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Processes in Reading Chinese as a Second or Heritage Language: Reading Performance, Problems and Problem-solving Strategies

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A thesis submitted for the degree of *Doctor of Philosophy* at
Monash University in *2020*
Linguistics and Applied Linguistics

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Abstract

Learning to read in Chinese is a problem for both second language (L2) and heritage language (HL) learners. However, the problems they encounter and the strategies they adopt to solve these problems may differ. Most studies in the field of Chinese reading have been concerned with character/word recognition (e.g., Perfetti & Tan, 1998; Shen, 2017), and more recent attention has been drawn to the role of phonological awareness (e.g., Song et al., 2016) and morphological awareness (e.g., Liu & McBride-Chang, 2010), especially in Chinese first language (L1) reading. However, there has been less attention to the nature of the Chinese L2 reading process as a whole, particularly aspects other than character recognition. The present study aims to fill this research gap, drawing on measures of reading performance, and identifying reading problems and problem-solving strategies in order to examine the process of reading Chinese for both HL and L2 learners.

14 Chinese L2 learners and 16 Chinese as heritage language (CHL) learners from an Australian university participated in the study, and were divided into intermediate and advanced level subgroups. Each participant was required to read two stories: one was read silently and the other aloud. Evidence from students' read aloud and retell protocols and retrospective stimulated think-aloud task performance was analysed for reading performance, reading problems, problem strategies and the reading process more broadly, from both emic and etic perspectives. The impact of Chinese heritage background, proficiency level and reading mode was also examined. The study applied and extended the reading systems framework by Perfetti and Stafura (2014) in order to better understand the sources of problems, and the interaction of lower-level and higher-level processes.

Both L2 learners and HL learners identify recognising characters and words as a fundamental problem, but these learners, especially L2 learners, also experience linguistic problems at both sentence and discourse levels, as well as issues relating to cultural knowledge. Generally, HL participants benefit from their Chinese background, and can draw on greater linguistic and cultural knowledge when they encounter problems. As a result, they are more capable of achieving automaticity of lower-level processing, and are more likely to be able to implement successful higher-level processing such as the use of linguistic and cultural schema. However, HL learners may be unable to understand some words that they know orally due to their inability to decode the written form. In addition, some HL participants struggle to read words aloud correctly, due to the influence of the Chinese dialects they use at home. L2 participants, on the other hand, tend to encounter more character/word level problems, e.g., unknown lexical items, confusion of characters with graphic proximity and non-automaticity of form-meaning mapping. They are also unable to activate higher-level processing successfully in many cases.

Some differences were also identified between intermediate level and advanced level participants. For example, they tend to rely more on different cueing systems in reading. Intermediate level participants relied more on character decoding and graphic cues, while advanced level participants relied more on higher-level processing and semantic cues.

This study contributes to the development of theoretical models for reading in Chinese as an L2 or HL, in particular analysing the processes involved in character and word recognition which are specific to the reading of Chinese. The results also have pedagogical implications for the teaching and learning of L2 and HL Chinese reading.

Declaration

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

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Publications during enrolment

The content in the thesis have been reported in the following conferences

Li, X. (2018, October). *Characters or meaning – What happens when Chinese L2 and CHL Learners Read*. Presented at the 17th China International Conference of Contemporary Linguistics, Beijing.

Li, X. (2018, October). *Reading problems for Chinese L2 and HL Learners*. Presented at the10th International Conference of Chinese Language Teaching in Asia-Pacific, Taiwan.

Acknowledgements

Xinxin Li, 2020

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Chapter 1. Introduction

1.1 Background to the study

Reading in Chinese has never been regarded as an easy task for learners, no matter if they are first language (L1), heritage language (HL) or second language (L2) learners. Especially for those learners whose first languages have alphabetic writing systems, reading in Chinese can be more like trying to solve mystic puzzles. In this digital age, writing by hand has been almost replaced by typing on a screen, which may be good news for Chinese learners as they do not need to spend enormous time and effort on remembering how to write every stroke in each character. The difficulty of reading, however, remains as great as before.

As reading is not only an important skill which contributes to language competence, but also an essential way of obtaining information in daily life, it has attracted researchers' interest for decades. Reading English as an L1 has the longest history among all the reading research, and various reading models (e.g., T. Anderson & Pearson, 1988; Gough, 1972; Stanovich, 1980) have been proposed aiming at explaining the process of reading English as an L1. These models show the progress researchers have made in our understanding of reading, and they have also had a huge impact on the studies of reading in other languages both as L1 and L2.

Building on these models, many researchers (e.g., McClelland & Rumelhart, 1981; Perfetti, 1999; Stanovich, 1980) nowadays, tend to see reading as an interactive process, that is, a process involving both interaction between a reader and the text and interaction between lower-level processing and higher-level processing. In other words, reading is not purely bottom-up nor top-down processing, but rather a more complicated process where lower-level and higher-level processing influence each other. In addition, to comprehend a passage, a reader not only needs to have enough linguistic knowledge to recognise words and sentence structure, but also needs to apply general knowledge and understand cultural background and references.

With all these achievements, however, very little research has been carried out on the exploration of reading problems Chinese L2 and Chinese as a heritage language (CHL) students encounter and problem-solving strategies they apply when reading texts in Chinese. Several factors may contribute to this. Chinese reading has only started to attract researchers' attention since the 1990s, and L1 reading, especially the children's L1 acquisition of Chinese remains one of the most popular research areas. Research on reading Chinese as an L2 has an even shorter history, and researchers have shown a particular interest in character recognition due to the characteristics of the Chinese writing system. Moreover, because of the uniqueness of the Chinese writing system, most models, which are based on alphabetic languages, cannot be fully applicable to the study of reading in Chinese. So far, there have been few empirical studies focusing on the reading performance, reading problems, problem-solving strategies and systematic analysis of the whole reading process for Chinese L2 and CHL. The purpose of this study, therefore, is to examine Chinese L2 and CHL learners' reading performance, to probe the reading problems that they encounter, the strategies that they apply and to resolve them to explore the reading processes.

1.2 Personal motivation

As a Chinese language teacher at an Australian university, I observed students' behaviours and errors when they learned Chinese. I also came up with some ideas and questions based on my teaching experience, which motivated me to conduct this study. I will list some of them here as the reason why I am interested in this specific topic.

Some students find that it is not too difficult to read and understand the text in the textbook, but when they read some simple but authentic Chinese stories, for example, the stories for Chinese children, they are unable to fully understand the message the story wants to convey. This may reveal the fact that the students are unfamiliar with some commonly used vocabulary, and they also lack knowledge of Chinese culture and pragmatics. Are students able to identify the problems that prevent full comprehension? Are they able to apply any strategies to deal with the problem?

How students were taught may also influence what problems students encounter in reading. In Australian contexts, Chinese L2 and CHL students are often taught in mixed groups, although they clearly have different backgrounds, oral ability, cultural knowledge, vocabulary size and exposure to the language. Given these differences, do the student have different problems and difficulties, or are there commonalities? Do they need different materials or support, and do they process texts in the same way?

Unlike many other languages in which there are boundaries between written words, a word is not easily defined in Chinese. However, as a basic unit to form sentences, words are significant when using a language. As a result, most Chinese textbooks for foreigners emphasise words over characters: there are vocabulary list for every lesson to list the new words a student should know, but no explanation for individual characters. How does this teaching method affect students' character recognition and word identification process in reading?

Many language teachers encourage students to read aloud in class as they believe reading aloud is a beneficial way to practice pronunciation, and it is easier for teachers to correct students' errors. However, does reading aloud really facilitate students' comprehension?

In addition, not many teachers and textbooks emphasise the structures, stroke orders and formation of Chinese characters. Will this influence their graphic decoding and character recognition in reading? In addition, many teachers and textbooks introduce the basic radicals to students. Will students be able to use the radical knowledge when they encounter some unknown characters in reading?

I realised that in order to answer these questions about how students read, what problems they encounter, and what teaching techniques might best assist them to develop their skills, the first step was to research the reading process itself.

1.3 Research questions and research scope

With the research gap and personal motivation to investigate the answers to the above questions, this study intends to address the following research questions:

1. How does reading performance in Chinese (measured in terms of reading speed and comprehension) differ between Chinese L2 and CHL students, and how is it influenced by the following factors:

     a. Students' proficiency level (i.e., intermediate and advanced level students)

     b. Reading modes (i.e., reading aloud and reading silently)

2. What problems do Chinese L2 and CHL students encounter when reading texts in Chinese, and what strategies do they employ to try to solve them? How effective are these strategies? How are reading problems and problem-solving strategies affected by:

     a. Students' proficiency level (i.e., intermediate and advanced level students)

     b. Reading modes (i.e., reading aloud and reading silently)

3. What insights into reading processes can be revealed by an examination of reading performance, reading problems and problem-solving strategy use?

The first two research questions define the scope of this research and the second question is based on the first two questions. The current study aims to investigate what happens (incl. reading problems) when Chinese L2 and CHL students read in Chinese, what they do (e.g., adjust reading speed and apply problem-solving strategies) to cope with the problems and the outcomes in terms of reading comprehension and fluency. Two things need to be clarified here. The first one is the reading comprehension investigated in this study is mostly at the literal level, and deeper-level comprehension (e.g., appreciative, critique, evaluative and applicative levels) is beyond the scope of this study. The second one is students' proficiency level in this study was mainly measured by their ability of reading words used in the reading material. Hence, the label of intermediate level and advanced level was only used to distinguish the two groups of students with different vocabulary size, which did not indicate their general Chinese proficiency. Exploring the reading performance, reading problems and problem-solving strategies may provide insights into the reading process of Chinese as a L2 and a HL. This study explores the differences and similarities between Chinese L2 and CHL learners. Given the increase of Chinese immigration in western countries, CHL learners have attracted more researchers' attention than before (see D. Li & Duff, 2018 for a brief review). It is worthwhile to investigate the Chinese learning of L2 and HL learners as two different groups (He, 2015), and it helps us gain further understanding of their diverse competence, difficulties and needs (H. Huang, 2011 & 2020). The difference between Chinese L2 learners and CHL learners can be large or small (He, 2015) depending on the degree of HL learners' background. For some HL learners who have a strong background, their learning process in Chinese may be more like that of Chinese speakers living in and educated in Chinese speaking contexts as the main language they use at home is Chinese, and their literacy might be quite high because they may also study Chinese at community school or at weekend school. For those who have a weak background, do not use Chinese at home or do not attend formal classes relating to Chinese, their Chinese learning may be more similar to that of L2 learners who share the same first language as they do. These are two extreme situations, and most of the HL learners are somewhere in between. H. Zhang

and Koda (2018) found that CHL may have some advantages compared to their Chinese as L2 counterparts (e.g., oral vocabulary knowledge, morphological awareness and lexical inference abilities), but not in print vocabulary knowledge. H. Huang (2011) pointed out that the advantage of speaking ability cannot fully apply to their reading and writing. Thus, exploring the differences and commonalities of Chinese L2 and CHL students' reading is one of the main aims of this study.

The first two research questions also set out to explore how the identified factors have an impact on the learners' reading. In this research, in addition to participants' background, their proficiency levels are also taken into account. Proficient readers tend to read faster (K. Goodman, 1996; Perfetti et al., 2005; F. Smith, 2012; Stanovich, 1980), and readers' language proficiency has an effect on processing strategies used (Pritchard & O'Hara, 2008; Sergent, 1990). However, whether readers with different proficiencies encounter similar types of problems and whether they are able to apply the same strategies to tackle them remains unclear.

In addition, two modes of reading (reading aloud and reading silently) are included in the investigation as they may reveal different aspects of the reading process. Researchers tend to have different views on reading aloud and reading silently, and which one is more helpful in terms of reading comprehension remains unclear. For example, Alshumaimeri (2011) and Fuchs et al. (2001) endorse reading aloud, whereas F. Smith (2012) recommends reading silently. By including it as a factor, this study may throw some light on the effect of these two reading modes on comprehension. The impact of text difficulty on reading performance and reading problems will also be discussed when answering the research questions. Although it was not one of the original aims of this study, text difficulty was brought up by the participants when the experiment was conducted. The two stories for each group were designed to be at the same difficulty level in terms of unknown characters, words, sentence length and grammar. The majority of the participants, however, reported that one of the stories was more difficult than the other one. To accurately describe the participants' reading process, including their problems and strategies, the difficulty of the text was considered in this research to investigate how participants coped with more difficult text and easier text. Some previous studies (e.g., Bahmani & Farvardin, 2017; Chiang, 2016; Namaziandost et al., 2019), in fact, investigated the difficulty of reading materials from an L2 learning perspective, but little research has been found to investigate this from the perspective of L2 reading processing. At the same time, it may also provide some insights into what factors may influence Chinese L2 and CHL readers' perception of the difficulty of the reading materials.

1.4 Significance of the study

This study, by investigating Chinese L2 and CHL students' reading performance, reading problems and problem-solving strategies, will further the understanding of how Chinese L2 and CHL students process information when they read in Chinese. There has been considerable debate and disagreement among researchers about a universal model of reading. Some researchers (see Frost, 2012 for a brief summary) hold the belief that reading across different languages is a similar process even though there are thousands of languages using different writing systems and they aim at providing a general framework of reading. Some researchers (e.g., Behme, 2012; Coltheart & Crain, 2012; Levy, 2012), on the other

hand, insist that the reading process is affected by different writing systems and thus believe that using one universal model to include reading in all languages does not work. It is still early for us to conclude if a universal model of reading should be expected, however, examining the reading process in different languages from different perspectives will further our understanding of reading – one of the most complex cognitive activities we do every day. Thus, based on the findings, this study will contribute to the discussion of the existing models for reading in alphabetic languages and for reading in general, and examine if reading in L2 Chinese can be explained by the model proposed by Perfetti and Stafura (2014).

In addition, this study explores the differences and similarities between Chinese L2 and CHL students in terms of their reading problems and problem-solving strategies, which will reflect their Chinese linguistic knowledge, strategic competence and other competences. Even though HL students, including CHL students, have attracted more attention from researchers, there are not enough support and resources (e.g., textbooks, programs) at tertiary (or post-secondary) level responding to their needs, interests and potentials (D. Li & Duff, 2018). By comparing Chinese L2 and CHL students' reading competence, this research may throw some light on what class instruction, textbooks are helpful for each group of them.

This study also introduces other factors (i.e., different proficiency levels and reading modes) to probe reading process in depth. In addition, the difficulty of the reading material is also considered when analysing the results to better evaluate what is happening when Chinese L2 and CHL students read. Little empirical research on reading incorporates so many layers into the design as reading itself is complex and includes different elements. However, from L2 acquisition perspective, these factors may help us better understand Chinese L2 and CHL students' readiness (including linguistic, cultural and strategic) for reading in Chinese in different situations.

In terms of methodology, researchers tended to use questionnaires (e.g., Muijselaar et al., 2017; Sheorey & Mokhtari, 2001) and the think-aloud protocol (e.g., Block, 1986; Everson & Ke, 1997; Pritchard, 1990) to investigate reading problems and the reading strategies that students apply. These two methods either are unable to reflect what students actually do during reading, or may interrupt the process of reading, which may influence comprehension. This study employed miscue analysis and retrospective stimulated think-aloud protocols to tackle these problems. Through the retrospective stimulated think-aloud protocol, we are able to understand the reading process from participants' perspective without interrupting their reading. Miscue analysis equips us with the opportunity to analyse reading problems from an etic perspective. Thanks to these two research methods, this study was able to identify reading problems, some that participants were aware of, and also others that they were not aware of.

It is hoped that this study may also provide useful information for teachers of Chinese, to assist them to develop teaching materials and strategies, especially for the teaching practice for reading. For example, this study did not use the unit in which participants were enrolled as a proxy for proficiency level to group participants; instead, the grouping was based on a character/vocabulary test that was designed to examine participants' vocabulary size and lexical and character knowledge. In addition, the

differences and similarities of the four groups may provide information on what kind of help different Chinese learners (e.g., L2 and HL learners and intermediate and advanced level learners) need respectively, and what kind of support may be helpful for all Chinese learners.

1.5 Definition of terms

To avoid any confusion, some key terms used in this study are briefly explained here. A more detailed definition can be found in Chapter Three, where more terms are elaborated with examples and literature.

CHL learners: CHL learners in this study refer to those who have at least one parent speaking Chinese dialects and/or Mandarin, but who have been brought up in an environment that Chinese is not their L1. The frequency of Chinese languages used at home may vary.

Reading miscues: A miscue happens when the reader's production departs from a fluent and accurate reading of the text (K. Goodman, 1996). In this study, six types of miscues can be identified in reading aloud, namely, pause, repetition, substitution, wrong segmentation, omission and insertion; while two types can be observed in reading silently: pause and repetition. A more detailed explanation can be found in Chapter 3 (3.5.1).

Comprehension problems: This includes misunderstandings, and inability to comprehend a section of text. In this study, comprehension problems are distinguished from reading problems as one of the purposes of this study is to investigate what kinds of reading problems lead to comprehension problems, and what types of problem-solving strategies are effective.

Reading problems: In this study, 'reading problems' refers to the difficulties that readers encounter during reading. Some of them may also cause the miscues and the comprehension problems. Reading problems are further classified into those at character/word level, sentence level and discourse level.

Problem-solving strategies: 'Problem-solving strategies' in this study refer to the strategies a reader adopts when reading problems occur, which may or may not resolve problems successfully. Problem-solving strategies, instead of reading strategies, are used in this study as this project focuses on the strategies readers adopt when they encounter a problem. Reading strategies is a broad concept, including planned actions (e.g., previewing the text, Lee-Thompson, 2008), which are not in the scope of this study.

1.6 The structure of the thesis

There are seven chapters in this thesis.

This introduction, as Chapter One, provides background information for this study, including a brief outline of the importance of the topic, previous research and the research gap. Following that, the research questions and the significance of the study are also discussed.

Chapter Two is a review of literature on both theoretical and empirical studies and on reading. In particular, it introduces the key reading models established for languages using alphabetic and non-alphabetic writing systems, studies on reading and language proficiency, and research on reading aloud and reading silently.

Chapter Three presents the approach and methodology adopted in this study. It describes the profile of participants in this study and the criteria for grouping them into four groups (i.e., L2 intermediate level (L2I) participants, HL intermediate level (HLI) participants, L2 advanced level (L2A) participants and HL advanced level (HLA) participants), and analyses the reading materials used in this study. This chapter also outlines the data collection procedures and discusses the ways in which the data is analysed.

Chapter Four presents the findings and results for RQ 1. It provides the reading performance of each group of participants, including their reading speed and reading comprehension performance, and it also examines if the reading performance was affected by participants' background and proficiency level, reading modes and text difficulty.

Chapter Five addresses RQ 2, It describes the details of reading problems and problem-solving strategies with the examples from participants in an attempt to provide a clear picture of what actually happens when these Chinese learners read. The effect of participants' background, reading modes and proficiency level on the problems and strategies is also summarised.

Chapter Six draws upon the results of the first two RQs to answer RQ 3. It discusses the process of Chinese reading as revealed by the observed reading performance, reading problems and strategies. Then by joining the processes together, this chapter also presents a framework of Chinese L2 reading adapted from the reading systems framework by Perfetti and Stafura (2014).

Chapter Seven presents the conclusions of this study. Firstly, it briefly summarises the answers to the research questions in terms of reading performance, reading problems and problem-solving strategies, and the reading process more generally. Some implications of these findings are then discussed. The chapter concludes with the discussion of limitations of this study and suggestions for further research.

Chapter 2. Reading in Chinese and Other Languages

2.1 Introduction

Reading is a daily activity for a lot of people, but it is not simple. It involves more than decoding printed symbols and extracting useful information from the passage. Although the act of reading can be different when the reader has different aims, comprehension is always the desired outcome of the reading. As a result, studies of reading not involving reading comprehension, such as using isolated words or single sentences as the test materials, cannot reveal the whole reading process.

This study focuses on the reading process in reading comprehension, especially the reading problems and problem-solving strategies, for reading Chinese as an L2 and HL, and to investigate it, some research needs to be reviewed first. Section 2.2 provides an overview of what has been studied in the research on reading in general and some key factors involved in the reading process. Section 2.3 focuses on different reading models for both L1 and L2 learners to provide the theoretical foundation for this study. Section 2.4 focusses on the characteristics of the Chinese writing system, which can provide readers with linguistic information, but can also be a barrier for readers, especially for those whose mother languages are alphabet-based. Section 2.5 focuses on reading problems and problem-solving strategies, which define the research scope. Four factors which may have an impact on reading processes are explained in Section 2.6, namely, language background, language proficiency, reading modes and the difficulty level of reading materials. This chapter is then wrapped up by a brief conclusion.

2.2 What is involved in the reading process

Reading can be investigated from different perspectives, but researchers agree that in order to comprehend a text, readers need to perform various psychological and social activities (Bloome & Green, 1984; Paris et al., 1983). From this psychological point of view, reading is the interaction between the text and the reader, and to be more accurate, it is the interaction between the information in the text and the prior knowledge and experience in the reader's brain.

2.2.1 Lower-level processing and higher-level processing in reading

Different terms are used to refer to lower-level and higher-level processing involved in reading. K. Goodman (1967, 1970) labelled the information in the text as 'language cues' (1967, p.47), and noted that three different kinds of information could be used during the reading process, namely, graphophonic information, syntactic information, and semantic information. In F. Smith's (2012) research, 'visual information' (p.13) was used to label the information that the brain receives from print, and the knowledge of the relevant language and other mental resources were called 'nonvisual information' (p.13). Similarly, Bernhardt (1986) used 'text-based' (p.105) and 'extra-text based' (p.105) to talk about these two conceptions.

From the cognitive processing perspective in reading, processing relating to local text, including word recognition, lexical access, etc., is often referred to as 'lower-level processes', while processes which help the reader to create a text representation, for example, integrating new information and

making references, are referred to as 'higher-level processes' (e.g., Hulstijn, 2001; Koda, 2005; Stanovich, 2000). This labelling is not based on the importance or complexity of the process. Thus, the skills which are required in the lower-level processing are by no means simpler than those required in the higher-level process, rather, they are the skills that have the potential to become highly automatized, and this automatizing of lower-level skills is fundamental for fluent reading (Hulstijn, 2001; Koda, 2005; Stanovich, 2000). The two levels together describe what happens when a reader reads a text, and different models of reading have been proposed based on the relationship between these two levels of processing, which will be elaborated in following sections.

When lower- and higher-level processing are analysed, it seems that scholars do not draw the identical boundary between these two and thus the components of the two are not the same. It is easy to confirm that word recognition, including phonological processing, lexical access and morphological processing belongs to lower-level processing (Grabe, 2009); it is also not difficult to understand that text-model formation (what the text is about), situation-model building (how readers interpret the text), inferencing, executive-control processing (how readers direct their attention) and strategic processing are components of higher-level processing (Grabe, 2009). However, whether sentence-level processing, including syntactic parsing (using grammatical information) and meaning encoding (building clause-level meaning from word meanings and grammatical information), should be classified into lower-level processing or higher-level processing is not consistent among scholars. Some scholars (e.g., Grabe, 2009; Yamashita, 2013) categorised it into lower-level processing as it can be seen as basic linguistic processes; while others (e.g., Bell & Perfetti, 1994; Koda, 1992; Nassaji, 2003 & 2014) classified it into higher-level processing as it is the first step of linking and combining the information together to arrive at a collective understanding of the whole.

This study categorises sentence- and discourse-level understanding into higher-level processing as it requires drawing on syntactic information and knowledge, which is not the information a reader can access only from the printed symbols; rather, it needs integration of one's prior and existing knowledge, and sometimes it also requires contextual information. Thus, it is a step to build text-model formation, which should be within higher-level processing.

Since there are two broad processes interacting while reading, researchers have investigated reading focusing on different topics. Some researchers have paid more attention to some specific sub-skills or specific reading processes. As word recognition is an important part in reading, it has interested some researchers (Everson, 1998; Ke, 1998; Perfetti, 2007; Perfetti & Hart, 2001; Y. Wang & McBride, 2016). Perfetti, for example, proposed a Universal Phonological Principle by investigating word recognition in different languages. More recently, the effect of cultural schemata on reading strategies and comprehension has drawn a lot of researchers' attention (Pritchard, 1990; Sharifian et al., 2012). In Pritchard's (1990) study, 30 American and 30 Palauan eleventh grade students identified as proficient readers were required to read a passage concerning funeral rites of the other culture. This study found that cultural schemata influence the processing strategies readers employ.

Although the research aimed at developing models of reading often adopted either the holistic view, which included both the information in text (lower-level processing), and schemata and prior knowledge and experience (higher-level processing), empirical studies which investigated the interaction between the two are rare. One of the main reasons could be the difficulty of the experimental design. When the research is aimed at word recognition or other parts of lower-level processing in reading, the ideal participants are young children or L2 learners as word recognition is automatic in native adults' reading. On the other hand, when the cultural schemata are the subject to be explored, recruiting less proficient L2 readers can be problematic since it is hard to distinguish whether the culture or the language influences the comprehension more.

Considering these difficulties and problems, one of the study's focuses will be on the reading process of Chinese L2 and CHL readers, particularly the lower-level text processing (word recognition, segmentation, etc.), the higher-level processing (incl. the prior Chinese linguistic and cultural knowledge or the experience of Chinese reading), and the interaction between the two. Within this research scope, the different models of reading and linguistic features of Chinese written language are crucial and hence will be examined in section 2.3 and 2.4 respectively.

2.2.2 Role of consciousness in reading

Consciousness plays a crucial role in L2 acquisition. When it comes to the process of reading, it also acts as the key to several important elements. First, it helps distinguish skills and strategies. Alexander & Jetton (2000) pointed out that the same procedures (e.g., finding the main idea) can be classified into both the skill and strategy categories, and one of the criteria is whether it functions in an automatic way or the reader consciously evokes the procedures. N. Anderson (2009) further explained that a skill is a strategy that has become automatic, and the goal of reading strategy instruction is to move readers from conscious control of reading strategies to unconsciously use reading skills. Based on the difference between skills and strategies, this study adopted retrospective stimulated think-aloud protocol to investigate what problem-solving strategies participants used when reading.

In addition, some reading processes may always require conscious attention, while some others may become automatic after it has been rehearsed many times. For example, many processes in word recognition may be automatic, including, orthographic processing, phonological processing and lexical access (Grabe, 2009). Registering for new information, however, always needs active attention and conscious processing. As all skills that can be applied automatically are used consciously at initial learning, whether conscious attention is required can also distinguish more skilled readers from less-skilled readers. In other words, more experienced readers are able to apply their prior knowledge and solve problems unconsciously during reading; while beginning readers may always need active attention to recognise words and consciously apply strategies to solve their reading problems.

2.2.3 Working memory and processing capacity in reading

According to Ellis (2005), working memory is the place where learners develop, apply and hone their metalinguistic insights into an L2 consciously. With such importance, an important concept to be

discussed in second language acquisition (SLA) is whether the attentional resources are limited or not. Although each side of the argument received support from a large number of scholars (e.g., Skehan, 1998, Van Patten, 1990 & 1996 argued that attentional resources were limited; while Robinson, 1995 & 2003, Wickens, 1992 claimed that they were unlimited), most scholars (e.g. Grabe, 2009; LaBerge & Samuels, 1974) who undertake research into reading believe the processing capacity is limited. As the working memory is the key concept for reading comprehension (Carpenter et al., 1994; Hannon & Daneman, 2001), it is important to understand how it works in the two processing levels of reading.

2.2.4 The method used to investigate reading process

To elaborate the reading process, different research methods were used to reveal different perspectives of reading. K. Goodman (1967), the proponent of miscue analysis, maintained that although it was hard to figure out what happened in readers' brains when they read, the parts where they made mistakes could act as a window, and the reading process could be revealed from it. As the reading process cannot be observed as easily as the process of writing or speaking, using the aid of some machines can be a solution. In the research of reading, therefore, eye-tracker and functional magnetic resonance imaging (fMRI) are sometimes used to illustrate the reading process. As miscue analysis was adopted in this study, it will be reviewed in details.

Since the 1960s, a great deal of research has been conducted on English reading utilizing K. Goodman's miscue analysis framework. In one of the major studies, K. Goodman & Burke (1973) investigated the reading process of 94 subjects with different language proficiencies using the Goodman Taxonomy of Reading Miscues. The main finding of this research included that 1) low proficiency readers' reading process is much the same as that of high proficiency readers; 2) the less proficient groups have less productive strategies for integrating graphic, syntactic, and semantic cues of the language; and 3) the percent of miscues semantically acceptable before correction is the best indicator of the reading proficiency of all readers.

The discipline of English as Foreign Language (EFL) has attracted a lot of interest, and using miscue analysis to investigate L2 English reading is an important research line. There is abundant research both on children's and adults' L2 English reading.

Miscue research on children's L2 English reading focuses on their miscue types and if miscues are able to predict their L2 language development. Tatlonghari (1984) examined the reading process of fourth-grade L2 English learners and found that these readers made substitution, omission, insertion, and reversal oral reading miscues. Also, these children produced oral reading miscues at rates and qualities similar to those of native language readers. In Miramontes's (1987) study, forty upper elementary Hispanic-American students were selected from year-round schools. The results showed that the group of students who have developed the highest level of bilingual proficiency also make miscues which reflect the most successful use of miscue strategies, not only in the decoding categories, but, more importantly, in the semantic categories.

For miscue research on adults' English L2 reading, scholars explore if the miscues that readers produce would be different in various circumstances. For example, Malik (1990) examined the reading

behaviour of English as L2 proficient readers by using culturally familiar and culturally non-familiar expository texts. The results indicate that proficient L2 English readers use syntactic and semantic information to make more effective predictions with the familiar rather than non-familiar text. While reading the culturally familiar and non-familiar expository texts, their use of integrating strategies is more effective with the familiar text.

There are also a few studies adopting Goodman's miscue analysis, and using authentic texts to examine Chinese L1 reading of both children (J. Chang et al., 1992; Y. Chang, 1987) and adults (W. Li, 1992; Tang, 1996; Tien, 1983). Tien (1983) compared Chinese L1 reading and English L1 reading by collecting data from ten L1 adult Chinese readers, which were used to make comparison with related studies on English reading. In the study of W. Li (1992), six adult Chinese native readers are asked to read both Chinese and English texts, and the study found that the readers use the same strategies in reading both Chinese and English texts. Tang (1996) conducted a similar experiment as W. Li (1992), and he found that the pattern of participants' comprehension processes remains the same with texts in different languages, however, the texts in different language do change the frequency of occurrences of some types of strategies.

Three studies were found to investigate Chinese L2 reading using miscue analysis for different research purposes. These studies explored what miscues Chinese L2 readers produced when they read text, which may reveal the interaction between lower-level and higher-level processing. Sergent (1990) was the first to investigate Chinese L2 reading using the completed procedures of miscue analysis. He investigated the miscues of twenty native English-speaking American students of Chinese who are at two levels of L2 reading proficiency: advanced and highly advanced. Among the 20 subjects, the amount of exposure to the Chinese language ranged from 300 contact hours in a classroom setting to three years living in a Chinese-speaking region, and this variation is very problematic because it may make the grouping invalid. Furthermore, the coding was solely done by the researcher, which might result in some misinterpretations of the data.

The focus of Y. Li's (1998) study was on how reading skills are taught in a beginning Chinese language course and which strategies Chinese as Foreign Language (CFL) beginners use when reading Chinese text, so the main body of her research consisted of classroom observation, questionnaire, and individual interviews, and miscue analysis was just one of the methods to answer the question of what cueing systems they use. In the section of reading aloud, the reading materials were chosen from the textbook, and the participants were provided with dictionaries and vocabulary list. At the same time the participants were encouraged to think aloud during reading, which means the reading process was interrupted.

S. Wang's (2006) study is the most recent research using miscue analysis in L2 Chinese reading. Her research tried to answer two questions, namely, how can the Goodman Taxonomy of Reading Miscues be adapted to reading in Chinese, and what are the characteristics of L2 readers of Chinese, as reflected in their miscues while orally reading a Chinese text. To answer these two questions, Wang used more than half of her thesis to interpret and analysis the Goodman Taxonomy of Reading Miscues

and related theories, and the characteristics of Chinese writing system. There were only 12 participants, which was a very small sample, and some of them had European background, while others were HL learners. There was no comparison between different backgrounds participants, which is one are area deserving further studies. In addition, the coding procedure was fully completed by the researcher, and the lack of participants' feedback may have led to some misinterpretations.

More importantly, all of these three studies failed to see reading from a holistic perspective, in which the lower-level processing and the higher-level processing are interactive, and both of them have crucial impacts on comprehension. In addition, there was no comparison between different difficulties of text, different backgrounds or cross proficient levels, except for Sergent's (1990) study where problems exist in his grouping of two levels of participants.

With all these explorations using miscues analysis, however, it can only analyse the parts when miscues occur, and hence, it was adopted mainly in the studies which are targeted at children, as normal L1 adult readers will not make a lot of miscues when they read. To examine the reading process more thoroughly, some machines, as the tool to reveal the cognitive process, are required. The means of eye-tracking methodology can be used to study the fixation during the reading process, which is determined by working memory, while the fMRI can be used to investigate what areas of brain are activated by different reading activities. Although these two are most commonly used in reading studies, both of them are not flawless. First, it is hard to provide a natural environment for the participants, and the experimental settings can make them uncomfortable, which may have an impact on their reading process and comprehension accordingly. The studies using eye-tracker require the participants to keep their heads still during the whole session, and to collect the data from fMRI research, the participants need to wear a hat which is used to detect the blood flow in the brain. Second, the data cannot reveal everything in the reading process. F. Smith (2012) argued that the fixation in the studies using eye-tracking could not be used to indicate that that was the part the reader paid attention or had problem, because the reader could pause and thought about some previous parts. The fMRI can be used to detect the activity in brain, but it still cannot reveal the details of how a reader reads.

2.3 Models of reading

The research on reading started with alphabetic languages, especially with English. In this section, different reading models based on alphabetic languages will be reviewed both in L1 and L2 disciplines.

2.3.1 Models of L1 reading

The research on L1 reading has a much longer history than research on L2, and the studies of L1 reading models have a huge impact on the studies of L2 reading. In the discipline of L1 reading, it is widely accepted that both lower-level and higher-level processing work during reading, however, researchers have different opinions on how these two levels interact and which acts dominantly. Within this debate, three different views based on the cognitive mechanism of how these two levels work are most influential, and will be introduced below.

2.3.1.1 Bottom-up

In early cognitive theorizing, information processing was depicted as a series of discrete stages (Stanovich, 1980), and the input in a specific stage would be transformed and passed on to a subsequent stage as new input (Sperling, 1967; Sternberg, 1969; Theios, 1973). When these models were introduced to reading, bottom-up models of reading was proposed and has remained influential (Geyer, 1970; Gough, 1972; LaBerge & Samuels, 1974; E. Smith & Spoehr, 1974).

Children learn letters to understand the text, from which the theorists hypothesised that the reading process was like solving a jigsaw puzzle – one needs to examine each piece of the puzzle before putting them together to make a whole picture. As a result, according to bottom-up models, the order of processing is from the lower level to the higher level, and the information in the text, which is called 'visual information' by F. Smith (2012, p.13), is the most important. Among different bottom-up models, the reading model by Gough's (1972) and a theory of automatic information processing by LaBerge & Samuels (1974) are the most influential.

According to Gough (1972), a reader needs to encode the print letters into speech sounds first, and then puts these sounds together to form words, and finally uses these words to make sense of the written message. LaBerge & Samuels (1974) claimed that reading depends on automatic information processing or automaticity. In their reading model, a reader can analyse visual input sequentially. Like a computer, the capacity of information a reader can deal with at a time is limited (i.e., limited memory capacity), so to improve comprehension, a reader must decode automatically so that the decoding process will not occupy too much attention.

F. Smith used 'outside-in' (2012, p.233) to describe the bottom-up process of reading, and according to him, from this perspective, the text is put in charge, which is insufficient and defective to explain some problems in reading. As a result, his research is strongly representative of the opposite top-down model, which is called 'inside-out' (2012, p.233) in his studies.

2.3.1.2 Top-down

Different from the bottom-up model of reading, the top-down model emphasises the importance of the whole text and readers' prior knowledge in the reading process. According to F. Smith (2012), from this point of view the control in reading is presumed to originate with the reader. In this model, reading is not about the precise process of retrieving individual linguistic units (K. Goodman, 1996), instead, it is how to predict the meaning of language they are about to read using background information. So in this model, the cognitive process of reading is from the higher-level to the lower-level, and the prior knowledge, which F. Smith called 'non-visual information' (2012, p.13), plays an important role.

T. Anderson and Pearson (1988) suggested that reading mainly involves an interaction between the reader's prior knowledge stored in memory (schemata) and the new information in the text. Word recognition does not play an important role in top-down model of reading, and a reader can understand the words in context that they cannot recognise in a word list. In this point of view, reading is a process where a reader brings the related prior knowledge to the text, predicts what the meaning will be in the next part, and then confirms or corrects these predictions.

F. Smith (2012) believed that the brain does not have time to attend to all the visual information available in the text, and also that the memory cannot cope with all this information, so reading has to be selective. Trying to cover all the visual information can cause a reader to become functionally blind due to the fact that the amount of visual information our brains can process at any one time is so limited. F. Smith (2012) argued that 'Prediction is the core of reading' (p.25), 'the basis of comprehension' (p.68), and it helps the reader to decide which information should be selected. F. Smith (2012) claimed that fluent reading depends on the ability to use eyes as little as possible as good readers are better at and more willing to make educated guesses on what the next words are, so that they only need to extract some letters to confirm their hypothesis. To make a good prediction, a reader needs to make maximum use of what is already known.

Based on the mechanism of reading in this view, K. Goodman (1967) proposed a novel method – miscue analysis, which can be used as a tool to gain insights into the nature of reading process and 'what happens to learners in their development of all language use and language learning' (K. Goodman & Goodman, Y., 2014, p.30). It focuses on the miscues readers produce when they read. Miscues happen when the reader's production is not exactly the same as the printed text. However, these should not be treated as errors, as they are not random, instead, they are seen as the 'window on the reading process' (K. Goodman, 1973, p.93) which can reflect what cues the reader is using.

This model also relates to a new teaching method – the 'whole language' approach. It argues that teachers should not teach reading as they have traditionally done, teaching the letters, the words, and then helping students to connect the sounds with the printed symbols. The whole language method does not emphasise phonological awareness, and holds that the least useful advice to students is to sound the word out when they encounter some words they do not know, instead, the most efficient strategy is making an educated guess according to the whole idea of the text and context.

Just like the bottom-up model, the top-down model has received attack as well because of its flaws (e.g., overlooking the importance of lower-level processing), and as a result, the interactive model has drawn more attention, and is favoured by a lot of studies.

2.3.1.3 Interactive

The studies of bottom-up and top-down models illustrate that both models can only explain how reading process works to attain comprehension partially, hence a model of 'combined' bottom-up and top-down is proposed and accepted by a lot of scholars. There are several different types of interactive models, such as the interactive-activation model (McClelland & Rumelhart, 1981) and the interactive-compensatory model (Stanovich, 1980), and the common feature is that the bottom-up and top-down process occur simultaneously throughout the reading process.

Even though some scholars claimed that interactive models are unnecessary, for example, F. Smith (2012), who favoured the top-down model, argued that top-down does not mean that reading doesn't involve interaction with a text, and there is no need to compromise that both top-down and bottom-up process occur at the same time, interactive model is still convincing and well-developed. It seems more reasonable to believe that a reader will use all sources of information, including graphic, phonemic,

semantic, syntactic, pragmatic, etc., to make sense of the text, and there is no strict set order of which one should be used first (Dechant, 1991; Rumelhart, 1994). This interaction allows cyclical movement (K. Goodman, 1988), which enables the reader to look back and forth along different processing levels.

Stanovich's (1980) interactive-compensatory model is one of the most influential models. In this model, the lower-level and higher-level processing are interactive – the influence can be mutual. When there is a deficit in a particular process, the reader would rely more on other knowledge sources. That is to say, only when the lexical knowledge is not enough, a reader would try to find some clues in text to help him/her to identify words. So, good readers do not need to rely on any other knowledge sources to recognise words. For the poor readers, even when the context can help them to compensate the lack of lexical knowledge, this compensatory process still occupies cognitive load, which will cause the comprehension to suffer.

Perfetti also developed reading models from the interactive point of view. He first proposed the blueprint of the reader in 1999, in which both the general reading processes (not language specific) and potential reading problems were discussed. In his blueprint, three levels of processes were identified: word identification, understanding sentences and comprehension beyond sentences (the text level). Writing system factors were also pointed out as it may influence the reading process, especially at the level of word identification. Some sources are assumed to lead to reading problems, such as decoding problems, phonological problems, working memory capacity problems, inferencing problems and syntactic problems, and these were explained by comparing skilled readers and less skilled readers. This blueprint of the reader, to some extent, emphasised word identification, which was seen as a 'recurring event in reading that is not shared directly with spoken language processes' (p.197), which is particularly true of Chinese; in addition, word identification has a dual role in reading: it is the output of decoding the visual input, and at the same time, it acts as the input of sentence processing. With word identification being distinctive, this blueprint gained the potential to be applied to explain L2 reading, as word identification tends to cause more problems in L2 reading than in L1 reading. Perfetti and some other researchers used this blueprint to further explore some other reading issues in English reading, e.g., word knowledge in reading comprehension (Perfetti & Stafura, 2014), event-related potential indicators of text integration (Yang et al., 2007), reading comprehension and reading comprehension problems (Perfetti et al., 2013), etc, and the blueprint was further developed as reading systems framework (Perfetti & Stafura, 2014).

