the punctuation facilitation observed in the comprehension of less-skilled readers when faced with garden path sentences could be explained in terms of a prosodic influence rather than syntactic, as prosodic factors can affect the early stages of parsing an interpretation (e.g., Kjelgaard & Speer, 1999; Nagle, Shapiro, & Nayy, 1994; Speer, Kjelgaard, & Dobbroth, 1996). While prosodic cues do affect the structure-building process, they are given less weight than morphosyntactic cues, but this only becomes apparent when there is a conflict between them (Marslen-Wilson et al., 1992). The less-skilled data certainly points towards an interpretation of prosodic cues linked to a comma coming into play only after the initial structural assignments have been suggested on purely morphosyntactic grounds (such as word order)—particularly given the self-reported preference for a prosodic stance on punctuation by less-skilled readers in the questionnaire.

In the case of skilled readers, when there is conflict between semantic cues and syntactic cues, then the syntactic function of the comma determined the outcome of the process, overriding the effect of plausibility. In contrast, the inability of less-skilled readers to deal with punctuation as effectively (syntactically) meant that the resultant misinterpretation persisted more often and semantic factors still had an impact on structural decision-making.

Although the specific function of punctuation that was applied by participants was not looked at in this experiment, it is reasonable to suggest, based on the findings, that perhaps skilled readers determine the first-pass analysis of a given sentence by using punctuation as a syntactic guide, whereas less-skilled readers use punctuational cues either as a 'weaker' prosodic signal or in some later-pass analysis. Thus, for less-skilled readers, punctuational cues would come into play only after initial structural assignments have been suggested by other factors, such as word order and plausibility. In contrast, punctuation appears to be used as a primary source of information in skilled readers, activating the direct syntactic route to successful analysis.
7.4.2 Conclusions

Experiment 3a sought to examine whether participants derived incorrect initial thematic-role assignments from relatively difficult garden path sentences, and, if so, whether initial interpretations would persist once suitable disambiguating punctuation was included. The results reinforced the viewpoint that models of sentence parsing and comprehension that do not include a role for punctuation are incomplete.

The garden-path account originally proposed by Frazier and Rayner (1982) maintains that the language processor initially builds a single, and the simplest, syntactic analysis that is consistent with phrase structure. These structures are initially constructed without consideration of other potentially relevant constraints, including discourse context or plausibility (Trueswell et al., 1994). Once an interpretation has been chosen, other information is used to evaluate its appropriateness. For example, if a person read Siobhan saw the man with the binoculars, the sentence would be understood to mean that Siobhan used the binoculars as an instrument. If it turned out that the man had the binoculars, the initial interpretation would be revised to be compatible with that semantic knowledge.

Alternatively, constraint-satisfaction theorists assume that all potential syntactic analyses are computed at once based on all relevant sources of information, with the analysis that has the greatest support being chosen over its competitors. Given the same example, the constraint-based approach assumes that the reader will activate both interpretations, finally selecting the one that is most fitting in the context. These two categories of model suppose drastically different architectures for sentence processing: in the garden-path model, analyses are proposed serially, and syntactic information is encapsulated from real-world knowledge and meaning while, according to constraint-based models, analyses are proposed in parallel, and the syntactic processor communicates with several relevant information sources (Ferreira, Bailey, & Vittoria, in press).
The findings reported here support a constraint-based account in which factors such as plausibility and, importantly, punctuation can be used to guide parsing. Such considerations exceed the processing basis and decision making capacity of the two-principled garden path model as, if they are influential in the initial structural analysis of the sentence, then the principles of late-closure and minimal attachment are, by themselves, inadequate to provide a sufficient description of parsing.

Frazier (1987), however, maintains that lexical considerations are not used in initial parsing. Instead, this source of information is only used in checking—a position similarly held by Mitchell (1989). Although the effect of plausibility in Experiment 3a can be explained this way, the apparent direct initial influence of punctuation on parsing for skilled readers does not suggest that punctuation is only used in rechecking. Rather, the decision to adopt either an early or late-closure analysis at a temporarily ambiguous point in a sentence appeared clearly, and initially, guided by punctuation.
7.5 EXPERIMENT 3B: PREAMBLE

One possible objection to many of the conclusions that have been drawn in the above experiments might be that the observed facilitatory effect of punctuation on the parsing of garden path sentences could merely be an artefact of ‘segmentation’. If this were the case, it would limit the generality of the finding that commas can influence the course of syntactic processing. Traditionally viewed as closely tied to pausing, and thus prosodic (Foley, 1993; Hanks & Fish, 1997), spatial features such as spaces and line breaks have been shown to cue clausal segmentation (Kennedy et al., 1989). Indeed, historically, many of the first types of punctuation involved the use of spacing.

Although a limited number of studies have looked at the effect of spatial segmentation on reading, its bearing on reading speed and comprehension remains unclear. In the past, researchers have found that the segmentation of sentences into smaller groups of meaningfully related words facilitates free recall, rote memorisation and comprehension (e.g., Anglin & Miller, 1968; Epstein, 1967), while other work has suggested that the spatial ‘chunking’ of material neither produces faster reading rates nor higher comprehension rates (e.g., Carver, 1970).

It appears that readers find texts that are organised sympathetically to their underlying clause structure easier to read and comprehend. The difference between good- and poor-readers’ comprehension may lie in the way in which they organise what they read. Readers who fail to code the words they read into meaningful phrases or ‘chunks’ have been shown to have difficulty comprehending even when they can attach meaning to individual words (Brozo et al., 1983). Skilled readers have been shown to be able to organise sentences into meaningful chunks, whereas less-skilled readers often struggle to

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28 For example, in 400 AD, St. Jerome devised punctuation per cola et commata (by phrases), which was a rhetorical classification especially intended for reading aloud.
organise material in a manner that is required for comprehension (Stevens, 1981). Spatial segmentation in normal text clearly provides some form of organization, which raises the issue of whether the skill of the reader influences the effectiveness of segmentation. The fact that good readers have been found to be significantly more able to recognise text organization (McGee, 1982; Sanacore, 1984), combined with the disparate influence of punctuation on skilled versus less-skilled readers, suggest that reading-ability may well influence the effect of segmentation. Caver (1970), however, found that the chunked format did not appear to be more beneficial to fast, slow, accurate, or inaccurate readers.

Hill (1998) recently examined the effect of extra-spacing on the reading speed of garden path and non-garden-path sentences (such as in 7.15 and 7.16), concluding that spacing may have a minor effect on processing under certain conditions—although he suggested that this is perhaps due more to physical segmentation rather than any ‘guiding’ of sentence parsing. Hill and Murray (2000b), in their eye-movement research, found that, although the extra-spacing condition did not produce an exact replication of the punctuation effects, there were more similarities than differences. The authors argued that while spacing is much more similar to the unpunctuated condition in processing terms, it is visibly closer to the punctuated condition so far as local eye-movement patterns are concerned (Hill & Murray, 2000b).

(7.15) While Laura dressed the baby lay on the bed.
(7.16) While Laura dressed the girl the baby lay on the bed.

7.5.1 Experimental Aims and Hypotheses

The purpose of Experiment 3b was to determine whether the previously observed disambiguating effects of commas could be simply credited to clausal segmentation. Extra-spacing was examined in order to ensure that any punctuation effects are not simply
attributable to an extended break between words. If meaningful verbal material tends to be coded into meaningful chunks by the reader, then the pre-organization of reading material into meaningful word groupings might improve parsing. Further, we were interested in whether the same pattern of greater magnitude of punctuation facilitation in skilled readers would manifest for extra-spacing. Based on the limited previous work (Hill & Murray, 1998, 2000b), it was expected that extra-spacing would have a positive effect on reading speed and comprehension—although not to the same extent as punctuation. Moreover, the degree of facilitation was expected to be greater for skilled readers.

7.5.2 Method

7.5.2.1 Participants

The thirty-six participants comprised 12 male and 24 female first-year psychology undergraduate students from The University of Adelaide, with an age range from 17 – 33 years and a mean age of 20.8 years ($SD = 3.62$), all of whom received course credit for involvement. Participants were native speakers of English, had not participated in previous experiments, and were naïve with regard to the nature of the hypotheses under investigation.

7.5.2.2 Materials

7.5.2.2.1 Sentence Stimuli

The sentences employed in this experiment were identical to those used in Experiment 3a (see Section 7.2.2.1). Instead of six conditions, however, only four were included, due to the omission of the implausible-garden-path short- and long-sentence conditions. Hence, each sentence potentially appeared in one of four conditions: garden path, a non-garden-path equivalent, and copies of these, each with a longer ambiguous region. The conditions were presented either with or without additional spacing (Table 7.5).
Table 7.5. Sample item illustrating the four stimuli conditions (both with and without extra spacing).

<table>
<thead>
<tr>
<th>Garden Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Short ambiguous region:</td>
</tr>
<tr>
<td>While Ben hunted the deer ran into the woods.</td>
</tr>
<tr>
<td>While Ben hunted the deer ran into the woods.</td>
</tr>
<tr>
<td>2. Long ambiguous region:</td>
</tr>
<tr>
<td>While Ben hunted the deer that was brown and graceful ran into the woods.</td>
</tr>
<tr>
<td>While Ben hunted the deer that was brown and graceful ran into the woods.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-garden-path</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Plausible, short ambiguous region:</td>
</tr>
<tr>
<td>While Ben hunted the rabbit the deer ran into the woods.</td>
</tr>
<tr>
<td>While Ben hunted the rabbit the deer ran into the woods.</td>
</tr>
<tr>
<td>4. Plausible, long ambiguous region:</td>
</tr>
<tr>
<td>While Ben hunted the rabbit the deer that was brown and graceful ran into the woods.</td>
</tr>
<tr>
<td>While Ben hunted the rabbit the deer that was brown and graceful ran into the woods.</td>
</tr>
</tbody>
</table>

**Question:** Did Ben hunt the deer?

The conditions were balanced across participants, using a Latin-square design. As a result, each participant was exposed to only one version of each sentence item, but viewed an equivalent number of items in each condition. Across participants, each sentence item appeared in each condition an equal number of times. As in Experiment 3a, the presentation order of the 48 experimental items and 80 filler items was random (see Section 7.2.2.1).

**7.5.2.2.2 Measures**

The computer, software and display system used in the current experiment were identical to those employed in Experiment 1 and 3a (see Section 5.1.1.2.1). The experimenter wrote the code for the testing phase. As in previous experiments, the CPA was used to measure reading skill (see section 5.1.1.1)

**7.5.2.3 Procedure**

The procedure for experiment 3b was identical to 3a (see Section 7.2.3), with the exception that participants were not asked to fill out the brief questionnaire on punctuation.
7.5.3 Results

7.5.3.1 Reading Time

The reading time means and standard deviations for all eight conditions are presented in Table 7.6. Although skilled readers tended to read faster than less-skilled readers across all conditions, this difference was not significant.

Table 7.6. Mean reading time (ms) for the eight conditions both with and without extra-spacing(s), for skilled and less-skilled readers.

<table>
<thead>
<tr>
<th>Reading Ability</th>
<th>Skilled</th>
<th>Less-skilled</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Short</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GP</td>
<td>2214.57</td>
<td>555.86</td>
<td>3376.69</td>
</tr>
<tr>
<td>GP(s)</td>
<td>2508.68</td>
<td>839.63</td>
<td>2614.02</td>
</tr>
<tr>
<td>N-GP</td>
<td>1961.69</td>
<td>459.46</td>
<td>2014.36</td>
</tr>
<tr>
<td>NGP(s)</td>
<td>1946.08</td>
<td>565.22</td>
<td>2026.36</td>
</tr>
<tr>
<td>Long</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GP</td>
<td>2967.01</td>
<td>898.11</td>
<td>3347.41</td>
</tr>
<tr>
<td>GP(s)</td>
<td>3179.80</td>
<td>972.96</td>
<td>2870.30</td>
</tr>
<tr>
<td>N-GP</td>
<td>2271.19</td>
<td>878.68</td>
<td>2542.31</td>
</tr>
<tr>
<td>NGP(s)</td>
<td>2121.60</td>
<td>856.85</td>
<td>2269.67</td>
</tr>
</tbody>
</table>

As in Experiment 3a, participants took significantly longer to read garden path sentences compared to non-garden-path sentences \( (F(1,34) = 91.97, p < .001) \)—consistent with a strong garden path effect. Similarly, there was a significant length effect \( (F(1,34) = 91.97, p < .001) \), with participants having substantially longer reading times in the lengthier ambiguous region conditions, which was no doubt related to the extra processing required.

Across all participants and all conditions merged, the extra-spacing was not shown to significantly facilitate reading time. However, once the factor of reading-ability was included, a clear disparity in the influence of extra-spacing emerged (Figure 7.3). There was a significant interaction effect between sentence type, spacing and reading-ability, where the extra spacing was shown to facilitate the reading speed of less-skilled readers and impede
that of skilled readers in the garden path sentence conditions, $F(1,34) = 4.69, p = .038$. The influence of extra-spacing on non-garden-path sentences, however, was far less clear, with negligible effects for both reading-ability groups in the short ambiguous region condition. There was a non-significant tendency, however, for both skilled and less-skilled readers to read faster in the longer unambiguous condition when extra-spacing was included.

