

# The Time Domain Factors Affecting EFL Learners' Listening Comprehension: a Study on Japanese EFL Learners

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## **Abstract**

A bulk of research has been conducted to clarify the effect of speech rate and pause duration on listening comprehension. Some previous studies have shown that a slower speech rate facilitates listening comprehension, while others have yielded opposite results. The conflicting results imply that it is very difficult to specify the most appropriate speech rate for every EFL listener. This study aims to clarify experimentally how pause duration and articulation rates affect EFL learners' listening comprehension by precisely controlling the two parameters: articulation rate and pause duration. Through two listening tests given to Japanese EFL learners, we obtained the result that longer pauses (450 ms) facilitate the listening comprehension of lower intermediate EFL learners, while slower articulation rate does not necessarily have a positive effect on learners' listening comprehension. This means a pause inserted in a passage provides listeners with additional information processing time and thus enhances the comprehensibility of the aural input.

## **1. Introduction**

Much research has been conducted for examining the effects of pauses and speech rate on listening comprehension in EFL (English as a Foreign Language) acquisition. Speech rate has been proposed as an important factor affecting EFL learners' listening comprehension. Previous studies have shown that a slower speech rate facilitates listening comprehension (Anderson-Hsieh & Koehler, 1988; Griffiths, 1992; Kimura, 1997). Matsuura, Chiba, Mahoney, and Rilling (2014) also found that a slower speech rate enhanced learners' understanding of even unfamiliar English varieties, such as Indian English. This finding coincides with our commonsense belief that the lower the speech rates are, the easier it is to understand, especially for EFL learners. Allowing individual EFL listeners to digitally control the speech rate on a recording, Zhao (1997) found that listening comprehension improved when the listeners slowed down the speech.

However, some earlier studies have yielded opposite results. Derwing (1990), for example, conducted an experiment in which native speakers (NSs) were asked to describe a short film to non-native speakers (NNSs) using various speech rates. Derwing found that communication was more successful between NSs and NNSs when the NSs spoke at a faster speech rate. These conflicting results concerning the effects of speech rate on listening comprehension imply that it is very difficult to specify the most appropriate speech rate for every EFL listener, since many other variables such as learners' language abilities, the vocabulary levels of listening materials, and familiarity with the topics affect listening comprehension.

In an experimental study, Blau (1990) found that Polish and Puerto Rican ESL (English as a Second Language) learners scored significantly higher on listening comprehension when they listened to English utterances with pauses added, and scored lower with natural materials and materials read at a slower speech rate. Blau also noted that the most advanced learners showed the best scores when they were given speech materials without pauses. The listening performance of EFL/ESL learners is influenced by various parameters such as pauses, speech rates, and their proficiency levels, leaving problems to be solved. Cognitive psychologists (Adam & Gathercole, 1996; Baddeley, Gathercole, & Papagno, 1998; Baddeley, 2000) have tried to elucidate the human information processing system by postulating that both auditory and visual information are temporarily stored and processed in working memory. It is speculated that pauses placed at grammatical junctures provide listeners with additional processing time in their working memory, resulting in improved comprehensibility of the aural input.

Kohno (1990, 1994, 1998) found that pauses inserted at every phrase and clause boundary enhance the listening ability of EFL learners, since every speech chunk surrounded by pauses corresponds to a perceptual sense unit (PSU). Following Miller (1956), a PSU consisting of seven plus or minus 2 syllables, within the interval of 330 milliseconds (ms) is thought to be the most relevant speech unit for enhancing the listener's holistic information processing. Kohno also argues that a pause longer than 420 ms facilitates the listener's analytic processing of aural information. Kano & Saito (1997) found that a slower speech rate (170 words per minute; wpm) aided Japanese EFL learners in a word recognition test and that artificially inserted pauses also helped their listening comprehension, though they did not specify the pause duration in their study. A longitudinal study by Suzuki (1991) also found that learners can improve their listening abilities by constantly listening to spoken materials with appropriate pauses.

Sugai, Kanzaki, and Yamane (2007) investigated the effects of pauses on Japanese EFL learners' listening processes to produce the following result that, after listening to test sentences of nine to 14 syllables in duration, learners achieved higher scores on sentences with one pause, two pauses, and no pause, in this order. Thus, one pause placed in a grammatical break facilitated listening comprehension. In order to further clarify the effects of speech rate<sup>1</sup>, articulation rate and pause duration on listening comprehension, we conducted the following experiment.

## 2. Experiment

### 2.1 Purpose

In this experiment, we aimed to clarify experimentally how pause duration and articulation rates affect EFL learners' listening comprehension by precisely controlling the two parameters: articulation rate and pause duration.