Perfetti and Stafura's (2014) reading systems framework will be used to explore the process of reading in this study. In the framework, lower-level and higher-level processing can work at the same time, and when the readers encounter some unknown characters or partially recognise some words, they can use their prior linguistic knowledge to figure out the unknown characters or words. However, using models of L1 reading requires caution. Especially in this research when participants' L1 is alphabetic-based and L2 is character-based, the word recognition can cause huge problems in reading. In these L1 reading models, word recognition is normally overlooked, because it is automatic in normal L1 adult reading. Although it can be problematic in L1 child reading, it is often caused by the lack of experience

of decoding, which is not identical with L2 reading. The reading systems framework (Perfetti & Stafura, 2014) is chosen over other models because it values the significance of lower-level processing, and at the same time, it also considers the difference between different writing systems. Thus, it can be adopted by Chinese reading with some modifications.

2.3.2 Models of L2 reading

The models of L1 reading are always used in L2 studies with some modifications. However, the process of reading and also the problems in L1 and L2 languages are different. Koda (2005, 2007) investigated L2 reading from a crosslinguistic perspective, and claimed that it involves two languages, thus, it is more complex than L1 reading. Although the process of L2 reading is complex, it does not mean that a novice L2 reader knows nothing when it comes to reading. The mechanism of transfer guarantees that readers do not need to learn from the beginning like they did when they tried to learn their L1 reading; some reading sub-skills will transfer through crosslinguistic interactions from L1 into L2 with adjustment. Although most L2 reading research would borrow the reading models from L1 studies, two L2 models have been developed: Coady's (1979) psycholinguistic model and Bernhardt's (1983) constructivist model of the L2 reading process.

2.30 4 0 3 " E q c f { ø u " r u { e j q n k p i w k u v k e " o q f g n

In Coady's (1979) model of an English second language (ESL) reader, three components, namely, conceptual abilities, background kn owledge and process strategies, are interacting as illustrated below (Figure 2.1).

Conceptual abilities ⟷ Background knowledge

Process strategies
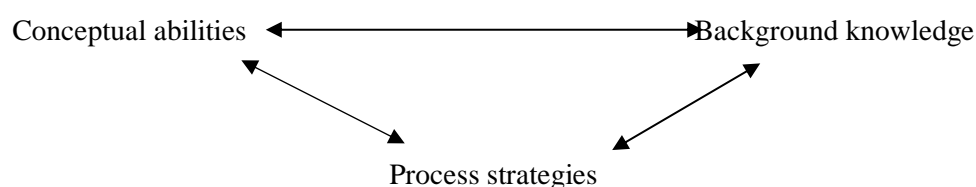
H k i w t g " 4 0 3 " E q c f { ø u " o q f g n " q h " c p " G U N " t g

First element in this model is conceptual abilities or general intellectual prowess, and Coady indicated that in L2 instruction, particularly reading instruction will have little impact on it as it relates to one's intellectual capacity. The second element, background knowledge, implies that the closer the first and second culture and language are the more rapid the acquisition of L2 reading skills. The third component, process strategies, consists of 'grapheme-morphophonemic correspondences, syllable-morpheme information, syntactic information (deep and surface), lexical meaning and contextual meaning, cognitive strategies, and affective mobilizers' (p.7).

Coady (1979) argued that L2 readers will employ these process strategies developmentally, and the combination can vary according to the type of reading materials, the degree of comprehension desired, the time available, etc.

Coady's model provides a two-dimensional construct of comprehension, and it provides the detailed information on process strategies that can be used in L2 reading. The model was criticised by

Bernhardt (1986) however, because it is not practical to conduct reading experiment as conceptual abilities are difficult to test and also there are no standard criteria to identify how close two languages are. In addition, the concepts in this model were adopted from the L1 psycholinguistic model, which can only be hypothetical in L2 reading.

2.30 4 0 4 " D g t p j c t f v ø u " e q p u v t w e v k x k u v " o q f g n

Compared with Coady's model, Bernhardt's (1983) constructivist model is much more complicated. By examining the data generated by readers of German, French and Spanish through recall protocol, Bernhardt's model (1983) involved six interacting features: phonemic/ graphemic features, prior knowledge, word recognition, metacognition, syntactic feather recognition, and intratextual perceptions, as shown below in Figure 2.2.
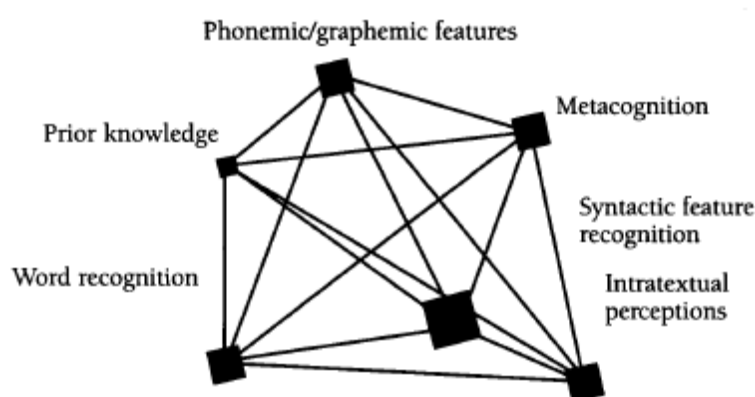
Hki wtg " 4 0 4 " Dg t p j c t f v ø**Reading** (**1986, p.103**)**e v k x k u v " Oq**

The components of this model can be divided into two groups: text-based and extra-text based (Bernhardt, 1986). Text-based components include word recognition, phonemic/ graphemic decoding, and syntactic feature recognition. Extratext-based components include intratextual perception, prior knowledge, and metacognition.

Bernhardt's model is multi-dimensional and interactive, which provides a big picture on what is involved when L2 reading happens. However, the details of how these components interact and how these help when the reader encounters some difficulties or problems are not indicated, part of which this study will try to explore.

In conclusion, there are some distinct features existing among L1 reading and L2 reading. As Nassaji (2002) noted, although the top-down view was supported in L1 reading, it lost its appeal in L2 reading, and the critical role of lower-level processes was documented more in L2 reading comprehension. As a result, when reading process is investigated, these differences are important and should be taken into account in the study.

2.4 Chinese written language and reading in Chinese

A lot of researchers claimed that some processes of reading are universal (K. Goodman, 1976; Koda, 2007; Perfetti, 2003; Perfetti, Liu, et al., 2005; Perfetti et al., 1992). However, character-based writing system has some unique characteristics, which may have an effect on learners' reading process. According to S. Ho (1976), in order to read in Chinese, a reader must have a great deal of knowledge which includes four parts: 1) First, he or she must be able to identify each character in the text; 2) then grasp its relationship to other characters; 3) he or she needs to recognise some special idioms; and 4) the reader should be familiar with the subject under discussion with cultural and other specific references. The last point relates to the cultural schemata, which cannot be directly and fully obtained from the writing system but is a part of the prior knowledge. The other three indicate the three different levels of linguistic information in Chinese text, which are Chinese characters, words, and phrases.

To understand how readers process information in text when they read in Chinese, the characteristics of Chinese writing system need to be analysed. This section will look closely into both character and lexical levels and sentence and discourse levels as they are not only the sources of information in text, but also are important linguistic knowledge required for reading in Chinese.

2.4.1 Chinese characters

Chinese characters are logographic. Unlike English, the character is the smallest free occurring unit of writing in Chinese (S. Wang, 2006), and in most cases, one character represents one morpheme. One of the biggest differences between Chinese and many other languages is that characters in Chinese do not link to pronunciation directly. Similar to morphemes in English, in modern Chinese, some characters can be used as a word by themselves, while some other characters cannot be used in isolation, and need to combine with other characters in order to form words. Even though the manner in which the Chinese characters are formed or derived varies, they are all structured and analysable.

2.4.1.1 Character composition

The smallest graphemic units are strokes, and Packard (2000) defined strokes as the basic spelling symbol in Chinese script. Individual strokes contain no phonological or semantic information with few exceptions (means 'one'). There are eight basic strokes in Chinese writing system, and the number of strokes in a simplified character varies from 1 to 64 (DeFrancis, 1984). The average stroke number for the 2,000 most common simplified characters is 9.8 (Zhou, 1979). Different strokes can be used to constitute components, which are combined to compose more complicated characters, while some of the components are characters by themselves (called single characters). The components related to the meaning of the character are called radicals, and there are 214 different radicals in Chinese.

2.4.1.2 The formation of Chinese characters

Chinese characters were formed through four [1] different ways, namely, pictographs, indicatives, ideographs, and semantic-phonetic compounds (S. Xu, 2013). The form or shape of the characters in the first three categories matches their meaning closely in different ways. Pictographic characters are like pictures to indicate an object, such as   ('sun') and   ('mountain'), while indicatives are often used to express abstract ideas, such as   ('above/ up') and   ('below/ down'). Ideographs are similar to indicatives, but normally are composed of two or more components, for example combining two characters   ('wood, tree') to make   ('woods'). Although Chinese characters are famous as a form of pictograph, only a small fraction of the characters belong to the first three categories.

Most Chinese characters are semantic-phonetic compounds, and the percentage has been expanded as it is the way how most 'new' characters are invented. According to Hoosain (1991), up to 90% of characters are semantic-phonetic compounds, and these characters are a combination of a radical indicating meaning and another component indicating pronunciation. For example,   (*hú*, 'lake') is made up of two components: means 'water' which indicates the meaning is water related, and   (*hú*, 'a common Chinese surname') indicates the pronunciation of the whole character is same as   . The character   , however, is an ideal example of semantic-phonetic compounds as both the semantic and phonetic components are accurate. The accuracy of semantic radicals as a predictor of whole-character meaning varies from 65% to 100%, and the reliability of phonological components in predicting the pronunciation of the whole character is only 26.3% (Fan et al., 1984). Although the semantic and phonological components cannot always be valid clues, they are still useful in Chinese reading and can provide both semantic and phonological cues.

2.4.2 Chinese words and segmentation

2.4.2.1 Chinese words

The notion of word in Chinese has not been well-defined. Different characters can be easily identified as there are clear boundaries between each character in written Chinese, but no physical boundaries (e.g., space) exist between words. In a syntactic sense, a word could be either one syllable or a combination of two or more syllables, usually with one syllable equating to one character. However, whether a poly-syllabic form is defined as a word or compound varies with individuals (Chao, 1968). Words with two syllables constitute the majority of modern Chinese words.

Although the boundary between words and compounds is ambiguous, the morphology of complex words (a combination of two or more syllables) falls into two main categories, namely, affixation and compounding. In the category of affixation, one of the characters in the word contains the core meaning, and another character only acts as an affix to satisfy the requirement for syllables and to reduce the number of homophones, such as in the word   ('shoes'), the first character   is the core meaning 'shoes', while   does not have any meaning in this word.

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[1] There are six writings in Xu Shen's *Shuowen jiezi*, which is called '   (liushu)' in Chinese. Two ways (i.e., rebus/ phonetic loan characters (   ) and derivatives/reciprocation (   )), however, are not about structural composition ('   '), instead, they refer to usage of characters ('   ').

The category of compounding is much more complicated as there are six different kinds:

1) The characters have similar meaning in the word. For example, the two characters in the word ('language') mean language and speech respectively.

2) One character in the word acts as a core, while the others act as modifiers.   , for example, means 'overcoat', and it is formed by   which means 'big', and   which means 'clothes'.

3) One character contains the core meaning, and the other provides some extra information. For instance, the word   means 'to correct', and the first character   contains the core meaning of 'to change' or 'to revise', and   adds the meaning of 'right' or 'correct'.

4) The structure of this kind is subject plus predicate. Taking   ('earthquake') as an example,   means 'earth' or 'ground', and   means 'to shake' or 'to quake'.

5) Verb plus object. Such as in the word   ('have a haircut'),   means 'tidy up', and   means 'hair'.

6) Repeated two-syllable words. For example, the word   ('younger sister') just repeats the character of   ('younger sister').

There are also some Chinese words translated from other languages, and these words normally adapt the original pronunciation into Chinese phonetic system so that the pronunciation in Chinese is similar as its original pronunciation, but not the same. These words often come from English, and often are constituted by more than two syllables due to the characteristics of English words. For instance, chocolate is translated as   (s k   ) in Chinese.

If a reader has learnt the rules of word formation, he or she can make an educated guess on the word meaning during reading when only part of the word is recognised. This linguistic knowledge can be helpful in reading when the lexical knowledge is limited, and it can also be used as a tool to learn new words faster and better.

2.4.2.2 Chinese word segmentation

As there are no boundaries between words in written Chinese, segmenting words generally causes problems in reading Chinese especially when a reader's linguistic knowledge of Chinese is insufficient and several unknown characters and words happen in a same row. Segmentation has attracted scholars' interests in both Chinese as L1 reading (e.g., Bai et al., 2008; Blythe et al., 2012; X. Li et al., 2009 & 2012; X. Li & Shen, 2013) and L2 reading (e.g., D. Shen et al., 2012; H. Shen & Jiang, 2013) since it is one of the characteristics of Chinese written language.

For established Chinese L1 readers, inserting spaces between words has been found to provide no benefit or harm compared to reading normally un-spaced Chinese text (Bai et al., 2008; Zang et al., 2011 & 2013). Bai et al. (2008) explained that the benefit from providing clear boundaries was counterbalanced by the unusual visual appearance as Chinese L1 speakers are used to the un-spaced text. However, Blythe et al. (2012) found that inserting spaces into Chinese text to provide unambiguous word demarcation helped Chinese L1 children learn new words, and the benefit maintained through the test phase. It also worked for L1 adults, however, the effect only occurred in the learning phase and disappeared in the test phase. They argued that the spaced text gave the reader a clear visual cue of

where the word was, and thus when they encountered the word again in an un-spaced test, they were able to identify and process it in a more holistic manner instead of a character-by-character basis. Moreover, X. Li et al. (2012) found that reading times were shorter for adult Chinese L1 speakers when characters belonging to one word were in a single line instead of on two different lines. Bai et al. (2008) also demonstrated that adding spaces between every character and between characters that yielded non-words interfered with reading. All of these studies indicated that words, not individual characters, are the unit of primary importance in L1 Chinese reading.

In addition to the effect of adding spaces between words and characters on reading, how words are segmented during reading also has attracted attention. Inhoff and Wu (2005) used an eye track experiment to test unidirectional parsing hypothesis and multiple activation hypothesis. The former assumes that characters are assigned to words in a strictly serial left-to-right process, while the latter one assumes that all possible words that can be combined by the characters falling into the perceptual span are activated. The result of the study was consistent with the latter hypothesis, and this may indicate that segmentation does not follow a liner processing, rather, it may depend both on lower-level processing (character recognition) and higher-level processing (the meaning of the sentence and contextual information). This was also supported by Li et al.'s (2009) research. They conducted five experiments to examine if word segmentation in Chinese influences character recognition through feedback. They argued that if top-down information is a key factor in segmentation, according to the holistic hypothesis, 'the segmentation and recognition of Chinese words involves an interaction of top-down and bottom-up processes' (p.543). Otherwise, word segmentation follows after character recognition, which is consistent with feed-forward hypothesis. In this study, they found that word segmentation does influence character recognition for Chinese L1 readers.

For Chinese L2 readers, segmenting words while reading requires lexical knowledge and thus it is always seen as an indicator of a reader's Chinese language proficiency. H. Shen and Jiang (2013) conducted an experiment to investigate the relationship between three lower-level processing components, including character naming speed, character naming accuracy and word segmentation accuracy, and reading comprehension among Chinese L2 learners who learn Chinese in China with different L1 backgrounds and in the USA with English as L1. The result showed that the three components in combination contribute to reading comprehension for all participants regardless of the learning settings and L1 background even though the segmentation accuracy itself is statistically insignificant.

A few studies have been conducted to examine the effect of adding interword spacing on Chinese L2 reading, however, the results were not identical. Everson (1986) used eye-tracking method to investigate American beginning level and advanced level Chinese L2 learners' and Chinese native speakers' reading speed and reading comprehension when they read unspaced and word-spaced Chinese texts. He found advanced level Chinese L2 readers fixated significantly more times when they read the word-spaced text than when they read the normal unspaced text, although their reading comprehension was not affected. Such disruption was not noted in either the Chinese native readers or the Chinese L2

beginners. Bassetti (2009) compared the effect of adding interword spacing into sentences written in characters and pinyin on Chinese reading in both Chinse native readers and Chinese L2 readers. The result indicated that interword spacing facilitated pinyin reading in English readers but not in Chinese native readers and it did not affect character reading in either group. D. Shen et al. (2012) adopted eye movement measures to examine Chinese L2 learners' reading speed when they read Chinese sentences with four types of spacing information, namely, unspaced text, word-spaced text, character-spaced text and nonword-spaced text. Unlike Chinese native speakers, the different types of text did influence L2 Chinese learners' reading. They read fastest when the text was word-spaced, and non-word spaced text caused the most disruption. This impact remained no matter whether the learners' L1 was spaced or unspaced, or whether it was character-based or alphabetic-based. Several factors may contribute to the difference in the results. First are the participants' Chinese proficiency levels. As indicated in the study of Everson (1986), adding interword spacing may have different effects on different proficiency levels of Chinese L2 learners. Reading materials may be another factor that may influence the result. In the study of Everson (1986), the participants were required to read a whole Chinese text, while in the other two studies (Bassetti, 2009; D. Shen et al., 2012) participants only read Chinese sentences. Despite the length of the reading materials, the difficulty of the reading materials may also vary. Moreover, the methodology adopted in the three studies were also not identical: both Everson (1986) and D. Shen et al. (2012) used eye-tracking to examine the eye fixation, while Bassetti (2009) only investigated the reading speed.

2.4.3 Chinese sentences and discourse

Unlike English and many other alphabetic languages which show grammatical relationships by affixes and internal changes in words, Chinese grammar is reflected either by changing the order of words (T. Xu, 2001) or by use of independent grammatical particles (D. Wang, 2006). In other words, the Chinese grammatical system is governed to a large extent by considerations of meaning, rather than of grammatical functions (X. Shen, 1992). Thus, providing a brief account of some characteristics of Chinese sentences may be helpful in terms of better understanding the process of Chinese reading.

Chinese is known as a topic-prominent (TP) language rather than a subject-prominent (SP) language. In Chinese, a topic is a basic unit of a sentence, whereas, in English, a subject is a basic unit (J. Huang, 1984). According to J. Huang (1989), as a TP language, Chinese allows empty elements to occur in three positions, namely, topic, subject and object, while English, as an SP language, does not allow empty elements occur in any of the three positions in a sentence. In other words, Chinese grammar allows more types of ellipsis than English, which may cause some ambiguities for readers. For example, the agent of actions may not always be clear, and Chinese syntax tolerates the omission of several subjects at the discourse level if the sentences are within the same topic chain (S. Wang, 2006). Moreover, the unit of Chinese sentence seems larger than that in English. Under the topic, several small sentences can be logically linked together (S. Wang, 2006) without discourse coherence signalling devices (L. Li, 2019), which may make it more difficult for Chinese learners to understand the sentences and the relation between them.

2.4.4 Reading Chinese as an L1 and L2

Even though the number of the studies on reading Chinese has been increasing in recent decades, it is still incomparable with the research on alphabetic languages. Studies on reading Chinese as an L1 tend to pay more attention to specific sub-skills, especially to character or word recognition (Perfetti & Liu, 2006; Perfetti, Liu, et al., 2005; Perfetti & Tan, 1998). These studies used word lists as the experimental materials, which failed to take the whole reading processes into account. A large number of studies on reading character-based languages focus on children's L1 acquisition. When it comes to adults' L1 reading, the scope is different, and the topics attracting researchers' interests include reading with dyslexia (e.g., McBride-Chang et al., 2011) and the phonetic, semantic activation in character recognition (e.g., Feldman & Siok, 1999; Tan & Perfetti, 1997). It may be difficult to explore what happens when L1 adult normal readers read as the processes tend to be automatic and unconscious.

The research on reading Chinese as an L2 also pays a lot of attention to word recognition as it is believed to be the major cause of the difficulties and problems for L2 learners (Everson & Kuriya, 1999; Koda, 1992, 1994 & 1996; Mori, 1998). For example, in the research by H. Shen & Jiang (2013) on Chinese L2 reading, three factors were examined, namely character-naming accuracy, character-naming speed, and word segmentation accuracy, and all three components contributed to reading comprehension. The problem with this research is that the character-naming and word segmentation tests were conducted before the reading comprehension test, which means the abilities of character naming and word segmentation were not treated and examined as parts of the reading processes. Since the lower-level processing (character naming and word segmentation) is dynamic during the process of reading, the interaction between the lower-level and higher-level processing cannot be revealed from this study.

2.5 Reading problems and problem-solving strategies

Reading problems and problem-solving strategies are important areas to investigate as they can help us better understand students' difficulties, and they may also deepen our understanding of reading process.

2.5.1 Reading problems

There are two main streams of reading problem research in L1 learning and teaching area. Some studies focused on what may be seen as indicators of dyslexia, for example, phonological processing (e.g., Share, 2008; Ziegler, 2006), phonological awareness (e.g., C. Ho et al., 2000), rapid automatized naming (e.g., Chan et al., 2007) and phonological memory (e.g., C. Ho & Lai, 1999). As when L1 readers have reading problems and difficulties, it is important to understand if they are at the risk of dyslexia. Some other studies may not view some reading problems as a handicap, rather, these problems are just 'windows' (known as 'miscues' in Goodman's model, 1967) which help us better understand the process of reading. The most influential research is miscue analysis, developed by Goodman in the 1960s (refer to 2.4.1.2). Hare's (1981) study is the only study using retrospection tasks, not surveys, to investigate L1 readers' reading problems. In this research, she asked 12 good readers and 12 poor readers to read one high-knowledge article and one low-knowledge article. When the students finished,

they were required to write down everything they noticed about their reading. In this research, both reading problems and their problem-solving strategies were identified. As the participants were L1 readers, the reading problems identified were limited: becoming distracted, eyes moving faster than mind, failing to understand a clause, failing to understand a word.

Goodman's miscue analysis has also been adopted in L2 reading research (refer to 2.5.1.2). Although miscue analysis identifies readers' reading miscues, including correction, dialect, graphic proximity, phonemic proximity, graphic alternative, allologs, retroflex suffix, code-switched form, syntactic acceptability, semantic acceptability, syntactic change, semantic change, segmentation, tone (S. Wang's Chinese taxonomy of reading miscues, 2006), the aim of these studies are not to better understand what reading problems L2 readers encounter during reading, but to focus on what cues readers rely on when they read. Thus, the categories of miscues cannot fully reflect L2 readers' reading problems. For example, it does not include vocabulary problems, which constitute the main problem for EFL students according to Yorio's (1971) survey.

In addition to miscue analysis, much L2 reading research also focused on the sources of reading failure, including learner variables, teacher variables and textual variables (see Davoudi & Yousefi, 2015 for a detailed review). However, few studies identified reading problems during L2 readers reading a text, except for the study of Numi (1991). A Think-aloud protocol was adopted in this study to analyse reading problems and problem-solving strategies of ten students from a Tanzanian university when they read Swahili and English texts. In this research, reading problems were classified into three categories: namely, word(s), sentences and paragraphs, and no subcategories were provided. In each category, the specific problems were listed, for example, all the words that participants had problems with were identified under the category of word(s). In this way, it is difficult to further generalise the findings as we only know that four participants in this study had problems with the word 'slogan', but we are unsure why this word caused problem: if it is because participants have never learned it, if they cannot remember the meaning when they read it, or if they are unable to contextualise the meaning in the sentence. This is the gap that the current study would fill.

'Reading problem' is used in this study instead of 'miscues' because although miscue analysis is adopted, this study does not stop at identifying each reading miscues. A retrospective stimulated think-aloud is also employed to explore what reading problems behind the miscues. Moreover, some reading problems identified in this study may not lead to any miscues. 'Failures' are also not used in this study to refer to the problems because reading problems can actually reveal the reading process. Some of them should not be regarded as 'failures', instead, they may indicate readers' capacities.

2.5.2 Problem-solving strategies

Reading strategies have been the subject of reading research for decades. They are defined as 'how readers interact with the written texts and how these strategies help to enhance text comprehension which includes mental plans, actions and techniques' (Rajoo & Selvaraj, 2010, p.1301). Reading strategies include all kinds of interactions between readers and the text. According to the resources published on the website of Ontario Ministry of Education, 'Think literacy cross-curricular approaches,

grades 7-12', readers use reading strategies before, during and after reading. For example, before reading they may 'preview the text by skimming and scanning to get a sense of the overall meaning' (p.7), during reading they can make notes to help remembering information, and after reading they can 'extend their understanding in critical and creative ways' (p.7). Those reading strategies, however, will not all be targeted in this study. Problem-solving strategies of reading, instead, are the focus of this research, which refer to the strategies readers adopt to solve reading problems they encounter.

Even though there are a huge number of studies investigating reading strategies (e.g., N. Anderson, 1991; Gürses & Bouvet, 2016; Muijselaar et al., 2017; Prichard, 1990), not many focus on problem-solving strategies. One reason may be that problem-solving strategies cannot exist without identifying reading problems first. As there is seldom research identifying reading problems during readers' reading (refer to 2.6.1), it is difficult to examine the problem-solving strategy itself. Numi's (1991) study was the only one found using a think-aloud protocol to analyse L2 reading problems, and its problem-solving strategies part will be discussed here. 19 strategies were reported by the participants: 14 were used while reading the text and 5 were indicated by participants that they would use but failed to do so during reading. Although Numi (1991) aimed at problem-solving strategies participants adopted when reading, some items (e.g., admitting failure from the start) do not seem readers use them to solve problems. In addition, some items are very similar, for example, using discrete contextual clues and using chunks of context, and deferring search after first attempt and anticipating information with solution. Thus, it is difficult to code strategies strictly following Numi's taxonomy.

Due to the lack of literature on problem-solving strategies, other studies on more general reading strategies need to be considered to better understand the studies of reading problems.

2.5.2.1 Research methods adopted to investigate reading strategies

Researchers adopted different methods to investigate the strategies employed by readers, and the most important two were questionnaire and think-aloud protocol. The data collection procedure is normally easily handled and controlled when questionnaires are the main research method, so one of the benefits of using questionnaires is it is possible to collect a huge amount of data (e.g., Muijselaar et al., 2017; Sheorey & Mokhtari, 2001). With this data, researchers are able to better understand a certain group of people, and draw some trends and tendencies. However, using questionnaires may overlook individual differences and for some participants their answers may be not accurate. The items on the questionnaire are same for each participant, but the reading experience may differ among readers. It is difficult to include every strategy in one questionnaire as the length is controlled and the items listed on the questionnaire may restrict participants' answers. In addition, when participants fill in the questionnaire, they have to recall their reading experience, so it is more about what they think they did rather than what they actually did during the reading. Some wordings of the questionnaire may also cause some problems. Different researchers used different wordings to refer to the same strategy, and as a result, participants may misunderstand some items when they fill in the questionnaires without any guide or further explanations.

Not as popular as questionnaire, but some studies (e.g., Block, 1986; Everson & Ke, 1997; Pritchard, 1990) used think-aloud protocol to investigate reading strategies. In these studies, participants were asked to read passages and self-reported the strategies they used. In some studies, participants were required to think aloud during their reading, so that the researchers could better understand the process of participants' reading and thinking, which, on the other hand, may interfere the reading process. Other studies chose to let participants finish reading first, and then asked them to report what they were thinking and doing during the reading. By doing so, participants were able to read in a more natural way, however, they may have already forgotten what they were doing and thinking in the think-aloud session.

In this study, a retrospective stimulated think-aloud was employed to more accurately reflect what strategies participants used during reading without interrupt the reading process. Using the video recording of their reading, it is easier for participants to recall some details happened during reading.

2.5.2.2 Categories of reading strategies

There are different ways to classify reading strategies, and the taxonomies can be very different in the research using questionnaires and think-aloud protocol, thus in this section, studies using think-aloud protocol are focused as it may fit better in this study.

When researchers used the think-aloud protocol to investigate reading strategies, different categories were applied. Generally, there are three different ways to categorise strategies. First, categorising strategies are based on different levels of factors in text. For example, in one of the earliest studies using think-aloud to examine reading strategies, Olshavsky (1976) categorised strategies into word-level, clause-related, and story-related. As the process of comprehension includes processing words, clauses, and the story, and all of these have an effect on one another, it is not always easy to classify a strategy into one of the categories. In one of the most influential studies, Block (1986) simplified the categories into two: general (comprehension) strategies and local (linguistics) strategies.

Another way of categorising strategies is analysing strategies as different conscious cognitive activities. For example, Sheorey and Mokhtari (2001) proposed the Survey of Reading Strategies (SORS), widely cited by other studies, and categorised strategies into metacognitive strategies, cognitive strategies, and support strategies.

The third way is to categorise reading strategies is based on the purpose of the strategies. For example, Sarig (1987) saw different strategies as reading moves with different purposes, and he proposed four different categories of these moves: technical-aid moves, clarification and simplification moves, coherence-detecting moves, and monitoring moves. Prichard (1990) classified processing strategies identified in his research into five categories: developing awareness, accepting ambiguity, establishing intrasentential ties, establishing intersentential ties and using background knowledge. N. Anderson (1991) also provided five main categories: supervising strategies, support strategies, paraphrase strategies, strategies for establishing coherence in text, and test-taking strategies.

One of the study's aims is to examine reading problems encountered by Chinese L2 and CHL students and the problem-solving strategies they applied; hence it makes more sense to categorise

strategies according to different purposes as categorising in this way makes it clearer what strategies participants adopted to solve different problems. In addition, Prichard's (1990) categories work better with data in this study as it states what resources readers use to solve their problems. Thus, this study adopts Prichard's five categories, and adds one category 'using aids and supports' during the data analysis.

2.5.2.3 The taxonomies of reading strategies used by Chinese L2 reading research

A few studies using the think-aloud protocol to investigate L2 Chinese reading strategies were found. A pioneer of such studies is Everson & Ke (1997) which explored the reading strategies of intermediate and advanced levels of CFL learners used when they read a short passage. As the number of the subjects in this study was limited, five for intermediate level and two for advanced level, they did not provide any taxonomies of reading strategies, instead, they focused on describing what these subjects thought of their reading. Although the focus of the study was on reading strategies, some reading difficulties were only identified through subjects' verbal report.

Lee-Thompson (2008) adopted the think-aloud protocol to examine what reading strategies American learners of Chinese use when processing Chinese narrative and argumentative texts. In the study, participants were required to report their thoughts when they encountered a red dot when they read, and they could use dictionaries whenever they needed. The classification schemes of reading strategies were mainly developed from Block (1986) with some input from other studies. 27 strategy items were recognised in Lee-Thompson's study and categorised into bottom-up strategies and top-down strategies.

S. Huang (2018) used think-aloud to investigate how L2 Chinese readers grouped multiple strategies to comprehend a Chinese text. Similar to Lee-Thompson's study (2008), in S. Huang's (2018) study, the participants were allowed to use dictionaries, and required to report their thinking during their reading. The taxonomies in this study were adopted from the previous studies (C. Chang, 2010; Lee-Thompson, 2008) with adaption. So, there were also two main categories in this study, namely, bottom-up strategies and top-down strategies with 26 items in total.

Both Lee-Thompson (2008) and S. Huang (2018) used categories of bottom-up and top-down to categorise strategies as they can reveal the reading process. However, as the bottom-up process and top-down process are interactive when reading, sometimes it is difficult to categorise one strategy item into one category. For example, in Lee-Thompson's (2008) study, skipping was classified into bottom-up strategies, while in S. Huang's (2018) study, it was categorised into top-down strategies. Thus, this study used Prichard's taxonomy as a framework for problem-solving strategies with some modifications.

2.6 Factors influencing reading

Four factors which may influence reading are included in this study, namely, the background of the readers, the language proficiency level of the readers, reading modes and text difficulty. These four factors will be discussed in this section respectively.

2.6.1 Language background and literacy

HL learners are a unique group in language study, who are different from both L1 learners and L2 learners. Valdés (2001) defined a HL learner in an English-speaking country as a language student who is raised in a home where a non-English language is spoken. This definition reveals that HL learners normally have the chance to speak and hear the language at home, but may not receive formal instruction in mainstream schools. He (2015) pointed out that the CHL learners have an ethnolinguistic affiliation to the Chinese cultural heritage, however, they may have a broad range of proficiency in terms of oral and literacy skills. The CHL learner thus is a label which applies to individuals with varieties of Chinese language knowledge and competences. He (2015) also claimed that these CHL learners 'exhibit linguistic and sociocultural traits that distinguish them from speakers of Chinese as a foreign language as well as from speakers of Chinese as a native language' (p.579), and thus their Chinese language use and learning deserves more attention and CHL learners should be treated as a different group from Chinese as an L2 or native language learners. In this study, CHL participants refer to those students who are from a Chinese ethnic background and exposed to Chinese language to different degrees at home.

As the number of HL learners keeps growing, HL education has drawn more and more attention. In the study of alphabetic languages, code-switching (Üstünel & Seedhouse, 2005), motivation (Geisherik, 2004) and identity (Creese et al., 2006) have been the focuses of the research. The research on CHL learners is 'a new territory' (Xiao, 2009, p.180), and how to teach those learners has attracted a lot of interests as CHL learners 'bring with them a set of linguistic ambiguities and skewed language skills' (Xiao, 2009, p.179). A number of studies (see D. Li & Duff, 2018 for a review) have been conducted to examine CHL learners' Chinese linguistic knowledge and competence, for example, character recognition and retention (Koda et al., 2008), grammar and syntax (Ming & Tao, 2008; Polinsky et al., 2010), pronunciation (C. B. Chang et al., 2009), etc.. Some studies have explored the relation between CHL learners' language experiences and their language development, including character learning (Ke, 1998), written Chinese achievement (Shen, 2003), Chinese language and literacy development (Xiao, 2006), literacy-related oral skills (Lü & Koda, 2011), word-level skills (Zhang & Koda, 2018) and word-knowledge development (D. Zhang & Koda, 2011; H. Zhang & Koda, 2019).

The study of H. Zhang and Koda (2018) found that CHL learners had advantages compared to their non-CHL counterparts in oral vocabulary knowledge, morphological awareness and lexical inference abilities, but not in print vocabulary knowledge. The findings suggest that CHL learners' early oral experience enhances their oral competence and skills with metalinguistic awareness, however, their advantage of speaking ability cannot fully apply to their reading and writing (H. Huang, 2011). From this point of view, although CHL learners know more spoken words than non-CHL learners, they may not be able to recognise and comprehend all of them in reading. This makes it interesting to compare CHL learners' and non-CHL learners' Chinese reading process.

2.6.2 Reading and language proficiency

It is widely believed that the language proficiency of the readers make a difference on processing strategies used (e.g., Pritchard & O'Hara, 2008; Sergent, 1990). In addition, it may also influence the efficiency of information processing and limit the resources that are available to readers.

F. Smith (2012) and K. Goodman (1969, 1988 & 1996) held that experienced readers use more context and prior knowledge than beginning readers do, and the reason why proficient readers read fast is that they can make predictions more effectively and efficiently on upcoming words based on context. Consequently, the proficient readers do not need to read each printed word, and the prediction and skipping makes the fast reading possible.

There is an opposite view believing that fast reading depends on automaticity of word recognition (Perfetti, Landi, et al., 2005; Stanovich, 1980). Experienced readers' word knowledge helps them to identify words without much effort, so that there is no context or other background knowledge needed. And because of the poor readers' deficit of word knowledge, they need context more as an extra help to identify words, though the success rate of word recognition for this group of readers is still low.

As these two views reveal two questions, namely, how prior knowledge will enhance comprehension, and how context will help to make guesses on unknown words, to which this study will conduct analysis to address.

2.6.3 Reading aloud and silently

Huey (1908) considered reading aloud as the opposite of 'reading for thought' (p.359), and it was much more difficult and unnatural than reading silently. As a result, according to him, instruction at the beginning of the 20th century has placed oral reading long after silent reading. Similarly, F. Smith (2012) held that reading aloud needed meaning identification first just like silent reading, and in addition, it also required an extra step – to say what was understood out aloud.

In his book, F. Smith (2012) explained silent reading as 'subvocalisation' (reading silently to oneself), which can slow readers down and interfere with comprehension. F. Smith (2012) claimed, however, that it can be useful in helping to hold the words in short memory which cannot be understood or dealt with immediately. However, he indicated that in such cases, comprehension suffers. So, subvocalisation tends to happen when the reading is difficult, and the reader cannot predict well. In the book, F. Smith (2012) also claimed that silent reading was the normal and the natural way to read, and the words can be interpreted immediately, like when we see pictures, without decoding the words into sound.

K. Goodman (1967) also held that silent reading is more efficient than oral reading, and he gave two reasons. First, readers need to divide their attention between decoding and recoding or encoding as oral output in oral reading, and the meaning construction (decoding) is not necessarily involved in the process of oral output. So, it is possible that a reader reads aloud a text perfectly with no idea of the meaning of it. Second, oral reading would restrict the reading speed, as the speed of speech production is much slower than the speed of processing information.

Some other researchers (Fuchs et al., 2001) from cognitive perspective, however, believe reading aloud can facilitate understanding since both visual and audial input is involved which will strengthen the outcome.

Gibson (2008) argued that some research recommended using reading aloud for different purposes in English learning. First, it can reinforce graphemic-phonemic correspondence and hence be used as a diagnostic tool (Birch, 2002; Grabe & Stoller, 2013). Second, it can be used as oral proofreading to develop writing skills. Finally, it can reduce the anxiety when students speak (Foss & Reitzel, 1988). Alshumaimeri (2011) compared the effects of different reading methods, namely, oral reading, silent reading and subvocalizing, on the comprehension performance of 145 Saudi EFL 10 grade students. The result revealed that oral reading had the greatest effect on comprehension among the three methods, and the feedback suggested that 'it helps in memorizing words and texts, concentration, and practicing and pronouncing words for real world encounters' (p.185).

It is still unclear that to what extent the reading aloud or silent reading will influence reading comprehension, especially the studies on reading character-based language are few. In addition, how the reading mode affects may also depend on the personal reading habits. As H. Shen and Jiang (2013) summarised, reading aloud may have its downside as it requires the involvement of oral and aural modalities, which demand more cognitive resources than silent reading, and thus it slows down the reading rate. However, for L2 readers whose word recognition have not reached the automatic level, reading aloud may help them make sound-graph connections. Due to the differences of reading aloud and reading silently, both of these two types of reading will be included in this study, and the performance of comprehension and the processing strategies used in reading aloud and silent reading will be compared.

2.6.4 The difficulty level of reading materials

The difficulty level of reading materials is an important factor to consider for language teachers to choose learning materials for their students, for experts to better edit language textbooks and for language learners when they want to improve their language skills. Thus, some studies (e.g., Crossley & McNamara, 2008) have been conducted to examine how to better assess the difficulty of reading materials.

Olshavsky (1978) investigated if good and poor L1 readers were able to adjust their strategies to accommodate increasingly difficult materials. The results showed that both good and poor readers used strategies less frequently when the stories became more difficult, which indicated that readers may judge the reading materials when they started reading and ''gave up' trying to understand the more difficult selections' (p.75).

Some other research that is focused on the effect of text difficulty on L2 readers or reading comprehension got mixed results. For example, Chiang (2016) investigated the effects of varying text difficulty levels on L2 reading attitudes and reading comprehension. In this study, 54 first-year students from a Taiwan University were randomly assigned into two groups: one group was given the easier English materials, while the other one was given the more difficult materials. The results indicated that

the easier materials contributed significantly to the reading attitudes, participants' reading comprehension, however, was not affected significantly by the varied difficulty levels of reading text. Bahmani & Farvardin (2017) examined the effects of different text difficulty levels on EFL learners' foreign language reading anxiety and their reading comprehension. The results showed that the anxiety decreased among students who studied easier reading materials and increased among those who studied the more difficult materials. All students' reading comprehension was improved significantly, which is in line with Chiang's (2016) study. A similar study was conducted by Namaziandost et al. (2019), which investigated the effect of various levels of text difficulties on reading comprehension and reading motivation. However, the result of this study is inconsistent with the other two studies. They found that the group reading the more difficult materials significantly outperformed the other group, and their motivation also increased.

It may be still not clear how the difficulty level of the reading materials would affect readers' development of reading comprehension in the long term. However, it certainly has an effect on reading process (e.g., causing more or different problems; the use of reading strategies). Thus, after participants reporting that one story is slightly more difficult than the other story, the difficulty level will be considered in this study to investigate how it affects Chinese L2 and CHL learners' reading process, including reading problems and problem-solving strategies.

