

Analysis of Influence of L2 English Speakers' Fluency on Occurrence and Duration of Sentence-medial Pauses in English Readout Speech

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Abstract

Pause plays important roles for the intelligibility, naturalness and fluency of speech. This paper reported the effect of native (L1) Bengali speakers' fluency of English on occurrence probability and duration of sentence-medial pauses with respect to three factors: phrase type, phrase length (l), distance (d). In this analysis, 40 nonnative (L2) English (L1 Bengali) speakers' data was divided into five different groups (poor, average, good, very good and excellent) based on their English fluency level. From result of this comparative study, it is seen that occurrence probability and duration of sentence-medial pauses for each phrase type, each l value and each d value increase as L2 English speakers' fluency decreases. Moreover like L1 English speakers, occurrence probability and duration of sentence-medial pauses are almost linearly dependent on l and d respectively for L2 English speakers regardless of their fluency. Furthermore effect of three factors on sentence-medial pauses of fluent L2 English speakers is more close to that of L1 English speakers compared to less fluent L2 English speakers.

1 Introduction

English is used as a language for international communication throughout the world today. English is also being studied and spoken as a second language in more countries than ever before. Thus, a comprehensive understanding of variations

present in the dialects of English spoken in the world today is a fundamental issue for the development of English language education as well as spoken language science and technology. Asia is home to the largest number of English learners and speakers in the world (Nunan, 2003), and it is important to learn about Asian language speakers' English and identify their features. In India, combining native (L1) and nonnative (L2) speakers, more people speak or understand English than any other country in the world (Visceglia *et al.*, 2009). Thus research on spoken English of Indian speakers from a multidisciplinary perspective is urgently needed. Therefore it is necessary to collect L2 English speech from as many regions of India as possible and compare with L1 English speech based on segmental and supra segmental aspects in order to derive a set of core properties common to all varieties of English spoken by Indian speakers (Miller, 1978). From the theory of second language acquisition, it is suggested that proper acquisition involves in correct production and perception of phonetic and prosodic features of English. One of the most important suprasegmental features in English is pause (Meng *et al.*, 2009), where proper positioning of pauses in speech of second language is necessary for the L2 speaker to understand in order to acquire the proficiency on that language.

During the act of generating spontaneous speech, pause is a highly variable phenomenon and is an outcome of processing activity (Fant *et al.*, 2003). The pauses occur in speech generally at syntactic boundaries. Pauses in text reading (readout speech) can be divided into three categories:

(1) pauses between paragraphs, (2) pauses between sentences in a paragraph, (3) pauses within a sentence (sentence-medial pauses). The occurrence of pauses is unconditional at sentence boundaries and paragraph boundaries, but is conditional at minor syntactic boundaries within sentences such as phrase boundaries, word boundaries (Fujisaki and Omura, 1971). Since sentence medial pause is conditional and based on syntactic structure of the text, so the aim of the current study is limited to the prediction of sentence medial pauses in English readout speech without specific foci and emotions. Their duration tends to be longer at the end of larger syntactic units, but have statistical variations. A speaker may choose to insert a pause at a location necessary to disambiguate a syntactic ambiguity, or if the preceding uninterrupted sentence segment is too long, or if he/she is simply out of breath. For instance, if there is no pause or if the pauses in a sentence are wrongly placed, then the meaning of the sentence will change. Control of pause occurrence and duration is an important issue for naturalness and correct meaning of the sentence.

There are few studies on analysis of occurrence probability and duration of sentence-medial pauses in readout speech. Fujisaki et al. (1999) investigated the occurrence probability and duration of sentence-medial pauses in Japanese readout speech. The results of this investigation showed that the occurrence probability and duration of sentence-medial pauses in Japanese readout speech increase almost linearly with phrase length and distance. Das Mandal et al. (2010) analyzed sentence-medial pauses for Bangla readout speech. This analysis also showed that occurrence probability and duration of sentence-medial pauses in Bengali readout speech are linearly dependent on phrase length and distance. In a study, Acharya and Das Mandal (2012) conducted a detailed investigation for sentence-medial pauses for readout speech of Bangla for different speech rates. The results of this study revealed that occurrence probability and duration of sentence-medial pauses in Bengali readout speech are linearly dependent on phrase length and distance in case of all speech rates; that means occurrence probability and duration of pause in case of fast speech is much lesser than the normal and slow. Moreover Saha and Das Mandal (2013) performed a comparative study of occurrence probability and duration of sentence-medial pauses in English readout speech between L1

