The Interplay Among Silent Reading Rate, Comprehension, and an Audio Reading Model

Etsuo Taguchi
Daito Bunka University
Japan

Greta Gorsuch
Texas Tech University
USA

Kristin Lems
National Louis University
USA

Hiroto Toda
Kumamoto University
Japan

Toshiko Kawaguchi
Aichi Bunkyo University
Japan

Kirsten M. Snipp
Takasaki University of Commerce
Japan

Abstract

This paper examines learners' fluency development in L2 silent reading rate and comprehension. In both L1 and L2 readings, a positive relationship between readers' silent reading rate and comprehension has not been as firmly established as theories might propose. Based on Wallot et al. (2014), the paper indicates the need to look at readers' silent reading rates as a process rather than a result of the reading act. Variability L2 readers face while reading reflects their successful and unsuccessful attempts to comprehend the text they are reading. Through a new examination of unpublished data from Taguchi et al. (2012), the paper proposes to look at readers' silent reading fluency development across a longer period. In addition, it indicates the need to consider different purposes readers set for their reading to understand how their rates vary. This proposal has practical implications for not only researchers but also classroom practitioners.

Keywords: reading fluency development, reading rate, reading comprehension, reading processes, L2 reading, reading fluency measurement

Reading ability is an essential skill in the world today with a large amount of information easily available in a second language (L2) or foreign language (FL). It is "one of the most important skills" for language learners to deal with large quantities of information (Pellicer-Sánchez et al., 2018; Renandya & Day, 2020) both in and out of classrooms (Council of Europe, 2018; Gorsuch et al., 2015; Griffee & Gorsuch, 2024). Reading in L2 or FL, however, is a laborious process (Anderson, 1999; Jensen, 1986; Segalowitz et al., 1991) and this is because the lower-order identification skills of word and character recognition of L2 and FL readers are relatively weak compared to those of L1 readers (Birch, 2007; Gorsuch & Taguchi, 2008, 2022; Grabe, 2004; Grabe & Stoller, 2019). It may be the case that L2 learners' reading is so slow that they cannot hold meaning representations in their working memory long enough to resolve "who did what to whom" within sentences or between sentences. As a result, learners may not be able to follow narratives or argumentation or to trace cause and effect.

Grabe (2010) and others have noted the need for teachers and administrators in L2 and FL programs to devote precious classroom time to developing learners' reading fluency (Gorsuch & Taguchi, 2022; Malakowsky, 2023; Nation, 2009; Teng, 2023). One task in carving out this time is to persuade teachers and program administrators that building reading fluency means building accuracy in psycholinguistic terms (Gorsuch & Taguchi, 2009). As Schmidt (1992), Segalowitz (2000), and Segalowitz and Segalowitz (1993) indicate, fluency and accuracy in L2 reading are not distinct and competing factors, but rather accuracy is an embodiment of enhanced fluency in language performance. That means, "fluency builds automaticity and chunking (recognizing bigger units)" (Grabe, 2010, p. 76), and thus fluency and accuracy develop hand in hand in L2 reading. In other words, fluency and accuracy are not a tradeoff existing at opposite ends on a continuum, as was—and sometimes still is—popularly thought (Gorsuch & Taguchi, 2009; Grabe, 2010), but have a recursive interaction.

The generally accepted definition of reading fluency has multiple components, including the ability to read with speed, ease, and accuracy and to read with appropriate expression and phrasing (Grabe, 2008, 2010). It is also generally accepted that reading fluency works as a foundation upon which learners develop into strategic readers who are skillful and versatile in using a variety of reading strategies and skills in order to achieve their goals (Hudson et al., 2009; Kintsch, 2013; LaBerge & Samuels, 1974; Perfetti, 1985; Samuels, 1994, 2004, 2006a, 2006b). Educators of L2 learners should have as their ultimate pedagogical goal that learners become independent readers who read productively (Nunn, 2009; Taguchi et al., 2021; Teng, 2023) and who enjoy what they read (Grabe & Stoller, 2011).

Reading fluency is understood to be reflected in silent reading rate, the rate at which readers read while maintaining adequate comprehension (Grabe, 2010; Nation, 2009; Chang & Millet, 2013). Within this working understanding, the relationship between reading rate and comprehension has been explored in past reading research (see the discussion of theories driving this research in L1 and L2 contexts below). Some studies found a positive relationship between efforts to increase reading rate and comprehension (Gorsuch & Taguchi, 2010; Gorsuch et al., 2015), while others failed to find such a relationship (see Gutierrez, 2017 for a thoughtful meta-analysis). Past

research has also found that reading a text while listening to its audio version (using an audio model) has some beneficial effect on readers' reading activity and comprehension (e.g., Chang & Millet, 2015; Gorsuch & Taguchi, 2008; Taguchi et al., 2012, 2016).

This study takes a new look at the unpublished portion of a previously published 2012 diary study, which had a mixed-method single case design. The data in the 2012 study was from a single Japanese participant who had a high L2 English proficiency. The data used for the current study, however, is both quantitative and qualitative. The quantitative data consist of her silent reading rates for 69 repeated reading sessions, and the qualitative data consist of her diary entries for the same sessions. The data were reanalyzed to examine fresh factors about the relationship between L2 silent reading rates and reading comprehension.

