Phonological Memory and Other Contributing Factors Affecting Listening Comprehension of Japanese Learners of English

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Chapter 1

Introduction

Recently, globalization in various fields has advanced and the information technology revolution has progressed remarkably. Thus, there is a strong demand for learners in Japan to acquire communication abilities in English as the common international language. In response to this demand, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) established an Action Plan to Cultivate “Japanese with English Abilities” in 2003. The action plan aims to achieve two goals. The first goal requires all Japanese nationals to be able to communicate in English upon graduation from junior high school and senior high school. The second goal requires those employed in specialized fields and those active in international society to be able to use English in their work upon graduating from university. In both aims, communication in English and practical use of English are highly emphasized. In this day and age, English is one of the essential skills to acquire in living as a member of the international society, more than a mere subject to study at school.

1.1 Focus

In line with the action plan, the listening comprehension section was first included in the National Center for University Entrance Examinations test in 2006. Its introduction has impacted English language teachers in Japan and has been expected to affect the way English language teachers develop their students’ listening comprehension ability. For one, shadowing practice has attracted increasing attention from English language teachers. As a result, the practice has gradually been adopted in English language classes. According to Tamai (2005), “Shadowing is an act or task of listening which the learner tracks the heard speech and repeats it as exactly as possible while listening attentively to the in-coming speech” (p. 34). Although shadowing was once regarded as one of the trainings which aimed to develop simultaneous
interpreters’ listening skill, it is now considered one of the common practices for Japanese learners of English to develop their listening skill. This may be a change which can be observed in English language pedagogy.

In addition, a new teaching guideline of MEXT for teaching English at secondary schools calls for high school English classes to be taught primarily in English from the academic year beginning in April 2013. Even though complicated explanations such as those about grammar may still be provided in Japanese, the aim of this drive is to enhance students’ communication skills in English, especially listening and speaking. This shift is quite reasonable because, for a long time, English language teachers in Japan have given priority to reading and writing. Greater emphasis should be put on listening and speaking in the future. Moreover, under the guideline, the total number of English words to be taught at junior and senior high school will be increased from 2,200 to about 3,000. The words are considered to provide Japanese learners of English with the vocabulary needed to communicate with people abroad. It cannot be overemphasized that a strong vocabulary is of great importance in foreign language learning. The aim of this drive is also to help enhance students’ communication skills in English. These changes are drastic, but if English language teachers are to perform their job and increase students’ ability to function as members of the international society, they should be welcomed.

The changes mentioned above aim at learners’ acquiring comprehensive communication abilities in “listening”, “speaking”, “reading”, and “writing” with a chief focus on listening and speaking. As far as listening and speaking are concerned, listening is indispensable in that speaking comes largely from listening. Regarding this connection, Rivers (1981) states that “Speaking does not of itself constitute communication unless what is being said is comprehended by another person” (p. 151). She also states that “Teaching the comprehension of spoken language is of primary importance if the communication aim is to be achieved” (p. 151). What is important, especially from this point of view, is that listening offers the key to be able to speak. Listening is the basis of speaking. As a natural consequence, priority should be given to listening comprehension and serious efforts should be made to develop listening comprehension ability of
Japanese learners of English from now on.

As far as the role and the process of listening comprehension are concerned, we cannot avoid taking reading comprehension into account. Reading comprehension plays an important role in gaining information literally, just as listening comprehension does verbally. The process of listening comprehension often seems to be related to reading comprehension. However, Japanese learners of English as a foreign language often find it more difficult to listen to English than to read it. A crucial difference lies between the skills of listening and reading. In listening, information is conveyed by a stream of speech sounds, whereas, in reading, by a string of letters. Spoken language is very different from written language in that written letters remain unchanged, but speech sounds gradually decay over time. In reading, readers can go over the text at their own pace. Listeners generally do not have the chance to do so in listening. According to Rubin (1995), listening is considered to be demanding since second/foreign language learners must retain information in short-term memory while they are trying to understand the information. It is clear that short-term memory and listening comprehension are closely related to each other in foreign language learning.

Furthermore, Japanese learners of English often fail to follow English spoken at a normal speed, which they can understand if they read it at leisure. When it comes to the process of aural comprehension, we cannot avoid taking into consideration two temporal factors: rate of speech and pauses. Chapter 2 will briefly overview the related literature on the effects of short-term memory span, speech rate and pausing on listening comprehension.

The purpose of this thesis is to investigate how phonological memory and other contributing factors affect listening comprehension of Japanese learners of English. The definition of phonological memory should be provided here. Phonological memory is roughly defined as auditory short-term memory for different types of verbal input. Call (1985) examined the relationship between auditory short-term memory and listening comprehension with 41 English as a Second Language (ESL) students. She tested short-term memory for various types of auditory input which appeared to be related to listening comprehension. They were memory for (a)
sentences in context, (b) isolated sentences, (c) random words, (d) random digits, and (e) musical tones. Memory for (a) sentences in context, (b) isolated sentences, and (c) random words were defined as speech-processing memory, while memory for (d) random digits and (e) musical tones were defined as primary memory, following the research of Cook (1977). Speech-processing memory is the ability to retain verbal input with meaning, whereas primary memory is the ability to retrain verbal input with no meaning. In this thesis, learners’ speech-processing memory is measured by the ability to repeat English, that is, the ability to repeat meaningful input. On the other hand, learners’ primary memory is measured by the ability to repeat verbal input with no meaning, also referred to as the ability to repeat meaningless input. Both linguistic short-term memory, which is determined by learners’ ability to repeat meaningful input, and nonlinguistic short-term memory, which is determined by learners’ ability to repeat meaningless input, are generically defined as phonological memory.

As mentioned earlier, this thesis mainly aims to explore the relationship between phonological memory and listening comprehension. What should be noted here is that phonological memory span (i.e., the capacity of the phonological loop of working memory) is determined by how fast listeners can repeat verbal input. The phonological loop, one of the components of working memory proposed by Baddeley and Hitch (1974), is considered to deal with sound or phonological information. The key to understanding the capacity of the phonological loop is that it has a time constraint. The capacity of the loop is not limited by a fixed number of verbal items, but rather by how much a listener can pronounce in approximately 2 seconds (Baddeley, Thomson, & Buchanan, 1975; Schweickert & Boruff, 1986). In other words, the size of memory span is dependent on (subvocal) rehearsal speed, which will be discussed in detail in Chapter 4. Although some studies have been done in regard to the relationship between the former concept of short-term memory and listening comprehension, very little research has been conducted on the effects of memory span coupled with the effects of speech rate and pausing on listening comprehension in the area of English as a Foreign Language (EFL) learning, based on the concept of the phonological loop of working memory.
This thesis also aims to investigate how other contributing factors affect listening comprehension of Japanese learners of English. Other contributing factors, which are assumed to affect learners' listening comprehension, are lexical and grammatical knowledge, reading comprehension, articulation speeds for Japanese and English words, ability to repeat English (i.e., the ability to repeat verbal input in English), short-term memory for digit memory span, reading rate, and reading efficiency. Lexical and grammatical knowledge and reading comprehension are considered to be the knowledge aspect of English in the Japanese EFL learning environment. They are generally measured by a written test. A number of studies to date have reported on the relationship between written tests, which commonly include vocabulary/grammar and reading comprehension sections, and listening comprehension tests. These studies will be discussed in detail in Chapter 3. This thesis is aimed at reconsidering how the knowledge aspect of English affects listening comprehension. Articulation speeds for Japanese and English words are regarded as the determinant sub-factors of the ability to repeat verbal input. Since the difficulty of listening comprehension often arises from speech rate, reading rate is another factor which will be clarified in this thesis. Reading efficiency index is defined as the reading rate at which learners can somewhat understand a passage.

1.2 Organization

The present thesis consists of six chapters including this introductory chapter (Chapter 1). In the introduction, the focus of this thesis is explained and the outline of each chapter is presented.

Chapter 2 reviews the related literature on listening comprehension. Component skills in listening and models of listening comprehension are presented first. Then, a brief overview is given of the relevant research on the effects of memory span, speech rate and pausing on listening comprehension. As for the effects of memory span, the importance of memory for linguistic input is greater than that for digits (i.e., nonlinguistic input) (Call, 1985). However, short-term memory as measured by digit memory span is related to listening comprehension (Dunkel et al.,
1989). It seems that nonlinguistic short-term memory somewhat affects listening comprehension as well as linguistic short-term memory. Concerning speech rate and pausing, researchers argue that the perception of auditory input being faster or slower generally arises more from the length and frequency of pauses between sense groups than from the speed of articulation. (Richards, 1983; Rivers, 1981). It appears that pauses at appropriate places facilitate second/foreign language listening comprehension. Moreover, in listening, learners cannot help relying on top-down processing when they cannot follow the fast speech. The importance of developing bottom-up processing is explained.

Chapter 3 first investigates the relationship between listening comprehension and knowledge factors, such as lexical and grammatical knowledge, as these factors are considered to be essential in language comprehension. The chapter also examines the relationship between listening comprehension and two other language skills: speaking and reading. Then, the chapter reviews the literature regarding the transfer of learning from listening to the other language skills: speaking, reading, and writing. Researchers have pointed out that the transfer of learning occurs most positively from listening to the other language skills. The importance of listening practice at the initial stage of foreign language learning is discussed.

Chapter 4 discusses mechanisms associated with listening processes, with a focus placed mainly on the phonological loop of working memory. Today, the concept of working memory has replaced the former concept of short-term memory. The phonological loop, one of the components of working memory, is assumed to play a crucial role during the process of aural comprehension. The chapter discusses the historical shift from the earlier concept of short-term memory to working memory, as well as the capacity of the loop and its functions.

Chapter 5 first formulates eight research questions that the present thesis is going to answer. Then, eight hypotheses are formulated. Next, the chapter reports on three experimental studies which were conducted to examine how phonological memory and other contributing factors affect listening comprehension of Japanese learners of English. Finally, the chapter discusses the results obtained from the experiments in detail. Brief reviews of the studies are described as
follows.

Study 1 made an attempt to explore the relationship between the ability to repeat meaningless input (i.e., rehearsal speed as measured by digit memory span) and listening comprehension ability of Japanese learners of English. Passage sentences or sense-group segments were presented to participants for listening comprehension under three presentation conditions: 1. [−Speed / −Pause], 2. [+Speed / −Pause], and 3. [+Speed / +Pause]. In the first condition, passage sentences were delivered at slow speech rates without any significant pauses between sentences. In the second condition, the same passage sentences were presented at normal speech rates without any significant pauses between sentences, and in the third, at normal speech rates with 2-second pauses between sentences. The study found that listening comprehension performance of learners with high ability to repeat meaningless input was significantly better than that of learners with low ability to repeat meaningless input. It is surmised that learners with high ability to repeat meaningless input can subvocally rehearse faster and they can rehearse longer incoming speech sound sequences than learners with low ability to repeat meaningless input. As a natural consequence, they find it easier to check what they have rehearsed in their mind against their prior knowledge in long-term memory. The study also found that significantly higher comprehension scores were obtained in the third condition than in the first. It is believed that pausing between sense-group segments can help Japanese learners of English better process what they heard because pauses are necessary for searching relevant prior knowledge activated in working memory.

Study 2 aimed to examine factors that might affect listening comprehension of Japanese learners of English. The factors were vocabulary/grammar, reading comprehension, articulation speeds for Japanese and English words, ability to repeat English (i.e., the ability to repeat verbal input in English), short-term memory for digit memory span (i.e., the ability to repeat nonlinguistic verbal input), reading rate, and reading efficiency. The study investigated these factors in first-year students at a Japanese senior high school and made an attempt to explore exactly how they affected listening comprehension of Japanese learners. The study found that
listening comprehension of learners with good short-term memory was significantly better than that of learners with poor short-term memory in cases where their vocabulary/grammar and reading test scores were within the same level. A significant correlation was also observed between the articulation speed for English words and ability to repeat English, and between ability to repeat English and listening comprehension. It is surmised that short-term memory span for digit memory span, which is assumed to be a useful indication of the capacity of the phonological loop (Baddeley, Gathercole, & Papagno, 1998), affects listening comprehension ability. It is also surmised that ability to repeat English is one of the factors that determine listening comprehension ability.

Study 3 aimed to examine factors that explained the development of listening comprehension of Japanese learners of English in an immediate and a delayed test. The factors were vocabulary/grammar, reading comprehension, articulation speeds for Japanese and English words, ability to repeat English, auditory short-term memory for digit memory span, reading rate, and reading efficiency as in Study 2. The study investigated these factors for first-year high school students at two time points; the first time point being at the beginning of the school year and the second being at least six month later. The study attempted to explore how they affected the development of their listening comprehension. Study 2 and Study 3 have found that listening comprehension had significant correlations with vocabulary/grammar, reading comprehension, and ability to repeat English. In comparison between learners whose listening comprehension developed and those whose listening comprehension did not, the former group got significantly higher scores in the vocabulary/grammar, reading comprehension, and ability to repeat English tests in the immediate test, although the listening test score of the latter group was significantly higher than that of the former group. Although a significant development was observed for ability to repeat English, short-term memory measured by digit memory span did not develop in either group. It is surmised that the development of the listening ability of Japanese learners of English can be explained in terms of the knowledge aspect of English such as vocabulary/grammar, reading comprehension as well as the strategic aspect of listening such as
ability to repeat English. It is also surmised that retention for material with meaning such as
ability to repeat English can be improved with practice, whereas retention with no meaning like
digit memory span cannot.

The last chapter reviews the preceding chapters and consolidates findings of the present
thesis and reveals their significance in English language education. After explaining what the
findings of the present thesis imply, it then proposes instructional implications for listening
comprehension and provides a direction of further research.
Chapter 2

Listening Comprehension and Memory and Temporal Factors

This chapter first reviews definition, components, and models of listening comprehension to explain characteristics of second/foreign language listening. Although various sets of components and models have been put forward at present, it still seems difficult to describe what listening comprehension is. While components of listening comprehension are explained, top-down processing and bottom-up processing are discussed. While models of listening comprehension are shown, roles of memory are discussed. Finally, this chapter reviews related literature on memory and temporal factors such as memory span, pausing, and speech rate and discusses how they affect listening comprehension.

2.1 Listening Comprehension Process

This section first presents the definition of listening comprehension to understand what listening comprehension is. It then points out components of listening comprehension and discusses how top-down processing and bottom-up processing work. Finally, it presents listening comprehension models produced by language researchers and discusses how information is processed cognitively.

2.1.1 Definition of Listening Comprehension

The Longman Dictionary of Language and Applied Linguistics (2002) defines the term "listening comprehension" as follows:

the process of understanding speech in a first or second language. The study of listening comprehension processes in second language learning focuses on the role of individual linguistic units (e.g. phonemes, words, grammatical structures) as well as the role of listeners' expectations, the situation and context, background knowledge and the topic. It
therefore includes both top-down processing and bottom-up processing. While traditional approaches to language teaching tended to underemphasize the importance of teaching listening comprehension, more recent approaches emphasize the role of listening in building up language competence and suggest that more attention should be paid to teaching listening in the initial stage of second or foreign language learning. (p. 313)

What is important in the definition is that when the process of listening comprehension is studied, both top-down processing and bottom-up processing should be taken into consideration and that more attention should be directed to teaching listening in the initial stage of foreign language learning.

### 2.1.2 Components of Listening Comprehension

Numerous language researchers have presented sets of components involved in listening to explain what listening comprehension is. Here is an example of a set of component skills proposed by Rost (1991). He points out that the component skills necessary for listening comprehension are:

1. discriminating between sounds
2. recognizing words
3. identifying grammatical groupings of words
4. identifying ‘pragmatic units’ – expressions and sets of utterances which function as whole units to create meaning
5. connecting linguistic cues to paralinguistic cues (intonation and stress) and to nonlinguistic cues (gestures and relevant objects in the situation) in order to construct meaning
6. using background knowledge (what we already know about the context and the form) and context (what has already been said) to predict and then to confirm meaning
7. recalling important words and ideas. (pp. 3–4)
In his statement, the integration of these component skills leads to successful listening. Furthermore, he categorizes these component skills into three skill sets, perception, analysis, and synthesis skills, as shown in Figure 2.1. He regards the integration of these three skill sets as a person’s listening ability.

Other theorists have presented different component skills based on different views. Richards (1983), for example, presents various lists of “micro-skills” for different purposes (p. 228). One list is micro-skills needed in listening to conversational discourse. He points out 33 micro-skills for conversational listening and Ommaggio (1986) reduces them to the following 17 skills:

1. Retain chunks of language of different length in short-term memory
2. Discriminate among distinctive sounds in the target language
3. Recognize stress and rhythmic patterns as well as intonational contours
4. Recognize reduced forms of words
5. Distinguish word boundaries
6. Recognize typical word-order patterns
7. Recognize vocabulary
8. Detect key words such as those identifying topics and ideas
9. Guess meaning from context
10. Recognize grammatical word classes
11. Recognize basic syntactic patterns
12. Recognize cohesive devices
13. Detect sentence constituents, such as subject, verb, object, preposition, and the like
14. Reconstruct and infer situations, goals, and participants
15. Use knowledge of the world to make the foregoing inferences, predict outcomes, and infer links and connections among the parts of the conversation or discourse
16. Detect relations, such as main idea, supporting idea, given versus new information, generalizations, and exemplifications
17. Adjust listening strategies to different kinds of listening purposes (pp. 126-127)

Based in part on the categorization of Rost (1991), Tamai (2005) divides the skills into the following classifications: 1 as a memory retention skill, 2 – 7 as perception skills, 8 – 13 as analysis skills, 14 – 16 as synthesis skills, and 17 as a proper strategic skill. In the classification of Tamai (2005), both perception skills and analysis skills are considered to be adopted in bottom-up processing, whereas synthesis skills are adopted in top-down processing. It seems that successful listeners make use of both top-down processing and bottom-up processing.

2.1.2.1 Top-down vs. Bottom-up Processing

As briefly mentioned in the previous subsection, it is obvious that listeners adopt two types of processing: top-down processing and bottom-up processing. This subsection reviews relevant studies as to whether listeners use "their knowledge of words, syntax, and grammar to work on form (bottom-up)" and then use "their knowledge of the world, situations, and roles of human interaction to focus on meaning (top-down)" or vice versa, and as to "when and how these two interact (i.e., when and how parallel processing takes place)" (Rubin, 1994, p. 210).

Lund (1991) compared listening and reading comprehension of university students of German and provided evidence in support for top-down processing. He found that listeners made misinterpretations on recall protocols and they were able to invent plausible context for
conversations. Based on the findings, he concluded that listeners relied considerably on top-down processing.

VanPatten (1989) reported on how top-down and bottom-up processing relate to language proficiency. He gave narrative passages to university students of Spanish in first-semester, fourth-semester, and third-year conversation courses. Tasks for the study involved: (a) listening for content only, (b) listening for content and a word-final morpheme, (c) listening for content and a separate morpheme, and (d) listening for content and a key lexical item. His study found the effect between student level and task to be significant. In his findings, when learners had trouble directing attention toward both content (i.e., top-down) and form (i.e., bottom-up), doing a task that required attention to form interfered with their comprehension of context. He suggests that when students have difficulty they should focus on meaning, (i.e., top-down processing), first.

Wolff (1987) worked with 12- to 18-year-old German students of English. Wolff found that students seemed to make complimentary use of bottom-up and top-down processes with an easy text. However, they used more top-down processing strategies for the more difficult texts. The result is consistent with those of Vanpatten (1989) discussed above.

In contrast to the findings of the previous two studies, Conrad’s (1985) study showed that as listeners increase in proficiency in the language they rely more on contextual semantic cues (i.e., top-down) than on syntactic or phonological cues (i.e., bottom-up). In her study, three groups were tested: native English-speaking university students, advanced non-native English-speaking university students, and intermediate non-native English-speaking university students. Semantically acceptable responses increased gradually for intermediate, advanced and native groups. On the other hand, responses based on syntactic structure decreased.