American English and L1 Bengali speakers and reported that, although the occurrence probability and duration of sentence-medial pause are linearly dependent on phrase length and distance for both speaker groups, but the occurrence probability and duration of sentence-medial pause of L1 Bengali speakers are much higher than L1 English speakers. The results from these previous studies support the view that one of the key issues for speech prosody is control of pause occurrence and duration; that means occurrence probability and duration play important roles in prediction of intra-sentential pause insertion in readout speech. It is necessary for a speaker to put pauses at appropriate place in order to get the fluency on target language. Pause controls the fluency of speakers on a language, where fluency is defined as a level of language proficiency and depends on naturalness, intelligibility, accent placement, lexical stress, segmental correctness (Kondo and Tsubaki, 2012). But there is no such significant study on effect of L2 speakers' fluency over pause occurrence and duration. This paper deals with that issue. The objective of present study is to analyze the effect of L1 Bengali speakers' fluency of English on occurrence probability and duration of sentence-medial pauses in English readout speech compared to L1 English speakers.

2 Speech Material

The material used for the present study was the Aesop's fable "The North Wind and the Sun", which produces a large range of segmental and suprasegmental characteristics in English (Mondoneto, 1999). The material was read by 10 (5 male, 5 female) L1 American English speakers and 40 (20 male, 20 female) L1 Bengali speakers whose native language was Standard Colloquial Bengali (SCB) (Bhattacharya, 1988). All speakers were in the age group between 20 to 40 years and L1 Bengali speakers had studied English as a second language for a minimum of ten years. In order to let the speakers decide where and how long they inserted pause, sentence-medial punctuation marks were removed from the text. The speech was recorded in quiet room with 16 bit 16 kHz digitization format. Pauses were detected and their duration was measured manually. To examine the effect of fluency of English on occurrence probability and duration of sentence-medial pauses in English rea-

dout speech, 40 L1 Bengali speakers' data was divided into five fluency groups. 10 English teachers evaluated 40 L1 Bengali speakers' English fluency level on a 5-point MOS scale based on naturalness, accent placement, lexical stress and segmental correctness. Figure 1 shows the distribution of average MOS score of the 40 L1 Bengali speakers' English fluency level. Average scores were grouped as follows: 1.5-2.49 (Poor), 2.5-3.2 (Average), 3.21-3.59 (Good), 3.6-4.19 (Very Good), 4.2-5 (Excellent). It is observed that the English fluency level of the majority of speakers was evenly distributed between 3 and 4.5.

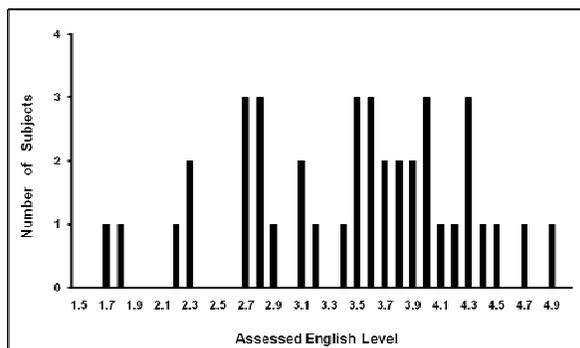


Figure 1. Distribution of average MOS score of L1 Bengali speakers' English fluency.

3 Factors Affecting the Occurrence and Duration of Sentence-Medial Pauses

Based on previous studies (Fujisaki et al., 1999; Das Mandal et al., 2010; Acharya and Das Mandal, 2012; Saha and Das Mandal, 2013), it is noted that the occurrence and duration of sentence-medial pauses in English mainly depends on the following three factors:

3.1 Phrase Type

In English, phrases are categorized into noun phrase (NP), verb phrase (VP), adjective phrase (AJP), adverb phrase (ADVP), prepositional phrase (PP) and conjunction phrase (CP). These types of phrases were considered in current study except prepositional phrase (PP), because there was only one prepositional phrase in the training corpus and it was at sentence final position.

3.2 Phrase Length

Phrase length is the length l of the phrase in terms of number of syllables. The phrase length is cumu-

lative if a pause does not occur at the end of the phrase. Figure 2 defines the cumulative phrase length.