![Reading Times](image)

Figure 7.3. Reading times (ms) for garden path and non-garden-path sentence conditions by skilled and less-skilled readers, for both short and long ambiguous regions.

7.5.3.2 Comprehension

As expected, skilled readers made significantly fewer comprehension errors across all sentences, $F(1,34) = 7.28, p = .011$. A garden path effect was also revealed by the comprehension measure; with significantly higher mean error rates in the garden path
conditions compared to the non-garden-path control conditions (Table 7.7). Although participants tended to have a higher error rate in the longer ambiguous region conditions, this difference was not significant.

Table 7.7. Mean number of comprehension errors for the eight conditions both with and without extra-spacing(s), for skilled and less-skilled readers.

<table>
<thead>
<tr>
<th>Reading Ability</th>
<th>Skilled</th>
<th>Less-skilled</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Short</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GP</td>
<td>1.53</td>
<td>.62</td>
<td>1.95</td>
</tr>
<tr>
<td>GP(s)</td>
<td>1.53</td>
<td>.88</td>
<td>1.74</td>
</tr>
<tr>
<td>N-GP</td>
<td>.35</td>
<td>.49</td>
<td>.26</td>
</tr>
<tr>
<td>NGP(s)</td>
<td>.06</td>
<td>.24</td>
<td>.32</td>
</tr>
<tr>
<td>Long</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GP</td>
<td>2.00</td>
<td>.71</td>
<td>2.37</td>
</tr>
<tr>
<td>GP(s)</td>
<td>1.35</td>
<td>.61</td>
<td>1.63</td>
</tr>
<tr>
<td>N-GP</td>
<td>.12</td>
<td>.33</td>
<td>.37</td>
</tr>
<tr>
<td>NGP(s)</td>
<td>.35</td>
<td>.49</td>
<td>.26</td>
</tr>
</tbody>
</table>

As evident from Figure 7.4, the introduction of extra-spacing had a significant facilitating effect on comprehension, $F(1,34) = 18.68, p < .001$. Moreover, there was a significant interaction effect between sentence type and extra-spacing ($F(1,34) = 6.33, p = .017$), with extra-spacing exerting a considerably stronger influence in the garden path sentence conditions. There was no significant difference in the effect of extra-spacing between the two ambiguous-region-length conditions. Finally, there was no interaction effect between reading-ability and extra-spacing, with groups responding similarly across conditions. It should be noted, however, that there was a possibility of floor effects in the comprehension measure, as it may not have allowed people to score extremely low on the variable.
7.5.4 Discussion

The effect of extra-spacing on reading time was quite minimal, with the only statistically significant finding being an unexpected interaction between sentence type, reading-ability and spacing, where spatial segmentation facilitated the reading speed of less-skilled readers and hindered that of skilled readers in the garden path conditions. The facilitatory effect of extra-spacing on the reading speed of less-skilled readers suggest that spatial segmentation is perhaps activating a prosodic-type cue that guides the correct attachments in garden path sentences (Gerken, 1996; Marslen-Wilson et al., 1992). This finding lends supports to Rubin's (1980) contention that poor readers rely on oral language features that do not necessarily exist in written language. In contrast, extra-spacing did not
appear to be as salient a cue with skilled readers, who presumably already use punctuation syntactically to organise text input into meaningful units. If skilled readers are accustomed to using effective coding strategies that involve punctuation, it is not surprising that extra-spacing failed to assist reading times (it is also conceivable that the strangeness of the format caused their observed slower reading times).

The findings pertaining to comprehension, however, indicated strong facilitation effects induced by the inclusion of extra-spacing, for both skilled and less-skilled readers. Notably, these facilitation effects were not as potent as the comma effects observed in Experiment 3a, yet spatial segmentation clearly assisted comprehension—particularly in the long-ambiguous-region conditions. It appears that extra-spacing aided in the delineation of significant clause breaks and, in its absence, readers failed to code the words they read into meaningful phrases or chunks. As a result, readers were led down the garden path, experiencing difficulty comprehending even when they were able to attach meaning to individual words, and thereby incurring a time-consuming reanalysis.

7.5.4.1 Conclusion

When the reading time and comprehension data are looked at holistically, the findings strongly suggest that the benefits of spatial segmentation are secondary, most probably during the reanalysis stage. In the case of skilled readers, therefore, punctuation appears to convey information related to sentence structure that is more potent than the simple chunking of text. Though prosody and punctuation overlap somewhat in function on tasks which are at once similar and quite dissimilar, reading entails different strategies from listening, and the cues provided by such elements as punctuation marks are used differently from those of prosody (Chapman, 1993).

The combined findings from Experiments 3a and 3b support the work of Hill (1998) and Hill and Murray (2000), as commas are doing more than simply physically segmenting text. Increased spacing may have a minor effect on processing under certain circumstances,
but this may perhaps be due to ‘segmentation’ rather than any guiding of sentence parsing
Commas, therefore, have a strong and structurally dependent influence on sentence
processing—particularly with skilled readers—as they can successfully avert the need for
major reanalysis, either by eliminating garden path effects altogether or activating rapid
repair.
Chapter 8: Experiment 4

8.1 PREAMBLE

Modern punctuation, intended to clarify syntactic structures rather than to indicate 'breathings', is for the most part a Renaissance invention, emerging during the first generations of the printing press, and codified in the eighteenth-century. Eighteenth- and nineteenth-century punctuation practices diverged considerably, but tended to be heavy in terms of the number of marks used. In recent times, punctuation practice has favoured the general direction of ever-lighter pointing, giving necessary guidelines to rhetorical delivery with some minimal marking of the logical units of a text.

Gitlin (1997), in a somewhat tongue-in-cheek study of book quality, examined the quantity of punctuation in the top ten novels on The New York Times best-seller list during the first week of October in 1996, 1976, 1956 and 1936. His findings cannot be regarded as definitive, since the methodology he used was rather crude, where the number of punctuation marks (of all kinds) before the period in the first sentence beginning on pages 1, 50, 100 and 150 were counted, and his sample-size was very low. Nonetheless, the number of marks was observed to have declined by 55 percent between 1936 and 1996, with the biggest decline occurring between 1956 and 1976 (Gitlin, 1997).

The current tendency toward a more open style of punctuation (open punctuation employs as few marks as possible; closed punctuation employs more extensive marks) is often attributed to new technologies such as the Internet (Commonwealth Department of Finance and Administration, 2002), although the decline in marking actually began many years before these developments (see Section 3.4.1). The distinction between the more traditional style of punctuating and the current minimal style has to do with optional
punctuation, particularly commas—a light style puts in relatively few commas in those places where they are optional rather than obligatory (The University of Chicago Press, 1993)

However, even in what is on the whole a light style, punctuation will tend to be added if its omission might result in an initial misreading of the sentence. Indeed, punctuation marks may be inserted to prevent misanalysis even in places where they would not, as a rule, be permitted (Nunberg et al., 2002). For example, compare 8.1 – 8.3:

(8.1) Liz recognised the t-shirt he took from the bag and gasped.
(8.2) Liz recognised the man who entered the room, and gasped.
(8.3) Most of those who can, work at home.

While 8.1 has no internal punctuation, 8.2—which has an equivalent syntactic structure in relevant respects—has a comma which functions to make clear that it was Liz, not the man, who gasped. In 8.3 the comma indicates the boundary between subject and verb (opposing the general rule prohibiting punctuation in this position); what makes it justifiable in this position is that without it work is likely to be at first taken as head of the complement of can rather than of the matrix predicate (Nunberg et al., 2002). In this example the comma replaces the missing words do so.

The rules of punctuation are not static; they have changed throughout the years and will continue to change. Punctuation conventions that once might have been considered improper may now be considered correct. Compounding the uncertainty surrounding punctuation are the unexamined assumptions about fundamental aspects of contemporary punctuation, in particular the failure to distinguish between obligatory punctuation and the vast area of optional punctuation. Consequently, punctuation continues to have an unclear status within the written language.

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If both the presence and the absence of punctuation co-occurring with the same syntactic structure are acceptable, the inclusion of the given mark cannot completely be syntactically motivated (Levinson, 1985). Semantic, stylistic and intonational factors are frequently recognised as governing punctuation; however, it has developed that punctuation is, by and large, described in grammatical terms. Perhaps, as suggested by Levinson (1985), this is because it is more straightforward to explain punctuation in the apparently clear-cut categories and extensive technical vocabulary of syntax than to try to associate it with other linguistic features, such as semantic concepts or prosody, where the units are far less clearly understood. Nevertheless, the pages of nearly any contemporary publication will have examples of text where the punctuation cannot be justified on the basis of its syntactically predicted disambiguating consequences—accomplished writing requires punctuation that goes further than simply guiding parsing.

The elasticity made possible by its semantic and prosodic factors brings punctuation out of the field of grammar and into a more tenuous domain, where style and meaning meet, and where perhaps style is meaning (Levinson, 1985). As Iyer (1988, p. 80) delightfully wrote:

*Thus all these tiny scratches give us breath and heft and depth. A world that has only periods is a world without inflections. It is a world without shade... A comma catches the gentle drift of the mind in thought, turning in on itself and back on itself, reversing, redoubling and returning along the course of its own sweet river music...Popping in a comma can be like slipping on a necklace that gives an outfit elegance, or like catching the sound of running water that complements, as it completes, the silence of a landscape."

Viewed in these terms, the momentum in modern writing away from the traditional and relatively flexible punctuation system, towards something altogether more minimalist, is perplexing. As Partridge (1964) noted nearly forty years ago, the supporters of an extremely open style of punctuation forget a very important fact: this sort of punctuation
serves fairly well for simple description, simple exposition and simple narrative, but it proves horribly inadequate for the more subtle, sophisticated and aesthetic kinds of description, exposition and narrative. Consequently, while the minimalist principles of punctuating as little as possible and only for clarity may serve in some instances, if generalised into all genres of writing this style proves inadequate and, perhaps, rather dull.

Though it may be the case that punctuation regulates the physical experience of reading, whether (as many pundits appear to assume) optional punctuation has a negative impact on the speed with which a reader makes his or her way through a text has not been empirically established. Inappropriate punctuation that is incongruent with the underlying syntax has been found to impair reading speed and comprehension (Cohen et al., 2001). Moreover, there is some evidence that that appropriate punctuation increases processing time for the zone in which it is located (Hill, 1996) as well as the length of fixation time (Hill & Murray, 2000b)—in what has been termed 'comma-effects'. These phenomena are localised, however, and whether they have an effect on the total sentence reading time in optional non-critical structures is far from clear. The work of Hill (1996) and Hill and Murray (2000b) with non-garden-path structures suggests that appropriate commas are, at worst, merely transparent when non-critical. Similarly, Clifton (1993) reported that the absence of a comma did not affect reading times when the comma was merely stylistically preferred. The current project has provided evidence that punctuation does play a role in non-garden-path structures and that this role, although diluted, is, if anything, facilitatory—particularly with skilled readers.

In contrast, Chapman (1993) found slower reading times with the inclusion of optional punctuation. He presents this finding as evidence that the trend in modern writing away from exhaustive punctuation of earlier eras, and towards minimal punctuation, is vindicated. Perhaps, however, this statement is somewhat bold, given that his observed trend was not statistically significant, that there were a number of methodological problems
with the experimental stimuli selected (see Section 4.2.5), and that he used a relatively small sample-size.

However, Chapman’s (1993) findings should not be dismissed too easily, as optional punctuation is not the equivalent of appropriate non-critical punctuation. Thus, although we can confidently say that the lack of necessary punctuation is capable of slowing a reader down, and that the inclusion of expected but non-critical punctuation does not substantially slow a reader down, the effect of optional punctuation is virtually unknown. If optional punctuation was observed to increase reading time, then this would provide support for a minimalist style of punctuation, particularly in expository texts. Conversely, if optional punctuation was found to have no influence on reading performance, it would provide compelling evidence against a minimalist style of punctuation, as the major precept of the proponents of this style—that additional punctuation equates to longer reading times and, as a result, less punctuation enhances reading—would be false. Indeed, if anything, the minimalist style would then be considered limiting, as the strategic use of commas and other punctuation marks allows writers to accomplish more than simple disambiguation.

8.1.1 Experimental Aims and Hypotheses

When the rules of punctuation are broken or are inefficient, the writer taxes or confuses the reader. Whether the exclusion of optional punctuation has any bearing on reading performance, however, is uncertain. Thus, the purpose of Experiment 4 was to explore whether optional punctuation has any effect on reading speed, comprehension and comprehension-confidence when used in a minimalist compared to a traditional manner. We were also interested in the overall confidence participants felt in their own ability to punctuate, and whether this was related to reading-ability.

Based on the previous findings concerning non-critical punctuation, it was expected that optional punctuation would not slow down reading or influence comprehension.
Given the lack of any previous relevant studies, there were no predictions regarding the effect of optional punctuation on comprehension-confidence, although it was speculated that, if anything, skilled readers would feel more confident when optional punctuation was included, while there would only be a negligible, if any, effect with less-skilled readers.

