CHAPTER THREE
DESCRIPTION OF THE STUDY

3.0 Introduction

In chapters one and two we discussed the theoretical underpinnings of this study. In chapter one we reviewed various theories that attempt to explain the process of reading comprehension and the reader and text factors involved in the interactive processing of text. In chapter two we revisited these theoretical perspectives vis a vis hypertext comprehension processes. In this chapter we will present how this researcher attempted to explore the hypertext comprehension processes of ESL readers and the roles played by reader factors and text factors in determining levels of comprehension achieved from various text types. Before that we will discuss the rationale and aim of the study and detail how it was designed to explore the various issues addressed.

3.1 Rationale and aim of the study

Reading theories discussed in chapter one inform us that adequate levels of language, availability of relevant prior knowledge and text factors like linearity and presence of coherence cues facilitate interactive processing of texts resulting in high levels of comprehension. We also saw that in the case of reading in a second language too, levels of language competence demonstrated determine levels of reading comprehension achieved (Linguistic Threshold Hypothesis, see section 1.6.1). Proficiency in language also facilitates comprehension in readers when reading unfamiliar texts: language skills help identify and make use of appropriate text cues employed and thus build up the required background knowledge using associative mechanisms (see section 1.5.1). Evidently, all these viewpoints recognize high levels of language competence as an indicator of successful reading comprehension, thereby sidelining issues related to language deficiencies that can be a part of any ESL setting. This research seeks to address this issue from a hypertext reading perspective.
As seen in chapter two (see section 2.2) hypertext reading is different from print reading since hypertexts lack many of the print text factors that readers rely on for successful comprehension viz., lack of an author-specified order, irretrievability of content, and availability of multiple reading aids. Research with self-navigating hypertexts – the type of hypertext that best promotes interaction between reader and text due to its fragmented nature – also upholds findings from research with print texts, that high language competence is essential for achieving good levels of hypertext reading comprehension. Research has shown that reader factors like high levels of language and availability of relevant prior knowledge can compensate for the lack of text factors like cohesion and coherence. Moreover, researchers (Hofman and van Oostendorp, 1999; Potelle and Rouet, 2003) have suggested that comprehension deficits bound to occur due to a lack of prior knowledge can also be overcome with self-navigating texts that demonstrate absence of text factors, typically held to be advantageous for reading comprehension. Thus, hypertext reading research proves that high language competence can compensate for absence of both text linearity and prior knowledge. Supporters argue that self-navigating hypertexts facilitates inferential reading and construction of situation models by providing readers access to additional information and supporting meaning-making by allowing reader-control over reading order and amount reading.

For the ESL researcher this has immense implications: as research with native or fluent users of English seems to suggest, do self-navigating hypertexts facilitate deep comprehension in ESL readers with varying levels of linguistic competence? This is one of the chief concerns of this study.

With the reach that the internet enjoys, more non-native users of English than native users use the electronic medium for information acquisition, thus admitting readership of hypertexts among a wide variety of readers characterized by three types of comprehension deficits: inadequacies in L2 (here English) proficiency, non-availability of prior knowledge, or both. A second concern of this research is whether hypertexts have the potential to help overcome these deficits. This researcher attempts to investigate whether subjects are able to overcome their comprehension limitations when they read types of hypertexts, and based on a comparison of comprehension
outcomes she tries to identify hypertext features that may affect reading comprehension.

Hypertext features studied are features of texts commonly found on the internet (i) linear texts: characterized by a pre-determined reading order and retrievable content, but no linked reading aids (ii) pre-structured texts: characterized by a pre-determined reading order and reading aids but irretrievable content, and (iii) self-navigating hypertexts: characterized by no pre-determined reading order and retrievable content, but reading aids.

Questions addressed by this exploratory study are:

1. Can self-navigating texts promote better comprehension in ESL readers with high L2 and high prior knowledge?
2. Can any hypertext type help ESL readers overcome L2 and/or prior knowledge deficits?

And to enable a richer and comprehensive description of the various processes involved in successful hypertext comprehension, we also seek to answer other questions like

3. What are the various reading strategies used by ESL readers with high language competence while reading hypertexts?
4. What are the various reading strategies used by ESL readers with low language competence while reading hypertexts?
5. Is there a difference in reading strategies used in the pre-structured and self-navigating hypertexts?
6. What are the various navigating strategies used by ESL readers of hypertexts? Is this dependent on language levels or availability of prior knowledge?
7. What are the various link types that promote successful reading of hypertexts?
3.2 Nature of the study

Denzin and Lincoln (2000) point out that exploratory case studies are of use especially when researching into territories not ventured into before. This researcher is not aware of any studies that have attempted a detailed and comprehensive observation of hypertext reading comprehension by ESL readers. Therefore, it was felt that it would be most appropriate to locate the methodology of the study in the exploratory research paradigm. Exploratory case studies thus help open up new areas for research by throwing light on factors that might influence a process and variables that might affect a product, thus helping us form hypotheses (Miles and Huberman, 1994). The results of this research could contribute to a better understanding of the reading strategies, navigating strategies and links used by successful ESL hypertext readers and the various text factors and reader variables that play significant roles in determining hypertext comprehension. This could help set parameters and identify issues for further research or for further investigation by conducting a large-scale research.