2.7 Conclusion

In this chapter, different models of reading, reading problems and problem-solving strategies are reviewed and information processing in reading are also examined based on the previous research. To investigate the reading process, a reading model which not only can provide guidelines for the research scope but also can take the characteristics of written Chinese into account is needed. As the most influential L2 reading model, Bernhardt's (1983) model outlined the components of the lower-level processing and higher-level processing and represented in an interactive way. However, the details of each component and how they interact are unclear, and these details are the key to revealing the reading process of Chinese reading for L2 and HL learners. Perfetti and Stafura's (2014) reading systems framework, on the other hand, elaborated processes happened in reading and how each process interacted with one other and with readers' knowledge. It will be a good guideline to investigate reading process systematically. This study will also adopt a think-aloud protocol to examine reading problems and problem-solving strategies, which may shed light on the reading process. In addition, factors that may have an effect on reading process will also be taken into account.

Chapter 3. Approach and Methodology

This chapter outlines the methods and procedures used to conduct this research. The participants and reading materials used for this study are described first, followed by the data collection and procedures. The main approach adopted in this study includes reading aloud, retell protocols and retrospective stimulated think-aloud task. The data analysis, which consists of both qualitative and quantitative components, is then reviewed, especially with respect to how the data from different data collection sections are elaborated. How these research methods work together to better reveal the reading processes is also discussed.

3.1 The participants

Participants in this study were 16 Chinese L2 learners and 18 CHL learners from Monash University, Australia. These participants were doing or just completed Chinese Intermediate 2, Chinese Proficient 1&2 and Chinese Advanced 1&2[2] when recruited for this study. All participants were screened first to assess their Chinese language competence using a background survey (see Appendix A) and a character/vocabulary test (see Appendix B). Participants' Chinese language learning experience and knowledge were revealed in the background survey, which also includes the Chinese language units in which they were enrolled, if they use Chinese language in their daily life, and self-assessment of their own proficiency level. In the background survey, participants were required to self-assess their Chinese language competency. There are four different levels for reading skills, and the question is about whether they normally do well in their reading tests. The statement for level 1 is 'I am pretty lost when I do reading tests'; level 2 is 'it is pretty hard, but I am still able to understand some parts'; level 3 is 'it is OK, but I find some words or parts are difficult to figure out'; and level 4 is 'I can understand it easily'. In this study, CHL learners are those who have at least one parent who speaks Mandarin or Chinese dialects as L1; and L2 learners are those whose first languages have alphabetic writing systems, and who had no knowledge nor skill of either Mandarin or any other Chinese dialects before commencing their academic study of Chinese.

The participants were grouped into advanced and intermediate level groups based on the result of a character/vocabulary test, and the details of participants' proficiency will be provided in 3.1.1 and 3.1.2. The character/vocabulary test was used as the criteria instead of which Chinese language units participants were enrolled in, because students from the same class are varied in terms of their linguistic competence, including reading, speaking, listening and writing. Thus, participants' lexical knowledge revealed by the character/vocabulary test may better reveal their reading ability than the units in which they enrolled. However, vocabulary knowledge is not the only factor that may contribute to reading comprehension, and thus assessing participants' proficiency level only by the character/vocabulary test is one of the limitations in this study, which will be further elaborate in the Conclusion Chapter. The character/vocabulary test (provided in a list, without context, in Chinese characters) consists of 40

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[2] The Chinese language units at this University, from lower level to higher level, are Introductory 1&2, Intermediate 1&2, Proficient 1&2 and Advanced 1&2. The number in each unit title identifies whether it is available in semester 1 or semester 2.

words from the four stories used in this study. According to *The Graded Chinese Syllables, Characters and Words for the Application of Teaching Chinese to the Speakers of Other Languages* (2010), ten words are from Level 1 (beginning level), 18 words are from Level 2 (intermediate level), and 12 words are from Level 3 (advanced level). The participants were required to write down the pinyin and also the English meanings for each word. As many students were not able to write the tones and the tones are not the focus of this study, tones were not considered when marking the character/vocabulary test. If the pinyin was correct for one word, one mark would be given; if the pinyin were half correct (i.e., some pinyin were correct and some incorrect), a half mark would be given. If the English meaning for one word was correct, 1.5 marks would be given. So, the total mark for the character/vocabulary test is 100. In order to group the participants into different proficiency levels, two factors in the character/vocabulary test were taken into account. The first is the mark that a participant received. Most of the intermediate level participants received fewer than 50 marks, and advanced level participants received marks higher than 60. The second factor was based on which passages these successfully recognised words come from. The reading proficiency level was the same for L2 and HL participants, based on the same criteria (i.e., the character/vocabulary test results), but the proficiency on speaking and listening were not taken into account in this study, and HL participants were expected to have higher proficiency level of speaking and listening.

Based on the criteria of background and proficiency, four groups were identified: L2 intermediate level (L2I) group (nine participants), HL intermediate level (HLI) group (nine participants), L2 advanced level (L2A) group (seven participants) and HL advanced level (HLA) group (nine participants). However, four of them were removed from the data analysis as two L2Is were not able to understand any parts of the stories, which indicates that the reading materials used in this study were completely beyond their level, and two HLIs were not able to reflect on their behaviours and thoughts during the think-aloud session due to poor memories, thus the analysis of the reading problems they encountered and the strategies they applied during reading would be unlikely to be accurate.

As a result, the data of 30 participants were analysed, stratified as shown in Table 3.1.

Table 3.1 Grouping of informants

	Advanced level group	Intermediate level group
HL group	9	7
L2 group	7	7

3.1.1 Intermediate level participants

There are 14 intermediate level participants in total, and the information about the background and other characteristics of the participants is given in Table 3.2. The information comes from the online background survey.

Table 3.2 The basic information of intermediate level participants

Participant	Country of birth	First language	Gender	Current (or last) Chinese unit at university level	Vocabulary test mark (out of 100)	Self-evaluated reading level
L2I1	South Africa	English	Male	Proficient 2	56.5	Level 4
L2I2	Australia	English	Male	Intermediate 2	39	Level 2
L2I3	Australia	English	Male	Proficient 2	41	Level 3
L2I4	Australia	English	Female	Intermediate 2	49	Level 3
L2I5	Australia	English	Female	Proficient 2	43	Level 3
L2I6	Australia	English	Female	Intermediate 2	27	Level 2
L2I7	Australia	English	Female	Proficient 2	35	Level 2
HLI1	Australia	English	Female	Intermediate 2	38	Level 3
HLI2	Australia	English	Female	Proficient 2	35	Level 3
HLI3	Australia	English	Female	Advanced 2	52.5	Level 2
HLI4	Malaysia	English	Female	Intermediate 2	47	Level 3
HLI5	Australia	English	Male	Proficient 2	47	Level 3
HLI6	Australia	English	Female	Proficient 1	40	Level 3
HLI7	Australia	English	Male	Proficient 2	37	Level 3

From the information the participants provided in the online background survey, twelve of them were born in Australia while participants L2I1 and HLI4 were born in South Africa and Malaysia respectively, and all of these participants reported that their first language is English. As shown in Table 3.2, three L2Is and two HLIs are male, and the other nine participants are female. As the proficiency grouping is mainly based on the character/vocabulary test, these intermediate level participants were studying different Chinese units from Intermediate 2 to Advanced 2, while most of them were from Chinese Intermediate 2 and Chinese Proficient 2.

As mentioned above, most intermediate level participants received marks lower than 50 in the character/vocabulary test, except for participant L2I1 and HLI3. Even though they got more than 50 in the character/vocabulary test, almost all of the words that they knew were from the reading materials for lower level participants. Therefore, they were grouped into the intermediate level group.

As for participants' self-assessed Chinese reading competency, we can see from Table 3.2 that except for participant L2I1, all intermediate level participants chose level 2 or level 3. All HL participants except HLI3 chose level 3, while half of the L2 participants chose level 2. The character/vocabulary test scores of L2Is seem to have a relation with their self-assessed reading competence: those who gained high cores in character/vocabulary test graded their reading competencies high. This trend, however, could not be identified in HLIs: HLI3 gained the highest vocabulary score and rated her reading competence the lowest, and other HLIs all rated the same level

of reading despite of their different vocabulary scores. Of course, vocabulary is only one factor which contributes to reading, other factors (e.g., grammatical knowledge, reading strategies) also need to take consideration to assess one's reading competence more accurately.

3.1.2 Advanced level participants

There are 16 advanced level participants in total, and the information about the background and other characteristics of the participants is given in Table 3.3.

Table 3.3 The basic information of advanced level participants

Participant	Country of birth	First language	Gender	Current (or last) Chinese unit at university level	Vocabulary test mark (out of 100)	Self-evaluated reading level
L2A1	Australia	French	Female	Advanced 2	55	Level 2
L2A2	Australia	English	Male	Proficient 2	67	Level 2
L2A3	Australia	English	Male	Advanced 1	66.5	Level 3
L2A4	Australia	English	Female	Advanced 2	72.5	Level 3
L2A5	Australia	English	Female	Proficient 2	66.5	Level 3
L2A6	Australia	English	Male	Advanced 2	57.5	Level 3
L2A7	Vietnam	Vietnamese	Male	Proficient 2	64.5	Level 3
HLA1	Australia	English	Female	Proficient 2	87.5	Level 3
HLA2	Hong Kong	English	Female	Proficient 2	61	Level 3
HLA3	Malaysia	English	Female	Proficient 2	66	Level 3
HLA4	Australia	English	Male	Proficient 2	73.5	Level 3
HLA5	Hungary	English	Female	Intermediate 2	81	Level 3
HLA6	Malaysia	English	Female	Proficient 2	64	Level 3
HLA7	Australia	English	Female	Proficient 2	70	Level 3
HLA8	Australia	English	Female	Proficient 2	81.5	Level 3
HLA9	Australia	English	Female	Proficient 2	79	Level 3

From the information advanced level participants provided in the background survey, all L2As were born in Australia except that L2A7 came from Vietnam. As for HLAs, their home countries were more diverse: five were born in Australia, two in Malaysia, one in Hong Kong and one in Hungary. It is interesting that the three HLAs who were born in Chinese-speaking countries and regions (Malaysia and Hong Kong) received the lowest scores in the character/vocabulary test. Most L2As and all HLAs reported that their first language is English. The only two exceptions are L2A1 and L2A7. As shown in Table 3.3, L2As include three females and four males, while HLAs only have one male and the other

eight are females. Most advanced level participants were studying or had finished the unit of Proficient 2 or Advanced 2 when they participated in this study. For L2As, half of them had the experience of doing the advanced level Chinese; while for HLAs all of them were from the unit of Proficient 2 except that HLA5 was from Intermediate 2.

As shown in Table 3.3, the scores of character/vocabulary test for advanced level participants were generally higher than 60. As explained in 3.1.1, when grouping the participants, not only the vocabulary scores were considered, but also if the successfully recognised words from the reading materials for the advanced level participants was considered. As a result, although L2A1 and L2A6 received scores under 60, they were still grouped into advanced level participants. It is also noteworthy that these two participants were from highest level unit (Advanced Chinese 2), while HLA5 from the lowest level unit (Intermediate 2) received the highest mark in the character/vocabulary test. This is the main reason why the character/vocabulary test result was used as criteria to assessment of their proficiency levels in this study instead of the unit participants were enrolled in.

When these advanced level participants were required to self-assess their reading competence, most of them rated themselves as level 3 ('it is OK, but I find some words or parts are difficult to figure out'), and only L2A1 and L2A2 rated as level 2 (it is pretty hard, but I am still able to understand some parts'). Compared to intermediate level participants, advanced level participants' self-assessed reading competence level was slightly higher.

3.2 Reading materials

There are four stories in this study in total, two for intermediate level participants and two for advanced level participants. These four stories can be found in Appendix C. Each participant was required to read two stories, and one was to read aloud, while the other one was to read silently.

All of these stories used in this study were based on famous Chinese stories or tales and re-written by the researcher. When rewriting the stories, the characters, words and sentence structures were checked using the textbooks that the participants use in their Chinese class. All of the sentence structures and most of the characters and words in these stories have been taught in class, and some words that may be beyond most participants' proficiency level were chosen purposely to investigate what strategies participants would use when they encounter some unknown characters and words in reading.

3.2.1 Reading materials for intermediate level participants

The two stories for intermediate level participants are *Selling Alcohol* and *Smart Kong Rong*, and the length of these two stories is controlled to be similar (261 characters for *Selling Alcohol* and 254 characters for *Smart Kong Rong*). The words used in these two stories were mainly selected from the textbooks used in the units of Intermediate 1&2 and Proficient 1. 21 words (some of them are not in the exact form) in the character/vocabulary test come from the two stories for intermediate level participants. According to *The Graded Chinese Syllables, Characters and Words for the Application of Teaching Chinese to the Speakers of Other Languages* (2010), nine of them are from Level 1 (beginning level), nine words are categorised as Level 2 (intermediate level), and three of them belong to Level 3

(advanced level). The average sentence lengths of these two stories are similar, with 29 characters for the first story and 28 characters for the second one.

Before each story, there is one line in English providing very brief information about the content of the story without many details. The Story *Selling Alcohol* is about a person's experience of running an alcohol business, and the Story *Smart Kong Rong* is a story talking about a famous person in Chinese history and his experience in mocking another person when he was a small child. The titles of the stories are used in the analysis for ease of reference but were not provided in the reading session to avoid giving extra hints on content and vocabulary.

3.2.2 Reading materials for advanced level participants

The two stories for advanced level participants are *Two Neighbours* (300 characters) and *The Emperor and the Bird* (307 characters), the length of these two passages are slightly longer than the two for intermediate level participants, while the average sentence length remains similar (30 characters for both stories). The story *Two Neighbours* is about the conflict and resolution between two neighbours, and the story *The Emperor and the Bird* is about how an emperor governs his country.

In addition to the length and more complex plots, the words used in the stories for advanced level participants were mainly selected from the textbooks used in the units of Proficient 2 and Advanced 1&2. 22 words (three of them are also used in stories for intermediate level participants) in the character/vocabulary test are from these two stories. According to *The Graded Chinese Syllables, Characters and Words for the Application of Teaching Chinese to the Speakers of Other Languages* (2010), two words are from Level 1 (beginning level), 11 are categorised as Level 2 (intermediate level), and nine words belong to Level 3 (advanced level). So, the main difference between the stories for intermediate and advanced level participants were the difficulty of the characters and vocabulary.

3.3 Pilot studies

A pilot study was conducted to examine if the reading materials were at the proper difficulty level and length for participants to read, comprehend and retell, and if the procedures of data collection was easy for participants to follow. Two students, one Chinese L2 learner and one CHL learner, participated. They completed the whole experiment and reported that the reading materials and the design of the experiment worked fine for them.

The HL participant in the pilot study was enrolled in the unit of introductory level for background students, however, according to the character/vocabulary test, he was able to read the stories for advanced level groups. It turned out that he was able to comprehend the two stories for advanced level participants very well (average 20/22 for the retell). It revealed that the unit students were enrolled in did not necessarily reflect their real linguistic competence, and thus, only the character/vocabulary test was used as the criteria to group participants into different proficiency level groups.

As the pilot study's main purpose was to examine the reading materials and procedures of data collection, the two participants' data were not included in the main study.

3.4 Data collection and procedures

The data collection for this study includes two sessions in six parts, namely background survey and character/vocabulary test, oral reading, silent reading, oral recall, stimulated think-aloud, and an interview, which will be explained below. The whole procedure for each student took approximate 90 minutes (for the breakdowns refer to Figure 3.1 below).

Sections	Tasks	Time needed
Pre-session	Background survey and vocabulary	20 minutes
One-on-one session	Reading silently	2-5 minutes
	Oral retell	3-10 minutes
	Reading aloud	2-5 minutes
	Oral retell	3-10 minutes
	Stimulated think-aloud	30-50 minutes
	Interview	10-15 minutes
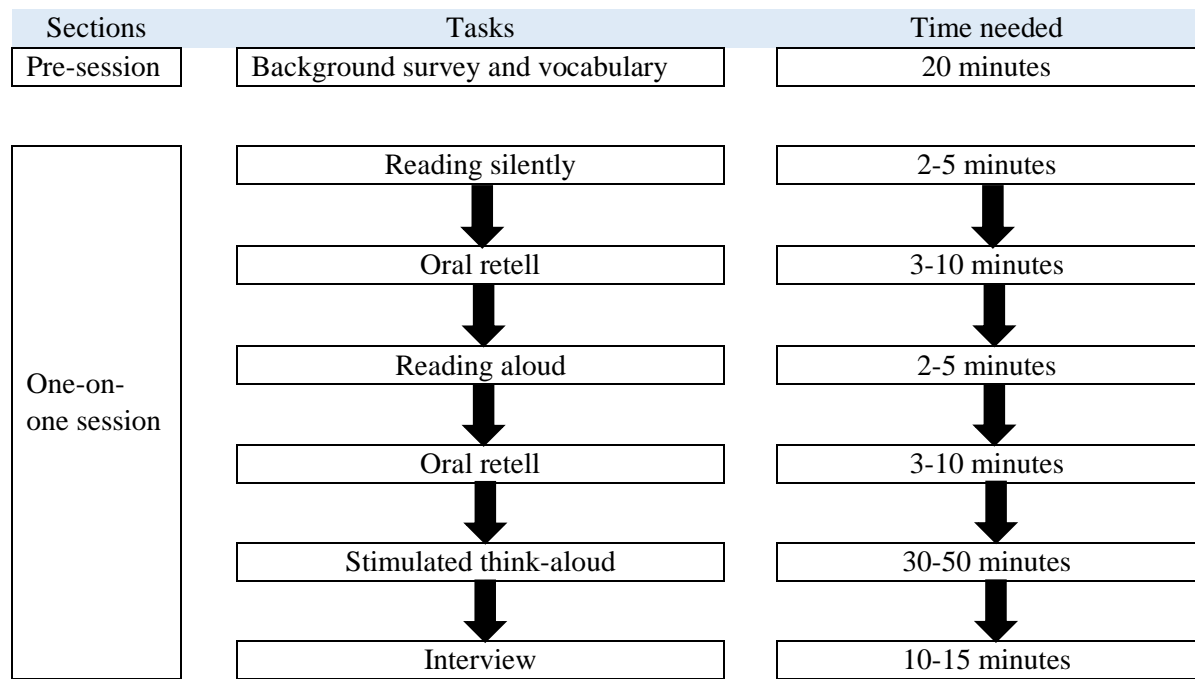
Figure 3.1 Data collection procedure

3.4.1 Pre-session – collecting background survey and character/vocabulary test

Both the online background survey and the character/vocabulary test were completed by participants before the one-on-one session. The answers of the background survey and the result of the character/vocabulary test were used as the main indicator to group the participants, as discussed above in section 3.1.

The background survey was conducted online using google forms and the link was sent to each participant after they emailed to express their interest in this study after the researcher invited them to attend the character/vocabulary test session. Most participants finished the online survey before they came for the character/vocabulary test, and those who did not finish in advance, were asked to finish it first when they came to do the character/vocabulary test. The background survey was written in English to make sure that each question was well understood. The questions were about the participants' language background including their first language, their experience of second language learning, their Chinese language competence, etc. To assess their Chinese language competence, the participants were asked to give information on the Chinese units they had enrolled in, the marks they got, and self-assessment was also employed. In the self-assessment, the proficiency in spoken Chinese and reading or writing Chinese were assessed independently. The complete survey is presented in Appendix A.

In the character/vocabulary test, a list of words written in Chinese was given to the participants, and they were required to write down the pinyin and translate them into English without any aids (see above). As these words would be used in the reading materials, after each participant finished the test, the paper was returned to the researcher, so that the participants were unable to review the vocabulary list. They were encouraged to write down the pinyin and translate as many words as they could, but they could always skip the words they had no ideas of. This test did not only examine their lexical and character knowledge, but could also be used to predict which words in the reading materials may cause problems. After the pre-session, participants were invited to attend the one-on-one session after one week. This interval period is to make sure that the participants do not have vivid memory of the vocabulary which may interfere with their reading process.

3.4.2 One-on-one data collection session

After participants had finished the background survey and the character/vocabulary test, they were allocated into four groups (for details refer to 3.1). One week after the pre-session, participants came to do the one-on-one session. This session was conducted in a micro-studio with audio and video recording equipment, and the researcher was present. The researcher had to be there to control the equipment, and at the same time could take some notes based on observation. In addition, the think-aloud session and interview session also needed the researcher's presence. It is noteworthy that the one-on-one session was conducted in an experimental environment, which may have an effect on participants' behaviours.

3.4.2.1 Reading silently and reading aloud

Each participant needed to complete both reading aloud and silently. According to K. Goodman (1967) and F. Smith (2012), the processes of reading can be different in the situation of read aloud and silently, as explained in section 2.7.3.

Each participant had received an instruction sheet before they started the reading session, and they were asked to follow the instruction sheet while the experimenter read it out aloud. The instructions on reading silently and reading aloud were each explained. Participants were asked to read at natural speed, and they could re-read words or any parts when necessary. They were told that they needed to retell the story after they finished reading, so they should concentrate on the meaning of the text. When they encountered any unknown characters or words in oral reading, they were encouraged to have a try if they had any clues: for example, they could say it in English if they knew the meaning, but they could skip the part if they did not have any ideas. The stories were printed on paper using simplified Chinese characters as the participants were taught simplified characters in class at university. In the silent reading part, the participants were required to use a pen to point at the character or the word they were reading. In the reading aloud, a pen was also provided for participants to draw lines or marks if they wanted. The whole reading session was video-recorded.

In the reading session each participant was required to first read one story silently, and then read the other story aloud. Half the students were asked to read Passage One first (silent reading) and then read Passage Two (read aloud), while the remainder read Passage Two silently, and followed by Passage

One aloud. The order of the stories was changed so that difficulty of the story could be judged across both reading modes. However, all participants were asked to read silently first as it was considered that reading aloud first might condition students to sound-out each character during any following silent reading, even if they did not normally do so. In addition, reading silently first can also give participants some time to calm themselves as reading aloud in front of a Chinese native speaker (the researcher) can be anxiety-inducing for some participants.

3.4.2.2 Oral retell

Once the participant finished reading one passage, an oral retell was conducted to examine their overall comprehension of the text. It consists of two parts: unaided retell and prompted retell. Through analysing their production of retell, we were able to find the words or sentences that participants were unable to understand fully and correctly. These words and sentences were the sections that participants had difficulties with and could not solve by strategies. In addition, we could identify some comprehension problems that were not revealed in the reading session. Therefore, the data from the retell session were good supplementary information for the reading session.

Firstly, an unaided recall was conducted. In this part, the participant was asked to retell the story he or she had read, and the researcher did not provide any help. Participants were told to give as much information as they could in this part. Given that the aim of the retell is to examine the comprehension of the text, both English and Chinese in retelling is acceptable. All participants in this study, however, chose to retell the story in English. They may use some Chinese words when they were unable to translate them into English.

When the participant retold the story, the researcher checked the main points of the story at the same time using a sheet listing the main ideas of the story (see in Appendix C). The researcher ticked when the participant recalled a point correctly, and for the parts that the participant missed or wrongly recalled, the researcher took notes for the reference in the prompted recall.

When the participant finished the unaided recalling, the researcher asked some questions about the story based on the information that the participant had already given. The aided recalling was used as a tool to remind the participants of some details that they understood but forgot to say, and it can also help the researcher to clarify some unclear parts produced by the participant in the unaided retelling part. In this section, the researcher was not allowed to provide information for the participants, so the questions used by the researcher were kept simple and general, for example, 'you mentioned there were two neighbours in the story, can you remember anything about them?'. In this part, the researcher asked the questions in English in general as it was the main language participants used to retell the story. However, if participants used some Chinese words in their retell, the researcher also used Chinese words to ask questions.

3.4.2.3 The retrospective stimulated think-aloud protocol

To reveal the reading problems and problem-solving strategies, a retrospective stimulated think-aloud protocol was used immediately after the participants finished the prompted retell for the second story.

In the think-aloud for silent reading, the video recording of the reading process and the lines or marks the participant drew during the reading were used as the stimuli. Each participant and the researcher watched the video together. The participants were asked to talk about what they were thinking or doing whenever they paused, re-read, drew on the paper, etc. The researcher also asked the participants to point out the unknown characters or words, the parts that caused problems, and the participants were also encouraged to share any of their thoughts about the text. Based on the retelling that the participant produced, the researcher sometimes asked some questions to investigate the misunderstanding revealed in the section of the oral recalling.

In the think-aloud for oral reading, the recording of the participants' reading was used as the stimulus. During the think-aloud task, the participant was asked to follow the text while they listened to the recording. The participant was required to stop the recording when they spotted any mistakes they produced, and discuss with the researcher what and how they thought when they read that part, and what caused the mistakes. They were also encouraged to stop the recording whenever they wanted to share something, including the problems or difficulties they encountered during the reading, the characters or words they did not understand, and any other thoughts they had about the text. If the researcher had any questions about any part which had not been picked up by the participant, they returned to the part in the end and asked the participant to clarify them.

During the think-aloud session, when participants verbalised what they had been thinking and doing during the reading session, any kinds of explanations were accepted. If the participants forgot what was happening or why they paused somewhere, the researcher did not force the participants to explain their behaviours in reading. There are two main reasons not doing so. The first one is if the participants were required to explain every single action, they may make up something when they could not remember or when they were unable to explain something. The second one is that doing so may make the participants nervous and frustrated, which would not help them to remember more details.

3.4.2.4 Interview

At the end of this one-on-one session, a brief interview was conducted to discuss some reading-related questions with the participants. These questions were asked after the participant had completed the experiment so that they would not be influenced by the questions on their reading process. The aim of the interview was to obtain important supplementary information for this study, to profile each participant as a reader, and to provide a chance for the participants to express their thoughts on both Chinese reading and this experiment. The complete questions of this interview can be found in Appendix D.

3.5 Data analysis

In this study, there were three main sessions: the reading session, the retell session and the think-aloud session. The data for Research Question 1 came from reading and retell session: reading speed was from the reading session and reading comprehension was from the retell session. The data for Research Question 2 came from all three sessions: these data work together to identify where the problems are,

what kind of problems they are, what strategies are used, and if the strategies work successfully (see Figure 3.2 for details).
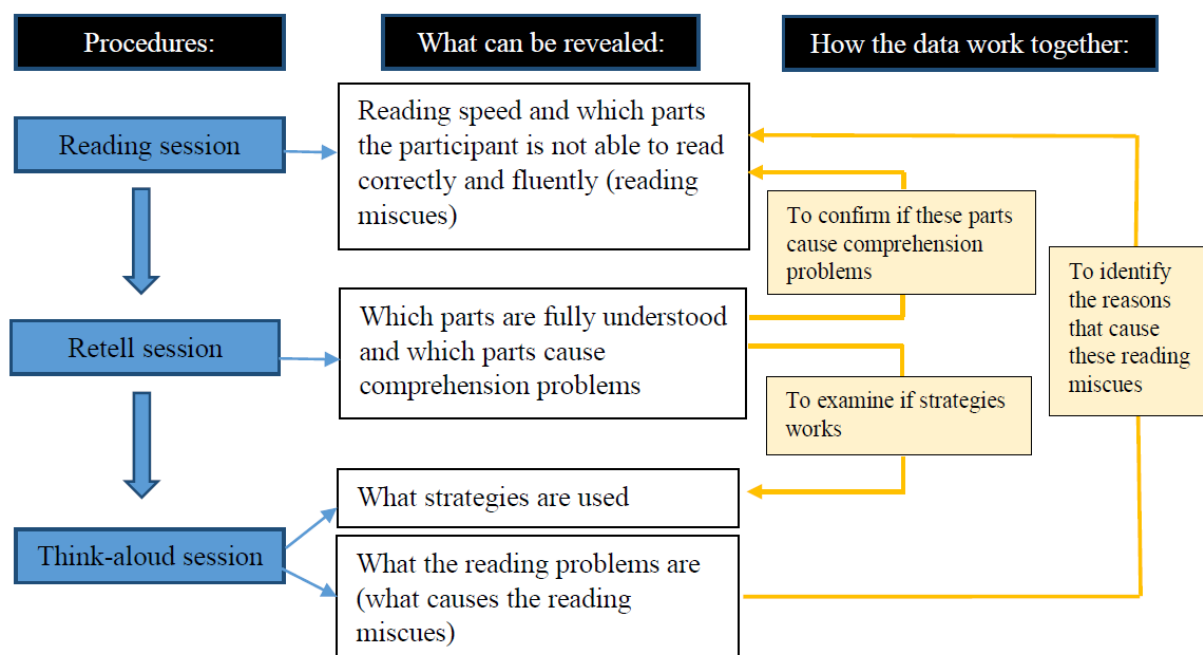
Figure 3.2 The data from the three sessions and the relations between the data

In the reading session, the process of reading was recorded, and by analysing it we can locate the words or sentences that the participant may have some problems with. The indicators of these problems are pauses and repetitions in the mode of reading silently, and in the mode of reading aloud more types of reading miscues (i.e., substitution, segmentation, omission, and insertion) can be seen as indicators.

The data from the reading session, however, were only able to identify some parts that participants may have problems with, and they had some limitations. First, parts where participants paused, re-read or made some miscues may not cause any comprehension problems. As Goodman (1967) pointed out when he explained why miscues are not necessarily a bad thing in reading, even for adult native speakers without reading problems, it is not easy to read exactly what is printed in the book all the time without any hesitations or mistakes. So, if the miscues do not cause any comprehension problems, they are not that significant as only reading fluency will be affected. Second, some problems can be overlooked because participants may do nothing when they encounter some difficulties during reading, and it is also possible that one can read a sentence correctly without understanding the overall meaning.

To minimise these limitations, a retell session was introduced in this study to examine participants' comprehension. The data from the retell session, however, can only provide the result of comprehension without the details of what happens during the reading. For example, a participant may have encountered a problem at some point, but solved it successfully by applying a reading strategy. The data from the retell session can only tell us that this participant understood that part of text correctly, but it is unable to reveal the strategy used, and sometimes it may not be able to reveal the initial problem either. To gain more details of the reading process, a think-aloud session was added into this study. The

data from the think-aloud session can assist us to identify the reasons that cause the miscues, and it can also reveal the strategies that participants used during reading. The data from three sessions will be illustrated with more details below.

3.5.1 Some terms used in data analysis

Some key terms used in the data analysis are defined below.

Miscues: The concept of miscues or reading miscues is from Goodman's miscue analysis (1973, see also section 2.4.1.2). A miscue happens when the reader's production departs from a fluent and correct reading of the text. In this study, reading miscues include pause, repetition, substitution, wrong segmentation, omission and insertion; however, in silent reading only two kinds of miscues, pause and repetition, are observable. All miscues are used as windows to reveal the parts of the text that participants are unable to follow correctly. Unlike some other studies in Chinese reading using miscue analysis (Sergent, 1990; S. Wang, 2006), not all pauses and repetitions are only labelled as miscues, because in some circumstances, pauses and repetitions can also be used as strategies to address problems in other parts of the text (e.g. a student may re-read a section they understand which appears immediately before a section they do not, to help in approaching it). Whether they were counted as a strategy depended on participants' report in the think aloud session. In addition, self-corrections are not counted as miscues, because unlike the miscues, self-correction reveals the participant's ability to notice and repair some errors.

Comprehension problems: This includes misunderstandings, and inability to comprehend a word, a sentence or a section. In this study, comprehension problems can be revealed in both retell sessions and think-aloud sessions. In retell sessions, general comprehension of a section was examined in points, and we also can obtain more detailed information, such as the misunderstanding of a word in the think-aloud session.

Reading problems: In this study 'reading problems' refers to the difficulties readers encounter during reading, which sometimes may cause the miscues and comprehension problems. Reading problems include character/word level problems, sentence level problems and discourse level problems. Unlike miscues, which are the observable behaviours in reading which indicate that there may be a problem, the reading problems themselves may sometimes be directly discernible from the nature of the miscue (e.g. where a character is read incorrectly as another character) or may only be revealed through retell sessions and/or think aloud sessions. The same type of miscues may be caused by different reading problems, and in different situations with different participants, the same reading problem may lead to different miscues. For example, a participant pauses somewhere, and the reading problem behind it can be unknown words or being unsure of the sentence structure. When encountering an unknown character, some participants may choose to skip it, while some other participants may make a guess and end up with a substitution. In addition, some reading problems may lead to comprehension problems, while some may not. For example, a *character/word not recognised* is likely to cause comprehension problems, while not able to pronounce a word but understand the meaning is less likely to lead to comprehension problems.

3.5.2 Data from the reading session

To examine the reading problems, all miscues were noted down using Elan and investigated thoroughly to classify reading problems. There were some common types of data in both reading aloud and reading silently sessions, however more kinds of miscues were identified in the reading aloud session, as the participants can be heard and the reading process may be more complex as words need to be pronounced.

3.5.2.1 Common data in both reading aloud and silently

1) The time each participant used to complete the story

The time required to complete the reading task for each participant was recorded in this study so that the reading speed (characters/minute) could be calculated. The reading speed was calculated as the total number of characters contained in the passage divided by the reading time (minute). Reading speed is 'the easiest aspect of reading to measure and has the greatest practical significance' as it 'limits the rate at which information is processed by the reader' (Pelli et al., 2012, p.35). In this study, the reading speed was calculated because it may provide some information on participants' reading process. For example, if participants were able to recognise characters/words automatically, they may read faster than those who were less able to. On the other hand, applying strategies also needed time, so if participants were unable to retell the story but read very fast, it may indicate that participants did not try to make sense of the story.

2) Pauses

Where and how long each participant paused was noted as an indicator of potential reading problems. Pausing here means that there is an observable stop or hesitation during the reading. As each participant's reading speed varies, there is no standard for determining what length of time can be considered as a pause. For fast readers, a one-second stop is obvious enough to be a pause, while for slow readers pauses longer than 2 or 3 seconds are noticeable and would be picked up. Pauses were easy to be identified in reading aloud session, and in the reading silently session, as participants were required to use a pen to indicate where they were reading, pauses were also able to be identified.

Normally, a pause implies the reader has encountered a problem, for example, *having difficulty in recalling learned character/word*, or *inability to process the meaning of the sentence*, and had to stop to figure it out.

3) Repetitions or regressions

Participants re-read some parts of the story when they had difficulty understanding them, or when they realised they had made some wrong predictions. Sometimes the participants re-read the part right after they finished it, and sometimes they decided to re-read some parts after continuing to read the story, going back to a section several sentences before. Some participants only re-read a word which caused understanding difficulties, while in some circumstances, participants chose to re-read a whole sentence or even more to better understand the grammar or the context. In most cases, participants re-read a certain part only once and then read on, but sometimes participants re-read a section several times before moving on. When the repetition or regression happened more than once, some participants re-read again and again, while others re-read, move on, and later decided to go back and re-read again. If

a participant read something again, no matter if it was a word, a phrase or a sentence, it was counted as a repetition. However, if the participant re-read a part to self-repair an error which was in another part, it was not counted as repetition.

3.5.2.2 Miscues in reading aloud sessions

In this section, the miscues in the reading aloud session that emerged from participants' data will be discussed.

1) Substitution

In the reading aloud session, participants' pronunciation was able to be checked. Substitution refers to the situation where the participant produces a sound which is different from the correct pronunciation of the character. From this study, there are different situations emerging from participants' data.

a. The participant recognises the character correctly, but their pronunciation is not accurate

In this situation, the participant mispronounces the character and it is not counted as a miscue in the study. It is well known that the pronunciation of Chinese is often considered difficult to master by foreign learners, not only because it has four different tones which are absent in many languages, but also because there are several unique sounds which a lot of foreign learners are not used to, such as j [　], q [　], x [　]. As a result, even some highly proficient Chinese learners have problems pronouncing certain sounds after years of practice and learning. In general, the mispronunciation is normally subtle, for example, wrong tones or inaccurate pronunciation of the initial consonant of a syllable, which will not cause too many problems in communication. Also, it will not cause any difficulties in reading comprehension. This type of mispronunciation will not be counted as a miscue as it is not the focus of this study.

b. The participant recognises the character as another one – *confusion with characters (graphic proximity)*

This situation is widely found in participants' data in this study, and the reason is due to some characteristics of the Chinese writing system. In the Chinese writing system, there are some characters that share the same component. For example,　,　,　,　,　, all share the same element　. For these characters, some share the same sound as well: both　and　are pronounced as *qíng*, and some characters' pronunciations are related but not identical: the tones are different between　(*s　*) and　(*s　*) and the initial consonants differ between　(*s　*) and　(*l　*). More importantly, the meanings of these characters are totally different. When a learner recognises a character as another one because of the same component, it will cause problems in understanding. Except for the problem caused by the same component, some characters look similar even though they have no similarity in sound or in meaning. For example, in the story *Selling Alcohol*, several participants recognised　(*niú*, 'cow') as　(*y　*, 'noon') or　(*nián*, 'year').

c. The participant recognises the character as another one – *confusion with characters (graphic alternative)*

Similarly to situation (1.b), participants also mix up some characters due to some other characteristics of Chinese language. In Chinese, the majority of the words contain two characters. Some

words are so commonly used that learners always see the two characters together as a combination. When they encounter a new word, which contains one character from the commonly used word, they are confused and uncertain if it is the first or the second character in the common word. In this situation, as the learner knows which word this character comes from, they are able to figure out the general meaning of the new words if the two words' meanings are related; however, if the meaning of the new word has nothing to do with the common word, then it is unlikely that the learner has the ability to figure out the meaning of the new word. For example, in the character/vocabulary test there is a word

which means the whole life, and it literally means 'one life one lifetime'. Some participants, however, recognised the last character   as   , because these two characters make up the word ('world'). As a result, these participants interpreted the word   as 'one life one world' which does not make any sense in Chinese.

d. The participant reads a word as a different word – *confusion with words (semantic related)*

Graphic similarity of some Chinese characters is the main reason for causing mispronunciation in the study, however sometimes the reader would read one word as another one because the meaning is somehow related. When a reader is trying to make sense of the text while reading, they will have some presumptions to help them predict the following words. There are times when the reader says the word they predict aloud before actually seeing the word, realises that it is not the word they thought and then makes changes. This kind of error normally happens among advanced level learners who no longer need to put too much attention to word recognition, and have more attentional capacity to make sense of what they are reading. In most cases, this type of error has high syntactic and semantic acceptability. For example, participant L2A1 read   (*i   q z,* 'happy') as   (*m   k,* 'happy'). The two words show little phonological similarity without graphic similarity, but they are exchangeable under most contexts without any semantic or syntactic change.

e. The participant reads a character incorrectly, but the sound produced is similar to the correct sound – *inaccurate pronunciation (phonetic proximity)*

This kind of substitution is noted in this study because it is significant in HL learners' reading as most of them can speak Chinese dialects, and the sound in Chinese dialects is different from that in Mandarin but these two still have connections. HL learners tend to self-repair this kind of substitution, because they know the difference between the dialect they speak and Mandarin, but their Mandarin is not good enough to always produce the correct sounds. As HL learners encounter this type of problem a lot, and they always try to correct the sound, this kind of substitution affects the process of reading among HL speakers. At the same time, it also happens among L2 learners. For example, Participant L2I1 pronounced   (*s   p* as *sk   p* which) can be another Chinese word with a different meaning. Although the meaning and the shapes of *qi* and *qie* are different, these two sounds have the same initial.

This type of substitution is different from the situation in (a) in this section, where the participants' pronunciation is not accurate. In (a), the difference between the sound produced and the correct sound is subtle, which will not cause any communication problems. However, in this type of substitution, the

difference between the sound produced and the correct sound is obvious enough to cause communication problems. As a result, they were treated as miscues.

f. Heteronyms – *confusion with heteronyms*

In this study, there are only a few heteronyms in the stories, however all of them caused a lot of comprehension problems. As one of the characteristics of the Chinese writing system, many Chinese characters have more than one pronunciation and the meaning will also change when the character is pronounced differently. It is not easy for foreign learners, especially beginners, to figure out the right pronunciation for the heteronyms when reading, and picking the wrong pronunciation results in poor comprehension. For example, there is a word   in the story *The Two Neighbours*. The first character   is a heteronym, and in the text it should be pronounced as *huán*, meaning 'to return something'. In the reading session, some participants read it as *hái*, which means 'still', as a result, the meaning of the word changes to 'still give something', which is opposite to the correct meaning. Thus, these participants misunderstood this part of the story.

g. The participant makes a random guess – *misread³*

In a few cases, the sound that participants produced could not be linked to any characters or words with graphic proximity, phonemic proximity, or semantic proximity. The participants were not able to explain why they produced such sound during the think-aloud session either. For these substitutions, it is very difficult to further analyse the reasons why participants produced them, so they are labelled as *misread*. There is another situation. The Story *Smart Kong Rong* contains two persons' names – *M   p i ″ Róng* and *N   ″ [.ʋ.* A few of participants mixed the two surnames sometimes and read it as *N   ″ T » p i   ″* although they knew the character *k   p.* This situation is classified into *misread* as the participant made the error randomly, and there are only couple of times when this error happens.

h. The participant switches the code – *pronunciation not recalled*

Occasionally, participants would use other languages to translate or explain some words that they do not know how to say in Chinese. Normally, participants are still able to understand the gist in this case. For example, in the Story *The Two Neighbours* participant HLA2 read   (*cánkuì*) as 'ashamed', which is the English meaning of this word. In the think-aloud session, this participant explained that she encountered this word in a Chinese drama recently. As she read the subtitles when she watched the show, she saw the Chinese word and English meaning, but she did not pay attention to the sound. So, when she saw the word in the text, she was not able to say the word in Chinese, and she chose to switch the code saying it in English.

