

# Some Cognitive Aspects in the Errors of Articulation of Mentally Retarded Children: Focusing on Down's Syndrome

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## Introduction

It has often been suggested that many Down's syndrome children (DC) have articulation disorders. It is reported that 95% of the DC population have articulation disorders (Schlanger and Gottsleben, 1957). Strazzulla (1953) reported that DC had the most difficulty to articulate [s], the second most [tʃ], [dʒ]. Muto et al. (1983), which investigated features of independent syllables articulated by DC, reported that the consonants [w], [t], [k], [m], [j], [n], [p], [b] could be articulated, but that [dz], [dʒ], [r] could not. Thus, many studies have reported on articulation disorders of DC in terms of their phonological aspects (e.g., error number or error types of independent phonemes), and suggested that the articulation disorders of DC might be due to organic or functional anomalies affecting articulatory skills. However, some studies suggest that the articulation disorders of DC may be due to disorders which should be studied through the cognitive method (cognitive disorders). Dodd (1976) carried out a comparative study of the number and the type of phonological errors that were made in spontaneous utterances and in imitations by DC, normal, and severely retarded children other than DC, who were matched by mental age; she reported that, compared to normal and other subnormal children, DC made significantly fewer errors in imitation than they did in spontaneous production. Her results indicate that difficulties in the motor programming of speech production might cause their articulation disorders. Cromer (1974) suggested that their articulatory skills might be affected by a failure of long-term motor planning. If it is hypothesized that DC have a cognitive deficiency, some peculiar features of DC which are different from those of normal and other subnormal children, for example, such inconsistent errors as their substituting [tasa] or [sasa] for [kasa] ("umbrella" in Japanese), may

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be understandable. If so, a new method of speech therapy for DC should be adopted in the future.

The present study investigates some features of articulation of DC, compared to those of normal and other subnormal children, by taking into account not only phonetic but also cognitive aspects, that is, by examining not only phonemes or syllables but also words, especially the relation between the errors and the length of words, or the position in a word which is difficult to articulate.

## Method

### *Subjects*

There were three groups. Each group constituted 9 Down's syndrome children (DC), 5 severely retarded non-Down's syndrome children (non-Down), and 9 normal infants (Normal). The mean chronological age (CA) of DC, non-Down, and Normal was 15:1 years (range 11:1 to 18:9), 16:2 (range 15:0 to 18:5), and 3:9 years (range 3:5 to 4:3), respectively. The mean IQ of DC and non-Down was 42 (range 22 to 58) and 33 (range 28 to 41), respectively. Each DC and non-Down subject attended a school for severely retarded persons, and the Normal subjects a nursery school. None of the subjects had any history of hearing loss or gross peripheral motor impairment that would affect articulatory skills.

### *Procedure*

Test (1): Subjects were asked to imitate experimenter's articulation of 100 independent Japanese syllables (monosyllables).

Test (2): There were 198 colored pictures of familiar objects: 66 words with 2 syllables, 66 words with 3 syllables, 45 words with 4 syllables, and 21 words with 5 to 7 syllables. Subjects were asked to imitate the experimenter's naming of the same pictures (Imitation Task). The pictures were then shown to subjects individually, and they were asked to name them (Spontaneous Task). Pictures were presented in a random order.

These testing sessions were repeated 3 times, and taperecorded. The syllables which were misarticulated 2 out of 3 times were analyzed.

## Analysis of data

The percentages of errors in articulation of monosyllables were evaluated by Test (1). The mean error percentage of DC, non-Down, and Normal was 23%, 14%, and 15%, respectively. The percentage of errors in articulation of

words with 2 to 7 syllables, excluding errors in articulation of monosyllables, was evaluated. For example, though [sa] in monosyllables can be rightly articulated, [sa] in the polysyllabic word [sakana] ("fish" in Japanese) can't be. The mean error percentage of Down, non-Down, and Normal was 21%, 23%, and 14%, respectively. This result indicates that monosyllables exactly articulated in Test (1) are not always exactly articulated in words with 2 to 7 syllables, especially in the case of children with mental retardation. In this study, therefore, words with 2 to 7 syllables, with the exception of errors in monosyllables, were analyzed. Differences between Imitation Tasks and Spontaneous Tasks have been discussed in previous studies in several ways (Templin, 1947; Snow and Milisen, 1954); and there were no significant differences between them in this study, so only results of Imitation Tasks were analyzed.

## Results

### *The Relation between Errors and Word Length*

Mean error percentage in the words with 2 to 7 syllables was evaluated in DC, non-Down, and Normal (Fig. 1, 2, 3). In each group, the more syllables in a word, the more errors made. In sum, it is difficult for them to articulate long words. DC and non-Down are similar in this tendency to Normal, but make more errors, especially in long words, than Normal. The functional deficiency affecting articulatory skills or the anomalies of memory span may make it difficult for severely retarded children to articulate long words.

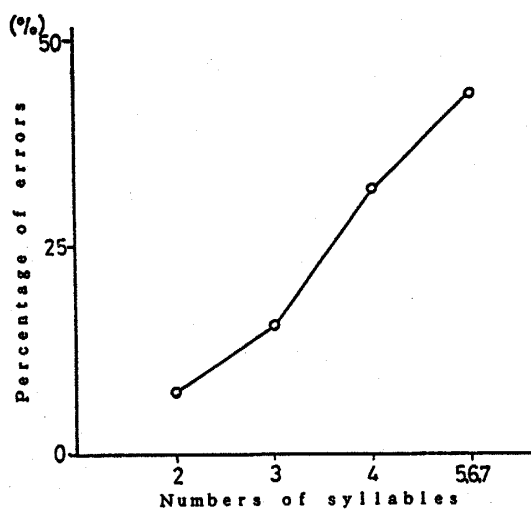


Fig. 1. The relation between errors and word length (DC).