A second advantage of the exploratory methodology is that it is most beneficial when a researcher attempts only a description of processes involved and does not control the phenomenon in anyway. This was precisely the intention of this researcher too: observe ESL readers access authentic hypertexts for information acquisition to explore the roles of various reader factors and multiple text factors. However, as discussed at the end of the previous section, certain guiding questions that helped probe the area were formulated to focus and facilitate the exploration. With the help of these questions, individual readers were observed and processes and outcomes of comprehension assessed in detail. (Since the study was exploratory in nature, it was possible to observe only twenty four subjects within the timeframe available.)

Since the study is exploratory in nature it employs a largely qualitative mode of data analysis. However, quantification of data has also been attempted wherever possible using appropriate statistical tools in order to validate the various qualitative observations made. And, in order to illustrate and validate observations made regarding types of texts and reading activities that promote comprehension we will also present inputs from some of the more representative samples.
3.3 Design and scope of the study

As mentioned, this study was conducted to observe the interaction-effects of reader factors and text factors in hypertext comprehension. Reader factors studied were levels of language competence and levels of topic familiarity. For this, based on their scores in IELTS test, subjects of this study were grouped into two: readers with high (HL2) and low levels (LL2) of English proficiency. To study the effects of availability of prior knowledge, subjects were asked to read texts that dealt with familiar topics (high prior knowledge, hpk) and unfamiliar (low prior knowledge, lpk) topics. And, to study the effects of text variables, each reader was asked to read two print texts, (PR - to assess the effects of availability of author-determined order of reading), two pre-structured hypertexts (PS - to determine the influence of pre-determined order and presence of comprehension aids), and two self-navigating hypertexts (SN - to observe how a lack of structure and availability of comprehension aids support comprehension processes). One text in each mode of presentation dealt with a topic familiar to the subjects and the second one with an unfamiliar topic.

So the structure of the design is

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High L2 (HL2)
   /   \
Familiar (hpk)   Unfamiliar (lpk)
   /     \                     /     \\
Self-navigating  Pre-structured  Self-navigating
(SN)    (PS)                 (SN)
   /     \
Print  Pre-structured   Print  Pre-structured
(PR)   (PS)             (PR)   (PS)
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The same pattern was followed with low L2 (LL2) readers too.
While reading each text, each reader was asked to verbalize his thoughts using a think-aloud protocol (for details see section 3.6.1). This was followed by a retrospective interview, after which they were asked to produce a free recall of text content, and finally attempt a summary task.

As detailed in section 3.1, the intention was to determine which text type would benefit each reader type by helping them best overcome their comprehension deficits. Reading strategies, navigating strategies, and nature of links selected were also identified to draw a detailed and accurate understanding of the nature of comprehension processes employed while reading each text type. Data is therefore analysed to look at: 1. Levels of text representation, 2. Reading strategies, 3. Navigating strategies, and 4. Number and types of links used.

Issues addressed under each section are listed below:

1. **Levels of text representation**

   Do ESL readers with high prior knowledge and adequate language competence comprehend self-navigating texts better than pre-structured texts?

   Are self-navigating texts capable of helping readers with high language competence overcome their prior knowledge deficits?

   Do text types help overcome deficits in L2 and/or prior knowledge levels?

2. **Reading Strategies**

   Are reading strategies used for comprehension in the print and electronic modes different?

   Are the reading strategies used by HL2 and LL2 different?

3. **Navigating Strategies**

   Is there a good navigation pattern that can help overcome language or prior knowledge deficits?

4. **Links Used**
Does number of links selected determine the amount of information recalled?
Do types of links selected determine the quality of information recalled?
What links are useful for overcoming prior knowledge and language deficits?

3.4 Texts used

Since this study aimed at capturing the effects of text factors on the comprehension processes of ESL readers with comprehension deficits, three text types commonly found on the internet were identified for data collection: (i) Texts in the linear, static mode (administered as print texts), (ii) Texts in the pre-structured electronic mode, and (iii) Texts in the self-navigating electronic mode.

Linear texts were administered in the paper mode to observe how use of strategies could vary when the medium of representation is paper, for instance to observe specifically the use of study strategies like underlining and compare the alternative strategies used by the same reader while reading in the electronic mode.
As earlier mentioned (see section 3.1), the text characteristics intended to be observed were availability of a pre-determined structuring of text content and built-in comprehension support aids. Linear print texts have an author-determined path, pre-structured texts possess a pre-determined structure and also make use of built-in reader supports, while the self-navigating texts lack a pre-determined reading order but make use of linked comprehension supports.

