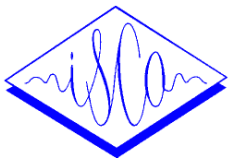

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PROSODIC FEATURES MARKING THE MAJOR SYNTACTIC BOUNDARY OF JAPANESE: A STUDY ON SYNTACTICALLY AMBIGUOUS SENTENCES OF THE KINKI DIALECT

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ABSTRACT

This paper investigates which of the two prosodic features, pause or F_0, has a greater effect on the comprehension of a syntactically ambiguous Japanese sentence of the Kinki dialect. The results of the experiment, where subjects judged the meaning of PARCOR-synthesized syntactically ambiguous sentences, showed that insertion of a pause at a certain point, which was supposed to cause the listeners' judgment for the other meaning of the sentence, does not greatly affect the listeners' judgment. On the other hand, it was found that manipulation of F_0 can completely change the listeners' judgment of the stimulus sentences.

I. INTRODUCTION

It is widely known that in Japanese a major syntactic boundary is usually marked by a pause and an F_0 contour resetting for the following phrase (i.e., the F_0 contour of the following phrase is relatively higher than that at the end of the preceding phrase). However, the past studies have not made it clear which of these prosodic features, pause or F_0 contour resetting, is more important for marking a major syntactic boundary in Japanese. Although our pilot studies showed that F_0 contour resetting contributes more than pause toward disambiguation of syntactically ambiguous sentences of the Kinki dialect in Japanese, the data obtained in these studies were not necessarily sufficient for our purpose [1][2].

Thus in order to verify the reliability of the results of our pilot studies, another research following the same method adopted in these studies was conducted using a different type of ambiguous sentence. This paper will describe the outline of this new study.

II. TEST SENTENCE FOR PERCEPTUAL EXPERIMENT

The test sentence used in this study was:

Nagoya de	mananda	*riron o*	nobeta.
H L L L	H HL L	H LL L	L H L
Nagoya-in	studied	theory-AC	explained

As the phrase *Nagoya de* could be considered to modify either the main verb *nobeta* or the verb phrase *mananda*, this sentence allows two kinds of interpretations as follows:

A. In Nagoya I explained the theory which I had studied (somewhere else).
STRUCTURE: [Nagoya de][[mananda]riron o] nobeta.

B. (In some place) I explained the theory which I had studied in Nagoya.
STRUCTURE: [[[Nagoya de]mananda]riron o] nobeta.

*The two meanings of this sentence will be shown as A and B hereafter.

An 18-year-old female speaker of the Himeji dialect (one of the Kinki subdialects) was asked to produce the sentence several times with an effort to differentiate the two meanings of the sentence. These utterances were tape-recorded and after the acoustic analysis, a typical

utterance for each meaning was chosen for the perceptual experiment. The audio signal and F_0 of these utterances are shown below.

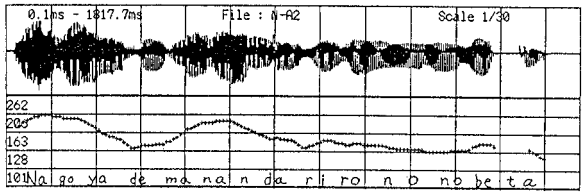

FIG. 1 Audio Signal and F_0 of a Typical Utterance for the Meaning A

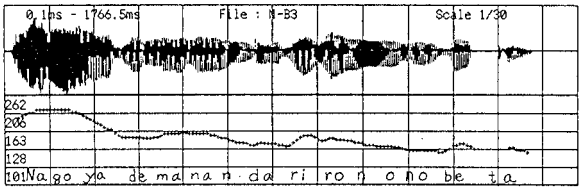

FIG. 2 Audio Signal and F_0 of a Typical Utterance for the Meaning B

From these figures it is clear that there is a significant F_0 contour resetting at the phrase *mananda* in the utterance for the meaning A, while the utterance for the meaning B is covered with a single F_0 phrase component.

III. PARCOR-SYNTHESIZED STIMULI WITH F_0 MANIPULATION

From the typical utterance for the meaning A, we made PARCOR-synthesized stimuli SNNA-1～SNNA-5 by lowering the F_0 of the total phrase *mananda* (the period was increased by the step of 0.2ms at the peak of the phrase), as this manipulation was considered to lead the listeners to the interpretation of the meaning B. A PARCOR-synthesized stimulus SNNA was also made from the original utterance without any modification of the F_0. The F_0 of these synthesized stimuli is shown in FIG. 3.

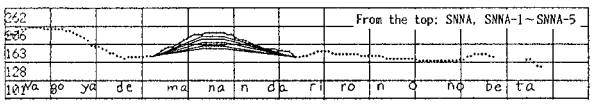

FIG. 3 F_0 of the Stimuli SNNA, SNNA-1~SNNA-5

Then the F_0 of the whole phrase *mananda* of the typical utterance for the meaning B was raised (the period was reduced by the step of 0.2ms at the peak of the phrase), and the PARCOR-synthesized stimuli SNNB-1～SNNB-7 were made, since these stimuli were supposed to cause the listeners' judgment for the meaning A. Without any revision, the original utterance was directly PARCOR-synthesized into SNNB. The F_0 of these synthesized stimuli is shown in FIG. 4.

