



On the Role of Pauses in Production and Perception of Discourse

Miyoko Sugito

Osaka Shoin Women's College
Higashiosaka-shi, Osaka, 577 Japan

ABSTRACT

This paper reveals that there is not always a significant correlation between the durations of pauses and utterances in discourse, and that the duration of pause is mainly controlled by syntactic factors, with physiological factors playing only a secondary role.

Listening tests were conducted using material collected from three different genres of speech, both with pauses intact and with pauses removed. The results indicate that pauses are indispensable for listeners as a rehearsal time for the short-term memory and therefore play an important role not only for the speaker, but also for the listeners.

1. INTRODUCTION

While pauses are physiologically necessary for the speaker to be able to inhale air, little data is available on other functions which pauses might serve in the production and perception of speech in discourse. Experiments using a respiratory monitor have shown that pauses without taking a breath are few in number, of short duration and not as syntactically important as once believed [1].

The duration of pauses is said to be correlated closely to the preceding utterance as the duration of the utterance is related to remaining air in the lung. This paper studies the correlation between the preceding utterances and the following pauses in naturally occurring speech, paying attention to the relationship of the utterance to changes in topic.

The role of pauses in perception was also studied by testing the recall of words in two groups. One of the groups listened to the passages with pauses intact and the other listened to the same passages with pauses removed.

2. MATERIALS, SPEAKERS, AND EXPERIMENTAL METHODS

Three speech samples were collected. Sample 1, a 77-second utterance extracted from a naturally-occurring conversation, Sample 2, a 71-second TV newscast, and sample 3, a 68-second rendition by a professional actor. The samples were analyzed by spectrograph and the durations of pauses and the utterances preceding them were measured. Fundamental frequencies were extracted and a new set of pause-less samples were produced using computer waveform processing software. Using these six samples, 3 with pauses and 3 without, listening tests were conducted on students to examine the difference in the listener's comprehension due to the presence or absence of pauses.

3. THE DURATION OF PAUSE AND PRECEDING UTTERANCE IN DISCOURSE

3-1. Naturally occurring conversation

This sample was extracted from one of the conversations which were recorded in cooperation with National Language Research Institute during a study of "Aspects of Text and Context" [2][3]. Four senior citizens were invited to a discussion chaired by one of the researchers. The segment used here was when the chairman purposely left the room to allow the four people to engage in a natural conversation. This paper analyzes a 77-second utterance by speaker AM who recalls the vehicles in Osaka 70 years ago. He touches on three topics, 1) the first street car in Osaka, 2) Jinrikisha and 3) a passenger boat on the river Yodo.

Table 1 shows the average number of morae per utterance (i.e. between pauses), the average duration of utterances and the average duration of the following pauses. Table 2 shows the ratio of utterance and pause to the total duration of utterance and following pause, plus the average speed measured in morae per second for the three topics.

Topic	Morae in Utterance	Utterance Time(sec)	Pause Time(sec)
1	7	0.93 (0.55)	0.42 (0.26)
2	10	1.09 (0.77)	0.38 (0.34)
3	14	1.54 (0.44)	0.31 (0.14)

Topic	Utterance	Pause	Speed
1.1	71%	29%	8.3
1.2	75%	25%	8.8
1.3	84%	16%	8.0

Average	76%	24%	8.4

The utterances of AM often overlapped those of other participants but the speaker often continued to speak without paying much attention to the responses. This type of conversational overlap is common among people who have a common topic to share.

3-2. Comparison of pause duration between conversation and newscast

Sample 2 is based on an TV newscast by announcer HK reporting on "Salmon and Trout Negotiations between Japan and the Soviet Union." Four reporters were recorded speaking on the same topic on the same day. The sample from HK was chosen for analysis after it was reported as being the easiest to understand by the judgement of 20 students. The sample also happens to be the one with the most pauses, thus making it especially suitable for this study.

Sample 2 consists of three paragraphs, 1) introduction, 2) the details of the negotiation and 3) the results. Table 3 shows the ratios in the same manner as Table 2.

Topic	Utterance	Pause	Speed
2.1	81%	19%	8.8
2.2	80%	20%	9.0
2.3	85%	15%	8.6

Average	81%	19%	8.8

Figure 1 shows the relationship between pauses and the preceding utterances for Sample 1 (AM, black marks) and Sample 2 (HK, white marks). We can observe that,

1) AM's speech includes, a much wider distribution of values while HK's are clustered together, all being relatively short,

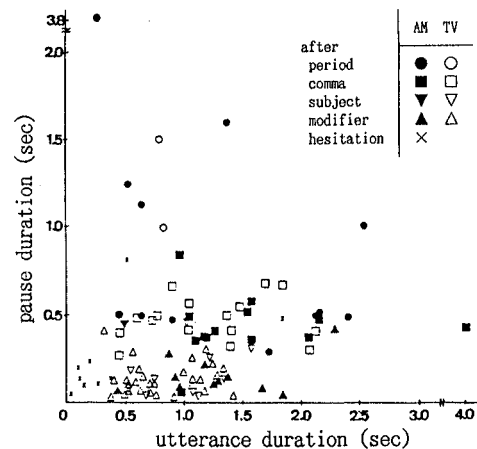


Fig. 1 Relationship between pauses and the preceding utterances for sample 1 (AM) and sample 2 (TV announcer).