3.4.1 Identification and mode of analysis of texts

In this section we detail how we identified texts for conducting data collection. Since one of the issues explored by this study was the effect of prior knowledge on comprehension processes and outcomes, a topic familiarity questionnaire was used to decide texts that were familiar and unfamiliar for the subjects. The Flesch-Kincaid Readability score was used to ensure that all texts chosen were more or less at the same level of difficulty.
Topic familiarity questionnaire

Since familiarity of text content, i.e., the availability of prior knowledge, was one of the variables studied, a questionnaire (reproduced in Appendix II A) was designed to help the researcher select texts that could be used for assessing processes of comprehending familiar and unfamiliar texts in three modes of presentation, viz., print, pre-structured, and self-navigating. The researcher chose fifteen texts from the internet that had the same rating in their reading difficulty levels (discussed in detail in the following section) some of which were familiar and some unfamiliar. Since all the subjects were from a similar work background, familiar topics were those that were related to their area of work and unfamiliar texts were identified by taking into consideration subjects’ educational backgrounds and area of expertise. Texts that have interesting content that might appeal to subjects despite being unfamiliar were finalised. (The first few lines from the opening paragraphs of each text were also inserted to help readers gain the context of each topic.)

The questionnaire was divided into three parts with topics being listed based on the text types they occurred in: print mode, pre-structured mode and self-navigating mode. Readers were asked to mark topics that were familiar and unfamiliar for them in each part. Based on subjects’ ratings of topics, the texts selected for each mode are as follows:

**Print**

Familiar: *What Are Business Rules?*

Unfamiliar: *Fatal anaphylactic reactions to food in children*

**Pre-structured**

Familiar: *Improving the Accessibility of Your Web Site*

Unfamiliar: *Reading: a cognitive process*

**Self-navigating**

Familiar: *Web development*

Unfamiliar: *Politexts, Hypertexts, and Other Cultural Formations in the Late Age of Print*

(See Appendices I - A1 to I - C2 for reproduction and description of texts used)
Difficulty levels of texts chosen

The six texts used for actual collection of data were comparable in reading difficulty levels: all were found to have a readability level between 9 and 10 on the Flesch-Kincaid scale. The Flesch-Kincaid Readability Score is part of the best-known readability scores that measure how easily an adult can read and understand a text. Readability scores are good predictors of the level of difficulty of documents, particularly technical ones. The Flesch-Kincaid Readability Score analyzes and rates texts on a U.S. grade-school level based on the average number of syllables per word and words per sentence. For example, a score of 8.0 means that an eighth grader can comprehend the text. Considering that standard writing falls between seventh and eighth grade, a Flesch-Kincaid score between 7.0 and 8.0 is generally considered easy reading.

After much deliberation, several viewpoints were considered while deciding an appropriate level of reading difficulty of texts to be used for this study. A large number of technical sites that were assessed by this researcher during the process of identifying and finalizing sites for actual conduct of data collection were found to vary between 7 and 12 on the Flesch-Kincaid readability score. An assessment of technical texts that were read and expected to be read by the subjects as part of their work requirements ranged between 9 and 11.

All the subjects selected for the study had graduation as a minimum educational qualification. According to the Flesch-Kincaid scores, readers at that level are expected to understand texts of a difficulty level of 12. However, US national literacy surveys indicate that many students read "below their grade level": the average adult reads at the 8th grade level and college graduates at the 10th grade level (DuBay, 2006). Keeping in mind all these factors and that all the subjects of this study are ESL readers, a range of 9 – 10 was fixed as the readability level for texts chosen for the study.

Given below is the web address and readability score of each text:
Print, familiar: *What Are Business Rules?*
*Flesch-Kincaid Readability Score: 10*

Print, unfamiliar: *Fatal anaphylactic reactions to food in children*
http://www.cps.ca/english/statements/AL/al94-01.htm
*Flesch-Kincaid Readability Score: 9*

II. Pre-structured, familiar: *Improving the Accessibility of Your Web Site*
http://www.w3.org/WAI/impl/improving
*Flesch-Kincaid Readability Score: 9*

Pre-structured, unfamiliar: *Reading: a cognitive process*
http://everything2.com/index.pl?node_id=1540719&lastnode_id=0
*Flesch-Kincaid Readability Score: 9*

III. Self-navigating, familiar: *Web development*
http://www.december.com/web/develop.html
*Flesch-Kincaid Readability Score: 9.5*

Self-navigating, unfamiliar: *Politexts, Hypertexts, and Other Cultural Formations in the Late Age of Print*
*Flesch-Kincaid Readability Score: 10*

Print texts were given on paper while the other four texts were read online. They were read by the subjects the way they appeared on the internet with the promotional banners, advertisements, links to other related sites, search boxes, dictionaries, colourful borders, etc. This was to ensure that the subjects read authentic texts in natural settings with all the extra details and distractions involved.

Since none of the subjects asked for any preferred order of reading texts, the researcher administered them in the following order: print familiar, print unfamiliar,
When analysing data derived from reading of texts, some researchers feel a propositional analysis of texts would be a useful framework to work with. However, based on their experience, Heeter et al. (1997) point out that a propositional analysis of texts provides a degree of detail that is unnecessary to determine comprehension and as observed by this researcher not very feasible with linked texts that have no fixed boundaries. Counting the occurrence of individual facts in texts to verify their appearance in readers’ mental models turned out to be a mammoth task and hence alternate ways of coding without losing useful results were looked at.