Not all translation or explaining a word using other languages can be included into this category. Switching code here only includes the situations when a participant says a word in another language (in most cases, in English) when following the text. If a participant reads a part in Chinese first, and then tries to translate this part, this is seen as a strategy, not code-switching, because in this situation, the participant finishes the action of reading, and tries to translate this part to better understand the meaning.

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³ Reading problems revealed by three types of miscues were categorised as misread as they shared one similarity: participants focused more on the semantic information instead of recognising each character and producing correct pronunciation.

As each story contains some repetitive words, in this study, the same substitution will only be counted once. So, if a participant mispronounces a character, and reads it wrong again when re-reading the whole sentence, the mispronunciation will only be counted once. If this character is in a different word when misread, the character will be counted again.

2) Segmentation

Wrong segmentations are found in almost every participants' reading aloud session. As there is no space between words in Chinese writing system, and a word can be made up by one character, two characters or more characters, segmentation can be a problem among foreign learners, especially when several unknown words are put together. Only in reading aloud, is the problem of segmentation observable.

3) Omission

The miscue was classified into the category of omission when the participants skip any characters or words. The action of omission can be conscious or unconscious.

a. Conscious omission – *character and/or word not recognised* or *misread*

There are two different situations when participants skipped a character or word purposely. The first one is when the participant did not know how to pronounce a character or word; the second is when the participant considered this word unimportant. For example, the participant might skip the given name of a character in the story, and only read the family name.

b. Unconscious omission – *misread*

Some participants may skip a character unconsciously in two different situations. (When the omission happens unconsciously, it normally involves characters only, and it is very unlikely that a reader will skip a whole word unconsciously as a word often contains more than one character.) The first situation is when the participant encounters some phrases they are not familiar with, especially when the phrase contains repeated characters. For example, Participant HLI2 read the phrase
as   .

The second situation is when participants skip some characters which would not change the meaning of the word or sentence too much without notice. In Chinese language, some words can be abbreviated without changing the meaning. For example,   ('but') and   ('but'). And at sentence level, deleting some constituents will neither break the grammar nor cause too much semantic change. For example, if   is deleted in one of the sentences in Story *The Emperor and the Bird*,

                ('but they did not dare to talk to the emperor directly'), the rest still makes sense.

4) Insertion – *misread*

Participants insert some characters occasionally when reading. This is the opposite of unconscious omissions: participants add a character on to a one syllable word to make it two syllables, which normally would not change too much meaning and thus not affect the comprehension. For example, reading   ('but') as   ('but'). There are also some situations when one character in a word comes from another commonly used word, and when participants saw the character, they said the commonly used word immediately by adding a character to the printed word. When a character is inserted into a

word, this often causes syntactic problems. For example, Participant HLI2 read   ('customers') in the Story *Selling Alcohol* as   , because   is a commonly used word for the meaning of customers. As there is no word   in the Chinese language, this insertion is not grammatically acceptable.

 5) Self-repair

After a substitution, insertion, omission or a segmentation problem happened, sometimes the participant would immediately try to self-repair the problem. There are also cases when participants 'repair' a correct one and make it incorrect. There are three situations:

 a. error – attempt to repair – successful repair. For example, L2I5 mis-read the word   ('several') as   ('one'), but she realised it immediately and successfully repaired it.

 b. error – attempt to repair – unsuccessful repair. For example, HLI2 was not sure about the pronunciation when she read aloud and encountered the word   (*gùkè*, 'customer'). She tried to pronounce the word in different ways and finally she pronounced the word as *gùikè*, which was still incorrect.

 c. no error – attempt to repair – error. For example, L2A1 read the word   ('response letter') correctly, but she was unsure about the second character. After hesitation, she repaired the word as   , which is not a real word in Chinese.

3.5.2.3 Summary

All of the miscues mentioned above act as indicators of potential problems. When seeking to examine reading problems, some problems are revealed from the miscue analysis. However, sometimes there is no detectable miscue when participants encounter some problems in reading, so we also need to consider other problems which are revealed in retell or/and think-aloud sessions, for example, the problems occurring at sentence or discourse level. When analysing reading problems, two situations should be distinguished: problems which participants are aware of and problems they are not aware of at the time of reading. Distinguishing the two situations can help us better understand the difficulties participants encounter when they read. When participants are aware of problems, no matter if they are able to successfully solve them, it reveals that participants have the linguistic knowledge to notice the problems. However, when participants are unaware of some problems, this may indicate that participants lack basic linguistic knowledge and thus these problems are likely to cause serious comprehension problems.

3.5.3 Data from the retell session

The retell protocol is employed to investigate to what extent the problems influence comprehension, and if the strategies participants adopted (to repair) are successful.

 A mark based on performance in the retell session was given to each participant, and this was used to assess participants' reading comprehension. The reading comprehension here only focuses on understanding the key information. Each story contains some key information, and each item is worth 2 points. A participant who retold the information correctly would get 2 points. If the information was

mentioned with some wrong or missing details, 1 point would be given. If the whole information was missing or understood incorrectly, no point was given.

In order to enhance the validity of the analysis, multiple examiners were invited to assess each student's comprehension. First, the researcher and a trained research assistant marked each participant's retell's transcripts separately. If the marks given by the researcher and the assistant were the same for one retell, then this was the final mark used in the data analysis. If the two marks were different, but the difference was less than or equal to 2 points, then the two marks would be averaged and then the averaged mark would be used in the data analysis. If the two marks were different and the difference was more than 2 marks, then a second trained research assistant would mark the retell again. In this study, only one participant's retell received marks differing by was more than 2 points. The mark that the second research assistant gave was only 1 point different from one of the marks given before, so these two marks were averaged and the averaged mark was used as the final mark.

The retell protocol was also used to confirm what happened in the process of reading. If some information was missing or misunderstood in participants' retelling, it is likely that the participant had problems when reading that part. If a participant read some parts smoothly and understood very well, then these parts were generally easy for this participant. If the participant read some parts with pausing, re-reading, but retold the parts very well, it meant the participant encountered some problems initially, and then solved the problems with some strategies. With these details, the retell session can also reveal specific problems of understanding, for example, misunderstanding a word. This information was used to check if a certain miscue caused a comprehension problem or not.

Additionally, the retell protocol was used to examine if a strategy worked as well, and in this study three different outcomes are discussed: successfully repaired, partially repaired and not repaired. Partially repaired means the participant is on the right track, but still does not fully understand the part. For example, some participants did not know the word   ('ashamed') in the Story *Two Neighbours*, but they used different clues to figure out that the word talks about a negative feeling. They still did not know the exact meaning of this word, but the general idea about this word makes it possible to understand the story.

3.5.4 Data from the think-aloud session

The data from this session contain two important parts: 1) the reasons why they paused, re-read, underlined some words, made some errors or if there were any other problems, and 2) what problem-solving strategies they employed during reading.

3.5.4.1 Data of reading problems

The problems that caused the participants to pause or re-read were classified into the problems at character/word level, sentence level, discourse level and other situations.

Problems at character/word level happen most commonly. The character and the word level are not distinguished here because the character-level problem is very likely to lead to the word-level problem. For example, for a two-syllable word, not knowing one of the characters will make it difficult

for the reader to understand the meaning of the word. In addition, sometimes the word level problem can also be a character level problem as some words are simply just one character. Most character/word level problems are revealed by the miscues identified in the reading session, and in the think-aloud session, and they can be further confirmed in this think-aloud session. However, two types of reading problems at the character/word level did not cause miscues in this study, and were only identified in the think-aloud session: *confusion with homonyms* and *confusion with homophones*.

The problem at sentence level here refers to the problems related to sentence structure and the meaning of the whole sentence. Some *sentence structures* make it difficult for participants to understand. For example, the Story *Selling Alcohol* contains a   …   … structure, and the sentence is

.   means 'enough' in English, but unlike the English structure, the adjective should be put behind

  in Chinese. So, the sentence should be segmented like   /   /   /   , which can be translated as 'as long as the alcohol is good enough and fragrant enough'. However, the Participant L2I1 does not know how to use   in Chinese, so he analysed this sentence using his knowledge from English language. He read it as   /   /   / , and interpreted the sentence as 'as long as the alcohol is enough and good enough, fragrance', which does not really make sense. In addition, *inability to process the meaning of the sentence* also caused comprehension problems for many participants. It refers to the situation when participants spend too much energy on lower-level processing and there is no enough processing capacity left for the higher-level processing. Additionally, *parsing* also causes comprehension problems for participants.

The problem at discourse level means the participant is not able to process information beyond the sentence level. Four types of reading problems at discourse level were identified in this study, namely, 1) *wrong noun/pronoun referents*, 2) *inability to contextualise information*, 3) *inability to process implied/pragmatic meaning,* and 4) *wrong inference*. *Inability to contextualise information* happens when participants miss an important detail in the story or misunderstand some key information, which make it impossible to contextualise some details mentioned later. *Wrong inference* also can cause comprehension problems even though not all participants encountered it. Some participants in this study tend to make assumptions while reading. It helps them to make sense of the story and also link the information together to understand the story as a whole. However, some wrong assumptions may make the story sound illogical, and cause difficulty for comprehension.

Some other reading problems also occur in the study, irrelevant to any above categories, generally in relation to participant's memory span or focus. For example, some participants mentioned that when they read aloud, it is hard for them to take in what they are reading, so they need to re-read the part or pause to re-think the meaning. Some participants also pointed out that they lose focus during reading sometimes, and they need to read it again to make sense of the sentence. This happens both in reading aloud and reading silently.

3.5.4.2 Data on reflecting problem-solving strategies

Participants also reported what kinds of problem-solving strategies they used when they encountered problems in the think-aloud session. All these strategies reported by participants were coded and

categorised using Prichard's (1990) widely cited study as a framework with some modification to better accommodate the data in this study. 21 identified strategies were classified into five categories from Prichard's study (for details refer to 2.6.2) plus one added category (i.e., using aids and support). Table 3.4 shows a full taxonomy of the problem-solving strategies identified in this study. Examples of how participants using these strategies can be found in Chapter 5.

Table 3.4 Taxonomy of reading strategies reported by Chinese L2 and CHL learners

Categories	Problem-solving strategies	Number of readers used	Total frequencies
A. Developing awareness	1. Referring to the experimental task	3 out of 30	3
	2. Identifying important information	4 out of 30	9
	3. Evaluating performance	6 out of 30	10
B. Accepting ambiguity	4. Skipping characters/words not recognised	11 out of 30	15
	5. Assuming general meaning of a word	13 out of 30	17
	6. Formulating questions	9 out of 30	12
C. Establishing intrasentential ties	7. Rereading	30 out of 30	307
	8. Reading slowly and carefully	30 out of 30	591
	9. Attending selectively	4 out of 30	9
	10. Literally translating	11 out of 30	27
	11. Using context clues to interpret a word/phase	24 out of 30	98
D. Establishing intersentential ties	12. Using context clues to interpret the meaning of a sentence	20 out of 30	57
	13. Reacting to author's style or text's surface structure	1 out of 30	1
	14. Extrapolating from information presented in the text	6 out of 30	10
	15. Confirming/ disconfirming an inference	20 out of 30	22
E. Using background knowledge	16. Applying linguistic knowledge	23 out of 30	68
	17. Acknowledging using or lack of cultural knowledge	3 out of 30	3
	18. Referring to the previous passage	1 out of 30	1
	19. Anticipating	3 out of 30	2
F. Using aids and supports	20. Expressing a need for a dictionary	8 out of 30	8
	21. Reading the English introductions before the text	13 out of 30	13

11 strategies were deleted from Prichard's taxonomy as they were not reported by participants in this study or they were not problem-solving strategies. Ten new items (Item 2, 3, 5, 8, 9, 10, 16, 17, 20 and 21) were added. Most of these changes are due to the difference in setting of the two studies. Prichard's (1990) study examined L1 reading, while this study examined L2 and HL reading. Thus, more strategies identified in this study were used to address linguistic-related problems, for example, item 2, item 6, item 11 and item 17. The category F *Using aids and supports* was added because of the design of the study: participants were not allowed to use dictionary in this study, however, it was the most important recourse when they encountered unknown words; and these was a brief English introduction before each story. When coding the new items, the terminologies for strategy items from previous studies (Lee-Thompson, 2008; Sheorey & Mokhtari, 2001) were adopted, so that it is easy for

other studies to compare and analyse. However, the last item was not included in any other studies as it was closely related to the study design. To better understand how learners used these strategies, the percentage of learners using a particular strategy item and the total frequencies of using each strategy item were also added in Table 3.4. By doing so, it is easier to know if a strategy item was widely used by participants, and if it was used a lot by participants.

When the result of problem-solving strategies was examined, it was classified into three categories depending on well it worked: i.e., successful, partially successful, and unsuccessful strategies. Being successful here means the participant solves the problem, comprehends the specific part correctly, and it did not have any negative effect on the comprehension of the general meaning of the whole story. For example, participant L2I3 did not know the meaning of the word   (Luoyang, the name of a city) when he read the story *Smart Kong Rong*. He made a guess based on the meaning of the sentence first, and then confirmed his guess when he read the next sentence as it also contained the word   . By doing so, he successfully solved the problem of unknown word, and understood   was a place. Being partially successful refers to the situation that the participant may not fully solve the problem so that they still did not totally understand the specific part, but it did not affect the general understanding of the whole story. For example, participant L2I1 encountered the word   (therefore) in the story *Selling Alcohol*, and he had no idea of the meaning of the word. However, by analysing the grammar of the sentence, he understood that the word   is a conjunction, and thus decided that it was unimportant for the story. In this case, the participant applied grammatical knowledge to help him decide whether a word was important enough to invest more time and energy on or if he should just skip it. Even though he did not manage to understand the specific meaning of the word, he understood its general function and the decision of skipping was actually correct and helpful, so the strategies were seen as partially successful. Unsuccessful strategies are those that do not help the participant comprehend the specific part and the general meaning of the story at all, and some of them even misled the participants. For example, participant L2I4 did not know the word   (remote). Even though she paused there to think, she did not understand the word, which subsequently affected her understanding of the story *Selling Alcohol*.

As seen from Figure 3.3 (next page), among the different situations of reading problems and strategies, three of them tend to result in comprehension problems, namely strategies are applied with unsuccessful result, participants are aware of the problem without applying strategies, and participants are not aware of the problem. Generally speaking, if the participants apply strategies unsuccessfully, comprehension problems will occur with no exceptions; however, the other two situations (participants are aware of the problem without applying strategies, and participants are not aware of the problem) do not necessarily lead to comprehension problems. For example, with some simple errors that could be realised immediately, participants may not spend any extra time on them and may also think that it is unnecessary to repair them. In this case, although there are no strategies being observed, the participants actually understand the part enough to enable comprehension. Even some problems that participants are not aware of may not result in comprehension problems. For example, wrong pronunciation may have

no negative impact on meaning retrieval especially in the situation when the participant always reads the word incorrectly without noticing but understands the meaning of the character. Also, if a participant reads a word as another word which is semantically related, there may be no comprehension problem. For example, Participant L2A7 read (*i q z*, 'happy') as (*m k*, 'happy') in a story, but this substitution would not lead to comprehension problems. With all these exceptions, the three situations mentioned above still lead to comprehension problems in most cases. These details are included in the data analysis in the hope that a better understanding of the nature of these reading problems, and of effective reading strategies in different contexts may help teachers better understand the difficulties of reading and provide more effective assistance to Chinese learners.
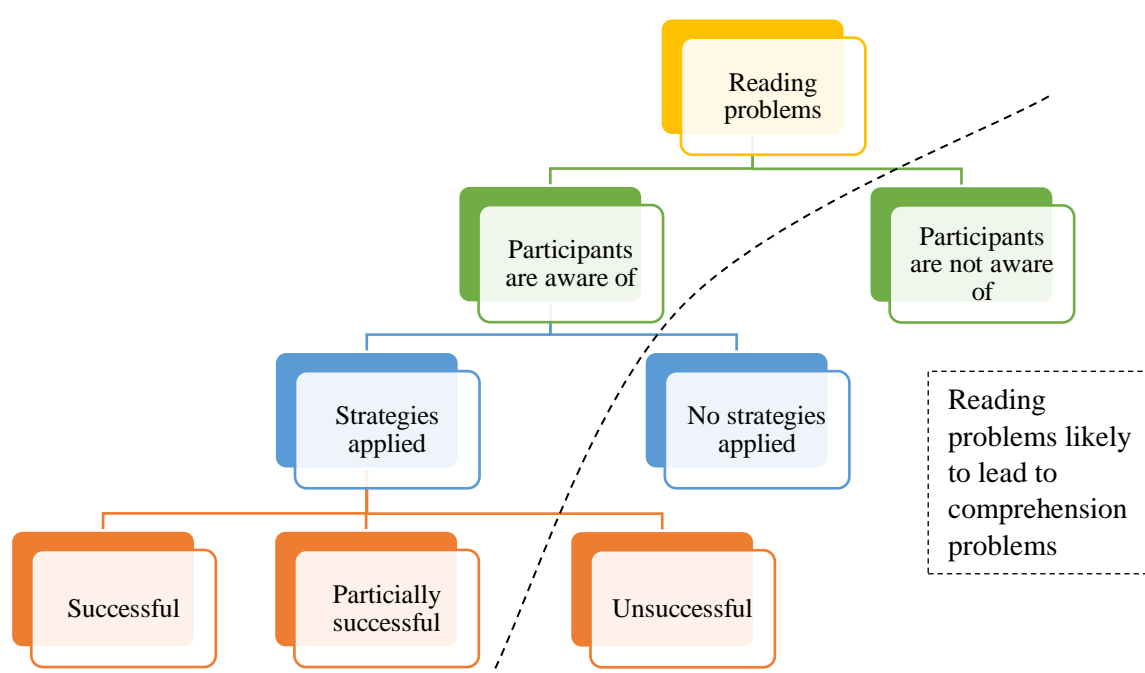
Figure 3.3 Situations likely to result in comprehension problems

Analysing the reading problems and problem-solving strategies can help us to reveal the reading process, that is, how these Chinese readers process the information contained in the text.

3.6 Summary

This chapter profiled the participants and described the reading materials. In addition, the procedures for data collection and data analysis were provided in detail. As a summary of this chapter, I want to discuss the main focus of this project from a more holistic perspective to provide an overall picture of this project.

It is noticeable that different perspectives (emic and etic) are involved in this study in terms of reading problems. Most reading problems are identified by the participants in the think-aloud session using miscues as stimuli, which is from an emic perspective. In addition, the researcher also identified some problems in the retell and think-aloud session, which were not realised by the participants. This

is an etic perspective. This distinction is significant in understanding what the learners do when they encountered some reading problems, and it is also interesting to know what kind of reading problems hinder the L2 readers' reading performance without their awareness. All the details can be seen in Figure 3.4.

Reading problems	Problem-solving strategies	The result of strategies
•Problems realised by the participants	•strategies applied	•Successful
•Problems not realised by the participants	•No strategies applied	•Partially successful
		•unsuccessful
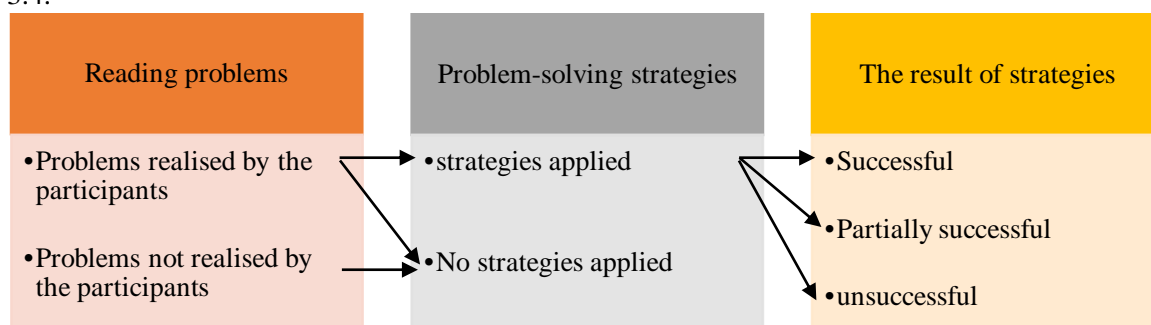
Figure 3.4 Different situations of reading problems and problem-solving strategies

Both problems which the participants were aware of, and those they were not aware of, are discussed in this study. These reading problems were identified from different data resources (reading session, retell session and think-aloud session), and the corresponding problem-solving strategies are also examined. When talking about how many reading problems attract problem-solving strategies, only problems that the participants were aware of are counted, because no strategies would be adopted if the participant did not realise there was a problem. When participants encountered a reading problem, they may be able to apply some strategies to solve the problems while sometimes they were not able to do anything and they just skipped it (in the case, no strategies being applied). However, if participants encountered a problem, and after some analysis they decided to keep reading because for example, they believed the word was not important, then this was counted as a problem-solving strategy (skipping characters/words not recognised).

In next chapter, the research findings, including reading performance, reading problems (both the ones that caused miscues and those that did not), and problem-solving strategies applied will be described in detail.

Chapter 4. Reading Performance

This chapter is to provide the answers to RQ1, i.e., 1. How does reading performance in Chinese (measured in terms of reading speed and comprehension) differ between L2 and HL students, and how is it influenced by a. Students' proficiency level (i.e., intermediate and advanced level students); and b. Reading modes (i.e., reading aloud and reading silently).

The reading performance of the participants is examined from two aspects: reading speed and reading comprehension. These two aspects were used to measure the reading performance because of their significance: reading comprehension is the main purpose and aim of reading, and reading speed 'has the greatest practical significance' (see 3.5.2.1). In particular, we took a comparative approach to looking into the variation in these two aspects respectively using backgrounds, reading modes and text difficulty as dependent variables. The qualitative data from students' interviews, think-aloud protocols were employed to explain some of the findings.

4.1 Participants' reading speed and influencing factors

Reading speed is examined in this study to reflect participants' reading performance as it may reveal the reading process to some extent (refer to 3.5.2.1). In this study, the number of pauses/hesitations, the number of repetitions/regressions, and the number of correction attempts may have an effect on reading speed, and thus will also be elaborated.

To investigate if participants' backgrounds, different difficulties of reading materials and reading modes have any effect on the reading speed, the reading speeds were examined using SPSS software taking the three factors as a dependent variable respectively. In the analysis, each factor was examined while considering the influence of the other two factors to better reveal the details. In this study, p value was used as a reference but the effect size was considered as the key index for the significance between groups because of the very small sample (i.e., each group is fewer than 10). The effect size was counted to be large when $Eta^2=0.14$ (Cohen, 1988) even though $Eta^2=0.13$ was also considered as big size in some cases because of the very limited sample size.

4.1.1 Reading speed and participants' background

Two one-way ANOVA tests were conducted to compare the effect of backgrounds on the reading speed in different reading modes and of different stories, and the descriptive results can be found in Table 4.1.

Table 4.1 Descriptive data of reading speed by different background participants

Proficiency level of participants	Factors		Background of participants	N	Mean reading speed (characters/ min)	Std. Deviation
Intermediate level	Reading modes	Read aloud	L2	7	93.99	35.58
			HL	7	102.31	24.27
		Read silently	L2	7	89.23	40.56
			HL	7	111.29	28.20
	Difficulty of stories	The easy story	L2	7	82.61	33.99
			HL	7	105.67	26.71
		The difficult story	L2	7	100.6	39.74
			HL	7	107.93	26.74
Advanced level	Reading modes	Read aloud	L2	7	106.63	19.11
			HL	9	124.99	16.19
		Read silently	L2	7	92.19	21.20
			HL	9	137.90	58.11
	Difficulty of stories	The easy story	L2	7	110.96	18.35
			HL	9	146.13	50.93
		The difficult story	L2	7	87.86	16.97
			HL	9	116.76	25.56

From Table 4.1 we can see that, no significance is detected between reading speed and participants' background for intermediate level participants in the two reading modes ($F_{(1,12)}$=0.26, p=.62>.05, Eta^2=0.02; $F_{(1,12)}$=1.40, p=.26, Eta^2=0.11). This means that for intermediate level participants, although the mean reading speed of HL participants is faster than that of L2 participants in the two reading modes, the difference is insignificant. In addition, for intermediate level participants, a significant difference of reading speed is only found between different background participants when they read the easy story but not the difficult story (respectively, $F_{(1,12)}$=1.99, p=.18>.05, Eta^2=0.14; and $F_{(1,12)}$=0.16, p=.69>.1, Eta^2=0.01). This indicates that for intermediate level participants, HL students read much faster than L2 participants when they read the easy story, whereas when they read the difficult story, L2 and HL students' reading speed was much similar.

In contrast, a significant difference is found between the L2 and HL participants at advanced level in both read aloud and read silently modes ($F_{(1,14)}$=4.33, p=.06>.05, Eta^2=0.24; and $F_{(1,14)}$=3.88, p=.07>.05, Eta^2=0.22 respectively) with large effect size, and when they read both the easy and the difficult story ($F_{(1,14)}$=3.00, p=.11>.05, Eta^2=0.18; and $F_{(1,14)}$=6.62, p=.02<.05, Eta^2=0.32 respectively) with very large effect size. It means that advanced level HL participants read much faster than L2 participants, whether they read aloud or silently, and whether they read the easy story or the difficult story.

In summary, for intermediate level participants, HL learners did not show much advantage in terms of reading speed compared to L2 participants, except when reading the easy story, while for advanced level participants, HL learners surpassed L2 participants significantly in terms of reading speed on both 'easy' and 'difficult' stories in both reading modes.

4.1.2 Reading speed and the different reading modes

Another two one-way ANOVA tests were conducted to compare the effect of the two reading modes on reading speed taking different stories and different backgrounds as dependent variables, and the descriptive results can be found in Table 4.2.

Table 4.2 Descriptive data of reading speed in different reading modes

Proficiency level of participants	Factors		Reading modes	N	Mean reading speed (characters/min)	Std. Deviation
Intermediate level	Difficulty of stories	The easy story	Read aloud	7	97.09	30.57
			Read silently	7	91.20	34.99
		The difficult story	Read aloud	7	99.21	30.95
			Read silently	7	109.31	36.17
	Background of participants	L2	Read aloud	7	93.99	35.58
			Read silently	7	89.23	40.56
		HL	Read aloud	7	102.31	24.27
			Read silently	7	111.29	28.20
Advanced level	Difficulty of stories	The easy story	Read aloud	9	124.97	15.59
			Read silently	7	138.17	64.57
		The difficult story	Read aloud	7	106.66	19.80
			Read silently	9	102.13	31.24
	Background of participants	L2	Read aloud	7	106.63	19.11
			Read silently	7	92.19	21.20
		HL	Read aloud	9	124.99	16.19
			Read silently	9	137.90	58.11

For intermediate level participants, reading speed is not found to be significantly different in the two reading modes, no matter if they read the easy stories or the difficult stories ($F_{(1,12)}=0.11$, $p=.74>0.1$, $Eta^2=0.01$; $F_{(1,12)}=0.32$, $p=.59>.1$, $Eta^2=0.03$), and no matter if the participants are L2 students or HL students ($F_{(1,12)}=0.83$, $p=.38>.1$, $Eta^2=0.06$; $F_{(1,12)}=0.03$, $p=.88>.1$, $Eta^2=0.00$). This means that for intermediate participants, their reading speeds were similar when they read aloud and read silently. For advanced level participants, reading speed is found to be similar in different reading modes, whether they read the easy story ($F_{(1,14)}=0.36$, $p=.56>.1$, $Eta^2=0.02$) or the difficult one ($F_{(1,14)}=0.11$, $p=.74>.1$, $Eta^2=0.01$). When the effect of reading modes on reading speed is examined among L2 and HL participants respectively, significant difference of reading speed is only found for L2 participants ($F_{(1,12)}=1.79$, $p=.21>.1$, $Eta^2=0.13$) not for the HL participants ($F_{(1,16)}=0.41$, $p=.53>.1$, $Eta^2=0.03$). This means that the two reading modes generally have no statistically significant effect on reading speed except for L2As.

Some other trends may also be suggested in Table 4.2. Intermediate and advanced level participants may have adopted different strategies to adjust their reading speeds when they read the two stories in two reading modes. When intermediate level participants read the easy story, they read a bit faster in read aloud session; while when they read the more difficult story, they read a bit faster in reading silently session. The opposite trend is found within the advanced level participants. When participants' background is taken into account, however, the same trend can be found between the intermediate and advanced level participants. For L2 participants, regardless of their proficiency level, they tended to read faster when they read aloud; while for HL participants, regardless of their proficiency level, they tended to read faster when they read silently.

4.1.3 Reading speed and the different text difficulties

Another two one-way ANOVA tests were conducted to compare the effect of the difficulties of the stories on reading speed in different reading modes and of different backgrounds of participants, and the descriptive results are found in Table 4.3.

Table 4.3 Descriptive data of reading speed of different stories

Proficiency level of participants	Factors		Difficulty of stories	N	Mean reading speed (characters/min)	Std. Deviation
Intermediate level	Reading modes	Read aloud	The easy story	7	97.09	30.57
			The difficult story	7	99.21	30.95
		Read silently	The easy story	7	91.20	34.99
			The difficult story	7	109.31	36.17
	Background of participants	L2	The easy story	7	82.61	33.99
			The difficult story	7	100.6	39.74
		HL	The easy story	7	105.67	26.71
			The difficult story	7	107.93	26.74
Advanced level	Reading modes	Read aloud	The easy story	9	124.97	15.59
			The difficult story	7	106.66	19.80
		Read silently	The easy story	7	138.17	64.57
			The difficult story	9	102.13	31.24
	Background of participants	L2	The easy story	7	110.96	18.35
			The difficult story	7	87.86	16.97
		HL	The easy story	9	146.13	50.93
			The difficult story	9	116.76	25.56

Although the stories *Smart Kong Rong* (intermediate level) and *The Two Neighbours* (advanced level) were reported by most participants to be more difficult than the other two stories, reading speed was only affected by the difficulty of the reading materials for advanced level participants. Reading speed is found significantly different in reading different stories regardless of reading mode (i.e., aloud or silently) ($F_{(1,14)}$=4.30, p=.06>.05, Eta^2=0.24; $F_{(1,14)}$=2.18, p=.16>.05, Eta^2=0.13) or background (i.e., L2 or HL participants) ($F_{(1,12)}$=5.98, p=.03<.05, Eta^2=0.33; $F_{(1,16)}$=2.39, p=.14>.1, Eta^2=0.13) for advanced level participants. That is, advanced level participants read significantly faster when they read easy stories than they read difficult stories, either when they read aloud or when they read silently. However, higher level participants could read the easy story significantly faster than they read difficulty story, no matter if they have Chinese background or not. This may indicate that advanced level participants adjusted their reading speed according to the difficulty of the reading materials when reading, and when they encountered the more difficult reading materials, they tried to slow down to make sense of it, although they may not be able to successfully solve the problems.

For intermediate level participants, reading speed is not found significantly different in reading different stories regardless of reading mode ($F_{(1,12)}$=0.02, p>0.1, Eta^2=0.00; $F_{(1,12)}$=0.91, p=.36>.1, Eta^2=0.07), or background ($F_{(1,12)}$=0.83, p=.38>.1, Eta^2=0.06; and $F_{(1,12)}$=0.03, p=.88>.1, Eta^2=0.00). This means that the difficulty level of reading materials has no significant effect on intermediate level participants' reading speed. This, however, does not indicate that these intermediate level participants were all skilled readers; one the contrary, it may reveal that intermediate level participants failed to

adjust their reading speed to respond different reading materials. According to the data from Table 4.3, the intermediate level participants actually read the more difficult stories slightly faster than they read the easier story. Even though the difference is not statistically significant, reading the difficult story faster is counterintuitive. This may indicate that when intermediate level participants read the story that they believed beyond their level, they tended to just finish the reading without trying to employ enough strategies to help them comprehend the difficult parts.

This finding seems not fully consistent with what Olshavsky (1978) found in his study (refer to 2.7.4). In his study, both good and poor L1 English readers used fewer strategies when the reading materials became more difficult, and he explained that readers would judge the story when they start reading and gave up trying to understand the more difficult text. This can explain what the intermediate participants did in this study, but not the advanced level participants. Two reasons may explain why advanced level participants in this study did not give up on the difficult reading materials like the subjects in Olshavsky's study. The subjects were required to read four stories with different readabilities in Olshavsky's (1978) study, while participants in this study were required to read two stories with similar difficulty (for detail refer to 3.2.3). So, the difficult story in this study may be still within participants' ability. Moreover, the subjects in Olshavsky's (1978) study were eleventh grade students, and their L1 reading was examined; while in this study, participants were adult university students, and their L2 reading was examined. So, participants in this study may have more general reading experience, and when they read in L2 Chinese in this study, some L1 general reading strategies were also available for them to use. For example, L2I3 reported in the think-aloud session that he knew reading aloud may make the story more difficult to understand as even when he read in English (his L1), he sometimes needed to read twice to comprehend if he read aloud. As a result, he paused and re-read more in the reading aloud session to achieve better comprehension. This transfer of reading strategies was also discussed by many researchers (e.g., Koda, 1990; Seng & Hashim, 2006).

4.1.4 The reading miscues that may influence reading speed

There are three types of reading miscues that may have an effect on reading speed, namely, the pauses, repetitions and self-correction attempts. Pauses and repetitions are not strictly distinguished in the study, as when the participants paused at some point, they may try to reread some parts as well. Correction attempts can only be identified in reading aloud, and it usually relates to incorrect character recognition, pronunciation problems, segmentation problems, and slip of the tongue errors, which will be elaborated in Chapter 5.
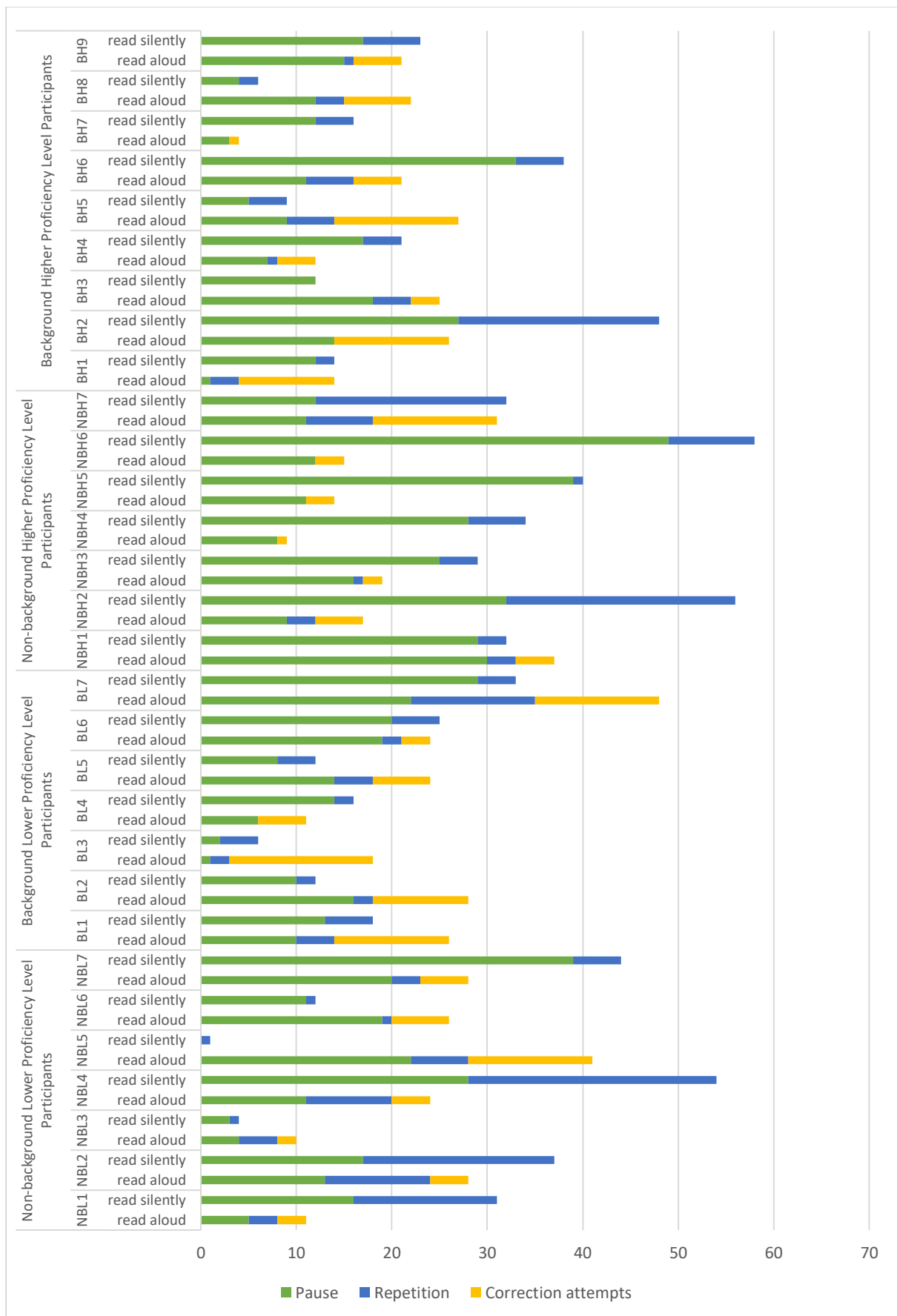
Figure 4.1 The number of pauses, repetitions and correction attempts in two reading modes

As can be seen from Figure 4.1, generally, L2 participants pause and re-read more than HL participants do, and correction attempts of L2Is are fewer than that of HLIs, although the difference between the two groups at advanced level is small. In addition, for L2 participants, the number of pauses and repetitions in the two different reading modes differs significantly (they tended to pause and reread more in silent reading mode), while for HL participants the difference between the two modes is small. This relates to L2 and HL participants' reading speed in the two reading modes, that reading modes influence reading speed significantly for L2As, while for HL participants, no significant difference on reading speed was identified between the two reading modes (refer to 4.1.2). According to participants' report in the interview session, L2 participants tended to feel obligated to read fluently when they read aloud, and they did not feel comfortable to pause and re-read in front of the researcher when they read aloud; while when they read silently, they felt free to do what they needed to make sense of the story. This may be the reason why L2 participants tended to read faster in reading aloud mode and also pause and reread much less than in reading silently mode. On the other hand, HL participants reported that reading aloud slowed them down as they focused on producing the correct pronunciation, while when they read silently, they were able to skim fast or even read in Chinese dialects they were fluent with. Thus, they read faster in reading silently. At the same time, they also felt more comfortable to stop or reread when they read silently just like L2 participants, and thus, the number of pauses and repetitions in the two reading modes were not that different compared to L2 participants.

4.2 Participants' reading comprehension and influencing factors

Four factors were examined in regard to their influence on reading comprehension: proficiency level of participants, the background of participants, reading modes (i.e., reading aloud and reading silently), and the difficulties of reading materials. In order to examine how the different factors affect student's comprehension, the comprehension marks were examined using one-way ANOVA test (SPSS software) taking background, reading mode and text difficulty as a dependent variable respectively. Proficiency level was not used as a dependent variable here, as intermediate and advanced level participants read different stories, and the comprehension result needed to be compared with caution (e.g., some differences between these two groups may be caused by the different reading materials).

4.2.1 Reading comprehension and participants' background

A one-way ANOVA was conducted to examine the effect of background on the comprehension of easy and difficult stories, and another was on the effect of background on the comprehension in different reading modes (i.e., reading aloud and reading silently). The descriptive results can be found in Table 4.4.

Table 4.4 Descriptive data of reading comprehension marks for different background participants

Proficiency level of participants	Factors		Background of participants	N	Mean score	Std. Deviation
Intermediate level	Difficulty of stories	The easy story	L2	7	13.71	7.54
			HL	7	16.57	2.51
		The difficult story	L2	7	7.71	3.95
			HL	7	12.29	3.15
	Reading modes	Read aloud	L2	7	8.86	7.01
			HL	7	14.00	2.52
		Read silently	L2	7	12.57	6.02
			HL	7	14.86	4.49
Advanced level	Difficulty of stories	The easy story	L2	7	12.71	3.40
			HL	9	14.56	4.85
		The difficult story	L2	7	7.71	4.42
			HL	9	12.22	5.19
	Reading modes	Read aloud	L2	7	9.43	6.19
			HL	9	13.44	5.70
		Read silently	L2	7	11.00	2.45
			HL	9	13.33	4.58

As we can observe, participants' background only had an effect on the performance of comprehension for participants when they read the difficult material. When the text is difficult, the difference of comprehension between L2 and HL participants was significant with a very large effect size for intermediate level participants ($F_{(1,12)}=5.74$, $p=.03<.05$, $Eta^2=0.32$), and with a large effect size for advanced level participants ($F_{(1,14)}=3.36$, $p=.09>.05$ $Eta^2=0.19$). However, no difference on comprehension marks was found between L2 and HL participants for intermediate level ($F_{(1,12)}=0.90$, $p=.36>.1$, $Eta^2=0.07$), and advanced level ($F_{(1,14)}=0.73$, $p=.41>.1$, $Eta^2=0.05$) when they read the easier stories. This means that when participants read the easy story, although the HL participants did better than L2 participants, the difference was not statistically significant; whereas when they read the difficult story, the HL participants did significantly better than the L2 participants.

