

Abstract

In recent years, owing to the growth and development of communication between China and other countries, the demand of interpreting professionals has been increasing and a lot of language learners are eager to take part in this career. Many universities even set interpreting major and at least three interpreting qualification exams are carried out nationwide, all of which have created a sound environment for China's interpreting development. The flourishing market leads to the further development of interpreting research. However, most prevalent interpreting training is unprofessional due to lack of systematic and scientific theoretical guidance.

In order to improve interpreting training, this paper firstly probed into previous studies on interpreting process with three models: namely Information Processing Model, Interpretative Model and Effort Model. In addition to the three models, the paper also tagged the cognitive science research on memory mechanism and SI brain operation. All of these theories indicate that memory training is the crux of the SI training and shed light on SI training. Based on the study of the theories, the author proposed a memory improvement strategy and systematic methods for interpreting teaching.

Keywords: interpreting process simultaneous interpretation memory training
working memory

符号说明

SI: Simultaneous Interpretation

CI: Consecutive Interpretation

SL: Source Language

TL: Target Language

LTM : Long-term Memory

STM : Short-term Memory

IP model: Information processing model

L: Listening and Analysis

M: Memory

P: Production

C: Coordination

TR: Total Requirements

LR, MR, PR, CR: Capacity Requirements for L, M, P and C

TA or TAPC: Total Available Processing Capacity

LA, MA, PA, CA: Capacity Available for L, M, P, C

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Introduction

Interpreting is complicated information processing. Both new and experienced interpreters find this profession demanding and challenging because they have to finish comprehension, memorizing, and production nearly at the same time. Processing amounts of information with the interference of listening and speaking poses great challenge to the interpreters' memory. In this sense, memory capacity seems crucial for an interpreter and how to improve memory skill remains the significant part of simultaneous interpreting research.

In this paper, the author intends to formulate some memory training strategies and methods for interpreting teaching based on the analysis of interpreting process. There are totally four chapters. Chapter 1 is an introduction which provides the general knowledge of interpreting as well as a literature review. Chapter 2 focuses on different SI process models and the contribution of cognitive science to simultaneous interpretation research. In 1970s, Gerver and Moser put forward an IP model (information processing model), which initiated the study towards SI process. Later on, Danica Seleskovitch and Marianne Lederer with Paris University proposed the *La theorie interpretative de la traduction*(interpretive theory). In 1995, Daniel Gile advocated Effort Model to explain the difficulties of interpreting process. In addition, cognitive science has also shed light on interpreting process by studying how sensory memory, short-term store and long-term store are interacted and operated. All of these theories respectively offer a theoretical foundation for the Chapter 3 which attempts to seek scientific memory training strategies and methods. Chapter 3 leads to a conclusion that memory training should follow effort component-oriented and process-oriented training. Then the author, based on the

analysis of interpreting process and memory mechanism in SI, emphasize the importance of working memory capacity enhancement and attention coordination effort in SI and suggest several training methods in these two categories: namely visualizing memorializing, chunking, outlining and retelling, brainstorming for anticipation in the first category of working memory capacity enhancement as well as shadowing, on-line-paraphrasing, note-taking, interpreting skills such as linearity and simplification on the second category of attention coordination effort. Chapter 4 is a concluding chapter. By eliciting the merits and demerits of this study, the author expects that the study can provide reference to those who are interested in this field to conduct a deeper research of SI.

Chapter 1 SI Interpreting and Literature Review

1.1 Definition and Types of Interpreting

“Translating” and “interpreting” are commonly defined as the transfer of message from one language into another. As Eugene Nida (2001:128) pointed out “Translation consists in reproducing in the receptor language the closest equivalent of the message couched in the source language, first in terms of meaning and second in terms of style.” To a wider extent, translating implies the rendering of information from one language into another so as to produce as accurately as possible all semantic and stylistic features of source language (SL) in the target language (TL). Interpreting refers to the oral translation of an oral message. Specially, it is the process of listening to a speech delivered in one language and then repeating the same speech in another language.

Traditionally, interpreting events have been characterized in a number of ways: 1) by institutional settings, such as educational, medical or legal where interpreting takes place; 2) by the language group with which an interpreter is associated (Chinese, English, French, etc); 3) by the number or type of participants (conference, community, liaison, one-to-one, etc) and 4) by the social occasion (wedding, graduation, retirement, etc.) From the above divisions, we can see the various types of interpretation. In recent year, with the rapid economic development and the trend of globalization, interpreting as a promising career is stepping fast ahead. However, these divisions of interpreting are always overlapping. For example, what kind of interpreting is in a lecture on cultures given to students in a medical university? Is it an educational setting, or a medical setting, or a conference setting? In this case, the division made along the mode of interpreting, namely, Consecutive Interpreting (CI)

and Simultaneous Interpreting (SI), is clearer and more helpful. Both CI and SI are centered on the interpreter and interpreting skills.

CI is the spoken rendering of a speech (part of a speech in most cases) after it has been heard in its entirety. This type of interpreting is often done with the help of note-taking. The interpreter takes notes throughout the speech and presents the rendering in the target language. At present, simultaneous interpretation seems increasingly popular, yet consecutive interpretation is still used extensively on various occasions. In this mode, the interpreter has time to take notes and ponders on some renderings based on analysis. The time lag of several seconds after the production of source language leaves time for the interpreter to analyze sentence structure and discourse as a whole. Needless to say, CI is more accurate, more complete and more logic than SI. This is the very reason why it is adopted more frequently than SI at the high-level press conferences or political talks in organizations such as the Security Council of UN.

In SI, the interpreter is seated in a soundproof booth receiving the speaker's voice through a headphone before interpreting what he/she hears into another language through microphone while listening. Participants of the conference can pick up the interpreter's voice through their own headsets. There is a booth for each language with two or sometimes three interpreters in it. In front of each interpreter, there is a control panel, on which there are three buttons—one is for volume control, one is mute button and the last is relay button, as sometimes several languages would be employed at conference or meeting. If the interpreter needs to cough, he or she can press the mute button so as to avoid any unpleasant disturb to audiences. Besides these buttons, there is also a switch button and a channel indicator on the control board, which is respectively for switching between the two interpreters and language indicating. Because of the high level of concentration required for

interpreting, interpreters cannot interpret for more than thirty or even twenty minutes in one stroke. The following are the key features of the SI, which was put forward by Chernov. (Chernov 1979: 277-278)

1. *The source language (SL) message is presented to the interpreter only once and it develops in time (a “left-to-right process”)*
2. *The two communicational acts, listening to the SL message and speaking (reproducing the message) in the target language (TL) are concurrent most of the time.*
3. *Only a limited account of time is available for message decoding, re-encoding and reproduction, as evidenced by the average time lag of a few seconds.*
4. *As follows from (3), only a limited amount of information can be processed per unit of text in SI*

Interpreting itself has a very long history. It is even safe to say that there have been interpreters since antiquity when people began to communicate by means of languages. In western countries, interpreting as a profession came into being around the 14th century in France. Not until after World War II at the Nuremberg Trials, was SI first employed to guarantee the completion of interpreting “simultaneously” after hearings, defense and trials of source languages, so as to save precious time. It poses enormous challenge to interpreters as this working model demands prompt response and rendition simultaneously following the delivery of source language. The demands of being a simultaneous interpreter are, to some extent, rigorous and rigid compared with other modes of interpreting. In addition to proficiency of source language and target language, simultaneous interpreters are supposed to be competent in memory, intelligence, psychological condition, familiarity with related cultures, interpreting techniques and coping skills with various situations. The post

World War II era sees a brand-new and sophisticated interpreting technique evolving from the old ones, which immediately became prevalent and was widely adopted in the UN and a number of international conferences due to its notable advantage—time saving and promptness. The SI style gained ground in many countries including China during the post-war period when the research on SI developed into a new direction of interpreting study. It is not exaggerating to assert that the Nuremberg Trials has been a turning point in the history of interpreting.

1.2 Literature Review : The History of Interpreting Research

According to Xiao Xiaoyan(2002), there are four periods of interpreting research. In 1950s, academics began to do research in this area. However, most of the research work was not scientific at that time (from 1950s to 1960s). They only concluded the interpreter's personal experience and have some observations of interpreting behavior and environment. This period was called Pre-research period. It was not until the mid-1970s that theoretically motivated research began to be undertaken in Europe and North America. Danica Seleskovitch of ESIT in Paris wrote about her "theorie du sens". Meanwhile, some psychologists and psycho-linguists also adopted some psychological and linguistic theories to study the cognitive process in interpreting and proposed some assumptions for interpretation, which provided new ideas to this area. The second period is called Experimental Psychology Period. By the late 1970s, some researchers began to study interpreting process. Psychologists, interpreters and interpreter trainers all started to adopt a multistage view of the interpreting process that included, roughly speaking, some mention of speech recognition, storage mechanisms, transfer, production, and output monitoring. So the third period is called the Practitioner's period. The last period is the Renewal Period. The interpretation conference held in Trieste University in Italy

in the year of 1986 was the turning point. From then on, different schools of interpreting research began to work together to study the subject of interpretation, thus the interpreting research became more scientific and interdisciplinary. For instance, in the 80s and 90s, researchers began to study what happens in the brain while a subject is interpreting. Daniel Gile, a prominent researcher in this field, has provided a comprehensive account of conference interpreting research in his book *Basic Concepts and Models for Translator and Interpreter Training*.

At the end of the 90s, some researchers became interested in community interpreting and courting interpreting and used their research to solve problems associated with all types of interpreting. At the beginning of new century, more and more people are interested in interpreting quality assessment. Besides the traditional topics like what are the criteria of simultaneous interpretation and the differences between SI and consecutive interpretation, some research projects borrowed theories from psychology, linguistics, communications, etc to discuss interpretation quality assessment in terms of terminology, psycho-linguistics and analytical discourses.