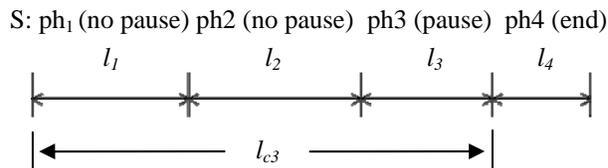


Figure 2. Illustration of the cumulative phrase length.

In Figure 2, Ph_{*i*} represents the *i*th phrase of the sentence S and l_i represents the length of the corresponding phrase. So the cumulative length will be sum of the length of ph₁, ph₂ and ph₃, i.e. $l_{c3} = l_1 + l_2 + l_3$ if a pause occurs after ph₃.

3.3 Distance between the Current Phrase and its Dependent Counter Part

A dependency is an asymmetrical syntactic relation between a pair of constituents in a sentence known as the head and the dependent; the head of each dependency is then the dependent of another constituent, forming a recursive structure which connects the entire sentence. A constituent is right branching if it is to the right of the external head to which it connects; left branching if it is to the left. English is mainly right branching, but has left branching structure in certain situation. In English, major constituent types (NP, ADVP, PP, CP) are dependent on verb phrase (VP), that means English is mainly verb dependent language (Temperley, 2007). Adjective phrase (AJP) and prepositional phrase (PP) are dependent on noun phrase (NP) also. The distance d between the current phrase and its dependent phrase is the number of words between head of the current phrase and head of its dependent phrase (Temperley, 2005). For the extraction of the parameter d , the text is manually tagged with Parts of Speech (POS) and phrase information. Figure 3 illustrates the calculation of d for a given English sentence.

	NP	VP	ADVP	CC	ADVP	NP	VP	NP
	Then the sun	shone out	warmly	and	immediately	the traveler	took off	his cloak
Word No.	3	4	6	7	8	10	11	14
Related Word No.	4	11	4	11	11	11		11
Distance d	1	7	2	4	3	1		3

Figure 3. Illustration of the distance parameter calculation for an English sentence.

4 Results and Discussions

4.1 Effect of Fluency upon Pause Occurrence Probability

For each of the five phrase types (NP, VP, AJP, ADVP, CP), the pause occurrence probability is defined as the number of phrase boundaries which are followed by a pause divided by the total number of phrase boundaries having a given set of values of l and d . In this section, the effect of L2 English (L1 Bengali) speakers' fluency on occurrence probability of sentence-medial pause was examined with respect to each individual factor: phrase type, phrase length (l), distance (d). In order to examine the effect of fluency on occurrence probability of sentence-medial pause, one way ANOVA was performed with fluency as between group variable for each individual factor (phrase type, l , and d). After that, a series of bonferroni corrected post-hoc t-test was performed to determine which L2 English speaker groups differ significantly from each other for each individual factor, where bonferroni corrected p value was 0.04.

Phrase Type: Figure 4 shows the average occurrence probability of sentence-medial pauses of L1 and five L2 English speaker groups for different phrase types. The result of one way ANOVA (fluency as a between group variable) over five groups of L2 English speakers for each phrase type was shown in Table 1. The result of one way ANOVA shows that, there was a statistically significant effect ($p < 0.05$) of L2 English speakers' fluency for each phrase type.

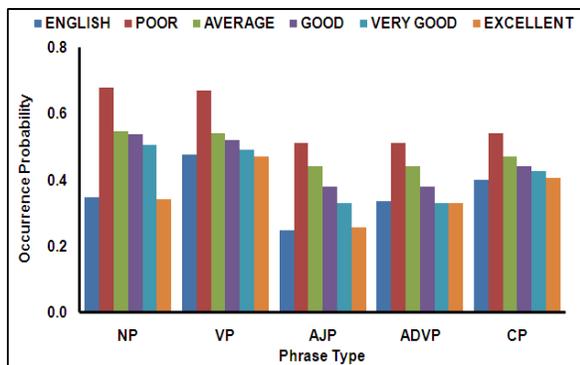


Figure 4. Effect of phrase type upon occurrence probability of sentence medial pauses at different fluency level.

Phrase Type	Result of One Way ANOVA
NP	$F(4,35) = 6.2361, p = 0.0067, p < 0.05$
VP	$F(4,35) = 3.2591, p = 0.023, p < 0.05$
AJP	$F(4,35) = 3.1053, p = 0.027, p < 0.05$
ADVP	$F(4,35) = 2.9656, p = 0.033, p < 0.05$
CP	$F(4,35) = 2.4755, p = 0.046, p < 0.05$

Table 1: The result of one way ANOVA for each phrase type.

