

A PRELIMINARY STUDY ON PAUSES AND BREATHS  
IN READING SPEECH MATERIALS

Miyoko Sugito\*, Ghen Ohyama\*\* and Hajime Hirose

1. Introduction

A preliminary study on pauses and breaths in reading speech materials has been conducted. In general, reading speech is produced by the exhalation of respiration, and inhalation causes pauses. However breath is not taken at all pauses. In general, pauses are classified into two categories, one with breath and another without breath. The former is called a physiological pause and the latter is called a grammatical pause<sup>1)</sup>. It is believed that the breath is taken in the case where the duration of a pause is long and is not taken in the case where the duration of pause is short. It is also believed that breath is taken in the case where the amount of the air in a lung is not enough to continue an utterance. It is necessary to investigate the relation among the pauses, breaths and grammar, using a respiratory monitor, since no paper has discussed this point while detecting the respiration.

As a preliminary study, one of the authors, MS, who has a good reading skill acted as a subject. She read two stories with several reading styles. Her speech and respiration were recorded and analyzed. This paper reports the relation among pauses, breaths and grammar.

2. Experimental materials

2.1 Reading materials

Two stories were selected for reading. One was the story of "Zashiki-bokko", and the other was the lines of "Weather forecast".

"Zashiki-bokko" is one of the folk stories in the book "Zashiki-bokko no hanashi"<sup>2)</sup> composed by Kenji Miyazawa. The rhythm of the sentences of this story is the so-called "7-5 chou (rhythm) of japanese poems". That is, the unit of the sentence is composed of 7 moras and 5 moras, and these sequences are repeated.

Subject MS read aloud this story with two kinds of reading styles.

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\* Osaka Shoin Women's College

\*\* Kansai Advanced Research Center Communications Research Laboratory Ministry of Posts and Telecommunications

- 1) Natural reading ; The Pauses were taken at every punctuation mark which was composed by author KM, and the speech rate of the utterance was moderate.
- 2) Quick reading ; Pauses were not always taken at every punctuation mark. That is, the punctuation marks were sometimes ignored intentionally, and the speech rate of the utterance was fast.

The "Weather forecast" was the lines composed by MS. A study has been conducted on the differences in the pauses and the pitch contours between the speech uttered by a professional announcer of NHK, TO, and that uttered by MS<sup>3)</sup>. In summary, the number of pauses in TO's speech was much greater than that in MS's speech, because, TO took pauses not only at the punctuation marks but also at other locations in the reading materials. On the other hand, MS took pauses, if at all, at the punctuation marks in the reading materials, she could express the phrase boundaries with a quick change in the pitch contour. The number of pauses in her speech was very few. The difference in the pitch contours between TO's speech and MS's one was small.

Two kinds of reading styles were also used for this story.

- 1) Free reading ; MS read in her own way.
- 2) Mimic reading ; MS mimicked the way taking the pauses in the same locations as TO listening to TO's speech through an earphone.

## 2.2 Experimental materials

The expansion and the compression of the chest and the abdomen were detected by the sensors placed around them. The amount of the inhalation and exhalation were detected using a flow-meter covering the mouth and the nose with a mask. These parameters were recorded in a data recorder, and the analysis of these parameters was recorded by a pen recorder. Whether breath was taken or not was judged observing these results.

The speech signal was also recorded using a microphone which was outside of the mask and were analyzed by the sound spectrogram.

The following were detected by the analysis results.

- 1) the durations of the utterances between pauses
- 2) the length of the pauses
- 3) the positions of the pauses
- 4) the presence of breath.
- 5) the speed of the utterances ( mora/sec )
- 6) the duration of each mora

## 3. Experimental results

Figure 1 shows an example of the analysis in the case of the natural reading of "Zasiki-bokko". In this figure, from the top to the bottom, the first, second, third and fourth line show

the movement of the chest and the abdomen, the result of the output from the respirator and the intensity of the speech, respectively. In the case of the first and second lines, an upward movement means that the chest or the abdomen expanded, that is, inhalation; and a downward movement means that the chest or the abdomen compressed, that is, exhalation or speaking. In the case of the third line, the positive and the negative valves indicate exhalation and inhalation, respectively.

In general, the breath was taken in the case where the amount of the air in the lung was not enough to speak. However, breath was sometimes taken in the case where the amount of air in the lung was enough for speech. Air was fully inhaled at the beginning of speech, but it was not always fully inhaled at the punctuation marks, even at periods, the rhythm of the utterance and the grammar were supposed to be more important than the amount of the air in the lung.