The development of China's market economy and opening -up has brought and will bring many opportunities for external exchanges, which more urgently calls for a large number of competent simultaneous interpreters than at any other time. Given the current situation, many Chinese publications have introduced training methods for SI and some studies have also been made in this area. It is true that compared to studies in Europe and North America, interpreting studies in China, starting quite late, are not systematic and a considerable number of books are still talking about personal experiences. However, some Chinese scholars also achieved remarkable results in this area. In interpreting process research, scholars like Liu Heping translated and introducing French "theorie du sens". Professor Feng Zhilin studied Gile's theories and introduced Efforts Model to China. Another important scholar is

Bao Gang. His *General introduction of interpreting theories* (2005) intended to establish interpreting theoretical system from the perspective of psycho-linguistics, information theory, neuro-linguistics, but his early pass-away left the work for the future followers. In the interpreting quality assessment, Cai Xiaohong has done a great deal of work. In 2002, *New Exploration in Interpreting Research--- New methods, New Ideas and New Trends* edited by Cai collected 11 high-quality papers on interpreting quality assessment. Moreover, her newly published book *Interpreting Assessment Studies* (《口译评估研究专论》) is the first book in the area of interpreting quality assessment in China. However, different from Europe and America, the mainland China's interpreting studies never touch on the community interpreting and court interpreting. This is because Chinese society at present doesn't need such service of the two sorts. However, with the development of globalization which requires China to integrate with the world more extensively and deeply, the studies in this area, I think, will become increasingly important.

Memory study in interpreting, as a very important area in interpreting research, has ever been mentioned by Danica Seleskovitch in "theorie du sens" and Gile's efforts model. In China, Bao Gang in his book mentioned above also explained the necessity of memory training from the analysis of interpreting process in terms of psychology and cognitive science and provided some helpful tactics but only in number memory training and note-taking training.

Moreover, a number of oral interpretation text books also talked about how to improve memory skills in interpreting, but most of them lacked in-depth theoretical analysis and didn't provide systematic and consistent training methods.

1.3 Summery

It is clear from this chapter that SI study has a relatively shorter history

compared with translation study, which is in part due to its nature of multi-task solving, promptness and easy elapse. However, many scholars have already done some research on SI and in recent years an interdisciplinary study is underway towards its nature and features. In the next chapter, we will systematically introduce recent-years' study on interpreting process, especially the research on human memory mechanism.

Chapter 2 The Theories of Interpreting Process

In the 20th century, the process of interpretation had been analyzed frequently and some related theories had been put forward by scholars of different schools, among which, three models of SI process deserve our attention, namely, information processing model proposed in 1970s, interpretive theory in 1980s and Daniel Gile's Effort Model in 1995. In addition, cognitive science also contributed a great deal to explain the human memory mechanism and SI brain operation.

2.1 The Informational processing model

In the second period of interpretation research, information processing model is very popular and it still has strong influence these days. Using concepts and modes of cognitive psychology, the researchers showed great interest in the information transmission between source language and target language, with grammatical structure of target language as major barrier in interpreting. SI is a complicated process allowing for overlapping operation in the multi-phase serial processes.

Massaro(1978) , who established the *Speech Comprehension Model* , says that “ Virtually every phase of information processing is reflected in SI: an interpreter decodes the surface structure of the original message, maps it into some abstract representation, converts this same abstract representation into a new surface structure, and finally articulates the translated message”. He also believes that “since time-sharing and parallel processing are necessary as it is in normal speech processing, but with two languages” (Massaro , 1978:300), SI requires some particular skills to cope with the complicated interpretation. He also lists several steps in speech processing: feature detection is accomplished within 250ms, then a

multi-phase parsing process, subject to feedback from contexts, yields meaningful phrases(syntactic-semantic structure) which are recorded and rehearsed before passing through a long-term-memory—resident network of conceptual nodes with different perceptual attributes for each language, to production. The extra perceptual codes for polyglots require postulating a filter and switching mechanism, since reaction time is now slower than in monolingual subjects. Rehearsal and recoding are “the workhorse of the SI task...and it is at this phase that the task becomes uniquely relative to normal language processing” (Massaro, 1978).

Based on Massaro’s *Speech Comprehension Model*, Moser and Gerver made primary attempt at a complete information processing models for SI. IP models regard human beings as the active information processor and probes into how the information is perceived, encoded, stored, retrieved and used in various phases.

In 1978, Moser, professor of University of Innsbruck, proposed a detailed IP model in a semantic flow chart aiming at presenting real-time processing during SI. The perception and translation parts of the model are both well developed with an emphasis on long-term memory (LTM). According to this model, in the perception phase, the source language (SL) message is received in the auditory receptor system and synthesized into strings of perceptual units by using the phonological rules of SL stored in LTM and the synthesized auditory memory, then they are transformed into meaningful units or words through secondary recognition by matching the perceptual information in the synthesized auditory memory to syntactic and semantic information for SL in LTM. This results in a string of processed words stored in generated abstract memory—somewhat equivalent to short-term memory (STM). The production process is seen as a process of “syntactic and semantic word/word-string processing.”

In the same year, Gerver also established a model to show how existing

knowledge of SI data in ear-voice span can be accommodated in a model that builds on findings from memory research. This is the earliest attempt at a complete processing model for SI. The three-phase model demonstrates how pieces of information are stored temporarily in order to get a continuous stream of input and output. The model helps draw out attention to the memory processes needed to explain on-line translation—how parts of the incoming speech have to be stored and forwarded to the comprehension system and how in production parts of information have to be stored in different buffers to arrive at a more or less smooth flow of speech. This model has been very influential in pointing out the role of memory mechanism in SI.

Later, the achievements of cognitive science have brought enlightenment to the interpreting research. Between the original source language speech and target language rendition, there is only a limited time lag that lasts from a few seconds (in SL) to several minutes (in CI). In 1998, Stewart et al. proposed a cognitive model of interpreting in 1998, which illustrates the elementary constitutions of the interpreting process. See Figure 2.1:

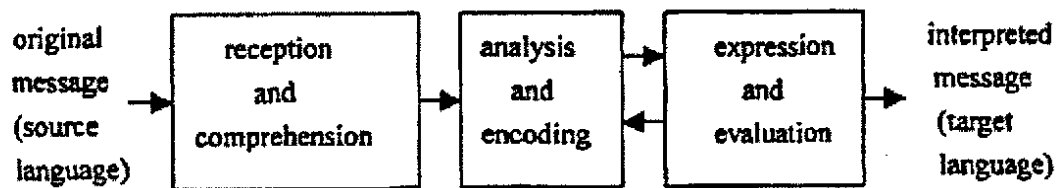


Figure 2.1: An interpreting model (Steward et al. 1998)

From this model we can see that in the first step, the interpreter receives and tries to comprehend the message from the source language. Then the interpreter analyzes the message and encodes it in the TL. The phase of expression includes the evaluation process, which in turn has an influence on the second step, that is,

“analysis and encoding” because the interpreter should make adjustments to enhance the accuracy of the interpreted message.

This model clearly explains the basic steps of interpreting process, however, it is too simple and abstract that we can hardly find out the detailed analysis on how the information is processed in interpreting, in other words, how it is perceived, memorized, transferred and reproduced.

2.2 The Interpretive Theory of Interpreting

D. Seleskovitch and M. Lederer are the pioneers in interpreting research. Viewing interpreting as a cognitive process based essentially on comprehension, Seleskovitch and Lederer developed the “*Theorie du Sens*”, or the Interpretive Theory of Interpreting (ITI) in the late 1960s and 1970s. This theory is based on the long-term observation and analysis of interpretation practice and grounded on the research of meaning transferring in interpretation instead of on the linguistic level. They say that translation is a communication behavior of human beings and in the normal communication, language functions as a tool and the objective translation is the content of information, in other words, the meaning (“*sens*” in French) instead of words or linguistic structures—“Be sure not to forget that the aim of interpreting is to transmit meaning and try not to be confined to the original sentence/clause structure and words. The original words and structures are just signs showing where the way it leads to, but it is not the way itself”. They view discourse interpretation as a natural process in which the synthesis between the semantics of an utterance and knowledge external to it produces states of consciousness which correspond to the message. Meanwhile, SI process is not regarded as a simple transformation of a text from the source language to the target language, but a rather complicated one involving double transformation. The translator first transforms the input message

into a certain type of representation of its meaning, followed by the second transformation of this semantic representation into a new text in the output language.

According to interpretive theory, the interpreting process can be illustrated as follows: the spoken original is primarily retained in short memory for only a few seconds, after which cognitive complements at work on these words transform them into meaning units. As soon as these meaning units are formed, they melt into larger meaning units (Seleskovitch & Ledere 1989:247).

They postulate three phases of interpreting process:

1. Verbal phase—inputting discourse

Using phonological rules and lexicon stored in permanent, long-term memory, interpreters will, through auditory perception, recognize the coming sounds as words or phrases before the recognized forms can be stored into short-term memory.

2. Non-verbal phase—processing

True comprehension of message takes place in this phase: words are transformed into sense referring to context, situation, and word forms in short-term memory; and the sense or the meaning which is not tied to any language is stored in medium short-memory.

3. Verbal phase—reproducing the message

The senses are converted into the target language with the working memory recollecting those senses from the short-term memory.

