

THE UNIVERSITY OF YORK
Department of Computer Science

AN INVESTIGATION AND EVALUATION OF HYPERMODE
ON THE DOLPHIN APOLLO SPEECH SYNTHESIZER

A system for increasing reading speed by the omission of selected words

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the requirements for the degree of
MSc in Information Processing

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ABSTRACT

This paper aims to discover whether Hypermode facilitates or hinders faster reading and to produce an improved version of the system. These aims have been implemented by controlled testing on six candidates, using texts with a variety of styles, subject matter and percentages of words omitted, followed by a series of comprehension questions. The linguistic criteria for word omission have been analysed and a revised version of Hypermode has been designed, implemented and tested. In addition, a questionnaire has been directed to Dolphin Apollo users via an internet newsgroup. Overall results indicate that the revised version produces on average 14.96% better comprehension levels than current Hypermode. However the comprehension level is still on average 11.61% lower than for non-Hypermode. Despite improved comprehension levels with new Hypermode, it is difficult to determine whether it can be defined as a help or a hindrance to faster reading as this is dependent on other criteria such as the definition of 'faster reading' and each user's own needs and expectations.

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1.0 INTRODUCTION

Most people take reading for granted, but for blind people access to the printed word is not so simple. In the past, printed texts were available to them only through the use of Braille and through friends and helpers who read aloud. Machines have brought great improvements - tape players have provided access to all kinds of texts and speech synthesizers with screen readers have opened the door to the use of computers. The quality and scope of such machines is improving continually.

Sighted people still have an advantage when it comes to reading speed. They can read at up to 300 words per minute, whereas spoken language, on which blind people depend, is much slower, usually around 140 words per minute, although this can be increased to some extent by the variable speed controls on tape players and speech synthesizers. In addition, when sighted people view a printed page, they can skim through the text to have a rapid general idea of its contents. This is a visual skill denied to the blind. The Hypermode feature of the Dolphin Apollo Speech Synthesizer aims at offering blind users a way of increasing their reading speed by a kind of audio skimming. This is done by a system of text reduction in which words considered non essential to understanding are omitted. Dolphin do not provide documentation regarding the words omitted or the criteria used in selecting them.

The aims of this paper are:

- To identify the words currently omitted by Hypermode
- To investigate whether the Hypermode feature is a help or a hindrance to faster reading by ascertaining whether, and to what extent, comprehension levels are affected
- To evaluate and revise the linguistic criteria for word omission
- To propose a new version of Hypermode and to write a program to implement the proposals
- To ascertain whether the new version produces any improvement in levels of comprehension.

This paper will first put the subject into context and look briefly into some related issues. This will be followed by a description of the testing for the current Hypermode word list, a linguistic analysis by word category and the compilation of a revised word list. User testing for both current and revised Hypermode will then be described and the results discussed.

2.0 BACKGROUND INFORMATION & RELATED ISSUES

2.1 Development of Synthetic Speech

Computer-generated speech began as a highly specialised area in the 1960s involving a small number of engineers, computer scientists and experts in such diverse fields as phonetics and digital signal processing.

Research and development were slow to advance over the next 20-odd years, but by the late 1970s the commercial market was becoming swamped with numerous talking devices, with new applications constantly appearing. From then on, research and commercial production have progressed side by side.

Currently, talking devices are used in a multiplicity of applications, from toys and appliances to interactive information services (telephone and travel enquiries etc.), warnings and instructions for computer users, machine operators and airline pilots. There are also many devices of great benefit to blind, partially sighted and handicapped people e.g. talking watches and calculators. In all these cases, the synthetic speech is pre-programmed to produce certain phrases in response to specific signals.

On a more complex level are PC screen readers and synthesizers with text-to-speech capabilities. These enable visually impaired people to have direct access both to a great deal of standard computer software and also to printed texts, whether articles etc. written by others or text composed by themselves e.g. on a word processor. Synthesizers vary in the degree of sophistication of their speech output, the more expensive models offering a better voice quality, a choice of voices both male and female and a greater degree of expression (prosody). Dolphin Apollo is a cheaper but widely used synthesizer offering the added Hypermode feature.

Speech technology has developed and matured greatly since its beginnings and progress continues to be the result of input from many disciplines, including linguistics and phonetics,

mathematics, electronics, computer hardware and software, psychology, physics, physiology etc.

Each of these is a huge specialist area in its own right and each bears some relation to the subject of this project. However, though recognising their importance, they are beyond the scope of this paper.

There are two basic ways of producing synthetic speech: copy synthesis (also called concatenation or synthesis-by-analysis), or synthesis-by-rule. For the former, a natural human voice is recorded, digitally encoded and stored by the computer, either as whole sentences, phrases, words or parts of words. These can then be used as such, or rearranged at will to form new words or sentences. This method is used in such applications as telephone enquiry services.

The second system does not involve a human voice. Speech is produced according to a set of rules based on phonemic principles (i.e. one letter representing one sound). This system can produce an unlimited vocabulary.

Text-to-speech systems produce a spoken version of an ordinary text file. The processes are extremely complex and all the disciplines mentioned above are involved. In simple terms, the text has to be normalised (i.e. symbols, numbers, abbreviations etc. have to be converted into words) and then transcribed phonetically by one of the two methods mentioned above. Aspects such as pitch, rhythm, timing and stress (prosody) have to be defined and encoded to produce an intonation contour. This involves some degree of syntactic analysis. The phonetic and prosodic information is then converted into an acoustic wave.

Prosody is a difficult area in the production of synthetic speech as the rules governing it are not yet fully understood. It is a main area of ongoing research, but currently most text-to-speech systems, and synthesizers in general, have a restricted intonational repertoire with little of the tremendous variety of expression typical of natural human speech. As a result, synthetic speech

is flat, monotonous and tedious to listen to, requiring greater effort from the listener to process it. Tests discussed by Waterworth and Talbot (1987) have shown that listeners find synthetic speech not only harder to listen to but also harder to remember than natural speech. Understanding and memory both seem to be worse when the listener is presented with isolated words and better when words are in meaningful sentences when the listener is helped by the context.

2.2 Comprehension of language: spoken vs. written

The processing and assimilation of language by the human brain is a vast area of debate and research. The following basic points are of interest here. Language is perceived and received by two main channels - the ears and the eyes. But seeing words written and hearing them spoken does not necessarily mean that they are understood. Various reasons can prevent understanding - e.g. the language may be foreign or the person may be illiterate. The brain has to process the information which is received either visually or aurally and sort it out into meaningful units of language. Researcher Thomas Sticht, as discussed in Crowder and Wagner (1992), calls the two stages either 'seeing' words followed by 'reading' them, or 'hearing' words followed by 'auding' them. He invented the word 'auding' as no English word describes the intermediate stage of language processing which follows 'hearing'. Understanding is the same whichever medium is used, however - again according to Sticht - 'auding' is more demanding on the memory than 'reading' as one can re-read when necessary but when listening to someone speaking this is not possible. Spoken language has the advantage of intonation, stress etc. (prosodic clues) which written language can only express through punctuation. In this paper we are dealing with the 'auding' of synthetic speech which has few of the prosodic clues of natural speech, hence makes even greater demands on memory, though the listener does normally have the advantages of speech control and can re-listen when necessary.

2.3 Language Acquisition

In order to determine which elements of language are the most necessary and fundamental to conveying information, it may be useful to consider the way in which children acquire language. A young child can be said to pass through four main stages (not counting the pre-speech, babbling stage):

- the holophrastic stage, when the child uses one word only to convey his meaning: the words used are predominantly nouns.
- the child then progresses to two to three word utterances, comprised almost exclusively of content words - nouns, verbs, adjectives - with very few function words such as articles, prepositions, conjunctions; this is called the telegraphic stage.
- the third stage is the morphemic-transformational stage. It is at this stage that function words, verb inflexions etc. begin to appear.
- lastly, the child begins to use more complex structures, including pronouns, question and negation forms etc.

The telegraphic stage most closely resembles the kind of reduced speech at which we are aiming for Hypermode, with certain additions such as verb inflexions, questions and negations from the later stages of development.

2.4 Telegraphese

This is the term applied to the type of language used in telegrams which aims at expressing the maximum information with the minimum number of words. There are two main ways of doing this: the omission of function words and the abbreviating and compounding of words. Words are often invented and several may be written together as one, just to reduce their number.

Telegraphese is characterised by ellipses, that is:

the omission of one or more words that are obviously understood but that must be supplied to make a construction grammatically complete.

[Longman 1991]

This is done to some extent in normal speech . e.g. The man (whom) I love; the house (that) I bought. It is done to a far greater extent in telegrams.

When adults read or hear reduced speech, they automatically, on the basis of their knowledge of the language, the world and how things generally happen, fill in the gaps to make a sensible interpretation . These interpretations, however, may sometimes make incorrect assumptions

2.5 Speed Reading

An average adult reads at about 250 words per minute. Speed Reading courses often promise to increase this by several thousand words per minute. They claim to teach students to take in more words with each eye fixation; not to subvocalise the text they are reading i.e. not to speak it silently and internally; to guide their reading down the page with their index finger; and to make assumptions and predictions about what the text is saying without trying to understand each point. Skim reading works on the same principles. Studies quoted by Crowder and Wagner (1992) into the physical and psychological aspects of reading (i.e. speed of eye movements, length of fixations at specific points of the text, number of fixations possible per minute, the number of letters/words which can be processed in each fixation) have produced estimates of an absolute outside limit for reading speed of 900 words per minute. When looking into the claims and methods of speed reading courses, it is obvious that their claims are suspect and their results are contrived, especially as regards the comprehension of the texts 'read'. In one detailed study of persons claiming to be speed readers (by Carver in 1985) it was found that their maximum speed was 444 words per minute, but that comprehension even at that speed was poor.

2.6 Netsumm

This is an experimental system recently produced by The Language Group at British Telecom Laboratories in Suffolk.

Its aim is to reduce any text to its essence, thus assisting executives, diplomats, financiers and many others who often have to wade through long reports and documents. Researchers have

discovered that 5% of any text can contain 70% of its information and that a summary 25% of the length of the original text can contain virtually all its information.

The method of Netsumm is, basically, as follows:

- the removal of all articles and conjunctions
- the reduction of remaining words to root forms (i.e. removing prefixes, suffixes, inflexions etc.)
- the counting of the frequency of appearance of each word in the text
- the determining of key words and phrases
- the summarising of the text using the sentences with the highest frequency rating

There are various levels of summarisation which can be chosen by the user. The system is most effective with texts which are highly factual and deal with one main theme. It has the advantage that the reduced version is presented in complete sentences; there is no disturbance of the structure or syntax.

