

A STUDY ON CHILD PRONUNCIATION

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1. An Analysis of Child Syllable Structure

1.1 Introduction

In the tape which I used for "A Study on the Acquisition of [r] in Children"¹ (a female child's free conversation recorded while she was seeing several slide films at the age of 2 years 8 months and 2 years 9 months for twenty minutes each), I found three types of pronunciation for the same phonemic target. I will report them here as a study on syllable structure in children.

1.2 Method of Analysis

Among the child utterances on the tape, three types for the same target were analyzed both for pattern displays and amplitude displays using a sound spectrograph. These utterances were all interrogative sentences meaning, "Will Papa come out?"

S-1-1 papa detekuju # (Will Papa come out?) Fig. 1-1

S-1-2 papa deteku: kaciane (I wonder if Papa will come out.) Fig. 1-2

S-1-3 papa detekuru kana (I wonder if Papa comes out.) Fig. 1-3

[kuju], [ku:] and [kuru] of these utterances were examined here. As for the order of their appearance in her speech, [kuju] (S-1-1) came first and was heard repeatedly; then [ku:] (S-1-2); and then [kuru] (S-1-3). The latter two were heard only once each.

1.2.1 Pattern Display

In Fig. 1-1, the [u] pattern appears after the release of [k], but it is soon replaced by the [j] pattern which is typical for its rising and falling. This [j] pattern leads into [u].

On the other hand, in Fig. 1-2, the [u] pattern after the release of [k] lasts about 0.22 sec. In Fig. 1-3, it lasts about 0.06 sec and then it is replaced by a frictional pattern (about 0.06 sec), and the [u] pattern, though irregular, appears finally. This frictional pattern may be the [r] -equivalent by ear.

1.2.2 Amplitude Display

In Fig. 1-1, [kuju] as a whole makes a hill-like shape, though uneven; while in Fig. 1-2, almost in the middle of [u] continuation, there is about a 15 dB decrease in the amplitude display; i.e., [ku:] appears to be two small hills. In Fig. 1-3, the amplitude display decreases about 15 dB at the point where the frictional pattern appears on the pattern display.

As for the amplitude decrease in Fig. 1-3, we can assume that it is caused by the momentary closure (or the momentary narrowing) for [r], as was claimed in my previous study.¹ On the other hand, in Fig. 1-2, where the [u] pattern appears

constant on the pattern display, further investigation is necessary on the cause of the amplitude decrease in the middle of the continuation of [u].

1.2.3 Comparison with [ki:]

S-1-4 oana no nakani ki:ga atte. (There was a tree among the flowers.) Fig. 1-4

[ki:] in Sentence 1-4 was chosen for comparison with [ku:], since both have prolonged vowels after [k]. In Fig. 1-4, the [i] lasts for about 0.2 sec², and it also seems constant on the pattern display. As for the amplitude display, it makes a rather smooth hill-like shape. Both [ku:] and [ki:] show constant vowel continuation on the pattern display. Nevertheless, the [u] in [ku:] shows a certain decrease in the amplitude display.

Next, [ku:] was analyzed into a sound spectrogram at a weak marking level (Fig. 1-2 a). During the pattern continuation of the F₁ of [u] for 0.22 sec, a faint section of 0.04 sec appears towards the middle, which corresponds to the decrease in the amplitude display. In addition, [ku:] was reproduced at a slow speed of 9.5 cm/sec and analyzed into a sound spectrogram. The result showed the same phenomenon (Fig. 1-2 b)³.

1.3 Conclusion

Three utterances [kuju], [ku:] and [kuru] were understood as having the target [kuru]. In progress towards [kuru], [kuju] and [ku:] were heard. [kuju] was examined in my previous paper. The present study emphasized the structure of [ku:]. The results showed that the [u] in [ku:] was not prolonged with an even level, and that there seemed to be a certain element which brought the amplitude display down. In other words, it was assumed that there is some compensatory force in the attempt to master [kuru]. For instance, there may be an articulatory attempt for [r] in the course of the [u:] pronunciation—at least an attempt to pronounce a two-syllable structure. If such were the case, the pronunciation of [u] might weaken just a moment and then recover immediately, which would affect the amplitude display and also the pattern display.