8.2 METHOD

8.2.1 Participants

The 50 participants were 24 male and 26 female readers, with a mean age of 20.58 years ($SD = 7.53$) and an age range from 15 to 55 years. The majority of participants were first-year psychology students attending The University of Adelaide—all of whom received course credit for participation. Sixteen of the participants were final-year high school students at Prince Alfred College, Adelaide, who participated as part of a their psychology practical—all of these students were male. Participants were all native speakers of English and had normal or corrected-to-normal eyesight. Students involved with the pilot studies or any of the previous experiments were not eligible to take part in Experiment 4, ensuring that all participants were naïve with regard to the nature of the hypotheses under investigation.

8.2.2 Materials

8.2.2.1 Stimuli

The twenty stimulus-items consisted of ten sentences (e.g., 8.4) and ten paragraphs (e.g., 8.5) taken from a local state newspaper. The only criterion used by the experimenters to select the stimuli was that the sentence appeared in a minimal (open) punctuation style, without the commas that would normally be expected if adhering to a strict traditional punctuation style. All of the sentence and paragraph stimuli were rated for ‘difficulty’, in terms of comprehensibility, by six independent judges in a similar manner to pilot study 2
(see Section 5.1.1.3). Not surprisingly, given that stimuli involved optional punctuation, all of the sentences and paragraphs were rated as being very low in reading difficulty (see Section 8.2.2.1.1 to follow).

(8.4) They do not want to cut services (,), so rate increases are very likely.

(8.5) The square is part of the Red Kangaroo Dreaming Place and (,) as such (,) holds special cultural importance. An indigenous statue would be erected (,) and the aboriginal flag would be flown atop one of the square's flagpoles.

Each participant encountered all 20 experimental items, with each item appearing only once in either of two categories: optional punctuation and no sentence-internal punctuation. These conditions were varied for each participant using a Latin-square design in order to get an equal distribution of each stimulus sentence in each condition. There were also 10 filler sentences and 5 filler paragraphs, bringing the total number of stimuli to 35, which were presented in random order. Half of the comprehension questions required a ‘Yes’ response, the other half a ‘No’ response. Due to the stimuli being relatively easy to comprehend, it was not expected that such a simple comprehension measure would be sufficient to probe the influence of optional punctuation on reading comprehension. Nevertheless, the measure was included as it enabled the subsequent investigation of confidence and, no doubt, encouraged readers to read for understanding, rather than merely speed.

8.2.2.1.1 Stimuli Ratings Study

On account of the optional nature of the punctuation in the experimental sentences, it was not expected that any of the sentences would be difficult to process in the absence of punctuation. Nonetheless, although the use of punctuation could be considered non-obligatory in each of the stimuli, the texts were not matched for length or structure and,
consequently, it was important to get an impression of the individual difficulty of each text in terms of ‘readability’.

Method

Participants

The six participants were four female and two male acquaintances of the experimenter, ranging in age from 19 to 37 years with a mean age of 27.16 (SD = 6.98).

Materials

A numbered list of the ten sentences and ten paragraphs that contained no sentence-internal punctuation (two versions in reverse order), and a rating sheet with a seven-point visual analogue scale, ranging from 1 = not at all difficult to 7 = extremely difficult, were the only materials used.

Procedure

Once participants had read the information sheet and signed the consent form, they were asked to rate each sentence and paragraph according to the seven-point scale provided. Upon completion, participants were thanked and asked for verbal feedback regarding the nature of the task. The rating phase took no more than 5 minutes to complete.

Results

Analysis indicated that there was a significant concordance between judges’ ratings of the sentences, with Kendall’s $W = 0.79$ and Kendall’s $\chi^2 (9, N = 6) = 42.851, p < .001$, as well as paragraphs ($W = 0.74$ and Kendall’s $\chi^2 (9, N = 6) = 40.136, p < .001$). Moreover, both the mean ratings (the mean difficulty score was 2.55 (SD = 1.06) for sentences and
2.16 (SD = .93) for paragraphs) and verbal feedback given by the judges indicated that the sentences and paragraphs were very easy to comprehend.

8.2.2.2 Measures

The computer and software used to run Experiment 4 were identical to those used in the previous experiments (see Section 5.1.1.2.1) and, as before, the experimenter wrote the code for the testing phase. Experiment 4 employed the Window Method for testing reading speed of both sentences and paragraphs, where the reader is exposed to the successive complete segments of text (the windows) by pressing a key. The Computerised (Reading) Placement Appraisal (CPA) was again used to classify participants on reading-ability (see Section 5.1.1.1).

8.2.3 Procedure

Upon arriving for the experimental session, participants were provided with a written general description of the experiment, and a consent form. The information sheet explained to the participants that they would undertake a brief reading-ability assessment and participate in a reading experiment where they would see a series of text passages on a computer, answer a question about each sentence, and then rate their confidence in their answer. After completing the consent form, participants were seated in front of the computer and commenced either the CPA or the experiment (the presentation order was counterbalanced). Participants were asked to complete the tasks as rapidly as possible, but asked not to improve speed to the detriment of accuracy.

In the experimental phase, the computer had colour-coded response keys, and a message appeared on the screen asking the participant to follow the instructions and press a button to initiate the trial. Participants were instructed to read the sentences and paragraphs at a normal pace for comprehension and to press the appropriate button to proceed to the question. After the brief instructions and diagrammatic information on the
screen, there was a practice phase in order to facilitate subject familiarity with the type of stimuli and response tasks. Participants were invited to ask questions before and immediately after the practice trials.

Throughout the experiment, pressing the ‘Ready’ button brought up a fixation marker (X) on the left middle of the screen. Pressing the ‘Right Mouse’ button replaced this with the text. Once participants had finished reading the text, pushing the ‘Right Mouse’ button again cleared the screen and after a delay of 500ms the question appeared in full. A ‘Yes’ or ‘No’ button press response was required, and the participants had six seconds to respond or the trial continued automatically. The participants were then required to rate their confidence in their comprehension response by pressing the corresponding number between 1 not at all confident and 5 extremely confident. The computer recorded reading times, comprehension errors and confidence-ratings. Before continuing to the next sentence, the ‘Ready’ button had to be pressed, which ensured that there was time available for the participant to rest, as there was no limit during the ‘ready’ phase.

Each participant took part in four practice trials: two sentences and two paragraphs. The participants then moved to the experimental phase, where the presentation order of the 20 stimuli and 15 filler texts was determined randomly for each of the participants. Once a participant had responded to all the sentences and paragraphs, they were asked give a general confidence-rating of their own ability to punctuate on a scale from 1 not at all confident and 10 extremely confident.

Upon completing the CPA and experimental phase, participants were thanked, given the opportunity to ask any questions, and provided with debriefing information. The experimental phase rarely lasted longer than 15 minutes, and the entire experiment generally did not exceed 35 minutes.
8.3 RESULTS

The mean differences between punctuated and unpunctuated conditions are illustrated in Figure 8.1, for both sentence and paragraph conditions. Although the inclusion of punctuation appeared to reduce reading time overall, this difference in central tendency was not significant for sentences \((z = -0.97, p = 0.33)\), for paragraphs \((z = -0.87, p = 0.39)\), or, indeed, overall \((z = -1.38, p = 0.17)\).

![Figure 8.1](image)

*Figure 8.1. Mean difference in reading time (ms) between punctuated and unpunctuated sentence conditions for each of the 20 stimuli (punctuated condition minus unpunctuated condition). The darker bars indicate paragraphs.*

In view of the fact that sentences and paragraphs were not matched for length or structure, any complete and reasonable account of the data needs to consider the effect of variance. It was apparent from the data that the variances in reading times for the individual sentences and paragraphs were quite heterogenous. An analysis was conducted which contrasted a model with constant variance across stimuli with an unstructured variance/covariance matrix model. The change in the restricted log likelihood ratio was highly significant, for both the sentence \((\chi^2(1, N = 55) = 227.07, p < .05)\) and paragraph
(χ² (1, N = 55) = 466.02, p < .05) conditions. Consequently, a mixed model analysis of variance was used which enabled an estimation of the variance/covariance structure for stimuli, and accounted for this in the overall model. Owing to the sentence and paragraph stimuli being relatively simple-to-process (see Section 8.2.2.1.1), the measure of comprehension (i.e., whether the participant answered the ‘Yes’ / ‘No’ question correctly) was limited to being used as a covariate in the model.

The results for the sentence-testing condition (see Table 8.1) revealed that punctuation had a significant and beneficial effect on reading time across all the sentences combined, F (1,48) = 4.59, p = .037. Although the reading-times of skilled readers were significantly lower than those of less-skilled readers, F (1,48) = 26.28, p < .001, there was no significant interaction effect between punctuation and reading-ability.

Table 8.1. Mean reading times (ms) for each of the ten sentences in the punctuated and unpunctuated conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Punctuated</th>
<th>Unpunctuated</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>s1</td>
<td>1105.70</td>
<td>329.72</td>
<td>1040.70</td>
</tr>
<tr>
<td>s2</td>
<td>1100.98</td>
<td>373.85</td>
<td>1337.92</td>
</tr>
<tr>
<td>s3</td>
<td>985.42</td>
<td>307.69</td>
<td>1267.17</td>
</tr>
<tr>
<td>s4</td>
<td>791.47</td>
<td>255.04</td>
<td>1050.42</td>
</tr>
<tr>
<td>s5</td>
<td>1074.25</td>
<td>300.45</td>
<td>987.17</td>
</tr>
<tr>
<td>s6</td>
<td>1029.27</td>
<td>317.08</td>
<td>993.87</td>
</tr>
<tr>
<td>s7</td>
<td>1256.24</td>
<td>291.71</td>
<td>1163.45</td>
</tr>
<tr>
<td>s8</td>
<td>1084.06</td>
<td>297.75</td>
<td>1099.68</td>
</tr>
<tr>
<td>s9</td>
<td>996.01</td>
<td>266.41</td>
<td>1020.75</td>
</tr>
<tr>
<td>s10</td>
<td>763.76</td>
<td>210.62</td>
<td>984.91</td>
</tr>
</tbody>
</table>

The inclusion of punctuation had no significant effect on the confidence-ratings of participants. Moreover, there was no difference between the reading-ability groups in terms of confidence in their comprehension response, nor was there any interaction effect between punctuation and reading-ability.
The reading times of paragraph stimuli (see Table 8.2) were significantly reduced by the inclusion of punctuation, $F(1, 47) = 4.77, p = .034$. As in the sentence conditions, the reading times of skilled readers for the paragraph stimuli were significantly lower than less-skilled readers, $F(1, 48) = 12.88, p = .001$. Again, however, there was no interaction effect between punctuation and reading-ability.

### Table 8.2. Mean reading times (ms) for each of the ten paragraphs in the punctuated and unpunctuated conditions.

| Condition | Punctuated | | Unpunctuated | | Total | |
|-----------|------------| | | | | |
|           | $M$        | $SD$ | | $M$ | $SD$ | $M$ | $SD$ |
| p1        | 2934.64    | 853.86 | | 2787.66 | 954.75 | 2861.15 | 899.49 |
| p2        | 2849.69    | 968.31 | | 3477.24 | 1270.09 | 3163.47 | 1161.82 |
| p3        | 3687.68    | 1128.64 | | 4698.67 | 1717.18 | 4193.18 | 1526.08 |
| p4        | 1527.53    | 492.22 | | 2027.30 | 624.13 | 1777.42 | 610.89 |
| p5        | 2513.75    | 703.05 | | 2309.98 | 655.00 | 2411.87 | 680.31 |
| p6        | 1513.03    | 466.11 | | 1502.47 | 502.23 | 1507.75 | 479.57 |
| p7        | 1616.57    | 446.67 | | 1562.50 | 420.07 | 1589.54 | 430.00 |
| p8        | 2705.82    | 743.19 | | 2744.80 | 645.76 | 2725.31 | 689.32 |
| p9        | 3117.51    | 833.85 | | 3047.48 | 961.44 | 3082.49 | 891.38 |
| p10       | 1932.31    | 532.86 | | 2491.82 | 977.14 | 2212.07 | 828.61 |

There was no difference in the confidence-ratings given by participants in the punctuated and unpunctuated paragraph conditions. Similarly, there was no difference in the confidence that skilled and less-skilled readers held in their comprehension answers. Once again, analysis indicated no interaction between reading-ability and punctuation. The effect of the comprehension measure as a covariate, however, was significant in the paragraph condition ($F(1, 320) = 24.3, p < .001$), which suggests that whether a participant answered the comprehension question rightly or wrongly influenced the confidence they held in their response (lower confidence when incorrectly answered)—a finding that was not present in the sentence condition.

Overall, participants appeared to be reasonably confident in their own ability to use punctuation marks ($M = 7.02, SD = 1.58$). There was a significant effect for reading-ability,
\( t(48) = 2.76, p = .008 \), with skilled readers reporting a higher confidence in their ability to use punctuation \( (M = 7.58, SD = 1.63) \) than less-skilled readers \( (M = 6.42, SD = 1.32) \).