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3.0 HYPERMODE

The only information in the Dolphin Hal's User Guide about Hypermode is as follows:

<ALT> and <Q> toggles Hypermode on and off. The Hypermode allows you to skim read by only including the important words. For example "The rain in Spain falls mainly on the plain" sounds like "rain Spain falls mainly plain". The <ALT> and <Q> command works in either screen reading or live mode. Please note that when in Hypermode the two alphabetic characters A and I do not give keyboard echo. This is because Hal thinks of them as single letter words and as a consequence ignores them. However they will have been entered into the text and this can be checked by turning Hypermode off.

There is no information about what words are omitted and no indication as to what criteria have been applied in selecting words for omission. Although referring to 'skim reading', the short example given implies that little meaning is lost and that comprehensibility will be high. In order to compile a list of omitted words the following steps were taken:

- Some preliminary testing had been carried out by the University of York Computer Science Department and a provisional list had already been compiled. This was checked using Hypermode and was found to be correct.
- Several different types of texts were then read using Hypermode and any further words omitted were noted.
- Random words were tested and, where appropriate, added to the list.

It was noted that in some cases, parts of words were removed e.g. al[*though*], further[*more*]. In some abbreviated forms e.g. [you]'ll , [I]'ll, [can]'t , Hypermode removes the *you*, *I* and *can* and leaves the remainder.

On the basis of the above testing the following word list was compiled. It is not known whether this is the complete and definitive list, however, all the evaluation and the modifications presented in this paper are based on it.

3.1 Current Hypermode Word List

3.1.1 Alphabetical List

a	him	then
almost	himself	they
am	his	those
an	however	though
and	I	thus
are	if	to
as	in	until
at	is	very
because	may	was
been	me	were
but	might	whether
by	more	while
can	moreover	will
could	my	with
do	of	withdraw
doing	on	withdrawal
done	or	within
for	shall	without
from	she	would
had	since	yet
has	the	you
have	their	your
he	theirs	yours
her	them	yourself
hers	themselves	yourselves

Total number of words: 75

3.1.2 List by Word Category

Nouns

withdrawal	more*	while*	can*	will*	may*
might*	without*	do*	[but*]		

Verbs

am	can*	do*	had	will*	was
is	could	doing	has	may*	were
are	would	done	have	might*	withdraw
shall					

Adjectives

his*	her	my	their	more*	your
those*	[on*]	[by*]	[for*]		

Adverbs

almost	more*	within*	to*	on*	while*
then	without*	since*	as*	by*	in*
thus	however*	moreover*	though*	but*	yet*

Prepositions

at	in*	with	until*	within*	without*
for*	of	by*	since*	without*	on*
from	to*	as*	but*		

Conjunctions

and	but*	if	though*	as*	however*
or	until*	because	since*	whether	while*
yet*					

Pronouns

I	you	he	she	they	them
him	her	hers	himself	yourselves	themselves
yours	me	his*	those*		

(* indicates that the word also belongs to other word classes, [] indicates that the word is rarely used in that word class)

4.0 LINGUISTIC ANALYSIS

Several words are frequently repeated in any book dealing with language, whatever linguistic aspect is under discussion. These are 'structure', 'system', 'pattern', 'organisation', 'arrangement'. No one aspect of language can be studied in isolation, as all the various elements are interlocking and interdependent, forming together a very complex whole. Every word has its specific role and contributes to the meaning and intelligibility of the text or speech.

Sentences can vary in length from a few words to lengthy and complicated structures of inter-related and inter-dependent phrases and clauses. They can be classified as simple if they contain one clause only, or complex if they contain more than one clause, linked by conjunctions, such as *and*, *but*, *or* (co-ordination), or by the subordination of one or more clauses to the main clause. These subclauses are generally signalled by conjunctions such as *that*, *although*, *because*, *since*, *unless*, *while* etc. Sentences can be statements, commands, questions or exclamations, each with its specific structure and characteristics. Within these general classifications there are numerous variations and subdivisions.

Sentences are, of course, made up of individual words which can also be divided into categories according to their function. There are two main word classes - major and minor. The major word classes are: main verbs, nouns, adjectives and adverbs (also called content words or lexical words). The minor word classes are: auxiliary verbs, pronouns, prepositions, conjunctions, articles (also called function words). Members of minor word classes belong to closed systems - i.e. there is a limited number of words belonging to each class and they cannot normally be added to. Therefore they can be listed. In the major classes, new words can be added or created.

For the purpose of this study, it is not possible to enter into any detailed analysis of the elements which combine to make language such a complex organism. It is essential, however, to be aware of this complexity and interdependence in order to be able to identify those

elements which, if omitted, will cause the least structural damage and therefore not interfere to any great extent with intelligibility.

When considering text reduction by the omission of selected words, one main point to decide is the level of understanding which is to be aimed at. If all function words plus adverbs and adjectives were omitted and only the main content words - nouns, main verbs - remained, these may be sufficient to convey to the listener the main subject matter of any given text. However, the purpose of Hypermode seems to be to provide the listener with texts which are reduced to some extent but still retain sufficient of the original to be meaningful.

Some words can be removed from most texts without affecting meaning or structure to any great extent. This is why telegrams, for example, can be used effectively for communication. However, in these cases the words to be removed are decided case by case as the need arises. Problems occur when it is necessary to make rules in advance as to which words will **always** be omitted, whatever the text.

Ideally a system could be created to assess the function and importance of each word in its own particular context, perhaps through Natural Language Processing. Categories of words could then be omitted, such as all pre-modifying adjectives and all adverbs ending in -ly. Other words could be omitted or retained according to their particular function and position. Even natural language processing has its limitations according to Waterworth and Talbot (1987, p123):

syntactic parsing (i.e. syntactic analysis on the basis of sentential structure) is not simple because of the complexity and ambiguity of natural language with the same words, or even types of words, being used in a variety of ways... No adequate syntactic parser for the whole of English has ever been written

The present task, however, is to compile a word list, valid for all texts. As will be seen, the complexities of the English language are great and the deeper one delves into grammatical functions the more one becomes aware of the intricacies, variations, exceptions and interdependencies of the many word categories and structures. As many words belong to more than one category, in some contexts they are more necessary to understanding than in others.

This section will endeavour to explore some aspects of the characteristics and uses of different word classes and categories. It does not aim to give an in-depth study - this is beyond the knowledge and ability of the writer and not the main purpose of this paper. Any comments and suggestions which are made are based on the grammatical observations in each section. Extensive testing would be necessary to demonstrate whether or not the conclusions, and therefore the words listed for omission or retention, are valid.

This linguistic exploration will help us to discover the criteria which may have governed the choice of words omitted by Hypermode. It will also give us guidelines for any variations or alterations.

We will look first at the four major word classes under the following headings: Definition; Words omitted by Hypermode; Grammatical Information; Comments and Suggested Changes to Hypermode.

4.1 Major Word Classes

4.1.1 Nouns

Definition

a word that is the name of a topic for discussion e.g. a person, place, thing, substance or state

[Longman 1991]

Nouns Omitted by Hypermode

withdrawal	more*	while*	can*	will*	may*
might*	within*	without*	do*	[but]	

(* indicates that the word also belongs to other word classes, [] indicates that the word is rarely used in that word class)

Grammatical Information

Nouns are one of the principle categories of content or lexical words. They are essential to any text and cannot be omitted without affecting the structure and the meaning.

e.g. The [*cat*] sat on the [*mat*].

The [*telephone*] was broken.

Comments and Suggested Changes to Hypermode

For the purposes of Hypermode, all nouns should be retained unless they are used much more frequently in another grammatical function.

- *will, may, can, might* can be nouns -

e.g. The month of *May*; A *can* of beans; He wrote his *will*; The *might* of the British Empire.

However they appear more frequently as modal auxiliaries and will continue to be omitted (see section on verbs)

- *more*, *while*, *do*, *within* and *without* can be nouns

e.g. Tell me *more*; stay here for a *while*; seen *from within/without*; *do*'s and don'ts

However they appear far more frequently in other word classes *while* (conj); *do* (v), *within* and *without* (adv./prep); *more* (adj./adv.) and will be considered under those headings.

- There is no apparent reason for the choice of *withdrawal* for omission so should be retained.

4.1.2 Verbs

Definition

a word that expresses the doing of an action, the occurrence of an event or a state of being

[Longman 1991]

Verbs omitted by Hypermode

am	can*	do*	had	will*	was
is	could	doing	has	may*	were
are	would	done	have	might*	withdraw
shall					

(* indicates that the word also belongs to other word classes)

Grammatical Information

Verbs, like nouns, are one of the major categories of content or lexical words and they are an essential component of clause structure. Main verbs cannot be omitted from a text without destroying both form and meaning.

Many verb tenses/forms are made up of the main verb plus a minor, or auxiliary verb. Auxiliary verbs can be divided into two categories: those used to form various verb tenses and also interrogative and negative forms - *do*, *have* and *be* - are called primary auxiliaries.

e.g. She *is* working today; I *have* not seen him; *Do* you like coffee ?

These three verbs can also be main verbs:

e.g. We *have* the books; He *is* a doctor; She *does* her work well.

Other verbs which also combine with main verbs are called modal. These are *can*, *may*, *shall*, *will*, *could*, *might*, *should*, *would*, *must*, *used to*, *ought to*, *need* and *dare*. They express degrees of probability, possibility, certainty, necessity etc.

e.g. You *should* not talk so much; I *must* go there tomorrow.

We *used to* live in that town; She *dare* not tell her husband.

They *might* come to the party.

Two of the verbs - *need* and *dare* - can also be main verbs (when auxiliaries, they do not have the -s, -ed and -ing forms).

Comments and Suggested Changes to Hypermode

For the purposes of Hypermode we will follow the rule that main verbs must be retained and auxiliary verbs which cannot also be main verbs can be omitted, with a few exceptions.

- The verb *withdraw* which has been omitted for no apparent reason will be retained.
- The primary auxiliaries which also function as main verbs will be retained i.e. the verbs *be*, *do* and *have*.
- *can*, *might*, *may* can also be nouns, *will* can also be a noun or a main verb - but as they all function far more frequently as modal auxiliaries they will continue to be omitted.

- The other modals currently omitted (*could*, *would* and *shall*) will continue to be omitted and in order to be consistent the other modal *should* will be added to the list.
- Of the remaining modals *used to* will continue to be retained as *use* is a main verb; similarly *dare* and *need* will be retained
- *must* (also occasionally a noun) and *ought to* will continue to be retained as they express obligation and may be important to understanding of text.