Tables 1 - 4 show the locations of the pauses and the breaths in the case of the natural reading of "Zashiki-bokko", the quick reading of "Zashiki-bokko", the free reading of "Weather forecast" and the mimic reading of "Weather forecast", respectively. In these tables, (P) indicates pauses without breath and (V) pauses with breath.

Tables 5 - 8 show the numbers of the pauses and the breaths at the commas and the periods in the case of the natural reading of "Zashiki-bokko", the quick reading of "Zashiki-bokko", the free reading of "Weather forecast" and the mimic reading of "Weather forecast", respectively. In these Tables, the values in parentheses show the rate of the pauses with breath and the pauses without breath in percentages at the periods or the commas.

In "Zashiki-bokko", the averaged speeds of the utterances were 6.6 moras/sec and 8.1 moras/sec in the case of the natural reading and the quick reading, respectively. The rate of the pauses with breath over all the pauses were 78.1% and 76.9% in the case of natural reading and quick reading, respectively.

In "Weather forecast", the number of pauses was 17 and 34 in the case of the free reading and the mimic reading, respectively. In the case of the free reading, pauses were not always taken, even at periods. The rate of the pauses with breath over all the pauses was 76.5% and 76.5% in the case of the free reading and the mimic reading, respectively.

In all cases, all of the pauses at the periods were pauses with breath. However, the pauses at commas were not always pauses with breath.

Figures 2, 3 show the relation between the durations of the utterances and the duration of the following pauses in the case of the natural reading and the quick reading of "Zashiki-bokko".

respectively. In these figures, the marks triangles and circles show the pauses with breath and the pauses without breath, respectively. The double circles indicate pauses at periods.

In general, at the periods, the durations of the pauses were long and breath is taken.

In general, breath is sometimes taken at the long pauses, however it is taken at even the short pauses.

In the case where the duration of the utterances is long, breath was taken in the following pause. However, breath was sometimes taken in the case where the duration of the utterances was short.

#### 4. Conclusion

A study on the pauses and the breath in reading speech materials was conducted. A respiratory monitor was used for detecting breath, or inhalation.

In conclusion, the following results were obtained.

- a. Breath is usually taken after long utterance, however is taken after even short utterance.
- b. Breath is usually taken at a long pause, however is taken at even a short pause.
- c. Breath is usually taken in the case where a small amount of air is left in the lung, however is taken even in the case where a enough air is left in the lung.
- d. Breath is taken at grammatically important pauses, and is not taken at grammatically unimportant pauses.

That is breath is due to grammar than amount of air in the lung, pause length and utterance length.

The above results were obtained from the analysis of only one subject reading. It is necessary to investigate these points using many subjects. Such results will be reported in the future.

#### References

- 1) For example "Gendai Gengogaku Ziten ( New Linguistic Dictionary )", ( in japanese) p.477 ,seibido (1988)
- 2) Kenji Miyazawa, "Serohiki no gosyu"(in japanese) kadokawa bunko(1989)
- 3) Miyoko Sugito, "Punctuation marks, and continuity or discontinuity in reading. -in reading speech of weather forecast --", Ann. bull. of Osaka shoin women's college, (in japanese) vol 22. .pp.1-7. (1985)

Table 1. Positions of pauses with breath (V) and pauses without breath (P) in the natural reading of "Zashiki-bokko"

Bokurano hoono, zashiki bokko no hanashi desu.(V)  
 Akarui hiruma,(P) miNnaga yama e hatarakini dete,(V) kodomo ga hutari,(P) niwade asoNde orimashita.(V)  
 Ookina ieni daremo orimaseN deshitakara,(V) sokorawa shiNto shiteimasu.(V)  
 Tokoroga ieno,(P) dokokano zashiki de,(V) zawa zawa tto hooki no oto ga shitano desu.(V)  
 Hutarino kodomo wa,(V) otagai katani shikkarito te o kumiatte,(V) kossori itte mimashitaga.(V) dono zashikinimo taremoizu,(V) katana no hako mo hissori to shite,(V) kakine no hinoki ga.(P) iyoiyo aoku mierukiri,(V) taremo dokonimo imaseN deshita.(V)  
 Zawa zawa tto hooki no oto ga kikoemasu.(V)  
 Tookuno mozu no koe nanoka.(V) kitakamigawa no se no oto ka.(V) dokokade mame o mi ni kakeru noka,(V) hutari de iroiro kaNgaenagara,(V) damatte kiite mimashitaga,(V) yappari doredemo naiyoodeshita.(V)  
 Tashikani dokokade,(P) zawa zawa tto hooki no oto ga kikoetanodesu.(V)  
 Moichido kossori,(P) zashiki o nozoite mimashita ga,(V) dono zashiki nimo taremo izu,(V) tada ohisama no hikari bakari sokora ichimeN,(P) akaruku hutte orimashita.(V)  
 KoNna noga zashiki bokko desu.