### 8.4 DISCUSSION

The earlier experiments indicated that punctuation marks perform a significant role in organising the strategies of readers, particularly skilled readers, when parsing ambiguous sentences. The findings of the current project have largely supported and, in some cases, extended previous research (e.g., Cohen et al., 2001; Hill, 1996; Hill & Murray, 2000b; Mitchell, 1986) that has shown that punctuation can guide potential attachments during sentence processing. Inappropriate or incorrect punctuation has also been found to have a severe impact on sentence parsing, impairing reading speed and comprehension (Cohen et al., 2001; Steinhauer & Friederici, 2001). Circumstances in which punctuation marks are obligatory for disambiguation or blatantly inappropriate, however, turn out to be few in comparison to the entire array of punctuation use (Levinson, 1985). The use of punctuation is more frequently optional than not, and depends on semantic, pragmatic and stylistic features, having to do with the length of an expression, its context, its closeness to spoken language, and the rhythmic effect intended (Garcia, 1975). Thus, although the study of garden-path-type sentences provides valuable information about the disambiguating properties of punctuation, studying more typical sentences is also useful, as they are what the reader would most frequently be exposed to.

The tendency to study syntactic parsing in isolation from all the intimate interactions between complicated semantic, pragmatic, and world knowledge issues arises partly because it is easier to do so, and partly for theoretical reasons. Reading research has largely focused on syntax, particularly the question of how to characterise those strings of words (in isolation) that are sentences of a language, and what structures can be assigned to them. However, syntax should not be studied independently from everything else, including how language is used. A universal justification for the distribution of punctuation is that it
disambiguates ambiguous sentences and also serves to prevent the incorrect parsing of the constituent structure of a sentence (Spradley, 1971). The distribution of a comma often has this effect, but it does not appear that this is the sole use of punctuation. The versatility made possible by the semantic and prosodic facets of punctuation brings punctuation out of the grammar and more into a stylistic domain (Levinson, 1985). Punctuation, therefore, should be viewed and studied not only in terms of its role in syntactic parsing, but in terms of what it can ‘offer’ the reader or writer—there is more to punctuation than syntax and disambiguation. Consequently, the current experiment aimed to explore an issue more relevant to style than syntax, and one relevant to punctuational practice, namely whether the addition of optional commas equates to longer reading times.

The finding of faster reading times with the inclusion of optional punctuation, for both skilled and less-skilled readers, failed to provide any evidence for a minimalist style of punctuation. This finding contrasted with Clifton’s (1993) observation that the lack of an ordinarily present comma did not appear to influence an otherwise acceptable sentence structure. Similarly, the findings do not endorse Chapman’s (1993) support for a minimal style of punctuation, although even he readily admits that: “leaving commas out of some punctuation structures may speed up already fast readers, but if they are good readers then they are likely to suffer and the intent of the read message may be lost” (p, 43).

The finding of optional punctuation leading to improved reading time was quite unexpected, and can perhaps be best explained by raising a distinction between commas as *preventers* of incorrect parsing and commas as *aids* to correct parsing—it is argued here that they do both. In this context, aiding implies increasing the facility with which a reader carries out a parse that he or she would be in no danger of mishandling even in the absence of punctuation. This possibility does not seem to be considered by style-guides (e.g., Australian Government Printing Services, 1988; Commonwealth Department of Finance and Administration, 2002; Hughes et al., 1993; Patridge, 1964; Paxon, 1986; Shaw, 1963; The University of Chicago Press, 1993).
The observed increased reading times in optionally unpunctuated sentences and paragraphs could be explained in terms of a ‘comma-starvation’ effect or an unfulfilled ‘comma-expectation’ (extending the argument by Adams et al., 1998). The increased reading times in the current experiment, combined with the absence of any difference in comprehension or confidence-rating scores, can certainly be used as evidence for the existence of a ‘comma-starvation’ effect. Moreover, the increased reading times by skilled readers in unpunctuated non-garden-path conditions (observed in Experiments 2 and 3a) could also conceivably be explained by ‘unfulfilled’ comma expectations.

However, the finding that less-skilled readers were also significantly aided by optional punctuation (although not to the same extent as skilled readers) is perplexing, as one would have assumed—based on the previous experiments—that any comma-expectations held by less-skilled readers would have been much lower than those of skilled readers. Conceivably, this finding can be explained by the fact that the optional punctuation used in the experimental sentences could have easily been construed as prosodic. In Experiment 3a the data on less-skilled readers suggested an interpretation of the observed punctuation facilitation in terms of prosodic cues—particularly given the self-reported preference for a prosodic view of punctuation by less-skilled readers in the questionnaire. Consequently, less-skilled readers may struggle with punctuation only when it offers primarily syntactic information, and nevertheless be capable of using it effectively when it offers prosodic guidance of sentence composition.

Although it is possible that frustration at the lack of appropriate or guiding punctuation could lead to slower reading times, any future investigation of this issue would need to clearly distinguish between commas as preventers of misparsing and commas as expected aids. Both would predict a reading-time effect in unpunctuated conditions, but only the latter would predict no comprehension effects with non-garden-path or optional punctuation conditions. Moreover, if it was also found that readers who commented negatively on the absence of punctuation (many did so conversationally in the current
project) showed longer reading times for these sentence types, then this would be strong evidence for the existence of the 'comma-starvation' effect.

8.4.1 Conclusion

Experiment 4 provided no support for the minimalist style of punctuation, where optional commas are omitted. Consequently, strict adherence to a minimal style of punctuation does not necessarily equate to enhanced reading, indeed it could be viewed as quite limiting—particularly in sophisticated and aesthetic forms of writing. A further objection to a systematic and extreme open style of punctuation is that it inevitably leads to the occasional inadvertent omission of commas that are essential for the prevention of a momentary misreading. Partridge (1978) suggests in his thorough treatise on punctuation that it is the uncertainty surrounding punctuation which leads to the endorsement of the extreme open style. It is suggested here that it is better to contend with, and attempt to resolve, uncertainly, rather than diminish the stylistic elasticity afforded by punctuation.
Chapter 9: General Discussion

When punctuation was first employed, it was in the role of the handmaid of prose; later the handmaid was transformed by the pedants into a harsh-faced chaperone, pervertedly ingenious in the contriving of stiff regulations and starched rules of decorum; now, happily, she is content to act as an auxiliary to the writer and as a guide to the reader.

—Harold Herd

9.1 PREAMBLE

Reading research not only assists us to explain, illustrate and predict the nature of the complex cognitive process of reading under variant experimental conditions, but also provides systematic direction for the manner in which reading should be taught in naturalistic settings (Henk, 1987). To a great extent, therefore, research into reading drives educational practice, while simultaneously shaping the nature of ongoing and future empirical inquiry. Undoubtedly, these functions represent significant components in the pursuit of improved literacy standards. The major aim of the current project was to examine whether punctuation, exemplified by commas, provides an effective and reliable cue for the facilitation of reading performance—as determined by reading speed and comprehension. The view that there is a redundancy continuum in punctuation, and the question of whether the comma exerts a varied influence on a range of ambiguous and unambiguous sentences, as well as simple- and difficult-to-process sentences, were also explored. Additionally, the relationship between the reading-skill of participants and the effect of punctuation was considered, particularly in terms of the nature and magnitude of facilitation.
It is the purpose of this chapter to briefly reiterate the main findings of the current project and to discuss, where possible, the relationship of the current findings to relevant past research. The implications of the findings for models of parsing are also discussed. Possible explanations are given concerning the difference in punctuational influence observed between skilled and less-skilled readers. Methodological considerations, particularly around the issues of overgeneralisation and stimuli selection, are also identified. Suitable areas for further research are suggested in the conclusion section.

9.2 SUMMARY OF FINDINGS

9.2.1 Theoretical Chapters

The relative rarity of research of the present kind may reflect an at least partial awareness of the complexity of the various roles that have been historically accorded to punctuation. Research inevitably requires a pragmatic simplification of the field under consideration and, as a result, an inevitable exclusion from consideration of some pertinent issues. This dissertation falls far short of approaching a unified theory of the use of punctuation. A comprehensive account must be based on a much broader set of symbols, a range of sentence-structures, various genres, writer-speaker combinations, and both micro- and macro-typographies need to be investigated. Consequently, it is important to be aware that, at least on some level, simplification of the punctuation system has taken place and that possible psychologically important functions and attributes of the system are not represented in this research.

The discussion of the origins of punctuation provided in the historical analysis (Chapter 2) and in the review of contemporary punctuation practice (Chapter 3) offered a suitable overarching theoretical framework within which the research aims could be placed. A familiarity with the facts of early punctuation practices in English (especially an understanding of their sources) and the current ‘roles’ of punctuation cannot fail to have a
positive effect on psycholinguistic approaches to contemporary punctuation. Nevertheless, it is important to note that this study has been restricted to investigating the comma; accordingly, sweeping inferences from observed 'comma-effects' to 'general-punctuation-effects' should be made tentatively, if at all.

In Chapter 2 it was suggested that written language has performed two distinct, though frequently overlapping, functions: graphically representing speech and providing an enduring record that is not anticipated to be vocalised. In Chapter 3 these two functions were portrayed as directly reflected in the two major traditions of punctuation: prosodic and syntactic. The first, and rhetorical, tradition views the role of punctuation as supporting the reader in reconstructing an oral interpretation of the text; while the second, and grammatical, tradition views punctuation as a set of relatively stringent conventions for marking the logical grammatical relationships in a text that is primarily intended to be regarded as a written document. Adherence to the prosodic or syntactic tradition reflects not only viewpoints about the role of punctuation in isolation, but also about the association between spoken and written language (Baron, 2001).

Although perhaps beyond the scope of this dissertation, the analysis of the history and modern use of punctuation suggests that it is a reader-oriented device, which is perhaps only minimally dependent on language structure. Moreover, it is not a coherent system, but a general 'framework' that readers become aware of as they develop literacy. Therefore, punctuation does not appear, rightly or wrongly, to be utterly governed by prescriptive rules; rather, it is likely that punctuation is governed by the same kind of motives that govern lexical choice (Levinson, 1985). Thus these two contrasting functions of punctuation—the informational use to group sentence-partialis for purposes of interpretation, in which the juxtaposition of sentence partials is crucial; and the prosodic use, where the intonational contours are elicited and the pace and rhythms of written
discourse are set (Levinson, 1985)—enable elasticity in the use of punctuation that carries it out of the realm of grammar, and brings it into the tenuous domain of style.

Perhaps it is necessary to recognise overtly that punctuation is not especially responsive to language structure—it is a convention inevitably and strongly linked to reading and writing technology. Such an analysis of punctuation implies that the practice and principles of punctuation marking have not changed in response to changes in the structure of English, but in direct and indirect response to profound changes in social and technological factors (Baron, 2001; Jones, 1996; Levinson, 1985; Parkes, 1992). It is hardly surprising, therefore, that the function of punctuation has changed, with the beginnings of modern punctuation seeking more and more to present information in a way that makes it easy for the reader both to read more rapidly and to comprehend better.

The current research is not extensive enough to comment in general on the deployment of punctuation for information grouping purposes, nor on its relationship to prosody. Nevertheless, by identifying a smaller set of instances where punctuation is not open to choice, as well as investigating possible factors which influence the effectiveness of punctuation, it has been a first step in investigating the technological utility (see Nüniluoto, 1993) of punctuation, with the overall pragmatic aim of increasing the effectiveness of reading. Moreover, it is a first step in providing empirical evidence that may resolve many of the disagreements concerning punctuation usage, particularly in relation to optional punctuation, so we can begin to better understand the hazy middle-ground that lies between mandatory and inappropriate punctuation use, where idiosyncrasy and disagreement reign supreme.

9.2.2 Experimental Findings

The bulk of the experimental findings reported in this dissertation provided evidence that the inclusion of appropriate commas can lead to a reader interpreting ambiguous phrases in a way dissimilar to that normally selected in the absence of punctuation.
Essentially, the findings have been that commas play a critical role in guiding the course of parsing and comprehension—empirically confirming the often-made claims by language researchers concerning the facilitation effects of punctuation. The reduction (and often removal) of processing difficulties in garden path sentences gave clear support to the notion that punctuation can convey critical syntactic information.

In Experiment 1, the reading time of simple- and difficult-to-process ambiguous sentences was significantly reduced by the introduction of appropriate commas. The results, however, provided no confirmation of the notion of syntactic redundancy in parsing with punctuation (see Baldwin & Coady, 1978; Hill, 1996). While there was a non-significant tendency for comma effects to be maximised in the difficult-to-process ambiguous sentences, the fact that there were strong facilitation effects in most simple-to-process ambiguous sentences as well suggested that the facilitating power of the comma remained, even when it acted only to support the existing lexically chosen structure. The strong observed interaction effect between the magnitude of punctuation facilitation and the reading-ability of participants suggested that the effectiveness of punctuation as an aid in parsing is partially dependent on the reading-skill of an individual.

Experiment 2 replicated many of the findings from Hill and Murray’s pioneering research into the impact of commas on the parsing of a range of garden path sentence structures. Strong punctuation effects were observed in the processing of early-closure and reduced-relative clause constructions, but not in the non-ambiguous versions of either of these, and not in the prepositional phrase ambiguities—supporting earlier work in both self-paced (Hill, 1996) and eye-movement (Hill & Murray, 2000b) studies. The cumulative design used in Experiment 2 made available information regarding the critical zone in which punctuation facilitates reading. The analysis indicated that, in many cases, the absence of punctuation led to prolonged reading times in the final ‘indicator’ zones.
(consistent with parsing failure), probably due to attempts to resolve the attachment anomaly.