4.1.3 Adjectives

Definition

a word typically serving as a modifier of a noun to denote a quality of what is named, to indicate its quantity or extent or to specify it as distinct from something else

[Longman 1991]

Adjectives omitted by Hypermode

his*	her	my	their	more*	your
those	[on]	[by]	[for]		

(* indicates that the word also belongs to other word classes, [] indicates that the word is rarely used in that word class)

Grammatical Information

Adjectives are another of the major word classes. They appear in clauses/sentences in a variety of positions and contexts which need to be considered before deciding whether or not they can be omitted:

- Adjectives can be followed by prepositions such as *at*, *of*, *about*, *on*, *for*, *with*.
e.g. good *at*; worried *about*; satisfied *with*

- Adjectives are often followed by a clause beginning with *that* (expressed or understood)
e.g. I'm happy *that* you're here; It's obvious [*that*] he'll win.
- Adjectives are often followed by 'to + infinitive':
e.g. She is *slow* to respond; He is *easy* to please; It is *essential* to arrive on time.
- Adjectives can precede or follow the noun they describe or be separated from it
e.g. A *close* friend; something *nice*; the case is *heavy*
- Some adjectives have the same -ing form as the present participle or the -ed form of the past participle.
e.g. a *frightening* film; a *satisfied* customer
- Some adjectives are also adverbs or pronouns
- Some adjectives can be preceded by the definite article and serve as nouns :
e.g. the *poor*; the *French*; the *young*.

Comments and Suggested Changes to Hypermode

All adjectives used as pre-modifiers could be omitted - however it is not possible at present to create a program to do this.

- Current Hypermode omits some possessives (which are always premodifiers) - *my*, *your*, *his*, *her*, *their*. These will continue to be omitted with the addition of *our* to make it consistent.
- Current Hypermode also omits one demonstrative adjective *those*. In their adjectival role the demonstratives are also pre-modifiers, hence the others will also be omitted - i.e. *this*, *that*, *these*. For testing purpose *such*, *some*, *any*, *whichever* and *whatever* will also be omitted as in their adjectival role they are generally premodifiers.

4.1.4 Adverbs

Definition

a word that modifies a verb, an adjective, another adverb, a preposition, a phrase, a clause or a sentence and that typically answers such questions as how?, when? or where? or expresses affirmation or denial

[Longman 1991]

Adverbs Omitted by Hypermode

almost	more*	within*	to*	on*	while*
then	without*	since*	as*	by*	in*
thus	however*	moreover*	though*	but*	yet*

(* indicates that the word also belongs to other word classes)

Grammatical Information

Adverbs are the fourth category of content words. As adverbs are ‘modifying’ elements in clause structure they are often optional i.e. they can be omitted without making the clause unacceptable but:

- Some adverbs are also adjectives :
e.g. *early, late, hard, still, yearly, monthly* etc.
- Some adverbs, especially those expressing time or place, are used as a complement of prepositions:
e.g. along *here*, down *there*, from *above*, from *outside* etc.
- Many adverbs combine with verbs to form phrasal verbs. Most of the adverbs involved are adverbs of place:
e.g. sit *down*, stand *up*
Some verbs change their meaning by the addition of the adverb:
e.g. give *in*, give *up*, give *out*, turn *on*, turn *up*, turn *out*, bring *up*, call *off*

Comments and Suggested Changes to Hypermode

- Adverbs which can also be adjectives cannot be omitted unless they comply with adjectival rules
- Adverbs which most commonly appear in compound forms i.e. *up, down, here, there, in, out, on, off*, will be retained. Therefore *in* and *on* will be removed from the current Hypermode list.
- Other adverbs can be added to the list especially those ending in -ly though, as many nouns and adjectives also end in -ly e.g. *lovely* (adj.), *elderly* (adj.), *assembly* (n), *ally* (n), no general rule can be made. The following adverbs will now be omitted (chosen mainly from the passages used for testing): *actually, certainly, clearly, commonly, currently, definitely, especially, essentially, extremely, fairly, generally, mainly, nearly, normally, possibly, probably, rarely, slightly, typically, usually*
- The following common adverbs will also be added to the current list for the purposes of further testing: *very, perhaps, also, just, sometimes, often, furthermore*.

4.2 Minor Word Classes

We will now consider the minor word classes. These classes are generally considered more dispensable than the major classes, hence it would seem logical to presume that the choice of words to be omitted should be comparatively simple, particularly in view of the fact that there is a limited number of words in each minor class. However, the reality is rather different. Because they are used in such a great variety of ways, because they often combine together to form compound forms, and because many words overlap word categories and have several functions, it is very difficult, if not impossible, to foresee the effects that the omission of some of them will have on sentence structure.

4.2.1 Prepositions

Definition

a word or word group that combines with a noun, pronoun or noun equivalent to form a phrase linking the noun in some way to the rest of the sentence

[Longman 1991]

Prepositions Omitted by Hypermode

at	in*	with	until*	within*	without*
for*	of	by*	since*	without*	on*
from	to*	as*	but*		

Grammatical Information

- There are simple prepositions (i.e. one word):
e.g. *by, of, at, to, with, in, after, since, until*
and complex prepositions (i.e. more than one word):
e.g. *away from, except for, in front of, in spite of, because of, according to, by means of*
- Prepositional verbs are verbs followed by a preposition that contributes to its meaning
e.g. *agree to, care for, compete with, comment on, call up*
- Phrasal prepositional verbs are idiomatic phrases which combine a verb, an adverb and a preposition :
e.g. *check up on, get away with, face up to, stand up for.*

Comments and Suggested Changes to Hypermode

- The simple prepositions *at, for, from, of, to, with, by, within* and *without* will continue to be omitted because:
 - a) when used on their own (i.e. not in complex forms) their omission does not generally prevent understanding:

e.g. They arrived [*at*] the hotel; She came [*with*] a friend; He is going [*to*] the office

b) when used as part of complex prepositions, prepositional verbs and phrasal prepositional verbs, the remaining words generally convey the meaning sufficiently for the purposes of Hypermode:

e.g. She won [*by*] means [*of*] hard work; I did not attend because [*of*] illness; They cared [*for*] her devotedly; Some people get away [*with*] murder

- Prepositions with a precise meaning indicating position or time will continue to be retained i.e. *after, before, above, below, under, over*
- Some prepositions with a less precise meaning will now be omitted i.e. *along, around, about, through and into*

4.2.2 Conjunctions

Definition

a word that joins together sentences, clauses, phrases or words...

[Longman 1991]

Conjunctions Omitted by Hypermode

and	but*	if	though*	as*	however*
or	until*	because	since*	whether	while*
yet*					

(* indicates that the word also belongs to other word classes)

Grammatical Information

There are two categories of conjunctions - co-ordinating and subordinating. The co-ordinating conjunctions are : *and*, *or* and *but*. These link words or clauses of equal importance in the sentence structure.

e.g. John *and* Mary live in London; Tom lives in England *and/but* Jane lives in Wales; Do you prefer apples *or* oranges ?

The subordinating conjunctions link sub-clauses and phrases to the main clause. The simple ones are a closed list as follows:

after, although, as, because, before, if, however, like, once, since, that, till, until, unless, when, where, whenever, wherever, whereas, whereby, whereupon, while.

The compound ones include: *as if, as though, in case* plus many that end in *that, as* and *than*: e.g. *in order that; as far as; as soon as; sooner than; rather than*

Comments and Suggested Changes to Hypermode

- Co-ordinating conjunctions (*and, or, but*) are not generally essential to meaning or to sentence structure thus they will continue to be omitted
- Subordinating conjunctions are more necessary for meaning and structure, however the following could be added to the list for omission for the purposes of further testing: *whenever, wherever, whereas, although.*
- As *as* is part of so many compound conjunctions it will be retained
- *because, if* and *until* will be retained on the basis that because of their meaning they may be more important for comprehension.

4.2.3 Pronouns

Definition

a word that is used as a substitute for a noun or noun equivalent and refers to a previously named or understood person or thing

[Longman 1991]

Pronouns Omitted by Hypermode

I	you	he	she	they	them
him	her	hers	himself	yourselves	themselves
yours	me	his*	those*		

(* indicates that the word also belongs to other word classes)

Grammatical Information

- They can be divided into many different classes and subclasses; the main classes are:

Personal: *I, you, he, she, it* etc.

Reflexive: *myself, yourself* etc.

Possessive: *mine, yours* etc.

Reciprocal: *each other, one another*

Relative: *who, whom, which, that*

Interrogative: *who, whom, which, what*

Demonstrative: *this, that, these, those*

- Other classes cover pronouns such as: *each, everybody, something, anything, nothing, any, some, whatever, whichever*
- Because of their number and variety, pronouns are used in a wide range of syntactical structures.

Comments and Suggested Changes to Hypermode

As is the case for prepositions and conjunctions, the choice of pronouns to omit is difficult. The current Hypermode list shows indecision and inconsistency i.e. it omits all personal pronouns

(subject) except *it* and *we*; it omits all personal pronouns (object) except *us*; it omits some reflexives but not *myself*, *herself*, *itself*, *ourselves*; it omits possessives but not *mine*, *its*, *ours*, *theirs*. It omits one demonstrative *those* but not *this*, *that*, *these*.

In view of the fact that insufficient grammatical knowledge and information are possessed on all the complex interactions involved to make different or improved choices, we will simply make the current Hypermode consistent - i.e. all personal , reflexive, possessive and demonstrative pronouns will be omitted.

4.2.4 Articles

Definition

a small set of words used with nouns to specify definiteness or indefiniteness

[Longman 1991]

Articles Omitted by Hypermode

a an the

Grammatical Information

For present purposes, discussion of the uses of *a*, *an* and *the* is irrelevant. They will continue to be omitted.