Since all facts in any text do not hold equal significance and comprehension of concepts rather than merely decoding various parts of sentences are primary concerns of reading researchers (Singer et al., 1996), it was decided that significant ideas in each text will be ascertained. So rather than coding every piece of text proposition, central ideas in each paragraph were identified. As LaBerge and Samuels (1974) point out, recall of more facts does not produce more learning, but nature of facts recalled is a valid indicator of good learning, and therefore, free recalls and summaries were scored for the presence or absence of these ideas identified.

Central ideas were identified by first determining the pausal units in each text. Pausal units are defined as a unit that has a "pause on each end of it during normally paced oral reading," (Bernhardt, 1991, p. 208). Total number of pausal units in each print text and the number of units in the first page of electronic texts were identified by the researcher by reading out the texts aloud and marking the pauses made. Significant ideas among these were then identified. Thus, the total number of idea units, as well as the main ideas and supporting details in each text was determined by the researcher and confirmed by a second rater, an English teacher teaching in one of the universities in Hyderabad. All disagreements were sorted out and a consensus reached between the researcher and the second rater before the lists of idea units and significant ideas were finalized. In addition, since neither the researcher nor the second rater was an
expert in topics familiar to the subjects, main ideas and supporting details identified in these texts were also given to a subject-specialist for verification.

Appendices I A1 to I C2 show details of text analysis: the total number of idea units, and main ideas and supporting details in each text.

3.5 Subjects for the study

For this study, twenty four adults who were all non-native users of English were selected. Subjects were working as technical writers, coders and testers, software engineers, software trainers and usability experts in the IT sector. These twenty four subjects were further subdivided into two groups based on their language proficiency – one group with high proficiency in English (HL2) and the other with low proficiency in English (LL2) (for details see section on Background information questionnaire below).

The following tools were used to help determine group characteristics and also categorization of subjects:

Background information questionnaire
Hypertext domain expertise questionnaire

a. Background information questionnaire

This questionnaire (see Appendix II B) was used to identify individual reader characteristics in order to group the subjects, and also draw group profiles based on reader responses. Purposes of items that appear in the questionnaire are described below:

Item number 1. Educational qualification: Educational qualification was a factor considered for selection of subjects – all subjects had to be graduates or above. The questionnaire reveals that fifteen subjects were graduates and nine were post graduates with most of them qualified in IT-related education. There were eight
subjects who were educated in non-IT areas like English Literature, Economics, Physics, and Business Administration.

IELTS/TOEFL scores: Since this research was designed to be conducted with two groups of readers, one with high proficiency in English (HL2) and another with low proficiency in English (LL2), scores received in these standard tests of English proficiency were considered for grouping of subjects. TOEFL scores were also considered for selection of subjects since it was not possible to get a homogenous group (Graduate IT professionals working in similar areas and with good hypertext expertise) who had cleared the IELTS examination. Conversions from TOEFL to IELTS were done based on:
http://www.shef.ac.uk/eltc/useful/toefl_ielts.html#toefl/ielts

Item number 2. The purpose of this item was to find subjects working in similar areas so that identification of text topics familiar and unfamiliar would be easy for the researcher. The intention was to reduce the number of texts used for the study. Further, subjects had to be uniform in their level of expertise in their work areas – only those with 5 to 10 years of work experience were considered for the study again to assure homogeneity among subjects selected.

Item number 3. Details regarding knowledge and use of computers: The purpose of item number 3 was to determine subjects’ familiarity in reading on and writing with computers.

All subjects reported a ‘Fairly well’ or ‘Very well’ response to familiarity with computer technology. They all mentioned having access to personal computers, using computers for more than 5 years, working on computers for 10 to 16 hours a day, and reported ‘often’ or ‘very often’ using a computer for reading and writing for work purposes, creating and HTML document, and writing for personal communication. However, all subjects pointed out that though they follow news on the internet, they ‘rarely’ or ‘sometimes’ read for pleasure using the computer. All of them agreed that reading novels, stories and poems was better on paper/book because such reading is “for relaxation” and “resting” and hence was best done “... lying down”.

96
Item number 4 was designed to initiate readers to start thinking about reading and writing using computers. Since during the course of the study they were expected to talk and comment on what/how they felt reading on paper and computer, this was considered a good beginning.

b. Hypertext domain expertise questionnaire

This questionnaire, adapted from Kellogg (1999), (see Appendix II C) was also administered before the beginning of the research to help the researcher in selection of subjects for the study. Since we planned to observe the reading behaviour of expert hypertext readers, the study required to use only subjects who have been reading hypertexts for five years or more. The intention was to establish hypertext domain expertise and availability of format schemata – a factor seen as contributing to effective hypertext comprehension in earlier researches (see section 2.6.2). Thus this questionnaire complemented item number 3 in the background information questionnaire and ascertained subjects’ expertise in reading with electronic texts and their familiarity with reading on paper texts.