### 2.2 Method

#### 2.2.1 Participants

Two hundred and four Japanese EFL students from eight classes at four different universities participated in this study. All of them were non-English majors, and their level of English proficiency was lower intermediate. None of them reported any hearing impairments. The participants from eight classes were divided into four groups by pairing two classes into one.

#### 2.2.2 Test materials

Twenty English short passages were chosen from STEP (The Society for Testing English Proficiency) Eiken test. All of the participants were students in the authors' regular English classes. Taking their proficiency level into consideration, the following materials were chosen: ten were from the pre-second grade level and ten from the third grade level. In choosing these twenty test passages, we controlled the vocabulary level to be below 2,000 word level of the JACET List of 8,000 Basic Words. In order to avoid cognitive overload caused by memory capacity, each phrase duration between adjacent pauses contained no more than eight syllables ( $M = 5.53$ ,  $SD = 1.60$ ), based on the assumption by Miller (1956) that short-term memory has a capacity of seven plus or minus two items. Each of the ten passages had one multiple-choice question following it. With this experimental design, we attempted to effectively measure learners' listening comprehension abilities without overusing mental resource. Ten passages, which were randomly chosen from a total of 20, were given to all participants as Test A in order to assess their listening proficiency and to control the level of participants. The remaining ten sets of test materials, whose speed and pause durations were digitally controlled, were used as Test B to examine the possible effects of articulation rate and pause duration on listening comprehension.

The original speech samples were read aloud by a native English speaker (37-year-old male from New York) at two different speeds, one with a natural speed and the other with a faster speed. They were digitally recorded (44.1 kHz sampling rate, 16 bit, monaural) using the following equipment: a dynamic microphone (SONY F-VX300) and an SE200 sound board (ONKYO) mounted on a Windows PC (FUJITSU FMV-5230).

The recorded original passages were digitally edited to make four sets of stimuli with two different articulation rates<sup>1</sup> and pause durations. First, in order to make faster stimuli, the

articulation rate of the faster original speech was increased in Sugi Speech Analyzer software (1.07) to an extent that would not impair the naturalness of the speech sound. Second, for each of the two speech rates, the durations of all 96 pauses were manipulated to become 200 and 450 ms, using Cool Edit 2000 (1.0). The shorter pause was made to be 200 ms in this experiment, based on the notion that the human ear can detect a pause as short as 200 ms in duration in natural speech (Boomer, 1965; Mercer, 1976). Then, the articulation rates of the slower stimuli were adjusted for the materials to have the same speech rates as their faster counterparts with 450 ms pauses. The detailed stimuli data is shown in Table 1.

Table 1  
*Test B Stimuli statistics*

Articulation rate	Pause duration (ms)	Total articulation (s)	Total pause duration (s)	Total duration (s)	speech rate (WPM)
faster	200	93	19.2	112.2	212.8
	450	93	43.2	136.2	175.3
slower	200	117	19.2	136.2	175.3
	450	117	43.2	160.2	149.1

*Note.* Pause durations are shown in millisecond (ms) and the other values are shown in second (s).

### 2.2.3 Procedure

This experiment on listening comprehension was conducted as part of regular classroom activities<sup>2</sup>. Test A, without any control on time domain, was administered to all 204 participants to test their listening proficiency. The students listened to the passages through loudspeakers equipped in each classroom and answered the multiple-choice questions. Then after a three-minute intermission, one of the four different versions of digitally controlled materials was given to each group of two classes as Test B.

## 3. Results

Based on the scores of Test A (Table 2), extraneous data not suited for statistical analysis were excluded following the criteria below. For some learners, these test materials were so easy that the ‘ceiling effect’ was observed; thus, the learners who scored more than 8 out of 10 in Test A were excluded. On the other hand, the subjects of the beginning levels whose scores in Test A ranged from 0 to 4 were also excluded from statistical analysis because their scores were too low for us to discriminate their proficiency.

Table 2  
Results of Test A

Group	Faster		Slower	
	200	450	200	450
<i>M</i>	7.29	7.93	6.18	6.85
<i>SD</i>	2.14	1.40	1.85	1.92
<i>n</i>	48	46	45	65

As a statistical analysis, we conducted two-way Analysis of Covariance (ANCOVA). While the result shows no main effect of articulation rates ( $F(1, 128) = 1.140, p = .288, \eta^2 = .01$ ), significant effect of pause duration was detected ( $F(1, 128) = .309, p = .002, \eta^2 = .07$ ).