When the addition of commas coincided with attachment boundaries in the non-garden-path default structures, they were found to be relatively redundant from a processing point of view, which was largely consistent with previous investigations (Hill, 1996; Hill & Murray, 2000b). However, the contrasting influence exhibited by punctuation for skilled and less-skilled readers in the unambiguous control sentences suggests that, although their role may be much more minor in non-critical structures, it is likely that commas shape, or at least have some bearing on, structural decision-making in unambiguous sentence types—appearing to assist skilled readers and to have little effect on (or perhaps even to impede) less-skilled readers. The observed discrepancy in influence between the two reading-ability groups was contrary to the simple redundancy view of punctuation and, as in Experiment 1, cautioned against blanket statements (e.g., Baldwin & Coady, 1978; Hill, 1996) that suggest punctuation marks are informationally vacuous when merely reinforcing lexical information.

Experiment 3a examined whether the insertion of appropriate punctuation would eliminate the influence of two variables known to affect the processing and comprehension of garden path sentences: plausibility of the potential attachment and the length of the ambiguous region. This enabled an examination of whether punctuation provides complete disambiguation of ambiguous sentences or simply facilitates in the process of reanalysis, as well as further judgements to be made about the suitability of the redundancy view of punctuation. Findings supported previous work into the effect of plausibility on parsing (e.g., Christianson et al., 2001; De-Vincenzi & Job, 1993; Ferreira & Clifton, 1986; Pickering & Traxler, 1998; Rayner et al., 1992; Speer & Clifton, 1998), as there was clear evidence that the implausible sentences were less susceptible to misinterpretation than were plausible sentences. Additionally, Experiment 3a replicated previous findings regarding
length of ambiguous region (e.g., Christianson et al., 2001; Ferreira & Henderson, 1991; Frazier & Rayner, 1982; Warner & Glass, 1987), as the longer a reader entertained an erroneous attachment, the more difficult successful parsing became. Punctuation appeared to be used as a primary source of information in skilled readers, activating the direct 'first-pass' syntactic route to successful analysis by overriding conflicting semantic or syntactic cues. For less-skilled readers, however, punctuation cues appeared to come into play only during reanalysis, after initial structural assignments had been suggested by other relevant factors, such as word order and plausibility.

The findings, specifically those related to the comprehension measures, supported the redundancy continuum model, as punctuation was observed to be more crucial in garden path compared to non-garden-path control sentences, in plausible compared to implausible conditions, as well as in long- compared to short-ambiguous-region conditions. On the surface, the data supported the notion that the effectiveness of punctuation is inversely related to the number of relevant cues, such as syntactic (e.g., word order) and semantic (e.g., plausibility) cues, as well as the extremeness of the garden path. However, the fact that appropriate commas were still observed to influence the parsing of the non-garden-path control sentences is problematic for the redundancy view, which sees punctuation as merely transparent when non-critical. Perhaps it is more profitable to view the continuum as one of 'usefulness' or 'criticalness', rather than redundancy, as this would then allow for the guiding properties of punctuation, even when they merely support an existing correct lexical structure. Moreover, it is unlikely that the correlation between the 'value' of punctuation, and the existence of other salient parsing cues is a simple inverse relationship; on the contrary, it is probable that it is mediated by such factors as an individual's exposure to punctuation and their capacity to process it.

In Experiments 1 – 3a commas were shown to exercise a considerable influence on processing when they were syntactically critical, appearing to be a powerful resource in the
delivery of structural information, and primarily used as evidence against default structures. Moreover, the findings empirically illustrated the potential of punctuation to disambiguate a range of ambiguous sentence structures.

Experiment 3b sought to determine whether these outcomes could be credited purely to the facilitating effects of clausal segmentation (e.g., Anglin & Miller, 1968; Epstein, 1967). The effect of spatial segmentation on reading time was quite minimal, appearing to only significantly facilitate less-skilled readers in the garden path conditions (unexpectedly, the reading-times of skilled readers were slowed by extra-spacing). The findings pertaining to comprehension, however, indicated strong facilitation effects induced by the inclusion of extra-spacing—for both skilled and less-skilled readers. Extra-spacing aided in the demarcation of significant clause breaks and, in its absence, readers were more likely to be unsuccessful in coding information into meaningful chunks. Notably, the magnitude of these effects, particularly for skilled readers, was not as large as that linked to punctuation, which supported previous investigations (Hill, 1996; Hill & Murray, 2000b). Punctuation, therefore, conveys information related to sentence structure that is more potent than that provided by simple segmentation of the text.

The previous experiments provided valuable information in relation to the disambiguating properties of punctuation during syntactic parsing, yet this by no means the sole purpose of punctuation. As discussed earlier (e.g., Sections 3.2.1 and 8.1), prosodic and semantic features of punctuation make possible certain versatilities in writing that extend beyond syntax. Experiment 4, by testing more ‘conventional’ sentence structures, aimed to explore a major stylistic controversy surrounding punctuation—namely whether the addition of optional commas equates, as suggested by the advocates of a minimalist style of punctuation, to longer reading times. Quite unexpectedly, the inclusion of optional punctuation actually led to significant improvements in reading times (for both skilled and less-skilled readers) in both sentence and paragraph conditions. This finding failed to
support a minimalist approach to punctuation, and was explained by raising the distinction between commas as preventers of misanalysis and commas as expected aids of correct parsing. Viewed as such, the longer reading-times in the optionally unpunctuated sentences were accounted for in terms of unfulfilled ‘comma-expectations’—although it is acknowledged that more specific research is needed to explore this possibility further.

9.3 METHODOLOGICAL CONSIDERATIONS

Although the experiments described indicate the promise that research designs similar to those used have in exploring the role of punctuation in reading, it is nonetheless clear that there are a number of methodological considerations and limitations that should be taken into account by researchers wishing to use them. It is the aim of this section to examine some of these issues.

9.3.1 Overgeneralisation

Since research scientists cannot assume they are dealing with absolute certainty—but rather with levels of probability—it is vital that reading researchers acknowledge the probability of erring in their conclusions as well as the consequences of indiscriminately generalising results (Henk, 1987). Data, particularly in the social sciences, ought to be perceived as evolutionary, fallible and tentative at best (Gravetter & Wallnau, 1992; Kerlinger, 1973). Thus, it is only through repeated testing, rechecking and redefining our concepts concerning the nature of the effect of punctuation on reading that uncertainty will be reduced and knowledge accumulate.

Theoretical generalisations of research into parsing are greatly limited by the fact that the bulk of the work revolves around little more than a dozen structures in just one language, and tends to involve a narrow range of participants (Mitchell, 1994). Future progress in understanding the influence of punctuation on parsing may depend, in part, on
extending this kind of research to other structures, sub-populations and languages—particularly those that are at least distantly related to English.

9.3.1.1 Participants

One of the most disturbing trends in reading research involves the inappropriate generalising of results to other populations and settings. Respectively, these types of external validity concerns are known as population and ecological validity—the process of directly measuring a sample selected from a distinct population and generalising the findings to the population as a whole (Henk, 1987). As pragmatics dictate that identifying the total population, let alone testing all its members, borders on the impossible, the current study, like a great deal of psychological research, made use of a sample that was immediately accessible (often known as a convenience sample). The problem with this approach is easily discerned: there is no guarantee that the accessible population represents the population as a whole.

Consequently, there is a risk in the current type of research of failing to acknowledge that there may be certain biases latent in the sample. Moreover, as these biases might predispose these participants to atypical behaviour, there is the need to temper generalisations accordingly. However, while not satisfactorily representing the broader population of mature readers in general, it is likely that the participants who took part in the current project are a perfectly adequate sample of the subpopulation they were drawn from, presumably intelligent regular readers.

Considering that a good deal of what is believed to be true about mature readers derives from experiments conducted with university students, the importance of distinguishing between target and accessible populations could not be clearer. Yet, in fairness to reading researchers, strict random selection of human subjects from a universal target population is basically impossible to achieve—time, distance and expense see nicely to that (Henk, 1987). This does not imply that experimentation with human participants is
prone to intolerable error and futility; rather, it simply means that researchers must resist the temptation to generalise indiscriminately. If, for example, a teacher were to operate on the assumption that findings such as those in the current study would hold true completely, he or she could by mistake provide instruction that might exacerbate problems or obstruct effective learning. The disparate influence of punctuation on the reading performance of skilled and less-skilled readers is a case in point.

9.3.1.2 Matching for Reading-Ability

A largely unresolved problem with experimental designs that take into account reading skill is the choice of the criterion of reading-ability for matching the groups. Clearly, reading is not a unitary phenomenon that can be assessed unambiguously. Thus, the choice of measure affects the composition and nature of the groups studied, and, consequently, the pattern of results obtained (Backman, Mamen, & Ferguson, 1984). Most commonly used reading tests evaluate just one aspect of reading, and they often do so in quite dissimilar ways. A single measure of reading does not ensure that participants will be equivalent in other areas of written language. Given the complexity of reading and the likely heterogeneity of the reading population, it seems unrealistic to expect that one could 'match' reading level in any absolute sense (Backman et al., 1984; Guthrie, 1981a). It is critical, therefore, that researchers using reading-ability measures describe explicitly the tests used to match participants and consider the effects that their choice may have had on the results obtained. The success in the current study of the Computerised (Reading) Placement Appraisal (CPA) in grading participants for reading-ability suggests that such on-line measures may be most suitable as assessment tools of reading-ability, since they reflect the on-line nature of the experimental tasks. Moreover, as well as being a more appropriate measure to be used in on-line reading research, where similarity between tests of reading-ability and experimental tasks is desired, the CPA has the added benefit of
providing a measure of usual-reading-rates, a feature not afforded by the standard off-line reading skill measures.

9.3.1.3 Stimuli

A central concern in experimental reading research is the generalisation of findings beyond the types of written discourse that were actually used in a particular experiment. Decontextualisation, a second type of overgeneralisation in reading research, refers to the process of taking factors out of context. Because text appears in a myriad of forms, it would be reckless to infer that the psychometric properties of one type will indisputably apply to another (Henk, 1987; Kent, 1994). There are, for instance, major distinctions of style, structure and intent between narrative and expository texts. Methodologically, of course, researchers must often concentrate on narrower subtasks of the reading process (such as syntactic parsing) and on a narrower range of textual inputs (such as individual sentences, or short newspaper articles). However, if the eventual goal of the endeavour is to add to an ‘all-encompassing’ theory of reading, then, eventually, researchers must begin to account for the gamut of texts used in the written language.

An account of reading must explain how the reader can understand ‘real’ natural language texts—narratives, stories, newspaper articles, dialogs, advertisements, and so on. This rules out models that focus only on the processing of single sentences taken out of context or of small researcher-constructed ‘stories’. Although such models are certainly important in that they provide crucial stepping stones towards understanding parsing and may even be a piece of the complete theory of reading, they do not by themselves constitute a satisfactory account of the human reading capability.

9.3.2 Setting and Self-Paced Reading

Language researchers also need to be cautious about possible disparities between the setting of an experiment and the setting in which the findings are to be applied. Participant
performance can be modified by cues in the testing that transmit the purpose of the study, by anxiety during assessment, by the influence to act in a socially desirable manner, or by being effected by the administration and scientific setting (Henk, 1987).

Though self-paced reading techniques have been demonstrated to be useful in the investigation of the current issues, there are quite a lot of severe problems, some associated with secondary tasks, others with each of the segmentation procedures, and again others with button pressing in general (for an overview see Mitchell, 1984). Even in Experiment 1, where a relatively natural form of reading was used (self-paced reading without any on-line judgements), it is likely that the button pressing itself interfered with normal reading. This may have resulted in increased reading times and, even more significantly, in ‘rhythmisation’ effects (where participants tend to equalise the word reading times along the sentence). Therefore, effects often may have spilt over into later sections, or only showed at the end of the sentence, if at all (Mitchell, 1984).

With cumulative presentation, such as Experiment 2, the link between button-press times and linguistic processing is even more loose: participants learn quickly that they can proceed through large segments of the sentence quickly and only then re-read it more careful (Just et al., 1982) Self-paced reading data, therefore, must be interpreted with care. Numerous features may weaken the explanatory power of such results, some of which do not only simply reduce the sensitivity of the technique, but also have the potential to produce significant artefacts.

### 9.4 MODELS OF PARSING

Within the framework of a psycholinguistic model of reading, no cue system exists in a vacuum. Grapho-phonetic, syntactic, and semantic cues complement each other in a multipart interaction, where the reader is presumed capable of selecting from the various, often superfluous, characteristics of the visual display some subset of minimal language cues which make possible the processing of written information (Baldwin & Coady, 1978).
Punctuation is a cue system that has received relatively little empirical attention, and is rarely recognised as having any place in models of reading. It has been shown in this project, however, that punctuation provides important structural information, which can diminish, or perhaps even circumvent, obstacles introduced by backtracking and dealing with misleading starts. The human parser, then, in addition to lexical and contextual information, has access to punctuation, which can be employed to guide its operations more effectively.