4.3 New Hypermode Word List

4.3.1 Alphabetical List

a	into	themselves
about	it	then
actually	its	these
almost	itself	they
along	just	this
also	mainly	those
although	may	though
an	me	through
and	might	thus
any	mine	to
around	moreover	typically
at	my	us
but	myself	usually
by	nearly	very
can	normally	we
certainly	of	whatever
clearly	often	whenever
commonly	or	whereby
could	our	wherever
currently	ours	whichever
definitely	ourselves	will
especially	perhaps	with
essentially	possibly	within
extremely	probably	without
fairly	rarely	would
for	shall	yet
from	she	you
furthermore	should	your
generally	since	yours
he	slightly	yourself
her	some	yourselves
hers	sometimes	
herself	such	
him	that	
himself	the	
his	their	
however	theirs	
I	them	

Total number of words : 107

4.3.2 List By Word Category

Nouns

can*	may*	might*	[perhaps*]	[then*]
------	------	--------	------------	---------

Verbs

can*	could	may*	might*	shall
should	will*			

Adjectives

any*	[by*]	[for*]	his*	her*
my	our	some*	such*	that*
their	then*	these*	this*	those*
through*	very*	your	whichever*	whatever*
just*	[about*]	[around*]		

Adverbs

about*	actually	almost	along*	also
any*	around*	but*	by*	certainly
clearly	commonly	currently	definitely	especially
essentially	extremely	fairly	furthermore	generally
just*	mainly	moreover	nearly	normally
often	perhaps	possibly	probably	rarely
since*	slightly	some*	sometimes	such*
that*	then*	through*	thus	to*
typically	usually	very*	within*	without*
yet*				

Prepositions

about*	along*	around*	at	but*
--------	--------	---------	----	------

by*	for*	from*	into	without*	
since*	through*	to*	with	within*	of

Conjunctions

although	and	but*	for*	however*
or	since*	that*	though*	whenever*
whereby*	wherever*	yet*		

Pronouns

any*	he	her*	hers	herself
him	himself	his*	I	it
its	itself	me	mine	myself
ours	ourselves	some*	such*	theirs
them	themselves	these*	they	this*
those*	us	we	whichever*	whatever*
you	yours	yourself	yourselves	

Articles

a	an	the
---	----	-----

(* indicates that the word also belongs to other word classes, [] indicates that the word is rarely used in that word class)

5.0 USER TESTING

5.1 Aims of Testing

- To ascertain if, and to what extent, comprehension levels are affected by the use of current Hypermode on the Dolphin Apollo (as compared to levels using the Apollo without Hypermode).
- To ascertain whether any change in comprehension levels is produced by the use of the revised Hypermode.

5.2 Method

In order to mirror as closely as possible the situation of potential Hypermode users and to produce the most realistic results, it was thought best to present candidates with several short, unknown texts in Hypermode, followed by a series of 6 to 9 straightforward questions to test their comprehension. All questions followed closely the wording of the text and were all of a similar level with no 'catch' questions. They pinpointed the most important points of each passage, thus correct answers would demonstrate an understanding of the essence of the text.

Table 1. Percentages of words omitted from test texts

	Test 1	Test 2	Test 3	Test 4
Current Hypermode	31.1%	37.3%	41.5%	44.1%
New Hypermode	29.5%	38.3%	39.2%	45.7%
	Retest 1	Retest 2	Retest 3	Retest 4
Current Hypermode	37.8%	32.5%	36.8%	41.5%
New Hypermode	33.5%	32.5%	37.3%	44.1%

In order to test current Hypermode, four texts of 150-210 words were chosen with a variety of styles and subject matter and an increasing percentage of words omitted. To ensure as valid a comparison as possible, the four texts chosen to test new Hypermode were from the same

sources with similar subject matter and style and a similar range in the percentage of words omitted (see Table 1 above). The retests took place several weeks after the first tests.

5.3 Users Tested

Six people were tested:

Candidate 1 : male, blind, everyday user of speech synthesizers but not of Hypermode

Candidate 2 : male, sighted, familiar with speech synthesizers

Candidate 3 : male, sighted, virtually no experience of speech synthesizers

Candidate 4 : female, sighted, virtually no experience of speech synthesizers

Candidate 5 : female, sighted, no experience of speech synthesizers

Candidate 6 : male, sighted, virtually no experience of speech synthesizers

5.4 Testing Procedure

For candidates not accustomed to synthetic speech a text was first listened to , not in Hypermode, to familiarise them with its distinctive sound and to gauge a suitable speed for listening to the tests.

For all further tests, that is:

Test 0 (non-Hypermode Test)

Test 1 - Test 4 (Current Hypermode Tests)

Re-test 1 - Re-test 4 (New Hypermode Tests)

the procedure was as follows:

- Each test text was listened to twice
- After the first hearing, each sighted candidate was given a list of written questions and they answered as many as possible
- While listening the second time, candidates continued to write in the answers

- For Candidate 1, the questions were read to him after the first and second listening and his answers were written down by the tester.

5.5 Questionnaire

In addition to the user testing described above, a questionnaire was also compiled and posted to the internet newsgroup of the British Computer Association for the Blind. It was directed to Hal (the screen reader used with the Apollo) users in order to obtain a wider picture of opinions and reactions to the Hypermode feature.

5.6 Pascal Programs

Two programs were designed in Pascal, the first to test current Hypermode and the second to test new Hypermode. The first program was designed to read a given text file and output it to the screen in full and then Dolphin Apollo Hypermode was used to read it. The second program implemented the revised version of Hypermode. It was designed to remove the designated words from given texts before outputting the texts to the screen. The Dolphin Apollo was then used to read the remaining words, so emulating Hypermode. The program does not take out part of words as in current Hypermode but it still has not resolved the question of abbreviated forms.

As every word from a text would require checking against a word list, a fast, efficient searching technique was required. A hash table data structure was used as it was considered to meet these criteria. Ideally no two words would hash to the same value, however, in practice, it was difficult to devise a hash function to do this. As the total number of words to be entered was known in advance, a method of linear probing was used to resolve hash collision. Having noted which words from the new Hypermode list were most frequently omitted (see Appendix D), they were placed first in the file so ensuring no hash collision and thereby faster lookup.

The overall structure of the program is very simple as follows:

- Reading each word to be omitted from a file and inserting it into a hash table. This involves:

- initialising the hash table with an empty marker
- reading each word character by character into an array
- hashing each word to obtain an integer value
- inserting each word into the table at the hash value position or repeatedly rehashing the word to find the next empty position
- Reading each word from a given text file, searching the hash table for it and if not found, printing it out. This involves:
 - reading each word character by character into an array
 - hashing each word to obtain an integer value
 - checking the table at the hash value position or repeatedly rehashing the word until either it is found or an empty position is found
 - printing the word out if it has not been found

The program listings can be found in Appendix C.

5.7 Texts used for Testing

The following nine texts and questions were used for testing the comprehensibility of current and new Hypermode compared with non-Hypermode. The *italic words in square brackets* indicate the words omitted by Hypermode. The number and percentage of words omitted will be indicated at the end of each text.

5.7.1 Non - Hypermode Test 0

Of course you want to have a happy holiday and in 90% of cases, you will. But what if things go wrong? To make sure you enjoy your holiday - or at least, get compensation for a ruined one - here are two common complaints and how to deal with them.

1. Misleading Brochures

If the brochure describes something that doesn't exist, such as a swimming pool, promises peace when you're next to a night club you can claim compensation. Take the brochure with you on holiday just in case, and complain to the representative, who should move you if your complaint is justified.

2. Poor Accommodation

Whatever your hotel rating and whatever country you are in, your accommodation must conform to basic standards of cleanliness and safety, so if you arrive to find there's no water or the room's teeming with cockroaches, complain immediately. Your rep should sort the problem out or move you to accommodation of the same standard as that booked. Don't let the rep pass the buck to the hotelier - in law, the tour operator is responsible.

[Good Housekeeping Magazine Aug. 1995, p137]

Test 0 Questions

- Q1. What percentage of holidays tend to be happy?
- Q2. If your holiday is ruined what should you at least try to get?
- Q3. How many common complaints are listed?

- Q4. What is the first common complaint?
- Q5. Give one example listed of misleading information?
- Q6. Who must you complain to?
- Q7. What is the second common complaint?
- Q8. What basic standards must the accommodation conform to?
- Q9. Who is ultimately responsible?

5.7.2 Current Hypermode Test 1

Richard Branson, [of] course, [is the] raffish 45 year old tycoon behind [the] business empire that flies [the] Virgin banner-arguably [the] most recognisable brand name [to] emerge [from] Britain [since] Rolls Royce. [He]'s [the] boarding school dropout who built Virgin Records into [a] gold [and] platinum mine [with the] help [of] folks like Janet Jackson [and the] Sex Pistols, [and then] sold [the] label [for] nearly \$1 billion. Not bad [for] someone whose closest encounter [with an] M.B.[A has] probably been serving champagne [to a] Harvard Business School Graduate [on] one [of his] Virgin Atlantic Airways planes. [While] it's not [yet] possible [to] fly around [the] world [on his] airline (only [the] America [to] Asia link [is] missing), [the] Virgin empire [has] colonised every corner [of the] globe, [with] operations [in] 22 countries [on] six continents. [The] unavoidable trademark [can] be found [on] computers, cola, vodka, video games, discount brokerages, travel firms, cinemas, bridal wear [and] much [more]. Virgin predicts that its products [will] generate revenues [of] \$3.2 billion this year [and] further enhance Branson's personal fortune, now reckoned [to] be \$1.2 billion.

[Time Magazine 8th July 1996, p35]

Total number of words: 183 Number of words omitted: 57 (31.1%)

Test 1 Questions

- Q1. How is Richard Branson described and how old is he?
- Q2. What are the current and previous most recognisable names to emerge from Britain?

- Q3. What are we told about his school days?
- Q4. Who helped to build Virgin Records into a gold and platinum mine?
- Q5. What has he done with the label?
- Q6. Why can you not fly right around the world on his airline?
- Q7. How widespread is the Virgin Empire?
- Q8. What financial predictions have been made for this year?

5.7.3 Current Hypermode Test 2

Internet books generally fall into two categories: *[the]* type that tell *[you]* far *[more]* than *[you]* want *[to]* know *[in]* unimportant areas *[and]* not enough *[on]* shortcuts; *[and the]* patronizing, simplistic ones that make it look easy *[in the]* bookstore, *[but]* *[are]*n't much use once *[you]* start *[having]* problems. *[And, if they]*'re written before mid 1995 , *[they]* should be filed *[in the]* ancient history section.

This guide gives it *[to you]* straight. We think *[the]* Net *[is a]* pushover. *[If you can]* figure out how *[to]* use *[a]* word processor, *[you can]* master *[the]* Net. *[But]* we know *[you]*'ll *[have]* problems, so we show *[you]* how *[to]* solve *[them and]* where *[to]* go *[to for]* help. Rather than compile everything there *[is to]* know about *[the]* Net, we give *[you the]* basics *[and]* tell *[you]* how *[to]* make use *[of the]* Net itself *[to]* find out more. *[Since the]* Net *[and]* its associated technology change *[almost]* daily, its wiser *[to]* get *[your]* information where its always fresh.

What's *[more]*, we'll show *[you]* how *[to]* get *[the]* best deal *[on]* Internet access, how *[to]* become *[an]* expert *[in the]* most important Internet programs, *[and]* how *[to]* locate anything, anywhere, *[on the]* Net *[without having to]* learn any difficult commands.