Most items remain the same as in their original version (by Kellogg, 1999), except for the deletion of 3 items that were not relevant for this study. However the answer choices for all items were modified: the original asked readers to mark the amount of time spent reading on screen and on paper (the choices were 0-19%, 20-39%, 40-59%, 60-79%, 80-100%). However, since this research did not require such detailed division of time spent reading various modes readers and also since readers with low English proficiency found it difficult to comprehend these response choices, they were changed to Most of the time, Sometimes, Rarely, and Very rarely. Items numbered 4 and 5 had an option called ‘no opinion’. This also posed some confusion with some rephrasing it as ‘no comments’. Therefore this answer choice was deleted. Answer choices given for items numbered 6, 7, 8 and 9 (strongly agree, agree, no opinion, disagree, strongly disagree) were also changed to True, Sometimes true, and Not true at all again due to low L2 readers’ inability to understand choices and correlate them with items.
Both HL2 and LL2 readers showed a preference for reading online: all readers commented that ‘most of the time’ or ‘sometimes’ they read on screen (item no. 1), and ‘sometimes’ they read on paper (item no. 2). Though most readers pointed out that it is easier to read on paper (items no. 4 and 5), everyone preferred to read on screen (item no. 3). When further questioned these respondents claimed that paper is “easy on the eyes” and “you can lie down and read” and therefore easy to read. On the other hand they preferred to read on screen since this was “easily available in office, you don’t have to carry it around,” “more updated information is available” and “you get a lot of help by visiting other sites and all the links.” Perhaps this is also why all of them also marked “true” and “sometimes true” for understanding more information while reading on-screen (items no. 8 and 9). However for items no. 6 and 7 there was no consensus: most LL2 readers said they remembered more information while reading on paper (9 out of 12) and most HL2 said the medium does not matter (11 out of 12).

3.5.1 Group profiles of subjects of the study

Readers with high language proficiency (HL2)

There were eight males and four females in the age group of 25 – 40 in this group. (For purposes of data collection and analysis, these readers have been identified as RA, RB, RC... RL.) Seven subjects were graduates and five were post graduates with 5 – 10 years’ experience of reading hypertexts for various purposes. These subjects also scored IELTS bands ranging from 6.5 to 8 since a minimum score of 6 is considered sufficient for admission to studies in many universities in English speaking countries. (For detailed explanation of IELTS bands, see Appendix V). Corresponding scores in TOEFL were between 575 to 680 in the TOEFL paper mode and 232 to 300 in the TOEFL computer mode. All except one reader in this group (referred to as HL2 henceforth) had scores ranging from 6.5 to 7.5; one of them had a band 8 which was the highest in this group. So, these were language users who were classified by IELTS, (a standard English language proficiency assessment exam) as ‘competent’ and ‘very good’ users of English.
Readers with low language proficiency (LL2)

There were ten males and two females in the age group of 29 – 40 in this group. (For purposes of data collection and analysis, these readers have been identified as Ra, Rb, Rc... Rl.) Nine subjects were graduates and three were post graduates with 7 – 11 years’ experience of working with texts on the internet. IELTS bands received by these subjects were between 3.5 and 5. Corresponding scores in TOEFL are: 425 – 500 in TOEFL paper mode and 113 – 173 in TOEFL computer mode. Ten subjects of this group had scores ranging from 4 to 5 and two in this group had a band of 3.5 which was the least in this group. These are readers who are characterised by IELTS as ‘extremely limited’ in gaining text meanings to ‘modest’ users of English. Description of reading ability demonstrated by readers in this group according to IELTS band descriptors points out that these readers are able to comprehend only the overall meaning of texts and that too of familiar texts. However, a ‘modest’ user, i.e., one with a band 5, might be able to gain overall comprehension of unfamiliar texts too

3.6 Tools used

Since the study aimed at capturing the comprehension process and estimating the comprehension levels achieved by various reader groups reading different text types, the following research tools were used to access their comprehension processes and assess reading outcomes:

The think aloud protocol
Metacognitive response sheet
Retrospective interviews
Free recalls
Distractor tasks
Summarizing task

3.6.1 The think aloud protocol

The think-aloud protocol (TOL) provides researchers direct access to readers’ thought process. In this study it helped understand the level of comprehension achieved by each reader while reading each text type, and also provided insights into the nature of
reading strategies used. Thus, data from the TOL protocol was a valuable guide that helped us decide the text type that promoted deepest comprehension.

During the think-aloud protocol subjects are asked to verbalize their understanding of each sentence in relation to the rest of the text. This is then recorded. In this research too, subjects were asked to do a think-aloud after every sentence or if this was found too intrusive and distractive, after 2 – 3 sentences. Ideally there is no need for a mediator. However, some readers might require prompting to voice their thoughts and hence in this study, the researcher was present during all the sessions.