In case of NP, Bonferroni corrected post-hoc t-test revealed that there were statistically significant differences ($p < 0.04$) in occurrence probability between every pair of L2 English speaker groups; only exception was pair of average and good L2 English speaker groups, where no statistical significant difference exist ($p > 0.04$); that means occurrence probability after NP for average and good L2 English speaker groups was almost equal. In case of VP, AJP and CP, Bonferroni corrected post-hoc t-test revealed that there were statistically significant differences ($p < 0.04$) in occurrence probability between every pair of L2 English speaker groups after VP, AJP and CP. For ADVP, Bonferroni corrected post-hoc t-test revealed that there were statistically significant differences ($p < 0.04$) in occurrence probability after ADVP between every pair of L2 English speaker groups except pair of very good and excellent L2 English speaker group ($p > 0.04$); that means occurrence probability after ADVP for very good and excellent L2 English speaker groups was almost equal. These findings and Figure 4 imply that occurrence probability of sentence-medial pause after each phrase was decreased as fluency of L2 English speakers was increased. In addition, a series of t-test was carried out to determine which group of L2 English speakers differed significantly from the L1 English speaker group for each phrase type. Result of t-test revealed that every group except excellent L2 English speaker group was differed significantly ($p < 0.05$) from L1 English speakers for each phrase type. From this result and Figure 4, it is observed that each L2 English speaker group, except excellent L2 English speaker group, produced more sentence-medial pause after each phrase compared to that of L1 English speakers; but probability of excellent L2 English speaker group to insert pause after each phrase was almost equal with L1 English speakers. From this result of analysis, it is revealed that occurrence probability of sentence-medial

pause after each phrase type for fluent L2 English speakers was lower than that of less fluent L2 English speakers, and occurrence probability of sentence-medial pause for each phrase type was almost equal for both L1 English speakers and excellent L2 English speaker groups.

Phrase Length (*l*): Figure 5 shows the average occurrence probability of sentence-medial pauses of L1 and five L2 English speaker groups for different phrase length (*l*).

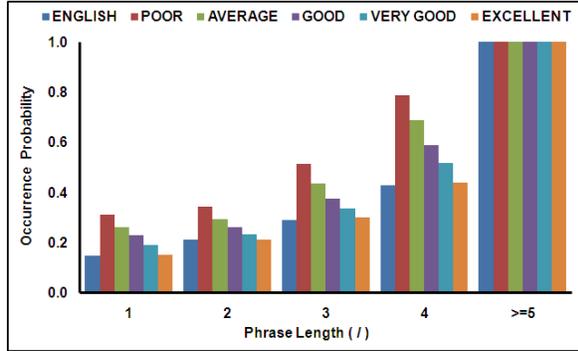


Figure 5. Effect of phrase length (*l*) upon occurrence probability of sentence medial pauses at different fluency level.

Table 2 shows the result of one way ANOVA (fluency as a between group variable) over five groups of L2 English speakers for each *l* (except phrase length 5).

<i>l</i>	Result of One Way ANOVA
1	$F(4,35) = 3.3115, p = 0.021, p < 0.05$
2	$F(4,35) = 3.7361, p = 0.012, p < 0.05$
3	$F(4,35) = 3.3672, p = 0.019, p < 0.05$
4	$F(4,35) = 4.8442, p = 0.0032, p < 0.05$

Table 2: The result of one way ANOVA for each phrase length (*l*).

The result indicates that there was a significant effect ($p < 0.05$) of fluency on occurrence probability of sentence-medial pause for each *l*. Bonferroni corrected post-hoc t-tests revealed that there were statistically significant differences ($p < 0.04$) in occurrence probability of sentence-medial pause between every pair of L2 English speaker groups for each level of *l*. From these results and Figure 5, it is observed that occurrence probability of sentence-medial pause was decreased as fluency level of L2 English speakers was increased for each *l* value.

Furthermore, one way ANOVA was performed on each L2 English speaker group with *l* as between group variable. Table 3 shows result of ANOVA for each L2 English speaker group.