Bacon (1992) found that students of Spanish employed more top-down processing with more familiar passages than with less familiar passages. She suggested that listeners used more bottom-up processing, which she regarded as less cognitively demanding on more difficult input. Her conclusions are similar to those of Conrad (1985) discussed above.

It is natural that the results of these studies differed. In these studies, different procedures
and scoring methods were used. Such differences in scoring methods could have lead to the differences in the results. It seems difficult to decide whether listeners use bottom-up processing and then use top-down processing or vice versa.

2.1.2.2 Parallel Processing

O'Malley, Chamot, and Kupper (1989) investigated the mental processes second language learners used in listening comprehension. The learners were intermediate level ESL students with Hispanic backgrounds. The researchers used think-aloud procedures in which learners were interrupted and asked to indicate what they were thinking during their listening comprehension activity. They found that "effective listeners seemed to be listening for large chunks, shifting their attention to individual words only when there was a communication breakdown in comprehension" (p. 429). Thus, there seems to be a cooperative interaction between bottom-up and top-down processing.

As Rost (1991) asserts, listening is not based on the individual skills themselves but based on a coordination of the component skills. In the view of language comprehension, it is important to keep in mind that different types of processing does not occur in a fixed order, but rather, that different types of processing may occur at the same time, or in any convenient sequence (Buck, 2001). Thus, the speech input is considered to be processed in a parallel manner in which both bottom-up processing and top-down processing occur in parallel.

With regard to this standpoint of information processing, Anderson and Lynch (1988) show an interesting model of listening comprehension, as shown in Figure 2.2. In listening comprehension, the listener tries to interpret what the speaker says by using knowledge of the language system; semantic, syntactic, and phonological (i.e., bottom-up processing), as shown at the bottom of the figure. At the same time, the listener attempts to interpret the speech input by making use of schematic knowledge; background knowledge and procedural knowledge (i.e., top-down processing), as shown at the top of the figure.
In summary, in listening comprehension, both top-down processing and bottom-up processing appears to be adopted in a parallel way, though the degree to which type of processing is used differs in accordance with the difficulty of the speech input. The two types of processing interact and complement each other.

When it comes to listening comprehension of Japanese learners of English, however, the development of bottom-up processing seems to be indispensable. Tamai (2005) asserts that Japanese students in the early stage of English learning rely more on top-down strategies simply because they cannot use bottom-up strategies even when they want to. He also asserts that a pedagogical method based on bottom-up strategies should be proposed to aim at the improvement of listening comprehension ability of Japanese learners. He proposes shadowing practice as a pedagogical method to develop listening comprehension ability with a focus on rehearsal speed. The importance of rehearsal speed is discussed in Chapter 4.
2.1.3 Models of Listening Comprehension

The previous section dealt with components of listening comprehension. This section reviews listening comprehension models to explain how speech input is processed. Language researchers proposed various listening comprehension models to date. From among them, three listening models are used here as examples to explain the process of listening comprehension. The first listening comprehension model is by Kohno (1984). His model is mainly based on the concept of Atkinson and Shiffrin (1968), who described human memory as having three constituents: sensory register, short-term memory store, and long-term memory store. The second model is by Nagle and Sanders (1986). They developed a model of adult second language listening comprehension, which was partly based on the concept of working memory proposed by Baddeley and Hitch (1974). The third model, “A general model of (phonological) memory”, was produced by Daro and Fabbro (1994). This listening comprehension model was based on the models and systems proposed by Tulving (1987) and Baddeley (1990).

2.1.3.1 Listening Comprehension Model by Kohno (1984)

Kohno (1984) shows a simple and comprehensible model based on Atkinson and Shiffrin (1968) and other researchers to explain the process of listening comprehension (see Figure 2.3). In his model, the filter device selects one of the sounds that have reached the ears and focuses attention on those particular sounds. The echoic memory, the auditory version of sensory memory, is considered to store the auditory input as it is heard and last only for a few seconds. Echoic memory can be expanded if the input is rehearsed in order to keep it, otherwise it decays. Together the filter device and echoic memory are classified as the preliminary auditory analysis stage. It should be noted here that Kohno maintains that a minimum listening unit is not a phoneme or a word, but a grammatical unit called a tone unit. A tone unit is a minimum meaningful group of words that is quite similar to a phrase. Kohno asserts that auditory input is stored in the form of tone units.
The next stage, the short-term memory stage, analyzes and synthesizes (or predicts and tests) the auditory input with the listener's information processing ability. Analysis by synthesis is considered to be the cognitive stage. Kohno regards it as the primary important stage in listening comprehension. In the short term memory stage, the auditory input is active as long as the listener can rehearse it and the input can be analyzed with the prior relevant knowledge in long-term memory.
The long-term memory stage is the stage in which part of the information in short-term memory is transferred into long-term memory. The better rehearsed and the more analyzed the auditory input is, the more likely it is to be retained in long-term memory.

What is important about Kohno's model is that it stresses "analysis by synthesis" as the primary stage in listening comprehension and attempts to clarify the role of memory in listening comprehension. Considering memory as a significant role in listening comprehension is necessary.

2.1.3.2 Listening Comprehension Model by Nagle and Sanders (1986)

Nagle and Sanders (1986) shows a model of adult second language listening comprehension processing (see Figure 2.4). They also assumes three different types of memory commonly described in the research literature: (a) echoic memory, where the sounds are held very briefly, (b) working memory, where the input is retained for as long as it is rehearsed while the information processing takes place, and (c) long-term memory, where linguistic knowledge and general knowledge are stored.

They suggest that the speech input is held briefly in echoic memory (i.e., Sensory Register in the figure), which catches the sound and passes it to working memory (i.e., STS and EXEC. in the figure). At this stage, affective factors such as interest or motivation may strengthen or weaken the input in accordance with the level of attention. The input is processed in working memory under the control of an executive processor (i.e., EXEC. in the figure). The input is processed via either controlled processes, automatic processes, or any degree of combination between these two types of processes. The information is then analyzed and synthesized with other types of knowledge, such as linguistic, contextual or relevant general knowledge in long-term memory. What should be noted here is that retrieval and inference in the figure do not take place after the information has been stored in long-term memory. Rather, they occur while working memory is active.
A feedback loop relates the information back to the executive processor, where it may be processed again if necessary. Thus, listeners must be able to synthesize the information through speech input with retrieved knowledge and the individual's inference about unfamiliar data. If retrieval and inference about the incoming information do not work well, listeners cannot interpret what the speech input means.

What is particularly useful about this model of the second language listening process is, as Buck (2001) says, that the distinction between controlled and automatic processing is stressed. He adds that while automatic processes are common in efficient language use, controlled processes are more common when performing new skills. As there is a limited amount of

Note: STS = short-term storage; LTS = long-term storage.

Figure 2.4 A model of listening comprehension processing in the adult language learner (Nagle & Sanders, 1986, p. 19)
attention available for controlled processes, when this attention capacity is exceeded, processing will break down.

In language comprehension, the listener may continue to process the speech input by paying attention to the input that is not immediately comprehended. This listening comprehension model implies that the more skillful listeners become, the more automatic processes they use. Making the effective use of the limited attention capacity and memory seems to be the key for Japanese learners of English to become better listeners.

2.1.3.3 Listening Comprehension Model by Daro and Fabbro (1994)

Daro and Fabbro (1994) show a schematic representation of memory based on the models and systems proposed by Tulving (1987) and Baddeley (1990) (see Figure 2.5).
First of all, the input is processed by the working memory system, which can either produce a direct output (5) or further elaborate the incoming information by memorization through episodic memory (1) and hence at least partially through semantic memory (3) and procedural memory (4), or as suggested by Cohen and Squire (1980), by direct processing through procedural memory (2). (Daró & Fabbro, 1994, p. 367)

This model presents the role of working memory and long-term memory, and the model also emphasizes working memory as an important role in listening comprehension.

As second/foreign listening comprehension is complex and difficult to describe, it is quite natural that listening comprehension models discussed here are supported by theories of cognitive psychology.

### 2.2 Difficulties Faced by Japanese Learners of English

Japanese learners of English as a foreign language often find it more difficult to listen to English than to read it. A crucial difference lies between the skills of listening and reading. In listening, information is conveyed by a stream of speech sounds, whereas, in reading, by a string of letters. Spoken language is very different from written language in that written letters remain unchanged, but speech sounds gradually decay over time. Rubin (1995), regarding this connection, states as follows:

For second/foreign language learners, listening is the skill that makes the heaviest processing demands because learners must store information in short-term memory at the same time they are working to understand the information. Whereas in reading learners can go over the text at leisure, they generally do not have the opportunity to do so in listening. (p. 8)

It is clear that short-term memory and listening comprehension are closely related to each other in foreign language learning.

Furthermore, Japanese learners often fail to follow English spoken at a normal speed, which they can understand if they read it at their own pace. When it comes to the process of listening
comprehension, this fact suggests that we cannot avoid taking into consideration two temporal factors: rate of speech and pauses. The next section briefly overviews the related literature on the effects of short-term memory span, speech rate and pausing on listening comprehension.

2.3 Memory and Temporal Factors

This section overviews the related literature on the effects of short-term memory span, speech rate and pausing on listening comprehension. As mentioned above, as far as the listening comprehension process of Japanese learners is concerned, consideration of memory and temporal factors such as short-term memory span, speech rate, and pausing is necessary.

2.3.1 Memory Span

This section reviews previous studies on the relationship between short-term memory span for auditory input and listening comprehension. The relationship is considered to be rather complex. The mutual relation between the two is currently not sufficiently understood, since the memory span was not defined as well as it is today. Rapid progress made in cognitive psychology has revealed that short-term memory has a time constraint. This is the key to understanding the relationship between the two factors. A discussion of this issue will be given in further detail in Chapter 4.

Nevertheless, early studies are of some help in clarifying the link between memory span and target language proficiency. The linkage of the two, as noted by Call (1985), is summarized as follows:

First, memory span for target language input is shorter than for native language input. Second, the amount of target language input that can be successfully processed seems to increase as proficiency in the language increases. A corollary of this finding is that the length of memory span for linguistic input is a good indicator of overall language proficiency. Third, knowledge of target language syntax seems to be an important factor in increasing the amount of linguistic material that can be retained in short-term memory.
Fourth, memory span for random digits, while correlating but weakly with memory span for linguistic data and with language proficiency, seems to be an aspect of short-term memory that is only marginally involved in language processing and is not a good indicator of overall language proficiency. (p. 769)

Call (1985) examined the correlation between auditory short-term memory span and the listening skill with 41 ESL students. “Memory for syntactically arranged words” proved to be the best predictor of listening skill in her series of tests (p. 777). She found that sheer digit memory was less important to comprehension than sentence memory. This result appears quite natural because memory for sentences is more closely related to the target language proficiency than is memory for random digits.

Dunkel, Mishra, and Berliner (1989) investigated the effects of short-term memory span on the encoding of English lecture material. Participants were students taking college freshman English classes. They were native speakers of English and nonnative speakers who were presumably at an advanced level in English. Results indicated that the students who had high short-term memory span correctly recognized significantly more concept information and detailed information than did the students who had low short-term memory ability. In this study, students’ short-term memory was measured based on digit memory span.

The results of the preceding two studies show that although the importance of memory for linguistic input (i.e., linguistic short-term memory) is greater than that for digits, short-term memory as measured by digit memory span (i.e., nonlinguistic short-term memory) is related to aural comprehension.

2.3.2 Speech Rate

This subsection reviews relevant studies on whether or not speech rate is directly or indirectly related to listening comprehension. Speech rate has been regarded as one of the key factors affecting listening comprehension.

It is necessary to begin with an idea of typical speech rates. Pimsler, Hancock, and Furey
(1977) investigated the issue of speech rate and proposed a set of standards as shown in Table 2.1. The table was based on an analysis of the speech rates of 15 French and 15 American news announcers combined with data from previous studies. Information was provided in terms of words per minute (wpm).

Table 2.1

*Standard Speech Rates (Pimsleur, Hancock, & Furey, 1977, p. 31)*

<table>
<thead>
<tr>
<th>Standard Speech Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAST = above 220 wpm</td>
</tr>
<tr>
<td>MODERATELY FAST = 190 to 220 wpm</td>
</tr>
<tr>
<td>AVERAGE = 160 to 190 wpm</td>
</tr>
<tr>
<td>MODERATELY SLOW = 130 to 160 wpm</td>
</tr>
<tr>
<td>SLOW = below 130 wpm</td>
</tr>
</tbody>
</table>

Tauroza and Allison (1990) pointed out that the estimate of English speech rate of Pimsleur et al. (1977) was based on one particular variety of English: that of radio news announcer and they analyzed four different types of situations: (a) conversations, (b) academic lectures, (c) interviews, and (d) radio monologues. It is generally accepted that the most common measure of speech rate is wpm. However, they further investigated syllables per minute, syllables per second, and syllables per word for British speakers for the four text types. One reason behind their detailed study is based on the fact that some words are longer than others, and there are differences in word length among text types. Their findings are summarized by Buck (2001) as shown in Table 2.2.

The native speakers normally have no difficulty in dealing with rates of speech up to about 275-300 wpm as is demonstrated in the L1 compressed speech reviews (e.g., Orr, 1968; Foulke & Sticht, 1969). Machida (1979), examining the relationship between speech rate and listening comprehension in both L1 and L2 languages, indicated that although listening comprehension in
the second language decreased when the speech rate increased, comprehension in the native language increased even when the speech rate increased. These results show that speech rate has little or no influence on listening comprehension in the native language.

Table 2.2

*Average Speech Rates for British English (Tauroza & Allison, 1990) in Buck (2001, p. 39)*

<table>
<thead>
<tr>
<th>Text Type</th>
<th>words/minute</th>
<th>syllables/minute</th>
<th>syllables/second</th>
<th>syllables/word</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Monologues</td>
<td>160</td>
<td>250</td>
<td>4.17</td>
<td>1.6</td>
</tr>
<tr>
<td>Conversations</td>
<td>210</td>
<td>260</td>
<td>4.33</td>
<td>1.3</td>
</tr>
<tr>
<td>Interviews</td>
<td>190</td>
<td>250</td>
<td>4.17</td>
<td>1.3</td>
</tr>
<tr>
<td>Lectures to NNS</td>
<td>140</td>
<td>190</td>
<td>3.17</td>
<td>1.4</td>
</tr>
</tbody>
</table>

As for second/foreign language listening comprehension, the situation is completely different. Ogasawara (1980) studied the effect of speech rate in listening comprehension in foreign language. In his study, speed of speech delivery was shown to be one of the factors which made listening comprehension difficult.

It is generally believed that a slower speech rate would facilitate listening comprehension in learning a foreign language. Despite this general belief that a reduced rate of delivery facilitates listening comprehension, empirical studies have shown contradictory findings.

Griffiths (1990) explored the effects of three speech rates: moderately fast (200 wpm), average (150 wpm), and slow (100 wpm) on listening comprehension. He had a group of lower intermediate nonnative speakers listen to three texts at three different speech rates. His results showed that a moderately fast speech rate resulted in a significant reduction in comprehension, but the participants did not significantly benefit from a slow rate of speech.

Griffiths (1992) reported a similar study with lower intermediate nonnative speakers. The
three speech rates he measured included: slow (127 wpm), average (188 wpm), and fast (250 wpm). The results showed that scores obtained at the slow rate are significantly different from scores at both the average and the fast rates, but the difference between the average and fast rates was not significant.

On the other hand, Blau (1990) found that mechanically reducing the velocity of speech from faster (170 wpm) to slower (145 wpm) did not significantly affect listening comprehension with intermediate- and advanced-level L2 students.

Rader (1991) obtained similar results in the context of Spanish as a second language. Three texts were recorded at the rate of approximately 156 wpm, which was considered to be a normal speed. The speeds of these three texts were slowed down by a computer to approximately 118 wpm (expanded speech by 135 percent) and 105 wpm (expanded speech by 150 percent). Although a difference was found among the overall means across texts for the three word rates, the difference did not reach a statistically significant level. She concluded that the speech expansion did not appear to facilitate the listening comprehension of university students of Spanish.

These four results have shown that even if the speed of delivery is decreased, it does not necessarily help listeners in listening comprehension. This is especially true with high-proficiency learners.

Rubin (1994) states that this conflicting evidence about the effect of speech rate on comprehension may be related to a number of variables such as how proficiency is measured, type of text used, amount of prior knowledge required and so on (p. 200).

2.3.3 Pausing

In Rivers’s (1981) and Richard’s (1983) view, pausing affects our perception of the pace of speech. They argue that the perception of auditory input being faster or slower generally arises more from the length and frequency of pauses between sense groups than from the speed of articulation (Richards, 1983; Rivers, 1981).
Kohno (1981) investigated the effects of pausing on listening comprehension with Japanese learners of English in four series of experiments. The first experiment showed that the length of pausing could be used effectively only by high ability students who got higher scores on an English test and a test of intelligence. In the second experiment, the results suggested that articulation (i.e., pronunciation) time without pause in passage presentation did not affect listening comprehension in a significant way. His results in the experiment also indicated that the frequency of pauses worked more effectively than did pause lengths. The third one demonstrated that the total pausing time was more closely related to listening comprehension scores than was the total utterance time. The forth study compared three kinds of speech: pausing at every word, pausing at every phrase, and normal speech. The scores of listening comprehension resulted in the following order from highest to lowest comprehension: pausing between phrases, normal speech, and pausing between every word. Kohno summarized the results of his experiments as follows:

The length of pauses may decide the time of analysis-by-synthesis or rehearsal time and the frequency of pause may help listeners group the flow of utterance, if pauses are set at some grammatically reasonable places. (p. 392)

Blau (1990) compared the effects of speech rate and pausing on listening comprehension in the second study. Three monologues were recorded in three different ways: (a) at “normal” speed (approximately 200 wpm), (b) slowing them down to approximately 185 wpm by a computer, and (c) with 3-second pauses inserted, which slowed the rate of delivery to approximately 150 wpm. The results showed that, at most proficiency levels, pausing aided auditory comprehension more than mechanical slowing or “normal” rate of delivery. Blau states that “pauses at constituent boundaries” significantly enhance the comprehensibility of aural input (p. 752). In summary, it appears that pauses at appropriate places facilitate second/foreign language listening comprehension.

In this chapter, definition, components, and models of listening comprehension were first discussed. Although there are currently various sets of components and models, it still seems
difficult to describe what listening comprehension is. While components and models of listening comprehension were explained and shown, top-down/bottom-up processing and roles of memory were discussed. The chapter finally reviewed related literature on memory and temporal factors such as memory span, speech rate, and pausing and discussed how they affected listening comprehension.

This chapter dealt with listening comprehension process and roles of short-term memory during the process of listening. A discussion of this issue will be given in further detail in Chapter 4 through the view of working memory and one of its components: the phonological loop.
Chapter 3

Relationships among Listening Comprehension, Knowledge Factors and Other Language Skills

The latter part of the previous chapter reviewed the related literature on memory and temporal factors of listening comprehension and discussed how they affected listening comprehension. This chapter first investigates the relationship between listening comprehension and knowledge factors, such as lexical knowledge and grammatical knowledge, as these factors are considered to be indispensable in language comprehension. This chapter also explores the relationship between listening comprehension and two other language skills: speaking and reading.

The chapter then reviews the literature concerning the transfer of learning from listening to the other language skills: speaking, reading, and writing. Researchers have pointed out that the transfer of learning occurs most positively from listening to the other language skills.