The current study has three research questions. First, we consider the relationship between theory-based efforts to increase learners' reading rates and some resulting effect on reading comprehension, to gain an understanding of the reasons behind such a wide range of results (pronounced positive effects versus little to no effect). Second, we use previously unpublished data from an existing study and judicious reading of the theoretical literature to propose a greater acceptance of variability in learners' reading rates as they comprehend various texts. We propose a practical means of measuring this variability. Our third purpose is to further report on ways an audio reading model has been found to benefit learners' L2 reading activity and comprehension.

Literature Review

One View of Reading Rate and Comprehension

We begin by suggesting that the construct of reading rate is complex and that it likely needs to be reconceptualized. We lay the groundwork here. Fluency in silent reading is often represented by reading rate in terms of wpm (words per minute) or characters per minute (cpm) while a sufficient level of reading comprehension is maintained. Theories of reading posit that reading rate and reading comprehension are closely tied to each other. For example, Automaticity Theory (LaBerge & Samuels, 1974; Samuels, 2004) and Verbal Efficiency Theory (Perfetti, 1985) propose that the attentional resources a reader expends are limited. The more resources that are spent on lower-level processes of word recognition and basic-level parsing of sentences, the less can be spent on higher-level, more resource-consuming processes of comprehending text, such as recalling past actions and reasoning out characters' intentions. In some cases, this presumed relationship between reading rate and reading comprehension has been highlighted for the purposes of designing remediation and solving perceived problems in both L1 and L2 contexts (see Rasinski & Nageldinger, 2015; Shimono, 2018).

As Wallot et al. (2014) indicate, in English L1 reading education, several studies have indicated a positive correlation between reading rate and comprehension, showing that fluent readers are better at text comprehension (Hosp & Fuchs, 2005; Hintze et al., 2002; Jenkins et al., 2003). However, other L1 studies have failed to show a positive relationship between them (LeVasseur et al., 2006; LeVasseur et al., 2008; McNerney et al., 2011; Wallot, 2011). The same results have been found in some L2 studies such as Chang and Millet (2013) and Taguchi et al. (2021).

Nonetheless, reading fluency training has been made a priority in L1 reading education (Hudson et al., 2009; Kintsch, 2013; LaBerge & Samuels, 1974; Perfetti, 1985; Samuels, 2004, 2006a, 2006b) as well as in L2 reading education (Beglar & Hunt, 2014; Grabe & Stoller, 2019; Nation, 2014; Grabe, 2008; Segalowitz, 2003). The assumption seems to have been that learners need to be helped to increase their reading rate regardless of reading in L1 or L2, and that this will improve their reading comprehension.

Reading Rate as a Reflection of How Readers' Text Comprehension is Proceeding and How They Have Adjusted Their Reading

Considering the mixed results in the L1 and L2 studies cited above, the relationship between reading rates and reading comprehension does not seem to be a simple, universal, or reflexive one. Pointing to this issue, Wallot et al. (2014) indicate that reading rates should be seen as an outcome of the reading process so that reading rate will be variable. On one hand, reading rate may be seen simply as a demonstration of reading skill, in which the more developed a reader's word recognition skill, the better their comprehension. Thus, the faster a reader reads and the more their word recognition skills are developed, the better their comprehension. On the other hand, reading rate may be seen more as a process, reflecting how a learner's text comprehension has proceeded as they read the text. That means reading rate varies greatly depending on how readers understand the text they read. See Figure 1. As can be seen with the graph on the top, an idealized line shows that the faster a learner reads, the higher their comprehension scores are theorized to increase. Any deviation from this line might be seen as a disconfirmation of this basic assumption. With the graph on the bottom, however, a learner's reading rate is seen as variable, with dips and rises.
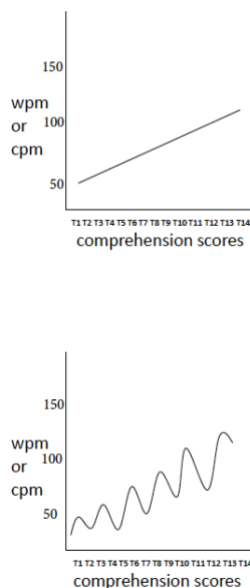

Figure 1. An L2 Learner's Reading Rate Over Time When Theorized as a Developmental Skill as Compared to a Process Related to Comprehension

As illustrated by the bottom graph, when learners encounter a problem in understanding the text, they need to take some strategic, compensatory actions to resolve the problem. If readers meet a

word that they do not know, they will likely slow down or stop. If it happens to be a word that they judge they need to know in order to understand the main part of the text, they may decide to use the context in which the word is embedded to better guess its meaning. This compensatory strategic process of reading will slow down their reading speed.