During the non-verbal phase, the verbal input of the first phase is split into meaning units which melt together with interpreters' stored knowledge (specific subject or general knowledge). These meaning units will, with the immediate short-term memory as its transition medium, enter the cognitive memory, thereby losing their verbal form by transforming into ideas. Based on this idea, Paris School later raised the well-known interpretation concept of "deverbalization". According to

D. Seleskovitch (1978), “the translation process appears to be not a direct conversion of the linguistic meaning of the source language to the target language but a conversion from source language to sense, the intermediate link being non-verbal thought which, once consciously grasped, can then be expressed in any language regardless of the words used in the original language.” That is to say, the process is considered as a dynamic process of comprehension and re-expression of ideas rather than a linear trans-coding operation.

Based on the above arguments, D. Seleskovitch established a triangle model for the illustration of the interpreting process: See Figure 2.2

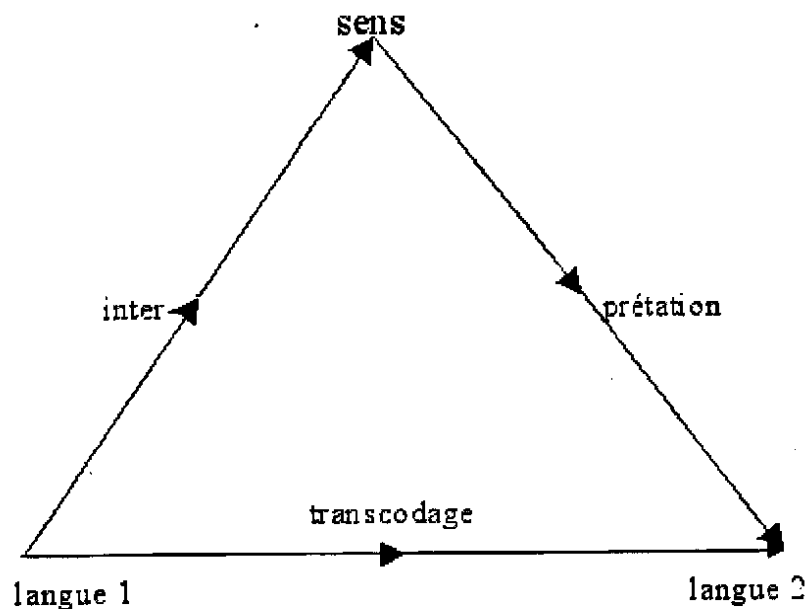


Figure 2.2: the triangle mode of interpreting process (Seleskovitch&Ledere, Wang Jiarong translated, 1990: 238)

This model shows a direct code-switch process from language 1 to language 2, and language 1 can reach the peak of the triangle (sens) before going to language 2 through “pretation”. Sens is dispatched from the peak of the triangle because once the source language is reverted to the original information; its form has been deverbilised from it. Then the linear exterior form of language 1 has no influence on

SI interpreter. According to D. Seleskovitch, “the interpreting can be assumed to be a triangle mode. From the peak of the triangle, the interpreter begins to deliver his own thoughts since the original form of source language has no restriction any longer. The bottom line means the direct translation of conception from source language to target language, not undergone any change of context and situation. These conceptions are only objective of knowledge, not objective of comprehension.” (Seleskovitch&Ledere Wang Jiarong, 1990: 239). That is to say, the process of interpreting is not a simple transformation of two languages; the “sens” at the peak of the triangle plays a major role in it. In most cases, the role of “sens” is decisive.

The essence and specialty of this theory is that, instead of a direct shifting from the source language to the target language, there is one more step in operation that is the process of deverbalization during this shifting. This important concept helps interpreter-trainees to concentrate on what people say instead of the actual words they use in their speech. Its instructive role in interpreting is measurable when structures of phonology, lexicon and syntax between source language and target language are quite different, such as those between English and Chinese. The interpreters are supposed to employ meaning-based strategy when being confronted with such interpretation. It is also applicable to student trainees as they haven’t developed enough skills in this field. Therefore, the advantage of interpretive theory lies in its instructive meaning in training, or its pedagogical meaning.

However, there are also some weak points about this theory, for example, this model can not explain clearly how the sub-processes are going on, how attention is allocated and how the cognitive processes, interpreting skills and language proficiency are interwoven together.

2.3 The Effort Model by Daniel Gile

One of the most striking and challenging phenomena in interpreting is its fundamental difficulty for the interpreter. Even for the experienced professional interpreters, errors and omissions are frequently found in their interpretation. It is not likely that these mistakes are not due to the subjects' insufficient understanding of English, nor because of fatigues, for in interpreting field, the same subjects take turns of 30 minutes in the simultaneous interpretation booth. Based on the experiment of professional interpreters, Daniel Gile raised Effort Model to explain the difficulties and efforts involved in both SI and CI.

The development of the Models originated in two ideas:

1. Interpretation requires some sort of mental "energy" that is only available in limited supply.
2. Interpretation takes up almost all of this mental energy, and sometimes requires more than is available, at which times performance deteriorates.

According to cognitive psychology, some mental operations (non-automatic operations) require attention or processing capacity while others (automatic operations) do not. "Non-automatic operations are those which cannot be automated, such as detecting a brief stimulus, identifying a non-familiar stimulus or a familiar stimulus presented under poor conditions, storing information in memory for later use, preparing for a non-automated response, controlling the accuracy of a movement, or manipulating symbols in the cognitive systems. Automatic operations include decoding a familiar stimulus presented under favorable conditions, triggering an automated response, and operating a motor program without control (Richard 1980: 149-150). From Gile's observation of simultaneous interpretation, SI could be modeled as consisting of three main components or Efforts: a Listening and Analysis

component, a Speech production component, and a Short-term memory component. There may be other significant operations associated with simultaneous interpretation that are not mentioned here, but they are probably marginal with respect to processing capacity requirements. The following part is an explanation of the three efforts.

1. The Listening and Analysis or Comprehension Effort (L)

According to Gile, Listening and Analysis Effort is defined as “ consisting of all comprehension-oriented operations, from the analysis of the sound waves carrying the source-language speech which reach the interpreter’s ears, through the identification of words, to the final decisions about the ‘meaning’ of the utterance.” (Gile, 1995: 162)

In fact, the comprehension effort is perhaps more intense for interpreters than it is for conference delegates for two reasons. Firstly, interpreters have to concentrate on everything the speaker says; whereas delegates can select the information they are interested in. Secondly, the interpreters’ relevant extra linguistic knowledge, and sometimes the terminological part of their linguistic knowledge, are less comprehensive than the delegates’.

2. The Production Effort(P)

The Production Effort means the output part of interpretation. In simultaneous interpretation, it is defined as “the set of operations extending from the mental representation of the message to be delivered to speech planning and the performance of the speech plan.” (Gile, 1995:165)

3. The Memory Effort(M)

During SI, short-term memory operations occur continuously. “Some are due to the lag between the moment speech sounds are heard and the moment they are interpreted: phonetic segments may have to be added up in memory and analyzed

until they allow identification of a word or phoneme.” Other short-term memory operations are associated with the time it takes to produce speech, during which the idea or information to be worded is present in memory.” (Gile: 1995:166)

Using these definitions, SI can be modeled as a process consisting of the three Efforts described above, namely the Listening and Analysis Effort L, the Short term memory Effort M, and the Speech production Effort P, plus a Coordination Effort C, which is required to coordinate the three other Efforts:

$$SI=L+P+M+C$$

During SI, each Effort deals with a different speech segment: in the simplest case, Production acts on speech segment A, while Memory acts on segment B which came after A, and Listening and Analysis acts on segment C which came after B. In fact, some overlapping and some inversions occur during interpretation, and at times anticipation results in the production of a target-language segment before the corresponding source-language segment has been heard. The processing capacity requirements for each individual effort are determined by individual requirements as well as their interaction.

In real SI, one, two or three of the Efforts are active simultaneously and a successful performance requires not only that $L+M+P+C$ be less than or equals to the Total Available Processing Capacity(TAPC), but also capacity for each Effort should be sufficient to complete the task the Effort is engaged in. That is to say, $TR < TA$ which means total processing capacity requirements(TR) should not exceed the total available capacity(TA); $LR < LA$ (capacity requirements for Listening) < LA(capacity available for listening), $MR < MA$ (capacity requirements for Memory) < MA(capacity available for memory), $PR < PA$ (capacity requirements for Production) < PA(capacity available for Production), $CR < CA$ (capacity requirements for Coordination) < CA(capacity available for Coordination). Failure may thus occur in

the event of either overall saturation of the TAPC, or a temporary lack or insufficient capacity for one of these tasks.

Gile identified two kinds of “problem triggers”: one is problems arising from an increase in processing capacity requirements, including high density of the speech, external factors such as the deterioration of the quality of the sound, unknown names or names whose target language version is unknown to the interpreter and saturation; the other is problems associated with signal vulnerability such as the case of numbers and of short names, including acronyms (Gile, 1995). It is expected that an interpreter adopt some SI strategies in a bid to save his energy, such as anticipation, which means that he is able to anticipate or guess what will be spoken out before the speaker’s utterance of later part of a phrasal or discourse structure.

Effort model, in conclusion, means that an SI interpreter must possess more processing capacity than the effort demanded by SI itself. It perfectly explains interpreting difficulties; what’s more, it also helps to develop strategies and tactics to solve these problems in real SI performance. However, “it fails to explain SI mental process in an profound and complete way as it remains anything but a cognitive structure theory for SI mental process” (Feng Zhilin, 2002: 455).

2.4 Memory Mechanism and SI Brain Operation

In recent years, researchers began to realize the limitation of pure linguistic studies of translation theory, and began to turn to cognitive science and neighboring disciplines to study the complicated cognitive interpreting processes in which encyclopedia knowledge, linguistic competence, pragmatic constraints and social factors are all integrated, and the mental operations involved in interpreting are quite complex.