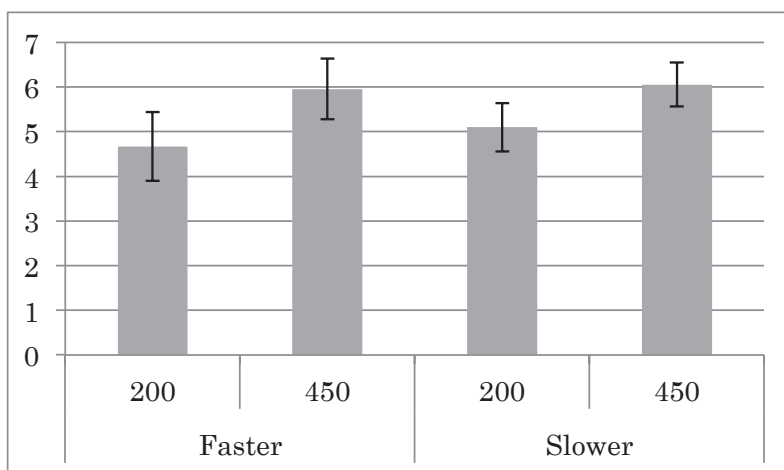
Figure 1 below graphically depicts the ANCOVA results shown in Table 3. We can see from these results that insertion of longer pauses exerted a positive effect on learners' listening comprehension. When longer pauses of 450 ms were placed in passages, it was found that the mean listening scores increased significantly both in faster and slower speeches.

Table 3  
Test B ANCOVA results

group	faster		slower	
	200	450	200	450
<i>M</i>	4.67	5.96	5.10	6.06
<i>SD</i>	2.04	1.81	1.53	1.76
95%CI	3.90 - 5.44	5.28 - 6.64	4.56 - 5.64	5.56 - 6.56
<i>n</i>	27	27	31	48

*Note.* In order to control between-group differences in students' English proficiency, analysis of covariance (ANCOVA) was chosen as a statistical measure with the pre-test score treated as a covariate.

As we have already mentioned earlier, the mean speech rates of the faster stimuli with 450 ms pauses were controlled to have the same value as their slower counterparts with 200 ms pauses. That is, though the articulation rates themselves are higher in the faster speech stimuli, insertion of long pauses of 450 ms made the mean speech rates the same as those in the lower speech with 200 ms pauses. It is interesting to note that learners scored higher in listening to faster speech if longer pauses are inserted than in listening to slower speech with shorter pauses, though the overall speech rates were exactly the same. These results imply that longer pauses of 450 ms enhance learners' listening comprehension, while slowed down speech does not have the same effect.



*Figure 1.* Listening comprehension scores for different pause durations and articulation rates (Test B)

*Note.* The two vertical bars on the left in this figure show the mean listening scores for faster articulation rate, and the two bars on the right indicate those for slower articulation rate. Controlled pause durations in each of the two sets from left to right are 200 ms and 450 ms. Error bars show 95% CIs.

#### 4. Discussion

We found in the experiment that pause duration possibly has an influence on learners' listening comprehension. The experiment shows that longer pause duration aided the listening comprehension of lower intermediate EFL learners. Conversely, slower articulation rate does not have a positive effect on learners' listening comprehension. This means a pause inserted in a passage provides listeners with additional information processing time and thus enhances the comprehensibility of the aural input. This result also supports Kohno's assertion (1990, 1994, 1998) that pauses longer than 420 ms facilitate listeners' cognitive process of analyzing incoming aural information.

In EFL listening activities, two methods can be used to help learners understand spoken English: the first is to slow down the speech rate, and the second is to insert pauses of an appropriate duration at grammatical breaks. Our results suggest that lowering the articulation rate does not always increase comprehension for Japanese EFL learners whose listening ability is lower intermediate.

Listening comprehension is influenced by the pause duration, not articulation rate. No significant effects of articulation rate were observed on the students at this level. This implies that

regardless of the speed of a passage, learners perceive incoming spoken information linearly and cognitively process the accumulated information during the pause phase.

## **5. Conclusion**

It is important to mention the limitations of our research. In our experiments, the participants who contributed to this study were confined to learners at the lower intermediate level, which is likely to comprise a certain population of Japanese EFL learners. Further experiments involving students of higher English abilities are necessary to validate the results obtained in the present study. Learners with higher or lower proficiency may yield different results concerning the effects of pauses and articulation rates on listening comprehension. More importantly, the test type largely affects the result. Thus, if more perception-oriented test had been used, the result might have been different.