When readers fail to understand a part of the text, their ability to maintain good comprehension will be based on how well they deal with the problem that has caused the comprehension breakdown. When they resolve the problem successfully, they go back to their smooth reading mode, with a faster, normal-for-them reading rate. If, however, they are not able to cope with the problem, their reading performance is severely affected, and their comprehension will consequently suffer. Wallot et al. (2014) state "reading speed can be reflective of both a time investment (careful reading, rereading, etc.) and severely compromised reading activity (problems with decoding, prolonged but unresolved uncertainty, etc.), but with very different consequences for the quality and outcome of the reading process" (p. 1751). In other words, reading speed represents how much readers allocate time strategically to resolve a problem in their reading comprehension. Readers often try to read carefully or reread the incomprehensible part of the text for a better understanding of it. This is quite natural behavior that teachers and practitioners would likely want to encourage. Thus, readers' strategic compensatory actions will slow down their reading speed, affecting their comprehension performances.

Such variability in readers' reading rate indicates the need for researchers and practitioners in L2 reading education to look at reading fluency development over a longer span. Multiple factors affect readers' text processing, thus facilitating or inhibiting their reading rate and comprehension. Those factors include text structure, readers' background knowledge about the topics discussed, and the language itself (vocabulary and grammar used). To be more specific, we would name text type and individual differences. In English L1 reading, Brysbaert et al. (2016), through an extensive meta-analysis, estimated that the silent reading rate for L1 readers of non-fiction texts is 238 wpm, while that for fiction texts is 260 wpm. They also suggest variability can come from "large and stable" individual differences. Considering individual differences, their reading rate for non-fiction texts varies from 175 to 300 wpm while that for fiction texts ranges from 200 to 320 wpm.

Returning to L2 readers, we suggest that researchers and practitioners should know that it does take time for readers' fluency to grow consistently with some occasional variability in their reading rates. We portray this in the bottom graph in Figure 1, where there are rises and dips in learners' reading rates and comprehension from session to session, but a general upward trend over time.

An additional wrinkle in time: Readers' goals. Reading rates also vary according to the goals readers set for themselves. Carver (1992) proposes different reading rates for different modes of reading, according to the amount of cognitive load imposed on the reader with the goals they set for their reading. Carver set five different reading modes:
- reading for memorizing information in the text
- reading for learning from the text
- reading for fun or information (Carver named this type of reading "rauding," which is a typical reading mode that we adopt in everyday life to enjoy fiction or informative

articles
- reading to "skim" or obtain a gist or summary of what we read
- reading to "scan" or search for a specific piece of information such as a restaurant name or a link for a telephone number to reserve a table at a restaurant

Note that all modes include some form of comprehension.

If we accept Carver's proposal, then whatever task learners are set to do in which their reading rate and comprehension are measured for classroom or research purposes will add more variability to their reading rates in the short term. L2 learners in Gorsuch and Taguchi (2008, p. 266) reported that they paid close attention to details while reading a test text because they knew they would have to answer questions about it later. Thus, they read more slowly on that occasion. This was a research study, and so learners' variability on this occasion affected the research findings. If this had been a single day in the classroom, a practitioner might simply have thought learners were having a "bad day" when in fact they were engaging in goal-oriented reading. See Beglar and Hunt (2014), Chang and Millet (2017), and Turnbull and Evans (2017) for different reports of task demands and different results for reading rate gains, and Chang and Millett (2017) and Turnbull and Evans (2017) for comprehension.

We would simply reiterate that learner reading rates vary in the short term in that they represent an outcome of readers' comprehension processes related to their purpose for reading. Reading rates will vary depending on the cognitive load required to achieve the goals the readers set. We understand this is a simplification and that many factors contribute to cognitive load in L2 reading, such as unfamiliar cultural elements in a text (see description in the next section). But we think learner goals are too often discounted. Instructors carefully select texts for fluency development with controlled vocabulary and grammatical structures and so on, and perhaps forget that learners set their own goals for reading.

A Practical Illustration of Progressive Patterns in a Learner's Reading Rates

A case study by Taguchi et al. (2012) of a Japanese learner of English helps us understand how reading rate fluctuates according to some factors L2 readers encounter while reading. We propose that there is a progressive pattern of reading rate development in a reading fluency program despite episodic fluctuations. Our mathematically simple proposal involves combining and averaging reading rates from every five sessions within a longitudinal fluency program. We will detail this at the end of the section.

The example for our model emerges from the data in a diary kept by the learner who participated in the research (Taguchi et al., 2012). The specific qualitative data presented here, which are as yet unpublished, illustrate well the complex relationship between reading rate and readers' comprehension. In the study, a Japanese EFL learner ("Naomi") was the single participant. She had a high English proficiency, and for the fluency development program, she read two books, a classic 1941 American children's novel *The Moffats,* written by Eleanor Estes, and a 2001 young adult novel *The Misfits,* written by James Howe. In the course of the study, Naomi engaged in 69 repeated reading (RR) sessions, while finishing the first book, *The Moffats,* and one-third of the second book *The Misfits*. In each session, she freely determined how much of the text she would read based on her schedule, and she read a session passage as many as six times. The first, fifth,

and sixth readings were silent reading, while the second, third, and fourth readings were done while silently reading along with the audio model of the passage. The audio model of the passage was simply the audio-recorded version of the text by a professional voice actor. Thus, her wpm reading rates were measured for her first, fifth, and sixth readings, where she read silently at her own pace (see Figure 2).