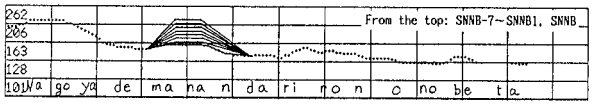

FIG. 4 F_0 of the Stimuli SNNB, SNNB-1~SNNB-7

*PARCOR-synthesis (frame:25.6ms－256 sample/ trapezoid window / 12 bit － 10kHz sampling/ LPF 4.5kHz) for this study was conducted by the Speech Processing System developed by Prof. Miyoko Sugito of Osaka Shoin Women's College.

IV. PARCOR-SYNTHESIZED STIMULI WITH PAUSE MANIPULATION

As the insertion of a pause after the phrase *mananda* of the original utterance for the meaning A was considered to lead to the interpretation of the meaning B, pauses ranging from 100ms to 700ms (step: 100ms) were inserted after this phrase and PARCOR-synthesized stimuli SNNAP-1～SNNAP-7 were made.

On the other hand, the insertion of a pause after the phrase *Nagoya de* of the original utterance for the meaning B was supposed to gain the listeners' judgment for the meaning A. Thus pauses ranging from 100ms to 700ms (step: 100ms) were inserted after this phrase and SNNBP-1～SNNBP-7 were PARCOR-synthesized.

V. PERCEPTUAL EXPERIMENT

51 female students at Kenmei Women's Junior College, having been brought up in and around Himeji city, participated in the experiment. The PARCOR-synthesized stimuli were presented over a cassette tape recorder and the subjects were asked to judge which of the two meanings, A or B, each stimulus was intended to be. There were two sessions

in the experiment, and in the first session, only the stimuli with F_0 manipulation were presented, while in the second session, only the stimuli with pause manipulation were presented. The stimuli had been compiled in a random order as "number — four second interval — stimulus — four second interval — number for the next stimulus..." In each session, a series of stimuli was presented to the subjects twice and they were allowed to revise their judgment at the second presentation of the stimuli.

VI. RESULTS OF PERCEPTUAL EXPERIMENT

Experimental data were analyzed by a microcomputer and a Binominal Test (two-tailed) was conducted on the difference between the judgments of each stimulus sentence. The results of the analyses are shown in TABLE 1.

TABLE 1 Results of Perceptual Experiment

Stimulus	Number of A	Number of B	Signif-icance	Stimulus	Number of A	Number of B	Signif-icance
SNNA	36	15	p<0.01	SNNAP-1	26	25	NS
SNNA-1	30	21	NS	SNNAP-2	29	22	NS
SNNA-2	21	30	NS	SNNAP-3	29	22	NS
SNNA-3	22	29	NS	SNNAP-4	23	28	NS
SNNA-4	17	34	NS	SNNAP-5	21	30	NS
SNNA-5	12	39	p<0.001	SNNAP-6	28	23	NS
SNNB	9	42	p<0.0002	SNNAP-7	32	19	NS
SNNB-1	8	43	p<0.0002	SNNBP-1	19	32	NS
SNNB-2	17	34	NS	SNNBP-2	25	26	NS
SNNB-3	31	20	NS	SNNBP-3	24	27	NS
SNNB-4	27	24	NS	SNNBP-4	31	20	NS
SNNB-5	42	9	p<0.0002	SNNBP-5	24	27	NS
SNNB-6	40	11	p<0.0002	SNNBP-6	23	28	NS
SNNB-7	43	8	p<0.0002	SNNBP-7	21	30	NS

From TABLE 1, it has become clear that the manipulation of F_0 can change the listeners' interpretation of a syntactically ambiguous sentence (SNNA-5; SNNB-5~SNNB-7), while the manipulation of a pause does not so much affect the listeners' judgment. These facts seem to allow us to conclude that in the case of the Kinki (Himeji) dialect:

(1) The most important prosodic feature to mark a syntactic boundary is F_0.
(2) Pause does not contribute so much toward the marking of a syntactic boundary as F_0.

REFERENCES

[1]J. Azuma and Y. Tsukuma, "Contribution of F_0 and Pause toward the Comprehension of a Syntactically Ambiguous Japanese Sentence: In the Case of the Kinki Dialect," *The Bulletin of the Phonetic Society of Japan*, Vol.191, pp.1-5, 1989. (In Japanese)

[2]J. Azuma and Y. Tsukuma, "Prosodic Features Determining the Comprehension of a Syntactically Ambiguous Japanese Sentence: In the Case of the Kinki Dialect," *Syntactic Structure and Prosodic Features*, pp.24-33, 1990. (Report on "Prosodic Features of the Japanese Language" — Grant-in-aid for Scientific Research on Priority Areas, the Ministry of Education, Science and Culture, Japan)

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