However, when the reading mode was considered, participants' background generally had no effect on the performance of comprehension for participants, except for intermediate level participants when they read aloud. When intermediate level participants read aloud, a significant difference on comprehension marks is found between L2 and HL participants ($F_{(1,12)}=3.34$, $p=.09>.05$, $Eta^2=0.22$) with a very large effect size. No significant difference is found when intermediate level participants read silently ($F_{(1,12)}=0.65$, $p=.44>.1$, $Eta^2=0.05$), or when advanced level participants read both aloud and silently ($F_{(1,14)}=1.82$, $p=.20>.1$, $Eta^2=0.11$; $F_{(1,14)}=1.47$, $p=.25>.1$, $Eta^2=0.10$). This means that although HL participants tended to receive higher comprehension marks than L2 participants in both reading aloud and reading silently, the difference in most cases is not statistically different. However, when intermediate level participants read aloud, HL participants comprehended much better than L2 participants did.

In summary, for intermediate level participants, HL participants received much higher comprehension marks than L2 participants both when the reading material was difficult and when they

read aloud. For advanced level participants, HL participants were only able to surpass L2 participants when the story was difficult.

4.2.2 Reading comprehension and different reading modes

Another two one-way ANOVA tests were conducted to examine the effect of reading modes on the comprehension of different stories and the effect of reading modes on comprehension for different backgrounds of participants. The descriptive results can be found in Table 4.5.

Table 4.5 Descriptive data of reading comprehension marks in different reading modes

Proficiency level of participants	Factors		Reading modes	N	Mean score	Std. Deviation
Intermediate level	Difficulty of stories	The easy story	Read aloud	7	13.14	7.03
			Read silently	7	17.14	3.02
		The difficult story	Read aloud	7	9.71	3.82
			Read silently	7	10.29	4.79
	Background of participants	L2	Read aloud	7	8.86	7.01
			Read silently	7	12.57	6.02
		HL	Read aloud	7	14.00	2.52
			Read silently	7	14.86	4.49
Advanced level	Difficulty of stories	The easy story	Read aloud	9	14.44	4.80
			Read silently	7	12.86	3.58
		The difficult story	Read aloud	7	8.14	5.96
			Read silently	9	11.89	4.26
	Background of participants	L2	Read aloud	7	9.43	6.19
			Read silently	7	11.00	2.45
		HL	Read aloud	9	13.44	5.70
			Read silently	9	13.33	4.58

The reading mode had an effect on the performance of comprehension for intermediate and advanced level participants, and the effect will first be discussed in terms of the difficulty level of the reading materials. When intermediate level participants read the easy story and when advanced level participants read the difficult story, the effect of the reading mode on comprehension was significant ($F_{(1,12)}$=1.91, p=.19, Eta^2=0.14; $F_{(1,14)}$=2.16, p=.16>.1, Eta^2=0.13) with a large effect size, and they tended to understand significantly more when they read silently. However for intermediate level participants, when it comes to the difficult story, the reading mode did not have an effect on reading comprehension ($F_{(1,12)}$=0.06, p=.81>.1, Eta^2=0.01), and similarly no significant difference was found between comprehension marks and the reading modes for advanced level participants when they read the easy story ($F_{(1,14)}$=0.53, p=.48>.1, Eta^2=0.04). This means that when intermediate level participants read the easy story, they comprehended more in silent reading mode, while when they read the difficult story, the silent reading mode became less helpful. On the other hand, when advanced level participants read the difficult story, they tended to comprehend more when they read silently, while when they read the easy story, their performance of comprehension depended less on the reading modes, and interestingly the reading aloud actually helped a bit. No significant difference was found between comprehension marks when L2 and HL participants read in the two reading modes for both intermediate

level ($F_{(1,12)}=1.13$, $p=.31>.1$, Eta^2=0.09 for L2 participants; $F_{(1,12)}=0.19$, $p=.67>.1$, Eta^2=0.02 for HL participants) and advanced level participants ($F_{(1,12)}=0.39$, $p=.54>.1$, Eta^2=0.03 for L2 participants; $F_{(1,16)}=0.00$, $p=.96>.1$, Eta^2=0.00 for HL participants). This means that both L2 and HL participants comprehended the story in the two reading modes about the same level.

In general, reading modes had very limited effect on reading comprehension for both intermediate and advanced level participants. However, all groups of participants, except for HLAs, received higher comprehension scores when they read silently, which may suggest that reading aloud (at least when reading for an audience) is distracting, especially when the reader is less proficient or the material is more difficult, as most participants (six L2Is, five HLIs, five L2As and five HLAs) reported in the interview that they were focusing on saying every word correctly instead of making sense of what they were reading. In contrast, reading aloud turned out to be helpful to assist in recall when advanced level participants read the easy story, which will be explained in detail in the following.

The result that reading silently is helpful for comprehension and recall for intermediate level participants to read both kinds of stories and for advance level participants to read the difficult story supports some other studies (e.g., Goodman 1967, Huey 1908, and Smith 2012). These studies found that when native speakers read English texts, reading silently is more natural and efficient than reading aloud. Smith (2012) mentioned that 'subvocalisation' (sounding out the text to oneself, which may be similar to reading aloud to some extent) can be useful in helping to hold those words in short term memory which cannot be understood or dealt with immediately, but he also emphasized that in this case, comprehension suffers. However, their theory cannot explain why advance level participants performed better in the reading aloud session than in the reading silently session when they read the easy story.

Other research, however, may explain this phenomenon from a cognitive perspective. The research (Foss & Reitzel, 1988; Fuchs et al., 2001; Gibson 2008) found reading aloud can facilitate understanding since both visual and audial input is involved, and it 'helps in memorizing words and texts, concentration, and practicing and pronouncing words for real world encounters' (Alshumaimeri, 2011, p.185). In the case of reading Chinese, as the Chinese writing system lacks the phonetic clues present in alphabetic writing, reading aloud may need more attentional resources especially when readers' proficiency level is not ready for the provided reading materials. In this circumstance, these L2 Chinese readers struggle to comprehend what they are reading, and as a result, the effect of audial input on memorisation is limited. When advance level readers read relatively easy material, their recognition of characters and words might be more automatic because of abundant rehearsal and high lexical quality (Perfetti, 2007), which requires little attentional resources. In this case, the audial input may facilitate memorising.

Although reading aloud may require more attentional resources, which may make the comprehension suffer, from L2 acquisition perspective, reading aloud may be a good method as it may facilitate students' language learning. As L2A7 reported in the interview,

> 'if I am fluent in a language, reading aloud slows down my reading speed [which is not
>
> useful]; if I am not fluent in a language, even though reading silently enables me to read

a little bit faster, it does not help, because it is only based on my visual. By reading

aloud, I can say, I can see, I can hear, which makes me remember the meaning easier'.

This corresponds to the study by Shen and Jiang (2013), who summarised four benefits of reading aloud for Chinese learners to enhance character-reading accuracy and speed: helping learners to make sound-graph correspondence, allowing instructors to identify students' oral reading problems, decreasing character-writing errors and allowing instructors to observe students' prosody and to provide appropriate intervention.

Although the two reading modes had no effect on reading comprehension for the four groups of participants statistically, most participants reported in the think-aloud session that they felt they did better in one mode than in the other mode, which may be related to one's reading habit. In this study, of the intermediate level participants, only HLI5 reported in the interview that he always reads aloud when he studies Chinese at home, because reading aloud 'helps with the tones, and it helps to remember more if [I] say it out'. Interestingly, HLI5 received higher comprehension marks on the passage that he read silently, which may be due to the lower difficulty of the story he read silently. Participants L2I6 and HLI3 also believed that reading aloud was better, even though they did not really read aloud when they studied. After reading two stories in different reading modes, L2I6 reported in the interview that 'it is better to read aloud, because you can see it, say it and hear it', and HLI3 made very similar comment, 'reading aloud forces you to read every character, and when I read silently I tend to skip… I pay attention more to the words when I can hear it'. In retell session, HLI3 did receive higher marks with the story she read aloud, but this happened with the easier story. As a result, it is difficult to say if the higher comprehension mark is closely related to the difficulty level of story or the reading aloud mode. On the other hand, L2I6 received a higher mark with the story she read silently, which happened with the more difficult story. The inconsistency of the participant's belief and the comprehension result may be linked to the lower proficiency level of L2I6, who received the lowest comprehension marks for both the story, and her marks of reading silently was only one point higher than that for reading aloud. Generally, more advance level participants (three for L2 and three for HL participants) reported that they would read aloud when they study Chinese, and three of them did receive higher marks on retelling, which may be explained by the role of audio in memory (e.g., Grimes, 1990).

In summary, the difference between reading aloud and reading silently and how they influence reading comprehension may be more complicated than most literature shows, at least in the context of Chinese as L2 and HL reading. It is noteworthy that the above result is based on the data collected in experimental circumstance, as reading aloud publicly (with audience) and reading aloud privately may be different. When asked about the difference between reading aloud and reading silently, several participants mentioned that when they read aloud, they felt awkward about their pronunciation or how their reading sounded (e.g., HLI2, HLA6) because they read in front of a native speaker of Chinese and their reading was recorded, and some reported that they tried to read at a speaking rate and avoided reread and pauses (e.g., L2I3, L2A5, HLA5). This might be less of a problem if they read aloud to themselves, and thus their comprehension performance may not remain the same.

4.2.3 Reading comprehension and the different text difficulties

Two one-way ANOVA tests were conducted to compare the effect of the text difficulties on the comprehension in different reading modes and with different backgrounds of participants respectively. The descriptive results can be found in Table 4.6.

Table 4.6 Descriptive data of reading comprehension marks with different text difficulties

Proficiency level of participants	Factors		Difficulty of stories	N	Mean score	Std. Deviation
Intermediate level	Reading mode	Read aloud	The easy story	7	13.14	7.03
			The difficult story	7	9.71	3.82
		Read silently	The easy story	7	17.14	3.02
			The difficult story	7	10.29	4.79
	Background of participants	L2	The easy story	7	13.71	7.54
			The difficult story	7	7.71	3.95
		HL	The easy story	7	16.57	2.51
			The difficult story	7	12.29	3.15
Advanced level	Reading mode	Read aloud	The easy story	9	14.44	4.80
			The difficult story	7	8.14	5.96
		Read silently	The easy story	7	12.86	3.58
			The difficult story	9	11.89	4.26
	Background of participants	L2	The easy story	7	12.71	3.40
			The difficult story	7	7.71	4.42
		HL	The easy story	9	14.56	4.85
			The difficult story	9	12.22	5.19

As we can observe from Table 4.6, the difficulty of stories had an effect on the participants' performance of comprehension, and the effect will be discussed in different reading modes and with different backgrounds of participants in this section. For intermediate level participants, a significant difference was found between the comprehension marks of the easy story and that of the difficult story ($F_{(1,12)}=10.27$, $p=.01<.05$, Eta$^2=0.46$) with a very large effect size when they read silently, which means when intermediate level participants read silently, they comprehended the easy story much better than the difficult story. For advanced level participants, when they read aloud, the different text difficulty had an effect on reading comprehension ($F_{(1,14)}=5.51$, $p=.03<.05$, Eta$^2=0.28$) with a large effect size. It indicates that unlike intermediate level participants, when advanced level participants read aloud, they comprehended the easy story much better than the difficult story. When intermediate level participants read aloud and advanced level participants read silently, the different text difficulty did not have an effect on reading comprehension ($F_{(1,12)}=1.29$, $p=.28>.1$, Eta$^2=0.10$; $F_{(1,14)}=0.23$, $p=.64>.1$, Eta$^2=0.02$). This indicates in these two situations, they comprehended the easy story and the difficult story equally well.

In addition, for intermediate level participants, a significant difference of reading comprehension was also found when they read the two different stories regardless of their backgrounds ($F_{(1,12)}=3.48$, $p=.09<.1$, Eta$^2=0.22$ for L2 participants; $F_{(1,12)}=7.94$, $p=.02<.05$, Eta$^2=0.40$ for HL participants) with a very large effect size. This indicates that participants at intermediate level, no matter if they were with Chinese background, they comprehended the easy story much better than the difficult story. For

advanced level participants, however, the significant difference was only found for L2 participants ($F_{(1,12)}$=5.62, p=.04<.05, Eta^2=0.32) with a large effect size, but not for HL participants ($F_{(1,16)}$=0.97, p=.34>.1, Eta^2=0.06). This means L2As comprehended better when the story was easier, while for HLAs, they were more able to comprehend the difficult story and thus the difference of comprehension marks between the different stories are small.

From the above analysis we can see that the text difficult had an effect on reading comprehension in most cases for intermediate level participants, except when they read aloud. For advanced level participants, on the other hand, the text difficulty only had an effect on reading comprehension when they read aloud or when L2 participants read.

4.3 Summary

From the analysis above, we can make the following observations about the variables that affect reading speed and comprehension.

1) Reading speed:
   a. HL participants generally read faster than L2 participants;
   b. Reading modes only had an effect on reading speed of L2A participants, while for other three groups, their reading speed was similar in the two reading modes;
   c. Compared to advanced level participants, intermediate level participants were unable to adjust their reading speed according to reading materials with different difficulty levels in both reading modes.

2) Reading comprehension:
   a. HL participants generally received higher comprehension scores than L2 participants;
   b. Reading modes did not influence participants' comprehension significantly;
   c. Compared to advanced level participants, intermediate level participants' reading comprehension were more easily influenced by reading materials with different difficulty levels.

After investigating the results for reading performance of different groups, the next chapter will focus on the reading problems the participants encountered and the problem-solving strategies they applied, which may explain their reading performance.

Chapter 5. Reading problems and problem-solving strategies

This chapter addresses RQ2, i.e., What problems do Chinese L2 and CHL students encounter when reading texts in Chinese, what strategies do they employ to try to solve them, how effective are these strategies, and how are reading problems and problem-solving strategies affected by: a. Students' proficiency level (i.e., intermediate level students and advanced level students), and b. Reading modes (i.e., reading aloud and reading silently).

As mentioned in the methodology chapter (3.5.2.3), reading problems were identified by analysing the reasons behind miscues, and problems which did not cause detectable miscues, such as *inability to process the meaning of the sentence*, were identified in the retell or think-aloud session. Two situations were distinguished when we examined reading problems: whether participants were aware or unaware of the problem. It should be emphasised that the number of problems identified is not necessarily a reliable indicator of either the difficulty level of the reading material or of the number of problems actually experienced, as the number of problems identified depends on the participants' ability to self-diagnose, the quality of the retell they produced and the reading mode (for example, it is impossible to identify pronunciation-related problems in the reading silently mode).

5.1 General trends of reading problems identified among four groups of participants

To provide a picture of the words and sentences in each story that cause reading problems, and to generally compare the problems different groups of participants encountered in different reading modes, we marked up each of the four texts as displayed in Table 5.1 below. Words which caused problems for more than one student were enclosed in a box, and phrase or sentence problems were indicated by the use of brackets. Numbers next to each character, word or phrase and sentence indicate the number of participants who had a problem with that part. For example, in the first text, the character (to sell) caused problems for two L2Is in the reading aloud mode (See Table 5.1). If a multiple-character word or phrase caused the problem, the box around the phrase is used to indicate these several characters caused problem together. For example, we can see a marked phrase in the first passage for L2Is in reading aloud mode $\boxed{_2}_4$. The subscript number 4 indicated that the phrase '

(a huge amount of effort)' caused problems for four L2Is, while the number 2 indicated that the character (cow) specifically caused problems for two L2Is. The brackets '()' were used to show the borders for longer phrases or sentences that caused problems.

In order to provide a clear picture of the 'difficult parts' in the text, the parts that only caused problems for one participant across the groups and different reading modes are not discussed here as they were not typical. The marked-up passages are shown below in Tables 5.1 to 5.4 (the translation of the text can be found in Appendix C).

Table 5.1 Reading problems and frequency by intermediate level participants in Passage 1 *Selling Alcohol*

	L2Is	HLIs
Reading aloud	4 participants	3 participants
Reading silently	3 participants	4 participants

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Table 5.2 Reading problems and frequency by intermediate level participants in Passage 2 *Smart Kong Rong*

	L2Is	HLIs
Reading aloud	3 participants	4 participants
Reading silently	4 participants	3 participants

Table 5.3 Reading problems and frequency by advanced level participants in Passage 1 *The Emperor and the Bird*

	L2As	HLAs
Reading aloud	4 participants	5 participants
Reading silently	3 participants	4 participants

Table 5.4 Reading problems and frequency by advanced level participants in Passage 2 *Two Neighbours*

	L2As	HLAs
Reading aloud	3 participants	4 participants
Reading silently	4 participants	5 participants

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I will first focus on some general trends that appeared from different groups in the two reading modes, and the details of the reading problems will be discussed in the next section. First, for both intermediate and advanced level participants, L2 participants had more common problems with vocabulary and sentences in all stories than the HL participants had. L2 participants tended to share difficulties, while each HL participant seemed to have different difficulties (some problems are not marked in the text because they were only experienced by one participant, and some will be discussed in sections 5.2 and 5.3). Their different language backgrounds and different levels of language exposure may be related to this. L2 participants revealed in the online survey that textbooks and Chinese lessons were the only learning resources for most of them, and they rarely used Chinese outside the classroom. As a result, they had a very similar level of knowledge of Chinese vocabulary and grammar. On the other hand, HL participants acquired similar knowledge in Chinese class, but their knowledge and abilities obtained outside class were diverse. According to the online survey, some HL participants often chat with parents or relatives in Chinese or Chinese dialects, and some reported that while they do not speak Chinese at home, their parents or relatives always use Chinese. The different degrees that the HL participants are exposed to Chinese and the opportunities to interact in Chinese on a more regular basis may lead to differences in their proficiency level. This can explain, at least partially, why HL participants encountered different problems while L2 participants had more common problems. In addition, the different levels of language exposure may also lead to different levels of linguistic knowledge, and thus L2 participants tended to experience more reading problems than HL participants did.

The intermediate level participants and the advanced level participants both identified one of the two texts as more difficult in the retell, think-aloud or interview session (for details refer to 3.2.3). However, the number of vocabulary problems the intermediate level participants had in the two texts was similar when the same group under the same reading mode is examined; furthermore, more sentence problems were identified in the 'easier' text than in the 'more difficult' one. This may be because the participants understood less of the more difficult story (for details of analysis refer to 4.2.3), so they were less able to analyse and identify problems when they read it; in the retell session, participants provided less feedback on this story, so it was more difficult for the researcher to investigate the details of their comprehension problems. When they read the easier story, these participants were more likely to pay attention to the meaning of sentences and the connections between sentences, thus they were able to identify more problems at the sentence level. The trend for the advanced level participants was more predictable as more vocabulary and sentence problems were identified with the more difficult story.

It is also noticeable that the two reading modes, reading aloud and reading silently, influenced the number of problems that participants encountered and identified. Generally, participants tended to exhibit more word problems in the reading aloud mode, and more sentence problems in the reading silently mode (for details, see Table 5.5, 5.6, 5.7 and 5.8). The reason for this differed for L2 and HL participants. L2 participants reported in the think-aloud or interview session that when they read aloud,

they were 'too busy to read each word, and had no brain [space] to process the meaning or what [they were] reading' (participant L2A3). This may confirm the claim (Van Patten, 1990, 1996) that the simultaneous processing of form and meaning is difficult due to the limited capacity of selective attention. However, HL participants reported that they tried to get the pronunciation correct as 'the sound and the tones are so important' (HLI4); so, in the reading aloud session, they tended to re-read some words several times to 'sound right' (HLA1). Participant HLI4 also mentioned that when she read aloud, she felt that her eyes moved faster than what she was saying; as a result, she found reading aloud was quite disturbing, and the poor 'eye and mouth coordination' led to some reading miscues, especially omissions. The participants may have had more sentence problems when reading silently for similar reasons that the L2 participants had more word problems in the reading aloud mode. When reading silently, participants were able to pay more attention to the meaning processing and the connections between the sentences. Because the participants comprehended the passage better, they were able to self-diagnose when they encountered problems – e.g., they were unable to contextualise some information. At the same time, they were more able to report these problems in the think-aloud session. In addition, from an etic perspective, the researcher was able to identify the parts comprehended incorrectly in the retell session when the participants produced a more complete story.

On the basis of the stories the participants read, the following two sections will discuss reading problems and problem-solving strategies for two different proficiency levels because the participants at the same level read the same stories. Reading problems will be discussed in detail at the word/character level, sentence level and discourse level, and the corresponding problem-solving strategies will also be discussed.

5.2 Reading problems and problem-solving strategies for intermediate level participants

Reading problems in this study were identified by analysing reading miscues and the data from retell session and think-aloud session (for details refer to 3.5). This section will focus on the reading problems and problem-solving strategies of L2Is and HLIs. It was predicted that L2Is would encounter more reading problems than HLIs due to their lower exposure to Chinese and lower linguistic proficiency. The number of reading problems and the problem-solving strategies are shown in Table 5.5 (next page).

The number in each cell indicates the total cases of problems for each situation, and the subscript number in brackets indicate how many participants encountered the problem. We can see from Table 5.5 that in the silent reading mode the L2Is had 148 (47+7+66+10+18) reading problems with an average of 21.1 problems per student in reading silently, and a range of 8 to 33. In most cases (87.8%), L2Is were aware of these problems. They had 218 problems in the reading aloud mode (51+8+63+45+51) with an average of 31.1 problems per student, and a range of 18 to 44. In most cases (76.6%), L2Is were aware of these problems. It seems that L2Is were aware of more reading problems in reading silently than in reading aloud even though more problems were evident when reading aloud.

Table 5.5 Reading problems and problem-solving strategies by L2Is

		Read silently (N=7)					Read aloud (N=7)				
		Self-identified problems				Unidentified problems	Self-identified problems				Unidentified problems
		Strategies applied					Strategies applied				
		Successful	Partially successful	Unsuccessful	No strategies applied		Successful	Partially successful	Unsuccessful	No strategies applied	
Character/ word level	Character not recognised	7 (7)	1 (1)	21 (6)	3 (2)		6 (4)	3 (3)	12 (6)	18 (5)	
	Word not recognised	5 (4)	5 (3)	16 (6)	5 (2)	7 (4)	2 (1)	2 (2)	17 (7)	9 (6)	9 (5)
	Pronunciation not recalled	2 (1)					2 (2)				
	Confusion with heteronym					1 (1)	2 (2)				7 (7)
	Difficulty in recalling learned character/word	15 (7)		3 (3)			18 (7)	1 (1)	8 (4)		
	Confusion with homonym	2 (2)							1 (1)		2 (2)
	Confusion with characters (graphic alternative)			1 (1)					3 (2)	1 (1)	2 (2)
	Confusion with characters (graphic proximity)	1 (1)	1 (1)	5 (3)		5 (5)	5 (3)		15 (5)	2 (2)	11 (5)
	Confusion with characters (homophones)	1 (1)		1 (1)							
	Confusion with words (semantic related)	1 (1)					2 (1)				2 (2)
	Inaccurate pronunciation (phonetic proximity)						6 (4)		1 (1)	1 (1)	1 (1)
	Misread character/word				1 (1)		2 (2)				4 (2)
Segmentation Verb + resultative complement									1 (1)	2 (2)	
Segmentation Wrong recognition						1 (1)					1 (1)
Segmentation Inability to process the meaning of the sentence				1 (1)			2 (2)	1 (1)		1 (1)	5 (5)
Segmentation Two-character prep./ adv.											3 (3)
Segmentation Unknown phrase				1 (1)		1 (1)		1 (1)	1 (1)	1 (1)	
Sentence level	Sentence structure	4 (2)		3 (2)			2 (2)		2 (2)	2 (2)	2 (2)
	Inability to process the meaning of the sentence	2 (2)		6 (3)					1 (1)		
Parsing Wrong prediction of the sentence							1 (1)			3 (2)	
Parsing Sentence structure										1 (1)	
Discourse level	Wrong noun/pronoun referents	1 (1)		4 (2)					1 (1)		1 (1)
	Inability to contextualise information	1 (1)		4 (4)			1 (1)				
	Inability to process implied/pragmatic meaning	2 (2)			1 (1)	2 (2)					
	Wrong inference					1 (1)					1 (1)
Others	Lost concentration	3 (2)								4 (2)	
Total		47	7	66	10	18	51	8	63	45	51

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Table 5.6 Reading problems and problem-solving strategies by HLIs

			Read silently (N=7)					Read aloud (N=7)				
			Self-identified problems				Unidentified problems	Self-identified problems				Unidentified problems
			Strategies applied					Strategies applied				
Level		Problem	Successful	Partially successful	Unsuccessful	No strategies applied		Successful	Partially successful	Unsuccessful	No strategies applied	
Character/word level		Character not recognised	8 (3)	1 (1)	6 (5)	1 (1)		2 (2)	2 (2)	11 (5)	5 (2)	
		Word not recognised	9 (5)	1 (1)	11 (5)	2 (1)	9 (4)	3 (3)	2 (2)	3 (3)	8 (4)	11 (5)
		Pronunciation not recalled	2 (2)					3 (2)		1 (1)	2 (2)	
		Confusion with heteronym					1 (1)	2 (2)				2 (2)
		Difficulty in recalling learned character/word	22 (6)	1 (1)	5 (3)			25 (6)	1 (1)	2 (1)		
		Confusion with homonym			1 (1)							
		Confusion with characters (graphic alternative)	1 (1)					1 (1)				1 (1)
		Confusion with characters (graphic proximity)	2 (2)		3 (2)	1 (1)	2 (2)	6 (3)				9 (5)
		Confusion with words (semantic related)						1 (1)				1 (1)
		Inaccurate pronunciation (phonetic proximity)					1 (1)	21 (7)		3 (3)	1 (1)	
		Misread character/word						1 (1)				8 (7)
	Segmentation	Verb + resultative complement										1 (1)
		Inability to process the meaning of the sentence	1 (1)					1 (1)		1 (1)		1 (1)
		Two-character prep./ adv.										2 (2)
		Change the line						1 (1)				
		Unknown phrase		1 (1)		2 (2)					1 (1)	
Sentence level		Sentence structure	2 (2)		1 (1)		3 (2)				2 (2)	1 (1)
		Inability to process the meaning of the sentence	2 (2)			3 (3)				1 (1)		
	Parsing	Wrong prediction of the sentence						3 (3)				
		Sentence structure			1 (1)			1 (1)				
Discourse level		Wrong noun/pronoun referents	2 (2)									1 (1)
		Inability to contextualise information	1 (1)		2 (2)		1 (1)					
		Inability to process implied/pragmatic meaning	1 (1)				2 (2)					1 (1)
		Wrong inference					1 (1)					
Others		Lost concentration	2 (2)								1 (1)	
Total			55	3	31	7	22	71	5	22	19	40

Compared with L2Is, HLIs may know more words and may be more familiar with Chinese sentence structures; however, as they are still at the lower proficiency level, they may also encounter a

lot of reading problems, and their problem-solving strategies may be less effective than advanced level participants. The number of detected reading problems and participants' employment of problem-solving strategies are shown in Table 5.6 (last page).

From Table 5.6 we can see that in the silent reading mode, overall speaking, HLIs had 118 (55+3+31+7+22) reading problems with an average of 16.9 problems per student in a range of 10 to 25. 157 occurred in the reading aloud mode (71+5+22+19+40) with an average of 22.4 problems per student in a range of 13 to 32. In most cases (81.4% for reading silently and 74.5% for reading aloud), HLIs were aware of these problems. Similar to L2Is, HLIs were also aware of more problems in reading silently than reading aloud. In the following section, reading problems and strategies will be discussed in detail for the L2I and HLI groups.

5.2.1 Character/word level problems and problem-solving strategies

a. In the reading silently mode

In general, the total number of problems identified in reading silently by the intermediate level participants is lower than that in reading aloud because it is impossible to identify pronunciation recall problems/phonetic decoding problems and identifying instances of misreading or mixing up characters is unlikely. The most common problems for L2Is in silent reading were *word not recognised* and *character not recognised*. These problems were not solved by the participants and caused comprehension difficulties (the successful repair rate was 32.3% and 25.0% respectively). *Difficulty in recalling learned character/word* and *confusion with characters (graphic proximity)* are the next two most common reading problems among L2Is; they were solved in 83.3% and 16.7% of cases respectively with the latter one causing comprehension problems.

Table 5.6 shows HLIs had the same four most common problems as L2Is did, but unlike L2Is, HLIs tended to have more problems of *difficulty in recalling learned character/word* than *character not recognised*. Similar to L2Is, most (82.1%) previously learned characters or words were eventually successfully recalled by HLIs using pausing, rereading and context as strategies; HLIs had a 31.3% successful repair rate for the problems *word not recognised* and 56.3% for *character not recognised*, which was higher than the L2Is' rates. This may indicate that the HLIs were more able to adopt useful problem-solving strategies than the L2Is were by drawing on their greater linguistic knowledge. *Graphic proximity* also caused comprehension problems for the HLIs, and the successful repair rate was 25.0%.

It is worth noting that for the intermediate level participants, *character not recognised* does not necessarily mean that they have not learned the character itself. Sometimes just changing the combination of characters can make a learned character difficult to recognise. For example, most L2Is had no problem recognising   ('weird') when they read it, but when they encountered another word   ('curious') in the same story, they had to pause to think about the character   , and a few of them even failed to recognise it. One participant (L2I7) did not know the character   ('alcohol') in the word   ('selling alcohol'), but when she read   ('drink alcohol'), she had no problem recognising it. According to her report, this is because when she learned   ('alcohol'), she learned it in the word

('drink alcohol'). This may indicate two problems. First, learners tend to learn and read a word as a whole, so they are unable to analyse it and recognise the individual characters in it. Second, these learners only learn Chinese from textbooks, so if a word is not in the textbook, they do not understand it when they encounter it elsewhere.

Although the successful repair rate of the character/word level reading problems for the intermediate level participants was generally not high, some trends were found. In most cases, the participants were not able to solve the problems *word not recognised* and *character not recognised* by applying strategies, and knowing all characters in a word did not increase success in understanding the meaning of the word.

The problems of *word not recognised* and *character not recognised* were most successfully repaired by intermediate level participants through using combined strategies. For both L2Is and HLIs, 'using context clues' was one of the useful strategies to interpret unknown words or phrases as it may help with establishing intrasentential ties (refer to Prichard, 1990 in section 2.6.2.2); however, it seems that the HLIs were able to utilise context more often than the L2Is did, and the success rate was higher. This may be because the HLIs had more background knowledge to rely on, for example, bigger vocabulary size. As a result, it may have been easier for them to guess a word with the aid of context, even when they did not know the characters. As a result, the idiom in *Selling Alcohol*,

('a huge amount of effort'), caused fewer comprehension problems for the HLIs than it did for the L2Is. For example, when participant HLI4 encountered the idiom, she used multiple strategies to successfully understand it as 'a lot of effort'. She first 'read slowly and carefully' to spend more time on the unknown idiom while underlining it for later reference, and then she realised that the phrase must be an idiom, and its meaning may not be related directly to each character. She thus avoided struggling with the characters and tried to understand it in context: the shop was on a small road that only a few people would pass by, so the person in the story found the shop with a lot of effort.

In addition to context clues, 'applying linguistic knowledge', especially recognition of literal character meaning, was also useful when dealing with unknown vocabulary. Like the strategy of 'using context clues', it seems that the HLIs also used linguistic knowledge more effectively than the L2Is did. For some words with transparent meanings, most HLIs were able to understand the word by recognising the literal meaning of each character. For example, participant HLI2 successfully understood

('teacher-student') by analysing the two characters and recognising the meanings as 'teacher' and 'student' respectively. She also 'used context clues' to make sure that her guessed meaning made sense in the sentence. On the other hand, when the L2Is tried to figure out the meaning of   ('teacher-student') by 'applying linguistic knowledge', they recognised the meaning of   was 'teacher', but they failed to recognise   as 'student' because   is a homonym. For example, participant L2I5 thought   meant 'alive' or 'born', which are correct meanings for   but did not make sense in this word. It is interesting that participant L2I1 also mentioned that he preferred not to analyse unknown words by combining the meaning of each character as in his experience as 'the meaning of some easy combinations can be very random'. As a result, in the case of   ('at the same time') he refused to

trust himself that the word meant 'at the same time' despite knowing   ('same') and   ('time') individually.

The strategies 'reading slowly and carefully' and 'rereading' seemed very useful when the participants tried to recall some learned characters or words. This may be because when they tried to recall characters or words that they thought they had learned, the participants normally had a vague impression of them or felt familiar with them, and these two strategies helped the participants gain more time to think about where they had learned or seen the characters and words. In addition, even though a few participants reported that they also used the context to help them recall, it is possible that when the participants paused or reread, they may have used some sub-strategies such as considering the context or linguistic knowledge, but they did not report them.

Another problem that led to the low rate of repair was that the participants mixed up some characters with *graphic proximity*. For example, a few participants recognised   as   due to the graphic similarity. However, some participants were unable to distinguish some characters that were not similar to Chinese native speakers, as they lacked basic knowledge of structural elements. For example, L2I1 recognised   ('only') as   ('long time').   has two radicals, left one and right one; while   is a single character, which cannot be further analysed. Thus, if taking the structure into consideration, these two characters are not similar. All the successfully resolved cases, in fact, used 'context clues' to find the problem and interpret the word correctly. However, as the intermediate level participants focused more on character recognition during reading, it was difficult for them to consider the context and the overall meaning to diagnose problems. This may confirm some scholars' views (e.g., Grabe, 2009; LaBerge & Samuels, 1974) that one's processing capacity during reading is limited; beginner readers focus on word identification, and thus they are unable to shift attention and make better use of other resources, which makes higher level processing more difficult.

b. In the reading aloud mode

More reading problems were revealed in the reading aloud mode. As with the silent reading mode, the problems of *character not recognised* and *word not recognised* occurred most frequently for all types of character/word level problems for the L2Is, and most of them caused comprehension problems. The success repair rate for *character not recognised* was 23.1%, and for *word not recognised* it was 10.3%. Same as in reading silently, *confusion with characters (graphic proximity)* and *difficulty in recalling learned character/ word* were the next two most common problems. It is interesting that *heteronyms* also caused some problems for the L2Is. Although there were only nine cases, seven of them L2Is were not aware of. More *segmentation problems* were also identified for L2Is in reading aloud mode.

Like the silent reading mode, *difficulty in recalling learned character/word*, *word not recognised* and *character not recognised* were common problems when L2Is read aloud. In addition, they also exhibited many *inaccurate pronunciation* problems. Most learned characters or words were successfully recalled after participants 'reread' the part, 'read slowly and carefully' or 'used the context clues' to retrieve the meaning of the word, with a 92.9% success rate. However, the successful repair

rates for *word not recognised* and *character not recognised* were much lower than they were in the reading silently mode: 18.5% and 20.0% respectively. In addition, the HLIs were more frequently unaware of these problems; they did not notice them as long as they were able to read. As discussed in section 4.1.2, HL participants focused more on pronouncing correctly when they read aloud. As a result, when they encountered unknown words, they applied fewer strategies than they did in the silent reading and tended to read on.

The problem of *confusion with characters (graphic proximity)* was more frequently identified in the reading aloud mode than it was in the reading silently mode as more information can be found in reading aloud for both L2Is and HLIs while L2Is had more of these problems than the HLIs did. This is consistent with other studies (e.g., Hatch, 1974; Hayes, 1988) found that L2 learners tend to attend more to the visual characteristics of what they read, which means they replied on graphic cues more than other cues, and thus they mixed up characters with *graphic proximity* and they were not aware of. HLIs successfully repaired more these problems caused by *graphic proximity* in the reading aloud mode, which may indicate that the phonological awareness and skills that the HLIs have may be helpful for them to distinguish two similar characters, especially in the reading aloud session as they needed to read each character aloud. At the same time, HLIs tended to be unaware of this kind of mistake when they read aloud, maybe due to their desire for fluency. As they tried to read fast, they did not have enough time to think about the meaning of every single character they read.

In addition to these common reading problems, when HLIs read aloud, another two phonologically-related problems stood out, which could not be identified in the reading silently mode. All seven HLIs read some characters or words incorrectly (*phonetic proximity*), and some appeared to be influenced by transfer of dialect forms. Most (96.0%) of the participants corrected the pronunciation successfully, and because this is only related to the pronunciation, these problems did not bring any comprehension problems. Such pronunciation issues illustrate that the HLIs, as they reported in the think-aloud session, valued pronunciation (refer to 5.1). However, when they read, four of them were influenced by their Chinese dialect (i.e., Cantonese), so they may have needed extra efforts to read each word correctly. It is also notable that all HLIs encountered the problem of *misread* (i.e., omission, insertion, etc.). In eight of the nine cases of this, the participants were unaware of the errors. In most cases, the phonological *misreading* did not cause any comprehension problems. For example, participant HLI5 read the person's name (*K ng Róng*) correctly first, and then he started to read his name as (*L Róng*) because the other person in this story had the surname (*L*). This error might have been due to nervousness, and it did not have any negative effect on understanding. Some other *misreading* may reveal that participants had Chinese 'linguistic knowledge' and used it to self-correct. For example, participant HLI6 skipped the classifier when she read ('one store'), which is incorrect in Chinese. As soon as she finished the phrase, she reread it again and corrected the mistake. It shows that this participant understood that the classifier is needed when a noun and its number are talked about, and thus she was able to spot the mistake immediately.

In the few cases that the L2Is and HLIs successfully figured out the meaning of unknown words in the reading aloud session, they used similar strategies as they did in the reading silently mode. For example, participant HLI2 used the strategy of 'reading slowly and carefully' and 'using context clues' to establish intrasentential ties (Prichard, 1990; as discussed in section 2.6.2.2) and thus to interpret the meaning of the unknown word   ('remote') as isolated. This indicates that although slowing down and rereading are not helpful to directly solve problems of unknown words, these two strategies are necessary because they can provide the readers time to think and apply other strategies to better solve the reading problems.

However, as the intermediate level participants comprehended less when they read aloud (for details refer to 4.2.2), the successful use of context was less frequent in reading aloud than it was in reading silently, especially for the L2Is. For example, for the word   ('disappointed'), most (three from four who read this story aloud) L2Is knew the character   from the word   ('hope'), but some did not know the character   ('to lose'), so they believed   ('disappointed') had a similar meaning to   ('hope') because many synonyms share one character in Chinese, although, these two words are antonyms. It seems that when the participants had some clues from the character to help them understand the word, they tended to use incomplete information directly rather than seeking help from the broader context to confirm their guess.

In all successful cases of distinguishing *characters with graphic proximity* in reading aloud, participants tried to 'read slowly and carefully' or 'reread' the part to have more time to think. In a couple of cases, the participants tried to 'use the context clues' to better distinguish similar characters, as most characters with similar shapes have different meanings. For example, when participant HLI3 (and several other participants) read the word   ('remote') in the reading aloud session, she thought it was the classifier for articles   . However, she managed to distinguish these two because she used grammatical knowledge and context as clues. As she reported in the think-aloud session, 'it doesn't make sense that a measure word got here' as the sentence is   ('open the shop in such a remote place'). Then, with the help of the context, she figured out that here it should mean 'hidden'. In other cases that only involved 'reading slowly and carefully' or 'rereading' a segment of text, it seems that these strategies worked in the reading aloud mode but not in the reading silently mode. This might be related to the fact that in reading aloud, the HLIs could hear what they were reading, and as several HLIs reported, the pronunciation was very important, and they needed it to better process the meaning. Taking time to sound out the confusing part may be more helpful when reading aloud than when reading silently. It may also imply that the reader's semantic readiness (i.e., having known the meaning of the word) is important.

Intermediate level participants also exhibited some *segmentation problems*, especially the L2Is (all of them demonstrating the problem). For both L2Is and HLIs, most *segmentation problems* were associated with broader problems with understanding a sentence of phrase. When this happened, they chose to stop after every two characters as most words contain two characters. It is interesting that five L2Is and one HLI reported in the think-aloud session that they did this unconsciously and they were

unsure about the meaning of the sentence. In these cases, trying to comprehend the general meaning of the sentence seemed helpful. As participant L2I3 mentioned in the think-aloud session, 'because I didn't really have the meaning of the sentence, I didn't really know the appropriate place to pause, I guess I just like paused after reading two sounds'. After comprehending the general meaning of the sentence, participants were more able to identify the word boundaries in the sentence, and thus repair the segmentation problem.