[Kennedy 1995, p1]

Total number of words: 209 Number of words omitted: 78 (37.3%)

Test 2 Questions

- Q1. How many categories do internet books generally fall into?
- Q2. What are the different types?
- Q3. What should happen to books written pre 1995?
- Q4. According to the guide, you can master the Net if what?
- Q5. Rather than compile everything about the Net, what does the guide do?
- Q6. For what does the guide help you get the best deal?
- Q7. What does it help you to become an expert in?

5.7.4 Current Hypermode Test 3

[The] development [of] marketing departments

Al[though] every organisation [is] different, it [is] often suggested that common patterns appear [in the] structure [of] organisations. [The] position occupied currently [by] departments [of] marketing [is] widely recognised [as having] evolved [from the] existence [of] sales departments. Traditionally all dealings [with a] marketplace [would have] been [the] responsibility [of a] sales director who [would] typically report direct [to] senior management. [At] this stage [a] marketing orientation [was] probably absent [and the] organisation [would] usually [have] been production [or] sales orientated. When [the] need [for a] marketing orientated approach became [more] apparent [a] marketing director [might] appear [in] parallel [to the] sales director, [but with] two distinct functional departments. [With] fuller recognition [of the] marketing approach [to] business, sales [and] marketing [would] become [a] single functional department, [but with] sales [as a] sub-group [within] marketing [as] opposed [to] marketing being [a] sub-group [within] sales. [Thus the] emphasis [within] organisational structures [has] generally moved [from a] sales department [to a] marketing department [as the] business philosophy changes.

[Marketing 1993, p16]

Total number of words: 171 Number of words omitted: 71 (41.5%)

Test 3 Questions

- Q1. What do different organisations have in common?
- Q2. What have the marketing departments evolved from?
- Q3. Who used to be responsible for dealing with the market place?
- Q4. How were organisations orientated in the past?
- Q5. What new approach developed?
- Q6. How many departments were initially involved?
- Q7. When a single department evolved, which was the sub-group and which the main group?

5.7.5 Current Hypermode Test 4

Private medical cover instructions

Once *[you have]* received confirmation *[of]* cover *[you can then]* proceed *[with]* private treatment. *[Your]* specialist *[will]* normally arrange *[for]* any tests, treatment *[or]* hospital stay needed. *[You can]* help *[them by]* showing *[them this]* leaflet, *[the]* benefits *[and]* exclusion section *[of your]* policy document *[and your]* guide *[to]* hospitals. After *[you have]* undergone treatment *[you will]* receive invoices *[from the]* hospital *[or]* specialists concerned. *[If you]* wish *[you can]* pay these *[and then]* reclaim *[the]* cost *[from]* us, *[however in]* most cases it *[would]* be easier *[to]* send us *[the]* unpaid invoices. We *[will then]* send *[a]* cheque *[to the]* hospital *[or]* specialist *[on your]* behalf *[and]* confirm *[to you in]* writing that we *[have done]* so. Whichever way *[you]* choose we must *[have the]* original invoice not *[a]* photocopy, fax *[or]* receipt. When *[you]* send any invoices *[to]* us, please make sure *[you]* write *[your]* policy number *[and]* claim number *[on]* each invoice *[and]* indicate clearly *[whether you]* want us *[to]* pay *[you]*, *[the]* hospital *[or the]* specialist. We advise *[you to]* retain copies *[of]* any invoices *[you]* send *[to]* us.

[Prime Health Policy Document]

Total number of words: 186 Number of words omitted: 82 (44.1%)

Test 4 Questions

- Q1. What is needed before proceeding with private treatment ?
- Q2. Who will arrange for you to have tests?
- Q3. What will you receive after treatment ?
- Q4. What two ways of paying are mentioned ?
- Q5. What must be written on each invoice ?
- Q6. What must be clearly indicated ?

5.7.6 New Hypermode Retest 1

Away [from] planes, trains [and] all [his] other business games, Branson faces two threats, one [to his] reputation [and the] other [to his] life. [The] risk [to] Branson's life is self-imposed. Not content [with] setting records [for] speed boat [and] balloon crossings [of the] Atlantic, [he] is planning [his] round [the] world flight [with] Swedish balloonmaker Per Lindstrand. Branson calls [the] effort "[the] last aviation record [and] adventure left on earth." Given [that] Branson has been fished [from the] sea [and] frozen wilderness on earlier adventures how good are [his] chances? [He] admits [he] has [probably] used up eight [of his] nine lives, one [of them] when [he] managed [to] remove [his] parachute rather than open [it] during [a] jump, only [to] be rescued in midair [by an] instructor. [He] had promised [his] wife [that his] ballooning days were over, [but he] has wangled [her] permission [for just] one more trip. [The] many silent partners who do [very] nicely out [of] Richard Branson's large assortment [of] Virgins [would probably] rather [she] had refused [and] kept [her] husband behind [his] modest desk dreaming up new ways [to] make money.

[Time Magazine 8th July 1996, p41]

Total number of words: 188 Number of words omitted: 63 (33.5%)

Retest 1 Questions

- Q1. What two threats does Richard Branson face?

- Q2. What records has he already set?
- Q3. What is he now planning to do?
- Q4. What does he call this 'effort' ?
- Q5. How did he lose one of his nine lives?
- Q6. What had he promised his wife?
- Q7. What would the silent partners have preferred his wife to have done?

5.7.7 New Hypermode Retest 2

Articles are grouped [by] topic [into] newsgroups. [With a] growing total [of] over 15,000 newsgroups accessible [to] more than 30 million users [you can] speak directly [to the] world's experts in every field. Usenet is [a very] fast flexible medium which [can] be accessed in various ways. [The] most convenient is [through an] account [with] full Internet access: [that] way [you can] read [and] post articles on-line switching between newsgroups as [you] please. If [you just] have [a] Bulletin Board [you] have [to] subscribe [to] groups [and then] wait [for] articles [to] arrive. [You can] get read-only access [through] satellite companies which provide [a] decoder which sits between [your] computer [and] satellite dish. [The] entire Usenet database is [then] transmitted via satellite during [the] night. [Your] Usenet provider keeps [a] database [of] articles which [it] updates in periodic exchanges [with its] neighbours. [It] receives articles anywhere [from] once [a] day [to] every few minutes. No provider [can] keep articles forever as [it] needs [the] space [for] new ones, so [it] expires [them] after [a] certain holding period. [It]'s usual [to] delete articles more than [about] four days old.

[Kennedy 1995, p73]

Total number of words: 188 Number of words omitted: 61 (32.4%)

Retest 2 Questions

- Q1. How are articles grouped?
- Q2. How many newsgroups are there?
- Q3. What is the most convenient way to access Usenet?
- Q4. How do you access articles if you only have a Bulletin Board?
- Q5. What type of access can satellite companies provide?
- Q6. How often do Usenet providers receive articles?
- Q7. How long are articles kept?

5.7.8 New Hypermode Retest 3

Marketing mix variables are [usually] summarised [into the] four Ps [of] product, price, promotion [and] place. [These] four variables are [the] heart [of a] marketing plan. [The] fourth element in [the] marketing mix is place [and this] component is [essentially] concerned [with the] processes [by] which [the] product is made available [to the] consumer. Other more [commonly] used terms [for] 'place' include distribution, delivery systems [and] marketing channels. [Although] place is [normally the] last element in [the] list [of] marketing mix variables, [its] importance [should] not be underestimated, [especially] in provision [of] services. After all, [a] considerable amount [of] marketing effort [will] be wasted if [the] product is not [actually] in [the] right place [at the] right time [to] enable [a] purchase [to] be made. [Furthermore, it] is beneficial [to any] organisation [to] give thorough consideration [to the] place component [of the] marketing mix [since] effective [and] efficient distribution [can] be [an] important source [of] competitive advantage. [However, the] choice [of a] particular distribution policy, [such] as whether [or] not [to] use wholesalers, [may] result in [the] company delegating [to] intermediaries much [of its] marketing function [such] as selling [to the] end user.

[Marketing 1993, p147]

Total number of words: 193 Number of words omitted: 72 (37.3%)

Retest 3 Questions

- Q1. Name two of the four variables at the heart of a marketing plan.
- Q2. What is the fourth variable (place) concerned with?
- Q3. Give two other terms used instead of 'place'?
- Q4. In what circumstances will marketing effort be wasted?
- Q5. Why is it beneficial to an organisation to give thorough consideration to the 'place' component?
- Q6. What might a company delegate to intermediaries?

5.7.9 New Hypermode Retest 4

In *[this]* section *[we]* have set out *[the]* rules *[for]* joining *[the]* policy.

[We may] refuse *[any]* person *[for]* membership *[without]* giving *[any]* reason. *[We may]* accept *[any]* person *[for]* membership *[for an]* extra premium *[or]* on *[any]* special terms which *[will]* be shown on *[the]* Certificate *[of]* Insurance. *[Your]* husband *[or]* wife *[and]* dependent children *[may]* apply *[to]* join *[at any]* time during *[a]* policy year. If *[we]* accept *[any of them]*, *[we will]* write *[to you and]* confirm *[the]* commencement date, *[the]* extra premium *[and any]* special terms which *[may]* apply. If *[you]* add *[a]* child *[of yours to the]* policy as *[an]* insured dependent *[within]* three months *[of their]* birth, *[we will]* cover *[them]* up *[to the]* next annual renewal date *[for]* no extra premium. *[And]* as long as *[they]* join *[within those]* three months *[we will]* not apply *[the]* exclusion *[for]* pre-existing medical conditions. Cover *[for your]* insured dependent children *[will]* stop on *[the]* first annual renewal date after *[their]* 21st birthday *[or]* marriage, *[whichever]* occurs first. If *[you]* die *[your]* insured spouse *[will]* automatically become *[the]* policyholder *[for the]* rest *[of the]* policy year.

Total number of words: 188 Number of words omitted: 83 (44.1%)

Retest 4 Questions

- Q1. What does this text set out?
- Q2. If a person is accepted what two things may be shown on the Certificate of Insurance?
- Q3. When may your husband, wife or children apply to join?
- Q4. How soon after birth does a child have to join to avoid the exclusion for pre-existing medical conditions?
- Q5. After what will cover for an insured dependent child stop?
- Q6. If you die, who will become the policy holder?

5.7.10 Text of Questionnaire

Calling all Dolphin Apollo/Hal users!! I am currently looking at the Hypermode feature of the Apollo as a means of speeding up reading, and at ways to improve it. For those of you who are not aware of Hypermode, the manual describes it as allowing you to skim read by only reading the important words. It is achieved by pressing <ALT> and <Q> in either screen reading or live mode. This research is for my MSc thesis at York University. I would be most grateful if you could take the time to answer some of the following questions even if you've never tried using Hypermode.