Table 2. Positions of pauses with breath (V) and pauses without breath (P) in the quick reading of "Zashiki-bokko"

Bokurano hoono, zashiki bokko no hanashi desu.(V)  
 Akarui hiruma, miNnaga yama e hatarakini dete,(P) kodomo ga hutari, niwade asoNde orimashita.(V)  
 Ookina ieni daremo orimaseN deshitakara, sokorawa shiNto shiteimasu.(V)  
 Tokoroga ieno, dokokano zashiki de,(P) zawa zawa tto hooki no oto ga shitano desu.(V)  
 Hutarino kodomo wa, otagai katani shikkarito te o kumiatte,(V) kossori itte mimashitaga,(P) dono zashikinimo taremoizu,(V) katana no hako mo hissori to shite,(V) kakine no hinoki ga, iyoiyo aoku mierukiri.(V) taremo dokonimo imaseN deshita.(V)  
 Zawa zawa tto hooki no oto ga kikoemasu.(V)  
 Tookuno mozu no koe nanoka, kitakamigawa no se no oto ka,(V) dokokade mame o mi ni kakeru noka,(V) hutari de iroiro kaNgaenagara.(V) damatte kiite mimashitaga.(V) yappari doredemo naiyoodeshita.(V)  
 Tashikani dokokade,(P) zawa zawa tto hooki no oto ga kikoe tanodesu.(V)  
 Moichido kossori, zashiki nonaka o nozoite mimashita ga,(V) dono zashiki nimo taremo izu,(V) tada ohisama no hikari bakari(P) sokora ichimeN,(V) akaruku hutte orimashita.(V)  
 KoNna noga(P) zashiki bokko desu.

Table 3. Positions of pauses with breath (V) and pauses without breath (P) in the free reading of the "Weather forecast".

Nishi nihoN o ootte iru idoossee kookiatsu wa shidaini higashi e idooshi,(V) itsuka wa kiatsu no tani ga tsuuka suru mikomi desu.(V) Konotame,(V) asakara ame no huru tokora ga ooku,(P) nicchuu wa. kakuchi tomo tokidoki ame ni naru deshoo.(V) Mata, ondaN zenseN no tsuuka ni tomonatte,(V) yoru wa ichiji teNki ga kaihuku suru deshoo.(V) Umi dewa, tokoro dokoro koi kirino tame mitooshi ga waruku,(V) tashoo nami ga aru deshoo.(V) Oosakahu,(V) kyoo, nicchuu wa,(P) higashi no kaze, kumori tokidoki ame.(V) Yoru wa, minami no kaze ga ichiji tsuyoku,(P) kumori tokidoki hare.(V) Tokoro ni yotte wa, niwaka ame ga huru deshoo.(V) Umi dewa tashoo nami ga aru deshoo.(V) Asuwa.(P) zeNpaN ni kumori ichiji hareno mikomi desu.

Table 4. Positions of pauses with breath (V) and pauses without breath (P) in the mimic reading of the "weather forecast"

Nishi nihoN o(P) ootte iru idoossee kookiatsu wa(V) shidaini higashi e idooshi,(V) itsuka wa(V) kiatsu no tani ga tsuuka suru mikomi desu.(V) Konotame.(V) asakara(V) ame no huru tokora ga ooku,(V) nicchuu wa,(P) kakuchi tomo(V) tokidoki ame ni naru deshoo.(V) Mata.(P) ondaN zenseN no tsuuka ni tomonatte,(V) yoru wa(V) ichiji teNki ga kaihuku suru deshoo.(V) Umi dewa, tokoro dokoro(V) koi kirino tame(P) mitooshi ga waruku,(V) tashoo nami ga aru deshoo.(V) Oosakahu,(V) kyoo,(V) nicchuu wa,(V) higashi no kaze,(V) kumori tokidoki ame.(V) Yoru wa,(V) minami no kaze ga ichiji tsuyoku,(V) kumori tokidoki hare.(V) Tokoro ni yotte wa,(P) niwaka ame ga huru deshoo.(V) Umi dewa(P) tashoo nami ga aru deshoo.(V) Asuwa,(V) zeNpaN ni(P) kumori(P) ichiji hareno mikomi desu.