Cognitive sciences, in particular cognitive psychology and psycholinguistics

have enabled us to better understand language acquisition and operational mechanism of SI process. Psychology employs information processing to explore cognitive activities, the main research field of which cover emotion, perception, attention, mental image, learning memory, reasoning and language processing, etc. The core element of cognitive psychology is to discover the inner mental mechanism of cognitive process, i.e. how information is obtained, stored, processed and used. As SI process is deemed a complex language processing and a mental activity, cognitive psychology will undoubtedly shed light on the SI research.

Riccardi Alessandra from University of Triests, Italy, illustrates impact of cognitive psychology on SI research:

“As a complex cognitive activity, interpreting was used in the 1960s and 1970s as an experimental paradigm to verify cognitive hypotheses on information processing and language production. However, probably because of its complexity as a cognitive task, it has not so far elicited the kind of interest from other disciplines that it would warrant... Language processes, especially lower-level ones, generally operate unconsciously and are not open to conscious introspection. Therefore, psycholinguistic models of basic principles on which speech production and comprehension rely are useful tools for shedding light on parts of the interpreting process, which would otherwise remain unperceived.” (Riccardi, 2002: 15-18)

The theory and experiment of cognitive science have greatly influenced SI research. Here we will introduce some concepts of cognitive sciences to explain the human memory mechanism and SI brain operation.

2.4.1 Human Memory Mechanism

In the past years, scientists and researchers have made enormous efforts to study human information processing system. One important progress they have achieved is human information processing system which can be summarized as the

following Figure 2.3:

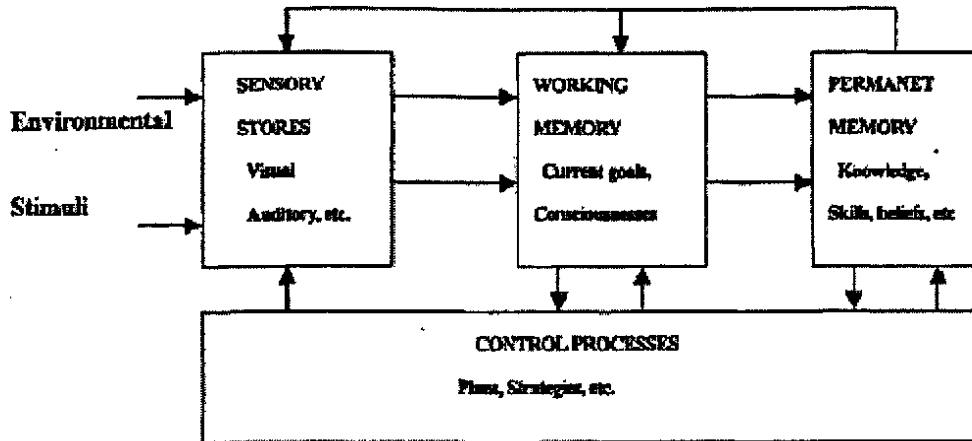


Figure 2.3: A general model of information processing (Carroll, 2000: 47)

In this figure, environmental information is successively encoded, stored, and retrieved by a set of distinct mental structures. This information processing system can be used in a wide range of activities, including SI which is a complex mental processing activity.

This model suggests that the information processing involves three major storing systems—sensory information, working memory and permanent memory that are respectively independent but also interconnected. In the SI process, an interpreter's memory plays an important role in the input and output of information. Memory can be defined as the capacity of an organism to adapt or change as a result of external stimuli.

In the first phase, environmental information is encoded and assimilated into the sensory information system, which filters the input information, converts stimuli received from the sensory organs and records them. Through the sensory of the body—sight, hearing, taste, touch and smell, human brain receives huge amount of information all the time. However, this information is too huge to be accepted by

human brain—it may overload and destroy the sensory system. A filter is needed in this case to reject the unnecessary information and save the valuable information. The information selected is then stored for about half a second in a sensory information storage—a significant phase in the sense that it converts chaotic and continuous sensory stimuli into a unit of information, turning sensation into perception.

In the second phase, the information selected from the first phase is passed on to the short-term memory system. In language processing especially SI process, it is the short-term memory and long-term memory that have significant impact on SI process. Short-term memory is limited in terms of its storage capacity and duration of stored information—only a short span of 20-30 seconds, assuming no new incoming data obliterates it or that it is kept in storage for a longer period by rehearsal. The prosperity of the research on short-term memory in the 1950s and 1970s has yielded meaningful fruition, of which on discovery by Miller. G.A (1956) is that the limited capacity of short-term memory is seven plus or minus two chunks. He holds that information in the short-term memory comes in the form of chunks instead of bits, as it extensively used in the information science. Chunk refers to the process that smaller units (such as letters) are combined in larger, more familiar units (such as words and phrases), as well as the results of this processing. It can be inferred accordingly that one chunk corresponds to a familiar pattern already stored in long-term memory. In this case, the above mentioned seven plus or minus two chunks means only five to nine items could be recalled in tasks where unfamiliar materials are to be remembered. Further substantiation by more psychologists have been made concerning the discovery, including the one made by Chinese scholars that the average duration of short-term memory for Chinese of various ages is a bit more than six characters that are irrelevant with each other and seven words or word

groups that are connected in meaning.

Current views in cognitive psychology indicate that short-term memory is not a passive store; instead it possesses active properties as well, which leads to the concept of working memory. Working memory is deemed as a memory buffer in which information is maintained when it is being processed. Baddeley(1986) defined working memory as “a system for the temporary holding and manipulation of information during the performance of a range of cognitive tasks such as comprehension, learning and reasoning”. A model was suggested based on working memory systems which presupposes the existence of a central executive system controlling the attention systems connected to a number of subsystems. These subsystems are:

Articulatory loop: a kind of “inner voice” that holds and repeats some two seconds’ worth of syllables.

Visuo-spatial sketch pad: the visual equivalent of the articulatory loop, an “inner eye” that hold a small amount of non-verbal data (equivalent in amount to the syllables in the articulatory loop) for processing.

Central executive: the controller of the activity which coordinates the analysis, keeps attention focused on what is relevant (i.e. relates the analysis to the goal being pursued at the time and uses the filter to reject non-relevant material) and handles both the retrieval of information from the long-term memory as required for the analysis and the input of information into the database. (Roger T. Bell, 2001:233)

In the process of SI, listening and concurrent speaking apparently prevent the phonological loop from working properly, impeding the normal functioning of the working memory for auditory verbal material, hence the difficulty of concurrent speaking and listening for interpreters arise.

The third phase—long-term memory, a depository of information in its real

sense, has a huge capacity holding information for quite a long time even forever. Researchers found that the capacity of long-term memory is likely to be increased by rehearsal or recoding, facilitating the training of the students majoring in interpretation who, in other words might well develop their processing abilities by practicing speaking. This helps answer the question why the experienced interpreters are more able to cope with the tough work than the student trainees. All the processed information in the memory system, the knowledge on the world, is stored in it providing an encyclopedic knowledge base for various activities so that the competence is enhanced in language learning and practicing, as well as in the performance of reasoning and problem-solving. Tulving and Donaldson, the Canadian psychologists (1972) maintain that long-term memory comprises two sub-systems, episodic memory and semantic memory. The former receives and stores situations and events in a given time of individuals, as well as connection of the given time and space while the latter refers to the indispensable memory during language learning. Considered a mental lexicology containing the systematic knowledge accumulation of words, phrases, language signs, formulas and their interrelations, the long-term memory requires predominantly semantic memory in SI. The growing significance of long-term memory is clearly reflected in message perception, comprehension, transference and delivery.

In the SI process, short-term memory retains temporarily in-coming information to allow it to be transferred into the more stable, potentially permanent long-term memory. In an attempt to better learn new information, Shiffrin(1977) proposed several control processes defined as strategies to facilitate the acquisition and retrieval of knowledge, including rehearsal, coding and imaging.

Rehearsal: the repetition of information, either aloud or silently over and over until it is learned.

Coding: the attempt made by human brain to put the selected information in the context of easily retrievable information, like the fact that the acronym “IAEA” is remembered effortlessly instead of “International Atomic Energy Agency”.

Imaging: creating visual images to remember verbal information.

Access to long-term memory is mediated by retrieval cues temporarily activated in working memory. Storage of these retrieval cues is also consistent with the capacity limits of working memory, in other words, short-term memory is the prerequisite of long-term memory. Certain methods are adopted so that retrieval cues to the integrated representation of the text might be maintained in working memory, which consists of several types of buffers. A direct approach to determine how these cues are stored is to selectively interfere with a buffer by forcing subjects to perform an additional task concurrently with text comprehension. To interfere with the articulatory loop, researchers might ask subjects to vocalize some unrelated verbalization during reading. Baddeley(1986) has found that the articulatory loop is not particularly by skilled readers for text comprehension; rather it is used as a supplement to rid them of incomprehension of those obscure texts.

Long-term memory remains a significant factor in the process of SI as it involves both linguistics and non-linguistics elements. Experiments proved that man is more likely to solve a problem if they have relevant background knowledge. The same is true when it comes to relating relevant existing knowledge to the given situation and applying it to the unknown challenge. This is supported by the fact that many interpreters tend to obtain materials ahead of time for preparation and inspect the venue the day before so that they will store the materials and venue to their long-term memory to facilitate their task. Of course, non-linguistics factors such as personal traits and cultural factors have their due impact on SI, not to mention interpreters’ psychological and professional conditions, political orientation as well

as ethical background. Therefore, an all-round understanding of these factors will definitely help illustrate the complicated nature of SI process.