- 1. How long have you been using Hal?
- 2. At what speed do you listen to text (1 to 10) ?
- 3. Are you aware of the Hypermode feature?
- 4. If you are not aware of it, is it something you might try?
- 5. If you are aware of Hypermode and do not use it, why not?

6. If you use Hypermode, do you use it frequently?
7. For what type of text do you use Hypermode?
8. Do you listen to Hypermode at the same speed as you usually listen to text?
9. Do you have any comments about what is good or bad about Hypermode and how it could be improved?
10. Would you mind if I contacted you again as my research progresses?

6.0 RESULTS AND EVALUATION

6.1 Evaluation of Testing Methods

- It would have been preferable had all candidates been equally familiar with synthetic speech. The results would then have demonstrated purely their understanding of Hypermode without being influenced by their level of understanding of synthetic speech.
- Candidate 1's results were the most realistic in view of the fact that all potential Hypermode users would be blind and thus more dependent on memory. Ideally all candidates tested would have been blind and users of synthetic speech.
- In retrospect it would perhaps have been preferable not to have allowed the sighted candidates to make notes during the second listening as this gave them an advantage over Candidate 1. However at the time it was considered that his superior knowledge of synthetic speech outweighed this potential disadvantage.
- Due to lack of time and availability of candidates, only one non-Hypermode test was carried out on each person. It would have been better to carry out four tests as for current and new Hypermode, in order to have a more accurate comparison.

6.2 Overall Findings

- As can be seen in Table 5 there is a considerable improvement in individual average results of new Hypermode tests as compared with current Hypermode tests. This is true of all candidates despite the differences between them in their experience of synthetic speech. The average improvement was 14.96%. Hence it can be concluded that new Hypermode maintains a higher level of comprehension than current Hypermode. Despite this improvement both current and new Hypermode cause comprehension levels to decrease considerably when compared with non-Hypermode, by 26.57% and 11.61% respectively.

Table 2. Non-Hypermode Test Results

	Test 0	
Candidate 1	9 / 9	100.00%
Candidate 2	9 / 9	100.00%
Candidate 3	8.5 / 9	94.44%
Candidate 4	7 / 9	77.78%
Candidate 5	7 / 9	77.78%
Candidate 6	8 / 9	88.89%
Averages	48.5 / 54	89.81%

Table 3. Current Hypermode Tests Results

	Test 1		Test 2		Test 3		Test 4	
Candidate 1	6.5 / 8	81.25%	3.5 / 7	50.00%	6.5 / 7	92.86%	4.5 / 6	75.00%
Candidate 2	5.5 / 8	68.75%	4.5 / 7	64.29%	5.5 / 7	78.57%	4 / 6	66.67%
Candidate 3	6.5 / 8	81.25%	5 / 7	71.43%	4 / 7	57.14%	3.5 / 6	58.33%
Candidate 4	5.5 / 8	68.75%	2 / 7	28.57%	5 / 7	71.43%	2.25 / 6	37.50%
Candidate 5	4 / 8	50.00%	2.75 / 7	39.29%	3.5 / 7	50.00%	4.75 / 6	79.17%
Candidate 6	7 / 8	87.50%	3.5 / 7	50.00%	3.5 / 7	50.00%	3 / 6	50.00%
Averages	35 / 48	72.92%	21.25 / 42	50.60%	28 / 42	66.67%	22 / 36	61.11%

Table 4. New Hypermode Tests Results

	Retest 1		Retest 2		Retest 3		Retest 4	
Candidate 1	6.5 / 7	92.86%	6.5 / 7	92.86%	3.5 / 6	58.33%	5.5 / 6	91.67%
Candidate 2	7 / 7	100.00%	6 / 7	85.71%	4.5 / 6	75.00%	4.5 / 6	75.00%
Candidate 3	6.5 / 7	92.86%	5 / 7	71.43%	5.5 / 6	91.67%	4.5 / 6	75.00%
Candidate 4	5 / 7	71.43%	6 / 7	85.71%	5.5 / 6	91.67%	3 / 6	50.00%
Candidate 5	5 / 7	71.43%	4.5 / 7	64.29%	4.5 / 6	75.00%	4 / 6	66.67%
Candidate 6	5 / 7	71.43%	4 / 7	57.14%	5.5 / 6	91.67%	4.5 / 6	75.00%
Averages	35 / 42	83.33%	32 / 42	76.19%	29 / 36	80.56%	26 / 36	72.22%

Table 5. Average Test Results of Current and New Hypermode

	Non-Hyper Scores	Current Hypermode		New Hypermode		% increase in average scores of New Hyp. over Current Hyp.
		Average Scores	% Loss from Non-Hyper.	Average Scores	% Loss from Non-Hyper.	
Candidate 1	100.00%	75.00%	25.00%	84.62%	15.38%	9.62%
Candidate 2	100.00%	69.64%	30.36%	84.62%	15.38%	14.97%
Candidate 3	94.44%	67.86%	26.59%	82.69%	11.75%	14.84%
Candidate 4	77.78%	52.68%	25.10%	75.00%	2.78%	22.32%
Candidate 5	77.78%	53.57%	24.21%	69.23%	8.55%	15.66%
Candidate 6	88.89%	60.71%	28.17%	73.08%	15.81%	12.36%
Averages	89.81%	63.24%	26.57%	78.21%	11.61%	14.96%

Table 6. Duration in seconds of Tests 1-4 in Non and Current Hypermode

	Test 1	Test 2	Test 3	Test 4	Average
Non-Hypermode	90	87	90	80	86.75
Current Hypermode	77	69	74	61	70.25
No. seconds gained	13	18	16	19	16.50
Time gained as %	14.44%	20.69%	17.78%	23.75%	19.02%

Table 7. Duration in seconds of Retests 1-4 in Non and New Hypermode

	Retest 1	Retest 2	Retest 3	Retest 4	Average
Non-Hypermode	80	86	93	80	84.75
New Hypermode	58	64	67	54	60.75
No. seconds gained	22	22	26	26	24.00
Time gained as %	27.50%	25.58%	27.96%	32.50%	28.32%

- As demonstrated in tables 6 and 7 above, texts read using new Hypermode showed a greater time reduction than passages read with current Hypermode. This may be due to the

fact that a number of words in the new list tend to be longer than those in the old list. Hence the new list allows users to increase their reading speed to a greater extent than the old.

- By timing the texts on the synthesizer, it was found that approximately the same time saving can be obtained by increasing the speed setting by one level to equal current Hypermode and by two levels to equal new Hypermode.

Prior to carrying out the testing, it was expected that the following factors would consistently influence the results: familiarity with synthetic speech, percentage of words omitted, style and subject matter. However when analysing individual results the following were noted:

- Although familiarity with synthetic speech was overall an important factor (Candidates 1 and 2 obtained the best averages), this was not consistently so in each test e.g. Candidate 1 obtained the lowest mark in Retest 3 and obtained highest marks in only 5 tests out of 9 (see Table 3 and 4).
- It was expected that as the percentage of words omitted increased, the level of understanding would decrease. This did not occur indicating that the percentage of words omitted is not necessarily a decisive factor in the understanding of Hypermode.
- It was expected that the simpler texts, that is with shorter words, shorter sentences and a higher readability score (as illustrated in Table 8 and 9 below) would, when reduced, be easier to reconstruct mentally and would thus produce better levels of comprehension. However, the results which can be seen in Table 3 and 4, do not correspond to the complexity level of the text. Although Test 1 and Retest 1 (Richard Branson) and Test 3 and Retest 3 (Marketing) were more complex according to the above criteria, candidates achieved higher results on these rather than the other simpler texts. This may be due to the fact that the simpler texts compress more information into fewer words, hence if even a few words are missed the sense is lost. The more difficult texts take longer to say less, sometimes using more complex constructions e.g. passives. Hence, if a few words are lost

the sense may still be clear. Therefore the readability rating of unreduced texts may not be applicable to reduced texts.

- During the non-Hypermode tests and the retests, 3 candidates made a note of which answers were written after the first listening and which after the second. It was evident that a higher level of comprehension was achieved after the first listening in non-Hypermode than in new Hypermode. In fact, in all tests with Hypermode, the candidates' level of understanding after the first listening was extremely low. This was ascertained by observation and discussion.
- Continued listening to synthetic speech did not noticeably cause results to deteriorate through synthetic speech fatigue or improve through increased familiarity.

Table 8. Readability Statistics of Tests 1 - 4 according to Microsoft Word

	Test 1	Test 2	Test 3	Test 4
Av. No. Words per Sentence	30.5	23.1	24.4	20.7
Av. No. Characters per Word	4.9	4.3	5.8	4.6
Passive Sentences	16%	11%	28%	0%
Flesch Readability Ease*¹	44.6	70.9	19.2	59.4
Flesch-Kincaid Grade Level*²	14.6	8.1	16.5	10

Table 9. Readability Statistics of Retests 1 - 4 according to Microsoft Word

	Retest 1	Retest 2	Retest 3	Retest 4
Av. No. Words per Sentence	23.5	17.1	24	21.1
Av. No. Characters per Word	4.6	4.8	5.2	4.5
Passive Sentences	12%	27%	50%	11%
Flesch Reading Ease*¹	59.7	55	30.9	56.4
Flesch-Kincaid Grade Level*²	10.8	9.5	14.9	7.5

As stated in Microsoft Word 6 Help:

*¹ The Flesch Reading Ease computes readability based on the average number of syllables per word and the average number of words per sentence. Scores range from 0 (zero) to 100. Standard writing averages approximately 60 to 70. The higher the score, the greater the number of people who can readily understand the document.

*² Flesch-Kincaid Grade Level computes readability based on the average number of syllables per word and the average number of words per sentence. The score in this case indicates a grade-school level. For example, a score of 8.0 means that an eighth grader would understand the document. Standard writing approximately equates to the seventh-to-eighth-grade level.

6.3 Results of the questionnaire

Replies were received from five people who had been using Hal for periods ranging between two and nine years. Four of the five were aware of the existence of Hypermode and the fifth expressed an interest in knowing more.

Of the four who knew about Hypermode, one used it occasionally, one “rarely”, one “very rarely”, one had tried it but no longer used it. The reasons given for not using it more often included the following:

- “it does not work”
- “it is possible to comprehend the text, but very hard work. Hypermode should be a short cut, an easier method to read some texts.”
- “Time saving with the Hypermode feature can be lost looking for the specific bit for which absolute detail is required.”
- “I found it too stressful”

On the rare occasions when Hypermode was used, it was for the following purposes and types of texts:

- “for getting the gist of something in a hurry”
- “anything for which a flavour of the text is enough: news headlines, summary reports etc.”
- “plain texts with easy words”
- “long text documents which I want to get a feel for and get a summary of contents in as short a time as possible”

The person who had not yet tried it, envisaged using it for “ providing a quick overview of long documents to provide an indication as to whether it was worth reading in part or in full. It would be useful for quick browsing of circulars, newspaper articles and information on the Internet”.