Table 5. The number of pauses with breath and pauses without breath in the natural reading of "zashiki-bokko". The values in parentheses are rate of pauses at periods and commas in percentages.

position	pause without breath	pause with breath	no pause
period	0 (0.0)	9 (100.0)	0 (0.0)
comma	7 (29.2)	16 (66.7)	1 (4.2)
others	0	0	
total	7	25	1

Table 6. The number of pauses with breath and pauses without breath in the quick reading of "Zashiki-bokko". The values in parentheses are the rate of pauses at periods and commas in percentages.

position	pause without breath	pause with breath	no pause
period	0 (0.0)	9 (100.0)	0 (0.0)
comma	4 (16.7)	11 (45.8)	9 (37.5)
others	2	0	
total	6	20	9

Table 7. The number of pauses with breath and pauses without breath in the free reading of the "Weather forecast". The values in parentheses are the rate of the pauses at periods and the commas in percentages.

position	pause without breath	pause with breath	no pause
period	0 (0.0)	8 (100.0)	0 (0.0)
comma	4 (25.0)	5 (31.3)	7 (43.7)
others	0	0	
total	4	13	7

Table 8. The numbers of pauses with breath and pauses without breath in the mimic reading of the "Weather forecast". The values in parentheses are the rate of pauses at periods and commas in percentages.

position	pause without breath	pause with breath	no pause
period	0 (0.0)	8 (100.0)	0 (0.0)
comma	3 (18.8)	12 (75.0)	1 (6.3)
others	5	6	
total	8	26	1