In spite of the above-mentioned limitation, the results of the present study clearly indicate that longer pauses facilitate the listening comprehension of lower intermediate EFL learners, while slower articulation rate does not necessarily have a positive effect on learners' listening comprehension. This may offer an important pedagogical implication. When learners have difficulties in understanding listening materials, inserting relatively longer pauses between PSUs will work more effectively than just slowing down the speed of the material since longer pauses provide sufficient time in processing incoming information for learners.

## **Notes**

1. In this study, we follow the definition by Field (2004): (a) speech rate is measured by dividing the total number of words by the total speaking time (including silent pauses); (b) articulation rate is calculated by dividing the total number of words by the total articulation time (extracting the pause duration from the total speaking time).
2. It was confirmed to use this data only for this research purpose on a written form. And participants were informed that participating this research would not affect their grading at all.

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**APPENDIX1: Script of the test material in Test B (“ / ” indicates pause locations)**

No 1.

My friend Jenny and I / live next to each other. / Our school isn't far away. / Jenny usually walks to school, / but I go by bike. / On rainy days, / we take the bus. /

Question: How does the boy usually go to school?

No 2.

George went to buy / his favorite newspaper, / but he was surprised / to see that / it was already sold out. / Then his friend John told him that / he could read the newspaper / on the Internet. / George had never used / the Internet before, / so John showed him how. /

Question: What did John show George?

No 3.

I enjoy drawing pictures. / Last month / my art teacher sent / one of my pictures / to an art contest. / I was surprised / because I got a letter / from the contest yesterday, / and my picture got first prize. /

Question: Why was the boy surprised?

No 4.

Tom's parents gave him a dog / for his birthday. / He named her Lucky. / Lucky kept running around / in Tom's room. / She never listened / when he told her to stop. / So Tom took her / to a dog-training school. / Now Lucky stops / whenever he tells her to./

Question: What did Tom do to stop Lucky running around?

No 5.

Today is John's birthday. / After school, / his friends are going to have / a surprise party for him. / Everyone will wait / in a pizza restaurant, / and John's best friend / will take him there. /

Question: What will John's friends do today?

No 6.

Welcome to London, / everybody! / This morning / we have three hours of free time. / You should try to visit / the museum and gallery. / There are also many gift shops. / Please be sure to return / to the bus by one o'clock. /

Question: Where should the visitors be at one o'clock?

No 7.

Welcome to South Forest Park. / You can ride bikes in the park, / but please don't pick the flowers  
/ or bring pets into the park. / Please throw away all your trash / in the trash cans. /

Question: What can people do in the park?

No 8.

Jane loved watching movies, / but she didn't have enough money / to see them very often. / Then  
one day / she got a part-time job / at a movie theater. / Her job was / to check everyone's  
ticket. / Now she is very happy. / She can watch movies for free / as often as she likes. /

Question: Why is Jane very happy?

No 9.

Yesterday, / Mark went shopping / with his mother / because he needed a new coat / for school. /  
There were lots of nice coats, / and Mark chose a brown one. / After that, / they had dinner  
/ at a restaurant / and went home. /

Question: What did Mark do yesterday?

No 10.

During a discussion, / the students were all asked / about their hobbies. / George answered that /  
he likes to go fishing / with his dad. / Jack said / he likes to watch movies / and play the  
guitar. / Mary said / she likes fencing and / has recently started / to play the piano. /

Question: What hobby do Jack and Mary have in common.

## Appendix 2: Multiple-choice answer sets for Test B

### No. 1

1. By bike.
2. By bus.
3. By train.
4. On foot.

### No. 2

1. How to use the Internet.
2. How to sell newspapers.
3. How to surprise his friend.
4. How to choose a computer.

### No. 3

1. He won first prize.
2. He found tickets to an art show.
3. His teacher called him.
4. His teacher gave him a picture.

### No. 4

1. He made Lucky run outside.
2. He ran outside with Lucky.
3. He bought Lucky a present.
4. He took Lucky to a school.

### No. 5

1. Stay at John's house.
2. Have a party for John.
3. Make pizza at school.
4. Wait at school.

### No. 6

1. In the museum.
2. In a shop.
3. At the bus.
4. At the art gallery.

### No.7

1. Pick flowers.
2. Ride bikes.
3. Play with their pets.
4. Give food to the animals.

### No. 8

1. She lives near the movie theater.
2. She checks everyone's ticket.
3. She is earning a lot of money.
4. She can watch movies for free.

### No. 9

1. He bought a new coat.
2. He went to his school.
3. He made dinner for his family.
4. He helped his mother at home.

### No. 10

1. They both like fishing.
2. They both play a musical instrument.
3. They both play sports.
4. They both like movie

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