2.4.2 Attention in SI Brain Operation

The concept of “attention” is widely used in cognitive science. “Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration, of consciousness is of its essence.” (Reed, 1988: 35) Broadbent (1958) holds that in the process of cognitive process, the tremendous information from the outside world is in contrast with the limited processing capacity of human’s brain, hence forming a bottleneck. To avoid the overloading of the nerve system, the filter is to be adjusted so that certain information could be selected to pass on to the complex analysis phase while the remaining information could be stored in short memory or long memory before being eliminated. SI is a complex process in which attention plays a decisive role. It is hard to imagine an absent-minded person could perform well during the SI task. Here are new models to explain the dual task features of SI process, namely, central resource theory, automatic processing and controlled processing.

2.4.2.1 The Central Resource Theory

Conducting two tasks concurrently is not uncommon in the daily life, such as listening to music while reading and chatting with others while riding a bicycle. But it is rather difficult for a cashier to chat with customers while tallying account. It seems that proficiency and quality of performing the dual tasks depends on whether the two tasks are similar to each other and whether the practitioners are skilled. There is no doubt that practice plays a significant role in performing dual tasks. In 1973, Kahneman proposed “the central resource theory” which suggests that in the mental mechanism of human being, attention appears in the using in certain aspects

of the resources it can maneuver. It also has a close relation with a certain stimulant. When resource is limited, the mental mechanism of human will promptly come up with a counter measure upon the changed amount of resource distribution, which is affected by man's emotion, medication, intentions and working pressure etc. A conclusion could be drawn that man is capable of being engaged in two or more mental activities at the same time so long as the energy they maneuver does not overrun the bottom line. If the energy they allocate overloads the centrum energy, human brain will fail to cope with the tasks. It seems that this theory has provided foundation for Gile's Effort Model.

2.4.2.2 The Automatic Processing and Controlled Processing

Schneider and Schiffrin (1977) proposed another theory of attention for further discussion – the automatic processing and controlled processing. On their influence towards SI, Gile (1995) claims that: "The idea that there is some association between the deterioration of the interpreter's performance". "Subsequent reading in cognitive psychology provided useful information revolving around the concepts of attention and automatic and non-automatic operations, thus establishing a link between Gile's intuitive ideas and some empirical research." (Gile, 1995:161)

Controlled processing, otherwise named non-automatic processing, refers to the processing demanding a great deal of attention and energy, which is of limited capacity and capable of flexible usage in changing circumstances. Less controlled by human's attention, automatic processing is fast achieved without reducing the capacity for performing other tasks. Once it is formed, it will adapt to the fresh environment instead of being subject to random changing. What controlled processing bears is the general meaning of "attention", which needs more energy; what automatic processing conveys is the habitual attention or skill, which consumes less energy.

These theories can explain different phenomena where people can perform two or more than two tasks concurrently. On one hand, human's mental mechanism can focus attention on one point; on the other hand, it can allocate attention to various facets. Whether it is focusing or dispersing, the energy it exerts is, however, within the total available sum of human mental mechanism. In the circumstances when focused attention is needed, mental mechanism will handle it freely with a free-of-trouble performance, as is the case of reading. When doing two tasks that need automatic processing, man can do it well too, like chatting with others while riding a bicycle. Contradictorily, when we try to perform two painful tasks, such as practicing vocality and doing arithmetic homework concurrently, we will be challenged. It is spontaneously inferred that man is unable to deal with two tasks that require controlled processing at the same time. It is hardly possible to dare to explain an SI interpreter's performance when he/she is conducting interpreting – the two complex tasks, i.e. (a) listening and comprehending source language, (b) interpreting, expressing and monitoring target language. The interpreter is under considerable pressure because both tasks they conduct are of controlled processing task consuming enormous energy and effort. Giles holds that “the operations making up interpretation are clearly on the non-automatic side and there is some basis for constructing an interpretation model around this idea of processing capacity limitations.” (Gile, 1995)

Generally speaking, human brain can not fulfill dual-task activity under normal conditions. But in some circumstances, man can streamline some complex operations or formulize the operations to form the systematic skills so that the energy consumed could be kept within the sum of mental mechanism. In the process of SI, the most painstaking problem for interpreter to tackle is the interactive interference between listening and speaking. The solution to this problem would

result in the effortless handling of other problems. The crux of the matter remains how to avoid interference between listening and speaking. “Dichotic listening tasks”, a psychological term, together with other experiments, substantiate that human’s left ear and right ear are born to be able to process information respectively.

In psychology, there is a “dichotic listening tasks” (Gui Shichun, 1985: 31). Together with other experiments, they prove that human’s left ear and right ear can process information respectively. Researchers found these experiments have a close relation with the subjects’ processing ways – it is the right hemisphere’s responsibility to process images, feelings and spatial sense while the left hemisphere deals with the abstract meaning. These experiments shed light on the SI in this way: human’s mental mechanism can operate the listening system of two ears and two hemispheres to make judgment of language information and non-language information, although some interference still exists. This shows practice is one of the efficient methods to make interpreter adapt to the interference between listening and speaking.

2.4.3 Top –down Processing and Bottom- up Processing

Cognitive psychology holds the view that perception process is formed by two categories – top-down processing and bottom-up processing, which are adopted from computer science. David W. Carroll defines bottom-up process below:

“We may now define bottom-up processing as that which proceeds from the lowest level to the highest level of processing in such a way that all of the lower levels of processing operate without influence from the higher levels. That is, the identification of phonemes is not affected by the lexical, syntactic, or discourse levels; the retrieval of words is not affected by syntactic or discourse levels; and so on. But we have some reasons to doubt that a strict bottom-up model will provide a comprehensive account of how we understand language”. “A top-down processing

model states that information at the higher levels may influence processing at the lower levels.” (Carroll, 2000: 53) As top-down processing starts from the objective, general knowledge, anticipation and assumptions play a significant role. The top-down processing is applied during the expectation of the incoming information and thus bears significant meaning in the research on situational context.

Brown and Yule think of the processing of incoming discourse as the combination of at least two activities. “In one part of the processing, we work out the meanings of the words and structure of a sentence and build up a composite meaning for the sentence (bottom-up processing). At the same time, we are predicting, on the basis of the context plus the composite meaning of the sentences already processed what the next sentence is most likely to mean (top-down processing).” (Brown & George Yule, 1983: 234)

It can be concluded that both bottom-up processing and top-down processing are adopted in the process of SI. Bottom-up model claims that the interpreter perceives every phoneme, organizes the perceived phonemes into syllables, then into phrases, clauses, and sentences, helping us build up some composite meaning on the basis of its structure and the meaning of the lexical items involved. On the other hand, a top-down process is also involved to help interpreters anticipate what is likely to come next in the text, which is generated on the basis of discourse context and background. Brown and Yule hold that it is our background knowledge, instead of the first piece of discourse encountered, that comes first when the processing of a discourse fragment starts. Therefore activation of our background knowledge or our previous experience decides the top-down processing, a sound explanation to the fact that a SI interpreter usually cannot handle the speech well if he is not familiar with what he is expected to interpret. This is due to the lack of background knowledge, which imposes the challenge on the interpreter in understanding, making him unable

to anticipate and operate top-down processing.

2.5 Summery

Three models of SI process have been reviewed to give a general scenario of the complexity of the SI performance. Elaborating on different facets of the SI process, they reflect different factors that pose obstacles to interpreters. The information processing model reflects the complexity and difficulty of SI, assuming that SI is a series of step-by-step processes of perception, memory, transcending, expressing and monitoring etc. Interpretative theory gives priority to the comprehension and conceptualization of senses, bearing a special significance for SI training. Gile's Effort Model postulates three Efforts in interpretation with requirement on interpreters' processing capacity. It is not only capable of explaining the performance failure that occurs during SI but also shed light on SI training strategy.

The latter half of this chapter will introduce some cognitive science's contribution to memory mechanism and SI brain operation. The crucial roles that memory and attention play in SI process, based on the findings of the cognitive psychology research, is significant to the SI performance and training.

All of the theories pave the way for the next chapter's memory training strategy and methods in interpreting teaching.

Chapter 3 Memory Training Strategy and Methods

As the international communication requires an increasing number of highly-qualified conference interpreters, we can no longer rely on natural talents alone. Interpretation can be defined as re-expressing in one language what has been expressed in another. At the lowest levels of performance requirements, this function can be fulfilled by persons having a minimum knowledge of the languages involved, with no specific training, but as requirements increase, performance problems may arise: comprehension problems, reformulation problems and technical problems (Gile, 1995). Some of the problems can be solved naturally by seeking to learn more through language training itself or knowledge acquisition in other disciplines, but some cannot. Formal training and practice are needed for reaching top level interpreting performance. In this sense, experience and training are of great importance because they lead to qualitative difference in how the task of simultaneous interpreting is carried out.

3.1 The Importance and Necessity of Memory Training in Simultaneous Interpretation

Gile (Gile, 1995: 3) holds that guidance into interpretation can be useful, “be it for the purpose of developing natural talents when they are present, or for instruction in technical procedures”. He further explains that formal training can perform two important functions: one is to help individuals who wish to become professional interpreters or translators enhance their performance to the full realization of their potential; the other is to help such individuals develop their translation skills more

rapidly than through field experience and self-instruction.

According to Farbbro & Gran's study on cerebral lateralization during intense training in a foreign language in adult age, they find that "training in the use of language and in simultaneous interpreting modifies the cerebral organization", and they suggest that "teachers should realize that not only do students develop linguistic knowledge and skills which will enhance their performance in SI; they also undergo the unconscious process of a cerebral reorganization of linguistic and attentive strategies".