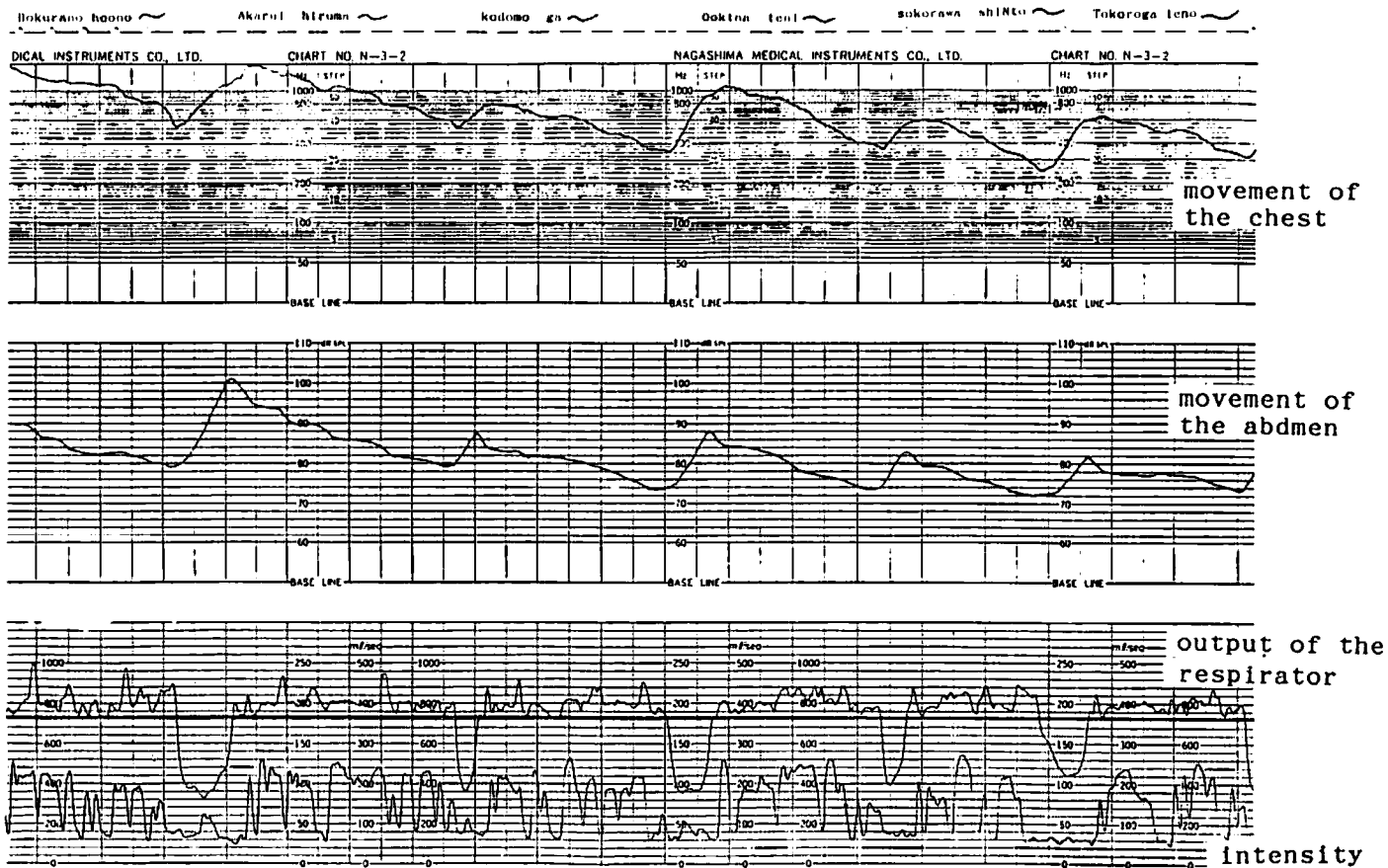


Figure 1. An example of the analysis of the results in the case of the natural reading of "Zashiki-bokko". the first, second, third and fourth lines show the movements of the chest and the abdomen, the result of the output from the respirator and the intensity of the speech, respectively.

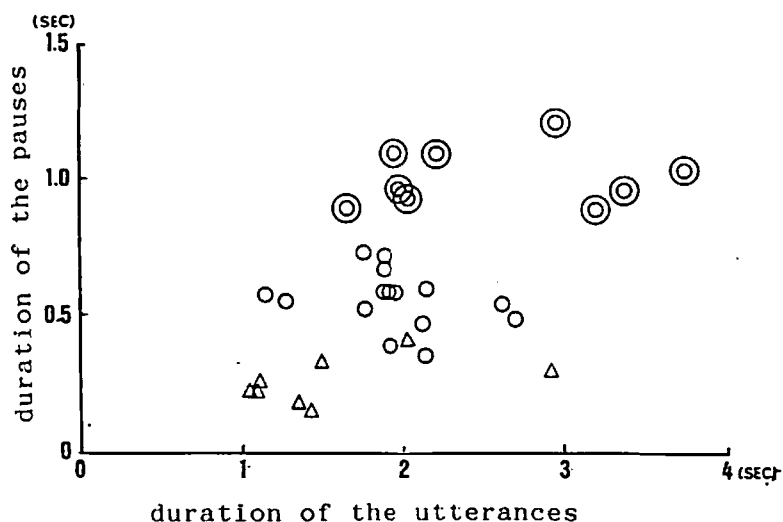


Figure 2. The relation between the duration of the utterances and the duration of the following pauses in the case of the natural reading of "Zashiki-bokko". The marks triangle and circle indicate pauses without breath and the pauses with breath, respectively. The double circles indicate pauses at periods.

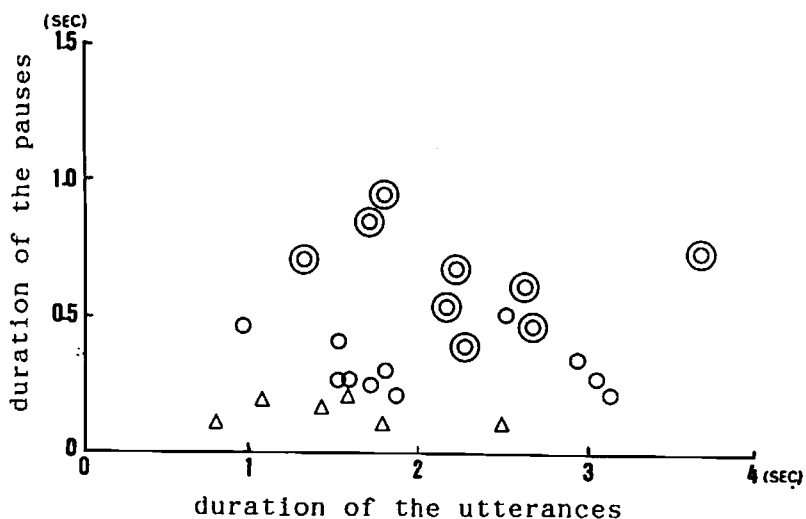


Figure 3. The relation between the duration of the utterances and the duration of the following pauses in the case of the quick reading of "Zashiki-bokko". The marks triangle and circle indicate pauses without breath and pauses with breath, respectively. The double circles indicate pauses at periods.