3.1 Knowledge Factors

Studies have been done regarding the relationships between listening comprehension and the other language skills as well as knowledge aspects of English such as vocabulary and grammar (DeMauro, 1992; Irvine, Atai, & Oller, 1974; Whitson, 1972). These studies show strong correlations between listening comprehension and knowledge factors, the other language skills, and general English proficiency. Factor analytic studies suggest listening comprehension is one of the factors that determine general English proficiency (DeMauro, 1992; Hale, Rock, & Jirele, 1989; Swinton & Powers, 1980). These studies can be interpreted as indicating that, although the four language skills are related to each other, listening comprehension seems to play a major role in developing and testing general English proficiency of learners.

Irvine et al. (1974) investigated correlations between listening comprehension, knowledge
factors, and language skills with 159 non-native speakers of English in Iran. They took the Test of English as a Foreign Language (TOEFL), as well as a cloze test and two dictation tests. The results are shown in Table 3.1.

Table 3.1

*Correlations between Listening Comprehension and Other Skills (Irvine et al., 1974)*

<table>
<thead>
<tr>
<th>Listening Comp.</th>
<th>Structure</th>
<th>Vocabulary</th>
<th>Reading Comp.</th>
<th>Written Expression</th>
<th>TOEFL Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening Comp.</td>
<td>.69</td>
<td>.56</td>
<td>.63</td>
<td>.68</td>
<td>.88</td>
</tr>
<tr>
<td>Structure</td>
<td>.64</td>
<td>.57</td>
<td>.65</td>
<td></td>
<td>.85</td>
</tr>
<tr>
<td>Vocabulary</td>
<td></td>
<td>.49</td>
<td>.60</td>
<td></td>
<td>.79</td>
</tr>
<tr>
<td>Reading Comp.</td>
<td></td>
<td></td>
<td>.58</td>
<td></td>
<td>.77</td>
</tr>
<tr>
<td>Written Expression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.85</td>
</tr>
<tr>
<td>TOEFL Total Score</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The results in the table show strong correlations between listening comprehension and knowledge factors such as structure (i.e., grammar) and vocabulary. It also shows strong correlations between listening comprehension and other language skills such as reading and writing.

3.1.1 Lexical Knowledge

This section deals with the relationship between listening comprehension and lexical knowledge. When it comes to considering lexical knowledge in the process of listening comprehension, two main tasks should be kept in mind. They are "identification of words" and "activating knowledge of word meaning" (Rost, 2002, p. 20). When words are recognized, several processes are occurring simultaneously. Rost (2002) summarizes the processes in recognizing words as follows:

1. Words are recognized through the interaction of perceived sound and knowledge of the
likelihood of a word being uttered in a given context.

2. Speech is processed primarily in a sequential fashion, word by word. Recognition of a word achieves two goals:
   - it locates the onset of the immediately following word
   - it provides syntactic and semantic constrains that are used to recognize the immediately following word (in other words, it allows for ‘proactive processing’).

3. Words are accessed by various clues
   - the sounds that begin the word
   - lexical stress

4. Speech is processed in part retrospectively, by the listener holding unrecognized words in a ‘phonological loop’ of a few seconds duration (Baddeley, 1986) while subsequent cues are being processed.

5. A word is recognized when the analysis of its acoustic structure eliminates all candidates but one – in other words, when the listener identifies the most likely or most relevant candidates. (p. 20)

What should be noted here is that although speech is basically processed proactively, it is processed in part retrospectively with the listener retaining unfamiliar words in the phonological loop. In other words, some words are so familiar that listeners do not need to retain their sound image before the interpretation, whereas other words are so unfamiliar that listeners need to retain their sound image for searching relevant prior knowledge. As for learners of English as a foreign language like Japanese students, they often face difficulty in listening comprehension. Foreign language learners must retain unrecognized words in the phonological loop (i.e., auditory short-term memory) while working to understand subsequent input.

Nishino (1992) examined correlations between listening comprehension and six relevant factors: (a) speech perception, (b) recognition of vocabulary, (c) grammatical knowledge, (d) short-term memory, and (e) logical inference. His study employed three types of listening comprehension tests: outline-making, fill-in-the-blanks-type, and dictation tests with 84 Japanese
university students. The results from these tests indicated that vocabulary recognition had the highest correlation with listening comprehension. He maintains that vocabulary recognition is a critical factor for successful listening comprehension of Japanese learners, although background knowledge and speech perception are also good predictors of listening comprehension. This study suggests that listening comprehension may be most facilitated by preparing the learner for better vocabulary recognition. In his study, recognition of vocabulary was measured in terms of the listener's ability to connect the sound of a word with its meaning.

Hirai (1999) studied the relationship between listening and reading rates of Japanese college students and reported that less proficient learners did not recognize words and phrases automatically, so they could not comprehend a stream of speech. He emphasized the importance of word recognition speed for fluent listening.

Yamaguchi (1977) examined the word translation time of an English word presented by a computer as auditory stimulus and found that good listeners can answer more rapidly and with better accuracy than poor listeners in conditions of both high frequency words and low frequency words. Yamaguchi (1999) also examined whether listening comprehension would be improved or not if the word recognition speed increased. She reported that the increased speed of word recognition in listening improved the listening comprehension skill of poor listeners.

The important implications of these studies are that the ability to connect the sound of a word with its meaning is essential in listening comprehension and that enhancing the word recognition speed may be the key to becoming a successful listener.

3.1.2 Grammatical Knowledge

Wall, Clapham, and Alderson (1994) attempted to validate a placement test for ESL course students at university. They investigated correlations between grammatical knowledge, writing, reading comprehension, and listening comprehension to clarify the validity and reliability of the test. Results showed that grammatical knowledge had the highest correlation with listening comprehension.
The above result is congruous with that of Demauro (1992). Table 3.1 shows that structure (i.e., grammar) also had the highest correlation with listening comprehension, compared with other skills except TOEFL total score.

It is quite reasonable to say that grammar and vocabulary, which are regarded as knowledge aspects of the target language, are crucially important in listening comprehension. Without knowledge on what a word means or how a structure works, learners would hardly understand speech input.

3.2 Other Language Skills and Listening Comprehension

As for the four language skills, the listening skill and the reading skill are regarded as receptive skills, whereas the speaking skill and the writing skill are viewed as productive skills. In this section, reading and speaking are discussed because both skills are somewhat connected with the listening skill. Reading has a lot in common with the listening skill in terms of processing input information. Speaking has much to do with the listening skill in that both skills deal with sounds. Writing seems to have the weakest involvement with listening compared with the other two skills.

Table 3.2

Correlations between TOEFL Listening Section and Other Tests (Demauro, 1992)

<table>
<thead>
<tr>
<th></th>
<th>TOEFL Section 1 (Listening Section)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOEFL</td>
<td>Section 1 (Listening Section)</td>
</tr>
<tr>
<td></td>
<td>Section 2 (Structure Section)</td>
</tr>
<tr>
<td></td>
<td>Section 3 (Reading Section)</td>
</tr>
<tr>
<td>TWE</td>
<td></td>
</tr>
<tr>
<td>TSE</td>
<td>Pronunciation</td>
</tr>
<tr>
<td></td>
<td>Grammar</td>
</tr>
<tr>
<td></td>
<td>Fluency</td>
</tr>
<tr>
<td></td>
<td>Overall comprehensibility</td>
</tr>
</tbody>
</table>
Demauro (1992) reported the relationships among the Test of Spoken English (TSE), the Test of Written English (TWE), and the Test of English as a Foreign Language (TOEFL) as shown in Table 3.2.

### 3.2.1 Speaking

According to Table 3.2, the correlation between listening comprehension and speaking (i.e., TSE) is higher than that between listening comprehension and writing (i.e., TWE). This section briefly discusses the relationship between listening and speaking.

Nord (1981) described the normal range of receptive and expressive language abilities by using the illustration below (see Figure 3.1). He compared listening comprehension (i.e., outer circle) with speaking (i.e., inner circle) in terms of range of lexicon and structure, and explained that listening comprehension always embraced a much greater range than speaking.

![Diagram of range for speaking and listening comprehension](image)

**Figure 3.1** Normal range of receptive and expressive language ability (Nord, 1981, p. 70)

As discussed in Chapter 1, what should be kept in mind is that listening offers the key to being able to speak. Listening is the basis of speaking. The receptive skills are considered to be more important than the productive skills particularly at the initial stage of language learning. If listening can be assumed to be an activity in which the listener imitates the speaker with their inner voice by repeating the speaker's voice, it can be said that the listener is always speaking while listening.
3.2.2 Reading

Whether texts are written or spoken, learners need lexical knowledge and grammatical knowledge as their relevant prior knowledge in long-term memory. In the process of understanding information, many similarities exist between listening comprehension and reading comprehension. It is therefore quite natural that listening comprehension and reading comprehension are related to each other.

Spoken language is very different from written language. Buck (2001) points out these three characteristics of speech: (a) speech is encoded in the form of sound; (b) it is linear and takes place in real time, with no chance of review; and (c) it is linguistically different from written language (p. 4). What should be taken from this is that speech is linear and takes place in real time, whereas written language can be reread because the information remains. Some readers read fast and others do not. In general, the reading rate of Japanese learners of English is relatively slow compared to the normal speech rate as shown in Table 2.1. If the person can read texts at the normal speech rate as mentioned earlier, the person might be a fluent listener as well as a good reader. It is interesting to consider the relationship between listening comprehension and reading comprehension in terms of speed.

3.3 Transfer of Learning from Listening to Other Language Skills

A lot of studies have researched into the transfer of learning, which occurs across the four language skills of listening, speaking, reading, and writing as shown in Table 3.3. According to the table, researchers have pointed out that the transfer of learning occurs most positively from the listening skill to the other skills: speaking, reading, and writing. This indicates that focusing on cultivating listening skills will lead to the improvement of the other language skills. Takefuta (1997) also supports the idea that concentrating on listening skills in the early stage of foreign language learning will promote all four language skills. His idea is congruous with the definition of listening comprehension discussed in the previous chapter.
Table 3.3

Magnitude of the Transfer of Learning among the Four Language Skills (Takefuta, 1997, p. 71)

<table>
<thead>
<tr>
<th>Direction of Transfer</th>
<th>Magnitude of Transfer</th>
<th>Researchers</th>
</tr>
</thead>
<tbody>
<tr>
<td>From reading to listening</td>
<td>−</td>
<td>(Mueller, 1980; Anderson and Lynch, 1988)</td>
</tr>
<tr>
<td>From speaking to listening</td>
<td>−</td>
<td>(Belasco (Pimsleur, 1971); Chastain, 1987)</td>
</tr>
<tr>
<td>From writing to listening</td>
<td>−</td>
<td>(Wada, 1992)</td>
</tr>
<tr>
<td>From listening to reading</td>
<td>+</td>
<td>(Nord, 1975, 1981; Lund, 1991)</td>
</tr>
<tr>
<td>From listening to speaking</td>
<td>+</td>
<td>(Asher, 1972; Anderson and Lynch, 1988)</td>
</tr>
<tr>
<td>From listening to writing</td>
<td>+</td>
<td>(Wada, 1992; Takefuta et al., 1993)</td>
</tr>
</tbody>
</table>

Note: The − sign shows that the magnitude of transfer is minimal, and the + sign shows that the transfer is large.

3.3.1 From Listening to Speaking

Some studies have been conducted on the transfer of learning from listening to speaking. Two studies are taken here as examples. Postovsky (1974) considered the effect of delayed oral practice on the four language skills with beginning students of Russian. An experimental group was deliberately kept from speaking. Instead they were required to respond only in writing. After 12 weeks, the experimental group performed significantly better in listening comprehension than the control group. In addition, the experimental group outperformed the control group on the other three skills. These results show that while the experimental group had less practice speaking, they scored higher than the control group.

Lyczak (1979) examined how exposure to the target language before learning session affected foreign language learning. Before a Thai language learning session, university students in Hong Kong were exposed to a recorded Thai conversation, Japanese conversation, or music. The students exposed to Thai produced more words than students exposed to music or Japanese. The students exposed to Japanese produced the fewest words. These studies indicate that
listening practice at the initial stage of foreign language learning can facilitate speaking.

3.3.2 From Listening to Reading

As shown in Table 3.3, some studies have shown positive transfer of learning from listening comprehension to reading comprehension. Asher (1972) conducted an experiment with a focus on the relationship between listening comprehension and reading comprehension of German. He required students in an experimental group not to speak. Instead he required the students to respond to oral stimuli with a movement of the body. After eight weeks, which included 16 hours of instruction, the students voluntarily pressed the instructor to let them speak. Once listening comprehension was achieved, transfer to the speaking skill was very rapid. As the result of 16 hours of instruction, students in the experimental group excelled in listening because students in the control group emphasized reading and writing. Surprisingly, reading comprehension scores of the students in the two groups showed no significant difference, even though the students in the experimental group had no systematic training in reading. He concluded that there was enough positive transfer from listening to reading.

Reeds, Winitz, and Garcia (1977) reported on an experiment which tested the hypothesis that reading comprehension in a foreign language was improved more quickly if reading instruction followed instruction and practice in listening comprehension. Results of the study indicated that there was a high degree of transfer from listening comprehension to reading comprehension.

These two studies indicate that there is a strong correlation between listening comprehension and reading comprehension and that there is a high possibility of positive transfer of learning from listening comprehension to reading comprehension.

In this chapter, the relationship between listening comprehension and knowledge factors such as lexical knowledge and grammatical knowledge were first discussed because these factors were considered to be indispensable in understanding language. The relationship between listening comprehension and other language skills such as speaking and reading were then
The chapter closed by reviewing the literature concerning the transfer of learning from listening to other language skills: mainly speaking and reading. Researchers have pointed out that the transfer of learning occurs most positively from listening to the other language skills. The implication of this is that listening practice at the initial stage of foreign language learning can enhance the four language skills.

The next chapter will discuss the theoretical background, that is, the phonological loop of working memory. Relationship between listening comprehension and working memory, the historical shift from short-term memory to working memory, and the roles of the phonological loop will be examined.
Chapter 4

Theoretical Background:
Role of Phonological Loop of Working Memory in Listening Comprehension

This chapter discusses the phonological loop of working memory and examines its relationship to listening comprehension. According to research to date, it is clear that short-term memory has relationship with the process of listening comprehension. The main purpose of this thesis is to investigate how phonological memory (i.e., both linguistic short-term memory and nonlinguistic short-term memory) affects listening comprehension of Japanese learners of English. In Chapter 2, the listening comprehension process and roles of short-term memory during the process of listening were discussed. This chapter discusses the issue in more detail through the view of working memory and one of its components: the phonological loop. The phonological loop is considered to be responsible for analyzing speech input and is believed to play an important role in listening comprehension.

The chapter first considers the relationship between listening comprehension and working memory in terms of active and complex processing of information, and then overviews the historical shift from the former concept of short-term memory to working memory based on cognitive psychological studies. In closing, the chapter discusses the capacity and the functions of the phonological loop and investigates how the loop affects listening comprehension.

4.1 Listening Comprehension and Working Memory

The listening comprehension models explained in 2.1.3 suggest that memory plays a crucial role in the process of listening comprehension. This section considers the relationship between listening comprehension and working memory from the perspective of active and complex processing of information.

Concerning listening comprehension, Littlewood (1981) claims the following:
Listening has often been called a passive skill. This is misleading, because listening demands active involvement from the hearer. In order to reconstruct the message that the speaker intends, the hearer must actively contribute knowledge from both linguistic and nonlinguistic sources. (p. 66)

Vandergrift (1999) also points out the following:

Listening is anything but a passive activity. It is a complex, active process in which the listener must discriminate between sounds, understand vocabulary and grammatical structures, interpret stress and intonation, retain what was gathered in all of the above, and interpret it within the immediate as well as the larger sociocultural context of the utterance. Co-ordinating all of this involves a great deal of mental activity on the part of the listener. Listening is hard work, and deserves more analysis and support. (p. 168)

These assertions suggest that listening comprehension should be regarded as active and complex processing of information.

Regarding working memory, which will be discussed in detail in this chapter, it is considered to be a system which provides temporary storage and active manipulation or processing of the information necessary for complex cognitive tasks such as language comprehension, learning, and reasoning. The above explanation suggests that working memory should be viewed as playing a role in both active and complex processing of information. We cannot avoid taking working memory into consideration when listening comprehension is discussed theoretically.

4.2 **Historical Shift from Short-term Memory to Working Memory**

The previous section stated that there seemed to be a close relationship between listening comprehension and working memory. This section reviews how the former concept of short-term memory has shifted to working memory. To date, cognitive psychologists have proposed various models and hypotheses to describe how information is processed in human memory. Among them, three predominant concepts are taken here as examples to explain the
process of memory. The first one is “the modal model” by Atkinson and Shiffrin (1968, 1971). They described human memory as having three constituents: the sensory register, the short-term memory store, and the long-term memory store. The second one is the “levels of processing” hypothesis by Craik and Lockhart (1972). They emphasized the importance of method and level/depth of processing. The third one, the “working memory” model, was proposed by Baddeley and Hitch (1974) and refined and revised by Baddeley (1986, 2000). Working memory put more emphasis on its active processing of information.

4.2.1 Modal Model by Atkinson and Shiffrin

A classical model of memory developed in the 1960’s assumed that all memories pass from a short-term to a long-term store after only a limited amount of time. The most influential model was that of Atkinson and Shiffrin (1968, 1971), which became known as “the modal model” (Baddeley, 2007, p. 3). This model assumed three separate types of memory (see Figure 4.1).

Atkinson and Shiffrin consider memory to have three types of memory: sensory, short-term, and long-term memory, as discussed in 2.1.3.1. In their model, short-term memory is assumed to act as a working memory of limited informational capacity. They suggested that the short-term store was necessary for learning, retrieval of information out of long-term store and so on.

![Modal model by Atkinson and Shiffrin](image)

*Figure 4.1 Modal model by Atkinson and Shiffrin (Atkinson & Shiffrin, 1971, p. 82)*
This model encountered at least two problems. One of the problems unitary short-term memory system faced was that patients with defective short-term store appeared to have a normal long-term learning ability. This problem was inconsistent with the assumption that all memories pass from a short-term to a long-term store. The other problem was that degree of long-term learning depended on the level and depth of encoding rather than on the length of time the material held in STS. The second problem was interpreted by Craik and Lockhart (1972) in terms of the “levels of processing” hypothesis (Baddeley, 2007, p. 4). In the tide of the history of memory research, Baddeley and Hitch (1974) abandoned the idea of a single unitary short-term memory system and they proposed a multi-component working memory system.

4.2.2 Levels of Processing by Craik and Lockhart

![Graph showing levels of processing](image)

Figure 4.2 Levels of processing by Craik and Lockhart (Craik & Lockhart, 1972) in Baddeley (1999, p. 176)

Atkinson and Shiffrin’s modal model was subsequently questioned by the levels of processing hypothesis proposed by Craik and Lockhart (1972) (see Figure 4.2). The figure
explains that “processing incoming information according to meaning appears to leave a stronger memory trace than processing on the basis of sight or sound” (Baddeley, 1999, p. 176). It suggested that the amount of information retained in long-term memory depends on how deeply it is processed, rather than how many times it is rehearsed, during learning. They found that the amount of learning relied on the type of processing, with “deep” processing a word in terms of meaning leading to much better retention than “shallow” processing (Baddeley, 1999, p. 41). Their hypothesis implies that the method and level/depth of processing as well as rehearsal should be carefully taken into consideration during learning.

4.2.3 Working Memory by Baddeley

![Working Memory Model](image)

*Figure 4.3 Working memory model by Baddeley (1986; Baddeley & Hitch, 1974) in Logie (1995, p. 18)*

44
The concept of a multi-component working memory model proposed by Baddeley and Hitch (1974) has been revised and refined from the earlier concept of a unitary short-term memory system, such as that proposed by Atkinson and Shiffrin (1968, 1971). As shown in Figure 4.3, Baddeley’s (1974, 1986) model of working memory is composed of three components: the central executive and two slave systems containing the phonological loop and the visuo-spatial sketchpad. The central executive is assumed to be a limited-capacity attentional system that controls the two slave systems, and relates them to long-term memory. The phonological loop stores and rehearses speech-based information. The visuo-spatial sketchpad is involved in maintaining and manipulating visual images. Working memory is a system which provides temporary storage and active manipulation or processing of the information necessary for complex cognitive tasks such as language comprehension, learning, and reasoning.