As Figure 2 shows, Naomi's silent reading rates as measured by wpm vary greatly for her first, fifth, and even sixth readings. It is difficult to see a solid upward developmental pattern of progress.
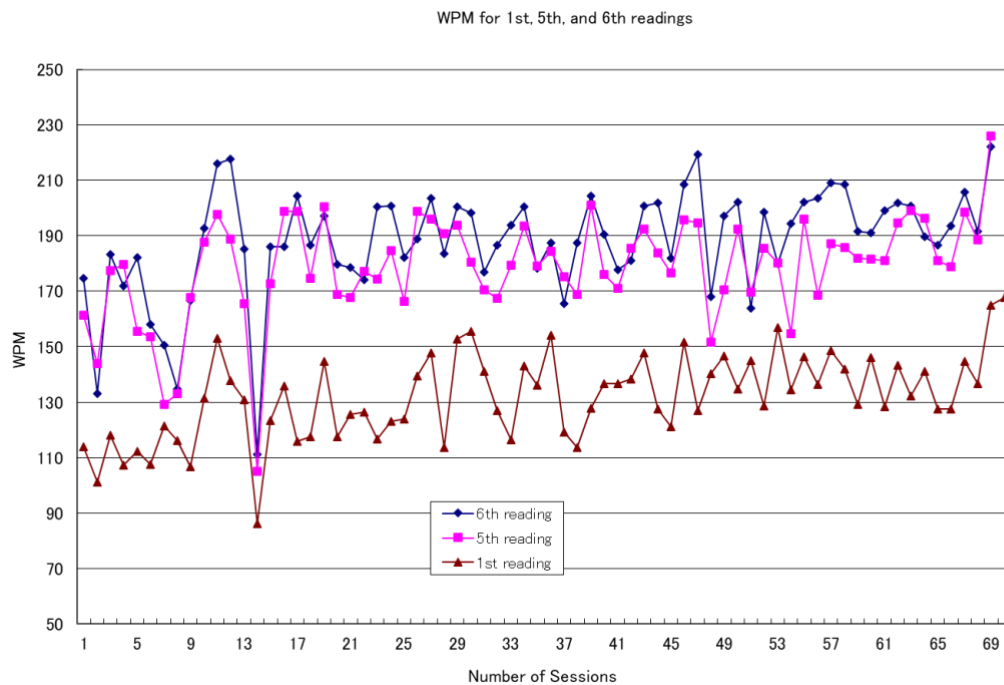

Figure 2. Naomi's WPMs for 1st, 5th, and 6th Readings

When we look at the decreases in her wpm rates, however, we see the problems she faced in her reading sessions. For example, in session #14, her first reading rate dropped greatly to 86.15 wpm, which is a 44.61 wpm decrease from 130.76 wpm in her first reading in session 13 (see Table 1 and Figure 2). Below is the diary entry from that session:

> "And in exactly three minutes after leaving the New Haven station, the express train came to a stop—the fireman lifted the two boys down—the engineer grinned and waved to them, and off the train went with everybody aboard staring out the window to find out why the express, that wasn't supposed to stop until it reached New York, had stopped in this funny little town." When I read this part, it took a while before I realized the subject is "the train" of "and off the train went with everybody aboard staring out the window to find out why the express." This is an inverted sentence of "and the train went off …." Am I right? I often see similar expressions as "out the door," "down the steps," and "into the school yard," and I confused this one with those expressions. (July 11, 2005, Session #14)
> *Note: Original entry in Japanese, translated into English by the first author.*

When she read the passage above, she did not realize "and off the train went with everybody aboard staring out the window …" has an inverted syntax. While she reread the sentence, she came to realize that it was an inverted sentence. She added that she confused "off the train" with such expressions as "out the door," "down the steps," and "into the school yard." This consequently slowed down her reading rate.

In session 28, her first reading rate again decreased to 113.51 wpm from 147.82 wpm in session 27, which was a 34.31 decrease in wpm (Table 1 and Figure 2). In session 28, she thought she encountered relatively more unknown vocabulary words, and this caused her to spend more time to finish reading the passage. She assessed her comprehension of the passage at about 70 percent. She thought she was able to guess the meanings of the unknown vocabulary words from the context and her background knowledge as well. She was, however, aware that she could not understand the meaning of one sentence: "Joe was thinking if he did as well turning pages as he had ushering, that ten cents was clinched." She wondered what "that" of "that ten cents was clinched" meant. This issue also contributed to the decrease in her reading rate (Figure 2).

> There were relatively many words I did not know or whose meanings I was not sure of, so it took longer to read today's session passage through in my first reading, and I guess my comprehension of the passage was about 70%. I think it better if I could read it through once at my own pace before I read it along with an audio model. Of the words whose meanings I was not sure, I managed to guess their meanings from the context, while I read it multiple times. There was one thing, however, I could not figure out. I wonder what "that" means in "Joe was thinking if he did as well turning pages as he had ushering, that ten cents was clinched." I guess it tries to describe the if-clause differently. (July 30, 2005, Session #28)

Another example is in session 37, where her first reading rate dropped to 119.21 wpm from 154.23 wpm in session 36 with a decrease of 35.02 wpm. In that session, she encountered two expressions whose meanings she was unsure of. One of them is "like sixty." She guessed that it was the expression to describe the quickness with which someone runs. She was surprised to know that the expression could be extended to sewing as in "Mama was in the Grape Room, running the sewing machine like sixty to finish some of those middy blouses." The other expression she did not understand was "on all fours" in "Rufus came into the sitting room on all fours in pursuit of an aggie that had gotten out of his hands and gone careening from corner to corner." While she was paging through the text, she found an illustration in the book, which drew Rufus "on all fours." Rufus could not stand up, so both of his hands and knees were on the floor. Now she was able to understand what "on all fours" meant.