The two most influential models of sentence processing take opposing positions on most issues of parsing (though many of the issues are orthogonal). The modular syntax-first garden path model asserts that the human parser processes and pursues a single structure attachment at ambiguous positions, and that this initial structure is computed on the basis of general phrase structure rules without consultation of frequency, context, or detailed lexical information (Frazier, 1987). Instead, structural simplicity, ensuing from the heuristics of late-closure and minimal attachment, is the principle that determines which configuration is pursued when local ambiguity is encountered. In contrast, supporters of the constraint-satisfaction approach claim that parsing is a process that uses multiple information sources (or constraints), including context and detailed lexical information—without special architectural primacy given to any particular constraint (Tanenhaus et al., 1989; Trueswell et al., 1994).

When faced with a simple, pragmatically plausible, and syntactic canonical sentence, the reader is, in all probability, able to extract the right meaning by using only superficial cues such as word order. However, when faced with more complex structures or with unexpected pragmatic relations, the reader is forced to rely on several sources of information and, in this case, syntactic cues become vital in specifying an interpretation of the sentence (Flores d'Arcais, 1982).
The involvement of punctuation during parsing is undoubtedly complex, and potentially quite powerful. Recently it has been suggested that many of the classical garden path effects may be observable exclusively in written sentences, and only if these are not punctuated (Cohen et al., 2001; Steinhauer & Friederici, 2001). Any suitable model of parsing must be sophisticated enough to incorporate punctuation, and to account for those situations when punctuation has an effect and those where it does not.

The current findings suggest that punctuation can direct the course of parsing, either immediately, by signalling correct attachments or, alternatively, during reanalysis (see Section 9.4.1 following). Further, punctuation may possibly influence parser’s confidence in and commitment to any particular structure. The present findings support Mitchell’s (1994) questioning of the completeness of tree-driven accounts, as something other than the parsing tree must be consulted prior to a decision being made. The principles of late-closure and minimal attachment, therefore, cannot blindly operate alone, as proposed by the garden path model, even if, it seems, when taking into account only the initial structural analysis (Hill, 1996).

In more recent times, exponents of the constraint-satisfaction viewpoint of parsing (e.g., MacDonald et al., 1994; Trueswell et al., 1994) have challenged the syntax-first nature of the garden path model. MacDonald et al. (1994) assert that parsing is not serial, and that the cognitive architecture is not modular. Instead, they suggest that parsing is carried out in a parallel fashion, with a range of information types influencing the parser at once. The contribution of punctuation to parsing can, without difficulty, be explained in terms of being a ‘constraint’, as multiple constraints are seen as affecting the parsing process simultaneously. Further, the dissimilar influence exerted by punctuation could also easily be explained under this model, as the fact that certain information appears to exert an earlier influence on the parsing process than other information is not viewed as necessarily due to
a modular architecture, but simply be due to the speed with which different information types accrue activation (MacDonald et al., 1994).

Neither of the two models have directly addressed the role of punctuation in sentence parsing, although Frazier (1987, p. 563) acknowledges that the principles of late-closure and minimal attachment apply unless prosodic information or punctuation prevents their application: "...if a string is locally disambiguated (e.g., by punctuation or by clear prosodic effects) then by definition there will be only one permissible analysis of the input and we would expect perceivers to construct that analysis." Despite this acknowledgement, there have been minimal attempts to develop a model that spells out the role of punctuation in parsing. The garden path model could perhaps be expanded by adding a discrete module that applies before syntactic structural assignment, or by expanding the existing syntactic module to include a mechanism for processing punctuation information at the same time as other syntactic information, allowing the two types of information to interact before the module's output is passed to the next stage. Given that relevant punctuation information can be viewed as 'syntactically driven' (Steinhauer & Friederici, 2001), the core 'modularity assumption' of the model is not affected, as the parser could still be assumed to operate exclusively on syntactic information.

The constraint-satisfaction model does not accommodate punctuation either, although the model is generally compatible with an early punctuational impact on syntactic processing. In principle, it would be possible to add punctuation information as another constraint to the multiple constraints already proposed, in the same manner as that proposed for prosodic information (Kjelgaard & Speer, 1999; Schepman, 1997). However, the constraint-satisfaction view would need to specify more clearly when and why punctuation would override other information types, such as lexical and semantic information.
9.4.1 Punctuation: Immediate Guide or Facilitator in Reanalysis?

The lack of any delay associated with a garden path effect in many of the experimental sentences (particularly with skilled readers), suggests that the guidance provided by punctuation in parsing does not take place after a reader encounters structural problems. If commas are simply markers that indicate where to backtrack to after a misparse is detected, then any recovery operation is extraordinarily fast for a progressive serial processor (Hill & Murray, 2000a). Thus, the rapid influence of comma information observed in the current study could be considered as evidence for delay-free parsing theories, where structures are created as soon as each information unit (e.g., words) is encountered.

It is likely, therefore, that commas act either as immediate preventers of misanalysis, or indicate where the structural analysis must diverge into parallel processing. Moreover, if parsing is actually performed deterministically and the parser temporarily suspends the attachment of phrases in its structural build-up in a ‘wait-and-see’ manner (e.g., Marcus, 1980), punctuation may be a cue that either eliminates the need for such a guarded approach to structural build-up in the first place, or specifies when the attachment can proceed (Hill, 1996).

In Experiment 3a, however, the data on less-skilled readers indicated that their interpretations often reflected the persistence of initial incorrect thematic role assignments, even once punctuation was introduced. The data certainly pointed towards an interpretation of comma cues as coming into play only after the initial structural assignments had been suggested on purely morphosyntactic grounds (such as that of word order). In the case of skilled readers, when there was conflict between semantic cues and syntactic cues, then the syntactic function of the comma determined the outcome of the process, avoiding the effects of other factors, such as plausibility. In contrast, the inability of less-skilled readers to deal with punctuation as effectively meant that the resultant
misinterpretation persisted more often, and semantic factors still had an impact on structural decision-making. Nevertheless, the comma was still shown to facilitate the reading performance of less-skilled readers, although it is likely that this facilitation took place only during reanalysis.

Reanalysis has been classified in terms of forward, backward and selective reanalysis (see Frazier & Rayner, 1982), all of which can be classified as backtracking schemes, since they involve the parser returning to previous states in the parse and pursuing alternative analyses by re-comprehending ambiguous material. *Forward* reanalysis is said to have occurred when the reader returns to the start of the sentence and re-comprehends the sentence, in all probability looking for choice points at which to make alternative decisions. In *backward* reanalysis, the reader proceeds backward through the sentence, appraising the various alternatives. In *selective* reanalysis, the reader concentrates only on the section of the sentence that caused the difficulty (Lewis, 1998). It is likely that punctuation aids to facilitate selective reanalysis, as the position of the comma may have been marked or flagged as the place to return to if problems are encountered later (Hill, 1996), thus assisting rapid recovery from the misparse.

**9.5 PUNCTUATION AND READING-ABILITY**

**9.5.1 The Nature of Reading-Ability and Punctuation**

A central issue relating to the nature of reading-ability is whether it should be considered as a whole or as a cluster of sub-skills. In support of the sub-skill view, correlations among sub-skills have been shown to be quite high for good readers but low for poor readers, suggesting that these groups differ in the way they organise component skills (Everatt & Underwood, 1994; Giora, Meiran, & Oref, 1996). The skilled reader is presumed to have mastered each of the sub-skills at the automatic level and, more importantly, to have made their integration automatic (LaBerge & Samuels, 1974).
Effectively, this means that the skilled reader is no longer conscious of the component nature of the sub-skills, and perceives the reading process to be a holistic one. The data of this project has supported the view that, even with experienced readers, whose reading skills are highly developed, large individual differences exist in sub-component efficiencies (Walczyk, 1995).

Many of the current findings support the capacity theory of comprehension (Just & Carpenter, 1992), according to which a higher-capacity reader is considered more proficient than a low-capacity reader in using a broad range of potential constraints during reading. Theoretically, any of these constraints may exclusively, or in combination with other constraints, influence the language perception and comprehension processes (Cohen et al., 2001). It is likely that punctuation is one such constraint, which strongly influences a reader's confidence in and commitment to any particular interpretation.

The observed difference in the influence of punctuation on skilled and less-skilled readers in the present study suggests that skilled readers have resources that permit them to profit from punctuation, both when it is syntactically critical and when it is merely appropriate. In contrast, less-skilled readers rely mostly on more basic syntactic cues, such as word order. Depending on an individual's reading-ability, therefore, parsing outcomes appear to be influenced differently by the presence or absence of appropriate punctuation. It is suggested here that punctuation is one of the constraints that high-capacity readers are better able to take account of, compared to low-capacity readers—supporting the view that punctuation is a tool used best in the hands of skilled readers (Chapman, 1993).

Although clearly agreeing on the importance of appropriate punctuation in critical garden path structures, previous studies (e.g., Clifton, 1993; Hill, 1996; Hill & Murray, 2000b) have reached very different conclusions from those of the current project regarding the role of punctuation in less-critical sentence structures. These results, however, may not be as conflicting as they at first appear. Throughout the experimental stages of this
dissertation, it has been suggested that it is possible to reconcile the contradictory results of the studies by taking into account the skill of the reader. Clearly more information is needed regarding how the use of punctuation changes with increased reading skill, and perhaps other relevant factors, such as individual punctuation practices (e.g., Steinhauer & Friederici, 2001).

9.5.1.1 Metacognitive and Organisational Aspects of Punctuation

Hierarchically structured language incorporates phonological, morphological, syntactic, and semantic information. Because of their competency in a particular language, readers are able to use this information. Additional non-linguistic information, for example metalinguistics knowledge and the physical characteristics of the message, also contribute to the communicative act, although such non-linguistic information can be a source of considerable variability (Cohen et al., 2001).

One possible reason why the magnitude of facilitation linked to punctuation was found to be larger with skilled readers could be the mismatch between the mode of responding to punctuation employed by less-skilled readers and the pattern of responding assumed necessary for successful comprehension to occur. Skilled readers have been found to be more able to organise sentences into meaningful chunks, whereas less-skilled readers frequently struggle to organise material in a manner that is required for reading comprehension (Stevens, 1981). Skilled readers have been observed to perform better, in terms of comprehension performance, for larger text segment size, whereas the opposite, but non-significant, tendency has been found for the less-skilled readers (Chen & Healy, 1995). Appropriate punctuation signifies structural relations by marking syntactic boundaries. It is quite likely that this marking facilitates the resolution of linguistic structure, thereby speeding the reading process (Cohen et al., 2001). It appears, then, that punctuation is a linguistic tool that enables skilled readers to apportion text into meaningful...
units—an organisational skill which less-skilled readers are not necessarily as proficient in using.

Studies of the metacognitive aspects of reading (where readers monitors their degree of understanding or its lack) in children provide additional support for this view, as good readers have been found to be significantly more able to recognise text organization (McGee, 1982; Sanacore, 1984). Similarly, skilled adult readers have been found to have a greater repertoire of strategies for building a structure of meaning within the text (Smith, 1985) and to draw more inferences regarding the structure of text (Wilson & Hammill, 1982), than less-skilled readers. Moreover, poorer readers have been shown to know less about such print-related concepts as word order in sentences, and notably, the function of punctuation marks (Stewart & Tei, 1983).

Presumably, readers in the current study who failed to code the words they read into meaningful phrases or chunks may have had difficulty comprehending even when they were able to attach meaning to individual words, thereby incurring a time-consuming reanalysis. Skilled readers on the other hand, presumably used punctuation to organise input into meaningful units, implying that they are using effective coding strategies that involve punctuation. The finding in Experiment 4 of skilled readers being significantly more confident in their ability to deal with punctuation is consistent with this notion. Moreover, it supports previous work that has found that good readers have better or more readily available orthographic knowledge (Jared, Levy, & Rayner, 1999).

An integral part of being a fluent and skilled reader is being aware of the reading process, and studies have shown that skilled readers are more conscious of various aspects of reading. Constructing meaning from text implies that readers must be able to recognise the significant elements and their role in the text. Fluent readers have a greater capacity to do this, as well as being more aware of internal text inconsistencies (Marshal & Glock, 1979; Stewart & Tei, 1983). When readers identify portions of text that are missing, or
ought not to be there, they show that they have been reflecting upon their comprehension and making judgements on their reading process—activities integral to metacognition.

A skilled reader may well be compared to an expert taxi-driver (Horowitz, 1985), who must be aware of the city layout. He or she needs to have an internal, global representation of the patterning of roads, including main highways, freeways (the macro-level text structures), and the side roads (micro-level structures). The expert taxi-driver must also know how to work with the cue system on the road—highway marks, road signs and lights. Similarly, the skilled reader needs knowledge about text patterns on a global level (e.g., chapter formats, paragraphs structures and so on), as well as microstructures (which includes knowledge about how to use punctuation). Poor readers are not aware of text structure and often do not use it in recall (Horowitz, 1985). The fact that skill begets practice and practice begets further skill perhaps plays a role in maintaining skill differences, and may partly explain, or at least be related to, capacity differences observed in adults. The right kind of practice, in effect, increases functional capacity (Perfetti, 1994).