It was evident that the users and the potential user, had high expectations of the system. When users put it to the test, however, they were disillusioned. On the question concerning listening speed, three people listened at the same speed as they normally listen to Hal, one commenting that “ fiddling with other settings would lose its benefit”. One person listened at a slower setting than usual, and the potential user foresaw a slower speed. One suggested that “it would be interesting to compare fast Hal (faster than a user’s default) to Hypermode and a good (= better) Hypermode”.

In their comments about possible improvements, one user was “reluctant to further complicate Hal or expend more base memory ...for a feature so rarely used”; another indicated that the word list should be revised as it currently “ leaves too many words in and takes the wrong ones out”; the third also suggested “carefully choosing more words for filtering out”, perhaps experimenting with word shortening as well as word omission and some degree of customisation. He also indicated that software which summarises may be a preferable approach.

7.0 CONCLUSION

The project achieved its aims in the following areas:

- it identified words currently omitted by Hypermode
- it identified some linguistic criteria for word omission indicating apparent weaknesses in the current word list
- it compiled a revised word list and designed a program to implement it
- it established, through user testing that new Hypermode produces improved comprehension levels and greater time saving than current Hypermode but that both versions show a decrease in comprehension levels compared with non-Hypermode.

It also established that criteria such as the percentage of words omitted, the style and complexity of the texts and the degree of familiarity with synthetic speech do not consistently affect results in the expected way. However all results and conclusions must take into account the limited nature of the testing.

One of the purposes of this project - to establish whether Hypermode (current or revised) is a hindrance or a help to faster reading - remains only partially answered owing to the following factors:

There is no objective scale of reference against which to measure levels of understanding in order to establish at what point the system can be defined as a help or a hindrance.

It is unclear exactly what level of understanding is envisaged by Dolphin or expected by users. The Dolphin Apollo manual refers to 'skim reading'. This by definition means that any text will be only partially assimilated. This applies to visual skimming as well as audio skimming. On this basis the average levels of comprehension attained both by current Hypermode (63.24%) and by new Hypermode (78.21%) indicate that the system is effective.

If the aim of Hypermode is to facilitate reading at speeds similar of those of sighted readers, assimilating most of the text, neither current Hypermode nor new Hypermode attain that standard. Expectation of such high level comprehension would seem to be unrealistic as any system of word omission would disturb syntactical structure and reduce comprehension levels to some extent. The option of increasing reading speed by adjusting speed controls on the synthesizer would seem more appropriate in this case.

The 'human factor' is an important element in assessing the effectiveness of the system. The general opinion both of candidates tested and of Hal users contacted via the questionnaire was not favourable towards Hypermode. The experience of listening to 'mutilated' English was considered unpleasant and requiring too much effort. For some users this was partly due to the unfamiliar sound of synthetic speech, while others, familiar with synthetic speech, still considered that the time gained was not worth the effort involved. Often initial expectations seemed to be too high. It is open to question whether users would become accustomed, with time and perseverance, to the 'Hypermode language' and find it more acceptable.

7.1 Suggestions for further investigation

- Wider user consultation should be carried out to discover what type of system would be considered to be most useful. Perhaps a system that could summarise texts while leaving grammatical structure intact would be preferable (e.g. along similar lines to NetSumm (section 2.6)).
- It would be interesting to carry out tests comparing comprehension levels of visual skimming with audio skimming, also tests comparing comprehension levels using Hypermode with levels using higher speeds than normal on the synthesizer.
- As improvement of Hypermode has already been attained with a very limited linguistic analysis, further in-depth specialist research into this area may bring yet further improvements. Alternative methods of implementation such as Natural Language Processing would also need investigation, as would the psychological aspects of language comprehension.

- On a practical level, a simple but possibly helpful adaptation would be to provide different levels of word omission. Users could then progress to a higher level as they became accustomed to the concept. e.g. Level 1 could omit just the articles and some conjunctions and other word classes could be added at each stage.
- It would be useful for users to have more detailed information included in the manual regarding how Hypermode works and which words it omits. It may then be possible to provide some level of user customisation giving users the ability to add or take away words from the list.

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APPENDIX A

A SELECTION OF COMPLETED TEST ANSWER SHEETS

APPENDIX B
COMPLETED QUESTIONNAIRES

From: -----
Organization: My Organisation will improve.
To: SILVIA CRISTINA TANCREDI
Date sent: Thu, 25 Jul 1996 14:23:52 +0100 (BST)
Subject: Re: bcab Dolphin Apollo/Hal Users
Priority: normal

On 24 Jul 96 at 14:23, SILVIA CRISTINA TANCREDI wrote:

> 1. How long have you been using Hal ?

Since it was called PCREAD and PCREADA, 1987.

> 2. At what speed do you listen to text (1 to 10) ?

7.

> 3. Are you aware of the Hypermode feature ?

yes.

> 5. If you are aware of Hypermode but do not use it, why not?

Very dependent on what is being done, skim reading usually has a need to look at something in closer detail, time savings with the Hypermode feature can be lost looking for the specific bit for which absolute detail is required, phone number, email address, etc.

> 6. If you use Hypermode, do you use it frequently ?

Rarely, ok for getting the jist of something in a hurry, so long as the output program being used to display it, cooperates by requiring minimal key strokes to get the text read by HAL at all. i.e. Output through BIOS so save the need to press the alt-p screen-window commands.

> 7. For what type of texts do you use Hypermode ?

Anything for which a flavour of the text is enough, news headlines, summary reports, etc.

> 8. Do you listen to Hypermode at the same speed as you usually listen to text?

yes, fiddling with other settings would lose the benefit.

Speed settings vary with certain applications and these are integral details of the hal config file for that application. The higher level of detail needed for the application, the slower the speed tends to be. i.e. the "." perfect nature of programming would be at a slower speed with all

punctuation switched on, word processing could afford to be faster for proof reading but still have punctuation on, just reading can be as fast or a little faster with most punctuation off.

> 9. Do you have any comments about what is good or bad about Hypermode and how it could be improved ?

Unless this was a feature of the synthisiser, I would be reluctant to further complicate Hal or expend more base memory with additional filtering code, for a feature so rarely used. The way I use hal, I would like to have seen something more modular so that redundant features could be compiled out to save memory.

Note: I still use an old version (4.5F) that only works in base memory and is 100k when loaded. The machine barely remains operable with larger modern software with such an imposition.

> 10. Would you mind if I contacted you again as my research progresses?

Ok, so long as it isn't seen as an assurance of commitment of time and effort in interviews, reports or the like.

Date sent: Thu, 25 Jul 1996 11:03:03 -0500 (EST)
From: -----
Subject: bcab Dolphin Apollo/Hal Users
To: SCT101@msc.cs.york.ac.uk

1. How long have you been using Hal?

I have used hal for 2years

2. At what speed do you listen to text (1 to 10) ?

6

3. Are you aware of the Hypermode feature ?

yes

4. If you are not aware of it, is it something which you might try?

5. If you are aware of Hypermode but do not use it, why not?

I found it to stressful.

6. If you use Hypermode, do you use it frequently ?

No

7. For what type of texts do you use Hypermode ?

Only plane texts containing nothing but easy words.

8. Do you listen to Hypermode at the same speed as you usually listen to text?

No, slower.

9. Do you have any comments about what is good or bad about Hypermode and how it could be improved ?

No

10. Would you mind if I contacted you again as my research progresses?

No.

From: -----
Subject: Re: bcab Dolphin Apollo/Hal Users
To: SCT101@msc.cs.york.ac.uk (SILVIA CRISTINA TANCREDI)
Date sent: Wed, 24 Jul 1996 15:34:56 +0100 (BST)

1. How long have you been using Hal ?

Since 1990.

2. At what speed do you listen to text (1 to 10) ?

7.

3. Are you aware of the Hypermode feature ?

Not until now.

4. If you are not aware of it, is it something which you might try?

yes.

5. If you are aware of Hypermode but do not use it, why not?

6. If you use Hypermode, do you use it frequently ?

7. For what type of texts do you use Hypermode ?

whilst I do not use it yet, I would envisage using it for providing quick overview of long documents to provide indication as to whether it was worth reading in part or in full. Would be useful for quick browsing of circulars, newspaper articles, and information on the Internet.

8. Do you listen to Hypermode at the same speed as you usually listen to text?

I suspect that I would listen at a reduced speed, say, 5.

9. Do you have any comments about what is good or bad about Hypermode and how it could be improved ?

an interesting question, i'd love to know about the response you get on this one. But I would say, in its favour, that this sort of feature would be rather 'tricky' for braille output!!

10. Would you mind if I contacted you again as my research progresses?

no.

Date sent: Mon, 5 Aug 1996 15:21:00 +0100
From: -----
To: sct101@msc.cs.york.ac.uk
Subject: Questionnaire on Hyper Mode

1. How long have you been using Hal ?

for 8 years

2. At what speed do you listen to text (1 to 10) ?

speed 7, sometimes 8

3. Are you aware of the Hypermode feature ?

yes

4. If you are not aware of it, is it something which you might try?

na

5. If you are aware of Hypermode but do not use it, why not?

na

6. If you use Hypermode, do you use it frequently ?

very rarely

7. For what type of texts do you use Hypermode ?

long text documents which I want to get a feel for quickly and get a summary of the contents in as short a time as possible

8. Do you listen to Hypermode at the same speed as you usually listen to text?

yes

9. Do you have any comments about what is good or bad about Hypermode and how it could be improved ?

I once heard Paul Blenkhorn, the creator of the dolphin apollo system talking about Hyper Mode. He said that the words that are not spoken in Hyper Mode had been hand selected, that is he had chosen the words rather than using a piece of program code to pick them out using some algorithm such as words less than 4 letters. This information encouraged me to use Hyper Mode, since I felt happier that the words had been selected using human rather than

computer judgement, (I might mention that this is not because I am new to computers, the reverse in fact is true as I have used them now for 21 years, and for this sort of word filtering task, I would rather trust an intelligent human any day).