> I met an expression "like sixty" again. When I met it before, I think it described fastness with which someone or something moves. This time it described how fast a sewing machine worked. I guessed it originally came from "60 miles an hour" and I am surprised to know it could be used with a sewing machine. In addition, I did not know an expression "on all fours" and I kept turning pages and found a picture of Rufus crawling on the floor and realized what the expression meant. This book is accompanied by some illustrations, so it helps to have an image of the story content. (August 10, 2005, Session #37)

Table 1. *First, Fifth, and Sixth WPMs for All Sessions*

Session #	1st wpm	5th wpm	6th wpm	Session #	1st wpm	5th wpm	6th wpm
1	113.85	161.22	174.55	36	154.23	184.47	187.41
2	101.04	143.87	132.99	37	119.21	175.12	165.49
3	118.21	177.32	183.28	38	113.58	168.83	187.40
4	107.15	179.73	171.91	39	127.73	200.95	204.47
5	112.15	155.66	182.25	40	136.74	176.16	190.38
6	107.55	153.50	158.10	41	136.68	171.05	177.81
7	121.33	129.27	150.55	42	138.36	185.47	181.10
8	116.00	133.06	134.64	43	147.71	192.41	200.88
9	106.62	167.63	166.77	44	127.62	183.81	201.89
10	131.45	187.84	192.77	45	121.04	176.53	181.78
11	152.98	197.83	216.05	46	151.64	195.77	208.50
12	137.80	188.77	217.58	47	127.01	194.75	219.44
13	130.76	165.53	185.24	48	140.40	151.56	168.00
14	86.15	105.00	111.26	49	146.62	170.48	197.06
15	123.24	172.83	186.18	50	134.68	192.31	202.02
16	135.75	198.90	185.96	51	144.90	169.72	163.99
17	115.73	198.83	204.26	52	128.52	185.41	198.42
18	117.59	174.74	186.64	53	156.81	180.36	179.82
19	144.67	200.41	197.18	54	134.43	154.72	194.47
20	117.50	168.99	179.76	55	146.50	195.94	202.26
21	125.69	167.76	178.70	56	136.26	168.56	203.49
22	126.47	177.06	174.22	57	148.60	187.06	209.21
23	116.66	174.44	200.43	58	141.97	185.88	208.44
24	123.20	184.80	200.87	59	129.09	181.87	191.66
25	123.98	166.30	182.05	60	146.23	181.73	191.17
26	139.57	198.85	188.82	61	128.44	181.03	199.05
27	147.82	195.96	203.43	62	143.34	194.69	201.98
28	113.51	190.65	183.50	63	132.19	199.06	200.63
29	152.89	193.80	200.39	64	141.22	196.45	189.57
30	155.44	180.54	198.33	65	127.47	181.13	186.63
31	141.07	170.50	176.87	66	127.62	178.97	193.42
32	126.91	167.33	186.69	67	144.79	198.66	205.84
33	116.52	179.36	193.90	68	136.56	188.62	191.62
34	143.15	193.57	200.54	69	164.91	226.03	222.20
35	136.10	179.17	178.36				

Naomi's reading activities described above included her successful or unsuccessful reading comprehension processes, which were reflected in her reading rate variability. Although her

wpms varied greatly by each individual session in the course of her repeated reading treatment period (see Table 1), a solid progress pattern revealed itself as a result, once her reading rates were averaged by combining and averaging each of the five wpms per session (see Table 2 and Figure 3). Averaging can extend to each five to ten or more wpms per session so as to show a more salient pattern of progress, depending on the overall length of the reading intervention.