5.2.2 Sentence level problems and problem-solving strategies

The number of sentence-level problems detected was much smaller than that of character/word level problems due to the different coding units. The coding unit for character/word level problems are characters and words, while for sentence level problems, the coding unit is sentence. The number of sentences in one story is much fewer than that of characters and words. Also, parsing problems could not be observed directly in the silent reading mode.

a. In the silent reading mode

Table 5.5 above shows that when L2Is read silently, the most common sentence-level problems reported were *inability to process the meaning of the sentence* and *sentence structure*. While the successful repair rate was low (25.0%) for the problems *inability to process the meaning of the sentence*, 57.1% of *sentence structure* problems were successfully repaired by the L2Is.

From Table 5.6 we can see that the number of sentence-level problems for the HLIs in silent reading mode was similar to that for the L2Is, and the most common problems were classified as *sentence structure* and *inability to process the meaning of the sentence*. For half of the *sentence structure* problems, the HLIs were unaware of them. For *inability to process the meaning of the sentence*, the HLIs were unable to apply any strategies in more than half the cases.

For the *sentence structure* problems, it seemed that the strategies of 'reading slowly and carefully' and 'rereading' the stimulus sentence alone were not effective (see Table 5.5 and 5.6), even though they were important in that they provided another chance to reprocess the sentence. Re-analysing the sentence with reference to the 'context clues' to establish intrasentential ties seemed a more effective strategy. For example, the sentence   ('at the same time was also very strange') caused problems for four L2Is (two in the silent reading mode). Although the sentence structure was simple, the omission of the predicate in Chinese may cause ambiguity for some participants in comprehension. Thus, this sentence should be analysed in context, and the full sentence is

          ,   ('this person was very disappointed [at it], and at the same time [thought it] was weird, and had no idea why [it] was like this'). This sentence may be a good example to illustrate that sentences are loosely linked together by the theme in Chinese. To a native speaker, it is clear that these sentences share the same theme (the preceding event), even though the theme is not repeated. As this type of ellipsis is not allowed in English, participants may have interpreted the meaning as 'this person was very disappointed, and at the same time he was weird', and, as participant L2I1 reported in the think-aloud session, 'this person did not seem weird'. Participant L2I2 successfully resolved this

problem by using the context and interpreting the sentence as 'and at the same time he found the situation was weird'. In the think-aloud session, the participant reported that, according to the context, that was the only possible meaning 'otherwise, I don't understand why this person was strange'.

If the first part of this sentence,   , is used alone, the meaning may be ambiguous to Chinese native speakers as what the second part refers to is unclear. However, several Chinese teachers (both Chinese native speakers and high proficiency second language speakers of Chinese) were asked to review the stories, and none of them brought up this sentence as an issue. This may indicate that this sentence can be understood without any questions in the context by proficient Chinese speakers. Participants' difficulty with this sentence to some extent reveals that when lower proficiency level learners read, what they focus is to understand each word, overlooking the connections between sentences and extra information in the context.

The intermediate level participants were less able to use problem-solving strategies to solve the problems of *inability to process the meaning of the sentence*. This type of problem refers to the cases when participants were able to read the sentence and understand the words, but they could not make sense of the whole sentence. It may arise from the fact that the process of character/word level is not automatic and requires much working memory load. Thus, this type of problem is often likely to be a combination of some issues with decoding words and clauses (unfamiliar vocabulary and grammar) and the limitations of working memory. As a result, participants are unable to process the sentence level information even though they are able to recognise words. As this kind of problem may not be easily alleviated by 'reading slowly and carefully' and 'rereading' during the reading process, it seemed difficult for participants to apply efficient strategies to solve it, and some of them were even unable to explain why they did not understand the sentence even though they had no problem of words or sentence structure. There were only four cases (two for L2Is and two for HLIs) where participants successfully diagnosed what caused these problems and repaired them by rereading the local sentence and also consulting the contextual information. In the think-aloud session, they reported that they were 'too busy to recognise the characters and word that [they had] no brain [processing capacity] for the meaning of the sentence' (L2I3). As participants were less able to identify these problems, which were identified both by the participants and the researcher in the session of think-aloud. In most cases, the participants were able to comprehend the sentence without any problems in think-aloud session when they discussed the story and their reading process with the researcher. This may be because in the think-aloud session, participants were more able to draw on the contextual information as it was the second time reading the story, and also the character/word recognition required less processing capacity.

b. In the reading aloud mode

As compared with silent reading mode, more *segmentation problems* could be identified in the reading aloud mode. The L2Is had problems with *sentence structure* when they read aloud, and some problems related to parsing were identified. For the problems caused by *sentence structure*, L2Is were aware of most of them (75.0%), while the successful repair rate of these problems was 25.0%. The

successful repair rate was lower in the reading aloud mode than it was in the silent reading mode, which is reflected in their comprehension performance (for details refer to 4.2.2).

From Table 5.6 we can see that the HLIs tended to have fewer sentence-level problems than the L2Is had in the reading aloud mode. The proportion of each sentence-level problem type was similar, and the number of *sentence structure* problems and *parsing problems caused by wrong prediction of the sentence* were slightly more than others. The *parsing problem caused by wrong prediction of the sentence* did not lead to any comprehension problems, while all *sentence structure* problems caused comprehension problems.

For the *sentence structure* problems, like in the silent reading mode, 'using context clues' turned out to be a useful strategy. For example, four L2Is (two in each reading mode) had a problem when they read the sentence

('At that time there was a person called Li Yuanli in Luoyang, who had a high social status, [he] only socialised with famous people, [when] ordinary people came, [he] would not see any [of them]'). The four L2Is were confused with the last part as they understood it as 'the ordinary people would not see Li Yuanli'. This miscomprehension was caused by the omission of the subject in Chinese as the grammaticalisation of Chinese sentences relies more on 'idea-joining' than on 'form agreement' (Shen, 1992). As a result, the meaning of the sentence depends largely on the specific context. In addition, in the reading aloud mode, participant L2I3 and HLI1 also 'used linguistic knowledge' to identify the linguistic form to solve comprehension problems. When these two participants read the sentence

('open the shop in such a remote place'), they paused and identified the '*ba*-structure', which is an important sentence structure emphasised in Chinese textbooks.

The *parsing problem caused by the wrong prediction of the sentence* mainly arose because the intermediate level participants had limited linguistic knowledge and limited exposure to Chinese. Thus, when they saw a word, they automatically recalled the phrase or sentence where they had learned the word. In most cases, the participants would correct the problem by 'rereading' the sentence when they became aware of the problem, and sometimes they chose to read on, but it generally did not lead to comprehension problems. For example, when participants HLI2 read the sentence

('open the shop in such a remote place'), she paused between the word   ('such') as she initially thought the sentence was   ('open the shop here'), but when she noticed 'there were more words after   ' (HLI2), and she repaired the problem by rereading the sentence with correct segmentation.

5.2.3 Discourse level problems and problem-solving strategies

The L2Is tended to have more discourse-level problems than the HLIs had. It may be because the L2Is had more sentence-level problems (for details refer to 5.2.2). Not understanding a previous sentence may make it difficult to understand the next sentence due to the lack of contextual information. The L2Is tended to identify more discourse-level problems in the silent reading mode than they did in the reading aloud mode, which may be because they were able to comprehend more when they read silently and thus were more aware of the connections between sentences (for details refer to 4.2.2). As a result,

they were able to report more discourse problems in the think-aloud session for the story they read silently, while for the one they read aloud, they were less able to identify these problems. As the number of context-level problems was quite small (32 cases for two groups), it will be discussed together with advanced level participants who had more of these problems.

5.3 Reading problems and problem-solving strategies for advanced level participants

This section will focus on the reading problems and problem-solving strategies that the L2As and HLAs had. The L2As were predicted to be readers with some Chinese language experience and higher Chinese proficiency level. Hence, it was predicted they would be able to apply some Chinese linguistic knowledge to solve some reading problems when they encountered them. However, as they do not have any Chinese background, they may have limited opportunities to practice their Chinese on a daily basis, which means they were very likely to struggle at some point during the reading. The number of reading problems and the problem-solving strategies applied are shown in Table 5.7 (next page).

Table 5.7 shows that there are 154 (42+15+58+10+29) reading problems identified in the silent reading mode by L2As themselves and the researcher with an average of 22 problems per student in a range of 17 to 30, and they were aware of 81.2% of these problems. In the reading aloud mode, 196 (55+18+34+25+64) reading problems were identified with an average of 28 problems per student in a range of 12 to 44, and they were aware of 67.3% of these problems.

5.7 Reading problems and problem-solving strategies by L2As

		Read silently (N=7)					Read aloud (N=7)				
		Self-identified problems				Unidentified problems	Self-identified problems				Unidentified problems
		Strategies applied					Strategies applied				
		Successful	Partially successful	Unsuccessful	No strategies applied		Successful	Partially successful	Unsuccessful	No strategies applied	
Character/ word level	Character not recognised	7 (3)	6 (4)	15 (7)	5 (4)	2 (2)	5 (4)	1 (1)	10 (3)	10 (3)	
	Word not recognised	7 (3)	4 (2)	24 (7)	2 (2)	6 (4)	8 (4)	1 (1)	8 (4)	5 (3)	11 (4)
	Pronunciation not recalled		1 (1)					3 (2)			
	Confusion with heteronyms	2 (2)				3 (3)	5 (4)	2 (1)	1 (1)		6 (3)
	Difficulty in recalling learned character/word	14 (5)	1 (1)	4 (4)	2 (2)		15 (6)	9 (5)	4 (3)	2 (2)	
	Confusion with homonyms	1 (1)	1 (1)	4 (3)		3 (2)	1 (1)				6 (5)
	Confusion with characters (graphic alternative)							1 (1)	2 (1)		5 (4)
	Confusion with characters (graphic proximity)					4 (4)	5 (3)	1 (1)	2 (1)		5 (3)
	Confusion with characters (homophones)					1 (1)					
	Confusion with words (semantic related)					2 (2)	1 (1)			1 (1)	1 (1)
	Inaccurate pronunciation (phonetic proximity)						2 (1)		1 (1)		4 (2)
	Misread character/word						9 (6)				19 (6)
	Segmentation — Verb + resultative complement						1 (1)				
	Segmentation — Wrong recognition				1 (1)						
	Segmentation — Unknown phrase									1 (1)	1 (1)
Sentence level	Sentence structure	3 (3)		3 (3)		2 (2)			1 (1)		2 (2)
	Inability to process the meaning of the sentence	1 (1)	1 (1)	3 (3)					1 (1)	3 (2)	
	Parsing — Sentence structure										1 (1)
Discourse level	Wrong noun/pronoun referents	1 (1)				2 (2)			2 (2)		1 (1)
	Inability to contextualise information	2 (2)	1 (1)	4 (2)		1 (1)			1 (1)		
	Inability to process implied/pragmatic meaning				1 (1)	1 (1)				3 (2)	2 (1)
	Wrong inference			1 (1)		1 (1)			1 (1)		
Others	Lost concentration	4 (3)					3 (1)				
	Total	42	15	58	10	29	55	18	34	25	64

The HLAs in this study were predicted to be the readers with the most Chinese language experience, given their Chinese background and in many cases much longer Chinese learning experience. As they were at advanced level, they were more likely to employ their background knowledge and useful

strategies to deal with the reading problems they encountered. The number of detected reading problems and the participants' employment of problem-solving strategies are shown in Table 5.8.

Table 5.8 Reading problems and problem-solving strategies by HLAs

		Read silently (N=9)					Read aloud (N=9)				
		Self-identified problems				Unidentified problems	Self-identified problems				Unidentified problems
		Strategies applied					Strategies applied				
		Successful	Partially successful	Unsuccessful	No strategies applied		Successful	Partially successful	Unsuccessful	No strategies applied	
Character/ word level	Character not recognised	2 (2)	1 (1)	18 (5)	4 (3)		1 (1)	1 (1)	4 (4)	3 (3)	
	Word not recognised	4 (3)	3 (3)	5 (4)		3 (3)	2 (2)	2 (2)	3 (2)	1 (1)	7 (5)
	Pronunciation not recalled	1 (1)	2 (2)		1 (1)			10 (6)			
	Confusion with heteronyms	3 (2)		3 (3)		5 (3)	5 (3)	1 (1)			6 (4)
	Difficulty in recalling learned character/word	17 (8)		2 (2)			19 (7)	2 (1)	3 (2)		
	Written form not recognised			4 (2)				1 (1)	8 (3)	1 (1)	
	Confusion with homonyms			1 (1)		7 (4)					6 (3)
	Confusion with characters (graphic alternative)					1 (1)					2 (2)
	Confusion with characters (graphic proximity)			1 (1)		5 (4)	4 (3)	1 (1)	4 (3)		8 (4)
	Confusion with words (semantic related)						1 (1)				8 (3)
	Inaccurate pronunciation (phonetic proximity)						18 (4)	3 (2)		1 (1)	6 (5)
	Misread character/word					1 (1)	19 (6)				19 (8)
	Segmentation — Inability to process the meaning of the sentence					1 (1)					
Sentence level	Sentence structure	2 (2)		2 (2)		2 (2)					
	Inability to process the meaning of the sentence	4 (2)		4 (3)					1 (1)	1 (1)	
	Parsing — Wrong prediction of the sentence						4 (2)				
Discourse level	Wrong noun/pronoun referents					4 (4)					
	Inability to contextualise information	3 (3)		9 (5)		1 (1)				2 (1)	1 (1)
	Inability to process implied/pragmatic meaning			1 (1)		2 (1)				1 (1)	1 (1)
	Wrong inference					1 (1)					1 (1)
Total		36	6	50	5	33	73	21	23	10	65

Table 5.8 shows there are 130 (36+6+50+5+33) reading problems identified in silent reading mode by the HLAs and the researcher with an average of 14.4 problems per student in a range of 4 to 31, and they were aware of 74.6% of these problems. In the reading aloud mode, 192 (73+21+23+10+65) problems were identified with an average of 21.3 problems per student in a range of 9 to 30, and they

were aware of 66.1% these problems. Compared to L2As, HLAs had fewer reading problems in both reading modes. In the following section, reading problems and strategies for advanced level participants will be discussed in detail.

5.3.1 Character/word level problems and problem-solving strategies

a. In the reading silently mode

From Table 5.7 and Table 5.8 we can see that in the silent reading mode, the most common problems at the level of character/word for both L2As and HLAs are the problems of *word not recognised*, *character not recognised* and *difficulty in recalling learned character/ word*. Compared to L2As, HLAs had fewer problems of *word not recognised,* and at the same time, they were more able to successfully repair these problems (successful repair rate for HLAs was 46.7%, while that for L2As was 25.6%). *Character not recognised* also caused comprehension difficulties (the successful repair rate was 37.1% for L2As and 12.0% for HLAs). Most cases of *difficulty in recalling learned character/word* were successfully solved by both L2As (71.4%) and HLAs (89.5%). It means that although L2As and HLAs were still unable to process lower-level information automatically, they were able to successfully retrieve the knowledge of most learned characters and words. In addition to these common problems shared with intermediate level participants, L2As also had the problem of *confusion with homonyms*, while HLAs *confusion with heteronyms*. As heteronyms mean different things when they are pronounced differently, it is possible to identify problems with them in the participants' retelling of the story. L2As were aware of 66.7% of instances of problems caused by *homonyms*, and they successfully repaired 22.2% of these cases. HLAs were only aware of 54.5% of the problems caused by *heteronyms*, and for the ones they were aware of, half (i.e., 50%) were successfully solved.

Even though the successful repair rate of *character not recognised* and *word not recognised* remained low for the two advanced level participants, it seems that the L2As tended to have greater success solving *character not recognised* (with successful repair rate 37.1%), while the HLAs tended to be better at solving the problem of *word not recognised* (with successful repair rate 46.7%). This may indicate that if L2As did not know the word as a whole, it was not helpful if they were able to identify the individual characters in the word; while for the HLAs, being able to identify the single character contained in an unknown word seemed to increase their chances of guessing the meaning of the word correctly.

The strategies that were adopted by the advanced level participants were similar to those used by the intermediate level participants. For the reading problems of *word not recognised* and *character not recognised*, all the successfully repaired cases used multiple strategies. In addition to 'reading slowly and carefully' or 'rereading', which could provide extra time to think and apply other strategies, in most cases advanced level participants also tried to establish intrasentential ties (Prichard, 1990; discussed in section 2.6.2.2) by 'using context clues' to work out the meanings of these words. For example,   ('to occupy') is an unknown word for most L2As; however, participant L2A2 was able to get the meaning of it as 'go over', which was correct in the sentence. The sentence also provided a context for the word   ('to occupy') as it said   ('The new house becomes bigger, and it

took Zhang's land'). By 'reading slowly and carefully' to provide more time to think, 'rereading' the sentence and 'using the context clues', he made an educated guess about the meaning of this unknown word. Context alone is sometimes not enough to understand the meaning of a word, and there are also cases where no useful context can be found to help with the unknown words. For example, no L2As worked out the meaning of the word   ('suffer losses') even though some of them tried to use the context to make a guess. The sentence was quite simple   ('The Zhang family suffered the loss'), which cannot provide any useful clues for the meaning of this word and the loss here referred to 'lost land', which was mentioned earlier. However, the information provided by the context was not enough for the participants to work out the exact meaning of   ('suffer losses'). The best guess made by the participants came from participant L2A5, who 'used the context clues' and the meaning of   ('to eat') and linked it to an English expression to guess   ('suffer losses') meant 'swallow bitterness', which was very close.

The HLAs also 'guessed the general meaning' when they encountered some unknown words in addition to applying some other strategies at the same time. For example, when participant HLA4 read   ('he has not done anything in the three years since he ascended to the throne'), he 'read slowly and carefully' as he had never heard the phrase   ('ascend the throne'). The only usage of   ('to climb') he was able to think of was from the textbook   ('I climbed the Great Wall'), where it was used in a different context. Instead of wasting too much time on this, he chose to accept the ambiguity (see section 2.6.2.2) and 'assumed the general meaning' of it would be 'took the position of the emperor', which worked in the context although he was not sure about the specific meaning.

For some words with transparent meaning, 'applying linguistic knowledge' by recognising the meaning of each character turned out to be a useful strategy as well. For example, although the word   ('eat, drink, and play') was a new word for the participants, most participants were able to understand it just by thinking about the meaning of each character. Participant L2A6 was even able to translate it as 'instant pleasure of life' when he retold the story. However, the precondition for this is to be able to recognise each character correctly. As the last character   in this phrase is a heteronym, it has two pronunciations and two meanings. In this phrase, it should be read as *lè*, which means 'fun'. However, participant HLA6 read it as *yuè* ('music') and thought it meant the emperor liked music. Furthermore, using this strategy is sometimes not fully reliable as the meaning of a word is not always equal to the combination of the meaning of each character. For example, when participant L2A5 encountered the unknown phrase   ('look down, not respect'), she literally translated it as 'not put [the other party] in the eyes', which did not make sense. While the meaning of some words can be worked out by looking at each part, recognising the meaning of each character should be used carefully. Although most participants worked out the meaning of   ('daydream') by recognising   ('daytime') and   ('dream'), participant L2A6 failed to do so. He comprehended the word literally as 'white sun dreams' without any further analysis, and it did not make sense. In Mandarin, we do not often use the word   to talk about daytime, instead,   ('daytime') is used much more

often. However, as   and   are exchangeable in a lot of cases because they share the same meaning of 'day', most L2As were able to work out the meaning of this word.

In some cases, 'applying linguistic knowledge' to guess the meaning of unknown word may lead to mixed results. Some participants were only able to recognise one character in a two-character word, and they assumed that the meaning of the whole word was similar to that of the learned character. For example, most L2As and a few HLAs did not know the word   ('to build'), but they had learned the word   ('to build'). As many Chinese words are formed by two characters with similar meanings, the participant L2A7 assumed that the meaning of the unknown word   ('to build') was similar to the meaning of   ('to build'). However, using this strategy alone may cause some problems because this rule does not work for all Chinese words. After using this to 'assume the general meaning of a word', the context should be used to check if the meaning works in the sentence, otherwise, it may lead to miscomprehension (for details refer to 5.2.1).

Using other aids and supports, e.g. 'the English introduction' was also a useful strategy. For example, Participant L2A1 used the English introduction before the text to work out the meaning of the unknown word   ('emperor'), although she also did not know the two characters. Using other aids, including pictures, is a useful strategy to obtain some general information; however, nearly half of the participants did not notice the brief English introduction before each story. Participant L2A7 read it but still failed to figure out the meaning of the word   ('emperor') despite it stating the story was about an emperor.

It seems very difficult for L2As to solve the problem caused by *homonyms*, as the different meanings always relate to each other. As a result, considering the word in the context of the sentence alone may not be enough to identify any problems caused by *homonyms*, and in most cases, establishing intersentential ties (e.g., 'relating the stimulus sentence to a previous portion of the text') is necessary. For example, in the passage *Two neighbours*, the two commonly used meanings for   are 'to tell' and 'to sue'. Since the word   ('to tell') is used more frequently, most of the advanced level participants thought it meant 'to tell'. However, the next sentence ('but the local officials are afraid of provoking the two families') involved the officials, which means there was a case, and   should mean 'sue' here. Only one participant took the context into account, and understood it as 'to report', while other L2As thought it meant 'to tell', and thus did not understand why there was an official in the next sentence. The successful repair rate of the problem caused by *heteronyms* for HLAs was a little higher, as only considering the meaning and the structure of the surrounding sentence was enough to figure out if it made sense or not.

b. In the reading aloud mode

Similar to reading silently, *word not recognised* and *character not recognised* were the two most common reading problems for L2As that led to comprehension problems, with 27.3% and 23.1% successful repair rates respectively. For 33.3% of the *word not recognised* problem, the participants were not aware of them. For example, the participant L2A1 thought   ('angry') meant 'worried', and participant L2A6 translated   ('appear') as 'discover'. These examples indicated that when

Chinese learners learn new words, sometimes they do not remember the exact meaning of these words, and when they see the word somewhere else, they may have a vague impression of the meaning. However, this may lead to misunderstanding. There were also cases that the participants did not report that they did not know some words, but when the researcher asked them to provide a translation for some parts, they were not able to translate these words. For example, participant L2A2 did not report the word   ('yard') as an unknown word, but when he talked about the sentence, he translated it as 'house'. L2A6 chose to accept the ambiguity (see section 2.6.2.2) when he encountered the word   ('until'), but when he translated the sentence, he skipped this word, and translated   ('until now') as 'now', which caused comprehension problems. Some cases may be because the participants forgot to mention it, but it may also indicate the method that Chinese learners use when they learn Chinese themselves. There were also a lot of cases of *trying to recall a learned character/word*, and *misreading character/word* but most of them did not lead to comprehension problems.

Several empirical studies (Joseph & Nation, 2018; Swanborn & De Glopper, 1999) found that reading can foster 'incidental' vocabulary learning; however, it will only happen when the learners can identify the unknown words. In Chinese, as the word boundary is not shown, and some words can be made up of two commonly used characters with totally different meanings, so it may be difficult for Chinese learners to identify if it is an unknown word or it is just a random combination of two characters (refer to the example of   ('at the same time') in section 5.2.1(a)).

In addition to these three reading problems, which were also very common in reading silently, *confusion with heteronyms* also occurred for six (out of seven) L2As. The number of problems was not large due to the small number of heteronyms contained in the text. In most cases, the participants knew that the character had two pronunciations with different meanings, but when they read, they did not think about it and just read the more commonly used sound without considering if it was semantically and grammatically acceptable. For example, in the sentence   ('no longer ask the neighbour to return the land to them'), the character   is a heteronym. When it is read as *huán*, it means 'to return'; when it is read as *hái*, it means 'still'. Although the meaning of 'to return' is the correct one in this sentence, most L2As understood it as 'still' as it is more commonly used. As a result, they understood the sentence as 'no longer ask the neighbour to still give them land', which is the opposite of what it said; in addition, this sentence is not correct as   ('still') is used wrongly here. When   means 'still', it means a situation remains unchanged. The sentence here, however, means the situation is changed with the word   ('no longer'). Thus, the two words   ('no longer') and   ('still') should not be in the same sentence.

From Table 5.8 we can see that *misread character/word*, *inaccurate pronunciation (phonetic proximity)* and *difficulty in recalling learned character/ word* were the three most common reading problems for the HLAs in reading aloud. *Misread* as explained before, normally did not influence comprehension. Half of the cases were not noticed by the participants and this kind of misreading also arises with native speakers (Goodman, 1967). Among the HLAs, only one case of misreading led to miscomprehension. Participant HLA8 read the sentence   ('You can

still see the Great Wall of China until now') as ('The Great Wall of China still has not been seen by now') by adding the character ('no, have not'). For *inaccurate pronunciation (phonetic proximity)*, reading some characters/words in Chinese dialects was noted by the researcher even though the participants were not aware of doing so, because it may reveal the influence of language background on learning Mandarin. For example, participant HLA8 read the surname (*Wú*) as 'Ng', which is the correct Cantonese pronunciation; however, the phoneme 'ng' does not exist in Mandarin at all. These phonetic decoding problems normally did not lead to comprehension problems. Indeed, 87.5% of the cases of trying to recall a learned character/word were successful, so it did not cause serious comprehension problems.

Some problems that led to comprehension problems for the HLAs in reading aloud were *confusion with characters (graphic proximity)*, *word not recognised*, and *confusion with heteronyms*. The HLAs were only aware of approximately 50% of these problems, and only half of them were repaired successfully. All problems of *confusion with heteronyms* that HLAs were aware of were successfully repaired. In addition, some words were reported by the HLAs as unknown words in the think-aloud session, but when the pronunciation was provided, the participants knew the meaning immediately. Therefore, it was not a matter of not knowing the word itself, but just its written form. To solve the problem of *confusion with characters (graphic proximity)*, the HLAs 'considered the context clues', and if the character repeated in the text, they 'read slowly and carefully' to avoid confusion with another character.

5.3.2 Sentence level problems and problem-solving strategies

a. In the reading silently mode

The most common sentence-level problems for L2As and HLAs were the same as for L2Is and HLIs in the mode of reading silently, namely, the *sentence structure* problem and *inability to process the meaning of the sentence*. L2As were aware of most of these problems (75% and 100% respectively), with successful repair rate of 37.5% and 40.0% respectively. HLAs were also aware of most of the problems (66.7% and 100% respectively), with successful rate of 33.3% and 50%.

The situation of strategy uses in response to grammatical problems and the problem of being unable to process the meaning of the sentence was same to that for intermediate level participants, and thus will not be repeated here.

b. In the reading aloud mode

Advanced level participants tended to have less *sentence structure* problems and *parsing* problems than intermediate level participants when they read aloud, but they tended to struggle more with *inability to process the meaning of the sentence*. HLAs had much less sentence-level problems in reading aloud mode than in the silent reading mode, which may also confirm that reading aloud actually helped with their comprehension (for details refer to 4.2.2).

From Table 5.7, the most common sentence-level problems for L2As in reading aloud were same to these in reading silently, which will not be repeated here (see above). Table 5.8 shows that HLAs

only had six cases of sentence-level problems, and four of them were *the parsing problem caused by wrong prediction of the sentence*, which did not lead to comprehension problems as the participants were aware of them.

There was only one case (L2A3) of *parsing problem* due to sentence structure for advanced level participants, but he was unaware of it, and it caused comprehension problem. The sentence was   ('but as long as it wants to fly, [it] can at once fly to a very high place'), and the word   here means a short while. When L2A3 read this sentence, however, he thought of the structure 'verb +   ', and thus parsed   together. The structure 'verb +   ' means 'give something a try', and   means 'be able to', which does not fit in the structure. L2A3 found it weird, but he did not know the reason. He reported in the think-aloud session that he would 'use his linguistic knowledge' to identify these special structures when he read in Chinese as they were different from English, so unless these were identified, one was unable to understand the sentence. However, being too sensitive to these structures, L2As did not pay enough attention to the grammatical meaning and function of the structure, and thus he parsed and analysed the sentence using the structure without noticing that it did not work.

5.3.3 Discourse level problems and problem-solving strategies

Advanced level participants had more discourse-level problems compared to intermediate level participants, and they also tended to have similar number of these problems in the two reading modes. As the number of context-level problems was relatively small, and the reading mode had limited impact on them, these problems will be discussed together. To be aware of this kind of problems, participants need to have the ability to formulate questions during the reading process so that they are able to notice the part that cannot be contextualised or seemed contradictory. The participants, in most cases, were able to identify these problems, however, the successful repair rate was low.

Inability to contextualise information was the most common problem at discourse level for all groups of participants in both reading modes. Generally, when participants were unable to contextualise a sentence, they would suppose that they missed some previous parts. However, some participants were unable to identify the sentence which caused the problem, and thus they were unable to repair the problem; on the other hand, some participants successfully identified the sentence that caused the problem, but they were unable to comprehend the sentence by 'rereading'. One successful example was from L2A4 when she read the sentence   ('and also gave the neighbour some land'). As she explained in the think-aloud session that she was able to 'understand every word, but the whole meaning didn't click in my brain', and the reason was that she did not understand why there were   ('and, in addition') and   ('again') in the sentence. She decided to 'relate the stimulus sentence to a previous portion of the text' by 'rereading' the sentence before, and the sentence said   ('no longer asked the neighbour to return the land'). By establishing the intersentential ties, she realised that she read the heteronym   wrongly and thus misunderstood it. The heteronym   in this sentence should be pronounced as *huán*, and the meaning is 'to return'; while she read it as *hái* in the first time, and thus understood it as 'still'. After reading the previous sentence correctly, she made

more sense of the local sentence, and understood that 'they let the neighbour keep the land and also gave the neighbour more'.

Inability to process the implied/pragmatic meaning also caused comprehension problems for all groups of participants. For example, the sentence   ('even if we gave them some land, what will happen?') caused problems for five (out of seven) L2As and four (out of nine) HLAs. Participants understood it as a real question, however, it is actually a rhetorical question, which is used to emphasise the points. In the story, it was used to indicate that it was fine to give some land to them. Some participants questioned if the sentence was a real question because it was on a reply letter which was supposed to provide suggestions, but they failed to understand it was a rhetorical question and thus missed the meaning behind it. It seemed that participants were unable to apply any strategies to address this kind problems, and it may be because it related to pragmatics which is difficult to teach in classroom and overlooked by a lot of textbooks.

In addition, *noun/pronoun referents* also caused comprehension problems for all four groups of participants. For example, the noun   ('the official there') in one of the passages for advanced level participants caused problem for three (out of seven) L2As and four (out of nine) HLAs. This noun refers to someone new in the story, but these participants thought it referred to the person who had been mentioned in the story as that person was   ('big official'). All of these seven participants were unaware of this problem and thus they misunderstood this section of the story.

There were also some cases when participants made some 'wrong inferences'. These 'wrong inferences' were classified into discourse-level problems because the wrong inferences normally indicated that participants misunderstood the settings of the story which was not limited to word or sentence level. For most cases, participants were unaware of the wrong inferences, and for couple of cases, the participants were not sure about the inference but they were unable to apply any strategies to help them decide if the inference was wrong or not. As some researchers (e.g., Daugaard et al., 2017; Perfetti, 1999) claimed, making inferences is an efficient reading strategy, which may indicate that 'wrong inferences' are not necessarily a bad thing as it shows the ability of participants to actively involve themselves in reading by connecting their experience to the story. For intermediate level participants, two of the three cases of wrong inferences were from the readers who received high comprehension marks. All these three cases the intermediate level participants were unaware of. One case related to the meaning of a word. When L2I2 read *The smart Kong Rong*, he thought the story happened in a restaurant as it mentioned   ('guest, customer'), and he understood it as 'customer' even though it should be 'guest' in the story. As a result, he mixed up who answered questions in the end of the story because he understood the story in a restaurant settings. Five cases of 'wrong inferences' was identified with advanced level participants, and they tended to overthink the meaning of some sentences. For example, three participants thought the small road in *The Two Neighbours* was a metaphor form which symbolised the friendship between the two families.

5.4 Reading problems and strategies by different groups of participants in different reading modes

5.4.1 Reading problems and strategies by L2 and HL participants

Generally, HL participants tended to have less reading problems and higher successful repair rate compared to L2 participants (refer to Table 5.5, 5.6, 5.7 and 5.8). HL learners tend to have more experience with the Chinese language as revealed in the questionnaire that most of them attended community school to learn Chinese since they were young, and their parents and relatives may speak Chinese to them at home whereas L2 participants rarely have any opportunity to use the language outside of the classroom. Most HL participants also reported in the questionnaire that they visit China or other Chinese-speaking countries or regions regularly; while for most L2 participants, they only have this kind of experience for a short of time (e.g., a few weeks). The experience of using the language may equip the HL learners with better language skills (Xiao, 2009). On the other hand, as He (2015) pointed out, HL learners may have a broad range of proficiency in terms of oral and literacy skills, and in this study, we found their prior language experience differs from one student to another. For most L2 participants, the Chinese classroom is the only place where they learn and practice Chinese. As a result, L2 participants tended to have lower linguistic proficiency, and to have more similar character/word-level and sentence-level problems than HL participants did (for details refer to 5.1).

Even though HL students tend to have higher speaking ability than L2 students (Huang, 2011), most of them are speakers of Chinese dialects (Cantonese in this study) instead of Mandarin. These Chinese dialects speakers had different views on their language backgrounds in terms of facilitating their Chinese (Mandarin) learning. Five HL participants (two with intermediate level; three with advanced level) mentioned being a Cantonese speaker, two in a negative way (one with intermediate level and one with advanced level) and three in a positive way (one with intermediate level and two with advanced level). For example, HLI1 believed that when she studied Chinese, she did not benefit from being a Cantonese speaker, and she explained that it may be due to her low proficiency level of Cantonese. HLA2 mentioned that because of Cantonese, she found the pronunciation of standard Chinese was very difficult. On the other hand, HLI2 and HLA1 used Cantonese as a resource to guess the meaning of words. They would try to relate the sound to Cantonese to see if they were able to think of a word which fit in the context. HLA8 also reported that when she read silently, she would read it in Cantonese, which helped her understand the story faster and more directly. From the perspective of multicompetence, it is very unlikely for multilinguals to perceive a text in the same way that monolinguals do (García & Kleifgen, 2019), and translanguaging actually privileges the meaning-making process as these multilingual readers are able to use their linguistic repertoire to interpret texts.

With all of these advantages, CHL students, however, are still unable to fully apply their oral competencies (e.g., grammatical and lexical knowledge) to reading and writing, because the phonological connection between spoken and written Chinese is not as strong as that in alphabetic languages (Huang, 2011). Hence, HL participants had problems with some vocabulary which they can understand in conversation, but were unable to recognise in the reading, which rarely happened to L2

participants. This is similar to what Zhang and Koda (2018) found in their study that CHL had advantage compared to their non-CHL counterparts in oral vocabulary knowledge, but not in print vocabulary knowledge. In this study, *written form not recognised* happened to six (out of nine) HLAs, and two of them reported recognising characters as the most difficult thing when they read Chinese. Only participant HLA5 (Mandarin background) reported in the interview that she tried to guess the pronunciation of words she did not recognise to see if she actually knew it. She normally was able to recognise one character in the word, and then she would try to use the context as a clue to see if she was able to guess the word.

HL participants (five HLIs and all HLAs) tended to have more cases that they did not know the pronunciation but knew the meaning (*pronunciation not recalled*) than L2 participants (two L2Is and two L2As) (for details refer to Table 5.5, 5.6, 5.7 and 5.8). The greater number of cases of unsuccessful phonological activation for HL learners than L2 participants may be explained by two reasons. First, this may relate to the HL participants' existing knowledge of Chinese dialect. For some words, HL participants may know the pronunciation in the dialect they speak, but not in Mandarin; so when they read, what they draw on is the link between the semantics and the orthography. These cases, however, should not be used as examples to discuss if phonological activation is necessary in Chinese reading (e.g., Chen & Shu, 2001; Perfetti & Tan, 1998; Perfetti & Zhang, 1995), for which the debate is still going. Second, it may also relate to the fact that HL and L2 participants use different strategies in word learning, and they may also acquire words in different contexts. In the interview session, most L2 participants reported that when they learned a new word, they would write down the characters, the pinyin and the English translation, and tried to remember the three. HL participants reported that they may learn some new words when they watched some Chinese TV dramas. HLA8 reported in the interview session that she would read the Chinese and English subtitles when she watched the Chinese TV dramas. If some words kept showing up, she would remember the characters and the meanings, but not the pronunciation as she did not always pay attention to the sound.

In summary, L2 and HL participants differ in many ways, for example, the resources they use to acquire Chinese language and the vocabulary size, especially the oral vocabulary size. Because of their generally superior underlying linguistic competence, including the ability to speak Chinese dialects in some cases, HL students were able to read faster and encountered fewer reading problems than their L2 counterparts did. The advantage of dialect speaking ability, however, also made HL students struggle more with accurate Mandarin pronunciation.

5.4.2 Reading problems and strategies by intermediate and advanced level participants

Advanced level participants tended to rely more on semantic cues when reading, while intermediate level participants tended to rely more on graphic cues. As a result, advanced level participants tended to have more reading problems that did not cause comprehension problems (e.g., *misread*). One reading strategy reported by several participants is interesting, which also revealed the difference between participants at different proficiency levels. Six participants (three L2Is, two HLIs, and one L2A) reported that when they read, they would actually translate the Chinese word into English, as L2I1

reported, 'the Chinese passage can actually be read in English'. It seems that intermediate level participants tended to do so more than advanced level participants, and L2 participants also tended to do so slightly more than HL participants. This strategy may relate to the method, grammar-translation method, which students have learned through fully or partially. As participants' ability increases, they need to rely on it less, and have more ability to process the target language directly. In addition, HL learners are likely to use it less as they also have acquired the ability to process (think in) Chinese directly. On one hand, translation may act as a reading strategy, which is common in L2 reading (e.g., N. Anderson, 1991; Lee-Thompson, 2008; see 2.6.2); on the other hand, it may also bring some problems, e.g., ignoring the discourse level information, which may lead to misunderstanding and pragmatic problems. Moreover, the translation strategy may also slow them down a lot, which may affect participants' reading speed (advanced level participants read faster than those at intermediate level and HL participants read faster than L2 participants, for details refer to 4.1.1). As a result, to understand the meaning more accurately, one may need to reread the sentence after understanding the literal meaning. Like L2A1 explained in the interview session, he would not translate directly into English when he was familiar with the words and phrases, but when he read something difficult, and when he felt uncertain about the words and sentences, he would start to think about every word in English. So, translation is a good problem-solving strategy to try to understand the gist of a sentence, but in order to build an accurate model of the situation presented by the text (Van Dijk & Kintsch,1983), a reader still needs enough linguistic knowledge (e.g., lexical knowledge and syntax knowledge).

In summary, advanced level participants had more automatic recognition of characters, as well as of the lexical and grammatical level structures, which enables them to process the text directly without translating every word into English, and thus advanced level participants tended to read faster than intermediate level participants did. In addition, advanced level participants showed higher ability to deal with more difficult texts than the intermediate level students through greater problem-solving skills and linguistic skills.

5.4.3 reading problems and strategies in the two reading modes

More character/word level problems were identified in the reading aloud mode for all four groups as the pronunciation could be examined in the session of reading aloud. However, the effect of reading modes on successful repair rate of character/word level problems was different among intermediate level and advanced level participants. For intermediate level participants, they were able to successfully repair more problems when they read silently, while for advanced participants, reading aloud facilitated their problem solving, which was also reflected by their comprehension performance except for L2As (refer to 4.2.2). L2As comprehended more when they read silently, and the difference of comprehension marks in reading aloud and reading silently was not statistically significant. However, they were the only group whose reading speed was significantly influenced by reading modes – they read much faster in reading aloud than in reading silently. So, their better comprehension in reading silently may relate more to the longer reading time.

Compared with reading aloud, more sentence level and context level problems were identified when participants read silently for all four groups. This may relate to the limited processing capacity (refer to 2.2.3) as when participants read silently, they were more able to pay attention to semantic information and thus they were more able to identify the problems occurred at sentence or discourse level; while when they read aloud, they had to pay attention to oral production, which may occupy the attentional resources. As for the successful repair rate for these problems, reading modes affected it differently for L2 participants and HL participants. L2 participants tended to repair more sentence level and discourse level problems when they read silently, which is also reflected in their comprehension performance – they were able to comprehend more when they read silently (refer to 4.2.2). On the other hand, HL participants tended to solve more sentence level problems when they read aloud, while they solved more context level problems when they read silently. It remained unclear why different trends were identified in terms of successful repair rate for sentence level problems and context level problems for HL participants, however, solving more sentence level problems in reading aloud may indicate that HL participants benefit from higher speaking and listening skills (Huang, 2011) and they were able to better understand sentences if they were able to hear it.

In summary, reading aloud and reading silently may influence reading due to two main reasons: first, reading aloud may require more attentional resources on phonetic cues, which may sacrifice comprehension; second, for HLAs, reading aloud may facilitate understanding and memorising as both visual and audial input were involved.