*Figure 4.4 Working memory model by Baddeley (Baddeley, 2000, p. 421)*
Baddeley (2000) extended the model by adding a fourth component called the episodic buffer. This component is the third slave system which is assumed to “form an interface between the three working memory subsystems and long-term memory” (Baddeley, 2007, p. 13) (see Figure 4.4). In the concept of working memory, the phonological loop is considered to play an important role in the process of listening comprehension.

4.3 Phonological Loop

This section discusses the capacity and the functions of the phonological loop and investigates how the loop affects listening comprehension. Cook (1996) devised a simplified diagram illustrating the phonological loop of working memory as shown in Figure 4.5. Cook used the term “the articulatory loop” in place of “the phonological loop” in her book because originally the phonological loop was referred to as the articulatory loop. The figure discussed here adopts the term “the phonological loop.”

![Phonological Loop Diagram](image)

*Figure 4.5 Phonological loop of working memory (Based on Cook, 1996, p. 68)*

4.3.1 Capacity of the Phonological Loop

The phonological loop is known to include a phonological store, which holds speech-based information in phonological form, and a rehearsal process, which serves to rehearse that
speech-based information and maintain a decaying representation in the phonological store (Baddeley, 1997; Baddeley et al., 1998; Gathercole & Baddeley, 1993). It should be noted that when listening not only to one's native language, but also to a foreign language, the input is being subvocally rehearsed. As mentioned in 2.3.1, the key to understanding the capacity of the phonological loop (which is equivalent to the auditory short-term memory span in the earlier concept of short-term memory) is that it has a time constraint.

The early quantification of the capacity limit associated with short-term memory was "the magical number seven plus or minus two" introduced by Miller (1956). He suggested that the memory span of young adults was about seven items, called chunks, regardless whether the items were the random lists of letters, words, numbers, or almost any kind of meaningful familiar item. Roughly speaking, for instance, memory span was thought to be about seven for digits, six for letters, and five for words.

On the other hand, some studies have found that the capacity of the loop is not limited by a fixed number of verbal items, but rather by how much a listener can pronounce in approximately 2 seconds. In other words, the size of memory span is dependent on (subvocal) rehearsal speed (Baddeley et al., 1975; Schweickert & Boruff, 1986).

![Figure 4.6](image)

*Figure 4.6 Relationship between word length and recall, and between word length and reading speed (Baddeley et al., 1975) in Baddeley (1999, p. 52)*
Figure 4.6 shows evidence that memory span is time-based. Baddeley et al. (1975) explored the relationship between word length and memory span. Their finding indicated that memory span decreased as the number of syllables in a word increased. Baddeley (1999) notes "longer words are more difficult to recall because they take longer time to articulate during rehearsal" (p. 52). This effect is called "the word length effect".

As pointed out by Cowan and Kail (1996), learners' processing speed and subvocal rehearsal speed largely affect their memory span. They place more emphasis on the significance of subvocal rehearsal speed than processing speed. In regard to this connection, they state:

the path linking memory and speech rate was significant. Processing was linked significantly to speech rate but not to memory. This indicates that the impact of processing speed on memory was mediated entirely by increases in rate of articulation. (p. 47)

Figure 4.7 Causal relationships among processing speed, subvocal rehearsal speed and memory span (Based in part on Cowan & Kail, 1996, p. 46)
Figure 4.7 shows that memory span is largely increased by subvocal rehearsal speed, and the rehearsal speed is increased by processing speed. Listening comprehension is facilitated by that increased memory span size. In summary, memory span (i.e., the capacity of the phonological loop) is determined by how fast listeners can repeat verbal input, also referred to as the ability to repeat meaningless input.

4.3.2 Functions of the Phonological Loop

Some argue for the view that the phonological loop has evolved as one of a range of language acquisition devices or language learning devices (Baddeley 1996, 1999; Baddeley et al., 1998). In one study, Baddeley, Papagno, and Vallar (1988) showed the importance of the phonological loop, using a neuropsychological patient. The patient was a young Italian woman called PV who acquired a very specific deficit in auditory short-term memory (i.e., the phonological loop) following a stroke. They found that PV had a normal capacity for learning to associate pairs of spoken words in her native Italian, but she was completely unable to learn to associate an unfamiliar spoken Russian word with its Italian equivalent (see Figure 4.8). This result suggests that the phonological loop is of crucial importance for new “long-term phonological learning” (Baddeley et al., 1988, p. 594).

Gathercole and Baddeley (1989) examined how the ability to repeat meaningless input affected the language development of young children. They demonstrated that 4-year-old children’s ability to repeat meaningless input, as measured by non-word repetition, predicted their vocabulary growth in their native language one year later. A significant correlation was also found between their non-word repetition and vocabulary scores at both ages four and five.

Gathercole and Baddeley (1990) investigated a link between the ability to repeat meaningless input, which was measured by non-word repetition, and learning speed for names and non-names for toys. They reported that low-ability children were slower at learning non-names than were high-ability children.
The results of these two studies are consistent with the view that the phonological loop, whose capacity is determined by the ability to repeat meaningless input, is closely related to the language development of children (Gathercole & Baddeley, 1989; 1990). Service (1992) carried out a study on Finnish children learning English. She gave them a range of tests before they began an English course. The results of the tests were compared with their performance on English language skills two and a half years later. The best predictor was a
non-word repetition test that involved hearing and repeating English sounding non-words. She concludes that the ability to represent unfamiliar phonological material in working memory is the basis of the acquisition of new vocabulary items in "foreign language learning" (p. 21).

Adams and Gathercole (1995) investigated whether or not the ability to repeat meaningless input based on non-word repetition is related to speech production in preschool children. Based on the analysis of 3-year-old children’s speech corpora, they found a correlation that a group of children who had high ability to repeat meaningless input produced lengthier utterances with wider vocabulary than a group of children whose ability to repeat meaningless input is low. The result of this study indicates that the ability to repeat meaningless input is associated with “spoken language development in young children” (Adams & Gathercole, 1995).

Papagno and Vallar (1995) compared the performance in tests of a group of polyglot university students with that of non-polyglot ones. The two groups were given a range of tests on verbal and visuo-spatial short-term memory and long-term memory, general intelligence, and native language vocabulary knowledge. The polyglots showed superior performance in auditory digit span, non-word repetition and non-word learning tasks.

In summary, these studies indicate that the phonological loop plays a crucial role in the process of language learning. These studies have proposed the following three points:

1. “The primary function of the phonological loop is the processing of novel speech input” (Baddeley et al., 1998, p. 170).
2. The phonological loop seems to provide “a back-up process” by repeating novel speech input (Baddeley, 1999, p. 55).
3. Verbal repetition of unfamiliar sound patterns in the phonological loop promotes their long-term learning.

The phonological loop plays a crucial role when novel speech input is comprehended and especially when a foreign language is listened to.

In this chapter, the relationship between listening comprehension and working memory was first discussed in that both of them process the information actively and complexly. A brief
overview was then given of the historical shift from the former concept of short-term memory to working memory based on cognitive psychological studies. The chapter closed by discussing the capacity and the functions of the phonological loop and investigated how the loop affected listening comprehension.

In the following chapter, the research questions and the hypotheses are presented and experimental studies to prove the hypotheses are reported.
Chapter 5

The Studies

This chapter first offers eight research questions that the present thesis tries to answer. Then eight hypotheses are formulated. Finally, this chapter reports the three experimental studies which were conducted. Each study is explained in the following order: purpose, hypotheses, method, results and discussion, and conclusion.

5.1 Research Questions

The previous chapter offered the theoretical background to explain how the phonological loop of working memory is involved in listening comprehension. Phonological memory is considered to play a significant role in the process of listening comprehension. Other factors, which are assumed to affect listening comprehension of Japanese learners of English, were discussed in Chapters 2 and 3. The primary interest of the present thesis lies in clarifying how phonological memory and other factors affect listening comprehension of Japanese learners.

Before presenting the research questions, the definition of phonological memory should be clearly defined once more. In the definition of the present thesis, as discussed in Chapter 1, phonological memory contains both linguistic short-term memory and nonlinguistic short-term memory. Linguistic phonological memory is the ability to retain verbal input with meaning. On the other hand, nonlinguistic phonological memory is the ability to retain verbal input with no meaning. In the following experiments, linguistic short-term memory is measured by the ability to repeat English, that is, the ability to repeat meaningful input, whereas nonlinguistic short-term memory is measured by the ability to repeat random digits, that is, the ability to repeat meaningless input.

The following eight research questions will guide the investigation of the present thesis.
1. How does the ability to repeat meaningless input affect listening comprehension of Japanese learners of English under different presentation conditions?

2. What type of presentation condition best facilitates listening comprehension of Japanese learners of English and how is it related to their ability to repeat meaningless input?

3. Does the ability to repeat meaningless input affect listening comprehension of Japanese learners of English in cases where their written test scores are within the same level?

4. Does reading rate affect listening comprehension of Japanese learners of English in cases where their written test scores are within the same level?

5. What relationships are there between articulation speed for English words and ability to repeat English, and between ability to repeat English and listening comprehension?

6. What factors are strongly related to listening comprehension in cases where vocabulary/grammar, reading comprehension, articulation speeds for Japanese and English words, ability to repeat English, digit memory span, reading rate, and reading efficiency have been examined in the immediate and delayed tests?

7. What factors explain the development of listening comprehension when comparing learners whose listening comprehension develops and those whose listening comprehension does not?

8. Is the development of the ability to repeat meaningful input related to the development of the ability to repeat meaningless input when comparing learners whose listening comprehension develops and those whose listening comprehension does not?

Question 1 is concerned with how learners’ ability to repeat meaningless input affects listening comprehension in cases where texts are within the understanding of the learner. As discussed in 2.3.1, nonlinguistic short-term memory seemed to be less important. However, it is still related to listening comprehension. Although some studies have been done researching the relationship between short-term memory span and listening comprehension, very little research has been conducted so far on the effects of memory span coupled with the effects of speech rate and pausing on listening comprehension in the area of EFL learning.

Question 2 is concerned with how speech rate and pausing affect Japanese learners of
English. This question is based on the theory that different presentation conditions will result from changing two temporal factors: speech rate and pausing. As discussed in 2.3.2 and 2.3.3, perception of auditory input being faster or slower generally arises more from the length and frequency of pauses between sense groups than from the speed of articulation within segments. The discussion leads to the conclusion that pauses at appropriate places facilitate second/foreign language listening comprehension. The research question attempts to reconsider how speech rate and pausing affect listening comprehension of Japanese learners, and examine how they are related to learners’ nonlinguistic short-term memory span (i.e., the ability to repeat meaningless input).

Question 3 is concerned with the relationship between nonlinguistic short-term memory span and listening comprehension of Japanese learners of English in cases where their written test scores are within the same level. This question expands on the basis of the first research question and looks for a more detailed relationship. A set of factors are vocabulary/grammar, reading comprehension, articulation speeds for Japanese and English words, ability to repeat English, digit memory span, reading rate, and reading efficiency. Among these factors, their written test contains a vocabulary/grammar test and a reading comprehension test. Based on the discussion in 3.1.1 and 3.1.2, foreign language learners need knowledge concerning vocabulary and grammar in order to interpret texts. In addition, as discussed in 3.2.2, many similarities exist between listening comprehension and reading comprehension as far as the process of understanding information is concerned. In the process of understanding spoken/written language, relevant prior knowledge in long-term memory is essential.

Question 4 deals with how reading rate affects listening comprehension of Japanese learners. As discussed in 2.2, Japanese learners often fail to follow English spoken at a normal speed, which they can understand if they read it at leisure. In general, Japanese learners of English seem to read texts relatively slower than the normal speech rate as shown in 2.3.2. If the person can read texts at the normal speech rate as mentioned earlier, the person might be a fluent listener as well as a good reader.
Question 5 is concerned with the relationship between articulation speed and ability to repeat English, and between ability to repeat English and listening comprehension. As discussed in 4.3.1, learners' processing speed and subvocal rehearsal speed largely affect their memory span. Cowan and Kail (1996) put more emphasis on the importance of subvocal rehearsal speed than processing speed. This suggests that, if learners can articulate English words faster, they might be able to repeat/rehearse more English. If they can repeat/rehearse more English, they might be able to comprehend English better.

Question 6 is concerned with the relationship between listening comprehension of Japanese learners and factors which might affect listening comprehension. Question 6 presupposes that two test batteries will be conducted after a long interval. If some factors indicate significant correlations between the two tests after a long interval, it can be said that such factors are strongly related to listening comprehension of Japanese learners of English. The contributing factors which might affect listening comprehension of Japanese learners of English are as follows: vocabulary/grammar, reading comprehension, articulation speeds for Japanese and English words, ability to repeat English, digit memory span, reading rate, and reading efficiency. Why some of these factors were chosen as contributing factors was already explained. Lexical and grammatical knowledge were explained as knowledge essential in comprehension. Reading comprehension was discussed from the perspective of having a similar process in terms of understanding information. Articulation speeds for Japanese and English words were briefly explained in terms of rehearsal speed in Question 5. Articulation speeds for Japanese and English words might be related to the ability to repeat verbal input. As for the ability to repeat meaningful input and the ability to repeat meaningless input, they were discussed again and again. Reading rate was described from the viewpoint of the possible relationship with speech rate in Question 4. Finally, concerning reading efficiency rate, it is defined as the reading rate at which each learner can somewhat understand a passage, which will be explained in more detail in the experimental section.

Question 7 is concerned with why some learners develop their listening comprehension
while others do not. By choosing learners whose listening comprehension develops and those whose listening comprehension does not, it seems possible to explain what factors affect the development of learners' listening comprehension.

Question 8 deals with the relationship between phonological memory and listening comprehension of Japanese learners of English. Phonological memory includes linguistic short-term memory and nonlinguistic short-term memory. Linguistic short-term memory is determined by learners’ ability to repeat meaningful input, and nonlinguistic short-term memory is determined by learners’ ability to repeat meaningless input. This question attempts to answer how the development of both the ability to repeat meaningful input and the ability to repeat meaningless input relate to each other when comparing learners whose listening comprehension develops and those whose listening comprehension does not.

5.2 Hypotheses

The following hypotheses were formulated. The discussion in Chapters 2, 3, and 4 helped in formulating these hypotheses.

5.2.1 Hypothesis 1

Hypothesis 1 is related to the first research question. Although nonlinguistic short-term memory (i.e., the ability to repeat meaningless input) appears to be less important than linguistic short-term memory, it is considered to be involved with listening comprehension (see 2.3.1 for further details). Nonlinguistic short-term memory span (i.e., the capacity of the phonological loop) is not limited by a fixed number of verbal items, but rather by how much a listener can articulate in about 2 seconds. As discussed in the previous chapter, the phonological loop plays a significant role when unfamiliar speech input is comprehended and especially when a foreign language is listened to. It seems that Japanese learners’ ability to repeat meaningless input affects listening comprehension. Some studies have been done looking into the relationship between short-term memory span and listening comprehension, yet very little research has been
done so far on the effects of memory span coupled with the effects of speech rate and pausing on listening comprehension in the area of EFL learning. When it comes to foreign language listening comprehension, we cannot avoid taking the ability to repeat meaningless input into account.

Hypothesis 1: The ability to repeat meaningless input affects listening comprehension of Japanese learners of English under different presentation conditions: (a) [-Speed / -Pause], (b) [+Speed / -Pause], and (c) [+Speed / +Pause].

5.2.2 Hypothesis 2

Hypothesis 2 is connected with the second research question. The hypothesis is based on the theory that different presentation conditions will result from changing two temporal factors: speech rate and pausing. The discussion of this question concluded that pauses at appropriate places enhance second/foreign language listening comprehension. Based on the discussion in 3.1.1, it is implied that the ability to connect the sound of a word with its meaning is indispensable in listening comprehension and that enhancing the word recognition speed may be necessary to become a successful listener.

Hypothesis 2: The presentation condition with appropriate pausing best facilitates Japanese learners’ listening comprehension and learners with higher ability to repeat meaningless input make the most of the presentation condition.

5.2.3 Hypothesis 3

Hypothesis 3 is linked to the third research question. Japanese learners of English usually fail to follow English spoken at a normal speed, which they can understand if they read it at their own pace. Spoken language is different from written language in that written letters remain, but speech sounds gradually decay. When the aspect of English knowledge is paid attention to, it can be said that the level of learners’ linguistic knowledge affects listening comprehension. Listening comprehension is a measurement of spoken language understanding, just as reading
comprehension is a measurement of one’s understanding of written language. Supposing learners’ written test scores, including vocabulary/grammar and reading test, are within the same level, their ability to repeat meaningless input might affect listening comprehension because better rehearsal can lead to better understanding.

Hypothesis 3: The ability to repeat meaningless input affects listening comprehension of Japanese learners of English in cases where their written test scores are within the same level.

5.2.4 Hypothesis 4

Hypothesis 4 has to do with the fourth research question. The research question was concerned with the relationship between listening rate and reading rate. Generally speaking, reading rate of Japanese learners of English is relatively slow because they often fail to understand English spoken at a normal speed. If the person can read texts at the normal speech rate as shown in 2.3.2, the person might be a fluent listener as well as a good reader. Supposing learners’ written test scores, including vocabulary/grammar and reading test, are within the same level, their reading rate might affect listening comprehension because fast reading implies fast processing of input information.

Hypothesis 4: Reading rate affects listening comprehension of Japanese learners of English in cases where their written test scores are within the same level.

5.2.5 Hypothesis 5

Hypothesis 5 is related to the fifth research question. In the process of listening comprehension, as discussed in 2.1, the development of bottom-up processing and the effective use of working memory seem to be necessary. In order to develop bottom-up processing and make the most use of the phonological loop of working memory, accelerating rehearsal speed up to normal speeds is required. Cowan and Kail (1996) emphasized the importance of subvocal rehearsal speed as being more important than processing speed. It is reasonable to suggest that the faster learners articulate English words, the better their ability to repeat English becomes.
The better a learners’ ability to repeat English becomes, the more they can comprehend English.

Hypothesis 5: Articulation speed for English words affects ability to repeat English, and in turn, ability to repeat English affects listening comprehension of Japanese learners.

5.2.6 Hypothesis 6

Hypothesis 6 is connected with the sixth research question. The research question asked which factors (i.e., vocabulary/grammar, reading comprehension, articulation speeds for Japanese and English words, ability to repeat English, digit memory span, reading rate, and reading efficiency) were considered to affect listening comprehension of Japanese learners. If a factor indicates a significant correlation in both the immediate test and the delayed test, it can be said that it is strongly related to listening comprehension of Japanese learners of English. Among these factors, vocabulary/grammar as a knowledge factor, reading comprehension as a language skill, and ability to repeat English as linguistic short-term memory are essential for the understanding of listening comprehension.

Hypothesis 6: Vocabulary/grammar, reading comprehension, and ability to repeat English are strongly related to listening comprehension in cases where vocabulary/grammar, reading comprehension, articulation speeds for Japanese and English words, ability to repeat English, digit memory span, reading rate, and reading efficiency have been examined in the immediate and delayed tests.

5.2.7 Hypothesis 7

Hypothesis 7 is linked to seventh research question. The seventh hypothesis also deals with the same factors that were mentioned earlier. Therefore, vocabulary/grammar as a knowledge factor, listening comprehension as a language factor, and ability to repeat English as linguistic short-term memory are once again the focus.