Speaker Group	Result of One Way ANOVA
Poor	$F(4,20) = 5.8464, p = 0.0028, p < 0.05$
Average	$F(4,30) = 5.0135, p = 0.0032, p < 0.05$
Good	$F(4,35) = 7.3465, p = 0.00021, p < 0.05$
Very Good	$F(4,60) = 9.9866, p = 0.00003, p < 0.05$
Excellent	$F(4,30) = 9.8869, p = 0.00092, p < 0.05$

Table 3: The result of one way ANOVA for each L2 English speaker group.

The result from Table 3 indicates that there was significant effect ($p < 0.05$) of *l* on occurrence probability of sentence-medial pause for each L2 English speaker group. Post-hoc tests using Tukey's HSD procedure were performed to determine which phrase length (*l*) type differs significantly from each other for each L2 English speaker group. Tukey's HSD procedure revealed that mean difference between every pair of *l* was statistically significant (mean difference $>$ HSD value, $p < 0.05$) for each L2 English speaker group. From this result and Figure 5, it is observed that mean occurrence probability of sentence-medial pause for each L2 English speaker group was almost linearly dependent on *l* like L1 English speakers and probability to insert pause was maximum (1.0) after phrases with length five or more for each L2 English speaker group.

Distance (*d*) between Current Phrase and its Dependent Counter Part: Figure 6 shows the average occurrence probability of sentence-medial pauses of L1 and five L2 English speaker groups for different *d*. Table 4 shows the result of one way ANOVA (fluency as a between group variable) over five groups of L2 English speakers for each *d* (except distance 7).

The result indicates that there was significant effect ($p < 0.05$) of fluency on occurrence probability of sentence-medial pause for each *d*. Series of Bonferroni corrected post-hoc t-test revealed that there were statistically significant differences ($p < 0.04$) between every pair of L2 English speaker groups for each *d*. From these results and Figure 6, it is observed that occurrence probability of sentence-medial pause for fluent L2 English speakers

was lower than that of less fluent L2 English speakers for each d .

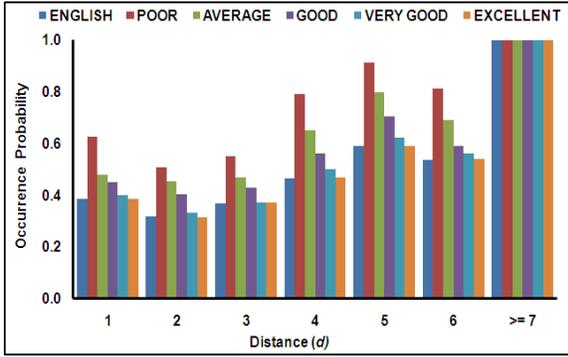


Figure 6. Effect of distance (d) upon occurrence probability of sentence medial pauses at different fluency level.

d	Result of One Way ANOVA
1	$F(4,35) = 6.7649, p = 0.00038, p < 0.05$
2	$F(4,35) = 2.6646, p = 0.0485, p < 0.05$
3	$F(4,35) = 4.4509, p = 0.0052, p < 0.05$
4	$F(4,35) = 6.7222, p = 0.0004, p < 0.05$
5	$F(4,35) = 3.4047, p = 0.019, p < 0.05$
6	$F(4,35) = 2.7127, p = 0.0456, p < 0.05$

Table 4: The result of one way ANOVA for each distance (d).

In addition, one way ANOVA was performed on each L2 English speaker group with d as between group variable. Table 5 shows the result of ANOVA for each L2 English speaker group.

Speaker Group	Result of One Way ANOVA
Poor	$F(6,28) = 4.7073, p = 0.0019, p < 0.05$
Average	$F(6,42) = 3.8736, p = 0.0036, p < 0.05$
Good	$F(6,49) = 4.8918, p = 0.00055, p < 0.05$
Very Good	$F(6,84) = 7.6766, p = 0.000014, p < 0.05$
Excellent	$F(4,30) = 6.9191, p = 0.00004, p < 0.05$

Table 5: The result of one way ANOVA for each L2 English speaker group.

The result indicates that there was significant effect ($p < 0.05$) of d on duration of sentence-medial pause for each L2 English speaker group. Post-hoc tests using Tukey's HSD procedure were performed to determine which distance (d) type differs significantly from each other for each L2 English speaker group. The result of series of Tukey's HSD procedure revealed that group mean

difference between every pair of d was statistically significant (mean difference $>$ HSD value, $p < 0.05$) for each L2 English speaker group. From this result and Figure 6, it is observed that mean occurrence probability of sentence-medial pause for each L2 English speaker group was almost linearly dependent on d like L1 English speakers. It is seen from Figure 6 that probability to insert pause was maximum (1.0) after phrases with d seven or more for each L2 English speaker group.

