

How Do Emotional Speech Affect Second Language Comprehension: Examining Learners' Eye Movements

Yingshan Chen*

HongYi Honor College of Wuhan University, Wuhan, Hubei 430072, China

*Corresponding authorEmail: cys0323@163.com

Abstract: Reading-while-listening has been proved to be helpful in second language reading comprehension under certain circumstances, while limited research has addressed whether the emotional auditory input effect reading comprehension, so the aim of this study was to identify this effect. In this study, second language learners were asked to read short passages while their eye movements were monitored. We found no significant effect on reading comprehension between two modes and we also found that reading-while-listening mode slower the reading speed. Moreover, there was a redundancy effect among participants.

Keywords: Eye-tracking, Reading comprehension, Reading-while-listening, Second language.

1. Introduction

The ability to read in a second language is one of the most essential skills that language learners need to master, as it offers language learners the variety of lexical items, grammatical structures, and additional schematic knowledge (Wilinson, 2012). Researchers have found that combining reading text and auditory input contributes to understanding and brings about larger learning gains. Reading while listening has been proved to be beneficial to developing auditory discrimination skills, refined word recognition (Osada, 2001; Vandergrift, 2007), and improving reading fluency (Chang, 2009; Chang and Millet, 2014, 2015) as well as vocabulary learning (Taguchi et al., 2004; Brown et al., 2008; Webb and Chang, 2015). Some studies have found that the speed of audio affects the learners' gains (Hill, 2001), but there is little discussion on whether the emotion in the audio effect reading. Therefore, the main purpose of this study is (1) to examine the effect of emotional audio in reading comprehension, (2) using eye movements to examine the reading status of different input modes.

2. Review of Literature

2.1. The Effect of Audio-assisted Reading

Now it is widely accepted by researchers that reading while listening is beneficial to language learning. Given that the learners receive both the reading text and the audio, this reading pattern is called bimodal input, which leads to higher quality and quantity of L2-input than unimodal input does (Tragant and Vallbona, 2018). Research indicated that reading- while-listening can improve learners' oral production (Trofimovich et al., 2009). Chang (2009) found that students in reading-while-listening mode gain better global comprehension as well as have more positive reading experience. Chang and Millet (2014, 2015) demonstrated that the audio-assisted reading can make improvement in reading rates and comprehension levels. Studies also indicate that audio-assisted reading results in better vocabulary learning (Webb and Chang, 2015). However, there are also some studies show that there is no significant difference between bimodal and unimodal input (Pellicer-Sánchez et al., 2018). Moreover, Diao and Sweller (2007) found that adding audio

input generated a negative effect at both lexical and text level comprehension, which conforms to the cognitive load theory.

2.2. Eye-tracking Reading

In reading, the readers' eyes include two basic phenomena: saccade and fixation (Rayner, 2009). Most saccades are from a known area to a new area, but sometimes there are saccades in the opposite direction, which are called regression.

First-pass reading time refers to the total time of all the fixations in the current interest area before the reader's fixation jumps to another one for the first time. Lookback fixation time refers to the time when the fixation returns to an interest area after the first reading, which reflects the reader's information processing. Regression count and regression-path time reflect the reprocessing of readers on previously read information (Castelhana and Rayner, 2008; Rayner, 2009).

We have discussed the advantages conferred by reading-while-listening, as possible explanations, the audio helps learners to segment individual words from the continuous speech stream. It also helps them match spoken and written forms and develop letter-sound correspondences (Conklin et al., 2020). Moreover, research shows that emotional prosody recognition is consistent across cultures (Pell et al., 2009; Scherer et al., 2001) and is beneficial to second language vocabulary learning (Chua and Schirmer, 2011). This study therefore seeks answers to the following questions: (1) how dose different modes of input affect listeners' reading comprehension? (2) Are there differences between different emotional auditory input in the reading-only and reading-while listening modes?

3. Study

3.1. Participants

This study selected 90 students from Wuhan University, whose native language is Chinese, including 27 boys and 63 girls. The subjects had normal or corrected-to-normal sight, and did not have any language, hearing, or cognitive impairment. The subjects signed a written informed consent before the experiment, and a certain amount of remuneration was obtained after the experiment. Due to serious track loss, the recordings from 6 participants were discarded before any

analyses were carried out, leaving a final sample of 84 participants (24 males; 60 females).

3.2. The Study Design

Single factor 3-level (emotional auditory + written input /neutral-emotion speech + written input/ written input only) between-subjects design. The dependent variables were the subjects' reading comprehension test scores and eye movement data.

3.3. Materials

Reading materials: Selected from the second and third volumes of New Concept English, adapted into 10 experimental essays, the average length of the essays is 162 words (range 132~217 words), 20 college students (not participating in the formal experiment) evaluate the difficulty and rationality of the questions and reading passages. Both difficulty and rationality are rated on a scale of 1 to 5, and the average score of rationality assessment is $M = 3.70$, $SD = 0.38$, average difficulty score $M = 2.12$, $SD = 0.44$, 1 essay were deleted because of the relatively low rationality and high difficulty.