We can say that in a child's pronunciation there exists a compensatory attempt in the process towards acquiring correct syllable structure.⁴

2. The [r] and [d] of a Child

2.1 Introduction

In my previous paper I stated that the pronunciation of [r] causes a child some effort: the tongue movement needs more time and certain pronouncing environments for [r] are also needed. Nevertheless, I have recently found that a boy, 11 years and 8 months old, pronounces [r] in place of [d].⁵

The purpose of this part of the present study is to explore his pronunciation of both [r] and [d].

2.2 Method of Analysis

First the distribution of the boy's [r] and [d] in his everyday conversation was

investigated. Next, based on this investigation, several sentences which contain [d] -problem words were chosen in order to let him read them. Finally, some of these sentences were analyzed using a sound spectrograph.

2.2.1 [d] and [r] in the Boy's Everyday Conversation

Table 2-1 [d] and [r] in the boy's everyday conversation

A-1	$d \rightarrow d/\# - \begin{Bmatrix} a \\ o \end{Bmatrix}$	ex.	da:rane (therefore) do:kkirikame:ra (shocking camera) - $\begin{Bmatrix} \underline{d}amoN \\ \underline{d}ajo \\ \underline{d}ake \end{Bmatrix}$ (conclusive auxiliaries) ⁶
A-2	$d \rightarrow d/\begin{Bmatrix} e(n) \\ a \end{Bmatrix} - e$	ex.	ike <u>d</u> e (at the pond) - en <u>d</u> e (for...yen) - ma <u>d</u> e (till)
B-1	$d \rightarrow r/\begin{Bmatrix} a \\ e \\ u \end{Bmatrix} - \begin{Bmatrix} a \\ o \end{Bmatrix}$	ex.	ma <u>r</u> a (yet), ta <u>r</u> a (free) bo <u>k</u> uratte (me too), ke <u>r</u> o. (but) ta <u>r</u> aima (Here I am!) ta <u>r</u> anori (a stolen ride) ima <u>r</u> atte (even now) ku <u>r</u> asai (Please give me.)
B-2	$d \rightarrow r/n \begin{Bmatrix} e \\ a \\ o \end{Bmatrix}$ (.)	ex.	nan <u>r</u> emonai (nothing else) mo <u>n</u> ra (It's) ko <u>n</u> ro (next time)

As shown in Table 2-1, [d] sounds are replaced by [r] except in the case of (A-1) and (A-2); i.e. [d] in word initial position and in some words where [d] is followed by [e].

2.2.2 Reading Sentences with [d] -problem Words

Based on Table 2-1, the following sentences were arranged so that (B-1) and (B-2) type words were both included. These sentences were read by the boy and recorded.

In the sentences of Table 2-2, [da] appears ten times, [de] five times and [do] four times. Certain words such as 「kedo」 (but) and 「tada」 (free), which are usually pronounced [kero] and [tara] in the boy's everyday conversation, are included more than once. These sentences were read twice at a natural speed, said by heart two times, and read at a fast speed once.

The taped sentences were listened to several times. To my surprise, the sentences read at a natural speed show [d] pronunciation correctly. Those read at a fast speed also show [d] pronunciation, though not quite accurate. On the other hand, the sentences said by heart show [r] pronunciation in place of [d] here and there.

Table 2-2 Sentences with [d] -problem words

Tarō to imōto no ohanashidesu.	(A story about Taro and his sister.
Tarō wa mada kaerimasen.	Taro has not come home yet.
Dakedo imōto wa kaerimashita.	But his sister has.
T: Tadaima.	"Here I am."
S: Okaeri. Nani kattano?	"Welcome. What did you buy?"
T: Koredake, Hyakuende.	"Here it is. It costs 100 yen.
Kedo Koremoratta, tadade!	But I got this for free!"
S: Tadade? Omakedane.	"For free? A bargain, isn't it?"
Kondo watashimo ikitai.	Next time. I'd like to go."
T: Kedona . . . Oshimaidayo,	"But . . . That's all, I'm afraid.
「Koredake」tte misenohito	"That's all." said the master of the shop.
ga ittanamon . . .	
T: Nandemonai. Oshimai.	Nothing else. That's all.")