Hypothesis 7: Vocabulary/grammar, reading comprehension, and ability to repeat English explain the development of Japanese learners’ listening comprehension when comparing learners
whose listening comprehension develops and those whose listening comprehension does not.

5.2.8 Hypothesis 8

Hypothesis 8 has to do with the eighth research question. Phonological memory contains linguistic short-term memory and nonlinguistic short-term memory. What should be kept in mind is that the ability to repeat meaningful input deals with linguistic verbal input, whereas the ability to repeat meaningless input involves nonlinguistic verbal input. It can be suggested that the ability to repeat meaningful input can be improved by practice especially with learners whose listening comprehension develops, whereas the ability to repeat meaningless input cannot be improved anymore with learners whose listening comprehension develops nor those whose listening comprehension does not.

Hypothesis 8: The ability to repeat meaningful input can be improved by practice especially with learners whose listening comprehension has developed, whereas the ability to repeat meaningless input cannot be improved.

5.3 Study 1

5.3.1 Purpose

The purpose of this study was to explore the relationship between the ability to repeat meaningless input and listening comprehension of Japanese learners of English under the following three presentation conditions: (a) [-Speed / -Pause], (b) [+Speed / -Pause], and (c) [+Speed / +Pause]. In the first condition, passage was delivered at slow speech rates without any significant pauses between sentences. In the second condition, the same passage was presented at normal speech rates without any significant pauses between sentences, and in the third, at normal speech rates with 2-second pauses between sentences.

5.3.2 Hypotheses

The hypotheses addressed by the study were:
1. The ability to repeat meaningless input affects listening comprehension of Japanese learners of English under different presentation conditions: (a) [−Speed / −Pause], (b) [+Speed / −Pause], and (c) [+Speed / +Pause].

2. The presentation condition with appropriate pausing best facilitates Japanese learners' listening comprehension and learners with higher ability to repeat meaningless input make the most of the presentation condition.

5.3.3 Method

5.3.3.1 Participants

A total of 62 EFL students took part in this study. They were second-year students at a Japanese senior high school with ages ranging from 16 to 17. None of them had ever participated in any kind of listening comprehension experiment like this before.

5.3.3.2 Instruments

Three passages were prepared for listening comprehension, with the following items taken into account (see Appendix A).

1. Passage length

The number of sentences constituting each of the three passages ranged from 14 to 16. Each passage averaged 15 sentences in length.

2. Sentence length

The number of syllables in each sentence ranged from 8 to 11. Each sentence averaged 9 syllables in length, since this would be the maximum sequence participants could possibly repeat back in about 2 seconds.

3. Rephrasing

All difficult words and phrases occurring in the passages were rephrased so that all participants should know them.
5.3.3.3 Conditions for Passage Presentation

Three presentation conditions were experimentally designed to examine if speech rates and pause lengths between sentences affect listening comprehension of Japanese learners of English (see Table 5.1).

Table 5.1

<table>
<thead>
<tr>
<th>Three Presentation Conditions for Listening Comprehension</th>
<th>Speech rates</th>
<th>Pauses between sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition 1: −Speed (Slow)</td>
<td>−Pause (Almost none)</td>
<td></td>
</tr>
<tr>
<td>Condition 2: +Speed (Normal)</td>
<td>−Pause (Almost none)</td>
<td></td>
</tr>
<tr>
<td>Condition 3: +Speed (Normal)</td>
<td>+Pause (2 seconds)</td>
<td></td>
</tr>
</tbody>
</table>

1. Condition 1: [−Speed (Slow), −Pause]

A recording was made of the passages at slow speech rates for use in Condition 1. The average speech rate associated with the three passages was approximately 129 wpm (see Table 2.1). These passages, without any significant pauses between sentences, were aurally presented to the participants.

2. Condition 2: [+Speed (Normal), −Pause]

Condition 2 dealt with passages recorded at normal speech rates. The average speed was approximately 175 wpm (see Table 2.1). These passages including no significant pauses were presented for listening comprehension.

3. Condition 3: [+Speed (Normal), +Pause]

Condition 3 used passages recorded with 2-second pauses between sentences. All the other settings were held constant as in Condition 2. Minute adjustments were made by a computer to control the exact length of each pause.

A recording was made of all the passages by a native speaker of American English for use as instruments in this experiment.
5.3.3.4 Procedure

In each presentation condition, the participants were instructed to listen to a passage twice in each specific listening condition. They were not allowed to take any notes or read any multiple-choice questions while listening. Soon after this they engaged in a rehearsal prevention task to prevent them from rehearsing the passage, which was followed by a listening comprehension test (see Table 5.2).

Table 5.2

Comparisons of Three Presentation Procedures

<table>
<thead>
<tr>
<th>Passage Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition 1: [−Speed (Slow), −Pause] × 2 times → RPT → LCT</td>
</tr>
<tr>
<td>Condition 2: [+Speed (Normal), −Pause] × 2 times → RPT → LCT</td>
</tr>
<tr>
<td>Condition 3: [+Speed (Normal), +Pause] × 2 times → RPT → LCT</td>
</tr>
</tbody>
</table>

Note: RPT = Rehearsal Prevention Task, LCT = Listening Comprehension Test

A 3×3 Latin-square design was adopted to counterbalance any variation that might occur due to practice effects. The participants were divided into three sections, and each of the three conditions was assigned to each section, as shown in Table 5.3.

Table 5.3

Counterbalancing Three Conditions by Introducing the 3×3 Latin-square Design

| Section 1: Condition 1 (Passage A) → Condition 2 (Passage B) → Condition 3 (Passage C) |
| Section 2: Condition 3 (Passage B) → Condition 1 (Passage C) → Condition 2 (Passage A) |
| Section 3: Condition 2 (Passage C) → Condition 3 (Passage A) → Condition 1 (Passage B) |

Immediately after listening to each passage, the participants engaged in a forward type of digit memory span task (see Appendix B). The memory span task was given for two reasons.
One of the reasons was that the participants must be prevented from rehearsing what they learned in each condition. The other reason was that the measure of their ability to repeat meaningless input had to be made to see how listening comprehension is differentially affected by the ability to repeat meaningless input. A sequence of 4 to 9 digits was read to them at the rate of one digit per second. Immediately after they heard each sequence, they were required to recall and write down the numbers in the same order as they heard. The digit memory span of a participant was the maximum sequence of digits correctly repeated, in which the participant was correct half of the time. The digit span measure provides a useful indication of the capacity of an individual’s phonological loop (Baddeley et al., 1998).

As soon as the rehearsal prevention task was finished, a listening comprehension test was administered to explore if there was any relationship between the ability to repeat meaningless input and listening comprehension. The test was a standard multiple-choice type composed of 10 questions printed in Japanese (see Appendix C). In response to these questions, the participants were asked to select the correct answer from four alternatives.

5.3.4 Results and Discussion

5.3.4.1 Hypothesis 1

Assessments of ability to repeat meaningless input were made of 62 participants, based on their digit memory span in the rehearsal prevention task used in this study. The mean size of their digit memory span was 6.4. Their ability to repeat meaningless input as determined by the memory span test was classified into three subsections: low, medial and high groups. The learners who were able to repeat 4 to 5 digits correctly were classified as the low group (N = 12). Those whose digit memory ranged from 6 to 7 digits were classified as the medial group (N = 39). Those who were able to repeat 8 or 9 digits were classified as the high group (N = 11).

Only low and high groups fell under the scope of this analysis, because we were mainly interested in exploring how learners with low as compared with high ability to repeat meaningless input differ in listening comprehension performance.
The experimental results are shown in Table 5.4 and Figure 5.1. Table 5.4 and Figure 5.1 indicate a relationship between ability to repeat meaningless input and listening comprehension under three conditions.

Table 5.4

<table>
<thead>
<tr>
<th>Ability to Repeat Meaningless Input</th>
<th>Low Group</th>
<th>High Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition 1 [−Speed (Slow), −Pause]</td>
<td>36.7</td>
<td>50.9</td>
</tr>
<tr>
<td>Condition 2 [+Speed (Normal), −Pause]</td>
<td>45.0</td>
<td>56.4</td>
</tr>
<tr>
<td>Condition 3 [+Speed (Normal), +Pause]</td>
<td>40.8</td>
<td>70.0</td>
</tr>
</tbody>
</table>

Note: Low Group (N = 12), High Group (N = 11)

Figure 5.1 Relationship between ability to repeat meaningless input and listening comprehension under three conditions
The design was a 2 x 3 mixed factorial, with the ability to repeat meaningless input (Low vs. High) being one between-groups factor, listening comprehension under three presentation conditions ( [−Speed / −Pause] vs. [−Speed / +Pause] ) being one within-groups factor. Comparisons were made of individual participants’ listening comprehension scores in an analysis of variance, which yielded a significant effect of the ability to repeat meaningless input on listening comprehension (F (1, 21) = 8.25, p < .01).

This clearly indicates that learners with high ability to repeat meaningless input were able to significantly better comprehend aural speech input than those with low ability to repeat meaningless input.

The following account may be able to explain such a difference. The high group learners can subvocally rehearse faster and they can rehearse longer incoming speech sound sequences within 2 seconds than can the low group learners. As a natural consequence, they find it easier to check what they have rehearsed in their mind against their prior knowledge in long-term memory.

Obviously, Japanese learners of English find it hard to make sense of what they hear if they do not have any relevant prior knowledge about it. In the present study, all difficult words and phrases in the passages were rephrased so that all participants would be familiar with them.

It is reasonably correct to state that if there is any difference in their comprehension performance, then it would be reflected by their ability to repeat meaningless input as measured by digit memory span. The digit memory span task was used to estimate the ability to repeat meaningless input (i.e., rehearsal speed) in this study. Digit memory span may not be able to predict EFL learners’ proficiency, but it is estimated to be a rough indicator of learners’ ability to repeat meaningless input, which in turn affects their listening comprehension ability.

Futatsuya (1999) graphically shows the relationship between the ability to repeat meaningless input (i.e., rehearsal speed) and listening comprehension ability (see Figure 5.2). He gives an example of rehearsal speed of Students A, B and C and illustrates how rehearsal speed differentially affects their listening comprehension. The rehearsal speed of Student A is faster than those of Students B and C. Student A repeats the whole utterance within 2 seconds before
its memory trace decays and the whole utterance can be encoded for syntactic and semantic processing, as long as any relevant prior knowledge exists. Students B and C, on the other hand, are not able to repeat the whole utterance before its speech sound sequence decays. In this case, these two students cannot repeat the speech sounds that have already decayed. Thus, they are unable to encode what has disappeared from the memory trace. The relationship between rehearsal speed and listening comprehension is graphically depicted in Figure 5.2.

The number of words
correctly repeated in 2 seconds

Student A
I'm really tied up today.

Student B
I'm really tied up today.

Student C
I'm really tied up today.

Figure 5.2 Comparisons of students A, B and C who can repeat from a memory trace in terms of the number of words within 2 seconds (Futatsuya, 1999, p. 30)
5.3.4.2 Hypothesis 2

A significant effect was also observed for presentation conditions (F (2, 42) = 2.46, p < .10). An analysis of further multiple comparisons showed that significantly higher comprehension scores were obtained in the third condition than in the first (MSe = 3.19, p < .05), whereas no significant difference was found between the first condition and the second, nor the second and the third. Flaherty (1979) asserts that “too slow an input rate can impair comprehension by prolonging the time a pattern must be held in the short-term memory and allowing more time for memory traces to fade” (p. 275). Pause lengths between sentences, on the other hand, can enhance the comprehensibility of aural input.

Speed of articulation in the first condition was created to be slower than that in the second and third. However, listening comprehension performance in the first condition is lower than that in the second and the third. Therefore, articulation at a slower speed was unlikely to make any contribution to listening performance.

On the other hand, listening performance in the third condition was higher than that of in the first. This was especially true for high group learners. The results indicate that slightly longer pauses between sense-group segments lead to better listening comprehension. Rivers (1981) states that “During the pause between segments, the organism can rehearse what it has heard, thus strengthening the memory trace” (p.174). Johnson and Friedman (1975) examined the effects of temporal spacing (i.e., pausing) and speech compression on aural comprehension. The significant results are as follows:

Compression did not interfere with accurate recall. (p.167)

The effect of temporal spacing was highly significant, both statistically and from the standpoint of psycholinguistics. (p.168)

Structural spacing reinforces the listener's ability to perceive and remember the rational properties of language. (p.169)

Rivers's (1981) statement about pausing and findings by Johnson and Friedman (1975) support the idea that the length of pause between sense-group segments can help EFL learners
better process what they heard. Speeding articulation up to a normal speed does not prevent EFL learners from comprehending aural speech input if there are proper pauses between sense groups.

In the view of the phonological loop, one of the main functions of the loop is to provide "a back-up process" by repeating the novel speech input. According to the interpretation of the loop by Cowan and Kail (1996), the speed of a covert process (i.e., processing speed) such as a memory search affects the efficiency with which items can be retrieved (and perhaps reactivated) during the silent period (i.e., pause). That is, the time needed for the memory search for a relevant verbal item determines its processing speed. Thus, the silent period is necessary for that memory search. Japanese learners of English with high ability to repeat verbal input are presumed to be able to make the best use of their capacity of the loop, which allows some room for effectively searching for relevant prior knowledge which was activated in working memory more quickly.

5.3.5 Conclusion

A brief summary is provided of the experimental results obtained in this study.

1. Listening comprehension performance of learners with high ability to repeat meaningless input was significantly better than that of learners with low ability to repeat meaningless input under different presentation conditions.

This clearly indicates that high group learners are able to rehearse faster, and this high rehearsal speed in turn enables them to rehearse longer aural speech input before its echoic trace decays. As a result, their comprehension improved more than slow repeaters. Learners' ability to repeat meaningless input, as measured by a digit span task, is considered to be a good predictor in foreign-language listening comprehension when they have relevant prior knowledge about speech input. To summarize, learners' ability to repeat meaningless input is considered to be the determining factor that helps estimate their listening comprehension.
2. Significantly higher comprehension scores were obtained in the [+Speed / +Pause] condition than in the [-Speed / -Pause] condition.

It is a reasonable conclusion that EFL learners show superior listening comprehension performance in the [+Speed (i.e., speech presented at normal speech rates) / +Pause (i.e., speech presented with slightly longer pauses between sense-group segments)] presentation condition. As Rivers (1981) states, the length of pause between the segments is of more importance for comprehension than the actual articulation speed within segments (p. 174). A lengthened pause is needed between sense-group segments for EFL learners to better comprehend speech input. If there is not enough of a pause inserted between them, they may not be able to encode input information. The phonological loop is most effectively used when there is a lengthened pause between phrasal units.

5.4 Study 2

5.4.1 Purpose

The purpose of this study was to examine factors that might affect listening comprehension of Japanese learners of English. The factors were vocabulary/grammar, reading comprehension, articulation speeds for Japanese and English words, ability to repeat English, digit memory span, reading rate, and reading efficiency.

5.4.2 Hypotheses

The hypotheses addressed in the examination were:

3. The ability to repeat meaningless input affects listening comprehension of Japanese learners of English in cases where their written test scores are within the same level.

4. Reading rate affects listening comprehension of Japanese learners of English in cases where their written test scores are within the same level.

5. Articulation speed for English words affects ability to repeat English, and in turn, ability to
repeat English affects listening comprehension of Japanese learners.

5.4.3 Method

5.4.3.1 Participants

A total of 232 EFL students took part in this study. They were first-year students at a senior high school in Okayama, with their ages ranging from 15 to 16.

5.4.3.2 Instruments

1. Listening Comprehension

The participants' listening comprehension was measured with the listening section (100 points for 12 items in 15 minutes) of the Basic Assessment of Communicative English (BACE) (Association for English Language Proficiency Assessment = ELPA). BACE was originally designed for first-year senior high school students and is considered a reliable and valid assessment of English proficiency because it was developed based on Item Response Theory as are TOEIC and TOEFL. The first edition of BACE 2006 was used in this study.

2. Lexical and Grammatical knowledge

The participants' lexical and grammatical knowledge were measured in terms of their scores in the vocabulary and grammar section (100 points for 16 items in 10 minutes) of BACE.

3. Reading Comprehension

The participants' reading comprehension was assessed on the basis of their scores in the reading section (100 points for 12 items in 20 minutes) of BACE.

4. Japanese/English Articulation Speed

The articulation speeds of Japanese and English words were respectively measured as the number of Japanese moras and English syllables read aloud in 2 seconds, following Tamai (2005).
It has been shown that short-term memory (i.e., the capacity of the phonological loop) is dependent on how much a listener can articulate in about 2 seconds (Baddeley et al., 1975; Schweickert & Boruff, 1986). The aim of this measure is to examine how English articulation speed affects ability to repeat English. The participants read aloud 40 Japanese words containing 219 moras and 40 familiar English words consisting of 93 syllables as fast as they could (see Appendix D). Articulation speeds were calculated as follows: Japanese articulation speed = 219 (moras in 40 words) / time for reading 40 words (sec.) x 2.0; English articulation speed = 93 (syllables in 40 words) / time for reading 40 words (sec.) x 2.0. All difficult English words used for measuring articulation speed were rephrased so that all participants should know them.

5. Ability to Repeat English (i.e., Ability to Repeat Meaningful Input)

In the test of ability to repeat English, made based on Shibukawa (2001), the participants listened to English sentences and were required to orally repeat what they heard immediately after each sentence. All difficult words and phrases occurring in the sentences were rephrased so that all participants should know them. The participants’ responses were all tape-recorded. Sentence length was gradually increased from 4 syllables to 16 syllables and three sentences were prepared for each syllable number (see Appendix E). Each participant’s sentence memory span was determined by the longest sentence he/she could remember, based on whether the participant could recall at least two sentences out of three correctly from that syllable group.

6. Digit Memory Span (i.e., Ability to Repeat Meaningless Input)

In measuring digit memory span, the participants were presented with a sequence of 4 to 9 Japanese digits and required to recall and write down the numbers in the same order as they heard (see Appendix B). A participant’s digit memory span was defined as the sequence length at which the participant is correct half of the time. The digit memory span provides a useful indication of the capacity of an individual’s phonological loop (Baddeley et al., 1998).
7. Reading Rate and Reading Efficiency

The reading rate was calculated from the number of words that each participant could silently read in one minute (wpm). Two passages were constructed by modifying the passages used in past STEP third grade examinations. One was 121-words long at Flesch-Kincaid Grade level 6.1 and the other was 123-words long at Flesch-Kincaid Grade level 6.2 (see Appendix F). The participants were given the following direction: Read the passage at your own pace trying to understand it and measure your silent reading time individually with a stopwatch; After recording your reading time, answer 4 comprehension questions about the passage without rereading it. Based on the recorded reading time and comprehension scores, the rates and indexes were calculated and the means of the two measurements were the participants’ reading rates and reading efficiency indexes respectively. Reading efficiency index, defined as the reading rate at which each participant could somewhat understand a passage, was calculated by multiplying each participant’s reading rate by his or her rate of correct answers in the comprehension questions about the passage. Since the number of comprehension questions was four, the formula for the index was: \((\text{wpm}) \times (\text{correct answers}) / 4\).