5.5 Summary

This section will summarise the descriptive data of reading problems and problem-solving strategies from the different groups in the two reading modes.

a. Problems and strategies at character/word level

In this study, the six most common reading problems at the character/ word level (in the order of frequency among the participants) were identified either by the participants themselves (from an emic view) or by the researcher (from an etic view) as follows:

1) word not recognised (all four groups),
2) character not recognised (all four groups),
3) difficulty in recalling learned character/word (all four groups),
4) characters mixed up due to graphic proximity (all four groups),
5) misreading (two advanced level groups), and
6) inaccurate pronunciation (two HL groups)

Problem number 1 and 2 indicates a lack of knowledge of the lexical item or its graphical form (characters). Problem number 3 means a lack of automaticity of graphic-phonetic mapping or form-meaning mapping. Problem number 4 is related to a lack of graphic redundancy of Chinese (Hayes, 1988) and possibly insufficient familiarity with the elements that make up characters. Problem number

5 indicates less attention to graphic cues and more to the semantic cues, while problem number 6 indicates a lack of knowledge of correct pronunciation of the lexical items. Problems number 3, 5 and 6 did not necessarily lead to comprehension problems, while the other three caused more comprehension problems. When repairing the detected problems of not recognising characters and words, students adopted many strategies (for the full version of taxonomy, refer to 3.5.4.2), among which the most effective ones were

- ' establishing intrasentential ties (incl. 'using context clues', 'reading slowly and carefully' and 'rereading')
- ' combinations of using background knowledge ('applying linguistic knowledge') and establishing intrasentential ties (incl., 'reading slowly and carefully' and 'rereading')

To solve character/word level problems, it seemed that establishing intrasentential ties and using background knowledge were generally useful, while using aids and supports were limited by the experimental design and accepting the ambiguity may lead to mixed results. When encountering a new word, participants generally 'read slowly and carefully' to think and 'reread' carefully to identify each character, and they 'used context clues' to make an educated guess or prior 'linguistic knowledge' to analyse the meaning of the word. Good examples of using these strategies can be seen in 5.2.1 and 5.3.1 in detail. Generally, the HL participants were more likely to successfully resolve these problems than the L2 participants were. As for different proficiency level participants, intermediate level participants tended to have higher successful repair rate when they read silently, while advanced level participants tended to successfully repair more problems when they read aloud. This may relate to their comprehension performance (for details see 4.2.2). Applying the strategy of using the context requires automatic recognition of vocabulary, so that participants still have enough processing capacity (Van Patten, 1996) to process the information at sentence level. For the participants who were struggling with word recognition, they were less able to obtain extra resources from the context to help them with rapid and accurate word recognition because of the limitations in the processing capacities.

It is noteworthy that no participants in this study reported that they used knowledge of semantic radicals to make an inference of the meaning of words they did not recognise, even though, according to the background survey, most of them had a basic knowledge of radicals. Some advanced level participants, however, tried to use the phonetic component of the character to guess the pronunciation, which was also found in other studies (e.g., Williams, 2013). Young Chinese children also use phonetic components to guess the pronunciation when learning the Chinese characters (Seidenberg, 1985), and ignoring the semantic radical was also found in other studies on learning Chinese as a second language (Feldman & Siok, 1999; Flores d'Arcais, 1992).

b. Problems and strategies at sentence level

The two most common reading problems at the sentence level were:

7) failure to understand sentence structure (all four groups)
8) failure to process the meaning of the sentence (all four groups)

The first problem related to comprehension of grammatical structures, but the second was more holistic, and could be related to a number of problems in the same sentence, or to overloading of processing capacity.

When repairing sentence-level problems, the most effective strategies the participants adopted were:

′   combinations of establishing intrasentential ties (incl., 'using context clues', 'reading slowly and carefully' and 'rereading') and establishing intersentential ties ('relating the stimulus sentence to a previous portion of the text')

′   combinations of using background knowledge ('applying linguistic (grammatical) knowledge') and establishing intrasentential ties (incl., 'reading slowly and carefully' and 'rereading')

Similar to character/word level problems, establishing intrasentential ties and using background knowledge were also helpful when solving sentence level problems. In addition, establishing intersentential ties was also effective when it comes to sentence level problems. HL participants were more able to resolve sentence-level problems, and they also tended to have higher successful repair rate in reading aloud session. Comparatively, L2 participants were less capable to solve sentence-level problems, and they tended to have higher success rate when they read silently. Good examples of using these combinations of strategies to resolve sentence-level problems can be found in 5.2.2 and 5.3.2. Generally, 'reading slowly and carefully' and 'rereading' provided participants with extra time to re-process the sentence, and 'context clues' within and beyond the sentence can provide extra information to make sense of the sentence and to make up for the lack of grammatical knowledge. The strategy of 'applying linguistic (grammatical) knowledge' (e.g., identifying the linguistic forms) was always the most effective to deal with grammatical problems (i.e. to apply conscious grammatical knowledge in cases where automatic processing had failed), however, most participants were unable to do so as lacking grammatical knowledge itself was also a major reason that caused sentence-level problems.

c. Problems and strategies at discourse level

More discourse-level problems were identified by advanced level participants than their intermediate level counterparts. This may be because they were more capable to notice the connection between different parts of the text, and thus it was easier for them to diagnose the discourse-level problems. The most common problems at the discourse level were:

9) Inability to contextualise information (all four groups)

10) Inability to identify the referents for noun/pronoun (all four groups)

11) Inability to process the pragmatic/implied meaning (all four groups)

It seemed that for all participants the context-level problems were the most difficult to deal with as it required students to analyse the cause of the problem, find the part that caused the problem and comprehend that part. This process includes three steps and multiple problems may be involved in it. Failures at any step may lead to unsuccessful repair. Due to the complexity of discourse-level problems,

it was difficult for participants to adopt effective strategies. For the successfully repaired cases, participants used the same strategies that were adopted to solve sentence-level problems.

In the next Chapter, the process of reading revealed by this study will be discussed in detail.

Chapter 6. Chinese Reading process

In this chapter, the evidence from the data for the nature of Chinese L2 and CHL reading processes will be discussed to provide answers for RQ3, i.e., What insights into reading processes can be revealed by an examination of reading performance, reading problems and problem-solving strategy use. In addition, a modified version of Perfetti and Stafura's (2014) reading systems framework will be proposed, as a framework for understanding Chinese L2 and CHL reading.

6.1 Chinese reading process revealed in this study

In this section, the details of the Chinese reading process as revealed from the data will be discussed, first at the lower levels (recognising individual characters and identifying words) and then at the higher levels (understanding sentences and the discourses they make up).

6.1.1 Lower-level processing

This section focuses on lower-level processing, which includes character recognition, segmentation and word identification in the process of Chinese reading. In Chinese, it is not easy for an L2 or HL student to recognise every Chinese character accurately or segment and identify Chinese words. Several factors are found in the study that may have contributed to this. In addition to the problems relating to character/word knowledge itself, the blurred boundary between characters and words (for details see 2.2.2.1) is one of the main reasons. The processes of character recognition and word identification affecting each other may also contribute. Lastly, it is difficult to distinguish the two by the researcher (as a native speaker of Chinese) unless the participants self-reported it – but it may not be easy for the participants to self-diagnose it either. These issues will be further explained with examples from this study. Despite the difficulties of clear differentiation, character recognition and word identification are still distinguished in this research, because Chinese characters and Chinese words are two different linguistic units, which is one of the distinct characteristics of Chinese. Mixing up these two units, some facts of Chinese reading processes may be left out. Most of the overlapping parts are discussed under character recognition, and they are carefully labelled as 'character/word'.

6.1.1.1 Character recognition

It is noteworthy that character recognition does not always happen first as some participants tended to recognise some words as a whole (similar to sight words in English). Character recognition, however, is still a crucial step in Chinese reading, especially when the word is not immediately understood by a reader.

The data of this study showed that character recognition required effort and time for most participants in the study. *Difficulty in recalling a learned character/word* remained one of the most frequent problems for all four groups of participants in both reading aloud and silently modes (see Table 5.5, 5.6, 5.7 and 5.8). It can be backed up by participants' answers to the question 'what is most difficult in reading Chinese' in the interview session, and all 30 but one participants (L2A6) mentioned Chinese characters. This indicated that participants in this study were unable to recognise some learned

characters automatically, which means the process of character recognition requires readers' attention (Samuels, 2004). Due to the limited capacity of working memory (Perfetti, 1999; Samuels, 2004; Van Patten, 1996), the higher-level processing of sentences and entire texts may suffer. Several participants (e.g., HLA8) mentioned in the interview session that they felt it was difficult to read and at the same time understand the text, and thus they normally needed to read it at least twice to understand a passage when they read Chinese, 'first time to quickly go through all the characters, and recognise them, and the second time focus on the meaning of the text' (HLA8).

It is easy to say that the reason which caused the difficulty of character recognition is lack of practice. Some scholars claimed (e.g., J. Anderson, 1983) that rehearsal would help the retrieval of some knowledge to become automatic. This may be true in reading Chinese as most participants replied in the questionnaire that they did not read outside the Chinese class time. More importantly, some characteristics of the Chinese writing system may also contribute to the difficulty of the process.
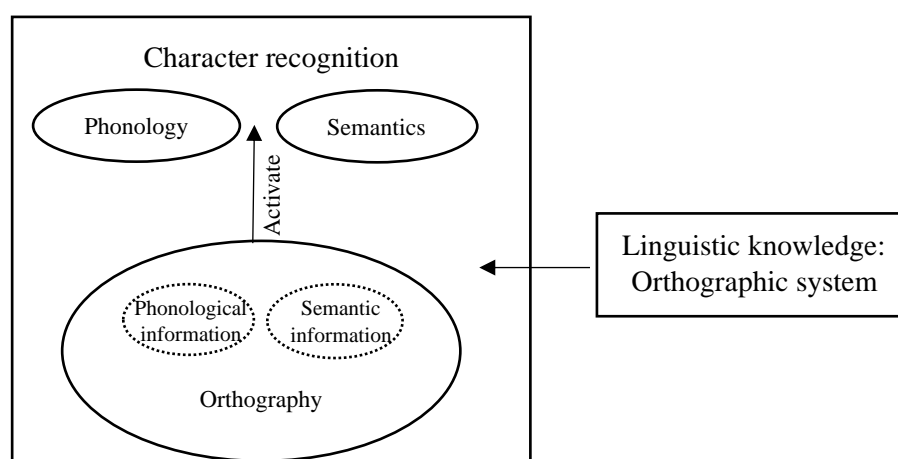

Figure 6.1 The process of Chinese character recognition

Chinese writing language adopts a logographic system, which accommodates Chinese language well (Frost, 2012), however, it may also cause some difficulties for English-speaking Chinese learners in terms of the mapping of orthography, semantics and phonology. In contrast with alphabetic writing, not all Chinese characters provide phonological information, and even for semantic-phonetic compounds, most of them only provide limited information on pronunciation and the meaning as shown (in dashed borders) in Figure 6.1 above (for details see 2.2.1.2). To recognise a character, a reader needs to examine the orthographic unit carefully and activate the orthographic system knowledge from their long-term memory to retrieve the pronunciation and meaning. In this study, four participants (HLI1, L2I3, L2A4 and HLA6) mentioned this in the interview session when they were asked why the most difficult part in reading Chinese was character recognition. Chinese characters are 'not like alphabet' (HLA6) as 'it cannot be sounded out by its shape' (L2A3), and 'it is hard to connect the sound, the meaning and how to write it' (L2A4).

Although in most cases, the radical may indicate the general meaning of the character (Fan et al., 1984; Gong, 2002), due to meaning changes over time, the meaning of some characters cannot be (fully) signified by the radicals. In addition, the radical can only provide some clues to the meaning of a

character, therefore it is impossible to ascertain the accurate meaning of a character by examining the radical alone. The unreliability of a radical may be the reason why most participants could/did not use the radicals to make a guess of the meaning of unknown characters. In the think-aloud session, radicals were not mentioned by the majority of participants when they explained what they did when they tried to figure out unknown characters (refer to 5.5). Several participants (three L2Is, two HLIs, two L2As and two HLAs) did mention that they would use radicals as clues when they tried to figure out the meaning of unknown characters in the interview session, but three of them (one for L2Is, HLIs and HLAs) also mentioned that radicals did not always work. Three participants (L2I1, HLI2 and HLA9) reported that they knew the radicals, but they did not use them to guess the meaning of the characters. Ignoring the semantic radical was also found in other studies on learning Chinese as a L2 (Feldman & Siok, 1999; Flores d'Arcais, 1992), although the awareness of semantic radical is critical in lexical learning for Chinese children (e.g., C. Ho et al., 2003; Shu & R. Anderson, 1997) and 'the semantic path is the default means of character recognition' for educated native Chinese speakers (Williams & Bever, 2010, p.589).

In terms of the pronunciation of an unknown Chinese character, Chinese learners cannot always rely on graphic cues as they can in reading alphabetic languages. According to some studies (Zhou, 1978; Ye, 1965; Gong, 2002), the reliability of the phonetic component in character recognition is much lower than for semantic radicals (refer to 2.2.1.2). However, in this study, more evidence was found that the participants actually used the phonetic component to guess the pronunciation of unknown characters. In the interview session, eight participants (two from each group) reported that they used the component or 'the shape' of characters to guess the pronunciation of a character, and none of them mentioned that it did not always work. During the reading aloud session, some cases were found where participants guessed the pronunciation based on the phonetic component, and a few cases were also reported by the participants in the think-aloud session for the reading silently mode with mixed results in terms of the correctness of their pronunciation. Eight cases (two for L2Is, one for HLIs, three for L2As and two for HLAs) were identified, four of them from the participants who reported that they used components as clues for pronunciation, and the other four cases from the participants who did not mention the strategy in the interview session. Using the phonetic component to guess the pronunciation is also found in other empirical studies (Jiang, 2001). In Jiang's study, she also found that as learners' Chinese proficiency increased, they tended to use the phonological cues more, which was not evidenced in this study. This may be due to the fact that phonological awareness was not the main target of this study and it was not taken into careful consideration when the experiment was designed. The small number of participants in each group may also make it difficult to reveal the pattern in the current design and settings of the experiment.

In addition to the difficulties caused by the mapping of orthography, semantics and phonology, other problems arose in the study for the participants because many characters look similar. As many participants in this study lack the knowledge of Chinese characters (e.g., the structure, and components, etc.), they may find more characters seem alike, making it more difficult for them to distinguish these

characters. As a result, after extracting physical features of a character, the phonetic and/or the semantic information of another character may be activated; or the information of all characters with graphic proximity are activated. In these cases, the reader was unable to decide which one was correct. *Confusion with characters (graphic proximity)* was one of most common problems for all participants in this study (see Table 5.5, 5.6, 5.7, 5.8), because they were less able to detect this kind of problem. And most cases of character confusion caused comprehension problems (see examples in 5.2.1). For intermediate level participants, L2 students had much more this kind of problems than their HL counterpart did; while for advanced level participants, no difference was observed between L2 and HL students. Participant L2I6 reported distinguishing between similar characters as the most difficult thing in reading Chinese in the interview. From the student we can see that characters with similar shape caused difficulties when recognising characters, however, little literature was found discussing this topic.

This study also found that different combinations of characters may also increase the difficulty in character recognition. In some cases, participants mixed up two characters as these two characters form a commonly used word (for examples, see   and   in 3.4.2.2 (c)). This problem (confusion with *characters (graphic alternative)*), unexpectedly, happened to most participants for all groups (i.e., five L2Is, three HLIs, five L2As and three HLAs). Even though the number was relatively small compared to other problems, in most cases the participants were not aware of this on their own, and thus it still caused comprehension problems. Participant HLA8 tried to analyse the problem in the interview by herself, and said when Chinese learners read and try to recognise characters, they 'need to pause and think where I have seen this character', and they normally remember a word with the target character in it. Then they need to think about which character this one is, and sometimes they are confused. She thought this problem happened because they 'learn [Chinese words] in this way'.

Learning Chinese words without analysing each character also leads to similar problems: sometimes participants can recognise a commonly used word, but failed to identify a component character when it was in another word (see 5.2.1(a) for the example of   and   ). In addition, focusing mainly on words and lacking the knowledge or the competence to analyse the vocabulary may also lead to another problem: some students do not seem to be fully clear about the concept of characters, because in most other languages (esp. their native language, i.e., English, French and Vietnamese), it is difficult for them to find the similar concept or linguistic unit that equals to characters. In the interview session, three participants (L2A1, L2A6 and HLA3) seemed a little confused about the distinctions between Chinese characters and words, as they talked about vocabulary when they were actually asked about their methods to memorise characters.

In addition to these factors related to the Chinese linguistic system, how Chinese learners memorise characters may also contribute to the difficulty of character recognition. Most participants reported in the interview session that they learned Chinese characters by rote learning: they just kept writing, and some participants also used flashcard to test themselves. Only Eight participants (two L2Is, one HLI, four L2As, and one HLA) mentioned they would analyse the characters or use the radicals

when they learn new Chinese characters. It seems that L2 participants were more likely to learn Chinese characters systematically by analysing them, and more advanced level participants found it useful. Two participants (one L2I and one L2A) also mentioned that they tried to use radicals when they learn characters even though it did not always work. This may explain why more participants claimed that they did not really use radicals, and three HL participants even emphasised that they did not use radicals as they did not find it useful.

6.1.1.2 Word segmentation

Segmentation is one of the unique problems a reader of Chinese may encounter, which is due to the lack of space between words to show the boundary. After recognising characters, readers need to segment these characters into words to better process as a semantic unit as shown in Figure 6.2 below. It is noteworthy that the recognition of the high-frequency or well-known words may have become automatized and a reader does not need to segment consciously as the word may have been processed as a 'chunk'; however for low-frequency words, readers may have to draw on their linguistic knowledge as well as the information provided in the context to segment. In the following diagram representing the word segmentation process (Figure 6.2), the common reasons that caused these problems and participants' insight regarding this problem will be discussed.
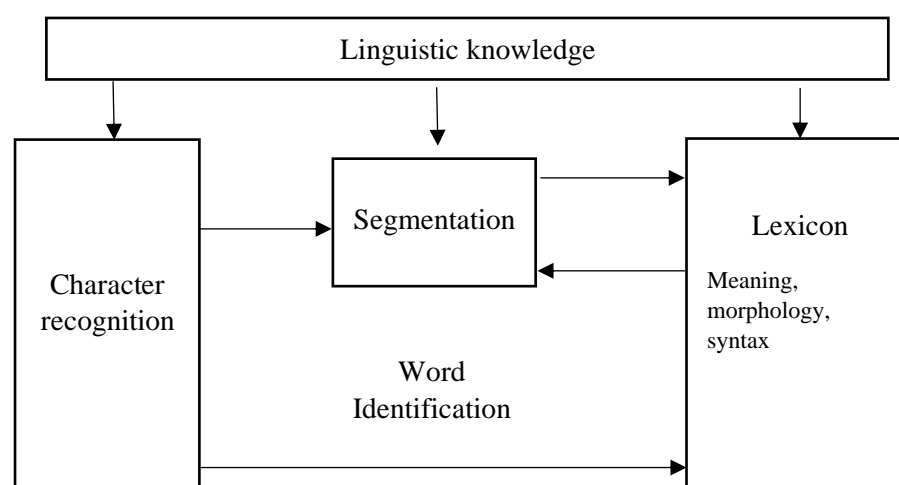
Figure 6.2 The process of word segmentation

Some trends were identified when we examined the number of segmentation problems and the successful repair rate from each group. In this study, 23 segmentation problems were identified among L2Is, 12 among HLIs, four among L2As and one for HLAs (for details refer to Table 5.5, 5.6, 5.7 and 5.8) in two reading modes in total (the two reading modes were not discussed separately here as segmentation problems were mostly identified in the reading aloud session). Participants' ability to solve these segmentation problems also varied: L2Is and HLIs successfully repaired four cases individually, L2As one case and HLAs no cases. These figures indicate that intermediate level participants struggled more with segmentation problems, while advanced level participants were generally able to segment appropriately while reading. At the same time, HL students were more able

to segment properly than L2 students. In addition, for intermediate level participants, HL students were superior to their L2 counterparts at resolving segmentation problems. The trend that segmentation accuracy improves when proficiency level goes up is also found in the study of H. Shen and Jiang (2013). In their study, participants were asked to segment some sentences in two minutes, and the error rate was calculated.

In this study, most segmentation problems that intermediate level participants (all L2Is and five out of seven HLIs) encountered were associated with the inability to fully process the meaning of text (sentences or phrases) while they read, and the strategy they therefore employed was to stop after each two characters as the majority of Chinese words constitute two characters. It might be overwhelming for intermediate level participants to read a new Chinese story, recognise each character and word, try to understand the meaning of it, and at the same time remember the plot for the retell session. Thus many of them were unable to process the meaning and think about the segmentation properly. The association between the inability to understand sentences and segmentation problems indicate that if top-down processing works well, it is likely that the bottom-up segmentation problem can be avoided or repaired when it happens; while when the segmentation problem happens in the absence of top-down processing, problems are more likely to arise. For advanced level participants, stopping after each two characters was not a common strategy to deal with segmentation problems. This may indicate that they were more capable of analysing the sentence and segmenting words even when the sentence was difficult, and the words were unfamiliar to them.

In spite of all the segmentation problems that happened during reading, only a few participants reported it as difficult in the interview session: only three participants (HLI1, HLI2 and HLI3) reported that segmentation may influence their understanding in some cases. This may reveal the fact that L2Is, even though they encountered the most segmentation problems among all four groups, were unable to be aware of segmentation problems in many cases (see table 5.5). There were also three participants (HLI6, L2A5 and HLA5) who mentioned in the interview that they found the rhythm of reading sometimes difficult, but they focused more on 'reading and stopping naturally' (HLI6), not on segmenting correctly to better comprehend. Generally, it is more likely that HL participants, who may benefit from their higher level of oral competence, were more capable of making the top-down processing work together with the bottom-up processing, and thus performed better on segmentation problems.

6.1.1.3 Word identification

Word identification is the result of lower-level processing, which also acts as the input for higher-level processing (Perfetti, 1999), and thus it is crucial as it is the process connecting the lower- and higher-level processing. The key point of this process is to finish the form-meaning mapping and also identify the correct form and meaning of each word. Two different ways of word identification were revealed in this study, i.e. the holistic and analytic approaches, as shown in Figure 6.3.
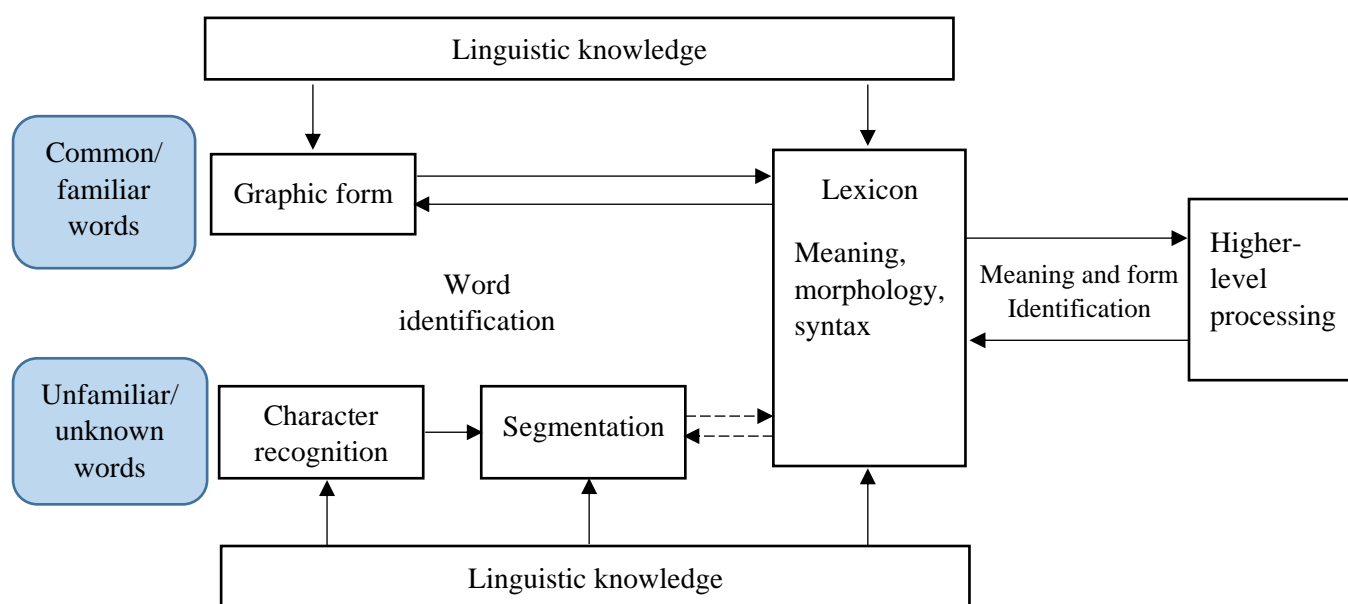
Figure 6.3 The process of word identification

As mentioned in the sections on character recognition and segmentation, for some commonly used words or the words that the reader is familiar with, the form-meaning mapping can happen automatically, and the reader does not need to consider the segmentation consciously. However, for the unfamiliar or unknown words, readers need to recognise each character first, segment them into words, and try to apply linguistic knowledge or use the clues from context (higher-level processing) to guess the meaning of the word.

Sometimes, when readers see a word, several similar words may be activated at the same time and readers need to identify the correct graphic form and meaning; when the target word is a homonym, readers need to identify the correct meaning according to the context; and when a word is a heteronym, readers also need to identify the correct phonetic form as well as the meaning. The context (the sentence or phrase that the word in) may provide more clues for the form-meaning mapping process.

In this study, unknown words (recognising characters without understanding the meaning of the word) generally is the most common problem encountered by all four groups of participants in both reading aloud and silent modes, except the HLAs had more problems with unknown characters in reading aloud (see table 5.5, 5.6, 5.7 and 5.8). In the interview session, most L2Is (six out of seven) reported that the unknown word was one of the most difficult part when reading Chinese, and some HLIs (three out of seven), L2As (two out of seven) and HLAs (four out of nine) also thought unknown words bothered them a lot when reading Chinese. According to participants' answers, there were two reasons that made unknown words so difficult for them.

The first reason, according to participant HLI3, was that 'really simple characters you put together, and they have completely different meaning'. This is 'deceptive' (L2I1) because 'sometimes you think you get it, but you do not' (L2I1). This was backed up by the data from the reading session and the

think-aloud session when participants sometimes were unaware of these unknown words (see table 5.5, 5.6, 5.7 and 5.8, and for examples, refer to 5.3.1 (b)).

The second reason related to participants' strategies when they encountered unknown words. When participants were asked what clues they would use when they encountered unknown words, most participants in the interview session reported that they would use the context to figure out the general meaning of the word, and use the dictionary (some apps) to look it up if possible. Seven participants (two from L2Is, HLIs, HLAs, and one from L2As) reported that they did not know what clues to use when they encountered unknown words as they always looked up the word immediately in the dictionary or just skipped the unknown words when they read; none of them tried to apply any strategies to make a guess. Some of them explained that understanding the accurate meaning of the word was very important, so they did not (want to) make any guess, which shows their low tolerance for ambiguity. From the data of reading sessions, retell sessions and think-aloud sessions, the most efficient strategies were using the context and analysing the meaning of each character in it (for details refer to 5.2.1 and 5.3.1). In this study, however, the successful repair rate of this problem was not very high (refer to 5.2.1 and 5.3.1), which may relate to the fact that participants were used to seeking help (e.g., looking up in dictionary, asking parents) when they encountered unknown words rather than using the strategies to 'guess' by themselves. These reveal these participants' low strategic competence in addition to their limited linguistic competence.

Looking at the method of how participants memorised new words may further reveal why most participants were unable to apply strategies to working out the meaning of new words. In the review session, seven participants (one L2Is, four L2As, and two HLAs) reported that they would try to make sense of the meaning by looking at the individual characters in it. Two L2As mentioned that some words can be explained well in this way, while others do not really make sense. 11 participants (two L2Is, two HLIs, four L2As, and three HLAs) reported that they would try to remember new words in context (sentence, passage, TV dramas). Other participants just learn new words by rote learning. Participant HLA9 reported that as she had higher proficiency level in Japanese, she found Japanese language could help her with some characters and words, which may reveal the benefit of multicompetence.

In summary, unfamiliar and unknown words require more effort to be identified than familiar words. As most participants in this study normally just looked up unknown words when they read on their own and did not (try to) apply strategies to guess the meaning, they were less able to make an educated guess in this experiment when they encountered unknown words. In addition, many participants did not or could not use their lexical knowledge to facilitate memorising new words, which may be one of the reasons why they forgot many learned words when they read.

6.1.2 Higher-level processing

In this section, higher-level processing is discussed including working memory capacity, understanding sentences and understanding discourse. Working memory capacity plays a role in both lower- and higher-level processing, and it is discussed here as it generally causes more problems in higher-level (i.e., sentence and discourse) processing.

6.1.2.1 Working memory capacity

The most common higher-level problem for all groups of participants was *inability to process the meaning of the sentence*. This may at least partly have been due to the limited working memory capacity. This occurred in the cases when lower-level processing was not automatic and required much attention and little could be allocated to the higher-level processing (for details refer to 5.2.2 (a)). Although this problem hindered the sentence-level processing, its root was character/word level problems, which were discussed with details earlier this chapter (6.1.2). It is noteworthy that, the sentence structure, or the lack of linguistic (syntax) knowledge may also contribute to this problem. It was easier to be aware of this type of problem when participants read aloud (as reported by L2I1, HLI1, L2A3, HLA2 etc.) and focused more on the pronunciation at the cost of meaning; however, when they read silently, they were less capable of diagnosing why they were unable to understand a sentence in spite of knowing all characters in it. This may be one of the reasons that participants tended to think reading aloud were more difficult to 'take in the meaning' (L2I1). Many participants mentioned in the interview session that 'reading and at the same time understanding' was difficult, especially in reading aloud mode, as was discussed in detail in 4.2.2.

In addition, some misreading (incl. omissions and insertions) occurred with advanced level participants and may indicate that higher-level processing was dominant over lower-level processing, when reading accuracy at the level of character/word recognition was sacrificed for maintaining the overall efficiency in comprehending the text.

6.1.2.2 Understanding sentences

From Figure 6.4, we can see that understanding sentence requires identification of words, and the context can also help with identification of the meaning and phonetic/graphic forms (refer to 6.1.1.3).
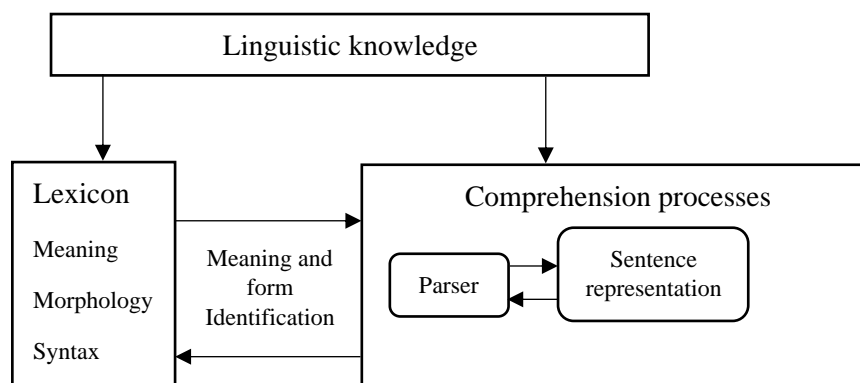
Figure 6.4 The process of understanding sentence

Issues with sentence structure and parsing were also common for all groups of participants (see Table 5.5, 5.6, 5.7 and 5.8), however, it was not reported as often as the character/word-level problem in the interview session. When participants were asked what was difficult in reading Chinese, most of them reported that they felt Chinese grammar was quite easy, although four L2Is, two HLIs, one L2A and three HLAs reported in the interview that they thought grammar and sentence structure sometimes

caused difficulties when they read. Three of them reported that 'Chinese sentences are a bit too lengthy with a lot of commas' and thus 'they are difficult to translate into English' (HLA8). Participant L2I2 commented that 'Chinese sentences use commas as full stops, and thus writing is more difficult'. This was also reported by participants in S. Wang's (2006) study. As S. Wang (2006) explained in her research, this may be because Chinese sentence structure is looser compared to English sentence patterns which are more fixed. As Chinese sentences relies more on idea-joining (X. Shen, 1992), the topic chain (Tsao, 1990) can be very long and linked logically together by the change of the time, the location or the sequence of the event. Two participants (L2I7 and L2A2) also mentioned that they felt some sentence structures were very difficult as they were very different from English and they felt some of the structures were strange. Participant HLI7 also mentioned some specific sentence structures that she felt were difficult, such as the '*u j k ǐ* ' sentence (the emphatic pattern), as the words or phrases inserted in the structure made it less clear which sentence structure was used. Some other participants only mentioned the sentence structure or grammar was difficult sometimes without further explanation.

The data of reading problems due to sentence structure in reading sessions were analysed in detail in last chapter (5.2.2 and 5.3.2). It indicated that if the structure had a distinctive symbol or pattern (e.g., *ba* sentence in 5.2.2 (b)), participants tended to recognise the structure and thus comprehended the meaning of the sentence. It is noteworthy that some participants (especially the L2 students) may learn the structure by rote, or only focus on or understand one distinctive structure, as a result, they would not consider the syntactic and semantic meaning of the sentence structure, and recognise the structure only by the symbol or pattern, which may lead to some mistakes (e.g., in 5.3.2 (b)). In sum, sentences that did not have any special grammatical markers tended to cause more problems for participants especially when the grammatical structure was different from English (e.g., the elliptical structure, see 5.2.2 (a)).

In summary, participants actually had some comprehension problems caused by sentence structures and wrong parsing due to the lack of grammatical knowledge, however, most of them did not think that Chinese grammar or sentence structure is difficult, which may indicate that many Chinese learners may overlook the importance of grammatical knowledge.

6.1.2.3 Discourse level comprehension

After understanding each sentence, readers also need to connect the sentences and understand the meaning of the passage as a whole. This step, however, is not as simple as adding the meaning of all sentences together; instead, it requires readers to have linguistic knowledge (incl., discourse structure, pragmatic knowledge), general knowledge (incl., cultural schemata) and the ability to generate inferences, as shown in Figure 6.5.
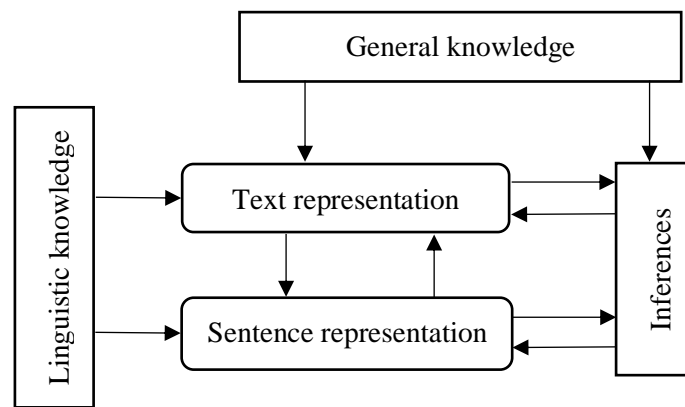
Figure 6.5 The process of discourse level comprehension

Participants in this study were less able to report their reading process on discourse level comprehension compared to character/word and sentence level processing, however, some of their problems may still provide some information on this. Except for discourse-level grammar, one problem seems to be prominent in this study, and that is lack of cultural and pragmatic knowledge.

In this study, several participants reported that the lack of cultural knowledge led to comprehension problems. In the interview session, three participants (one L2I and two L2As) mentioned that they did not understand some parts because of the culture. In the reading session (both reading aloud and reading silently), more cases were reported as culture related. Several participants from all four groups reported that they felt one story was easier than the other story as the latter one required more cultural knowledge, for example, the names of Chinese people and places (e.g., L2I1, L2I6, L2I7, HLI2, HLI6, L2A3, L2A4, L2A7, HLA2, HLA4, HLA6, HLA7, etc.). Participant L2I1 also found the ending of the story *Smart Kong Rong* did not make sense to him due to the cultural difference. As many studies (e.g., An, 2013; Carrell, 1987; Erten & Razı, 2009) revealed that cultural schemata play a crucial role in reading comprehension, it did influence the reading comprehension in this study as well even though cultural schema was not designed as a main factor in this study. However, in some cases there was possibility that the cultural schema was a little over emphasised by participants as it was easier to attribute some comprehension problems to cultural difference than to other reasons (e.g., lack of linguistic competence).

Inability to process implied/pragmatic meaning is one of the most common problems in this study at discourse level (see Table 5.5, 5.6, 5.7 and 5.8), which also revealed that participants did not have enough cultural and pragmatic knowledge. Three participants (two L2Is and one L2A) noticed this problem and reported in the interview session that they found it easier to understand the literal meaning but 'it is difficult digging down to the true meaning' (L2I1), which may indicate that some participants in this study lack pragmatic competence (for examples refer to 5.3.2 (b)). This may confirm that the cultural and pragmatic issues, which were reported by researchers (Gumperz et al., 1982; Rintell, 1984) in L2 listening comprehension, also happened in L2 reading comprehension.

In addition, making inferences may also require cultural and pragmatic knowledge, and it is essential to comprehend a text as the reader 'generally must go beyond the explicit text information by

making inferences' (Perfetti, 1999, p.189). In this study, advanced level participants had more incorrect inferences than intermediate level participants (for details and examples, refer to 5.3.3), which may indicate that they made more inferences during reading. At the same time, this may also indicate that the lower-level processing occupied less attention for advanced level participants as compared to intermediate level participants. This is because inference making takes place within the constraints of working memory, as noted in models such as the Landscape model (Van den Broek et al., 1996), and limitations in working memory may affect a reader's ability to make inferences while reading. In addition, it showed that advanced level participants tried to activate relevant, existing background knowledge when they read, which could improve reading comprehension in general (Elbro & Buch-Iversen, 2013).

6.2 A framework of Chinese L2 and CHL reading

Chinese L2 and CHL reading process was discussed step by step in last section (6.1), and in this section, a completed framework of Chinese L2 and CHL reading, which builds on Perfetti and Stafura's (2014) reading systems framework will be explained.
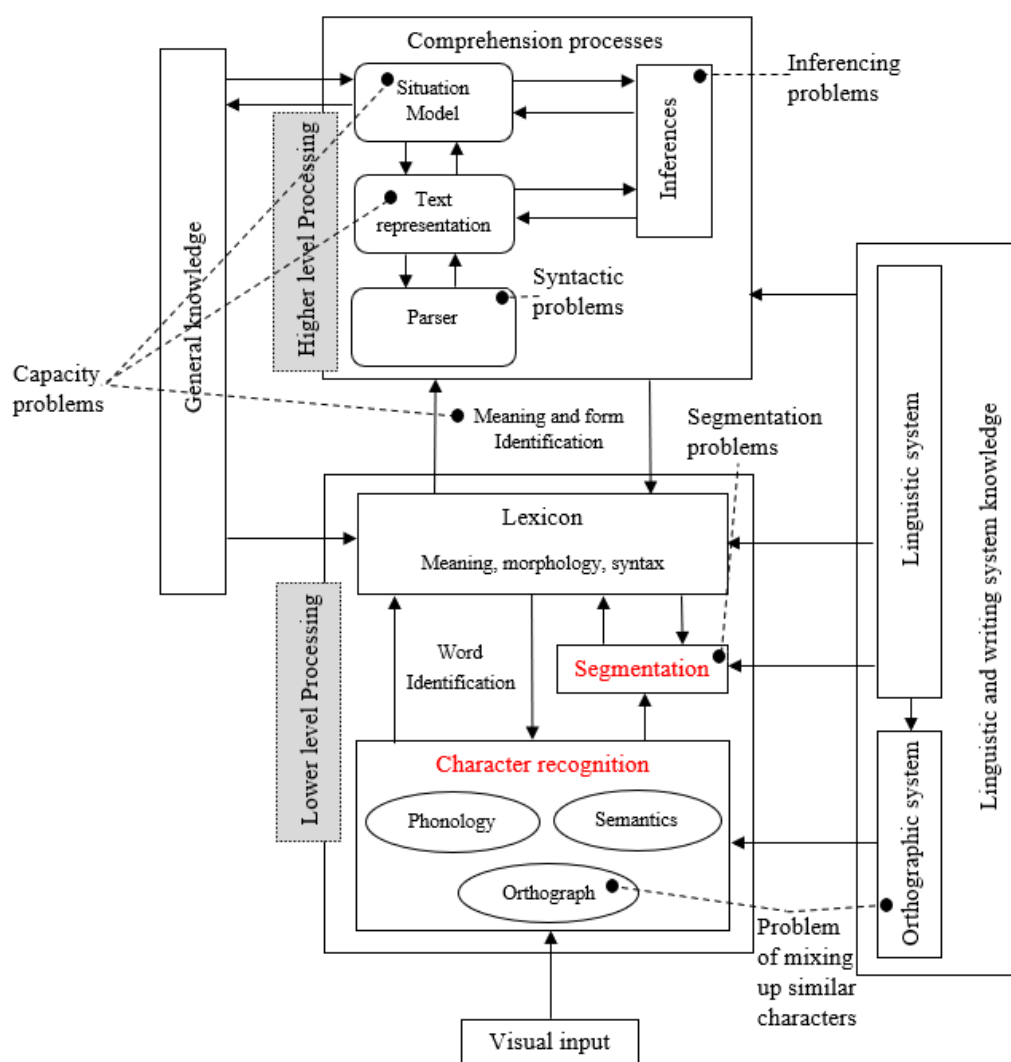

Figure 6.6 Chinese L2 and HL reading process and sources of some reading problems

6.2.1 Modifications to Perfetti's reading systems framework

Figure 6.6 shows the reading process of Chinese L2 and CHL reading with some reading problems identified in this study. To better represent higher- and lower-level processing, the process starts from the bottom. The flow arrows indicate the direction of the information. As reading is a highly interactive activity, in many cases, the flow arrows go both direction, which indicate that these components can affect each other.