4.2 Effect of Fluency upon Pause Duration

For each of the five phrase types (NP, VP, AJP, ADVP, CP), the pause duration is defined as the amount of pause measured in millisecond (ms) at the phrase boundary. In this section, effect of L2 English (L1 Bengali) speakers' fluency on duration of sentence-medial pause was examined with respect to each individual factor (phrase type, l, d). For each factor, one way ANOVA was performed with fluency as between group variable to find out effect of fluency on pause duration. After that, a series of bonferroni corrected post-hoc t-test was performed to determine which L2 English speaker groups differ significantly from each other for each individual factor, where bonferroni corrected p value was 0.04.

Phrase Type: Figure 7 shows the average duration of sentence-medial pauses of L1 and five L2 English speaker groups for different phrase types.

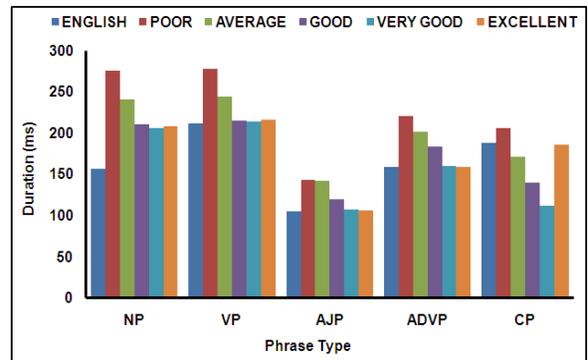


Figure 7. Effect of phrase type upon duration of sentence medial pauses at different fluency level.

The result of one way ANOVA (fluency as a between group variable) over five groups of L2 English speakers for each phrase type was shown in Table 6. The result shows that, there was a statistically significant effect ($p < 0.05$) of fluency for each phrase type.

Phrase Type	Result of One Way ANOVA
NP	F(4,35)=8.9039, p= 0.0045, p < 0.05
VP	F(4,35)=3.6386, p = 0.014, p < 0.05
AJP	F(4,35)= 3.5406, p = 0.016, p < 0.05
ADVP	F(4,35)=5.3151, p = 0.0019, p < 0.05
CP	F(4,35)=3.5309, p= 0.016, p < 0.05

Table 6: The result of one way ANOVA for each phrase type.

In case of NP and VP, there were statistically significant differences ($p < 0.04$) in pause duration between every pair of L2 English speaker groups, except good-very good, good-excellent, very good-excellent pairs where no statistical significant difference exist ($p > 0.04$). This finding and Figure 7 imply that duration of sentence-medial pause after phrase NP and VP was almost equal for good, very good, excellent L2 English speaker groups; otherwise duration of sentence-medial pause after phrase NP and VP was decreased as fluency of L2 English speakers was increased. In case of AJP, there were statistically significant differences ($p < 0.04$) in occurrence probability between every pair of L2 English speaker groups except poor-average pair. This finding and Figure 7 reveal that duration of sentence-medial pause after phrase AJP was almost equal for poor and average L2 English speaker groups; on an average duration of sentence-medial pause after phrase AJP was decreased as fluency of L2 English speakers was increased. For ADVP, bonferroni corrected post-hoc t-test revealed that there were statistically significant differences ($p < 0.04$) in pause duration between every pair of L2 English speaker groups except pair of very good and excellent L2 group ($p > 0.04$); that means pause duration after ADVP for very good and excellent L2 English speaker groups was almost equal. This finding and Figure 7 imply that duration of sentence-medial pause after phrase ADVP was decreases as fluency of L2 English speaker was increased. For CP, bonferroni corrected post-hoc t-test revealed that there were statistically significant differences ($p < 0.04$) in occurrence probability between every pair of L2 English speaker groups, which implies that duration of sentence-medial pause after phrase CP was decreased as fluency of L2 English speakers was increased (as shown in Figure 7). In addition, a series of t-test was carried out to determine which

group of L2 English speakers differed significantly from the L1 English speakers for each phrase type. Result of t-test revealed that every group except excellent L2 English speaker group was differed significantly ($p < 0.05$) from L1 English speakers for each phrase type. From this result and Figure 7, it is observed that duration of sentence-medial pause after each phrase for each L2 English speaker group except excellent L2 English speaker group was comparatively higher than that of L1 English speakers; but duration of pause after each phrase (except NP) for excellent L2 English speaker group was almost equal with L1 English speakers. From this result of analysis, it is revealed that duration of sentence-medial pause after each phrase type for fluent L2 English speakers was lower than that of less fluent L2 English speakers, and duration of sentence-medial pause for each phrase type was almost equal for both L1 English speaker and excellent L2 English speaker groups.