Table 2. *Mean WPMs for Each Five Sessions for the Entire Course of Study*

| Sessions	1st wpm		5th wpm		6th wpm	
	mean	SD	mean	SD	mean	SD
1–5	110.48	6.60	163.56	15.05	169.00	20.71
6–10	116.59	10.30	154.26	24.40	160.57	21.53
11–15	126.19	24.93	165.99	36.40	183.26	43.16
16–20	126.25	13.15	188.37	15.22	190.76	9.80
21–25	123.20	3.88	174.07	7.49	187.25	12.54
26–30	141.84	16.96	191.96	7.05	194.89	8.39
31–35	132.75	11.02	177.99	10.19	187.27	10.10
36–40	130.30	16.00	181.10	12.41	187.03	13.96
41–45	134.28	10.28	181.86	8.27	188.69	11.69
46–50	140.07	9.70	180.97	19.45	199.00	19.25
51–55	142.23	11.03	177.23	15.73	187.79	15.79
56–60	140.43	7.89	181.02	7.36	200.79	8.84
61–65	134.53	7.33	190.47	8.71	195.57	6.98
66–69	148.35	17.58	198.07	20.30	203.27	14.12
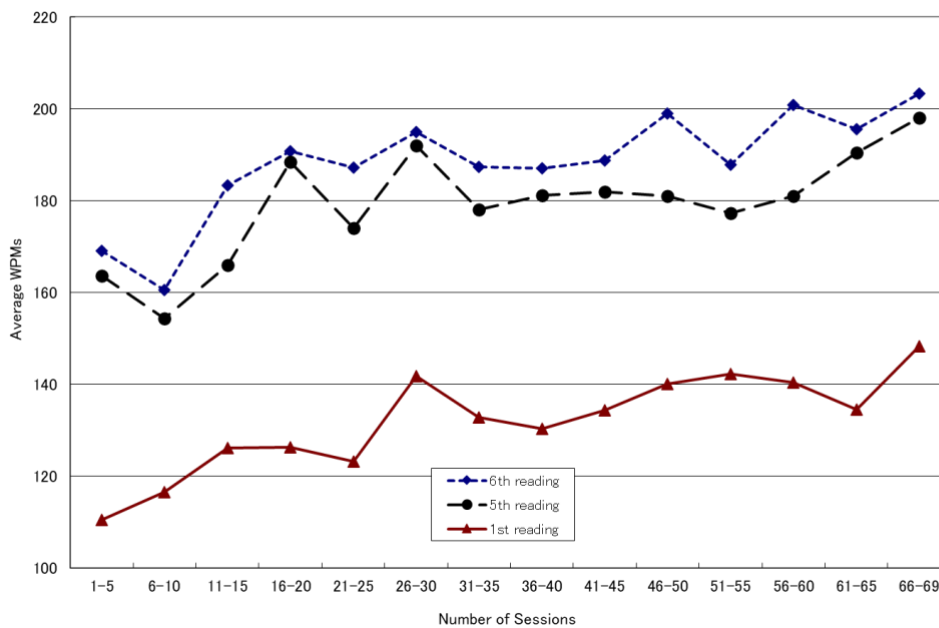
Figure 3. Naomi's WPM Reading Rates Averaged for Each Set of Five Sessions in Taguchi et al. (2012, p. 39)

Once some averaging is done, overall progress in Naomi's reading rate is more apparent over time. For instance, her average reading rate for the first reading of a passage in sessions 1–5 is about 110 wpm, but towards the end of the fluency training program, she is reading around 138 wpm on average during sessions 61–65 and 150 wpm on average during sessions 66–69 on new, unpracticed first readings of a passage. On the fifth reading of a passage, Naomi is reading around 162 wpm on sessions 1–5 and almost 200 wpm on average on sessions 66–69.

The Role of Audio Models in Repeated Reading and Reading-While-Listening

Using an audio model of reading seems to have some beneficial effects which facilitates L2 reading. We think this phenomenon is of interest to both teachers and researchers. For the purposes of the following sections, an audio model is simply an exact audio version of the text passages learners are reading in a fluency training program, such as an audio book. One of these beneficial effects is that an audio model helps L2 readers set the pace for their reading because they need to read at the same speech rate as the audio model, which is supposed to be slightly faster than the readers' own pace of reading (Chang & Millet, 2015; Taguchi et al., 2012, 2016), particularly at the early stages of a single session such as the second or third reading of a passage. See Figure 3 for example where Naomi's first silent reading rate is slower than her fifth and sixth reading rates. We can surmise from Figure 3 that earlier in learners' sessions, their reading rates are slower.

The audio model helps learners read a little faster than their normal reading speed without necessarily sacrificing their comprehension of the passage. English language learners in Vietnam reported this in Gorsuch and Taguchi (2010). Interestingly, American learners of Japanese in Gorsuch et al. (2015) reported that reading and listening to a passage in early stages of a repeated reading treatment helped their comprehension by making them read a little more *slowly* than they needed to. As a result of their increased comprehension, they believed their reading rates in later stages of a given treatment were much faster.

As for pacing readers, a replication study by Alexander and Nygaard (2008) reveals how an audio model affects reading in L1. This may offer some clues as to how an audio model helps L1 and L2 learners develop lower-order word recognition skills toward achieving automaticity. Alexander and Nygaard (2008) focus on prosody in an auditory model. Prosody can be called "the music of language" and has four major properties: pitch, duration, stress, and pausing (Kuhn et al., 2010, p. 234). Spoken language in an auditory model has a rich repertoire of prosodic features that are used to convey a speaker's intentions and emotions. Ramus et al. (2000) state that prosody provides listeners with grammatical "parsing points" in connected speech. Parsing is the process in which a sentence is divided into its syntactic structure and meaning. Using the dividing points, listeners parse the stream of speech into meaningful phrases and understand their meanings.

Alexander and Nygaard (2008), replicating an earlier study by Kosslyn and Matt (1977), asked participants to listen to a casual two-minute conversation between a fast speaker and a slow speaker. Then, the participants were asked to silently read one of the two passages that they were told had been "written" either by the fast speaker or by the slow speaker. The passages were not accompanied by the audio reading models, and the participants simply silently read the passage.