Some of the above results were analyzed using a sound spectrograph: sentences read at a natural speed (Fig. 2-1, Fig. 2-3); those said by heart (Fig. 2-2, Fig. 2-4); and those at a fast speed (Fig. 2-5).

2.2.3 Sound Spectrograph Analysis

S-2-1 Tarō wa mada kaerimasen. (Taro has not come home yet.) Fig. 2-1

Table 2-3 Sound Spectrograph Analysis
– natural speed –

Duration	Resonances	Amplitude display
[r] about 0.01 sec	1,400 ~ 1,800 Hz	15 dB*
[d] about 0.02 sec	below 800 Hz 1,700 ~ 2,000 Hz	15 dB**

* lower than neighboring sounds

** a little lower than neighboring sounds

The word 「mada」 was heard as [mada] in S-2-1, which was read at a natural speed. Fig. 2-1 shows resonances below 800 Hz and weak ones around 1,700 ~ 2,000 Hz for [d]; and the amplitude display as 15 dB, not zero. This suggests that [d] was not completely closed. But when we compare this [d] with the [r] of 「Tarō」 in the same sentence, we can realize their durational differences. The duration of [d] is about twice as long as that of [r]. Therefore, the closure of [d] is not complete here but is still different from a momentary closure such as that in [r] (a so-called flap).

S-2-2 Tarō wa mada kaerimasen. (Taro has not come home yet) Fig. 2-2

Sentence 2-2 was the same sentence but was said by heart.

Table 2-4 *Sound Spectrograph Analysis*
– said by heart –

Duration	Resonances	Amplitude display
[r] almost zero	almost continue from and to the neighboring sounds	20 dB*
[d] almost zero	almost continue from and to the neighboring sounds	20 dB**

* lower than neighboring sounds

** on an increasing line

The boy tried to pronounce the sentence in the same way as sentence 2-1. But the difference is clear on the sound spectrogram. Though heard as [r], this [r] does not have a clear duration: only irregular resonances moving from [a] to [o] can be seen. As for [d], it does not show any duration either, but a discontinuation of the resonances can be seen only around 1,000 ~ 2,000 Hz for a very short time. There is no decrease in the amplitude display. This [d] is different from that of S-2-1, and was actually heard as [r].

S-2-3 kedo koremo (But this also) Fig. 2-3Table 2-5 *Sound Spectrograph Analysis*
– natural speed –

Duration	Resonances	Amplitude display
[d] 0.04 sec	below 500 Hz	5 dB
[r] 0.01 sec	below 800 Hz around 1,500 Hz	10 dB

S-2-3 was read and it contains the word $\overline{\text{kedo}}_1$, which is usually pronounced [ke $\overline{\text{ro}}$] in the boy's everyday conversation. But this time, as is shown in Table 2-5, the [d] in $\overline{\text{kedo}}_1$ shows a 0.04 sec duration, resonances only below 500 Hz, and the amplitude display at a low level. This suggests a clear closure for [d], which contrasts with the momentary closure (0.01 sec duration) of [r] in $\overline{\text{koremo}}_1$ in the same sentence.

S-2-4 dakedo kore tadade (But I got this for free.) Fig. 2-4

S-2-4 was said by heart. There are four [d]'s. Fig. 2-4 shows that [d]₁ in sentence initial position is a complete closure; while [d]₂ and [d]₃ are not complete but can still be discriminated from [r] in terms of duration. This sentence was pronounced without written stimuli but was pronounced rather slowly due to the necessity of remembering the sentence, and the [d]'s were pronounced correctly here.

Table 2-6 *Sound Spectrograph Analysis*
 – said by heart –

Duration	Resonances	Amplitude display
[r] 0.02 sec	below 700 Hz	8 dB
[d] ₁ *	none	0
[d] ₂ 0.03 sec	below 500 Hz around 2,000 Hz	7 dB
[d] ₃ 0.04 sec	below 500 Hz around 1,000 Hz around 2,000 Hz	5 dB
[d] ₄ 0.04 sec	below 700 Hz	0

* The beginning of the duration is not clear because of its sentence initial position.