Phrase Length (l): Figure 8 shows the average duration of sentence-medial pauses of L1 and five L2 English speaker groups for different phrase length.

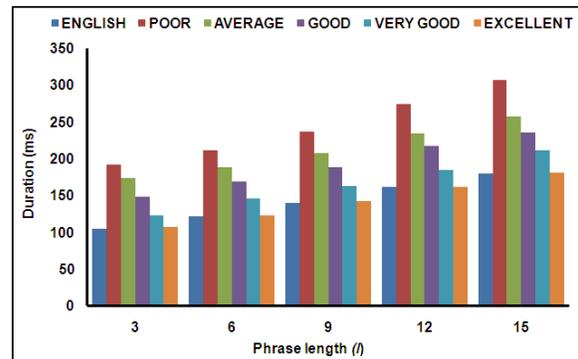


Figure 8. Effect of phrase length (l) upon duration of sentence medial pauses at different fluency level.

Table 7 shows result of one way ANOVA (fluency as a between group variable) over five groups of L2 English speakers for each l . The result indicates that there was significant effect ($p < 0.05$) of fluency on duration of sentence-medial pause for each l . Bonferroni corrected post-hoc t-tests revealed that there were statistically significant differences ($p < 0.04$) in duration of sentence-medial pause between every pair of L2 English speaker groups for each level of l . From these results and Figure 8, it is observed that duration of sentence-

medial pause was inversely proportional to fluency level of L2 English speakers for each l .

l	Result of One Way ANOVA
3	$F(4,35) = 2.7402, p = 0.044, p < 0.05$
6	$F(4,35) = 2.9548, p = 0.033, p < 0.05$
9	$F(4,35) = 3.8137, p = 0.011, p < 0.05$
12	$F(4,35) = 3.4439, p = 0.018, p < 0.05$
15	$F(4,35) = 3.5634, p = 0.015, p < 0.05$
18	$F(3,31) = 3.9202, p = 0.018, p < 0.05$
21	$F(1,18) = 6.0181, p = 0.025, p < 0.05$

Table 7: The result of one way ANOVA for each phrase length (l).

On the other hand, one way ANOVA was performed on each L2 English speaker group with l as between group variable. Table 8 shows result of ANOVA for each L2 English speaker group.

Speaker Group	Result of One Way ANOVA
Poor	$F(4,20)=9.3092, p = 0.00021, p < 0.05$
Average	$F(5,36)=13.4473, p=0.00002, p < 0.05$
Good	$F(5,42)=16.0595, p=0.000008, p < 0.05$
Very Good	$F(6,84)=16.9523, p=0.000099, p < 0.05$
Excellent	$F(6,42)=12.9145, p=0.000033, p < 0.05$

Table 8: The result of one way ANOVA for each L2 English speaker group.

The result from Table 8 indicates that there was significant effect ($p < 0.05$) of l on occurrence probability of sentence-medial pause for each L2 English speaker group. Post-hoc tests using Tukey's HSD procedure were performed to determine which phrase length (l) type differs significantly from each other for each L2 English speaker group. From the results of post-hoc Tukey's HSD procedure, it is observed that mean difference in pause duration between every pair of l was statistically significant (mean difference $>$ HSD value, $p < 0.05$) except 3-6, 6-9 pairs of each L2 English speaker group. From result of this investigation and Figure 7, it is seen that mean duration of sentence-medial pause was almost linearly dependent on l for each L2 English speaker group like L1 English speakers.

Distance (d) between Current Phrase and its Dependent Counter Part: Figure 9 shows the average occurrence probability of sentence-medial pauses of L1 and five L2 English speaker groups

for different distance. Table 9 shows result of one way ANOVA (fluency as a between group variable) over five groups of L2 English speakers for each d . The result indicates that there was significant effect ($p < 0.05$) of fluency on duration of sentence-medial pause for each d .