Memory training belongs to the component training of SI training. Given the fact that simultaneous interpreting is an extremely difficult task, experts assures that the acquisition of theses skills will be supported by component training. Component training may change the performance on the whole task, and under some sets of circumstances, it may even be more effective than whole-task training. There are indications that part-task training is more effective than whole-task training with difficult tasks and with low-aptitude or inexperienced students. This is also in line with Gile's Effort Model introduced in Chapter 2

According to Gile's Effort Model, simultaneous training includes three components of Effort—listening and analysis or Comprehension Effort (L), the Production Effort (P) and the Memory Effort (M), plus a Coordination Effort(C).

$$(1) SI = L + P + M + C$$

Besides this, other conditions have to be met:

$$(2) TR = LR + MR + PR + CR$$

TR: total requirements

LR, MR, PR, CR: capacity requirements for L, M, P and C

$$(3) TR < TA$$

$$(4) LR < LA$$

(5) $MR < MA$

(6) $PR < PA$

(7) $CR < CA$

TA: total available processing capacity

LA, MA, PA, CA: capacity available for L, M, P, C

The last four inequalities state that capacity available for each Effort should be sufficient to complete the task. If the other two Efforts like Comprehension Effort and Production effort are sufficient while the Memory effort is not, then failure or problem may arise. Therefore, memory training can help students effectively save energy in Memory Effort so that they can have more capacity to coordinate Comprehension Effort and Production Effort. What's more, according to cognitive science about SI process, the three efforts are also interdependent and connected. In SI process, an interpreter has to perform multi-functions, with the mind under stressful workload. An interpreter resorts to memory for keeping in mind what has been acquired from the Listening process, and then he will extract information from memory and reproduce in target language. Consequently memory serves as the linkage between the processes of Listening and Production. In addition, even in the the processes of Listening and Production themselves, memory also plays its due part. For Listening, memory wakes up the meaning for an incoming word and expression, and it won't make sense until certain grammatical rules or background information can be memorized and recalled. For Production, memory offers corresponding expressions for what's been acquired during Listening and the Production won't be sequential until the reasoning and logic behind the utterance can be memorized. In short, memory works in a continual state of stressfulness during the process of SI, resulting in interpreters' tiredness. As a result, whether memory can be relieved of extreme stress makes a great difference to interpreters'

performance.

3.2 The Basic Strategy of Memory Training: Effort Component training and Process-oriented practice

As we know memory training is very important, then how can we improve the memory capacity in the SI process? In Chapter 2, we have introduced some interpreting process models which not only explains how interpreting operate from different perspectives but also gives some insightful ideas about memory training.

3.2.1 Effort Component training

Daniel Gile's Effort Model, which clearly explains the relationship of Comprehension, Memory and Production, can help us figure out a basic strategy for component training, including memory training.

According to Gile's Effort model, the capacity available for each Effort should respectively suffice the capacity requirements in a successful interpretation process. In this sense, if we want to improve one Effort capacity, we can not cancel the others because each effort is indispensable and well-connected; instead we can reduce the difficulties of the other Efforts to the simplest level, so that we can save more energy to concentrate on the target effort training. For example, if we want to have memory training of SI, the material we dispatch, at first, should be easily understood. The teacher can read slowly to the students so that they don't have to spend more energy for listening and analysis and they are not asked to interpret the whole passage. In this way, comprehension and production capacity requirements have been reduced to a lower level so that students can put more efforts in memorizing. After a period of time, they can effectively deal with memory effort and master skills of memory relief load, and then we can turn to other Efforts' training through increasing the

other Efforts' capacity requirement. This strategy can well explain that why interpreting training needs to be implemented step by step.

3.2.2 Process-oriented Practice

Process-oriented approach is, as defined by Gile(1995:10), to focus in the classroom not on results, that is , not on the end product of the interpretation process, but on the process itself. It means that teacher should introduce to the students some good interpretation principles, methods, and procedures, rather than simply comment on what is "right" and what is "wrong" in the target language versions produced.

By focusing on the process, teachers can be more flexible when they have to comment on results. They can verify that the students have indeed followed certain principles, approach or a process, but need not insist on obtaining a particular result. Compared with the classic result-oriented approach, Gile believes that process-oriented training is a powerful teaching tool during the training.

3.3 The Methods of Memory Training

In fact, the concept of working memory is significant to explain the SI cerebral operation. Cognitive psychologists believe that working memory is a special short-term memory. Different from short-term memory, working memory not only stores information temporally with limited capacity, but has to process and encode the stored information. The dual functions of keeping and processing information in working memory are significant to the SI process. Based on a large number of empirical researches in SI, cognitive psychologists find that the capacity of interpreters' working memory is usually larger than people in other areas. It is a common phenomenon that professional interpreters' performances are better than interpreting trainees. In the experiment, the professionals' working memory

capacities are also larger than that of trainees. Therefore, researchers find that working memory capacity has a great influence on interpreting process. The larger working memory capacity is, the better interpreting performance an interpreter will have. Thus, to improve working memory capacity is vital for simultaneous interpreters. Their studies also show that even though working memory with limited capacity for recourses, can not keep information for long, the capacity is fluctuating all the time. In SI process, the decoding and encoding information simultaneously indeed put high pressure on interpreters for information keeping, but at the same time activate the working memory, and thus improve interpreters' working memory capacity. In this sense, some methods in SI training which can practice keeping and encoding information simultaneously, such as outlining, retelling and visualizing, will be able to effectively improve SI performance through enhancing working memory capacity.

In Chapter 2, we also introduced some cognitive theories about attention in SI process which also bear significance to explain memory working process. In fact, researchers in the experiment also notice that sometimes interpreters at different levels don't differ greatly in working capacity. For this phenomenon, some psychologists believe that even working memory capacity affect the accuracy and efficiency of interpreting process, but the differences of individual interpreting performance sometimes not lie in the interpreters working memory capacity, but in their skills of attention coordination effort in memory resources.

According to cognitive psychology, in the process of SI, listening and concurrent speaking apparently prevent the phonological loop from working properly, impeding the normal functioning of the working memory for auditory verbal material, hence form the articulatory suppression which affect the keeping and recall of the source language information. How to overcome the articulatory suppression and how to effectively distribute memory resources are essential to

improve working memory as well as interpreting performance. Based on this perception, some training methods attempting to coordinate attention and relieve memory load are introduced in memory training process in this paper, such as shadowing, on-line paraphrasing, note-taking and some interpreting strategies.

In conclusion, In SI process, working memory capacity and its coordination effort are complementary to each other. If we want to improve working memory, we must figure out methods not only enhance working memory capacity, but also help students well coordinate attention effort in SI.

3.3.1 Working Memory Capacity Enhancement

Many times we read or listen to discourse with no intention of remembering its content, as when reading a newspaper or listening to a casual conversation. In such instances, our primary cognitive activities are to identify the topic of discourse, tie sentences together, and follow the flow of what is being said. On other occasions, when reading a textbook or listening to a particularly interesting speech, we wish to remember some or all of the passage. Since comprehension and memory are closely related, much of the work needed to remember a passage is accomplished when we understand it well. It has been proposed that our memory for discourse exists on three distinct levels. One level is that of a surface representation, in which we remember the exact words that we encounter. Second, we construct a propositional representation of the discourse, which specifies the meaning apart from the exact words used. These two levels are obviously similar to the corresponding levels in our memory for sentences. Third, we construct a situational model of the discourse, which is a model of the state of affairs in the world as described in the passage.

In SI, the first level, or surface representation, is less likely to be encountered, except for some numbers, names, etc, demanding the function of short-term memory. Differently the second level functions more frequently, in which the necessity for

comprehension prevails. In interpretation, both consecutively and simultaneously, what has been reproduced by interpreters is not the equivalent for the exact words, but for the meaning of the discourse based on comprehension. (Seleskovitch, 1992:35) Specifically for SI, the interpreters are supposed to start interpreting only seconds behind the speaker, hence less time for him to react to the meaning of the original expression. Given such situation, the third level of memory for discourse, namely the situational model, should be given top priority in SI. Unlike the first two models of memory for discourse, featuring repetition of the exact words or reproduction of meanings, situational model represents the state of affairs that a text refers to. That is, the assumption is that as we comprehend the propositions of a text, we construct a mental or situational model of the world as described by the text. So if we give special training on situational model practice, then we can improve the working memory.

3.3.1.1 Visualizing

Visualizing memorization is to visualize what the speaker is saying, for example, to form a picture or certain scenes to accentuate memory. Such pictures and scenes are just called situational models which are built on the basis of special or consequential relationship of contexts and thus acquire the longest time to be remembered. A British psychologist named Frederic C. Bartlett (1998:279) regarded memory as the reconstruction of an image. Here, image refers to perceptual image. The result of experiments showed that the capacity of memory of viewed pictures and image is much larger than that of words and speech. If interpreters can store the information of source speech as a single or a series of situational models rather than just words and sentences, they can memorize relatively more information with fewer symbols. Visualized memorization well comply with the memory process in cognitive science. According to the research of half a century, cognitive scientists

believed that there are three kinds of memory systems: sensory store, short-term store and long-term store. The sensory store refers to the action of “taking in variety of colors, tones, tastes and smells that we experience each day and retain them, for a brief time, in a raw, unanalyzed form.”(Carroll, 2000:47) Sensory stores the sensible information achieved by human being’s sensory organs, but only lasts for a very brief time (0.25-2.0 seconds), therefore interpreters first store and retain words, numbers and some simple sentences in sensory memory, but only for a very short time. But sensory memory tends to be visualized, and what retain in it are the pictures and images instead of “sense” or meaning. That’s why a lot of experiment results showed that the capacity of memory of viewed pictures and image is much larger than of words and speech. Then sensory memory can be converted into working memory and permanent memory by means of attention on memorizing materials and pre-existing experiences. In this sense, visualized memorization can help interpreters increase their memory capacity at the beginning and remember information more complete and longer. It can be illustrated by the following example:

“I was walking in the park with a friend recently, and his cell phone rang, interrupting our conversation. There we were, walking and talking on a beautiful sunny day and –poof—I became invisible, absent from the conversation. The park was filled with people talking on their cell phones. They were passing other people without looking at them, saying hello, noticing their babies or stopping to pet their puppies. Evidently, the untethered electronic voice is preferable to human contact.”
(Wang Yan,2004: 151)

When memorizing the information or sense of this paragraph, if the interpreter can visualize an image that I was walking with a friend on conversation which suddenly was interrupted by cell phone, then I looked around to see that the park was

full of people talking on the phone, then the interpreter just turned a complicated description into a vivid and familiar scenario so as to build a situational model, his memory will be strengthened and be beneficial to the later stage. In fact, visualized memorization can also activate experience stored in long-term memory by source speech and make it work and interact with the newly received information in working memory to achieve the aim of better memorization.