S-2-5 Tarō wa ma₁da₁ kaer₂imasen, d₂aked₃o imōto wa kaerimasita.
 (Taro has not come home yet, but his sister has.) Fig. 2-5

Table 2-7 *Sound Spectrograph Analysis*
 – fast speed –

Duration	Resonances	Amplitude display
[r] ₁ 0	almost continue from and to the neighboring sounds	20 dB
[r] ₂ 0.005 sec	below 250 Hz around 2,000 Hz	10 dB
[d] ₁ 0.04 sec	below 700 Hz around 1,500 Hz	15 dB
[d] ₂ 0.04 sec	below 500 Hz	0
[d] ₃ 0.04 sec	below 700 Hz	5 dB

S-2-5 was read at a fairly fast speed and was rather carelessly pronounced, as can be seen in Fig. 2-5. Nevertheless, both [d]₁ and [d]₃ show enough duration for a plosive, lasting about 0.04 sec. A decrease in the amplitude display can be seen for both of them. As for [d]₂, in word initial position, there was a 0.04 sec duration and 0 dB in the amplitude display: an almost complete closure.

2.3 Conclusion

The present study explored one boy's [r] and [d] production. He was 11 years and 8 months old and pronounced [r] in place of [d] in his everyday conversation. An analysis was made first by ear and then using a sound spectrograph.

As for everyday conversation, [r] takes the place of [d] in almost every environment except in word initial position and in some words where [d] is followed by [e], as shown in Table 2-1. On the other hand, the boy's reading pronunciation contains a [d] that is correctly pronounced almost every place, even at a fairly fast speed. The pronunciation of sentences said by heart, however, contains some words where [d] is replaced by [r].

We can conclude that it is not true that this boy cannot pronounce [d] in his everyday conversation but that he uses [r] as an undershot form of [d]. For this reason he pronounces [d] in cases when word stimuli are given.⁷

Acknowledgments

I would like to express my sincere gratitude to Associate Prof. Hajime Hirose for his kind and valuable suggestions in preparing this paper.

Notes

1. Ann. Bull. RILP (1982) No. 16, 173-182.
2. In her pronunciation, short vowels usually last about 0.1 sec.
3. When [ku:] at both 19 cm/sec and 9.5 cm/sec tape speed was evaluated several times by ear, I heard it on a high even pitch level, but there was still an impression of the voice being swallowed a moment halfway through.
4. In another female child's pronunciation, [tʃi:z] was first pronounced as [tʃi:¹] (a pitch change was found in [i:] itself); then as [tʃi:n]; then [tʃi:u]; and gradually as the target sound. The same child pronounced [ja¹jɔ:], [i¹ja¹jɔ:] and finally [i¹ja¹jɔ] in acquiring the three-syllable word [ijajo] (No, I don't). Here, the child cleverly uses pitch changes and also weak gliding sounds for mastering a three-syllable word.
5. This boy succeeded in pronouncing [r] around the age of two, but in general [r] is said to be a difficult sound for children as I mentioned in my previous paper.
6. It is not certain whether there is a pause (#) before these auxiliaries.
7. I cannot make any comment on the relative difficulty of [d] production in comparison with that for [r] here. But I would like to add here that the boy began to use [d] correctly even in his everyday conversation after this report.

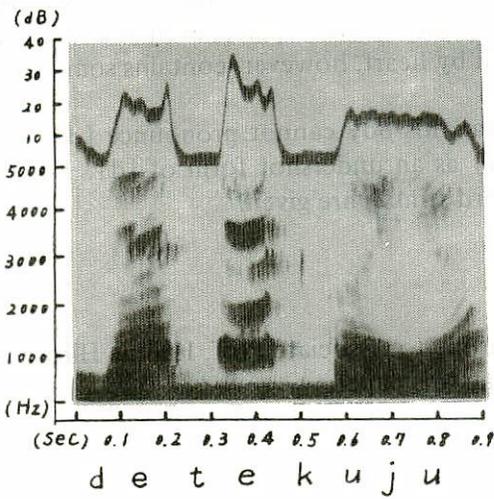


Fig. 1-1 Spectrogram of [dete kju#] at a tape speed of 19 cm/sec.

