STATISTICAL CHARACTERISTICS OF PAUSES
IN DIFFERENT SPEECH STYLES

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1 Introduction

Since spoken discourse is understood by hearing both segmental and prosodic features, investigating prosodic features in natural speech is of great interest. However, comparatively little is known about the characteristics of these features.

We may divide the varieties of spoken discourse into two types.

(1) spontaneous speech

      (a) lecture-style speech: a speaker makes a spontaneous speech before a
         group of hearers

      (b) conversation: participants talk in turn

(2) reading aloud: a speaker reads aloud a written text

In this paper, we make a comparison of data among these speech styles, using pause phenomena as a basis for building an analysis of chunking in different types of spoken discourse.

2 Material, Definition of Pauses and Methods of Measurement

The lecture-style speech materials were recordings of two videotaped lectures (T.I.T. 1987).

The material was computer-analyzed on a High-Speed Speech Analysis System (Imagawa 1989). In measuring the duration of pauses, silences longer than 0.15 seconds were defined as unfilled pauses. In the case of filled pauses, we simply measured the duration of the sound.

We found three types of hesitation in the material.

(1) unfilled pauses: silence

(2) filled pauses: speakers uttered conventional 'planning markers' at the begin-
    ning / end of an utterance.

(3) combinations of the above: filled pauses occurred adjacent to unfilled pauses.

We treated these three types of hesitation as pauses in our analysis.

Sugito (1986,1987,1989) reports on the characteristics of pauses in two different styles of spoken discourse: two TV newscasts and a monologue from a natural conversation. Sugito's materials and our material can be considered examples of speech styles (2), (1)(b) and (1)(a), respectively. To study the different characteristics of these speech styles, we recalculated Sugito's data so that we could make a direct comparison.

The followings is the result.

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Table 1. Number of Pauses (lecture A)

	0.15~0.3sec.	0.4~0.7sec.	0.8sec.~	total	min. sec.	max. sec.
unfilled pauses	24	20	2	46	0.15	1.00
filled pauses	10	4	2	16	0.13	0.88
combinations	6	26	30	62	0.28	3.83
total	40	50	34	124		

Table 2. Number of Pauses (lecture B)

	0.15~0.3sec.	0.4~0.8sec.	0.9sec.~	total	min. sec.	max. sec.
unfilled pauses	31	22	10	63	0.16	3.76
filled pauses	0	1	1	2	0.47	1.79
combinations	3	13	24	40	0.29	3.96
total	34	36	35	105		

Table 3. Number of Pauses (conversation)

	0.15~0.3sec.	0.4~0.5sec.	0.7sec.~	total	min. sec.	max. sec.
unfilled pauses	9	10	5	24	0.16	1.23
filled pauses	1	0	0	1	0.19	
combinations	0	0	6	6	0.77	2.84
total	10	10	11	31		

Table 4. Number of Pauses (newscast A)

	0.15~0.3sec.	0.4~0.6sec.	1.0sec.~	total	min. sec.	max. sec.
unfilled pauses	14	15	2	31	0.15	1.50
filled pauses	0	0	0	0		
combinations	0	0	0	0		
total	14	15	2	31		

Table 5. Number of Pauses (newscast B)

	0.2~0.4sec.	0.8sec.~	total	min. sec	max. sec.
unfilled pauses	20	4	24	0.21	1.43
filled pauses	0	0	0		
combinations	0	0	0		
total	20	4	24		

(1)spontaneous speech
(a) lecture-style speech
      lecture A   280 sec. by A. Egashira " On Translation"
      lecture B   226 sec. by T. Akiyama " On Multi- Variable Analysis"
(b) conversation
      monologue   73 sec.
(2) reading aloud
      newscast A   71 sec. by caster HK
      newscast B   67 sec. by caster MW

3 Statistical Analysis of the Material

3-1 Number of Pauses

The number of occurrences of the three types of pauses is shown in Tables 1 to 5. Combination type pauses occurred frequently in the lecture-style speech. Unfilled pauses seem to appear frequently in the conversation. but 20 out of our 24 unfilled pauses were filled with other participants contributions. such as brief responses or encouraging noises.