2) For both speakers, pauses are longer when occurring at points of punctuation, which indicates that there is a relationship between the duration of pauses and syntax, and

3) Hesitations by AM (marked with 'x') are clustered in the lower left, indicating that they were relatively short in duration.

Table 4 compares the data of senior citizen AM with TV announcer HK. The values show that the duration of both utterances and pauses were longer for AM whose standard deviation shows that there was a much wider variation.

	Num-ber	Average Duration (SD)	Sum.	Min.	Max.
Utter-ance	TV 56	0.97 (0.43)	54.41	0.34	2.14
	AM 47	1.18 (0.80)	55.46	0.06	3.90
Pauses	TV 56	0.28 (0.27)	15.67	0.02	1.50
	AM 47	0.48 (0.60)	22.38	0.05	3.85

(The values for the final utterance and pause of each speaker were discarded.)

Only a negligible correlation was found between the values for utterances and following pauses for AM (0.04) while a small, but significant correlation was observed for HK (0.229).

3-3. Speech material from a professional actor

A short tale, "Failure of the Wolf," read by a well-known actor, Jukichi Uno was

used for the analysis. The story consists of four paragraphs, and as the following values show, the ratio of utterance to pause was much higher for the third and fourth paragraph. (Durations of pauses between paragraph were eliminated.)

Paragraph	1	2	3	4
Percent utterance to Utter. + Pause	64%	66%	90%	84%

Figure 2-(1) shows the change in the utterance/pause ratio as the topic progresses. Figure 2-(2) shows the change in speed as the topic progresses. We can see from these data that the length of utterance to pause becomes longer as the topic progresses with the utterances becoming faster at the climax of the topic. This tendency is most clearly seen in the material from actor JU [4].

In JU's speech, a slight correlation was found in the durations of pauses and utterances. In the third paragraph in JU's rendition, utterances are long while the pauses are very short. It appears that a little air was taken in at these pauses until a longer pause at the end of the paragraph.

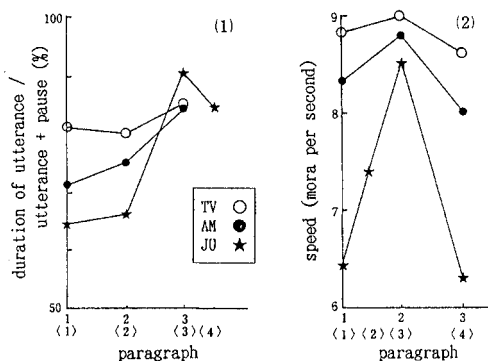


Fig. 2 (1) Change in the utterance / utterance + pause ratio as the topic progresses, (2) Change in speed.

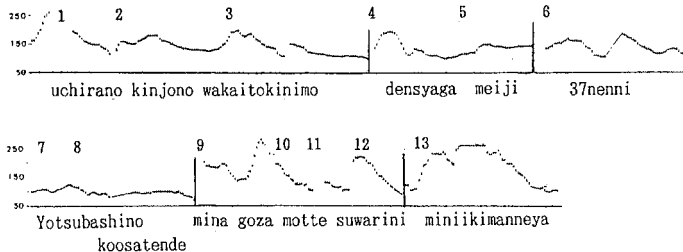


Fig. 3 Fundamental frequency contour of the stimuli for test 1, Vertical lines show the time points where pauses were removed.

In summary, there are intrinsic similarities in the utterances of the three speakers even though the genres of speech were quite different. It has been assumed the duration of pauses and utterances are controlled not only by the physiology of breathing but also by syntactic function.

4. THE ROLE OF PAUSES IN PERCEPTION

Listening tests were conducted using the above materials in order to ascertain whether the presence or absence of pauses makes a difference in the ability of the listener to comprehend the utterance.

4-1. Rehearsal times for the short time memory.

Two versions of an ungrammatical sentence uttered by AM were used for this test, one with pauses removed (Test 1), the other with pauses intact (Test 2). Figure 3 shows the Fo contour of the 9-second sentence with the vertical lines indicating where pauses were eliminated. The numbers 1~13 indicate the minimal semantic units which were used in the recall assessment procedure.