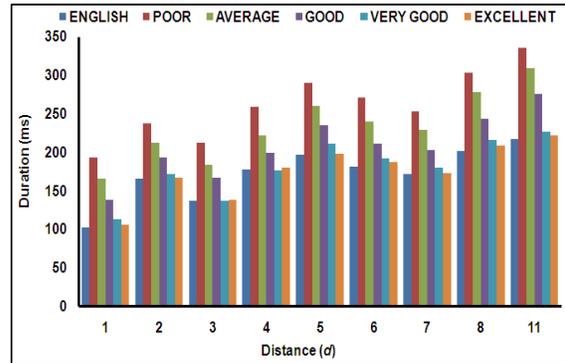


Figure 9. Effect of distance (d) upon duration of sentence medial pauses at different fluency level.

d	Result of One Way ANOVA
1	$F(4,35) = 8.1601, p = 0.0093, p < 0.05$
2	$F(4,35) = 3.0539, p = 0.029, p < 0.05$
3	$F(4,35) = 2.9908, p = 0.032, p < 0.05$
4	$F(4,35) = 2.8627, p = 0.038, p < 0.05$
5	$F(4,35) = 3.0933, p = 0.028, p < 0.05$
6	$F(4,35) = 3.7137, p = 0.013, p < 0.05$
7	$F(4,35) = 4.4027, p = 0.0055, p < 0.05$
8	$F(4,35) = 2.8347, p = 0.039, p < 0.05$
11	$F(4,35) = 3.5055, p = 0.017, p < 0.05$

Table 9: The result of one way ANOVA for each distance (d).

Bonferroni corrected post-hoc t-test revealed that there were statistically significant differences ($p < 0.04$) in pause duration between every pair of L2 English speaker groups except very good-excellent pair for each d . From these results and Figure 9, it is observed that duration of sentence-medial pause was almost equal between very good and excellent L2 English speaker groups for each d and duration of sentence-medial pause of fluent L2 English speakers was comparatively lower than that of less fluent L2 English speakers for each d .

In addition, one way ANOVA was performed on each L2 English speaker group with d as between group variable. Table 10 shows result of ANOVA for each L2 English speaker group.

Speaker Group	Result of One Way ANOVA
Poor	F(6,42)= 5.2162, p=0.00023, p < 0.05
Average	F(8,54)= 4.9018, p=0.00014, p < 0.05
Good	F(8,63)= 6.1464, p=0.000076, p < 0.05
Very Good	F(8,99)=3.4713, p = 0.0014, p < 0.05
Excellent	F(8,54)= 2.6484, p = 0.016, p < 0.05

Table 10: The result of one way ANOVA for each L2 English speaker group.

The result indicates that there was significant effect ($p < 0.05$) of distance on duration of sentence-medial pause for each L2 English speaker group. Post-hoc tests using Tukey's HSD procedure were performed to determine which distance (d) types differ significantly from each other for each L2 English speaker group. Tukey's HSD procedure reveals that mean difference between every pair of phrases (except some pairs of phrases) of each L2 English speaker group was statistically significant (mean difference $>$ HSD value, $p < 0.05$). From Figure 9 and result of Tukey's HSD procedure, it is seen that average duration of sentence-medial pauses for each L2 English speaker group was almost linearly dependent on distance (d) like L1 English speaker group.

5 Conclusions

From this study, it is seen that there was significant effect of L2 English (L1 Bengali) speakers' fluency on occurrence probability as well as duration of sentence-medial pause. Result of this comparative study reveals that, for each phrase type, each phrase length level, and each distance level, occurrence probability and duration of sentence-medial pause were increased as fluency level of L2 English speakers was decreased. In particular, occurrence probability and duration of sentence-medial pause of every L2 English speaker group except excellent L2 English speaker group for each phrase type, each phrase length level, each distance level, were higher than L1 English speaker group, but occurrence probability and duration of pause after each respective phrase type, each phrase length level, and each distance level for excellent L2 English speaker group were almost equal to that of L1 English speakers. Moreover, occurrence probability and duration of sentence-medial pause were increased almost linearly with phrase length as well

as distance for every L2 English speaker group respectively. From this detailed comparative study, it may seem to suggest that occurrence probability as well as duration of sentence-medial pauses in English readout speech of fluent L2 English speakers are lower than that of less fluent L2 English speakers at every phrase length and distance values respectively. In addition, occurrence probability and duration of sentence-medial pauses in English readout speech are linearly dependent on phrase length and distance respectively for fluent as well as less fluent L2 English speakers.

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