3.3.1.2 Chunking, Outlining and Retelling

Experiments in cognitive psychology prove that chunked information will be retained longer than those un-chunked bits of information. In fact, the processing function of working memory is used to organize the words into constituents and there is a limit for working memory, generally people can store 7 plus or minus 2 chunks and last for about one minute, however, easily to be disturbed. To chunk in interpreting means to reorganize the information by meaning groups contained in the messages of the speech rather than by phrases or syntax. Therefore, Chunking in interpreting is a process during which interpreters actively analyze, summarize and reorganize the messages of the speech. The external representation of chunking is to extract the key words from various layers of senses. The key words can either from the original speech or generated by interpreters to best summarize the intended meaning of a specific layer. In doing so, the memorization of a whole paragraph becomes the memorization of several key words. Therefore, Chunking is proved as an effective way to enlarge the working capacity in interpreting because it allows interpreters to handle more information at one time by recoding the information held in STM with the activation of relevant information in LTM to form new meaningful larger units of information that are familiar to interpreters.

However, the collective use of key words cannot represent full message intended in the speech since there do exist logical links between different layers of

meaning as between different chunks. Interpreters must, therefore, search for or generate the logical links during the chunking process besides extracting or generating the key words of messages. Key words are the pearls in a memory necklace while logical links are the thread that links the pearls. Together, they form the meaning structure of the full messages contained in speech. During the memorizing stage, interpreters mainly memorize the key words and logical links while in the recalling stage, they have to reactivate them as the correspondent clues of the speech and then make out the sense of the speech they are going to interpret. As for how to accelerate the processing speed of STM in the working memory, an effective method is to accelerate the retrieval of relevant information stored in LTM to help process the stimuli entering STM. As we know information stored in STM is in a passive state most of the time, we have to reactivate the relevant information if we want to extract it. The speed of reactivation is in proportion with the familiarity of the incoming stimuli or recognition of the words to be more specific. The speed of recognition is in fact the speed of reactivation the relevant knowledge of the words from LTM. In other words, if the incoming words are among the frequently used words stored in our LTM vocabulary, the reactivation speed will soar and the processing speed will be accelerated to a larger extent.

In this sense, outlining, compared to chunking practice, not only can train interpreters to pick key words and form meaningful chunks, but also enable them to grasp the right logic links of the original passage. What's more, interpreters can also learn how to fast activate relevant information in long-term memory so that all the information can be completely generalized and included.

Based on the practice of chunking and outlining, we can advance the practice into the retelling stage, in which students are required to retell the whole passage in source language with clear thesis statement and details as much as possible. This can

fully tap the potential of working memory from the meaning groups, logical links as well as the passage structure. What's more, in this practice, students will also be trained to employ meaning-based strategy in their interpretation, just as the interpretive theory introduced in Chapter 2 indicates that interpreting is not word-to-word matching process and "sense" is decisive.

For example, we can read a passage to interpreter trainee:

近年来中国网络产业急速发展。据中国因特网信息中心的统计数据，中国的公共网络已覆盖 365 个城市，上网电脑达 520 万台，经常上网者达 1260 万人以上，网址有 23000 个。估计两年以后，中国的网民人数将跃居全球第二，仅次于美国。

然而，这个快速发展的产业出现了一些问题，其中大部分问题产生的原因是因为中国在准备不足的情况下飞速越入了这个信息时代，遇到的问题涉及到网络服务、网络信息、电子商务等。

为了促进中国网络产业快速而健康的发展，我们必须采取一些恰当的措施。我在这里提一些建议，供各位参考。

首先，中国应该对国内和国外因特网市场的发展情况、网络投资政策以及反托拉斯政策进行研究。第二，政府应该尽快起草有关电信、网络投资和服务收费等方面的法规。第三，中国网络公司应该尽快在国内上市。我国的网络投资者往往把资金分别投在不同的公司上，我认为他们应该集中投资，使公司具备更强的金融能力。（高级口译教程：328）

After listening to the passage once, the trainees are required to select the key words of the passage and then give a title, such as "中国网络产业的发展、问题与对策". Then the teacher can read the passage again and this time the students are asked to outline the passage, for example: "中国网络产业发展迅速，但出现一些问题，主要是因为中国进入信息时代的准备尚不充分，为此我们必须采取一些措施，例如：政策研究、法规制定和推动网络公司上市等。" If the students can

successfully summarize the main idea, it demonstrate that they can understand it well, then the teacher can read the passage again, and ask students to retell the passage in their own words based on the outline, with details as much as possible. As the previous paragraphs have clearly explained that memory training should be a process-oriented training, the teacher should help students shift attention from comments of results to whether they have followed certain good principles and strategies , so that students can gradually form the awareness that interpreting is not word-to word match and “sense” is decisive.

3.3.1.3 Brainstorm and Anticipation

Anticipation in SI refers to the process of anticipating and inferring from possibly appearing information of source language and interpreting it into target language. It is the interpreter’s reaction of pre-inputting and processing to the existent linguistic and nonlinguistic stimuli. Normally speaking, as Daniel Gile indicated in 1995, anticipation in SI can be classified into two categories: linguistic anticipation and extra-linguistic anticipation. (Gile, 1995: 176) The former one is generated by interpreters based on the language rules of the source language and the target languages so that the uncertainty can be reduced in transition from one speech segment to the next, while extra-linguistic anticipation refers to “some knowledge of the plausibility of the speakers reacting or speaking in a particular context or situation”. (Gile, 1995:178). We have previously mentioned that an effective method to accelerate the processing speed of STM in the working memory is to accelerate the retrieval of relevant information stored in LTM to help process the stimuli entering STM. In fact, the strategy of anticipation is just to activate the information in the LTS to enhance working memory capacity and relieve memory burden and strain especially when the two languages have totally different word orders and syntactic structures such as English –Chinese.

One convenient method to train the skill of anticipation is to brainstorm. We can select one topic such as environmental protection for students and require them to anticipate what the speaker may say. The students may think of the related background knowledge on this topic: such as climate change, water pollution, Kyoto Protocol, emission trading, etc. What's more, they can also brainstorm frequently-used words on this topic, such as greenhouse gases, emission reduction targets, climate control regime, carbon, etc. In this way, brainstorm just activates the LTS of interpreter trainees so that they can save their memory effort in interpreting. Of course, the precondition of good anticipation is that the interpreter must be familiar with the background knowledge and a sound preparation is necessary before interpreting.

3.3.2 Attention Coordination Effort

Generally speaking, human brain can not fulfill dual-task activity under normal condition. But in some cases, man can streamline some complex operations or formulize the operations to form the systematic skills so that the energy consumed could be kept within the mental mechanism. In the process of SI, the most painstaking problem for interpreter to tackle is the interactive interference between listening and speaking. The solution to this problem would result in the effortless handling of other problems. The core of the problem remains how to avoid interference between listening and speaking, which we usually call "articulatory loop".

In Chapter 2, as we introduce the cognitive science, we mention a psychological term "dichotic listening tasks" which substantiate that human's left ear and right ear are born to be able to process information respectively: the right hemisphere's responsibility to process images, feelings and spatial sense while the left hemisphere deals with the synthetically abstract meaning. These experiments indicate that

human's mental mechanism can use listening systems to make judgment of language information and non-language information, although some interference still exists. This shows that practice is one of the efficient methods to make interpreter adapt to the interference between listening and speaking.

In Chapter 2, we also introduce some cognitive theories about attention. As a matter of fact, interpreters have to distribute their attentions into different tasks, such as comprehension of the source language, searching information from long-term memory and restore information to working memory and short memory, decoding informing, expressing in the target language and the coordination of the above efforts. Therefore, making a sound distribution of attention to different tasks seems significant to interpreters. However, it is hardly possible to make a quantitative research towards how much attention is supposed to be distributed to a certain task. What we can do is to come up with a system to better train interpreting students by approaching the interpreters' performance so that the students are better accustomed to two complex mental activities occurring at the same time. To achieve this goal, the following exercises are among the efficient ones: shadowing exercise, on-line paraphrasing, note-taking as well as some interpreting skills.

3.3.2.1 Shadowing

Shadowing exercise requires trainees to repeat and parrot what he hears exactly at a 2-3 second time lag in an incessant flow. In this exercise, listening, comprehension, memory, rehearsal and monitoring effort are all mobilized to make trainees of SI have the first touch with distribution of attention.

When students are accustomed to the initial exercise, then they can advance into the second level—backwards counting while shadowing. This exercise requires trainees to count backwards, say, from 100 to 0 on paper, while listening to a speech or dialogue at the same time. If we intend to increase the attention-split difficulty, we

can ask them to count from 100, 97, 94, 91... or even other number sequences. For a period of training, students will gradually adapt to speaking and listening with such kind of interference.