Fourteen female students were divided randomly into groups. Each subject then listened to one of the stimuli and immediately afterwards was asked to perform 15 seconds' mental mathematics (since 15 seconds is considered to be the maximum duration of the short term memory). They were then asked to recall what they heard. Another tape recorder recorded their responses.

Table 5 shows the number of semantic elements recalled by groups 1 and 2:

Phrase	Gloss	Test	
		1	2
1. uchira-no	our	4	7
2. kinjo-no	nearby	1	4
3. wakai-toki	young	4	4
4. densha-ga	streetcar	4	5
5. meiji	Meiji period	0	3
6. 37nen-ni	year 37	1	2
7. Yotsubashi	<u>Yotsubashi</u>	6	7
8. koosaten-de	intersection	2	6
9. mina	everyone	1	0
10. goza	grass mat	3	6
11. motte	bring	3	4
12. suwari-ni	sit	0	0
13. miniiki	go to see	3	6
-manneya			
Total recalled by seven subjects each		32	54

The difference in phrases recalled by the two groups was significant ($p < 0.001$). The results show that pauses are indispensable for the listeners as rehearsal time for the short term memory.

Additionally, it was observed that all of the subjects of Test 2 (pauses intact) recalled a grammatical sentence despite the fact that the stimulus they heard was ungrammatical. This suggests that listeners tend to create and remember grammatical sentences from the elements that they heard, ignoring the original ungrammatical stimulus [5].

4-2. Pauses as a time for comprehension

A similar experiment was conducted using Sample 2, the TV newscast which has a large number of pauses. Twenty students participated in the experiment with half listening to Test 3 (pauses removed) and Test 4 (pauses intact). The subjects were asked to write down what they heard after listening to the stimulus. While all subjects of Test 3 were able to write down the content of the stimulus to some extent, no subject in Test 4 could write more than the topic title [6]. The subjects commented that the speech was too fast, and that more than one person was speaking at a time which made it difficult for them to understand.

4-3. Pauses influencing the perception of speed

Pauses were removed from the story read by actor JU (Test 5). The story with pauses was used as Test 6. Ten students listened to each version of the story. As with Test 4, the subjects reported that the story was read so fast that they soon got tired with listening to it, whereas the subjects for Test 6 reported that they enjoyed the story and the change of speed at its climax.

It appears that the speech itself is perceived to have been spoken faster than was actually the case when the pauses are removed. Even with a passage that has been read skillfully, if the pauses are removed the listeners do not evaluate the speech highly.

5. CONCLUSION

1. A significant correlation was not found between the durations of utterances and following pauses in speaker AM, whereas a low correlation was found in the TV news and actor JU.

2. The ratios of the duration of pauses to utterances of speakers change as the topic progresses. At the climax of the topic, pause lengths sometimes become extremely short. It can be assumed that only a little air is taken in at short pauses until a longer pause at the end of the paragraph.

3. Pause duration is mainly controlled by syntactic factors, with physiological factors playing only a secondary role. Pauses are one method used to indicate syntactic units and convey the intentions of the speaker to the listeners so that they can easily follow the topic.

4. In perception, pauses can be considered as a rehearsal time for the short term memory. It was supposed that when listeners are storing what they have heard they construct their own grammatical sentences even when what they heard was ungrammatical.

5. TV news without pauses was considered too fast to understand and even though there was a single speaker, sometimes it was perceived that two speakers were overlapping each other.

6. A lack of pauses changes the listener's perception of the speed of speaking.

In summary, the results show that pauses are indispensable, not only for the speakers physiologically, but also for the listeners, as an aid to comprehension.

REFERENCES

- [1] M. Sugito, G. Ohyama and H. Hirose, "Preliminary Study on Pauses and Breaths in Reading Speech Materials," Ann. Bull. RILP, 24, pp.121-130, July 1990.
- [2] National Language Research Institute (Kokuritsu-kokugo-kenkyuusho), Aspects of Text and Context, 1987. (in Japanese)
- [3] M. Sugito, "Pauses and Intonation," Aspects of Text and Context, pp.107-138, 1987. (in Japanese)
- [4] M. Sugito, "Correlation between the Durations of Pauses and Meaning - An Approach Effective 'Story-Telling'," STUDIA ROMANICA, 11, pp.67-77, 1977. (in Japanese)
- [5] M. Sugito, "Characteristics of Durations and Function of speech Pauses in Discourse," Studies in Phonetics and speech Communication II, pp.53-68, 1987. (in Japanese)
- [6] M. Sugito, "Pauses and Intonation in Discourse," Japanese language and Education, pp.343-364, 1989. (in Japanese)