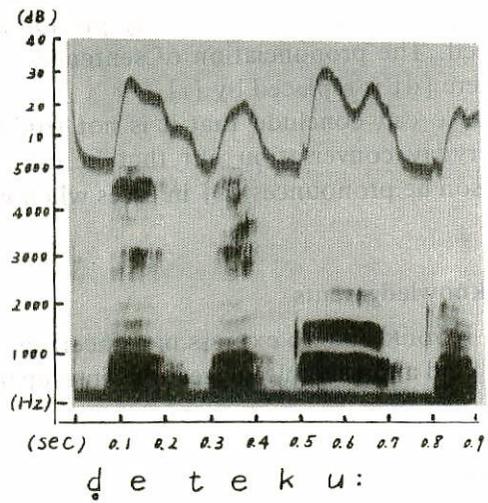


Fig. 1-2 Spectrogram of [ɖete ku:] at a tape speed of 19 cm/sec.

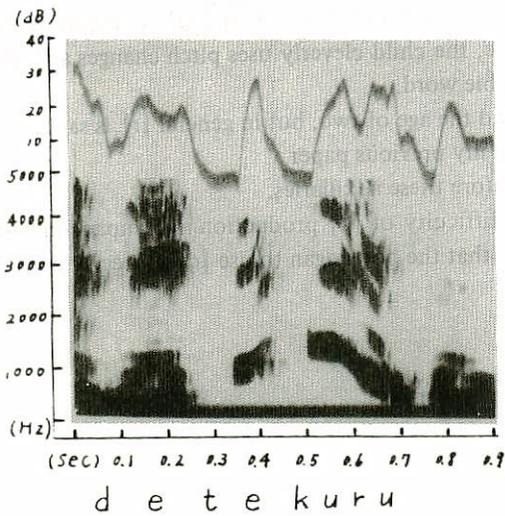


Fig. 1-3 Spectrogram of [dete kuru] at a tape speed of 19 cm/sec.

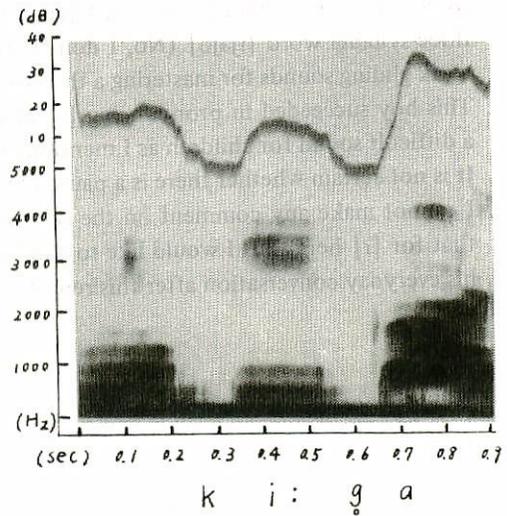


Fig. 1-4 Spectrogram of [ki: g̚a] at a tape speed of 19 cm/sec.