### 9.5.2 Reading-Ability, Syntax and Prosody

The population that was investigated in the current research was first-year undergraduate students. Even the youngest of these students have had almost two decades of experience with listening and speaking—with almost constant practice and reinforcement in these skills in their daily lives. In contrast, their familiarity with reading, and even more with writing, is based on a much more limited experience (Dale, 1991). It is not surprising, then, that many students are speaking experts and writing novices. Moreover, the carrying over into writing of various ‘speech based practices’ is far from startling (see Danielewicz & Chafe, 1985).

The unsophisticated reader, therefore, may have problems with punctuation (such as those observed in the current project) not because he or she has no proficiency with sentences whatsoever, but because the written language possibly demands some new
competencies that have not necessarily been entirely taught or mastered. These capabilities include not only knowledge of the functions of the various marks of punctuation, but also the capacity to manage the structures that writers depend upon to overcome the redundancy, fragmentation, and loose sequencing that are so usual in speech (Shaughessy, 1977).

The dynamics of reading and writing diverge in many ways. Speaking is spontaneous, rapid, social and unstructured, whereas writing is in general slow, purposeful, structured, and produced in isolation. Since speech is a higher-order function, writing experience inevitably develops out of speaking—this priority is especially evident in the creations of inexperienced writers, for whom the transition from speaking to writing skill has not fully manifested (Calkins, 1980; Cordeiro, 1988; Danielewicz & Chafe, 1985). In writing, punctuation is a mechanism for dividing texts into units, or to indicate semantic and syntactic relations. In speaking, these functions are performed by the prosodic features of intonation and pausing (see Section 3.2). As previously discussed, the correlation between spoken language prosody and punctuation is, although relatively high, far from perfect, creating problems for inexperienced writers and readers, who have not yet become familiar with the complexity of the relationship. Developmental research (e.g., Calkins, 1980; Cook-Gumperz & Cook-Gumperz, 1981; Cordeiro, 1988; Cordeiro et al., 1983; Edelsky, 1983) has repeatedly shown that punctuation errors made by young writers more often than not reflect prosodic interpretations.

The punctuation errors observed in the present research can be seen as a valuable source of information on how the spoken language influences the written language, particularly given that less-skilled participants were significantly more likely to consider prosody to be the main function of punctuation, while skilled readers viewed punctuation as more closely tied to syntax (see Sections 6.3.4 and 7.3.3). As discussed in Chapter 3, there has been considerable debate as to whether punctuation in English should be based
on the places where one should pause while reading aloud (prosody), or on grammar (syntax). Evidently, grammatical divisions and pauses for breath frequently fall in the same places, but not always. Those who favoured using punctuation to mark grammatical divisions won the debate—this is important to note, as one cannot settle on how to punctuate a passage just by relying on ones inner ear or by reading it aloud. The finding of less-skilled readers preferring prosodic interpretations is a strong piece of evidence against an overemphasis on the prosodic functions in the teaching of punctuation—as, conceivably, this could promote poorer reading.

Prosodic punctuation, however, is certainly a useful instrument by which a writer can impress speed restrictions or pauses upon the reader, producing a state more comparable with spoken language. In contrast to spoken language, the features of intonation and prosody, along with other forms of emphasis and non-lexical information that convey desired interpretations and meanings of sentences, are often lost in written language. Punctuation, therefore, may be a key factor in differentiating between active and passive theories of language comprehension; specifically, when deciding whether language delivery (including rate of delivery) and the preferences for structural interpretation are dominated by the recipient of the information or by the communicator.

Nonetheless, the current findings might be seen as a warning that punctuation should not be treated purely as a handmaiden to informal speech (see Baron, 2001)—particularly considering the proliferation of new communication-technologies, such as e-mail and phone-text-messaging. Indeed, the finding that nearly half of the participants viewed prosody as the main function of punctuation, coupled with Scholes and Willis’s (1990) finding that nearly a third of their eighty participants were, for the most part, insensitive to the syntactic function of punctuation, suggests that, although both elocutionary and syntactic uses of punctuation persist among contemporary writers and readers, the importance of syntax in punctuation should not be ignored. The fact that less-skilled
readers in the current study did not use syntactic punctuation cues as much as skilled readers, in almost all reading tasks, provides further evidence for this contention. This is particularly important given that past researchers have suggested that the less efficient use of syntactic cues in reading may be symptomatic of a more general deficit in linguistic knowledge (e.g., Willows & Ryan, 1981).

The relationship between punctuation and prosody appears still largely unresolved (Clifton & Duffy, 2001). Hill (1996) rejects Chafe’s (1988) contention that there is a direct correspondence between punctuation and parsing. However, the empirical data (similar to the findings in the present research) only rules out the equivalence of commas and pauses (Steinhauer & Friederici, 2001). If punctuation is actually mediated by (overt or sub-vocal) prosody, then the processing of punctuation should resemble that of overt prosody. A study of event related potentials found that both commas and prosodic boundaries can influence syntactic parsing in the same way, and, moreover, that they are possibly mediated by the same brain structures (Steinhauer & Friederici, 2001).

Outcomes similar to the comma-facilitation effects observed in the current study, and in previous work (e.g., Cohen et al., 2001; Hill & Murray, 2000b; Mitchell, 1986; Mitchell & Holmes, 1985), particularly in closure ambiguities, have also been reported for the auditory modality (e.g., Marslen-Wilson et al., 1992; Speer et al., 1996; Warren, Grabe, & Nolan, 1995). Prosodic cues such as speech boundaries have been demonstrated to affect parsing preferences in a manner analogous to that found for commas. It should, however, be noted that there have been contradictory findings that have challenged the view that prosody can immediately influence parsing decisions (e.g., Pynte & Prieur, 1996; Watt & Murray, 1996).

While punctuation shares many of its characteristics with prosody, it cannot be described as an exact equivalent; written and spoken language have significant enough differences, as complete systems, to prevent this (Hill, 1996; Marslen-Wilson et al., 1992).
Moreover, modern punctuation has syntactic uses that are not transferred into speech and there are many qualities of speech that are potentially meaningful, but not encoded in any graphical form (such as variations in pace, volume and pitch). The relationships between punctuation, syntax and prosody, therefore, certainly warrant further research attention.

9.6 MODES OF PUNCTUATION

It was the famous lexicographers Henry Watson Fowler and Francis George Fowler in *The King’s English*, published in 1906, who established the current British practice of lighter punctuation, declaring: “The objection to full stopping [closed style of punctuation] that is correct is the discomfort inflicted on readers, who are perpetually being checked like a horse with a fidgety driver.” The brothers went on to emphasise, however: “but better a slight irritation than the grave doubt which often results from the ambiguity caused by under stopping” (cited in Partridge, 1978, p. 94). Punctuation practice in the United States has followed much the same path as in Britain, but the rules laid down by American authorities have in general been more rigid than the British and Australian rules (Nunberg, 1990).

In more recent times, punctuation practice has favoured minimal marking of the logical units of a text, and a great deal of confusion and idiosyncrasy in the use of punctuation has developed. However, as discussed in Chapter 8, there is no reason to suggest that these extremely useful tools should be whittled away to nothing, particularly if the sole motivation is the fact people are not informed enough in their use. There are ongoing discussions concerning punctuation rules in a variety of countries, and in a variety of languages. Understanding the interrelations between rule knowledge, salience, and processing mechanisms concerning punctuation in more detail may help establish more empirically based punctuation rules (Steinhauer & Friederici, 2001).

The ultimate goal of the research on punctuation, however, should not be to devise a genre-specific all-inclusive grammar of punctuation, but rather to advocate a general set of
ideas that will indicate the function and meaning of a given punctuation in any position in which it occurs (Bruthiaux, 1993). This raises the important issue of whether punctuation should be treated descriptively or prescriptively. Prescriptivists by and large regard innovation as dangerous, or at any rate to be resisted; descriptivists, whether with or without resignation, swiftly identify new linguistic habits and record them in dictionaries and grammars, with little or no indication that they might be unwelcome or, at any rate, debatable (for a good review of these issues see Delin, 2002).

Although nearly all style and grammar books give a prescriptive account of punctuation, most scholarly investigations of punctuation (reviewed in Chapter 3 and 4), have centred on describing the information-providing functions of punctuation (Say & Akman, 1997). With the exception of Nunberg (1990) and Jones (1996), there has been no attempt to provide a formal perspective on punctuation, or, indeed, to put forth any empirically based prescriptive opinions. The current project has shown that appropriate disambiguating commas are essential in critical structures and, at worst, they appear to be transparent when used correctly in non-critical structures. Moreover, as suggested in this dissertation, the observed facilitatory effect of optional punctuation raises the distinction between commas as preventers of incorrect parsing and commas as facilitators of correct parsing. It is suggested that they do both, a possibility that does not seem to be considered by style-guide preparers or other language researchers.

Although the findings from Experiment 4 are far from mandating the exceedingly heavy punctuation style of eighteenth- and nineteenth-centuries, they certainly caution against an extreme open (minimalist) style of punctuation. The modern trend in punctuation practice is towards less use of marks, particularly commas, where possible. However, it is suggested here that the phrase where possible is significant. Often the rules of punctuation usage state that, for example, a comma must be used in a particular place, and it cannot be left out on the grounds that ‘less punctuation is better’. Sometimes, too, the
use of a comma may be optional from a technical point of view, but it can nevertheless make the text easier for a reader to comprehend. It is undesirable for punctuation practice to change for no other reason than that some people are uncertain or mistaken about usage. Systematizing the rules of punctuation and emphasizing principles that enhance reading performance promises to make punctuation easier to learn, as this approach appeals to reason and semantic intentions, rather than to ones need to be correct according to a set of unsystematised rules (see Dawkins, 1992a).

9.6.1 Pedagogical Implications

Reading is essential at the university level, and students must read with understanding and apply critical insights to the wide range of printed sources that accompany academic coursework (Chaplin, 1982). University students ought to be capable of melding new knowledge with previous knowledge, and to adjust their thinking accordingly. To do this, they have to be competent and efficient readers—they must be aware of past experiences that may help them in understanding present encounters. This can only be completed efficiently if students have acquired meaning from the texts.

It is often assumed (incorrectly) that all university students have developed this ability, and that they need no further instruction. Many students, however, although capable of reading and comprehending at a relatively high level, may not possess a fully developed capacity to competently exploit the wide range of textual and orthographic cues available. If a student has not had sufficient experience with, or developed competence in, the phonemic, syntactic and visual systems of the language, then they must be given the opportunity to develop these abilities so that these important textual cues can be correctly decoded. Readers’ actions are based on their reading resources at particular times in their lives and, perhaps, past experiences with punctuation are reflected in these responses.

Undoubtedly, readers use punctuation as a clue to meaning. It plays an important role in signalling how meanings combine, or do not combine. Readers who know the
traditional punctuation rules may well become irritated when those rules are broken or not followed in a piece of writing. Readers may also become confused if the punctuation signals blend meanings in ways that fail to fit the context. In the case of university students, when a grade or employment is at stake, reading-confusion and irritation should be kept to a minimum.

As discussed in Section 9.5.1.1, to get control of the written mode of language it is necessary to become more conscious of it. In the earlier phase of our development, getting control of language in the spoken mode seems to be largely an unconscious activity. The interaction we have with others while developing language is often characterised as implicit. Later in development, the written mode becomes important, and it is here that we alter our way of learning from a less conscious to a more conscious one (Winser, 1988). The current project has provided strong grounds for making the teaching and clarifying of punctuation more explicit, as students need to understand the structural operations that organise sentences into hierarchical clustering of words, along with the processes that manipulate them.

9.7 CONCLUSION

In reading, it is not sufficient that words be identified. Words need to be combined into a coherent structure that indicates their interrelationships (Ferreira & Henderson, 1990). The current study has provided further insight into how sub-component efficiencies and available resources influence reading outcomes under various task conditions. Throughout this research, it has been consistently demonstrated that the processing disadvantage for baseline-ambiguous structures disappears when sentences are presented with appropriate punctuation. Taken together, the experimental results are consistent with the predictions of a reading model in which information from punctuation can influence the operation of the syntactic parsing mechanism. Moreover, the results from Experiments 2 and 3a provide evidence that punctuation cues can influence the resolution of temporary
syntactic ambiguities quite early in the parsing process. The evidence, particularly for skilled
readers, is consistent with the view that information available from punctuation
immediately determined the assignment of syntactic structure. An adequate model of
sentence parsing, therefore, must clearly delineate the role of punctuation and, importantly,
specify its interaction with other linguistic information sources during processing.

The discussion of English punctuation provided throughout the dissertation has
attempted to demonstrate that, while punctuation may appear a confined, even esoteric
topic, that is of little interest to the language researcher, the principles and practices
governing punctuation reflect, in part, a much larger domain of assumptions about spoken
and written language (Baron, 2001; Bruthiaux, 1993). Paradoxically, punctuation marks not
only articulate language, thereby bringing writing closer to speaking, but also provides
structural information (Van den Berg, 1995). Consequently, punctuation marks often come
into conflict with their own mimetic nature. However, it is suggested here that if people
approach punctuation with an understanding of its origin and flexibility, they will not be
intimidated by the conventions of punctuation, and will be able to modify their conditioned
responses to punctuation appropriately.