The results showed that the participants' reading rates were significantly influenced by the speech rates of the speakers they had heard before they read the passage. Those reading the passage that they thought had been written by the slower speaker read the passage more slowly than those who read the passage they thought had been written by the faster speaker. This may occur for L1 readers and is explained by the Implicit Prosody (IP) Hypothesis.

The Implicit Prosody (IP) Hypothesis (Fodor, 2002) theorizes the role prosody plays in silent reading. When readers read silently, they are likely to retrieve phonological representations from the text to access its meaning. The IP Hypothesis suggests that a default prosodic contour is projected during silent reading and influences readers' resolution of ambiguities in the text. The IP Hypothesis assumes that readers access implicit prosodic representations in the text through their inner speech, even when the speech sounds are not physically present. In other words, readers seem to mentally hear the "voice" of the text while they are reading it silently (Rayner et al., 2012). Considering Alexander and Nygaard's 2008 study, we suggest that the prosodic information in an auditory model helps readers pace their reading and read faster. We wonder to what extent this is true for L2 readers.

The Role Audio Models Play in L2 Reading Needs Further Investigation

In this final section, we recount empirical and anecdotal reports on the facilitative roles an audio reading model has on L2 readers, but then we move on to what we believe is a pressing issue: What is the mechanism and process by which an audio reading model supports L2 readers' silent reading?

Anecdotal benefits of audio models for L2 readers. L2 readers who read silently along with an audio model have reported that they experience the stories as more interesting and attractive than when they are reading them silently without a model (Chang & Millet, 2015; Gorsuch & Taguchi, 2010). Learners also suggest that the reading-while-listening mode increases their focus and degree of concentration while reading (Gorsuch & Taguchi, 2010). Tragant et al. (2016) state that the dual mode of reading-while-listening makes it possible for L2 readers to read according to their preferences. That means learners can choose to focus either on written input or audio input. Moreover, L2 readers enjoy reading with an audio model while they engage in reading-while-listening (Chang & Millet, 2014; Lightbown et al., 2002; Pellicer-Sánchez et al., 2018; Taguchi et al., 2004, 2012, 2021; Tragant et al., 2016).

Mechanisms and processes of reading with audio models. We think that the mechanism and process of how an audio reading model actually supports L2 readers' silent reading have not been sufficiently explored. We offer some directions for future research. These focus on two areas. One is the meaning scaffolding provided by an audio model as learners encounter dialogue in a narrative text. A second is the rate of speech, which includes the pauses within an audio model.

First, using an audio reading model seems to provide L2 readers with a kind of meaning scaffolding (Wood et al., 1976) that facilitates their reading. In a study by Taguchi et al. (2021), L2 readers who were learning Japanese as a foreign language at an American university noted that the model helped them in their reading of dialogues, such as identifying who was talking to

whom in dialogues, and who was doing what to whom in the narrative structure. This was a theme in previous studies (Taguchi et al., 2012, 2016). In the single case study, we conducted (Taguchi et al., 2012), the difficulty that L2 learners have reading dialogues was thrown into strong focus, as was the help that the audio model presented. We discovered that the participant consistently better understood the frequent dialogues in the story because of the audio model simply in terms of parsing out who was talking, and who was being spoken to. We are encouraged by the growth of eye-tracking studies in reading, particularly those that employ reading tasks of extended texts (see descriptions in Kuperman et al., 2023). Even more useful findings would emerge from investigations that merged learners' perceptions of what they experienced with the text during audio-supported RR sessions along with eye-tracking data from the same moments. Is more attention paid to some features at first and then less during subsequent readings? Is more attention paid to other features later? Which features? Are learners able to talk about them?

A second area is how the speech rate of an audio model affects L2 readers when they engage in reading a text while also listening to its audio version. Speech rate is the rate at which an audio version of the text is presented to the reader while they are reading the text silently, which is represented by the speed and pauses contained in the audio text. These two components of the audio input create the clarity and intelligibility of the message to be conveyed (Rodero, 2012). We recommend that in any standard RR program learners would read a given text two or three times, and one or two of those times would be audio-supported. This will help readers discriminate the part that they have understood from the part they have not and utilize the context to efficiently guess unknown words they encounter. It will also help them consolidate the grasp of what they have learned in terms of vocabulary and grammar through multiple exposure to it (Taguchi et al., 2021). Thus, regardless of whether an audio model is slower or faster than an individual learner's silent reading rate during a given RR session, the learner still has the opportunity within a session to benefit from the fluency and comprehension-building qualities of RR.

But we briefly play the devil's advocate here, for theoretical reasons: if the speech rate is too fast for the readers, and there is a lack of adequate number of pauses for processing upcoming information in text, they then are unable to assimilate the information in the text because of the limited capacity of their working memory. Thus, part of the information is gone without being integrated in learners' memories (Campanella & Belin, 2007). Readers need time to retain the text information in their working memory in order to integrate it into their comprehension. However, since the text is read in "real time," if the audio reading model is delivered too fast, they will not be able to engage in ordinary reader behavior. On the other hand, if the audio input is provided more slowly than the pace at which they usually read silently, the readers' comprehension equally suffers because there is an incongruous gap between the rate they are listening to and the rate at which they comfortably enjoy reading. The slower pace makes them bound to be unable to go ahead of the text (Rodero, 2012), and, as in the previous case, they cannot engage in ordinary reader behavior. We think one area that can be investigated is whether learners have perspectives on this. Do they believe some audio models are better than others in terms of their rate and pauses? Do they notice pauses? Would eye-tracking show specialized learner activity during pauses? Moreover, what would readers think of the role that a new AI-generated audio reading model plays?