5.4.4 Results and Discussion

5.4.4.1 Descriptive Statistics

Table 5.5 shows the descriptive statistics of listening comprehension and other factors. The minimum, maximum, mean (scores) and standard deviation of each factor are listed.
Table 5.5

Descriptive Statistics of Listening Comprehension and Other Factors (N = 232)

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Listening Test</td>
<td>24</td>
<td>89</td>
<td>59.19</td>
<td>11.47</td>
</tr>
<tr>
<td>2. Vocabulary/Grammar Test</td>
<td>10</td>
<td>90</td>
<td>60.51</td>
<td>10.18</td>
</tr>
<tr>
<td>3. Reading Test</td>
<td>0</td>
<td>100</td>
<td>51.56</td>
<td>20.70</td>
</tr>
<tr>
<td>4. Written Test*</td>
<td>34</td>
<td>174</td>
<td>112.07</td>
<td>27.50</td>
</tr>
<tr>
<td>5. Japanese Articulation Speed</td>
<td>10.3</td>
<td>31.3</td>
<td>19.65</td>
<td>3.69</td>
</tr>
<tr>
<td>6. English Articulation Speed</td>
<td>2.0</td>
<td>10.2</td>
<td>6.57</td>
<td>1.46</td>
</tr>
<tr>
<td>7. Ability to Repeat English</td>
<td>4</td>
<td>11</td>
<td>7.02</td>
<td>1.67</td>
</tr>
<tr>
<td>8. Digit Memory Span</td>
<td>4</td>
<td>9</td>
<td>6.25</td>
<td>1.07</td>
</tr>
<tr>
<td>9. Reading Rate</td>
<td>35</td>
<td>171</td>
<td>72.15</td>
<td>20.49</td>
</tr>
<tr>
<td>10. Reading Efficiency Index</td>
<td>26</td>
<td>150</td>
<td>63.54</td>
<td>19.06</td>
</tr>
</tbody>
</table>

*Scores for the Written Test are the summation of the scores for the Vocabulary/Grammar Test and Reading Test.

5.4.4.2 Correlations

Pearson product-moment correlation coefficients were calculated between listening comprehension and other factors (see Table 5.6).

Table 5.6 shows that listening comprehension had significant correlations with vocabulary/grammar (r = .211, p < .01), reading comprehension (r = .281, p < .01), written test (r = .290, p < .01), ability to repeat English (r = .281, p < .01) and with digit memory span (r = .130, p < .05), reading efficiency (r = .162, p < .05). The result showed that factors such as vocabulary/grammar, reading comprehension, and ability to repeat English may affect listening comprehension of EFL learners. Moreover, nonlinguistic short-term memory and reading efficiency, though their correlations are not very high, might affect listening comprehension.
Table 5.6  

**Correlation Matrix between Listening Comprehension and Other Factors**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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<tbody>
<tr>
<td>1.LT</td>
<td>1.00</td>
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<td>.281**</td>
<td>.290**</td>
<td>.104</td>
<td>.093</td>
<td>.281**</td>
<td>.130*</td>
<td>.067</td>
<td>.162*</td>
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<tr>
<td>2.VGT</td>
<td>1.000</td>
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<td>.770**</td>
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<td>.245**</td>
<td>.280**</td>
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<td>.134*</td>
<td>.339</td>
<td>.377**</td>
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<tr>
<td>7.ARE</td>
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<td>.349**</td>
<td>.207**</td>
<td>.273**</td>
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<td>.842**</td>
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</tr>
</tbody>
</table>

**p<.01  *p<.05**

Notes: 1. LT = Listening Test  2. VGT = Vocabulary/Grammar Test  3. RT = Reading Test  4. WT = Written Test (i.e., VGT + RT)  5. JAS = Japanese Articulation Speed  6. EAS = English Articulation Speed  7. ARE = Ability to Repeat English  8. DMS = Digit Memory Span  9. RR = Reading Rate  10. REI = Reading Efficiency Index

### 5.4.4.3 Hypothesis 3

This hypothesis tested whether or not the ability to repeat meaningless input as measured by digit memory span affected listening comprehension in cases where students’ vocabulary/grammar and reading test scores were within the same level. In order to investigate the question, two groups were prepared, based on their digit memory span test and written test scores. The learners who were able to repeat 8 to 9 digits correctly with their written test scores ranging from 91 to 135 were classified as the upper group (N = 20). Those whose digit memory ranged from 4 to 5 and whose test scores were between 93 and 132 were classified as the lower
group (N = 28). Only students whose English scores for the written test were within the same range while their nonlinguistic short-term memory spans were different, fell under the scope of this analysis. We were mainly interested in exploring how learners' nonlinguistic short-term memory affects listening comprehension ability when scores for written tests were within the same level.

Table 5.7

Descriptive Statistics of Written Test and Listening Test Scores for Upper Group and Lower Group based on Nonlinguistic Short-term Memory

<table>
<thead>
<tr>
<th></th>
<th>Written Test</th>
<th>Listening Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Min</td>
</tr>
<tr>
<td>Upper Group</td>
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<td>91</td>
</tr>
<tr>
<td>Lower Group</td>
<td>28</td>
<td>93</td>
</tr>
</tbody>
</table>

Table 5.7 shows the descriptive statistics of the written test and listening test scores for both the upper and lower group based on their nonlinguistic short-term memory span. In order to check whether their written test performance was within the same level or not, comparisons were made of the scores of their written tests. No significant difference was found between them (F (1, 46) = 1.55, ns) and therefore their vocabulary/grammar and reading comprehension level were considered to be similar. A one-way factorial ANOVA revealed that there was a significant difference in the means of listening tests between the two groups (F (1, 46) = 5.63, p < .05). It seems that short-term memory measured by digit memory span significantly affects Japanese learners' listening comprehension under circumstances in which learners' written scores are within the same level. Call (1985) found that sheer digit memory was less important to comprehension than sentence memory. However, it was confirmed that short-term memory — measured by digit memory, which is equivalent to the capacity of the phonological loop — was strongly related to listening comprehension ability (Dunkel et al., 1989, Takeno, 2004).
Baddeley et al. (1998) note "The digit span measure provides a useful indication of the capacity of an individual's phonological loop (p.159)." The capacity of the phonological loop depends on how much a listener can pronounce in approximately 2 seconds (Baddeley et al., 1975; Schweickert & Boruff, 1986). The following account will probably explain the result of this study. Learners in upper group can subvocally rehearse faster and rehearse longer speech sound sequences within 2 seconds than can lower group learners. Learners' memory span is largely affected by their rehearsal speed, which in turn affects listening comprehension. Many studies have proposed the following three points: (a) "the primary function of the phonological loop is the processing of the novel speech input" (Baddeley et al., 1998: 170); (b) the phonological loop seems to provide "a back-up process" by repeating the novel speech input (Baddeley, 1999: p. 55); (c) verbal repetition of unfamiliar sound patterns in the phonological loop promotes long-term learning. The phonological loop plays a crucial role when novel speech input is comprehended and especially when that novel input is in a foreign language. It is quite reasonable to hypothesize that phonological short-term memory span, i.e., the capacity of the phonological loop, affects listening comprehension of foreign language learners.

5.4.4.4 Hypothesis 4

By choosing students whose written test scores were within the same level, the second hypothesis considered the relationship between reading rate and listening comprehension. To achieve this aim, two groups were created, based on their reading rate and written test scores. The learners who were able to read 88 to 145 wpm with their written test scores ranging from 92 to 132 were classified as the upper group (N = 20). Those whose reading rate was from 35 to 51 wpm with their test scores from 93 to 131 were classified as the lower group (N = 20). Only students whose English scores for the written test were within the same range, while their reading rates were different, were targeted in this analysis, because our interest was mainly in exploring how learners' reading rates affect their listening comprehension when their scores for written tests were within the same level.
Table 5.8

Descriptive Statistics of Written Test and Listening Test Scores for Upper Group and Lower Group based on Reading Rate

<table>
<thead>
<tr>
<th></th>
<th>Written Test</th>
<th>Listening Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
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<tr>
<td>Upper</td>
<td>20</td>
<td>93</td>
</tr>
<tr>
<td>Lower</td>
<td>20</td>
<td>93</td>
</tr>
</tbody>
</table>

Table 5.8 shows the descriptive statistics of the written test and listening test scores for the upper and lower groups based on their reading rate. In order to check whether their written test performances were within the same level or not, comparisons were made of the scores of their written tests. No significant difference was found between them (F (1, 38) = 0.72, ns) and therefore their vocabulary/grammar and reading comprehension levels were considered to be the same. A one-way factorial ANOVA showed that there was no significant difference in the means of listening tests between two groups (F (1, 38) = 0.13, ns).

An upper group (N = 20) and lower group (N = 20) for reading efficiency were also created, based on students' reading efficiency index and written test scores. Their written test scores ranged from 93 to 131 as in the former analysis. A one-way factorial ANOVA revealed that there was no significant difference in the means of listening tests between the two groups (F (1, 38) = 2.01, ns), though a significant difference was found between them in the means of the written test (F (1, 38) = 8.01, p < .01). This is reasonable because there is a correlation between the written test and reading efficiency index (r = .372, p < .01), as seen in Table 5.6.

The result obtained in this study is that reading rate and reading efficiency does not affect listening comprehension. One reason is that the participants were required to read a passage at their own pace trying to understand it. Some learners may be able to read a passage faster and understand it if they are asked to read as swiftly as possible. Another reason is that listening rates were not taken into consideration because listening rates were not modified. It is also
possible that reading rate or reading efficiency index may not affect listening comprehension in cases where vocabulary/grammar and reading comprehension performances are within the same level.

Hirai (1999) investigated the relationship between listening and reading rates of Japanese EFL learners and found that those students who had higher English proficiency were able to read more swiftly and comprehended faster speeches. In this study, as shown in Table 5.6, significant correlations were found between the written test and listening comprehension (r = .290, p < .01), the written test and reading rate (r = .220, p < .01), and between the written test and reading efficiency index (r = .372, p < .01). When all the participants were divided into two groups based on their scores for written tests, ANOVAs revealed that significant differences were observed in the mean scores of the reading rate (F (1, 230) = 10.52, p < .01) and reading efficiency index (F (1, 230) = 27.81, p < .01). This result is congruous with the result obtained in Hirai (1999) in that those students who have higher English proficiency are able to read faster, though testing methods used in the respective studies were different.

5.5.4.5 Hypothesis 5

Table 5.6 shows that a significant correlation was observed between articulation speed of English words and ability to repeat English (r = .312, p < .01). A significant correlation was also found between ability to repeat English and listening comprehension (r = .281, p < .01). On the other hand, no correlation was found between English articulation speed and listening comprehension (r = .093, ns). In this study, the articulation speed of English words was measured as the number of syllables read aloud in 2 seconds. The average number of syllables was 6.57. However, in the test of ability to repeat English, the participants were presented with English sentences ranging from 4 to 16 syllables and were asked to orally repeat what they heard immediately after each sentence. Since the average number of syllables was 7.02, it is surmised that learners could articulate 7.02 syllables in about 2 seconds with the capacity of the phonological loop and with the help of their prior relevant knowledge in long-term memory.
Tauroza and Allison (1990) estimated standard rates of speech and noted that the average number of syllables per minute is 230-280, which is 7.67-9.33 syllables per 2 seconds (see Table 2.2). These figures showed that the number of syllables Japanese learners could articulate in 2 seconds or the number of syllables they could repeat with the limited capacity of the phonological loop is not good enough.

A significant relationship between ability to repeat English and listening comprehension ability was discovered in this study. It can be said that learners with high ability to repeat English sentences are able to rehearse faster, and this high rehearsal speed in turn enables them to rehearse longer aural speech input before its echoic trace decays. This result is consistent with the idea that the capacity of the phonological loop has a time constraint, which is determined by rehearsal speed. To summarize, learners' ability to repeat meaningful input, the ability to repeat English utterances fast and accurately, is considered to be a determining factor in predicting their listening comprehension.

5.4.5 Conclusion

A brief summary is provided of the experimental results gained in this study.

3. The ability to repeat meaningless input measured by digit memory span test is one of the factors that affect listening comprehension in cases where their written test scores were within the same level.

The ability to repeat meaningless input appears to be regarded as one of the predictors in EFL learners' listening comprehension in cases where their written test scores were within the same level. When learners' written test scores are within the same level, that implies their knowledge aspect of English does not influence listening comprehension. Therefore, it might be the ability to repeat meaningless input that helps predict the proficiency of EFL learners' listening comprehension in cases where the knowledge aspect of English is within the same level.
4. It cannot be said that reading rate affects listening comprehension of Japanese learners of English in cases where their written tests scores were within the same level.

In this study, listening rates were not examined because listening rates were not modified. As for their reading rate, the learners were asked to read a passage at their own pace trying to understand it. However, some learners may have been able to read a passage faster and understand it if they were told to. Further study is needed to verify this point.

5. Articulation speed for English words affects ability to repeat English, and in turn, ability to repeat English affects listening comprehension of Japanese learners.

Interpretation of the results concerning this hypothesis overlaps with that of Hypothesis 3. The difference between the ability to repeat meaningless input and the ability to repeat meaningful input is that the ability to repeat meaningless input deals with nonlinguistic verbal input, whereas the ability to repeat meaningful input involves linguistic verbal input. As Call (1985) maintains, linguistic short-term memory is more important to comprehension than nonlinguistic short-term memory.

As pointed out by Cowan and Kail (1996), learners’ processing speed and subvocal rehearsal speed largely affect their memory span. Although they place more emphasis on the significance of subvocal rehearsal speed than processing speed, processing speed should be paid attention to when considering the difference between linguistic short-term memory and nonlinguistic short-term memory. Linguistic short-term memory seems to depend on processing speed as well as rehearsal speed more than nonlinguistic short-term memory does. (see Figure 4.7)

5.5 Study 3

5.5.1 Purpose

The purpose of this study was to examine factors that explained the development of
listening comprehension of Japanese learners of English. The factors were the same as in Study 2 (Takeno & Takatsuka, 2007).

5.5.2 Hypotheses

The hypotheses addressed in this investigation were:

6. Vocabulary/grammar, reading comprehension, and ability to repeat English are strongly related to listening comprehension in cases where vocabulary/grammar, reading comprehension, articulation speeds for Japanese and English words, ability to repeat English, digit memory span, reading rate, and reading efficiency have been examined in the immediate and delayed tests.

7. Vocabulary/grammar, reading comprehension, and ability to repeat English explain the development of Japanese learners’ listening comprehension when comparing learners whose listening comprehension develops and those whose listening comprehension does not.

8. The ability to repeat meaningful input can be improved by practice especially with learners whose listening comprehension has developed, whereas the ability to repeat meaningless input cannot be improved.

5.5.3 Method

5.5.3.1 Participants

The participants were 197 Japanese learners of English who took a series of tests in each study. The interval between the two studies was more than half a year. The participants were first-year students at a senior high school in Okayama, with ages ranging from 15 to 16.

5.5.3.2 Instruments

In (1) Listening Comprehension, (2) Vocabulary/Grammar, (3) Reading Comprehension, different tests were used in the immediate test battery and the delayed test battery. With regard to the other tests, the same tests were used in both the immediate and delayed test batteries.
5.5.4. Results and Discussion

5.5.4.1 Descriptive Statistics (Immediate Test)

Table 5.9 shows the descriptive statistics of listening comprehension and other factors in the immediate test (Immediate Test). The minimum, maximum, mean (scores) and standard deviations for each factor are listed.

Table 5.9

<table>
<thead>
<tr>
<th>Description</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
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<td>60.56</td>
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</tr>
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<td>3. Reading Test</td>
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<td>20.09</td>
</tr>
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<td>4. Written Test*</td>
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<tr>
<td>5. Japanese Articulation Speed</td>
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<tr>
<td>6. English Articulation Speed</td>
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</tr>
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<td>7. Ability to Repeat English</td>
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<td>1.69</td>
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<td>9</td>
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</tr>
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<td>9. Reading Rate</td>
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<td>10. Reading Efficiency Index</td>
<td>26</td>
<td>150</td>
<td>64.52</td>
<td>19.10</td>
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</table>

* Written Test scores are the summation of the Vocabulary/Grammar Test and Reading Test scores.

5.5.4.2 Correlations (Immediate Test)

Pearson product-moment correlation coefficients were calculated between listening comprehension and other factors in the immediate test (see Table 5.10).
Table 5.10

<table>
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<td>.280*</td>
<td>.290*</td>
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<td>.083</td>
<td>.287*</td>
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<td>.055</td>
<td>.138</td>
</tr>
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<td>.781*</td>
<td>.161*</td>
<td>.251*</td>
<td>.281*</td>
<td>.069</td>
<td>.146*</td>
<td>.296*</td>
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</tr>
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<td>.286*</td>
<td>.370**</td>
<td>.405*</td>
<td>.135</td>
<td>.218*</td>
<td>.356*</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>.370**</td>
<td>.408*</td>
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<td>.217**</td>
<td>.377*</td>
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<td>.189**</td>
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<td>.381**</td>
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<td>.285**</td>
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<td>.026</td>
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</tbody>
</table>

**p<.01  *p<.05

Notes: 1.LT=Listening Test  2.VGT=Vocabulary/Grammar Test  3.RT=Reading Test  4.WT=Written Test (i.e., VGT + RT)  5.JAS=Japanese Articulation Speed  6.EAS=English Articulation Speed  7.ARE=Ability to Repeat English  8.DMS=Digit Memory Span  9.RR=Reading Rate  10.REI=Reading Efficiency Index

5.5.4.3 Descriptive Statistics (Delayed Test)

Table 5.11 shows the descriptive statistics of listening comprehension and other factors in the delayed test (Delayed Test).
Table 5.11

Descriptive Statistics of Listening Comprehension and Other Factors in Delayed Test (N=197)

<table>
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<td>8.19</td>
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5.5.4.4 Correlations (Delayed Test)

Table 5.12

Correlation Matrix between Listening Comprehension and Other Factors in Delayed Test

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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</tbody>
</table>

**p<.01  *p<.05
Pearson product-moment correlation coefficients were calculated between listening comprehension and other factors in the delayed test (see Table 5.12).

### 5.5.4.5 Hypothesis 6

This hypothesis tested what factors were strongly related to listening comprehension in cases where vocabulary/grammar, reading comprehension, Japanese/English articulation speed, ability to repeat English, digit memory span, reading rate, and reading efficiency had been examined in the immediate and delayed tests. Table 5.10 shows that listening comprehension had significant correlations with vocabulary/grammar ($r = .215$, $p < .01$), reading comprehension ($r = .280$, $p < .01$), written test ($r = .290$, $p < .01$), ability to repeat English ($r = .287$, $p < .01$). On the other hand, Table 5.12 shows that listening comprehension had significant correlations with vocabulary/grammar ($r = .414$, $p < .01$), reading comprehension ($r = .297$, $p < .01$), written test ($r = .411$, $p < .01$), Japanese articulation speed ($r = .193$, $p < .01$), ability to repeat English ($r = .341$, $p < .01$), Reading efficiency index ($r = .209$, $p < .01$) and English articulation speed ($r = .168$, $p < .05$).

The results of the two studies were not entirely consistent. However, common factors were observable in both of the studies. The common factors were: vocabulary/grammar, reading comprehension, and ability to repeat English. The result shows that factors such as vocabulary/grammar, reading comprehension, and ability to repeat English may affect listening comprehension of Japanese learners. Listening comprehension is significantly correlated with knowledge aspect of English, such as vocabulary/grammar as well as the strategic aspect of listening, such as ability to repeat English.

### 5.5.4.6 Hypothesis 7

By comparing learners whose listening comprehension had developed and learners whose listening comprehension had not, the second hypothesis considered what factors explained the development of listening comprehension of Japanese learners of English. To achieve this aim,
two groups were created, based on their first and second listening test scores. The learners who
whose listening comprehension test scores had increased by 19 to 43 points were classified as
Group A (N = 45). Those whose scores decreased by 8 to 52 points were classified as Group B
(N = 44).

Table 5.13 shows the descriptive statistics of listening comprehension and other factors of
Group A. Table 5.14 shows those of Group B. The minimum, maximum, mean (scores) and
standard deviations of each factor are listed. Figures in square brackets are the results of the
immediate test.