9.7.1 Future research

Although the studies reported in this project answer some of the central questions
regarding the role of punctuation in sentence parsing, many questions still remain
unanswered. In this section, some avenues for future research will be suggested. The
empirical work reported in this dissertation focussed, for the most part, on whether readers
use commas as cues to syntactic parsing. Seemingly, it would be valuable to acquire more
systematic knowledge regarding the constraints affecting the probabilities with which
readers are prepared to effect syntactic closure, or ‘disambiguation’, on the basis of
punctuation. As stated before, these may include the perceptual criticalness of the
punctuation cues, the number of possible interpretations of these cues, the style of writing, and the predispositions of the reader (e.g., experience and capacity with punctuation).

Ultimately, it would be appealing to develop a theoretical model of syntactic parsing which could incorporate a role for punctuation. In such a model, identifying the role of punctuation marks in guiding syntactic information may be complex, as the mapping from punctuation to syntax does not appear straightforward. Before a theoretical model can be built, however, there is a need to gather further empirical data both on the conditions under which punctuation information is used during parsing, and on the time-course of the use of such information.

The findings of an absolute removal of some garden path effects in the current project provide a strong case for the claim that commas produce immediate effects on syntactic parsing (primarily in blocking erroneous attachments), particularly with skilled readers. However, if commas are truly dominating features of written language, then strong negative effects caused by incorrect punctuation should be inducible without difficulty (Hill, 1996). If future research found strong disruptive influences linked to inappropriate punctuation (similar to Cohen et al., 2001) then this would give further credibility to the view of commas as immediate guides, while simultaneously weakening the view that commas merely direct repairs (e.g., selective backtracking). If, however, punctuation marks are found to guide parsing only tentatively, warning of potential syntactic boundaries in an otherwise featureless environment, then a strong negative influence is by no means certain. Alternatively, if such future research was to also consider the variables of reading-ability or punctuation-experience, punctuation might well be found to both act as an immediate guide and a facilitator of reanalysis, depending on such factors as the individual reader, and the mode of punctuation.

The current project has been restricted to investigating the comma; thus, as previously stated, inferences from observed comma-effects to general-punctuation-effects
should be tentative. Nevertheless, it is probable that punctuation marks which have structural defining functions similar to those of commas (see Section 3.3, Figure 3.1); marks such as full-stops, colons and semicolons, are likely to exhibit equivalent syntactic effects on parsing, but of varying strength. Colons and semicolons could, however, be prone to exhibit exaggerated qualities because of their relative infrequency and their greater physical presence—as they are, essentially, a combination of two of the more frequent punctuation marks (Hill, 1996).

Additional uncertainties about generalising from the observed comma-effects are raised by punctuation marks such as exclamation and question marks, which convey important semantic information without modifying the structure of the sentence until its conclusion. The importance of these marks is less important in formal writing, where lexical information can guide interpretation, yet there is still a clear distinction between 9.1 and 9.2.

(9.1) What is that idiot Ben doing now?

(9.2) What is that idiot Ben doing now!

Moreover, certain punctuation marks act as lexical modifiers, and not as strict syntactic cues. For example the apostrophe denotes either omission or possession, and the hyphen functions to signify the combined meaning resulting from the merging of two words. Much of the operational capacities of punctuation and its domains of influence, therefore, remain unclear.
The clear-cut differences found in the present study between skilled and less-skilled readers, combined with Steinhauer and Friederici’s (2001) finding that commas are more effective guides for individuals accustomed to strict punctuation rules (and, hence, the subjective relevance of this information), suggest that future experimental designs ought to control for reading ability and/or idiosyncratic punctuation habits. Researchers should be cautious, therefore, in using punctuation as a means of providing unambiguous control sentences (such as in Christianson et al., 2001; Pickering & Traxler, 1998), as it is likely that punctuation information will have dissimilar influence on individuals, depending on factors such as reading-ability or punctuation preferences.

Continued research will also help in uncovering the many similarities and dissimilarities between written and spoken language, benefiting both teaching and communication skills. One goal of future research into punctuation should be to identify the structures in which most poor readers have difficulty with punctuation and to use that information as the basis for intervention. In considering how studies of reading failure can lead to improved instruction, it ought to be recognised that the majority of intervention studies have their origins in investigations of beginning readers. Thus, the principles derived from these studies tend to focus on processes that are part of the early development of reading skills, as beginning reading skills are the level at which most poor readers fail. The current research provides further evidence that studies of adult readers are also capable of supplying valuable information on reading failure, thereby giving important information about the targeting of intervention and further education.
9.7.2 Final Remarks

Punctuation is essential to the processing of written language, yet empirical research on its functions, influence and effectiveness has been sparse. Although perhaps possessing only minimal visual impact, a comma is capable of being a very influential feature of syntactic parsing, which can promote successful and efficient transfer of information. This, consequently, enhances reading speed and comprehension—resulting in overall improved reading performance. The studies reported here form part of the converging evidence for the major contribution that punctuation makes to the processing of written language, specifically to its strong influence on the extraction of meaning from sentences.
References


Commonwealth Department of Finance and Administration. (2002). *Style manual for authors, editors and printers* (6 ed.). Canberra: John Wiley and Sons.


Hopkins, H. (1982). Speech is phonic: Print is graphic... or -- You can't look at sounds and you can't listen to print. Reading Education, 5(1), 22-26.


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Appendices

A: Reading behaviour questionnaire

B: Experiment 1: four stimuli conditions

C: Off-line punctuation questionnaire
APPENDIX A

Reading Behaviour Questionnaire

The following questions relate to reading OTHER THAN that done for study or work. Please read them carefully and tick answers where appropriate.

General Recreational Reading Questions

1. If you read for pleasure please tick what areas you read in (in bold), and of those you have selected please answer the more specific questions.

Books
What type of books do you read?
- Fiction books
- Non-fiction books
- Mostly fiction, but some non-fiction
- Mostly non-fiction, but some fiction
- Other, please explain:

Magazines
What type of magazines do you read?
- Magazines catering to specific hobbies
- Scientific, computing or technical magazines
- Health and lifestyle magazines
- Other, please explain:

Newspapers
If you read newspapers, do you:
- Read from start to finish
- Read the majority of sections, only ignoring a few articles that do not interest you
- Read only certain sections that are of interest to you
- Skim headlines and look at pictures
- Other, please explain:

2. If you read books for pleasure, on average what is the approximate number of books you would read (from start to finish) in a year?

3. Please tick the genre(s) you enjoy reading in:
- Historical
- Philosophical
- Technical
- Romance
- Sporting
- Religious
- Health/Lifestyle
- Instructional
- Science-fiction
- Educational
- Mystery/Thriller
- Poetic
- Biographies
- Other(s), please explain

4. How often do you discuss material you have read?
- Very frequently
- Occasionally
- Rarely
- Occasionally
- Rarely
- Never
Instructional and Technical Reading Questions

1. These days many devices come with more or less complex instructional manuals, when first attempting to use such devices do you:
   - Read the whole manual first
   - Read the most of the manual
   - Read some of the manual
   - Read sections of the manual as you need information for the particular aspect you are attempting to do
   - Only look in manual when problems arise
   - Never read the manual

2. Do you find the majority of manuals to be:
   - Easy to read
   - Relatively easy to read
   - Difficult to read
   - Almost impossible to read

Word-Processing and Other Software Questions

1. When learning about new software, such as word-processors and spread-sheet packages, do you:
   - Familiarise yourself with manual prior to attempting to use software
   - Look things up in the manual as you need them
   - Avoid manual all together

2. When using software, if problems arise do you use the help file?
   - Readily
   - Reluctantly
   - Not at all
Vocabulary Test (taken from Diack, 1975)

Please read the following, and tick only words that you would be able to provide definitions for:

Test No 1:

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 1 amusement</td>
<td>☐ 11 crusade</td>
<td>☐ 21 dexterity</td>
<td>☐ 31 anathema</td>
<td>☐ 41 argot</td>
</tr>
<tr>
<td>☐ 2 discipline</td>
<td>☐ 12 deposit</td>
<td>☐ 22 expediency</td>
<td>☐ 32 encomium</td>
<td>☐ 42 bistre</td>
</tr>
<tr>
<td>☐ 3 hollow</td>
<td>☐ 13 eclipse</td>
<td>☐ 23 expel</td>
<td>☐ 33 incipient</td>
<td>☐ 43 etiolated</td>
</tr>
<tr>
<td>☐ 4 immense</td>
<td>☐ 14 humud</td>
<td>☐ 24 gravity</td>
<td>☐ 34 juridical</td>
<td>☐ 44 hierophant</td>
</tr>
<tr>
<td>☐ 5 macaroni</td>
<td>☐ 15 interfere</td>
<td>☐ 25 intersect</td>
<td>☐ 35 leit-motif</td>
<td>☐ 45 ichnolite</td>
</tr>
<tr>
<td>☐ 6 performance</td>
<td>☐ 16 landmark</td>
<td>☐ 26 malefactor</td>
<td>☐ 36 morphology</td>
<td>☐ 46 kohirabi</td>
</tr>
<tr>
<td>☐ 7 radiator</td>
<td>☐ 17 obstruct</td>
<td>☐ 27 medley</td>
<td>☐ 37 osænsible</td>
<td>☐ 47 llano</td>
</tr>
<tr>
<td>☐ 8 repeat</td>
<td>☐ 18 rural</td>
<td>☐ 28 tranquility</td>
<td>☐ 38 parabola</td>
<td>☐ 48 objurgate</td>
</tr>
<tr>
<td>☐ 9 tackle</td>
<td>☐ 19 salvage</td>
<td>☐ 29 verdict</td>
<td>☐ 39 sargasso</td>
<td>☐ 49 raddle</td>
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<tr>
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<td>☐ 20 veterinary</td>
<td>☐ 30 zenith</td>
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Test No 2:

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<td>☐ 21 colossus</td>
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<td>☐ 13 ignorance</td>
<td>☐ 23 humilate</td>
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<td>☐ 15 merriment</td>
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<td></td>
</tr>
</tbody>
</table>

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Informal Interview

Are there areas of reading that you find particularly difficult to make yourself do? If so, please explain:
APPENDIX B

1. After the customer had left, the small shop closed its door.

2. After the customer had left the small shop closed its door.

3. Geoffrey watched the rain beat down on the narrow street from his small shop's window. He looked around his store and mused about the changing times, not so long ago his shop had thrived; now, in a technical age, it had an archaic air that many considered quaint. Geoffrey didn't like that idea, but reluctantly had to admit that he had failed to change with the times and had lost out to those 'flashy' bookstores. So be it, he loved his 'quaint' little store. His brooding ended when the familiar chiming that indicated the opening of the store's door. Geoffrey walked over to the customer and politely greeted her. He received a curt nod and a grunt. No one wanted to converse much these days, he thought. Geoffrey waited patiently and, after what he considered a sufficient time, asked if he could be of any service. Another grunt followed by a mumbling of the familiar phrase 'just looking'. Geoffrey walked away and waited for the inevitable. After the customer had left, the small shop closed its door. Geoffrey sighed and returned to his attention to the terrible weather and his terrible mood.

4. Geoffrey watched the rain beat down on the narrow street from his small shop's window. He looked around his store and mused about the changing times, not so long ago his shop had thrived; now, in a technical age, it had an archaic air that many considered quaint. Geoffrey didn't like that idea, but reluctantly had to admit that he had failed to change with the times and had lost out to those 'flashy' bookstores. So be it, he loved his 'quaint' little store. His brooding ended when the familiar chiming that indicated the opening of the store's door. Geoffrey walked over to the customer and politely greeted her. He received a curt nod and a grunt. No one wanted to converse much these days, he thought. Geoffrey waited patiently and, after what he considered a sufficient time, asked if he could be of any service. Another grunt followed by a mumbling of the familiar phrase 'just looking'. Geoffrey walked away and waited for the inevitable. After the customer had left the small shop closed its door. Geoffrey sighed and returned to his attention to the terrible weather and his terrible mood.
APPENDIX C

THE UNIVERSITY OF ADELAIDE

Department of Psychology

PSYCHOLINGUISTIC RESEARCH: THE STRUCTURE OF TEXT

General Information

- Name:
- Sex:  male  female
- Age:
- Average number of books read per year (excluding course related material):
- Favourite genre(s) for reading (if applicable):

Questions on Punctuation:

- Did you notice that some sentences contained commas whilst others did not?
  Yes  No

- If possible, please give an approximation (%) of the number of sentences which contained commas (please circle):
  10  20  30  40  50  60  70  80  90  100

- Do you feel that any sentences were over-punctuated (i.e. too many commas)?
  Yes  No

- In your own writing, how confident (on a scale of 1 – 10) are you of the correctness of your use of punctuation (please circle)?
  1  2  3  4  5  6  7  8  9  10

  Not at all confident  Extremely confident

- In your opinion, the primary purpose of punctuation is to indicate (please circle):
  a) The structure of a sentence (helps to group words together)
  b) How a written text would be spoken (shows pauses etc. in speech

Thank you!