In reading comprehension, think-aloud protocols have been used by many researchers for multiple purposes: to show online causal inferences, reveal the contents of working memory, investigate the relationship between memory and inferences, and assess whether a coherent situation model is being constructed (Zwann and Brown, 1996). According to Bernhardt (1991) think aloud protocols are acceptable determiners of reading comprehension and "provide a purer measure of comprehension, uncomplicated by linguistic performance and tester interference" (p. 200). Since post-reading comprehension checks alone may not be able to assess readers' ability to generate a coherent understanding of the text accurately, some researchers (Myers, 1990) point out that while-reading measures of comprehension like the TOL protocol that accesses reading processes and demonstrate integration of text during reading, if any, along with post-reading measures may provide a more comprehensive measure of comprehension.

Ericsson and Simon's (1984) instructions to subjects in think-aloud experiments were modified and adapted for this study. The instructions given by this researcher were "In this experiment we are interested in what you think about when you read a text... In order to do this I am going to ask you to think aloud as you go along reading. What I mean by think aloud is that I want you to tell me everything you are thinking from the time you first see the text until you think you have completed reading the text". Following Rikard and Langley's (1995) advice that adequate introduction to the think-aloud process should be given to subjects, each subject was given practice in the TOL protocol using two linear texts (on paper) and two non-linear texts (on computer).
The following texts were used for developing practice in using the think-aloud protocol:

1. *Introduction to Instructional Design and the ADDIE Model*
   http://www.e-learningguru.com/articles/art2_1.htm

2. *Animals have complex dreams, MIT researcher proves*

3. *Management education*
   http://tip.psychology.org/manage.html

4. *Dolphins, as a form of alien intelligence*
   http://www.daviddarling.info/encyclopedia/D/dolphins.html

5. *On alien abduction*
   http://www.skepdic.com/aliens.html

Texts 1 and 2 were printed and administered in the paper format while the other three were read online.

Observing readers using the think aloud tool, this researcher saw that it was difficult for readers with low proficiency in English to do a TOL in English. She attempted encouraging subjects to do their TOL in their mother tongue if they felt comfortable in it. However, except for a few sentences and words, not many did their TOL in their mother tongue. Analysing the TOLs it was evident that generation of surface clauses in English seemed effortless, but production of textbase clauses and situation clauses seemed difficult in English to some extent. These were generated after some deliberation; evidently participants were exerting for language required for performing the TOL. I am not sure of the implications involved here: if loss of spontaneity affects the quality of clauses generated or if the need to produce a TOL affected the nature of clauses generated.
Yet another problem was that, in spite of practice using the TOL protocol, some readers continued to need intrusive guidance to verbalize their thoughts and hence a metacognitive response sheet was provided as a prompt.

### 3.6.2 Metacognitive response sheet

This was given to the subjects as an aid to do the TOL protocol (Appendix III A). The response sheet was presented in two parts: the prompts in the first part were to be used while reading print texts and both parts were to be used while reading electronic texts. Inputs from the second part were expected to give insights into why a reader clicks a link. The prompts mentioned were only to function as guides to formulate and verbalize readers' thought process and not be answered item by item every time they did a TOL.

Item number 1 was expected to reveal subjects' comprehension processes and provide direct access to reading strategies used. Items numbered 2 and 3 revealed the role of prior knowledge: how availability of prior knowledge can help comprehension and what readers resort to when there is non-availability of prior knowledge. Most importantly, these items were designed to also determine if some readers are unable to summon relevant prior knowledge while reading text familiar to them.

Part 2 of the response sheet was designed to gain insights into the types of links chosen by various readers. This would also tell us why a reader visits or does not visit a link, link contents that prove most useful in aiding comprehension of familiar and unfamiliar texts and types of links that are least helpful. The TOL produced would also reveal reader decisions that go into selecting a link. Item numbered 4 is designed to inform the researcher the navigating strategies used by each reader. This would help us not just identify navigation strategies used by each reader but also provide a better understanding of the reader factors that influence navigation strategies.

### 3.6.3 Retrospective interviews

Retrospective interviews were held immediately after the TOL protocol. The main purpose of this tool was to clarify inadequacies in the TOL protocol. Several
Researchers point out that interrupting a subject while performing a TOL breaks the natural flow of thoughts. So, to maintain spontaneity and avoid discontinuity in the TOL protocol, retrospective interviews were used after the completion of the TOL protocol to cross check researcher observations made regarding subject behaviour and link choices, and clarify gaps in the TOL if it was found to be incomplete in any sense. Some sample questions asked during retrospective interviews are attached in Appendix III B.

3.6.4 The free recall protocol

This tool helped access the nature and level of representation of text in readers’ short term memory. Subjects were asked to do a free recall immediately after they completed reading a text. The instructions given were: “Now I want to see how much you can remember about the text. We are interested in all that you actually can remember. If possible I would like you to tell me the content in the sequence in which it occurred in the text” (adapted from Ericsson and Simon, 1984). Research has suggested that free recall content indicates the interaction of text content with reader’s prior knowledge (Freebody and Anderson, 1983). So this task was expected to give insights into how much a reader remembers from reading a text, and how this is influenced by the availability of prior knowledge.