Audio materials: Neutral and emotional materials were used in the experiment, both of which were read aloud by the same English major female student of Wuhan University with high English proficiency and clear pronunciation, who was informed in advance of the purpose of the experiment.

Experimental equipment: Eyelink1000 plus was used in the experiment, the sampling frequency was 2000 Hz, the refresh frequency was 240 Hz, the resolution was 1024×768 pixels, the distance between the subjects' eyes and the screen was 76 cm, and the short text materials were presented in black font on a white background, the movement of the left eye was recorded (the right eye of 8 students were recorded because of their eye conditions). The sound stimuli were presented to the subjects through a multimedia speaker at around 60 decibels.

3.4. Procedure

- (1) The subjects sat in front of the instrument and placed

their heads on the stand naturally, make the subjects can look at the center of the screen.

- (2) Perform nine-point calibration on the instrument. The average error is less than 0.3° .

- (3) The eye tracker automatically recorded the subjects' eye movements and keyboard responses. There were 9 short texts in total and 3 questions after each short text. The experiment lasted approximately 30 minutes. In order to ensure the validity of the data, the subjects were asked to answer 11 questions about the English learning background.

4. Results

The experimental indicators are divided into two categories. One is the integral analysis using the whole passage as the interest area, and the other is the partial analysis using sentences as the interest area. Indicators for the integral analysis included total reading time, mean fixation duration and number of fixations. Indicators for the partial analysis included first pass reading time, look back reading time, number of fixations in first reading and look back reading, number of regressions in one interest area and regression path reading time.

All of the three groups showed good understanding of the stories. In the experiment, the correct rates of reading under emotional speech, neutral speech, and silent conditions were 74.37%, 76.76%, and 73.21%. No difference in accuracy between conditions was significant ($p > 0.05$).

4.1. Integral Analysis

The statistical indicators of the integral analysis of passage reading are shown in Table 1. The experimental results show that there was no significant difference in subjects' score ($F = 1.03$, $p = 0.36$), number of fixations ($F = 3.07$, $p = 0.05$), and mean fixation duration ($F = 0.92$, $p = 0.40$) among three conditions. However, the total reading time in the reading-only condition was significantly less than that in the other two conditions ($F = 4.22$, $p < 0.05$).

Table 1. The mean and standard error of each eye movement indicators in the integral analysis.

Background sound	score	Total reading time	Total fixation count	Mean fixation time
Reading only	19.76(0.49)	47571.54(2594.66)	208(10.77)	228.26(4.35)
Reading with Neutral speech	20.72(0.50)	54480.22(1930.74)	232(9.10)	236.73(4.69)
Reading with Emotional speech	20.08(0.47)	56329.94(2127.40)	241(9.07)	234.51(5.06)

4.2. Partial Analysis

The statistics of each indicator in the partial analysis of reading are shown in Table 2. There was no significant difference in first reading time ($F = 0.06$, $p = 0.94$), number of fixations in first reading ($F = 0.03$, $p = 0.97$), and regression path reading time ($F = 2.92$, $p = 0.06$) among three conditions.

However, there was a significant difference in the look back reading time ($F = 28.31$, $p < 0.001$), look back fixation count ($F=16.17$, $p<0.001$), and regression count ($F=134.84$, $p<0.001$). The look back reading time were shorter and the number of fixations is less when subjects were reading under neutral speech, while the regression count is larger in the group in which participants received neutral speech input.

Table 2. The mean and standard error of each eye movement indicators in the partial analysis.

	Reading-only	Reading with neutral speech	Reading with emotional speech
First pass reading time	19294.84(1428.25)	19730.9908(1415.60)	19938.0696(1145.35)
First reading fixation count	83.17(5.27)	81.74(5.52)	83.44(3.93)
Look back reading time	18817.28(1134.40)	13146.12(618.10)	22950.33(867.51)
Look back fixation count	82.34(4.84)	66.04(2.65)	97.79(3.64)
Regression count	9.06(0.52)	33.29(1.80)	11.48(0.59)
Regression path reading time	76580.46(4000.90)	79833.87(2443.80)	87991.62(3367.00)

5. Discussion

The above experimental results can be discussed and analyzed from the following aspects:

5.1. The Effect of Bimodal Input for Reading Comprehension

In this study, the average scores of the two groups of subjects who input listening materials were slightly higher than those who did not input listening materials, but the difference is not significant. Meanwhile, the behavior of learners who listened to emotional audio was not better than those who listened to neutral audio, which is inconsistent with our assumption. Therefore, this study does not fully support this view.

5.2. The Presence of Audio May Moderate Reading Speed

Conklin (2020) studied students who use English as first and second language and found that if the participant listened to audio while reading, their reading speed was delayed by the audio, especially for the L1 subjects who were more proficient learners. This may explain the results in my study that the total reading time, first pass reading time and mean fixation duration of bimodal input participants were greater than unimodal input ones.