In comparison, learners whose listening comprehension developed and those whose
listening comprehension did not, Group A got significantly higher scores than that of Group B in
the vocabulary/grammar (F (1, 87) = 6.46, p < .05), reading comprehension (F (1, 87) = 10.01,
p < .01), and ability to repeat English (F (1, 87) = 6.25, p < .05) tests in the immediate test even
though the listening test score of Group B was significantly higher than that of Group A (F (1, 87 )
= 16.38, p < .01).

Table 5.13

| Descriptive Statistics of Listening Comprehension and Other Factors of Group A (N = 45) |
|---------------------------------|-------|-------|-------|-------|
|                                 | Min   | Max   | Mean  | SD    |
| 3. Reading Test                 | 32[0] | 100[100]| 57.82[57.49]| 12.89[21.96]|
| 4. Written Test                 | 69[50]| 166[169]| 121.13[121.20]| 22.06[29.40]|
Table 5.14

<table>
<thead>
<tr>
<th>Description</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
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<tr>
<td>3. Reading Test</td>
<td>24[0]</td>
<td>77[89]</td>
<td>51.16[44.45]</td>
<td>12.65[16.45]</td>
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<tr>
<td>10. Reading Efficiency Index</td>
<td>31[26]</td>
<td>188[131]</td>
<td>85.79[61.98]</td>
<td>32.74[19.84]</td>
</tr>
</tbody>
</table>

5.5.4.7 Hypothesis 8

Table 5.13 shows the results obtained in the first and second studies of Group A, and Table 5.14 shows those of Group B. In the t-test, a significant difference was found for ability to repeat English within Group A (t (44) = 6.73, p < .0001), but was not detected for digit memory span within the group (t (44) = 1.93, p = .061). Similarly, there was a significant difference for ability to repeat English within Group B (t (43) = 6.79, p < .0001), but not for digit memory span (t (43) = .85, p = .402). That is, retention of material with meaning through ability to repeat English improves by practice, while retention of material with no meaning like digit memory span does not.

5.5.5 Conclusion

A brief summary is given to the experimental results obtained in this study.

6. Factors such as vocabulary/grammar, reading comprehension, and ability to repeat English are strongly related to listening comprehension in cases where vocabulary/grammar, reading
comprehension, articulation speeds for Japanese and English words, ability to repeat English, digit memory span, reading rate, and reading efficiency have been examined in the immediate and delayed tests.

If some factors indicate significant correlations in both the immediate and delayed tests, it can be said that such factors are strongly related to listening comprehension. In this examination, listening comprehension showed a significant correlation with the knowledge aspect of English such as vocabulary/grammar as well as the strategic aspect of listening, such as ability to repeat English.

7. It cannot be said that vocabulary/grammar, reading comprehension, and ability to repeat English explain the development of Japanese learners' listening comprehension when comparing learners whose listening comprehension developed and those whose listening comprehension did not.

By comparing learners whose listening comprehension developed and those whose listening comprehension did not, the former group got significantly higher scores than the latter in the vocabulary/grammar, reading comprehension, and ability to repeat English tests in the immediate test even though the listening test score of the latter group was significantly higher than that of the former group. Factors such as vocabulary/grammar, reading comprehension, and ability to repeat English are considered to help estimate and explain the development of listening comprehension in EFL learning.

8. The ability to repeat meaningful input can be improved by practice not only with learners whose listening comprehension developed but also with those whose did not, whereas the ability to repeat meaningless input cannot be improved.
To summarize, it appears that linguistic short-term memory such as ability to repeat English can be improved by training. However, nonlinguistic short-term memory measured by digit memory span test does not seem to improve.

This chapter tested eight hypotheses by referring to the results of the three studies. The results are summarized in the following. These results will be discussed in the final chapter.

Table 5.15

<table>
<thead>
<tr>
<th>Study</th>
<th>Hypothesis</th>
<th>Result</th>
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<tbody>
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<td>Study 1</td>
<td>Hypothesis 1</td>
<td>Supported</td>
</tr>
<tr>
<td>Study 1</td>
<td>Hypothesis 2</td>
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</tr>
<tr>
<td>Study 2</td>
<td>Hypothesis 3</td>
<td>Supported</td>
</tr>
<tr>
<td>Study 2</td>
<td>Hypothesis 4</td>
<td>Not Supported</td>
</tr>
<tr>
<td>Study 2</td>
<td>Hypothesis 5</td>
<td>Supported</td>
</tr>
<tr>
<td>Study 3</td>
<td>Hypothesis 6</td>
<td>Supported</td>
</tr>
<tr>
<td>Study 3</td>
<td>Hypothesis 7</td>
<td>Not Supported</td>
</tr>
<tr>
<td>Study 3</td>
<td>Hypothesis 8</td>
<td>Partially Supported</td>
</tr>
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</table>
Chapter 6

Conclusion

The final chapter reviews the previous five chapters briefly and consolidates the significance of the present thesis. It also makes a proposal on pedagogical implications based on the review and consolidation. Finally, it discusses the limitations of the present thesis and suggests further research possibilities.

The purpose of the present thesis is to clarify how phonological memory and other contributing factors affect listening comprehension of Japanese learners of English. To achieve this purpose, Chapter 2 gave detailed discussion on listening comprehension and memory and temporal factors. Several sets of component skills in listening were described to explain the listening comprehension process with a focus on top-down/bottom-up processing, as well as parallel-processing. Some models of listening comprehension were also presented to discuss the listening comprehension process with a focus on the importance of memory, especially of phonological short-term memory. Several experimental studies were observed which examined the effects of memory span, speech rate, and pausing on listening comprehension. The chapter concluded by confirming that bottom-up processing, memory span, and two temporal factors: speech rate and pausing are important in foreign language listening comprehension.

Chapter 3 dealt with relationships among listening comprehension, knowledge factors and other language skills. The chapter first reviewed the relationship between listening comprehension and knowledge factors such as lexical knowledge and grammatical knowledge because these factors are considered to be essential in the comprehension of language. It then discussed the relationship between listening comprehension and two other language skills: speaking and reading. In closing, the chapter reviewed the literature regarding the transfer of learning from listening to the other language skills: speaking, reading, and writing. Researchers are in favor of the idea that the transfer of learning occurs most positively from listening to the
other language skills. The suggestion that stems from this is that more attention should be given to teaching listening in the initial stage of foreign language learning.

Chapter 4 presented the theoretical background of this thesis. In this thesis, the phonological loop of working memory was regarded as the reliable theoretical background because the phonological loop was considered to play a crucial role in listening comprehension. This chapter first discussed the involvement of working memory with listening comprehension in terms of their active and complex cognitive activities during the process of information. The chapter then put focus on the historical shift from short-term memory to the phonological loop of working memory, and discussed the capacity and the functions of the phonological loop. What should be restated here is that phonological memory span can be explained well when it is understood to have a time constraint. It is not limited by a fixed number of verbal items but by how fast and accurately a listener can rehearse subvocally before sounds disappear. That is the key to understanding what phonological memory is.

Chapter 5 provided eight research questions and eight hypotheses. This chapter reported the three experimental studies that had been administered to verify the eight hypotheses.

6.1 Significance

This section reviews the findings of the present thesis and discusses the significance of the findings. Three experimental studies were carried out to test the hypotheses. Study 1 examined how the ability to repeat meaningless input affected listening comprehension of Japanese learners of English under three presentation conditions. The first result showed that the ability to repeat meaningless input affected listening comprehension under these conditions. In the study, three presentation conditions were created by changing speech rate and pausing. Texts used in the study were within the participants' understanding level. The second result indicated that the presentation condition with appropriate pausing best facilitated Japanese learners' listening comprehension. Also, learners with higher ability to repeat meaningless input made the most of that presentation condition.
The importance of Study 1 lies in that it investigated the effect of memory span coupled with the effects of speech rate and pausing on listening comprehension. Another important point is that the study regarded memory span as changeable. Memory span was interpreted in this thesis as ability to repeat verbal input. Therefore, it depended on how fast learners (subvocally) rehearsed and how well they remembered the speech input in their mind.

Study 2 investigated how possible contributing factors affected listening comprehension of Japanese learners of English. The first result indicated that the ability to repeat meaningless input affected listening in cases where their written test scores were within the same level. The second result of the study showed that reading rate did not affect listening comprehension in cases where their written test scores were within the same level. The third result revealed that articulation speed for English words affected ability to repeat English, and in turn, ability to repeat English affected listening comprehension.

The significance of Study 2 is that it revealed the ability to repeat meaningless input to be a good indicator of listening comprehension when learners’ knowledge of English was within the same level. Furthermore, this study’s finding that there are correlations between articulation speed and ability to repeat English, and between ability to repeat English and listening comprehension is significant. The link had already been suggested by Cowan and Kail (1996), however, very little research has been conducted so far in the area of EFL learning.

Study 3 explored how possible contributing factors affected listening comprehension of Japanese learners of English in the immediate and delayed tests. The factors were the same as in Study 2. The first result showed that vocabulary/grammar, reading comprehension, and ability to repeat English were strongly related to listening comprehension. These factors were considered to be strongly related to listening comprehension because they indicated correlations in both the immediate test and the delayed test. As for the second result, it cannot be said that vocabulary/grammar, reading comprehension, and ability to repeat English explained the development of the listening comprehension when comparing between learners whose listening comprehension developed and those whose listening comprehension did not. However, as for
learners whose listening comprehension developed, they got significantly higher scores in the vocabulary/grammar, reading comprehension, and ability to repeat English tests from the beginning. It can be said that vocabulary/grammar, reading comprehension, and ability to repeat English affected listening comprehension. The third result revealed that the development of ability to repeat English related not only to learners whose listening comprehension developed but also to learners whose listening comprehension did not, and that nonlinguistic short-term memory like digit memory span did not improve.

The significance of Study 3 lies in that it somewhat clarified contributing factors which affected listening comprehension of Japanese learners. They are: vocabulary/grammar as knowledge factors, reading comprehension as a language skill, and ability to repeat English. Another point that should be made here is that linguistic short-term memory, such as ability to repeat English, developed by practice in general. However, nonlinguistic short-term memory like digit memory span did not.

6.2 Pedagogical Implications

The results of hypotheses 1 and 2 in Study 1 indicate that practice for speeded repetition is needed to improve English aural comprehension ability. Futatsuya and Kaneshige (2001) examined the relationship between rehearsal speed and listening comprehension by using a repetition task and found that articulation speed and recognition accuracy are the two determining factors that help predict EFL learners’ aural comprehension ability fairly accurately. They also found that listening comprehension is improved with intensive practice by accelerating rehearsal speeds up to normal speed with phonological accuracy. They add that giving practice only in slow listening neither affects nor improves EFL learners listening comprehension. This means that practice given in accelerating articulation speeds is effective in activating and encoding phonological, lexical, semantic, and syntactic information in working memory.

Futatsuya (1999, 2004) suggests that learners should be given practice in compressing a series of English speech sounds and words in sense-group segments more rapidly with better
accuracy. One of the efficient ways he proposes is to place a prolonged pause (temporal spacing) between sense-groups and to articulate each sense-group at a closer-to-normal speech rate. He concludes that it is of vital importance to improve the ability to listen to speech compressed into a normal speed (see Figure 6.1).

Figure 6.1 Compressing a series of English speech sounds and words in sense-group segments more rapidly and accurately and giving wider pauses between sense-group segments (Futatsuya, 2004, p.14)

The results concerning Hypothesis 3 in Study 2 indicate that short-term memory is one of the factors that affects listening comprehension. It can be said that phonological short-term memory, specifically the capacity of the phonological loop, is largely affected by the learner’s rehearsal speed. Practice in repeating English input quickly and accurately should be given in English instruction. Tamai (2005) examined the effect of shadowing practice on listening ability. He found that shadowing does not necessarily work on the reinforcement of knowledge aspect of English, such as lexical knowledge and grammatical knowledge, but rather it works to strengthen the strategic aspect of listening (see Figure 6.2). Shadowing is also considered to activate the phonological loop of working memory, and it eventually promotes listening comprehension.

Furthermore, repetition practice with a focus on recognition accuracy — initially with short sentences then gradually longer sentences — should be given because it helps make effective use of the phonological loop and aides in backing up longer speech input.
According to the results related to Hypothesis 4 in Study 2, it cannot be said that reading rate affects listening comprehension of Japanese learners of English in cases where their English scores for written tests were within the same level. In this study, listening rates were not examined because listening rates were not modified. As for their reading rate, the learners were asked to read a passage at their own pace while trying to understand it. However, some learners may have been able to read a passage faster and understand it if they were told to. Further study is needed to verify this point. Although no significant correlation was found between reading rate and listening comprehension ($r = .067, \text{ns}$), a significant correlation was discovered between
reading efficiency index and listening comprehension \((r = .162, p < .05)\). When all the participants were divided into two groups based on reading efficiency index, a one-way factorial ANOVA showed that there was a significant difference in the means of listening tests between them \((F (1, 230) = 4.51, p < .05)\). It is reasonable to assume that fast reading with accuracy may affect Japanese learners' listening comprehension. One possible area of study in the future lies in confirming this. Moreover, students with higher written test scores were able to read faster and more accurately. This is a very interesting result because they were simply told to read a passage at their own pace while trying to understand it.

Interpretation of the results concerning Hypothesis 5 in Study 2 overlaps with that of Hypothesis 3 in Study 2. This clearly indicates that ability to repeat English is one of the factors that determine listening comprehension. Although significant correlations were found between English articulation speed and vocabulary/grammar \((r = .245, p < .01)\) and between English articulation speed and reading comprehension \((r = .338, p < .01)\), no significant correlation was observed between English articulation speed and listening comprehension \((r = .093, \text{ns})\). It is difficult for English articulation speed to affect listening comprehension directly. One possible reason behind this is that articulation speed for English words relies mostly on articulation speed itself. On the other hand, ability to repeat English depends mainly on rehearsal speed as well as the ability to retain linguistic input. Further study is needed to answer these unresolved questions.

The results concerning Hypothesis 6 in Study 3 indicate that factors such as vocabulary/grammar, reading comprehension, and ability to repeat English affect listening comprehension. In understanding input information by listening, phonological, syntactical, and semantic/contextual analyses are necessary (Tamai, 2005). Lexical knowledge and grammatical knowledge are stored in long-term memory. They are indispensable in the process of syntactical and semantic analyses. Reading comprehension is similar to listening comprehension in that syntactical and semantic/contextual analyses are conducted in the process of understanding information. On the other hand, ability to repeat English is mainly related to the strategic aspect
of listening, that is, phonological analysis. It is reasonable to believe that those factors determine Japanese learners' listening comprehension.

The results related to Hypothesis 7 in Study 3 shows that Group A got significantly higher scores than Group B in the vocabulary/grammar, reading comprehension, and ability to repeat English tests in the immediate test even though the listening test score of Group B was significantly higher than that of Group A. Factors such as vocabulary/grammar, reading comprehension, and ability to repeat English are considered to help predict and explain the development of listening comprehension of Japanese learners of English. This result overlaps with that of Hypothesis 6. It can be concluded that the development of the listening ability of Japanese learners of English can be explained in terms of the knowledge aspect of listening such as vocabulary/grammar, reading comprehension. The strategic aspect of listening, such as ability to repeat English, also aids in the explanation of the development of listening comprehension.

The results concerning Hypothesis 8 in Study 3 show that, with practice, retention for material with meaning improved as ability to repeat English improved. However, retention for material with no meaning like digit memory span did not improve. This result can be explained in that learners' memory span is largely increased by rehearsal speed, and rehearsal speed is increased by processing speed (Cowan & Kail, 1996; Takeno, 2004). It can be said that ability to repeat English improved in accordance with the improvement of learners' processing speed (i.e. speed for searching relevant prior knowledge in the long-term memory). However, processing speed for digit memory did not improve. Further study is needed to confirm how (subvocal) rehearsal speed is influenced by processing speed.

6.3 Limitations

The present thesis had the following limitations. First, the listening comprehension process is very complicated and difficult to observe, as Rubin (1994) pointed out. For example, one aspect of listening comprehension known as phoneme recognition would have been too complicated for inclusion in this thesis. Rather than focus on overly complicated aspect of
listening comprehension, such as phoneme recognition, this thesis chose to focus more on rehearsal, one of the determinant factors of phonological memory.

Second, there is no universally accepted model for the listening process. In this thesis, the process of listening seems to be described as a relatively linear process. Therefore, emphasis was put more on the sequential information process (i.e., bottom-up processing) than on top-down processing and parallel processing.

Third, the interpretation of the phonological loop is also very complicated. Numerous explanations have been presented on the phonological loop of working memory to date (Baddeley, 2007). This thesis was theoretically based on the phonological loop, and relied on “the word length effect” to explain the time constraint capacity of the loop. The word length effect is still commonly accepted. However, there are various interpretations to it. Again, in this thesis, stress was put more on the sequential information process of the input sound where the phonological loop is considered.

Fourth, it is quite difficult to test what should be measured directly when it comes to listening comprehension. Thus, several studies in the literature review offered contradictory conclusions, since the measures used were different and indirect. It cannot be said that the measures used in this thesis completely reflect what wanted to be measured in listening comprehension.

Fifth, the present thesis did not prove the relationship between reading rate and listening comprehension. Although there seems to be a lot of similarities between reading comprehension and listening comprehension, the crucial difference is that learners can reread the text if they want to in reading. On the other hand, they cannot listen to the text again in listening. If further research is conducted on the relationship between the two skills, more specific and detailed instructions/conditions should be provided.

6.4 Implications for Future Research

Four implications for future research are explained in the following.
First, Studies 1, 2, and 3 mainly dealt with how closely EFL learners’ subvocal rehearsal speed was related to listening comprehension in terms of the ability to repeat verbal input as measured by their memory span size. As cited earlier, the view taken by Cowan and Kail (1996) is supportive of possible causal links that run from processing speed to speech rate (i.e. subvocal rehearsal speed), and from speech rate to memory span (see Figure 4.7). One possible area of study on phonological memory in the future lies in confirming the view that processing speed enhances subvocal rehearsal speed (i.e. the ability to repeat verbal input) in the area of EFL learning. It might be somewhat related to automatic processing, as discussed in 2.1.3.2. Making effective use of the limited capacity of attention and memory appears to be the key for Japanese learners of English to become better listeners.

Second, it would be beneficial to investigate that the difference between shadowing practice and repetition practice. Both practices should be considered to be significant in that they can enhance bottom-up processing during the process of listening comprehension, as discussed in 2.1.2. Shadowing practice stresses its importance on repeating the speech input as accurately as possible while listening to the incoming speech. On the other hand, repetition practice puts emphasis on repeating the speech input as accurately as possible immediately after the speech input is heard while retaining of the input in the phonological loop. If shadowing practice and repetition practice are defined this way, it is worth investigating the differences of these two practices.

Third, in line with the previous two implications for future research, relationships among listening comprehension, articulation speed for English words and ability to repeat English should be considered in future research. In the experiments in this thesis, correlations between articulation speed and ability to repeat English, and between ability to repeat English and listening comprehension were confirmed. However, a correlation between articulation speed and listening comprehension was not. One possible reason might be that articulation speed for English words relies mostly on articulation speed itself, whereas ability to repeat English depends mainly on rehearsal speed as well as the ability to retain linguistic input.
Fourth, in this thesis, a correlation between reading rate and listening comprehension of Japanese learners of English in cases where their English scores for written tests were within the same level was not confirmed. However, it is reasonable to assume that fast reading with accuracy may affect listening comprehension. This should be researched in future studies. In this thesis, students with higher written test scores were able to read faster and more accurately. This is a very interesting result because they were simply told to read a passage at their own pace trying to understand it. Future research is needed to answer the unsolved questions mentioned in this section.

Recently, as mentioned in Chapter 1, English is considered to be one of the essential skills to acquire in living as a member of the international society, more so than a mere subject to study at school. The author hopes that what the present thesis has clarified will make contributions to further development of research on phonological memory and other contributing factors affecting listening comprehension and to the improvement of English education in Japan.
References


Rost, M. (2002). *Teaching and researching listening*. Harlow: Longman.