Recall protocols alone are not sufficient indicators of comprehension because though the quantity of information recalled may be good, the reader may not be able to convey a coherent understanding of the text. So to more accurately measure comprehension this research also employed a summarizing task (See section 3.6.6 below).

3.6.5 Distractor tasks

A distractor task was administered to each reader after every free recall. The sole purpose of such tasks was to take their mind away from the text read. Subjects were encouraged to choose any task they felt like from a collection of 10 distractor tasks. Distractor tasks varied in their difficulty levels and types – they ranged from simple tasks that required readers to match headings with corresponding texts, complete
cloze tests, fill in word puzzles based on short texts, write instructions based on pictures of a process, create notices, to more complex ones like appreciate poems and write their own Haikus, answer questions based on short news items, find words in a maze, complete a story, or re-order jumbled stories. Most of the time attempting a distractor task was followed by a lunch break, attending a client meeting, or some other work-related activity.

3.6.6 Summarizing task

After the distractor task and ensuring a sufficient time gap has occurred, (around 1 – 2 hours) subjects were asked to summarize the text they read. The instructions clearly indicated that they should mention the main idea and supporting ideas of the text in their summaries. An example for instructions used is: “Now try and write down what you think are the main ideas and supporting details of the text. The main idea will be the most important idea in the text. There can be more than one main idea in the text. By supporting ideas I mean the ideas that are of lesser significance than the main idea. These are less important than main ideas, but still important for comprehending the gist of the text. There will be many other details in the text that may not be significant at all. You don’t have to mention these”.

Whereas retelling or recalling reflects overall comprehension of the text, summarizing involves restating the main ideas and important details of a text. It reflects an understanding of the underlying text structure and the ability of the reader to identify significant ideas in the text (Kissner, www.talkplaythink.com). And since it was performed after a time gap, this task might have provided access to the contents of readers’ long term memory.

3.7 Method of collecting data

Since all the subjects of this study were employed at the time of the study, no exclusive sessions could be organized for collecting data. Most of the sessions happened in the subjects’ offices with a few happening in the researcher’s house. One disadvantage of this was the inability to use tracker data. At the beginning of the study it was planned to use inputs from tracker software – tracker data was expected to
reveal the total number of links clicked, the types of links clicked, the order in which they were clicked, and the amount of time spent at each link. However, since most companies did not allow this due to security reasons, the absence of tracker software was made up by the detailed observation notes made by the researcher.

The nature of data collected required sessions to be one-to-one/face-to-face. This meant that it took six sessions to complete collection of data from each subject. And each session ranged from 3 to 5 hours since the subjects were not asked to complete reading within a specific time limit: in order to ensure authentic reading settings, subjects were allowed to read each text for as long as they felt comfortable. Since subjects were sometimes required to attend to work demands, data collection sessions were not continuous; they were spread out depending on the availability of each subject. Therefore, in some cases it took more than a month to complete all six sessions of one subject. However, the researcher made sure that reading and recording of comprehension outcomes of one text was completed in one session.

Each subject read the six texts in the following order:

print familiar (PR hpk)
print unfamiliar (PR lpk)
pre-structured familiar (PS hpk)
pre-structured unfamiliar (PS lpk)
self-navigating familiar (SN hpk), and
self-navigating unfamiliar (SN lpk).

While reading each text subjects were required perform the TOL protocol, and after reading each text they were asked to do the following in the order given below:

a) Respond to Retrospective interview questions
b) Record a Free recall
c) Perform a Distractor task
d) Give a Written summary
Of these, TOLs, free recalls and retrospective interviews were orally produced and recorded while summaries were written on paper and keyed into the computer. In the next section, we discuss how data received from each of these sources was analysed to answer the issues explored.

3.8 Mode of analysis of data

Data was collected through three primary sources, viz., think aloud protocols, free recalls, and summaries. We shall now describe how each of this was analysed to explore the issues addressed by this study.

*Analysis of the think-aloud protocol*: Ericsson and Simon (1984) delineate what to do once the TOL data is collected – make verbatim transcripts of the tapes by listening to the record repeatedly. This, they point out, makes it easier to analyse and code the data. The TOL produced by each subject of this study was recorded and transcribed by the researcher. This was then parsed into think-aloud utterances. A think-aloud utterance is defined as “those words spoken aloud by a student that were preceded and followed by some period of silence” (Hartman, 1995, p.529). The think-aloud data was therefore chunked at the points where subjects paused their utterances for a few seconds.

Payne (1994) suggests that the parsed data is to be then coded into instances in which certain types of thought seemed to occur. The frequency of occurrence of different types of thoughts has to be computed across reader types and text types. In this study, the different types of thoughts looked at were restatements of text, paraphrasing of text information, and integration of text information with subjects’ prior knowledge, each indicating the three categories – surface, textbase and situation representation of text (van Dijk and Kintsch, 1983) – respectively. This type of coding helped us look at levels of text representations that are revealed through types of thoughts.

