

# Longitudinal Study on Fluency Among Novice Learners of Japanese

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**Abstract.** The present study examined various aspects of the development of learners' fluency in Japanese using a large set of speech samples collected over a long period, using an online speaking practice/assessment system called *Speak Everywhere*. The purpose of the present study was to examine: (1) how the fluency related measures changed over time, and (2) which linguistic factors were correlated with each fluency measure. This study used oral production of English-speaking learners enrolled in the first year Japanese courses at a university in the U.S. The students submitted two types of speaking assignments using *Speak Everywhere*: (1) sentence-level oral reading and (2) short Q&A. The assignments were collected at the end of each chapter for two quarters. The study used speech rate and pause related fluency measures adapted from [Ginther, Dimova, and Yang \(2010\)](#). For the data analysis, we used Praat ([Boersma & Weenink, 2011](#)) for acoustic analysis and Mecab ([Kudo, 2011](#)) for morphological analysis. The results of one-way repeated measures ANOVA revealed that several measures of fluency deteriorated in both oral reading and Q&A tasks as expected from the previous research ([Segalowitz & Freed, 2004](#)). This study then examined what complexity factors affected these measures, using the mixed model approach. Overall, it was found that because various factors influence the development of fluency, temporal measures alone cannot explain fluency development.

**Keywords:** fluency, Japanese, *Speak Everywhere*, longitudinal study, objective measures.

## 1. Introduction

Previous research on fluency has shown that among temporal fluency measures, speech rate and total pause time significantly correlate with language proficiency ([Iwashita, Brown, McNamara, & O'Hagan, 2008](#)), but that fluency does not develop in a linear

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fashion (Ellis, 2009). Ellis (2009) suggested that there were trade-offs among fluency, accuracy, and complexity. This trade-off idea has yet to be substantiated. The purpose of the present study is to examine: (1) how the fluency-related measures change over time, and (2) which complexity factors (lexical and syntactic complexity) are correlated with each fluency measure.

## 2. Method

### 2.1. Participants

The participants were students enrolled in first-year Japanese courses at a university in the U.S. They were all native English speakers. The duration of the study was 20 weeks. Twenty students completed the two courses and oral data from these students were used for data analysis.

### 2.2. Materials

Two types of exercises were given as speaking homework in each chapter using an online oral practice/assessment platform called *Speak Everywhere*. At the beginning of each chapter, two to three exercises were assigned in which the students read sentences aloud following video cues. In this task, they repeated sentences after the instructor in the video. Each assignment included 12-13 items each of which consisted of one to four sentences containing new and old vocabulary words and structures. At the end of each chapter, the students worked on two types of review tasks: 1) oral reading of sentences without video cues and 2) short Q&A. In the oral reading task, 18 items, each of which consisted of one to four sentences, were given. In the Q&A task, one open-ended question was asked. The students' oral productions in these two review tasks were collected automatically by *Speak Everywhere* and used for data analysis.

### 2.3. Measures

The following speed-related and pause-related fluency measures were adapted from Ginther et al. (2010): speech time ratio, speech rate, articulation rate, running time, number of silent pauses, mean silent pause time, mean silent pause time within AS-units, mean silent pause time between AS-units, and silent pause ratio.

### 2.4. Data analysis

The audio data from Lessons 4, 7, and 11, which were collected at the beginning of the second term, at the end of the second term, and at the end of the third term, respectively, were used. All the fluency measures were calculated using Praat (Boersma & Weenink, 2011) and Mecab (Kudo, 2011), a Japanese morphological analyzer, and custom-written PHP scripts. They were then analyzed with one-way repeated measures ANOVA to answer research question 1. The within-subjects factor was lesson. To test sphericity assumption, Mauchly's test was used. For a post-hoc test, Fisher's Least Significant

Difference (LSD) was used. For question 2, the following complexity factors were examined using the mixed model approach: new structures, new words, katakana words (loanwords), the number of moras, and the number of moras within AS-units.

### 3. Results and discussion

#### 3.1. Research question 1

Table 1 shows the means of the fluency measures.