In both lecture-style speech and conversation, unfilled pauses were relatively shorter than the combination-type.

Only unfilled pauses occurred in the newscast. In both newscasts, the unfilled pauses could be roughly divided into two groups, shorter pauses and long pauses. The long pauses were few in number and occurred after sentence boundaries.

3-2 Proportion of Pauses to Utterances

Table 6 shows the proportion of pauses to utterances and the duration of 'planning markers' (which occurred in the filled pauses and in the combination-type) compared to the total duration of pauses.

The proportion of pauses was greatest in the spontaneous speech. This was mainly due to the degree of 'planning markers' in such speech, where the speaker had to speak alone and needed to show that speech was continuing.

3-3 Speaking / Reading Rate

The average speaking rate was slower than the average reading rate, and slowest in the lecture-style speech (Table 7).

Sugito (1986) reports that the quantity of pauses in speech affects hearers evaluation of the speaking / reading rate, and that when speech contains a high proportion of pauses, hearers tend to consider the speech rate slow. Considering the high proportion of

Table 6. Proportion of Pauses to Utterances

	prop. of utterances	prop. of pauses	prop. of 'planning markers' in pauses
lecture A	67%	33%	10%
lecture B	62%	38%	7%
conversation	78%	27%	5%
newscast A	81%	19%	0%
newscast B	84%	16%	0%

Table 7. Speaking / Reading Rate (morae/sec.)

	avg.	min.	max.
lecture A	8.2	2.5	13.2
lecture B	7.7	3.6	10.6
conversation	8.6	4.8	12.3
newscast A	8.9	7.3	11.3
newscast B	8.7	7.6	9.9

Table 8. Average Duration of Utterances and Pauses (sec.)

	utterance	pause
lecture A	1.49sec.	0.76sec.
lecture B	1.33sec.	0.83sec.
conversation	1.57sec.	0.65sec.
newscast A	1.81sec.	0.44sec.
newscast B	2.23sec.	0.46sec.

Table 9. Number of Morae in an Utterance

	avg.	min.	max.	1~10 morae	11~20 morae	21morae ~
lecture A	12.8	1	55	52.8%	32.8%	14.4%
lecture B	10.4	1	32	56.2%	36.2%	7.6%
conversation	13.4	2	29	46.9%	25.0%	23.5%
newscast A	15.7	3	30	28.1%	46.9%	25.0%
newscast B	19.2	4	34	8.0%	52.0%	40.0%

pauses in spontaneous speech. especially in lectures. (see Table 6). the lectures should sound slower than they really are.

The difference between the minimum and the maximum speaking rate was greatest in spontaneous speech. The speakers read the text with a comparatively regular reading rate in the newscast.

3-4 Duration of Utterances and Pauses

Table 8 shows the average duration of utterances and pauses. The average duration of utterances was longest in the newscast and shortest in the lecture-style speech. The average duration of pauses was shortest in the newscast and longest in the lecture-style speech.

In the newscast, the speakers read the written text at relatively long intervals with short pauses, whereas in the lecture-style speech. the speakers paused at shorter intervals with longer pauses.

Sentences were broken into longer chunks in the newscast and shorter chunks in the spontaneous speech. The proportion of short utterances was greater in spontaneous speech, especially in the lecture-style speech (Table 9).

4 Discussion

In spontaneous speech, the speaker makes up a text, whereas in reading aloud the speaker reads a text. This difference in speech styles was typically shown in the type of hesitations which appeared in the material. Hesitations containing the 'planning markers' (filled pauses and combination types) did not occur in the newscasts.

As to the other features we compared. the features of newscasts and the lecture-style speech contrasted, with the features of conversation somewhere inbetween.

	lecture	conversation	newscast
speaking / reading rate	slow	inbetween	fast
duration of utterance	short	inbetween	long
duration of pauses	long	inbetween	short
number of morae in an utterance	short	inbetween	long

We can summarize the difference among the speech styles as follows. In the newscast, the speaker read the text fast. pausing at relatively long intervals with short unfilled pauses. In the spontaneous speech, filled pauses and combination- type pauses occurred frequently, and pause intervals were shorter; the duration of pauses was longer and the proportion of pauses was greater in spontaneous speech.

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