As far as improving Hyper Mode is concerned, I am not sure you can get much further using exactly the same approach, though carefully choosing more words for filtering out may help. Of course improved speech quality will always allow you to listen back to any words faster as well. A few other ideas you might consider are:

- a) Perhaps having application specific Hyper Mode word filters, particularly where specific long words occur frequently in a given application or context
- b) Try word shortening in addition to leaving words out altogether. That is, see if leaving out say the middle parts or particular endings of long words can be done without losing meaning. This clearly needs experimentation to see whether it can work in practise.
- c) Giving the user the ability to specify their own word filter dictionary, so that if there are particular words they want to be ignored or shortened they can specify them as part of the speech environment.
- d) I think to get any really significant improvement what you require is a somewhat different approach, for example, to develop software which can provide some sort of document or paragraph overview so that the user can perhaps avoid having to pass through whole sections of text. The availability of the HTML document specification standard should help in the construction of this software. Such software may already exist. The sort of thing I have in mind is something that would allow you to read the first say 3 lines of each paragraph and decide whether you want to read more of that paragraph or to skip to the next or previous one. Similarly the software could provide a menu of the main headings and/or subheadings of a document, or search specifically for sections called "abstract", "summary", "conclusions" etc. Once more the ability to configure the document filter to particular formats found in users' applications may be helpful.

10. Would you mind if I contacted you again as my research progresses?

Certainly not, I lecture and research in the area of HCI myself and would be delighted to help further, particularly if we might establish some proper collaboration, though I appreciate that may be tricky in the timescale you probably have, I do have access to some other visually impaired Hal users. . If you happen to know or be working with Alistair Edwards, please pass on my regards to him, . I do not know him very well but we have met on a number of occasions. My contact information is as follows:

From: -----
To: SCT101
Date Sent: Wed Aug 28 15:51:48 1996

1. How long have you been using Hal?

Since 1989

2. At what speed do you listen to text (1 to 10) ?

7

3. Are you aware of the Hypermode feature ?

yes

4. If you are not aware of it, is it something which you might try ?

5. If you are aware of Hypermode, but do not use it, why not?

Because it doesn't work. It is possible to comprehend the text but very hard work.
Hypermode should be a short-cut, an easier method to read some text. It leaves too many words in and takes the wrong ones out.

6. If you use Hypermode, do you use it frequently ?

7. For what type of texts do you use Hypermode ?

It should be good for e-mail, novel material, manuals etc

8. Do you listen to Hypermode at the same speed as you usually listen to text?

It would be interesting to compare fast Hal (faster than a user's default) to Hypermode and a good Hypermode.

9. Do you have any comments about what is good or bad about Hypermode and how it could be improved ?

It could be improved by making it better. It probably needs to be too clever to ever really work properly. However, it does need to take lots more words out.

APPENDIX C
PASCAL PROGRAM LISTINGS

A PROGRAM USED TO TEST CURRENT HYPERMODE

program Hyper1 (input,output) ;

{This program allows a user to repeatedly enter the names of different text files. These are read character by character printing each character out. }

type

chfile = file of char;

var

c, answer : char;

source: chfile;

sourcefile: string; *{the text file name entered by the user}*

begin {Hyper1}

repeat

writeln ('Please enter the name of the test file');

readln (sourcefile);

assign (source,sourcefile);

reset (source);

while not eof(source) **do**

begin

read(source,c); *{reads each character from the file}*

write(c) ;

end;

writeln;

writeln;

writeln ('Do you want to try another test file ? Enter y or n');

readln (answer);

while (answer<>'y') **and** (answer<>'n') **do**

begin

writeln ('Please enter y or n');

readln (answer);

end;

until (answer = 'n');

end. {Hyper1}

A PROGRAM USED TO TEST NEW HYPERMODE

program Hyper2 (input,output);

{This program produces a new version of 'Hypermode' - a text reduction system that omits selected words. Firstly these words are read from a named file (using wordread unit). Each word is then entered into a hash table data structure (using hashing unit). The user can then repeatedly enter the names of different text files to be read. Each word is checked against the hash table (using hashing unit) and if not found is printed out. }

uses wordread, hashing;

const

rejectfile = 'c:\tp1\rejectwords.pas'; *{the file containing the words to be omitted}*

var

wd : a_word;

source, source2 :chfile;

sourcefile: string; *{the text file name entered by the user}*

ch, answer: char;

begin {Hyper2}

 assign (source,rejectfile);

 reset (source);

 hashinitialise; *{initialises each location in the table}*

while not eof (source) **do**

begin

 readwd(source, wd, punctmark, ch);

 hashinsert(wd); *{reads each word to be omitted and inserts it }*

end; *{into the hash table}*

repeat

 writeln ('Please enter the name of the file');

 readln (sourcefile);

 assign (source2,sourcefile);

 reset (source2);

while not eof(source2) **do**

begin

 readwd(source2,wd,punctmark, ch);

```

        if (hashsearch(wd) = -1 ) then readarray(wd) ;
            if punctmark then write (ch,' ');
            {if the last character that was read in readwd was a punctuation
            mark then it is printed out here after the word has been printed}
        end;

    writeln;
    writeln ('Do you want to read another file? Enter y or n');
    readln(answer);

    while (answer <> 'y') and (answer <> 'n') do
        begin
            writeln ('Please enter y or n');
            readln (answer);
        end;

    until (answer = 'n');

end. {Hyper2}

```

unit hashing;

{a unit that uncludes functions and procedures for the processing of hash table data structures - for initialising table values, for inserting and for searching. These functions and procedures have been adapted from ones found in Sedgewick,R.(1988) Algorithms, Addison-Wesley Publishing Company}

interface

uses wordread;

const

MaxTable = 211; *{the maximum size of the table}*

type

tabletype = array[1..MaxTable] of a_word;

index = 0..maxtable;

var

table: tabletype;

wd2:a_word;

procedure hashinitialise;

function hash(key:a_word): index;

procedure hashinsert(key:a_word);

function hashsearch(key:a_word):integer;

implementation

procedure hashinitialise;

{a procedure which will initialise each position in the table with 'xyz'.This is used to indicate a vacant position used when inserting or searching}

var i: integer;

begin *{hashinitialise}*

wd2[1] := 'x';

wd2[2] := 'y';

wd2[3] := 'z';

for i:= 0 **to** maxtable **do** table[i] := wd2;

end; *{hashinitialise}*

function hash(key:a_word):index;

{a function that computes the hash value for a specific word. It uses Pascal's ord function to convert each letter to an integer and multiplies it by its position in the word}

var

i,value: integer;

begin {hash}

i := 1;

value := 0;

while (i <= maxwordlen) **and** (key[i] <> ' ') **do**

begin

value := value + (ord(key[i]) * i);

i := i + 1;

end;

hash := value mod maxtable;

end; {hash}

procedure hashinsert(key:a_word);

{a procedure that inserts a word into the hash table. It firstly calls the hash function to compute the current word's hash value. It then checks the table at that position. If there is a word there (which isn't the current word) and the word present isn't 'xyz' then it moves on to another position in the table and checks again until the correct word is either found or 'xyz' is found indicating a space in which to insert the current word}

var

i:index;

begin {hashinsert}

i := hash(key);

while (table[i] <> key) **and** (table[i] <> wd2) **do**

begin

i := (i + 1) mod maxtable;

end;

if table[i] = wd2 **then** table[i] := key;

end; {hashinsert}

function hashsearch(key:a_word):integer;

{a function very similar to the hashinsert function except when the correct word is found it returns its position in the table to the main program, or if it does not find it, it returns -1}

var

i:index;

begin {hashsearch}

 i := hash(key);

while (table[i] <> key) **and** (table[i] <> wd2) **do**

begin

 i := (i+1) mod maxtable;

end;

if table[i] = key **then** hashsearch := i

else hashsearch := -1

end; {hashsearch}

end. {hashing unit}

unit wordread ;

{a unit that contains procedures to read characters from a file and insert letter or number characters into an array. It does this until a character is read which is neither a letter or number, or the end of the file is reached}

{Adapted from David Duke's readword procedures given in lectures and from my previous assignment for a Concordance Program}

interface

const

maxwordlen = 25; *{the estimated maximum length of words to be read}*
difference = 32; *{the difference in ASCII value between lowercase and uppercase}*
endline = 13; *{the carriage return character's ASCII value }*
punctuationSET = [33..34,36..41,44,46,58..59,63];
{the ascii code for ! " \$ % & ' () , . : ; ?}

type

a_word = packed array [1 ..maxwordlen] of char;
chfile = file of char;

var

wd1, wd3 : a_word;
letter, punctmark : boolean;
c: char;

procedure readwd (**var** f: chfile; **var** wd1: a_word; **var** punctmark: boolean; **var** c:char);
procedure readarray(**var** wd3:a_word);

implementation

procedure isletter (**var** c:char);

{a procedure that checks that a given character is a letter or number. It changes any uppercase letter to lower case and returns the resulting character back to the readwd procedure. It also checks to see whether the character is in the defined punctuation set and if so punctmark is returned as true to the main program}

begin {isletter}

punctmark := false;
letter:= false;

if (c in ['a'..'z']) **or** (c in ['0'..'9']) **then** letter := true
else
if (c in ['A'..'Z'])**then**


```

    begin
        c:= chr(ord(c)+ difference);
        letter := true;
    end
    else
        if (ord(c) in punctuationSET) then punctmark := true;

end; {isletter}

procedure readwd (var f: chfile; var wd1: a_word; var punctmark: boolean; var c:char);

{a procedure that reads a word character by character and stores it in an array. The estimated maximum word length is 25 characters, if words are shorter the extra locations are filled with spaces. }

var
h,i : integer;
done, found: boolean;

begin {readwd}

found := false;
done := false;
i := 1;

while not eof (f) and not found do
{it reads characters from the file until it finds a letter which is then assigned to the first location in the array}

    begin

        read (f,c);
        isletter(c);
        if letter then
            begin
                wd1[i] := c;
                found := true;
            end
        end

    end;

while not done and (i<maxwordlen) do
{while there are still more letters/numbers in the word}

```

```

begin

    if eof(f) {ie and the end of a word} then done := true
    else
        {otherwise it reads more characters in, checks they are letters/numbers and adds them to the array}
        read(f,c);
        isletter(c);
        if letter then
            begin
                i := i + 1;
                wd1[i] := c;
            end
        else
            {if the character is not a letter then it is assumed that the word has finished so done is set to true}

            done := true;

        end;

    for h := i+1 to maxwordlen do wd1[h] := ' '
    {the rest of the array is filled in with spaces}

end; {readwd}

procedure readarray( var wd3:a_word);
{a procedure that reads the contents of the array in which the word has been stored and prints it, not including any empty spaces at the end}

var
j :integer;

begin {readarray}

    j := 1;
    while (j <= maxwordlen) and (wd3[j]<>' ') do
        begin
            write (wd3[j]);
            j := j + 1;
        end;

    write(' ');

end; {readarray}

```

end. *{readword unit}*

APPENDIX D