A second rater assisted the researcher to categorize clauses. The second rater, a qualified English teacher at the university level, was trained by the researcher in identifying the various types of clauses. She also read some reports of other researchers who used similar parsing techniques. Both raters then individually
categorized a sample of 200 clauses. Disagreements were resolved through consensus. The rest of the clauses were categorized by the researcher alone.

The TOL protocol along with researcher observations and reader responses to retrospective interview questions provided data also regarding the reading strategies used, navigation patterns followed and types of links selected by each reader.

While categorizing parsed TOL data it was observed that there were a number of pausal units that could not be classified as surface, textbase or situation clauses. For instance, interest levels in reading texts varied depending on topic familiarity; some readers appeared uninterested in reading some of the unfamiliar texts chosen for this study. This was evident in the large number of non-text related clauses in their TOLs like “On my way back I should be dropping in at the bank” or “If you grade me for this I think I might land with an F right?” or “Oh! I almost forgot, I should be checking my mails now” or “Was Spencer’s open when you came here?” etc. In addition there were text-related comments, made as part of reading a text but still not classifiable under the van Dijk and Kintsch categories. For example, “I don’t know what parafoveal means” “Why has the author linked such common words like eye, brain etc.?” “I know these kinds of texts, they just don’t tell us what to read and then it is very difficult for us to understand” “Look at this, if it goes on like this to another link and then another set of links, then where do we get information from?” These are called metacomments (Zwann and Brown, 1996). Metacomments represent subjects’ lack of understanding of text, an unfamiliar word or a difficult sentence. They also include comments made about the text structure, nature of links and types of support available. A third type of reader comments that occurred in the TOLs collected is called evaluations (Zwann and Brown, 1996). These are ethical, moral, or affective statements that reveal the subject’s state of mind and are based on his past experience reading earlier parts of the text. For instance if they were unclear about some part of the text that got clearer while reading a later part, such statements are made: "Yeah, now that makes sense" “You know I was worried about this word politexts, I don’t know if it is a word I should be knowing, so then yeah...” “Oho! is that what the author wanted to say?” “Alright so that is sorted out, it is clearer now” etc.
All these three types of clauses were not counted while calculating the total number of clauses generated. This was to control for verbosity. However, all of them serve as indicators during the qualitative analysis of data. Non-text-related clauses were taken as indicators of lack of attention or interest since they were clearly examples that showed the subjects were not motivated enough to read the texts. Metacomments and evaluations were treated as indicators of subjects’ comprehension processes. They gave evidence for aspects like what was difficult for them to comprehend in texts, what in the text made something easier to comprehend, and their opinion on link types and purposes of links.

**Analysis of free recall tasks:** Free recall tasks were also orally produced by each subject. Each recall was recorded and transcribed. This was then assessed for the quantity of information recalled. To decide the amount of information recalled, the number of significant idea units produced in free recalls was counted and compared with the total number of idea units identified by the researcher in each text (see section 3.4.1, point c). In the case of free recalls produced after reading electronic texts scoring was based on the number of units identified on the main page of each text. It was observed that free recalls of electronic texts also contained additional information based on the links visited by each subject. Such additional details were analysed to facilitate a qualitative discussion to understand if the number of links selected affected the amount of information recalled, i.e., if selecting a large number of links produced larger free recalls. Free recalls were only scored for the presence of text ideas and not their order of presentation. Coherence in information acquired was marked in the summary tasks.

**Analysis of summary tasks:** Summaries were produced either written on paper or keyed into a computer. Summaries were scored for the presence of main ideas and supporting details as identified by the researcher. Each main idea was awarded two marks and each supporting detail received one mark. Like the free recall protocols, the summary tasks too contained additional information depending on the links visited by each reader. These were not scored but were considered for a qualitative discussion to explore the issue if types of links visited determined the quality of information recalled, i.e., are there specific link types identified by readers as significant for information acquisition from hypertexts?
Representative data from one HL2 and one LL2 subject have been presented as Appendices IVA1 to V a 6. These include sample TOL protocols transcribed and parsed, free recalls and summary output produced by one HL2 and one LL2 subject after reading a familiar and unfamiliar text in the three presentation modes.

3.9 Conclusion

This study was intended to explore the reading comprehension processes of ESL readers with varying levels of language proficiency reading familiar and unfamiliar texts presented in three modes: print, pre-structured and self-navigating. The design of data collection was finalized with the intention of accessing levels of text comprehension achieved, and achieving a description of reading strategies, navigating strategies and links used while reading each text. In this chapter we have provided a detailed description of how the researcher planned the study to accomplish its research objectives; the criteria for selection of subjects, tools chosen to collect data, and the organization of data collection sessions. In the following chapter we shall present analysis of actual data collected in the course of this study and the interpretation of conclusions drawn from the analysis. This, I hope, will make clear the effect of text types on reader variables and provide insights into a clearer understanding of hypertext reading comprehension processes of ESL readers.