5.3. The Redundancy Effect

Cognitive load theory assumes that two working memory channels (auditory and visual) are partially independent and both are subject to capacity limitations. If both channels are presenting identical information such as written and spoken text, it will cause a redundant effect (Diao and Sweller, 2007). In this study, the total reading time, mean fixation duration, regression path reading time and number, as well as the first reading time and fixation number of the subjects with reading-while-listening input were higher than those of the subjects with reading-only input. This result may have a redundant effect. Because the auditory materials, especially the emotional audio, may give learners larger cognitive load. This told us that for those who are not proficient in second language, presenting both written and spoken material simultaneously may not be optimal.

6. Conclusion

(1) The presence or absence of auditory materials has no significant effect on reading comprehension performance, and does not support the dual-mode input theory.

(2) The properties of auditory materials did not play a

positive role in reading comprehension, and did not support the hypothesis that adding emotional information to audio could help reading comprehension.

(3) Listening played a role in moderating reading speed, and learners' reading speed was faster under the condition of reading only.

(4) The audio material repeated with the reading text increases the cognitive load of the subjects and may interfere with their reading.

References

- [1] Wilkinson, D. (2012). A data-driven Approach to increasing student motivation in the reading classroom. *Language Education in Asia*, 3(2), 252-262.
- [2] Vandergrift, L. (2007). Recent developments in second and foreign language listening comprehension research. *Language teaching*, 40(3), 191-210.
- [3] Osada, N. (2001). What Strategy Do Less Proficient Learners Employ in Listening Comprehension?: A Reappraisal of Bottom-Up and Top-Down Processing. *Journal of Pan-Pacific Association of Applied Linguistics*, 5(1), 73-90.
- [4] Chang, A. C. S. (2009). Gains to L2 listeners from reading while listening vs. listening only in comprehending short stories. *System*, 37(4), 652-663.
- [5] Chang, A. C., & Millett, S. (2014). The effect of extensive listening on developing L2 listening fluency: Some hard evidence. *ELT journal*, 68(1), 31-40.
- [6] Chang, A. C. S., & Millett, S. (2015). Improving reading rates and comprehension through audio-assisted extensive reading for beginner learners. *System*, 52, 91-102.
- [7] Taguchi, E., Takayasu-Maass, M., & Gorsuch, G. J. (2004). Developing reading fluency in EFL: How assisted repeated reading and extensive reading affect fluency development.
- [8] Brown, R., Waring, R., & Donkaewbua, S. (2008). Incidental vocabulary acquisition from reading, reading-while-listening, and listening to stories.
- [9] Webb, S., & Chang, A. C. (2015). Second language vocabulary learning through extensive reading with audio support: How do frequency and distribution of occurrence affect learning?. *Language Teaching Research*, 19(6), 667-686.
- [10] Hill, D. R. (2001). Survey. Graded readers. *ELT journal*, 55(3), 300-324.
- [11] Tragant, E., & Vallbona, A. (2018). Reading while listening to learn: Young EFL learners' perceptions. *ELT Journal*, 72(4), 395-404.
- [12] Trofimovich, P., Lightbown, P. M., Halter, R. H., & Song, H. (2009). Comprehension-based practice: The development of

- L2 pronunciation in a listening and reading program. *Studies in second language acquisition*, 31(4), 609-639.
- [13] Pellicer-Sánchez, A., Tragant, E., Conklin, K., Rodgers, M., Llanes, A., & Serrano, R. (2018). L2 reading and reading-while-listening in multimodal learning conditions: An eye-tracking study. *ELT Research Papers*, 18(01), 1-28.
- [14] Diao, Y., & Sweller, J. (2007). Redundancy in foreign language reading comprehension instruction: Concurrent written and spoken presentations. *Learning and instruction*, 17(1), 78-88.
- [15] Rayner, K. (2009). The 35th Sir Frederick Bartlett Lecture: Eye movements and attention in reading, scene perception, and visual search. *Quarterly journal of experimental psychology*, 62(8), 1457-1506.
- [16] Castelano, M. S., & Rayner, K. E. (2008). Eye movements during reading, visual search, and scene perception: An overview.
- [17] Conklin, K., Alotaibi, S., Pellicer-Sánchez, A., & Vilkaitė-Lozdienė, L. (2020). What eye-tracking tells us about reading-only and reading-while-listening in a first and second language. *Second Language Research*, 36(3), 257-276.
- [18] Kendeou, P., van den Broek, P., White, M.J., & Lynch, J.S. (2009). Predicting reading comprehension in early elementary school: The independent contributions of oral language and decoding skills. *Journal of Educational Psychology*, 101 (4), 765 – 778 .
- [19] Tschirner, E. (2001). Language Acquisition in the Classroom: The Role of Digital Video. *Computer Assisted Language Learning*, 14(3-4), 305–319.
- [20] Min, C. S., & Schirmer, A. (2011). Perceiving verbal and vocal emotions in a second language. *Cognition & Emotion*, 25(8), 1376–1392.