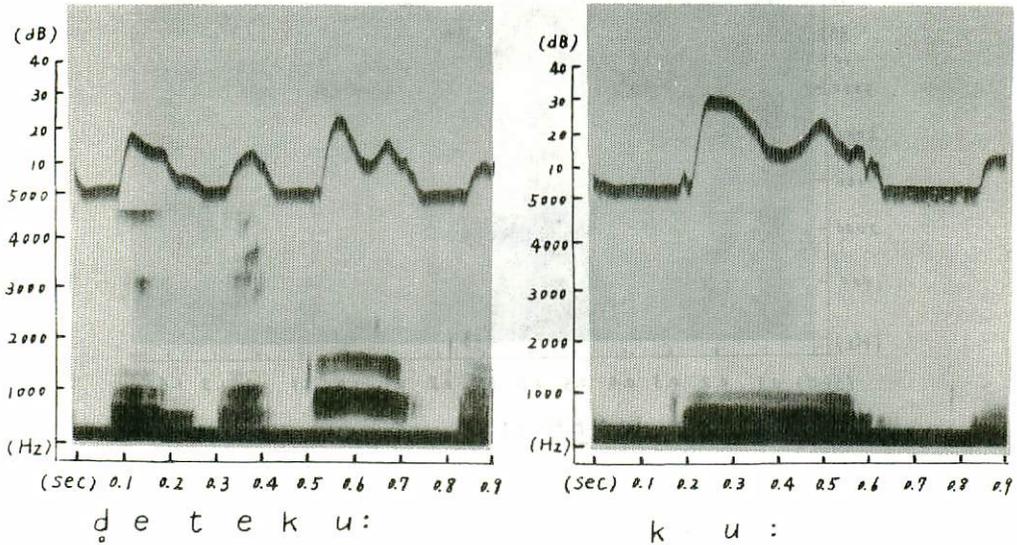


Fig. 1-2 a Spectrogram for Fig. 1-2 at a weak marking level and at a tape speed of 19 cm/sec.
 Fig. 1-2 b Spectrogram for Fig. 1-2 at a weak marking level and at a tape speed of 9.5 cm/sec.

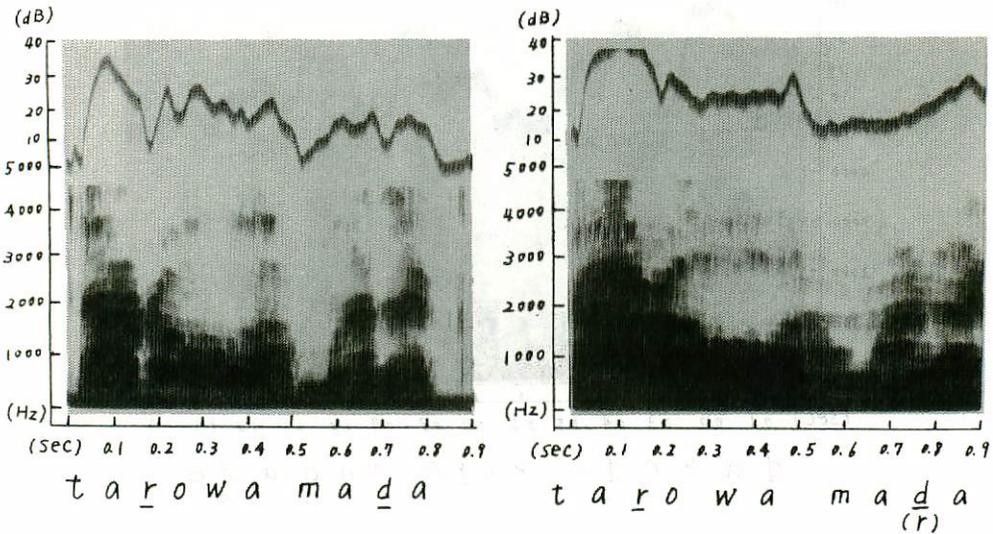


Fig. 2-1 Spectrogram of [taro wa mada] at a tape speed of 19 cm/sec; read at a natural speed.
 Fig. 2-2 Spectrogram of [taro wa mada] at a tape speed of 19 cm/sec; said by heart.