In fact, learners do likely have perspectives on this issue as we found in our single case study (Taguchi et al., 2012). The entry below was taken from Naomi's weekly report:

> I think I can usually understand almost all of a session passage during my first reading, but sometimes there is a part when I need to take more time to read it carefully again to better comprehend it. If possible, I prefer to read the text carefully without using an audio model. It would be more effective if we were allowed to read with an audio model after we have read the text through and dealt with some ambiguous parts of the text. There were times when I thought so. Since the pace of an audio reading model is very fast, it is difficult to have time to think over the ambiguous part while reading with a reading model. In addition, the last reading without an audio model is the phase in which how well readers understand the text, I think I want to attempt to solve the issues I have about the passage as much as possible before I read with an audio model. To think that way, I would like to read a session passage more carefully before I read it along with an audio model. For example, I read the text twice or read the part carefully that I could not understand in my first reading. (July 18 to July 23, 2005, Sessions #19–22)

Besides audio model rates which are faster or slower than learners' usual reading rates, LaBarbera and MacLachlan (1979) add another potential effect of slightly increased speech rate of audio models, indicating that it raises attention and learning of general listeners who are not necessarily reading. For those who research L1 "listenability" (e.g., Borden, 1927; Lumley, 1933; Nelson, 1948), it has been found that the optimal speech rate for news broadcasts is around 165 to 175 wpm. We wonder whether this can be extrapolated to enhance the attention of L2 readers. Silent reading rate for L2 readers is somewhat slower than for L1 readers, measuring 80 to 130 wpm compared to 200 + wpm (e.g., Hirai, 1999; Taguchi & Gorsuch, 2002; Yamashita & Ichikawa, 2010). To discern an optimal reading rate for reading-while-listening with enhanced comprehension, further research is needed.

Conclusion

The current paper explores the interplay among reading rate, reading comprehension, and an audio reading model. Readers' silent reading rates often vary, reflecting how they read and understand the text and what purposes they set for their reading. The degree of fluctuations in their silent reading rate reveals both their reading process and purpose for reading. One way to show a developmental pattern of progress that takes this natural variation into account is to take averages of each set of their reading rates, along with specific examples that demonstrate their strategic adaptations. In addition, the role an audio reading model plays in L2 reading should be explored further to better understand how it might facilitate L2 readers' reading. Suggestions on avenues of such research are offered.

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About the Authors

Etsuo Taguchi is a Professor at Daito Bunka University, Tokyo, Japan. He is interested in reading processes, especially how lower identification skills such as word recognition interact with higher comprehension skills, including metacognition in reading. He has published in many journals including *Reading in a Foreign Language, Pedagogies: An International Journal, System,* and *Language Teaching Research.*
Email: taguchi@ic.daito.ac.jp

Greta Gorsuch is a Professor of Applied Linguistics at Texas Tech University, USA. She has written articles that have appeared in *Language Teaching Research*, *Language Teaching*, *Foreign Language Annals*, and *Reading in a Foreign Language*. She edited and wrote *Tests that Second Language Teachers Makes and Use* (2019) and co-authored *Second Language Course*

Evaluation (2016), *Second Language Testing* (2018), and *Using Theories for Second Language Teaching and Learning* (Bloomsbury Academic, 2024). She is interested in reading fluency research, testing, and evaluation.
Email: greta.gorsuch@ttu.edu

Kristin Lems, Ed.D., is a Professor at National Louis University, Chicago, USA, where she educates teachers on ESL/bilingual/dual language education and the intersections of language, linguistics, and literacy. Her original research about adult ESL oral reading fluency and silent reading comprehension was a finalist for Outstanding Dissertation of 2005 from the International Reading Association. She is the first author of *Building Literacy with Multilingual Learners: Insights from Linguistics*, now in its third edition (Guilford 2023).
Email: kristinlems@gmail.com

Hiroto Toda is a guest Professor in the Graduate School of Instructional Systems at Kumamoto University in Japan. He holds an M.B.A. (Master of Business Administration) from Sanno University, Tokyo, Japan. His research areas are Instructional Design, Organizational Behavior, Learning Analytics, and E-learning.
Email: htoda@kumamoto-u.ac.jp

Toshiko Kawaguchi is an Associate Professor at Aichi Bunkyo University, Aichi, Japan. Her major research area is British and American Literature. She is also interested in using literature and other cultural and content materials in L2 learning.
Email: acidantheras@gmail.com

Kirsten M. Snipp has been teaching in Japanese universities for more than 30 years. She is an Associate Professor at Takasaki University of Commerce, Japan. Her areas of interest are Contrastive Linguistics and L1 Transfer, particularly in the areas of vocabulary mastery and pronunciation, as well as the application of analysis to aid in L2 learning strategies.
Email: k-snipp@uv.tuc.ac.jp