3.3.2.2 On-line Paraphrasing

However, some experts believe that shadowing exercise omits the active analysis of the speech input in SI, because interpreting is not passive repetition process, but also involves in comprehension and reproduction. Therefore, some teachers require the students to rehearsal what they have heard after shadowing the speech. This exercise is more challenging than pure language shadowing because it sets up a distracting obstacle for trainees and forces them to distribute their attention to performing comprehension task at the same time.

In fact, on-line paraphrasing is also an efficient way to train students to focus on comprehension while practicing concurrent speaking and listening. In Moser-Merger's words (1994:60), "oral paraphrasing of a message received is commonly used to develop trainees' language competence, accuracy, speed of comprehension and production and the ability to listen and speak simultaneously."

Paraphrasing is the restatement of a text or utterance, giving the same meaning in another form. It is the expression of what someone has written or said in another, possibly clearer or more comprehensible way. On-line-paraphrasing, actually refers to the restatement of utterance while listening simultaneously.

According to De Groot (1997:52) in his book *The Cognitive study of Translation and Interpretation: Three Approaches*, paraphrasing involves "the conversation of a message expressed in a given language into an equivalent message in the same language but worded differently". He notes that the person producing the paraphrasing does so on-line (simultaneously); the demands of the paraphrasing task appear very similar to those of simultaneous interpretation. Not only do the two tasks

share the requirement of simultaneous comprehension and production of speech, but, unlike shadowing, they also both require a “translation act”, an act of recoding the same content in a different form. Indeed, simultaneous interpretation and paraphrasing are occasionally referred to as “inter-language paraphrasing” and “intra-language translation” respectively (Malakoff & Hakuta, cited in De Groot 1997). In one way, translation may be expected to be more difficult than paraphrasing. Only the former involves the simultaneous engagement of two language systems.

3.3.2.3 Note-taking

Note-taking is a basic skill which is of utmost significance to aspirant interpreters. Even though note-taking is widely used in consecutive interpreting, it is rarely employed in simultaneous interpreting because it will undoubtedly bring more burdens to interpreter’s already stressed mental capacity. However, note-taking practice is still important in simultaneous interpreters’ training, for this practice can effectively practice working memory and attention-split effort. In note-taking, interpreters try to put down the key words of a speech with simple symbols and words at very fast speed, so that they can effectively form the chunk groups and activate their working memory capacity. In this process, taking notes also diverts attention and interferes with listening to set obstacles for interpreters.

On the other hand, note-taking sometimes can also help interpreters to relieve memory load in SI. When confronting with a long series of figures, one can hardly have time to remember the figures correctly in SI. Therefore, interpreters sometimes need to take a very short note or ask their coworkers who sit besides them to render help when necessary at the risk of missing other items of information that come before or after those written down.

3.3.2.4 Interpreting skills for memory load relief

In SI, in order to well coordinate attention effort, we have to use some interpreting skills to relieve memory load, such as the principle of linearity and simplification.

We first take linearity for example. “Linearity” which is just to follow original sentences, may be the most important interpreting skill in SI training. It refers to the practice that interpreter will chop sentences into meaning groups, then add or adjust some words or use some conjunctions to link the meaning groups following their original order and interpret its meaning. In translation, people begin to translate after fully understand the whole sentences, because expressions and syntax differ greatly between Chinese and English. However, a simultaneous interpreter usually can not wait to start interpreting until they finish listening to the whole sentence. They have to reduce the time lag so that they can follow the speaker closely. Therefore, if they can master the skill of following original sentences, they can listen to some meaning groups, and then interpret it without necessity of storing information for the following part. In this way, they can effectively relieve the memory load so that they can coordinate their interpreting efforts well. We can see some examples as follows:

“We also grieve for the loss of journalists and others killed in Iraq and for Iraqi civilians and many of those conscript Iraqi troops forced into the front line. If the forecasts of mass carnage proved thankfully wrong, nonetheless, innocent people died along with the guilty and it places upon us a special and profound responsibility for Iraq’s future.”

In translation, we translated like this “ 我们也为失去记者和其他死于伊拉克的人感到悲伤，为伊拉克平民和那些被伊拉克军队强迫上前线的义务兵感到悲伤。即使有关大规模杀伤性武器的预测被幸运地证明不存在，但是无辜的人民与有罪者同样丧生，这就把伊拉克的未来这个特殊而又深刻的责任放在了我们的肩膀上。” In this passage, we found that we can not translate some sentences until

we finish the whole one. However, following the “linearity”, we can chop the sentences into different meaning groups like this:

Original Sentence	Interpretation following “linearity”
We also grieve for the loss of journalists and others killed in Iraq and for Iraqi civilians and many of those conscript Iraqi troops forced into the front line.	我们也感到悲伤 为失去记者 和其他死于伊拉克的人悲伤 为伊拉克平民 和许多义务兵悲伤 他们被伊拉克军队 强迫上了前线。
If the forecasts of mass carnage proved thankfully wrong, nonetheless, innocent people died along with the guilty and it places upon us a special and profound responsibility for Iraq’s future	如果预测中的 大规模杀伤性武器 被幸运地证明不存在 那也有无辜的人丧生 与有罪者同去 这就给了我们 一个特殊而又深刻的责任 要为伊拉克的未来负责。

Besides linearity, simplification is also an important skill in SI. Simplification refers to a summarizing or explaining skill employed by interpreters when meeting some complicated information or some names of places or conferences. For example, in a speech on the Asia-Pacific Seminar on Regional Follow-up to the Second World Assembly on Ageing, there is a sentence like this: “ Finally, I would like to thank you again for the Asia-Pacific Seminar on Regional Follow-up to the Second World Assembly on Ageing.” Since this is a conclusion sentence, and the name of the conference is the known knowledge for the audience, it is acceptable for the

interpreter to say “最后我再次感谢各位参加此次会议” instead of interpreting the full name of the conference like “最后我再次感谢各位参加第二届老年人口大会亚太地区后续会议”. Through such simplification, the interpreter can save much energy to prepare for the next sentence.

3.4 Summery

Based on the previous chapters' theoretical analysis on SI process, this chapter begins to explore some training methods for interpreting training. Since memory is the crux of interpreting performance, the author focuses on memory training for interpreting teaching.

First, the author proposed a basic strategy for interpreting: shift training attention to component training and process-oriented practice. Then, with the theories of memory mechanism in SI process on the cognitive science, the author comes to a conclusion that working memory capacity and attention coordination effort are significant for SI memory improvement. Under the two categories, some training methods are discussed with theoretical support, such as visualizing practice to activate sensory memory, chunking to activate working memory and anticipation to activate long-term store, shadowing and on-line-paraphrasing to practice attention-split, note-taking and interpreting skills for memory load relief.

Chapter 4 Conclusion

Interpreting is a complicated psycholinguistic process consisting of some interactive stages and a lot of related researches have been carried out in this area and relevant theories have been proposed by many scholars. In order to explain the interpreting process, three models were established, namely Information Processing Model, Interpretive Model and the Effort Model. The first model focuses on the information processing procedure in interpreting and analyzes how the information is perceived, encoded, stored, retrieved and used in interpreting. The second model ground the study on the research of meaning transferring in interpretation instead of on the linguistic level. It emphasizes that what is to be interpreted should be the meaning rather than the language itself. The third model, analyzing the three efforts in interpretation, namely Listening and Analysis Effort, Memory Effort and Production Effort, to explain the difficulty and efforts of SI process. In addition to the three models, cognitive science explains the operation of human memory mechanism and SI brain operation which also shed light on the SI teaching.

Based on the theoretical foundation of SI process and memory mechanism, the author, indicating the importance of memory training, proposed Effort component-oriented and Process-oriented strategies according to Gile's Effort Model as well as some methods from the perspective of cognitive psychology (See Table 4.1).

Table 4.1: Memory Training Methods

	Exercise I	Exercise II	Exercise III	Exercise IV
Working Memory Capacity Enhancement	Visualizing Memory: activating sensory memory by visualizing images.	Chunking, outlining and retelling: Activating working memory by forming meaning groups	Brainstorm: an exercise for anticipation skill to activate long-term store.	
Attention Coordination Effort	Shadowing: attention-split training	On-line Paraphrasing: restatement of text while listening	Note-taking: attention coordination training as well as memory relief training	Interpreting Skills: Linearity and Simplification for memory relief

Due to increasingly frequent international exchanges in the field of politics, economy and culture, interpreting, as a career, is flourishing. Many language learners show great interest in taking training in this area and professional exams, at least three at the national level, are carried out every year. However, many interpreting books which provide some guidance and a large number of exercise passages to the trainees, rarely tap the theoretical foundation of these training. This paper probes into interpreting skills from the prospective of interpreting process and memory mechanism, systematically list some training strategies and methods, with the hope that interpreter trainees can acquire a clearer understating on these skills to make progress in their training. However, the limitation of the paper is that it only focuses on memory training in SI, but does not mention trainings of other efforts:

Comprehension and Production Effort. Besides this, it lacks quantitative research so that it can not measure how much these methods will affect the students' training progress. It is expected that the future research could make up for the demerits of the paper.

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Acknowledgements

I avail myself of this opportunity to express my heartfelt gratitude to all those who have given a lot of help and support in my preparation of this thesis. Without them, this thesis would not be possible.

Firstly, I am sincerely indebted to my supervisor, Prof. Cui Yonglu, for his valuable comments and suggestions on every draft of the paper. He has assisted considerably in shaping and strengthening the focus and in pointing out errors and inaccuracies.

My warm thanks also go to Prof. Lü Shisheng, Prof. Wang Chuanying, and Prof Luan Haiyan, whose inspiring lectures on interpretation are of great help to my thesis.

I am also grateful to those professors and teachers who have spent precious time in finishing my thesis. Their critical comments will be of great benefit to me in the improvement of this thesis and in my later years of academic research.

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