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Appendices

Appendix A: Passages Used in Study 1

Passage A
1. Yesterday I went to a movie. (9)
2. Luckily I could get a good seat. (9)
3. The movie was an exciting one, (9)
4. but I was not able to enjoy it. (10)
5. Two people were sitting behind me. (9)
6. I heard them talking rather loudly, (9)
7. so I could not hear the movie well. (9)
8. I turned around and looked at them angrily. (11)
9. They did not pay any attention to me. (10)
10. They kept talking with each other loudly. (10)
11. At last I turned around to them again, (10)
12. and said angrily, “I can’t hear a word!” (10)
13. I was quite surprised when one of them said, (10)
14. “Hey, why don’t you mind your own business?” (10)
15. This is our private conversation!” (9)

Note: (Number) = the number of syllables

Passage B
1. I had a funny experience last year. (10)
2. I left a small town in the south of France, (10)
3. and decided to drive down to the next town. (11)
4. A young man waved to me on the way. (9)
5 I stopped my car in front of him. (8)
6 He asked me for a ride to the next town. (10)
7 He quickly got in and sat next to me. (10)
8 I said good morning to him in French. (9)
9 and he gave an answer to me in French. (10)
10 I don’t speak any French except for a few words. (11)
11 because I am a traveler from London. (10)
12 The two of us didn’t speak during the trip. (10)
13 Toward the end of our trip to the next town, (11)
14 the young man said to me very slowly. (10)
15 “Do you speak English if I may ask?” (9)
16 I soon learned he was English himself. (9)

Note: (Number) = the number of syllables

Passage C
1 Fishing is one of my favorite sports. (10)
2 I often go fishing in the lake nearby. (11)
3 but I don’t catch anything at all. (9)
4 This does not worry me so much. (8)
5 There are some unlucky fishermen. (9)
6 They catch shoes and cans instead of fish. (9)
7 I am much less lucky than they are. (9)
8 because I can not even catch old boots. (9)
9 After spending whole mornings in the lake, (10)
10 I always go home with an empty bag. (10)
11 My friends often tell me to give up fishing. (11)
12 I think they don’t know one important thing. (10)
13 I do not enjoy fishing so much. (9)
14 I only enjoy sitting in a boat, (10)
15 I am interested in doing nothing. (11)

Note: (Number) = the number of syllables

Appendix B: Digit Memory Span Test (Rehearsal Prevention Task Used in Study 1)

1) 9 2 6 1
2) 3 8 7 2
3) 5 8 4 1
4) 2 8 1 7 3
5) 4 9 5 2 9
6) 6 4 1 8 5
7) 7 3 9 2 1 5
8) 1 9 6 4 1 8
9) 8 2 5 3 9 7
10) 2 9 8 1 3 6 4
11) 3 7 2 1 8 3 6
12) 5 2 3 8 5 7 4
13) 8 3 5 2 1 5 8 6
14) 3 7 9 2 4 1 2 8
15) 1 5 7 3 5 8 2 8
16) 2 6 3 5 1 2 9 2 4
17) 6 8 2 1 9 6 7 3 2
18) 9 3 8 2 4 5 7 6 1

Note: One digit per second
Digit memory span test

これから、数字を続けて読みます。「ピン」という合図を聞いてたら、その数字を言われた順番に思い出せるところまで記入してください。ただし、聞いていないときにメモを取ってはいけません。
必ず「ピン」という合図を聞いてから記入を始めてください。では、始めます。

(例) 5 4 1 7 「ピン (合図の音)」 ⇒ 5 4 1 7

1) __ __ __ __
2) __ __ __ __
3) __ __ __ __
4) __ __ __ __
5) __ __ __ __
6) __ __ __ __
7) __ __ __ __
8) __ __ __ __
9) __ __ __ __
10) __ __ __ __ __ __
11) __ __ __ __ __ __
12) __ __ __ __ __ __
13) __ __ __ __ __ __
14) __ __ __ __ __ __
15) __ __ __ __ __ __
16) __ __ __ __ __ __
17) __ __ __ __ __ __
18) __ __ __ __ __ __
Appendix C: Listening Comprehension Test Used in Study 1

Passage A

先ほど聞いた英文の内容を思い出しながら以下の設問に答えなさい。答えは右の( )内に番号で記入すること。

(1) 私はいつ映画に行きましたか。
1. 昨日
2. 先週
3. 先月
4. 昨年

(2) 私はどのような席に座りましたか。
1. 良い席
2. 惜い席
3. 賢れた席
4. 特別席

(3) 私が見た映画はどのような映画でしたか。
1. つまらない映画
2. 感い映画
3. 見ぐような映画
4. かくわくするような映画

(4) 私の映画館での様子を表しているのはどれですか。
1. 私は映画を楽しんだ
2. 私は後ろの人との会話を楽しんだ
3. 私は映画を楽しめなかった
4. 私は後ろの人との会話を楽しめなかった

(5) 私の後ろには何人の人が座っていましたか。
1. 一人
2. 二人
3. 三人
4. 四人

(6) 私の後ろに座っていた人はどのような様子でしたか。
1. 静かにしていた
2. 小さな声で話をしていました
3. 大きな声で話をしていました
4. 私と話しかけていた

(7) 私には映画の音がよく聞こえていましたか。
1. よく聞こえていた
2. よく聞こえていなかった
3. 聴いていたので聞こえなかった
4. 後ろの人と話をしていて聞こえていなかった

(8) 私は後ろに何回振り返りましたか。
1. 一回
2. 二回
3. 三回
4. 四回以上

(9) 私は後ろの人は何と言いましたか。
1. どうかしましたか
2. おもしろそうな話ですね
3. 映画に注意を払ってください
4. 一言も聞こえません

(10) 後ろの人は何に何と言いましたか。
1. ごめんなさい
2. なぜ言っていることがわからないのですか
3. これは私の会話です
4. 仕事の話をしましょう

答え（  ）
## Passage B

<table>
<thead>
<tr>
<th>( ) 組</th>
<th>( ) 番</th>
</tr>
</thead>
<tbody>
<tr>
<td>先ほど聞いた英文の内容を思い出しながら以下の設問に答えなさい。答えは右の（  ）内に番号で記入すること。</td>
<td></td>
</tr>
<tr>
<td>(1) 私がおかしな経験をしたのはいつですか。</td>
<td></td>
</tr>
<tr>
<td>1. 昨日</td>
<td></td>
</tr>
<tr>
<td>2. 先週</td>
<td></td>
</tr>
<tr>
<td>3. 先月</td>
<td></td>
</tr>
<tr>
<td>4. 昨年</td>
<td></td>
</tr>
<tr>
<td>答え（  ）</td>
<td></td>
</tr>
<tr>
<td>(2) 私はどこで運転をしていましたか。</td>
<td></td>
</tr>
<tr>
<td>1. イングランド北部</td>
<td></td>
</tr>
<tr>
<td>2. イングランド南部</td>
<td></td>
</tr>
<tr>
<td>3. フランス北部</td>
<td></td>
</tr>
<tr>
<td>4. フランス南部</td>
<td></td>
</tr>
<tr>
<td>答え（  ）</td>
<td></td>
</tr>
<tr>
<td>(3) 運転の途中で私に手を振ってきたのはどのような人でしたか。</td>
<td></td>
</tr>
<tr>
<td>1. 若い男の人</td>
<td></td>
</tr>
<tr>
<td>2. 若い女の人</td>
<td></td>
</tr>
<tr>
<td>3. 年配の男性</td>
<td></td>
</tr>
<tr>
<td>4. 年配の女性</td>
<td></td>
</tr>
<tr>
<td>答え（  ）</td>
<td></td>
</tr>
<tr>
<td>(4) その人はどこに行きがたがっていましたか。</td>
<td></td>
</tr>
<tr>
<td>1. ロンドン</td>
<td></td>
</tr>
<tr>
<td>2. パリ</td>
<td></td>
</tr>
<tr>
<td>3. 私の町</td>
<td></td>
</tr>
<tr>
<td>4. 私が出発した町</td>
<td></td>
</tr>
<tr>
<td>答え（  ）</td>
<td></td>
</tr>
<tr>
<td>(5) 私たちはお互いに何語で会話をしましたか。</td>
<td></td>
</tr>
<tr>
<td>1. 日本語</td>
<td></td>
</tr>
<tr>
<td>2. 英語</td>
<td></td>
</tr>
<tr>
<td>3. フランス語</td>
<td></td>
</tr>
<tr>
<td>4. イタリア語</td>
<td></td>
</tr>
<tr>
<td>答え（  ）</td>
<td></td>
</tr>
<tr>
<td>(6) 私はフランス語をどの程度話すことができますか。</td>
<td></td>
</tr>
<tr>
<td>1. 私はフランス語を全く話すことができない</td>
<td></td>
</tr>
<tr>
<td>2. 私はフランス語をほんの少ししか話すことができない</td>
<td></td>
</tr>
<tr>
<td>3. 私はフランス語と日本語を同じくらい話すことができる</td>
<td></td>
</tr>
<tr>
<td>4. 私はフランス語と英語を同じくらい話すことができる</td>
<td></td>
</tr>
<tr>
<td>答え（  ）</td>
<td></td>
</tr>
<tr>
<td>(7) 私の母国はどこですか</td>
<td></td>
</tr>
<tr>
<td>1. 日本</td>
<td></td>
</tr>
<tr>
<td>2. 英国</td>
<td></td>
</tr>
<tr>
<td>3. フランス</td>
<td></td>
</tr>
<tr>
<td>4. イタリア</td>
<td></td>
</tr>
<tr>
<td>答え（  ）</td>
<td></td>
</tr>
<tr>
<td>(8) 私たちの車の中の様子はどうでしたか。</td>
<td></td>
</tr>
<tr>
<td>1. 静かに座っていた</td>
<td></td>
</tr>
<tr>
<td>2. 日本語で話していた</td>
<td></td>
</tr>
<tr>
<td>3. 英語で話していた</td>
<td></td>
</tr>
<tr>
<td>4. フランス語で話していた</td>
<td></td>
</tr>
<tr>
<td>答え（  ）</td>
<td></td>
</tr>
<tr>
<td>(9) 車に乗ってきた人は旅の最後に何と言いましたか。</td>
<td></td>
</tr>
<tr>
<td>1. 英語が話せますか</td>
<td></td>
</tr>
<tr>
<td>2. フランス語が話せますか</td>
<td></td>
</tr>
<tr>
<td>3. ありがとうございますしました（英語で）</td>
<td></td>
</tr>
<tr>
<td>4. ありがとうございますしました（フランス語で）</td>
<td></td>
</tr>
<tr>
<td>答え（  ）</td>
<td></td>
</tr>
<tr>
<td>(10) 車に乗ってきた人は何人でしたか</td>
<td></td>
</tr>
<tr>
<td>1. 日本人</td>
<td></td>
</tr>
<tr>
<td>2. 英国人</td>
<td></td>
</tr>
<tr>
<td>3. フランス人</td>
<td></td>
</tr>
<tr>
<td>4. イタリア人</td>
<td></td>
</tr>
<tr>
<td>答え（  ）</td>
<td></td>
</tr>
</tbody>
</table>
Passage C

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Appendix D: Japanese/English Words Used for Measuring Japanese/English Articulation Speed

（1）日本語音読速度テスト
次の40個の単語をできるだけ速く音読してください。読み終わるまでの時間を測ります。

<table>
<thead>
<tr>
<th>才能</th>
<th>デザイン</th>
<th>中国語</th>
<th>心理学</th>
<th>直線</th>
</tr>
</thead>
<tbody>
<tr>
<td>恋愛小説</td>
<td>偶数</td>
<td>文法</td>
<td>魅力</td>
<td>図書館</td>
</tr>
<tr>
<td>年間試合数</td>
<td>田中さん</td>
<td>旅の思い出</td>
<td>哲学</td>
<td>オリンピック</td>
</tr>
<tr>
<td>情報処理</td>
<td>価値観の違い</td>
<td>歴史</td>
<td>内科</td>
<td>国境</td>
</tr>
<tr>
<td>先生</td>
<td>整理整頓</td>
<td>効果</td>
<td>柔道</td>
<td>焼肉定食</td>
</tr>
<tr>
<td>統計</td>
<td>遺言</td>
<td>神経</td>
<td>漢方医</td>
<td>駐車禁止</td>
</tr>
<tr>
<td>記憶力</td>
<td>時計</td>
<td>じゅうたん</td>
<td>コンパクトディスク</td>
<td>焼き芋</td>
</tr>
<tr>
<td>分析</td>
<td>経済社会</td>
<td>看板</td>
<td>交通安全</td>
<td>戦争と平和</td>
</tr>
</tbody>
</table>

（  ）秒

（  ）年（  ）組（  ）番 氏名（  ）

（2）英単語音読速度テスト
次の40個の単語をできるだけ速く音読してください。読み終わるまでの時間を測ります。

breakfast  child  dance  every  father
high  Internet  kitchen  language  member
November  difficult  interesting  question  restaurant
science  telephone  understand  volunteer  weather
yesterday  teacher  strange  popular  vacation
afternoon  busy  basketball  color  down
communication  find  homework  computer  minute
notebook  racket  present  someone  Japanese

（  ）秒

（  ）年（  ）組（  ）番 氏名（  ）
### Appendix E: Sentences Used for Measuring Ability to Repeat English

<table>
<thead>
<tr>
<th>Syllables</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>She is sleeping.</td>
</tr>
<tr>
<td>5</td>
<td>I bought a book.</td>
</tr>
<tr>
<td>6</td>
<td>I went to school.</td>
</tr>
<tr>
<td>7</td>
<td>Tom bought a book.</td>
</tr>
<tr>
<td>8</td>
<td>I am free today.</td>
</tr>
<tr>
<td>9</td>
<td>I bought a pencil.</td>
</tr>
<tr>
<td>10</td>
<td>I go to school by bike.</td>
</tr>
<tr>
<td>11</td>
<td>Please come here and help me.</td>
</tr>
<tr>
<td>12</td>
<td>Aki is eight years old.</td>
</tr>
<tr>
<td>13</td>
<td>Jack is in the English club.</td>
</tr>
<tr>
<td>14</td>
<td>What time do you go to bed?</td>
</tr>
<tr>
<td>15</td>
<td>You can use the telephone.</td>
</tr>
<tr>
<td>16</td>
<td>He is walking to the station.</td>
</tr>
<tr>
<td></td>
<td>She made dinner for my sister.</td>
</tr>
<tr>
<td></td>
<td>The movie starts at ten o’clock.</td>
</tr>
<tr>
<td>17</td>
<td>August is the eighth month of the year.</td>
</tr>
<tr>
<td>18</td>
<td>I will meet you at the restaurant.</td>
</tr>
<tr>
<td>19</td>
<td>I try to study hard every day.</td>
</tr>
<tr>
<td>20</td>
<td>Let’s go to the river this afternoon.</td>
</tr>
<tr>
<td>21</td>
<td>I want to the festival with my friends.</td>
</tr>
<tr>
<td>22</td>
<td>Bob is going to visit the small house.</td>
</tr>
<tr>
<td>23</td>
<td>Every day he goes to the school library.</td>
</tr>
<tr>
<td>24</td>
<td>She is taking pictures of all her friends now.</td>
</tr>
<tr>
<td>25</td>
<td>John will travel around Japan for two months.</td>
</tr>
<tr>
<td>26</td>
<td>They usually watch soccer games in their room.</td>
</tr>
<tr>
<td>27</td>
<td>He went out of the room without saying good-bye.</td>
</tr>
<tr>
<td>28</td>
<td>I like this town better than any other place.</td>
</tr>
<tr>
<td>29</td>
<td>I play tennis every Saturday with my father.</td>
</tr>
<tr>
<td>30</td>
<td>There is a wonderful park near the beautiful house.</td>
</tr>
<tr>
<td>31</td>
<td>I will show you how to write a letter in Chinese.</td>
</tr>
<tr>
<td>32</td>
<td>Many of them practice tennis every day after school.</td>
</tr>
<tr>
<td>33</td>
<td>My father and I went to a baseball game yesterday.</td>
</tr>
<tr>
<td>34</td>
<td>I will take care of his big dog when he is on a trip.</td>
</tr>
<tr>
<td>35</td>
<td>I did not think there would be snow on the mountain in April.</td>
</tr>
<tr>
<td>36</td>
<td>Please remember to turn off the light before you go to bed.</td>
</tr>
<tr>
<td>37</td>
<td>Bill has been in different countries and he speaks four languages.</td>
</tr>
<tr>
<td>38</td>
<td>It is really difficult for me to speak English very well.</td>
</tr>
<tr>
<td>39</td>
<td>My father really wants to buy the beautiful house near the sea.</td>
</tr>
</tbody>
</table>
Last summer Kenta went to Oxford to study English. There were many students from different countries in his English class. One day their teacher, Mr. White, took Kenta and the other students out for lunch. They went to a fast food restaurant and everyone ate fried fish and fried potatoes. British people call this “fish and chips.”

Mr. White told his students about fish and chips. He said it was probably the first fast food in Britain. At first, fried fish was sold as a meal without fried potatoes. The fish was also usually cold. Then, about 150 years ago, one restaurant sold hot fried fish and fried potatoes. Fish and chips were very cheap, so they soon became very popular.
(1) When did Kenta go to Oxford?

1. Last month.
2. Last year.
3. Last summer.
4. Last winter.

(2) Where did Kenta eat fish and chips?

1. He ate them in a restaurant in Oxford.
2. He ate them in a fishing town near Oxford.
3. He ate them at his teacher’s home near Oxford.
4. He ate them at a newspaper company in Oxford.

(3) When were hot fish and chips first sold?

1. Before there were potatoes in Britain.
2. Before there were newspapers.
3. Many hundreds of years ago.
4. About 150 years ago.

(4) Why were fish and chips popular many years ago?

1. Because the fish was cold.
2. Because people liked fishing.
3. Because people read the newspaper.
4. Because they were cheap.

(1) ( ) (2) ( ) (3) ( ) (4) ( )

/ 4

( ) 年 ( ) 組 ( ) 番 氏名 ( )
Yoko is a high school student in Japan. During spring vacation, she visited her American pen pal, Mike, in Chicago. On the first day, Mike showed her around the city. Yoko was surprised, because many people were wearing green clothes. Mike said, “Today is a special day. It’s called St. Patrick’s Day.* We have a big festival on this day every year.”

St. Patrick is a famous hero in Ireland.* He traveled around the country about 1,600 years ago. He taught Christianity* and built schools for people. He was a great man and loved by the people of Ireland.

After lunch, Yoko and Mike bought green hats at a store on the street and joined the dancing. They really enjoyed their “green day.”

*St. Patrick’s Day: 聖パトリックの日
*Ireland: アイルランド（ヨーロッパ北西部の島国）
*Christianity: キリスト教
(1) What did Mike do when Yoko visited him?

1. He traveled around America with her.
2. He showed her around Chicago.
3. He called her family in Japan.
4. He gave her some green clothes.

(2) Why was Yoko surprised on the first day?

1. Because she became popular there.
2. Because she worked at an American store.
3. Because she met her American pen pal, Mike.
4. Because she saw many people in green clothes.

(3) When did the famous hero build schools in Ireland?

1. On March 17.
2. On St. Patrick’s Day.
3. About 1,600 years ago.
4. About 260 years ago.

(4) What did Yoko and Mike do after lunch on St. Patrick’s Day?

1. They ate green cookies and cake.
2. They visited many parts of Ireland.
3. They bought green hats on the street.
4. They played some Japanese music.

(1) ( ) (2) ( ) (3) ( ) (4) ( )

/ 4

（ ）年（ ）組（ ）番 氏名（ ）