Two main changes were made according to the data from the study which is focused on the investigation of L2/HL learners' reading of Chinese (see the red parts in Figure 6.6). Firstly, character recognition is inserted as a necessary addition for the form-meaning mapping of the word which includes three elements, namely, the orghograph, the phonology, and the semantics, although not all of three elements may be activated at the character level before they are activated at word level. Chinese writing system uses a writing system that is different, i.e. morpho-syllabic (DeFrancis, 1989), compared to alphabetic languages and syllabic languages, and the orthgraphic unit does not relate to the phonological unit directly. The majority of Chinese characters are sound-meaning compounds, which include a semantic radical and a phonetic component even though the accuracy of the semantic information and phonetic information is limited (for details refer to 2.2.1.2). The radicals, however, may or may not be activated by readers who are fluent, or when readers encounter some commonly-used characters; instead a holistic method would be adopted without registering each element of the character. Any problems occuring in relation to any of the three aspects (orthograph, phonology and semantics) and the mapping of any two of the three may cause reading problems (at least in reading aloud mode for phonetic-related problems). Secondly, segmentation is considered an important step in reading Chinese. Characters and words are two distinguished linguistic units in Chinese writing system, and characters are separated with boundries but not words. This makes the process of word identification more complex, and necessitates the addition of the process of segmentation, especially when readers encounter unfamiliar words or unknown words and they need to segment before they recognise the meaning of a word. In reading commonly-used words, the segmentation might be already automated and readers do not need any consious segmentation.

6.2.2 The general process of Chinese L2/HL reading

Figure 6.6 shows the processing of Chinese L2/HL reading. A reader first needs to recognise characters and words. For well-known words, readers tend to recognise them as a whole unit, and the process of form-meaning mapping may be highly automatic. For unfamiliar words and unknown words, the process is more complex. Readers may try to decode each character individually. By identifying the orthographic unit, a reader's orthographic knowledge stored in the long-term memory may be activated, which includes the pronunciation and the meaning of the character. In some cases, the orthographic unit also provides some semantic and phonetic information. When a reader's orthographic knowledge is not completed or accurate, some character recognition problems may occur. For example, most participants (e.g., L2I2, HLI1, L2A5, HLA6, etc.) in this study forgot the pronunciation or/and the meaning of some characters, and a lot of participants (e.g., L2I1, HLI5, L2A3, HLA8, etc.) mixed up some characters

due to graphic proximity. For less familiar words, if readers are able to recognise one or more of the characters in the word, the meaning of the word may be successfully activated, especially with the assistance of contextual clues. When several unknown/unfamiliar words appear in a row, readers need to segment them properly to better identify each word, and they may use their linguistic knowledge to help them analyse the part and segment in the right place. After they segment the word, they may be able to use some other clues (incl. prior linguistic knowledge and context) to puzzle out the meaning of the word.

To finish the word identification and start to process the sentence, readers also need to identify the correct graphic form and phonetic form and map it to the correct meaning (and phonetic activation is necessary at least in the reading aloud mode) if several characters with graphic proximity are activated or if the word is a heteronym or homonym. The contextual information then becomes very important because it will help readers to distinguish characters with graphic proximity, choose the correct pronunciation and map the correct meaning for heteronyms, and choose the right meaning for the homonyms. However, in this study, most participants tended to be incapable of using the context fully given their limited knowledge or reading experience.

It is also noteworthy that lower-level processing may not be identical in reading aloud and reading silently. In reading silently, the oral production is not required, which makes the phonological activation less important. For example, some HL participants may read in their dialects (refer to 5.4.1) and some intermediate level participants may be able to focus more on meaning and translate each word into English while they read (refer to 5.4.2) rather than reading and understand every sentence in Mandarin Chinese. While oral production is required in reading aloud sessions, phonological activation is more important, and readers might need to pay more attention to phonological activation, which sometimes may negatively impact on other parts of the reading process, especially those with lower proficiency level.

The identified form and its mapping with the meaning (which means the successful word identification) will be the input for higher-level processing at the sentence level. Simultaneously, readers also need to apply their syntactic knowledge to parse the sentence. After comprehending the sentence, readers' mental text representations will be established gradually. This, however, is not the end of the reading comprehension. Readers also need to connect the sentences together and work out the meaning of the passage at the discourse level. To achieve this step, readers need relevant cultural knowledge to better understand the meaning of the passage and the knowledge of the genre to better understand the purpose of the text among other things. In addition, in order to build situation models (e.g, Van Dijk & Kintsch, 1983), which are 'semantically deep, containing situation-specific meanings' (Perfetti, 1999, p.189), readers also need to generate inferences and understand the implicit information hidden in the passage. This situation model (mental presentations of text) may in turn broaden the reader's general knowledge of this world.

The interaction between the lower-level processing and higher-level processing should be emphasised, and the flowchart of the reading process does not work in one direction. As explained

before, the output of lower-level processing acts as the input of higher-level processing, but it does not mean that the higher-level processing has no effect on the lower-level processing. In fact, comprehending the sentence and the discourse level of the text may provide context/schema as extra clues for readers to better predict the words used and to better guess the meaning of unknown words.

6.2.3 The similarity and difference of Chinese L2 and HL reading process

As for reading process, no significant difference was identified in this study. Compared with L2 participants, HL participants tended to have more linguistic knowledge, cultural knowledge and higher speaking competence, and thus encountered less problems and achieved higher successful repair rate. The reading process, however, was similar to both L2 and HL participants. This is similar to what K. Goodman and Burke (1973) found in their study in terms of the reading process between English as L1 low proficiency and high proficiency readers (refer to 2.5.1.1). The reading process of these readers is same, except that high proficiency readers were more able to apply productive strategies, and more miscues they produced were semantically acceptable, which indicates these high proficiency readers focused on semantic cues to make sense of the text.

6.3 Summary

This chapter discussed the reading process revealed in this study by investigating participants' reading performance, reading problems and strategies. Perfetti and Stafura's (2014) reading process framework was modified to elaborate Chinese L2/HL reading process. This may indicate that reading different languages shares similar processes, and at the same time, the details of some processes (especially in the lower-level processing) are also influenced by the writing systems. In the next chapter, the implications from this study will be discussed, limitations will be identified, and directions for future research will be proposed.

Chapter 7. Conclusion

This chapter will first summarise the key findings of this study, and then discuss the implications of the study. This is followed by a consideration of the limitations of the research undertaken, and suggestions for possible future research.

The focus of this study is the reading processes of Chinese L2 and CHL learners from four groups of participants, informed by their reading performance (reading fluency and reading comprehension), reading problems and problem-solving strategies. The data in this study was collected using background questionnaires, vocabulary tests, video-recording of reading sessions (reading aloud and reading silently), retell protocols, retrospective stimulated think-aloud task and a structured interview. The number of participants is small so the study does not claim that the results are generalisable to broader populations. While recognising that no two readers will be exactly alike, the intensive analysis of the performance of a small number of representative informants is intended to provide a window to examine the features of the Chinese L2 and CHL reading process, and the factors influencing different groups of Chinese language learners in reading. The previous chapters have presented a detailed analysis and discussion of the results of the study. Thus, only key findings will be summarised here.

7.1 Reading performance

RQ 1. How does reading performance in Chinese (measured in terms of reading speed and comprehension) differ between L2 and HL students, and how is it influenced by the following factors:

    a. Students' proficiency level (i.e., intermediate and advanced students)

    b. Reading modes (i.e., reading aloud and reading silently)

The key findings for research question 1 are:

In general, HL participants' automaticity of character/word recognition, and syntactic and lexical processing seemed to be comparatively higher, and they were able to read faster than L2 participants on average and achieved higher levels of comprehension.

Participants with different proficiency levels tended to have different levels of ability to deal with the difficult stories. Intermediate level participants did not adjust their reading speed according to the difficulty of the reading materials, and they were also unable to comprehend the difficult story as much as they did the easy one. On the other hand, advanced level participants read the difficult story slowly and carefully, but the comprehension performance was varied between L2As and HLAs: the differences in difficulty of reading materials generally had no effect on HLAs' ultimate reading comprehension, while in most cases, L2As had poor comprehension, despite slowing down (for details refer to section 4.1.3 and 4.2.3).

Reading modes are also found to impose an effect on participants' reading performance. L2 participants read slightly faster when they read aloud, but comprehension was much less effective in this mode. In contrast, HL participants read faster when they read silently, and reading mode had no effect on their reading comprehension (some possible reasons were discussed in section 4.2.2).

7.2 Reading problems and problem-solving strategies

RQ 2. What problems do L2 and HL students encounter when reading texts in Chinese, and what strategies do they employ to try to solve them? How effective are these strategies? How are reading problems and problem-solving strategies affected by:

a. Students' proficiency level (i.e., intermediate and advanced students)

b. Reading modes (i.e., reading aloud and reading silently)

The key findings for research question 2 are summarised below.

Overall, both L2 and HL participants encountered many reading problems, including problems of form-meaning mapping for characters and words, and problems relating to lexical knowledge, sentence level syntax and discourse level issues (refer to section 5.5 for a more detailed summary). The effective strategies were similar for all participants, including using background knowledge, establishing intrasentential ties and establishing intersentential ties (refer to section 5.5 for a more detailed summary). However, differences were identified between L2 and HL students in this regard. Compared to L2 participants, HL participants encountered fewer reading problems and could rely on more resources (both linguistic knowledge and general knowledge) to apply effective strategies when they did have problems (some possible reasons for this were discussed in section 5.4.1). At the same time, HL participants tended to struggle with the correct pronunciation when they read aloud, influenced by their Chinese dialects (for details refer to section 5.4.1).

The common reading problems encountered by different proficiency level participants were not identical. Intermediate level participants, especially L2I students struggled with segmentation when reading, while advanced level participants rarely had segmentation issues. However, they tended to misread more than intermediate level participants but the misread words generally made sense in the context. The successful repair rates for intermediate level participants and for advanced level participants could not be compared directly as they read different stories, but some trends were found to be interactive with different reading modes, which will be summarised below with other effects of reading modes.

Reading modes affected the number of reading problems identified in this study, and it also influenced participants' successful repair rate. More character/word level reading problems were identified when participants read aloud as more information (e.g., participants' pronunciation) was revealed. On the other hand, more sentence level and context level problems were identified when participants read silently as most participants comprehended more overall when they did so. For intermediate level participants, they were able to successfully repair more character/word level problems when they read silently, while for advanced participants, reading aloud facilitated their problem solving, which was also reflected by their comprehension performance except for L2As. Some possible reasons for these findings are discussed in section 5.4.3. In addition, L2 participants tended to repair more sentence level and discourse level problems when they read silently. However, HL participants tended to solve more sentence level problems when they read aloud, while they solved more

context level problems when they read silently. Therefore, the interactions between the reading modes, heritage background and higher-level processing is inconclusive in the study.

7.3 Reading process

RQ 3. What does a consideration of reading performance, problems and strategy use reveal about reading processes?

Participants' reading process can be revealed through examining the first two research questions, and the key points are summarised below.

7.3.1 Lower-level processing

Lower-level processing is crucial and fundamental in Chinese L2 and CHL reading, and it is influenced by higher-level processing which is happening simultaneously. In this study, character/word recognition remained a problem for all groups and threatened comprehension performance. Even when the problems that did not cause comprehension problems (e.g., trying to recognise learned characters/words), the time and effort needed for the lower-level processing occupied much of readers' attentional capacity, which made higher-level processing impossible or less effective. In addition, when character/word recognition does not achieve automaticity, reading aloud may hinder comprehension (Smith, 2012) as it requires phonological activation and oral production. Thus, rapid and efficient lower-level processing is critical to the operation of higher-level processing and achievement of comprehension (Breznitz, 2006; Perfetti, 2007; Stanovich, 1996 & 2000).

Given the importance of automatic character/word processing, it is crucial to understand if these readers adopted holistic and analytic approaches to processing characters and words. In this study, many participants tended to recognise words holistically, rather than decode the constituent characters independently, which is similar to the findings of Liu et al.'s (2010) study conducted with Chinese fourth grade children. That is to say, Chinese learners in this study tended to read and recognise words as a whole. As a result, it was easier for them to recognise the commonly used words, however, when a known character appeared in words they were not familiar with, they were often unable to recognise it, or use it to help decode the word. On character level processing, a change of method was identified. In this study, L2I tended to decode characters holistically, and thus it was easy for them to mix up similar characters with graphic proximity. The other three groups (i.e., L2A, HLI, HLA) had fewer such problems, which may indicate their higher orthographic awareness.

By analysing participants' reading miscues, processing strategies adopted by readers can also be identified from another perspective: what cueing systems participants focused on when reading. According to Goodman's miscue analysis (1969), every language has at least three cueing systems (i.e., graphophonic, semantic and syntactic cueing system). Skilled readers make good use of all, while relying heavily or solely on one or two cueing system may lead to errors. In this study, intermediate level participants focused more on decoding each character and word, which means they relied heavily or fully on graphic cues. As a result, they did/could not pay enough attention to the meaning of the word in context. On the other hand, advanced level participants, especially HLA, focused more on making

sense of the passage, and thus they relied heavily on semantic cues. As a result, they misread more, although in most cases, these misreads did not affect overall comprehension.

The three basic dimensions in all writing languages, namely, orthography, phonology and semantics (Frost, 2012), are not equally important in terms of reading comprehension. Phonology is the only dimension that will not necessarily cause comprehension problems in reading Chinese if not activated successfully due to the more direct relationship between graphic form and meaning. In this study, HL learners tended to make more phonetic errors when reading aloud in Mandarin, but these errors generally did not cause comprehension problems.

7.3.2 Higher-level processing

When examining higher-level processing, both general knowledge (e.g., cultural schema) and linguistic knowledge (incl. grammatical and discourse knowledge) are found to play important roles in L2 and HL readers' reading comprehension. For example, some unknown names of people and places (proper nouns) increased the difficulty on comprehension from readers' perspective in this study. Moreover, linguistic knowledge (including vocabulary knowledge, grammatical knowledge and syntactic knowledge) seems to be the first useful resource when participants encountered problems even though most participants were unable to apply it due to their limited linguistic proficiency. Thus, in this study, the lack of general knowledge and linguistic knowledge imposed a negative effect on these participants' reading comprehension.

7.3.3 Interaction between lower- and higher-level processing

It is well established by much research that lower-level processing and higher-level processing interact during reading (refer to 2.4.1.3), however, the two processing levels are not used necessarily in a reciprocal manner (Nassaji, 2014). Lower-level processing can operate well without top-down processing being involved; however, the reverse is not possible (Perfetti & Roth, 1981). In addition, if lower-level processing is not automatic, the higher-level processing may lack attentional resources to operate, which happened often to participants of each group in this study.

Moreover, some problems in lower-level processing can be compensated by higher-level processing (e.g., guessing unknown words based on contextual information and linguistic knowledge) although it is limited by a threshold. Being able to use the context clues requires that one cannot have too many problems in lower-level processing to ensure that higher-level processing can occur successfully. Otherwise, readers will fall into a virous circle like group L2I in this study, and are unable to make sense of what they are reading.

7.4 Implications of this study

By exploring the reading problems Chinese L2 and CHL students encountered during reading Chinese stories in reading aloud and reading silently and the problem-solving strategies they applied, this study carries some important implications for reading in Chinese as a L2 and HL, as well as teaching and learning of Chinese reading for both L2 and HL learners.

1) Reading speed and reading comprehension

Reading speed is important as some scholars (e.g., R. Anderson, Hiebert, Scott, & Wilkinson, 1985; Grabe, 1988; Hall, White, & Guthrie, 1986; Smith, 2012) pointed out. If reading is too slow, all the words and phrases are impossible to hold in the working memory for long, and thus one is unable to process the meaning of a sentence. However, reading speed or sounding fluent are not the principal goals for reading. Readers read to comprehend. For readers who are still learning to read in a language, especially, pausing, re-reading and self-correction are essential and helpful. In this study, most L2 readers read fast when they were required to read aloud, even though they were informed in advance that the reading aimed to understand the passage. They did not feel comfortable to stumble in reading aloud, and they wanted to sound natural and fluent. However, they comprehended less in reading aloud than in reading silently (for details of the relation between reading speed and reading comprehension refer to 4.1.4). For HL readers, they were concerned with their pronunciation too much when reading aloud, and they kept correcting themselves, which may also interrupt the process of comprehension. However, when HL readers read silently, some of them skimmed the text too fast as the pronunciation would not hold them back, and as a result, they skipped some key parts and misunderstood some sections.

2) Linguistic multicompetence and L2 reading

Multicompetence was also found to be important in reading even though it is not the focus of this project. Several HL learners reported that they preferred reading silently as they could read the text in their own Chinese dialect, which helped them read faster and also comprehend better. A couple of students who study Japanese also found that sometimes the Japanese language could help them understand some Chinese words as Japanese language uses Kanji based on Chinese characters. However, in this study, not all participants regarded their other languages as being useful in enhancing their reading skills in Mandarin. Specifically, some HL learners claimed that they did not think their ability to speak a Chinese dialect is helpful when they learn Mandarin. A few of them even saw their dialect speaking ability as an obstacle to learning Mandarin pronunciations. In the context of this study, for Chinese dialect multilinguals the one-language-at-a-time strategy would not necessarily help them better make sense of texts, instead, 'translanguaging privileges the unbounded and agentive dynamic and fluid use of bilinguals' entire linguistic repertoire' and thus serves 'to maximize their meaning-making potential' (García & Kleifgen 2019, p.5). In other words, translanguaging, may act as a strategy in language learning and use, which requires both language teachers and learners to treat it positively (e.g. Ascenzi-Moreno & Espinosa, 2018; García et al., 2017; Wei Li, 2011).

3) Chinese L2 and CHL learners

The data of this study shows that the difficulties of reading for Chinese L2 and CHL learners are not identical, and HL learners generally did better than L2 learners (refer to 4.3 and 5.4.1), indicating HL students did benefit from greater proficiency in spoken Chinese, and greater cultural knowledge. It is not easy, however, for HL learners to fully apply their knowledge of spoken Chinese to reading as

the Chinese writing system is not based primarily on phonetic encoding of words. This makes character recognition and understanding of how characters combined into words the core skill which HL learners must acquire in order to connect the written symbols to the words they have already acquired in communication. For L2 learners, while character recognition is clearly essential, an equally important task is to increase the exposure to the target language, thus to expand their linguistic knowledge and skills, and their automatic processing capacities. This will be discussed in more detail in the following section.

With the difference between L2 and HL students, delivering the same lessons and using the same teaching methods and materials may not maximise the outcome of teaching and learning. L2 learners usually learn Chinese from scratch in the classroom settings, and they do not have many opportunities, to practice it in 'real-life'. The positive side for teaching them may be that, at least in the beginning level, their proficiency levels are similar, which makes preparing lessons and teaching materials a little easier. However, this is not the case for HL learners. Most HL learners start their Chinese lessons with some Chinese language knowledge, which they are able to use at least in speaking and/or listening out of the classroom; however, the degree of their background varies. According to the background questionnaire of this study, some HL learners visit Chinese-speaking countries and regions regularly, and always communicate with their family in Mandarin or a Chinese dialect; while some others only went to China once or twice, and rarely use Chinse at home. The diversity of the degree of their background leads to differences in oral competence, and thus it is more difficult to prepare teaching materials that suit every student.

4) Chinese characters and words

Characters and words cause many reading problems and comprehension problems for all four groups of participants in this study. The most common problems include being unable to analyse the graphic representation of the characters and unable to make an educated guess of the meaning of the unknown words.

The character itself is difficult for Chinese learners no matter if they have prior Chinese spoken skills, especially for those coming from an alphabetic language background. From the data in this study, it is very easy for them to mix up characters with graphic proximity and they may find it difficult to map the graphic form of characters to its phonetic form and meaning. Thus, teaching these learners how to analyse a character, including the structure, the radicals, the stroke order, etc., may be useful. This will provide learners with a better basis for learning and recognising characters, and may help them to better distinguish similar characters, and to use the semantic radical to help with the form-meaning mapping process. Achieving automaticity in character recognition, according to the findings of Shen & Jiang's study (2013), will contribute to reading comprehension for L2 Chinese learners, which requires a lot of rehearsal.

As for the problem of being unable to guess the meaning of words, one reason may be that Chinese learners lack the knowledge of how Chinese words are formed from their constituent characters. As most participants reported in the interview that they memorise new words as a whole without trying to

connect to the characters or words they have previously learnt, they did not analyse the characters in the word. As a result, some participants in this study were unable to recognise characters which they knew well in the context of common words if they were combined with other characters in different words. This may bring up the issue or whether characters should be emphasised when teaching Chinese reading. In the research of Chinese as L2 teaching, scholars and teachers also have different views on if words or characters should be emphasised more heavily (e.g., Lin & Wang, 2019; Lv, 2007). In most Chinese textbooks that are commonly used for L2 and HL learners, it seems words receive more attention than single characters: for example, there are word lists for every lesson, and some frequently used words are given more example sentences. Characters, in most cases, are not explained. This is understandable as the words can be used directly in sentences, while for characters, they are just the basic 'bricks' to construct words. The character/word level problems the participants encountered in this study, however, may provide some useful information on development of Chinese curriculum and teaching materials which highlight the fundamental features of characters more explicitly.

5) Understanding the sentence and context

In addition to helping students better understand the Chinese writing system, we can see from the study that it is also important to teach and emphasise how to read and understand sentences in Chinese. For example, some participants in this study pointed out that the sentences they learn in class from the textbook are not the sentences Chinese people use in their daily life. As a result, after several years of learning Chinese, they still find understanding others, including listening and also reading, is still a challenge, and the sentences they produce are not native-like. Moreover, it was difficult for participants to understand some long sentences especially when the referential of pronouns is unclear or the pronouns are omitted. What's more, even advanced level participants found it difficult to understand the implied meaning, which may indicate their lack of discourse and pragmatic competence, and they were unable to apply any efficient strategies to solve these problems. Therefore, in order to read and comprehend a passage, it is very important for learners to be equipped with the skills of decoding discourse level features such as cohesive devices. This does not only include sentence structures and Chinese grammar, more importantly, students need to understand the background and root of the language (culture) and also how Chinese language is used by Chinese people authentically (pragmatics). Most Chinese textbooks emphasise Chinese grammar, but some characteristics of Chinese sentences, for example, that Chinese is a topic-prominent language (C. Li & Thompson, 1976), are overlooked. In addition, most Chinese textbooks concentrate on sentence-level grammar, but lack attention to discourse-level structures.

7.5 Limitations and suggestions for future research

Due to constraints on time and resources, the present study has some limitations on both the data collection and the results obtained.

7.5.1 Limitations of the study

The number of participants in this study was relatively small, and several factors caused this. To make the grouping manageable, the participants were recruited from one university. Grouping the participants into intermediate and advanced levels was a challenge as participants' proficiency level varied even for those who were studying the same unit. Different universities use different textbooks and the curriculum is also not the same. Thus, recruiting participants from several universities may make the grouping even more difficult. Some groups of participants were more difficult to recruit than others as the total number of them was comparatively small. One of the challenges was to recruit advanced level L2 learners. Every year, the number of L2 learners who choose/are able to do advanced Chinese is limited, and for those who are studying the advanced unit, not every one of them is qualified as 'advanced level' in this study. To complete the study, participants needed to spend around two hours and meet up with the researcher twice. This was not easy for participants, and some of them dropped out of the study part way through. As each participant provided rich data for this study, it took tremendous time to transcribe and carefully analyse the data, and the time of analysing data will be much longer if more data is collected.

As the number of participants was limited in this study, some quantitative data analysis could not be conducted. In addition, it may make more sense if participants were divided into sub-groups, for example, more skilled readers and less-skilled readers, as the proficiency level of participants was diverse in the same group. However, as the total number of participants for most groups was only seven (nine for HLAs), sub-grouping would make the analysis of the data statistically invalid.

In addition, 'HL learners' is a general label, and these learners' background is very diverse. Some HL learners in this study rarely used Chinese at home, and their oral competence was very low compared to some other HL learners. A couple of HL learners had experience of living in Chinese-speaking countries and regions for one or two years when they were young, and some had native-like spoken skills, some in Mandarin and some in dialect. The diversity of the degree of background makes investigating HL learners' reading problems and strategies very complicated, and simply grouping them as 'HL learners' may miss some important observations.

It is also noteworthy that even though this project was aiming to understand what the L2 and HL students do when they read in Chinese, it focused more on the character/word-level processing, including problems and strategies. As for higher-level processing, it is more difficult to investigate by looking at (for reading silently) or listening to (for reading aloud) participants' reading and asking what participants did when they read, because it is more complicated and more factors are involved. Although some clues to higher level processes were found through analysis of the retell protocols and comprehension questions, this study was unable to describe the actual detailed processes when it comes to sentence and discourse processing.

Some limitations can also be found in the instruments in this study. First, the categorisation of intermediate and advanced level groups was only based on the vocabulary test, and students' grammatical and discourse knowledge were not examined. The categorisation will be more accurate if

a more sophisticated measure for proficiency, for example, reading proficiency test, is adopted. Second, when choosing the reading materials for participants, only the word frequency and the sentence length were considered. The topic familiarity may also influence the reading process, however, it was not investigated in this study. Last, no interrater reliability was reported for the initial 21-strategy item identification, the subsequent strategy classification, and the categorisation in this study as they were completed solely by the researcher.

7.5.2 Suggestions for future research

Given the limitations and potential of the study, there are a few possible directions for future research. The most promising area which deserves further research is the differences and similarities between L2 and HL learners. It will be helpful to examine the effect of background on reading process if HL learners' background is carefully examined, and learners are grouped into different sub-groups according to different degrees of background. By doing this, we may be able to better understand these learners' advantages and disadvantages under different circumstances, which may be also helpful for curriculum and material development.

Another recommendation for future research is expanding the number of participants, and investigate if there is any difference in reading process between more skilled readers and less skilled readers. By investigating the reading process of readers who have different levels of reading skills, the study may reveal the impact of linguistic competence and strategic competence on reading. This may help researchers better understand the interaction between readers and text and what readers with different strategic competence can draw on when they lack linguistic knowledge. For general linguistic skills, it may be interesting to conduct a longitudinal study on this topic to explore the development the reading competence and to examine how the reading process will change when readers have more reading experience and linguistic knowledge.

In addition, the details of higher-level processing, for example, how readers process sentences and the discourse level information, are not fully revealed by this study due to the limitations of methodology. Also, this study mostly examined the surface-level (literal-level) comprehension, rather than deeper-level comprehension (inferential, appreciative, critique, evaluative, or applicative level). By introducing some other methodology (e.g., utilising technology of neuroscience), the process of reading, including both lower-level processing and higher-level processing, and the deeper-level comprehension may be investigated in a very detailed manner. It may provide richer information on what is going on when an L2 or HL reader reads a Chinese text.

There are also a few of recommendations for future research in terms of study design and data analysis. First, a more sophisticated measure for proficiency should be conducted prior to the study. Second, different measurements should be adopted to examine the difficulty of the reading materials, for example, the word frequency, the sentence length and the topic familiarity. Last, it is better to recruit more raters to work on the data analysis, e.g., the strategy identification and categorisation, to increase the accuracy of the data analysis.

In conclusion, by collecting and analysing detailed data from multiple sources, this study provides insights into the reading process when Chinese L2 and CHL students read Chinese stories. Both emic and etic perspectives were used in this study to elaborate students' reading problems and problem-solving strategies. By comparing the four groups (different backgrounds and different proficiency levels) and introducing the two reading modes, this study provided useful information on the problems students encounter, the strategies they employ and their effectiveness. Drawing on the findings, this study also attempted to provide a model of the L2 and HL Chinese reading process. Due to the uniqueness of Chinese written language, exploring the reading process for Chinese will further our understanding of reading in general, one of the most complex cognitive tasks, by identifying what processes are universal and what are driven by different written languages. In addition, investigating Chinese L2 and CHL reading processes may help us better understand the differences and similarities of L2 students and HL students and thus may also offer some suggestions for future study in the field of SLA.

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Appendices

Appendix A: Background survey

These questions are about your experience with languages especially with Chinese. Please try to provide as much information as possible. Thank you!

1. Country of birth

2. Your gender: Male, Female

3. What is your first language?

4. How do you rate your reading ability in your first language?

à   Speed: 5 4 3 2 1 (very fast, fast, average, slow, very slow)

à   accuracy: 5 4 3 2 1 (very high, high, average, low, very low)

à   comprehension: 5 4 3 2 1 (very well, well, average, poor, very poor)

5. How many languages can you read? Please list all of them.

6. How long have you studies Mandarin?

7. What is the highest level of Chinese you studied before coming to Monash University?

- I have never formally studied Chinese, and I was unable to speak and understand any Chinese (Mandarin, Cantonese, Hokkien, Hakka etc.)
- I have never formally studied Chinese but am able to speak and understand some Chinese (Mandarin, Cantonese, Hokkien, Hakka etc.)
- I have studied Chinese at primary school in Australia
- I have studied Chinese at secondary school in Australia but below VCE level
- I have completed VCE/IB second language basic stream
- I have completed VCE/IB second language advanced stream
- I have completed VCE/IB first language
- I have studied at a Chinese primary school
- Other

8. Have you studied Chinese at Chinese community schools?

9. What Chinese language units have you studied at Monash University (including the current one)?

10. Have you ever been to Chinese-speaking countries or regions?

à   If yes, could you please indicate the place, frequency and duration?

11. Do your parents or relatives speak Chinese (Mandarin or any other dialects) with you?

- Always
- Often
- Sometimes
- Never

12. Do you speak Chinese (Mandarin or any other dialects) with your parents or relatives?

- Always
- Often
- Sometimes
- Never

13. Do you speak Chinese (Mandarin or any other dialects) with your friends?

- Always
- Often
- Sometimes
- Never

14. Please evaluate your Chinese proficiency of listening. (Choose the one that indicates your level best)

- I can understand when I watch Chinese films/TV programmes. (Level 4)
- I can understand what teachers and classmates said in Chinese class. (Level 3)
- I don't have too many problems when it comes to daily life topics. (Level 2)
- I can only understand some basic Chinese. (Level 1)

15. Please evaluate your Chinese proficiency of listening. (Choose the one that indicates your level best)

- I am able to express myself in Chinese on most topics. (Level 4)
- I am able to use Chinese to communicate when it comes to the topic I am familiar with. (Level 3)
- To some extent I am able to use Chinese to communicate when it comes to daily life topics. (Level 2)
- It is difficult for me to communicate in Chinese as my Chinese is limited to single words and a few basic phrases. (Level 1)

16. How do you usually go with your vocabulary tests in your current Chinese class?

- 90 out of 100 and above
- From 70/100 to 89/100
- From 50/100 to 69/100
- 49 out of 100 and below
- Not applicable

17. Please match the following characters with the English meaning of the radical they contain

	grass	sun	human	knife	silk	earth	heart	metal	clothing	water	unsure

18. How do you usually go with your reading tests?

- I can understand it easily. (Level 4)
- It is OK, but I find some words or parts are difficult to figure out. (Level 3)
- It is pretty hard, but I am still able to understand some parts. (Level 2)
- I am pretty lost when I do reading tests. (Level 1)

19. Have you ever encountered these situations when you read Chinese passages?

à There are a few characters or words that I can't pronounce, but I am able to figure out the meaning based on the shape of the character: Always, Often, Sometimes, Never

à There are a few characters or words that I can't pronounce, but I am able to figure out the meaning based on the context: Always, Often, Sometimes, Never

à There are a few characters or words that I can read without knowing the meaning: Always, Often, Sometimes, Never

à I am able to recognise every characters and words in a sentence but still misunderstand or have difficulty to figure out the meaning of the whole sentence: Always, Often, Sometimes, Never

20. How often do you read in Chinese?

- Rarely
- Only in Chinese class (1 or 2 times a week)
- In Chinese class, and when I study for Chinese after class
- In addition to textbooks and materials for class, I sometimes read other material in Chinese (e.g. books, websites, emails etc)

- In addition to textbooks and materials for class, I often read other material in Chinese (e.g. books, websites, emails etc)

à Other than class materials, what kind of materials do you read in Chinese and why?

21. When you read in Chinese, do you read printed materials or on your phone or computer?

- Only printed materials
- Only on my phone or computer
- Both, but I read printed materials more often
- Both, but I read on my phone or computer more often
- I read printed materials as often as I read on my phone or computer.

22. Do you prefer reading printed materials or reading on your phone or computer?

- I prefer printed materials
- I prefer reading on my phone or computer
- No preference

23. How do you use reading aids when you read Chinese?

- I tend to look up unknown words immediately when I see them.
- I try to guess the meaning first and look up the words I can't guess.
- I will finish the whole sentence or paragraph first and then look up the unknown words.
- I try to minimise my use of reading aids, and only look up words if they are crucial for understanding the overall meaning.

24. Could you please briefly explain the reasons you chose to study Chinese?

25. Your name:

Thank you for your time!

Appendix B: Character/vocabulary test

Please write down as many as you can.   Name_____

No.	Characters/words	Pinyin	Meaning
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Appendix C Reading materials, translation and the list of main ideas

1. Intermediate level passage one *Selling alcohol*

A person started his own business. How did it go?

A man wanted to open a shop to sell alcohol, and he thought it should be opened at a busy location.

So, he spent a lot of money renting a shop in the busiest part of the city centre, thinking that with so many people there, the liquor business would thrive.

Unexpectedly, in the month since opening, only a few people came to buy alcohol.

This man was very disappointed and at the same time he felt it was strange, having no idea why this was the case.

Therefore, he went to people who love drinking and asked where they usually go for alcohol, and everyone answered with the same place.

This made him very curious about that shop and he decided to see why it was better than his own shop.

As a result, the man spent a lot of effort to find the store, because the store was on a small road with few people passing, and it looked very ordinary.

This person asked the owner of the store: "Opening the store in such a remote place, aren't you afraid of not having customers?"

The owner replied: "As long as you have delicious quality wine (the wine is good enough and fragrant enough), even if you open in a place harder to find, customers will be attracted by the wine's aroma."

No.	Key points	Tick
1	A man opened a shop to sell alcohol.	
2	He believed the location of the shop was very important, and it needed to be busy.	
3	/ He opened the shop in the city centre/the busiest place.	
4	He believed that his business would do well.	
5	However, few people came to buy alcohol.	
6	He asked others where they liked to buy alcohol.	
7	People all favoured the same place.	
8	He went to that shop.	
9	/ That shop was difficult to find/ on a small road.	
10	He asked the owner why he opened the shop at a place with few people.	
11	The owner said the quality of the alcohol was more important.	

2. Intermediate level passage two *Smart Kong Rong*

Kong Rong was a famous person in China, and here is a story about him when he was a child.

In ancient China, there was a very famous man named Kong Rong, who had been very smart since a young age.

Kong Rong lived in Luoyang when he was a child. At that time, Luoyang had a very prominent man named Li Yuanli, who only dealt with famous people. When ordinary people came, he refused to see them.

One day, ten-year old Kong Rong came to Li Yuanli's door and said to the gatekeeper: "Go tell your master, I am his relative."

So, Li Yuanli let Kong Rong in and asked him: "How are we related?"

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Kong Rong said slowly and calmly: "My ancestor Confucius and your ancestor Lao-Tze (Li Dan) were in a teacher-student relationship, so we can be regarded as family friends!"

Li Yuanli was surprised that a 10-year-old child could come up with such things.

At this time, one of Li Yuanli's guests said: "People who are smart as children do not necessarily turn out to be smart adults."

Kong Rong said to this guest immediately after hearing this: "Then you must have been very smart when you were a kid!"

After that, the guest was speechless for a long time.

No.	Key points	Tick
1	There was a man (Kong Rong) in ancient China who was very smart from a young age.	
2	Kong Rong lived in Luoyang (a place) when he was a child, and there was a man (Li Yuanli) with high social profile.	
3	Li Yuanli only dealt with famous people.	
4	10 One day, ten-year old Kong Rong went to visit Li Yuanli.	
5	Kong Rong told the gatekeeper that he was a relative of Li Yuanli's.	
6	Li Yuanli asked Kong Rong how they were related.	
7	Kong Rong said his ancestor and Li Yuanli's ancestor were teacher and student, which then made them family friends.	
8	Li Yuanli thought Kong Rong was very smart.	
9	A guest believed people who were smart as a child would not be smart when grew up.	
10	Kong Rong said that guest must have been smart when he was little. (Kong Rong has mocked the guest)	
11	The guest did not know what to say.	

3. Advanced level passage one *The emperor and the bird*

Here is a story about an emperor. Was he a good one?

In ancient times, there was an emperor who hadn't done anything important in the three years since he took the throne. Each day he hardly ever worked and instead daydreamed all day long.

Some serious problems occurred in the country, but he couldn't care less.

Some people were very happy to see the emperor's behaviours, because they didn't have to work hard either; other people were anxious and worried, but they didn't dare tell the emperor directly.

One man couldn't bear to see the emperor doing nothing every day, other than eating, drinking and playing around, so he decided to use a story to see what the emperor really was thinking about.

He said to the emperor: "I heard that there is a bird in someone's yard, and it doesn't fly for several years, nor does it make any sound. What kind of bird is it?

The emperor replied: "I know this kind of bird. It doesn't move when it doesn't want to fly, but when it does wants to fly, it can fly to a high place at once; it is usually quiet, but when it chirps, its call will surprise everyone, because no one had heard such a beautiful sound before."

It turned out that the emperor just wanted to use this method to test who really cared about the country.

From then on, the emperor began running the country seriously and he governed the country very well.

No.	Key points	Tick
1	There was an emperor who did not work.	
2	Problems occurred in the country, but he did not care.	
3	Some people were happy, and some people were worried, but they did not dare say anything.	
4	There was one man who couldn't stand it any longer, and he decided to tell the emperor a story.	
5	This man wanted to know the reason why the emperor was doing this.	
6	He asked the emperor, "There is a bird that doesn't fly or chirp. What kind of bird is it?"	
7	The emperor said this bird either kept still or flew very high.	
8	It either kept quiet or surprised everyone with its voice.	
9	The emperor had deliberately not worked to check if anyone really cared about the country.	
10	Afterwards, the emperor started to work seriously.	
11	This country became well-governed.	

There were two big families in a town. What happened between them?

There used to be two families neighbouring each other, the Zhang family and the Wu family, and both were rich. The relationship between the two of them was tense, and they looked down on each other.

There was a man named Zhang Ying from the Zhang family, who was a high official in the government.

One day, the Wu family rebuilt their house, and the new house was bigger and occupied part of the Zhang family's land.

The Zhang family was very angry and sued the Wu family, but the local officials did not dare offend either of these families, and did not know what to do.

The Zhang family lost the land and wrote a letter to Zhang Ying, asking Zhang Ying to punish the Wu family.

Within a few days, the Zhang family received Zhang Ying's reply and they quickly opened it. The letter said: You were so anxious to write to me just because of a wall. What if we give them some more land? You see that the Great Wall can still be seen nowadays, but Qin Shi Huang, who built the Great Wall, is long gone.

The family was ashamed after seeing the letter, and they no longer asked for the lost land from the neighbour, and they even gave the neighbour more land.

Then the Wu family also felt embarrassed, and immediately moved their wall back by three feet.

As a result, a pathway appeared between the Zhang family and the Wu family, allowing pedestrians to pass through.

No.	Key points	Tick
1	There were two rich neighbouring families, who looked down on each other.	
2	There was a man in the Zhang family who was a high-up government official.	
3	The Wu family rebuilt their house, and it took some of the Zhang family's land.	
4	The Zhang family was very angry and sued the Wu family.	
5	The local official did not dare get involved between them.	
6	The Zhang family wrote a letter to their family member who was the official.	
7	The reply letter said not to worry about this, and asked the family to give up some more land.	
8	The family felt ashamed, so they gave up some more land.	
9	The other family also felt ashamed, and gave up the land they took.	
10	This land became a small path between the two families.	
11	The path was convenient for pedestrians.	

Appendix D: Interview questions

1. How do you usually memorise new Chinese characters?

2. How about new words?

3. When you encounter some unknown words during reading, what kind of clues would you use to make a guess of the meaning?

4. How difficult were the two passages for you? Were the two at the same difficulty level?

5. When you read Chinese at home for study or other purposes, do you ever read aloud?

6. Do you think reading aloud or reading silently are different in terms of your understanding of what you read or how you read?

7. When you are reading silently, are you ever aware of sounding out the passage in your head?

8. What do you think are the most difficult things when reading Chinese?

9. Do you have any questions or comments about the reading experiment we just conducted?