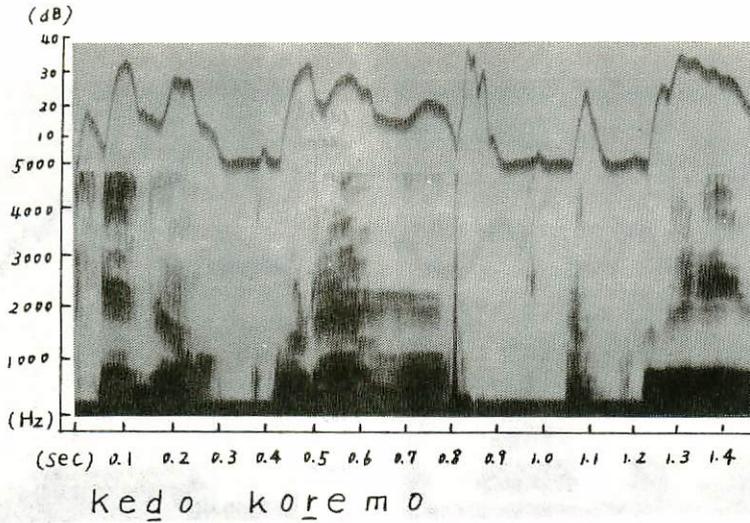


Fig. 2-3 Spectrogram of [kedo koremo] at a tape speed of 19 cm/sec; read at a natural speed.

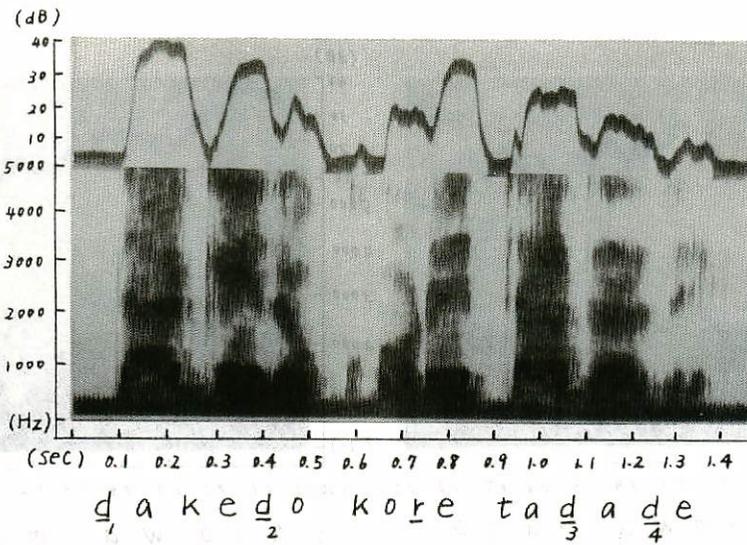


Fig. 2-4 Spectrogram of [dakedo kore tadade] at a tape speed of 19 cm/sec; said by heart.

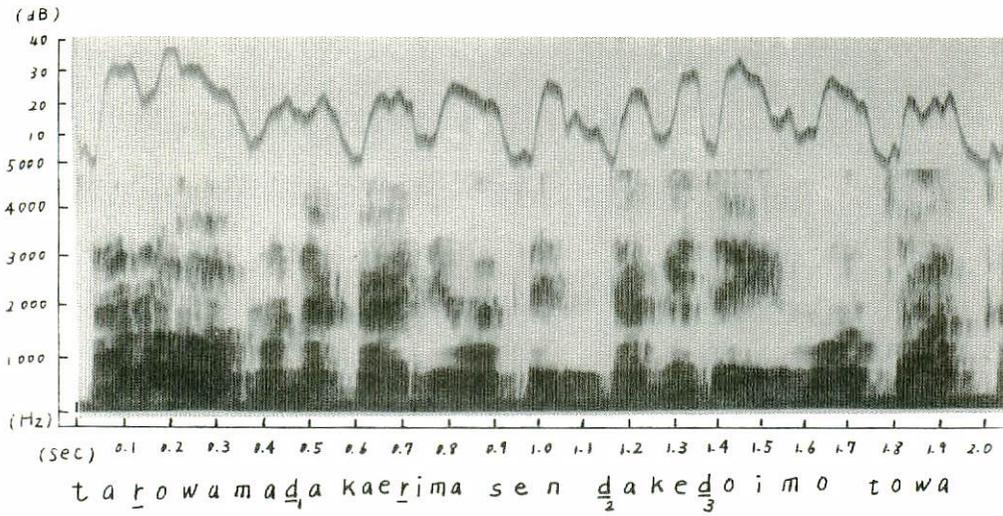


Fig. 2-5 Spectrogram of [taro wa mada maerimasen dakedo imoto wa] at a tape speed of 19 cm/sec; read at a fast speed.