Table 1. Means of fluency measures

	Lesson 4		Lesson 7		Lesson 11	
	oral reading	Q&A	oral reading	Q&A	oral reading	Q&A
Speech time ratio	.9367	0.7323	.7987	0.6139	.7614	0.6805
Speech rate	5.0058	3.9353	4.0954	3.1796	3.7687	3.6374
Articulation rate	5.3236	5.3723	5.1011	5.1784	4.9634	5.3381
Running time	13.3699	6.0134	8.5410	5.3708	8.1019	6.5704
Mean silent pause time	.1782	0.4384	.4607	0.7135	.4886	0.6084
Mean SPT within AS units	.1765	0.6482	.5627	0.9394	.5778	0.8037
Mean SPT b/w AS units	N/A	0.7931	.5824	1.2771	.6346	1.0649
Silent pause ratio	.0688	.2677	.2103	.3861	.2385	.3259

##### 3.1.1. The oral reading task

Using one-way repeated measures ANOVA and t-test, the present study found the following. The students decreased their speaking speed over the course of learning. The utterance length between pauses became shorter in Lesson 7 and Lesson 11 than in Lesson 4 even though their learning experience increased. The pauses within AS units as well as between AS units significantly increased as the lessons moved on.

Although these results contradict some previous studies (Freed, 1995; Lennon, 1990; Towell, Hawkins, & Bazergui, 1996), they are consistent with Segalowitz and Freed (2004), who found no measurable improvement on fluency in a group of students who studied the target language in a formal foreign language classroom for one semester. Perhaps, 20 weeks is still too short to detect measurable gains in fluency.

##### 3.1.2. The Q&A task

According to an ANOVA and a subsequent post hoc analysis, the speed-related measures showed a V-shaped pattern; i.e., they decreased between Lessons 4 and 7 and increased between Lessons 7 and 11. The pause-related measures, on the other hand, generally increased, meaning that pauses became longer over the course of learning.

There are two possible explanations for these results. First, for the deterioration of fluency observed between Lessons 4 and 7, trade-offs among fluency, accuracy, and complexity may have been a strong factor; some students may have struggled with difficult materials. Secondly, these results might indicate a delayed learning effect. As

in the studies by Ellis (2009) and Lennon (1990), the students might have had difficulty in improving their fluency initially due to the trade-off effect, but in time they overcame it and developed their fluency towards the end of the study period.

### 3.2. Research question 2

The present study further analyzed the data with the mixed model approach in order to find out whether or not there were complexity factors affecting the students' fluency, and if so, which ones. The complexity factors we investigated were new structures, new words, katakana words (loanwords), the number of moras, and the number of moras within AS-units (see Table 2). The fixed effects were tasks, (oral reading or Q&A) and the repeat effects were lessons. Subjects were nested within sentences.

Table 2. Means of complexity factors in the oral reading and the Q&A tasks

Complexity factors	Oral reading	Q&A
Number of moras	42.66	78.53
Number of moras within AS units	22.70	18.91
New words	.85	.28
New structures	.43	.45
Katakana words	.44	.39

#### 3.2.1. The oral reading task

It was found that the greater number of moras and new words had a negative effect on fluency, while Katakana and the number of moras within AS units had a positive effect. For the speed of utterances and pauses, the number of moras (i.e., sentence length) was the major disfluency factor. For the length of the utterances between pauses, new words and the number of moras shortened the utterances. For the total pauses, the number of moras and the number of moras within AS units were the factors to make the pauses longer. The pauses within AS units, however, became longer only when the number of moras increased.

#### 3.2.2. The Q&A task

The Q&A task, on the other hand, had only one significant factor, new words, that affected fluency. When the students used new words, their utterances slowed down, the length between pauses became shorter, and the pauses became longer.

#### 3.2.3. Discussion of the mixed model analysis

The significant factors in the oral reading task and those in the Q&A task were different, presumably corresponding to different production processes called for by the tasks. In the oral reading task, the students read aloud sentences created by the instructor focusing on the structures and vocabulary words introduced in each chapter, while in the Q&A task, they produced utterances on their own. Therefore, the tasks themselves

also affect the fluency measures. For an illustration of this point, notice that in Table 1 the mean silent pause time is always longer in the Q&A task than in the oral reading task. This can be attributed to the assumption that students need longer preparation time in the Q&A task to first formulate what to say and to construct utterances to express it.

The number of moras per item in the oral reading task was much smaller than that in the Q&A task. However, fluency was affected only in the oral reading task by the number of moras. The reason may be that since the students chose the words and structures in the utterances, they were able to choose ones that they could use effortlessly. In the oral reading task, on the other hand, the students had no control over the sentences. Therefore, the number of moras (which translates into longer and perhaps more complex sentences) negatively affected the students' fluency.

#### 4. Conclusions

This study found a generally declining trend in the fluency development of first-year learners of Japanese. Through the mixed model analysis, we were able to identify such complexity factors as new words putting pressure on fluency development. What is needed to overcome the pressure might be a greater amount of oral fluency building practice. Conducting a similar study at other levels (e.g., intermediate and advanced) might also be a fruitful avenue of research.

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