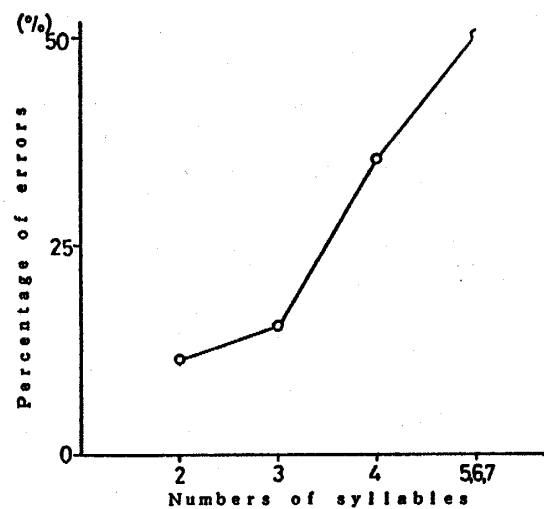


Fig. 2. The relation between errors and word length (non-Down).

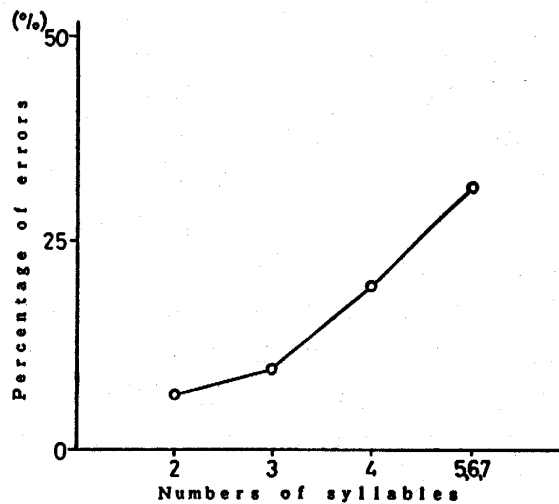


Fig. 3. The relation between errors and word length (Normal).

*The Position in Words that is Difficult to Articulate*

Most DC made more errors in the initial syllables of words, and fewer errors in the middle and the final syllables regardless of the length of words (Fig. 4). Few errors in the final syllables in long words, especially no errors in the 6th and 7th syllables, were made. The error percentage in the initial syllables of DC was higher than any other children.

Many non-Down made more errors in the middle syllables of words, and fewer errors in the initial and the final syllables, except for words with 2 syllables (Fig. 5). However, this tendency is less remarked than with DC, and varies with each non-Down subject.

Normal made more errors in the initial syllables in words with 2 and 3

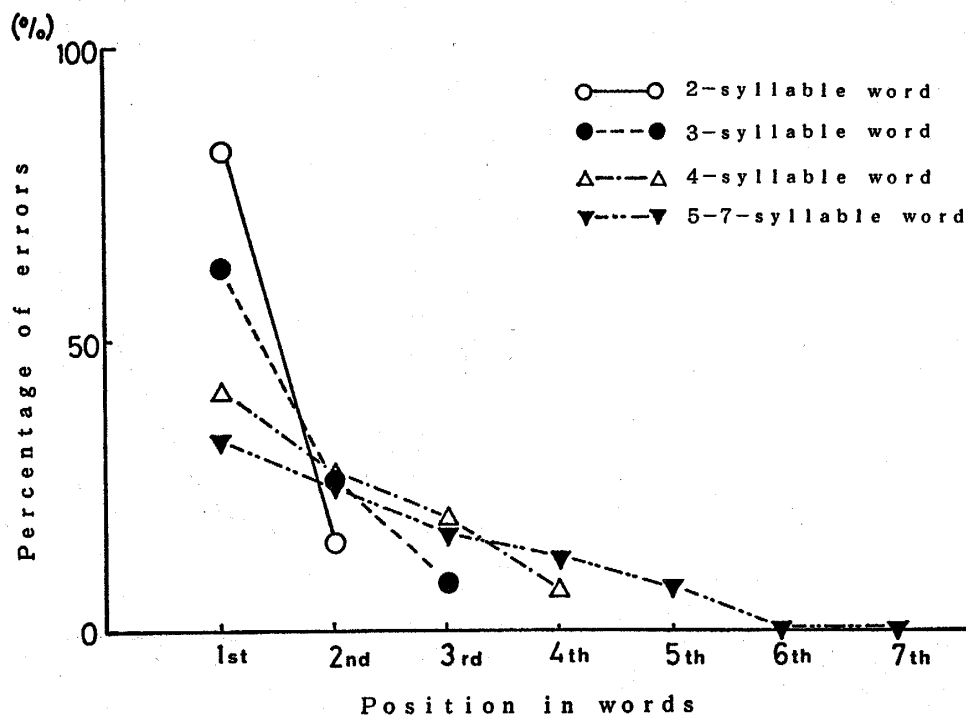


Fig. 4. Word positions difficult to articulate (DC).

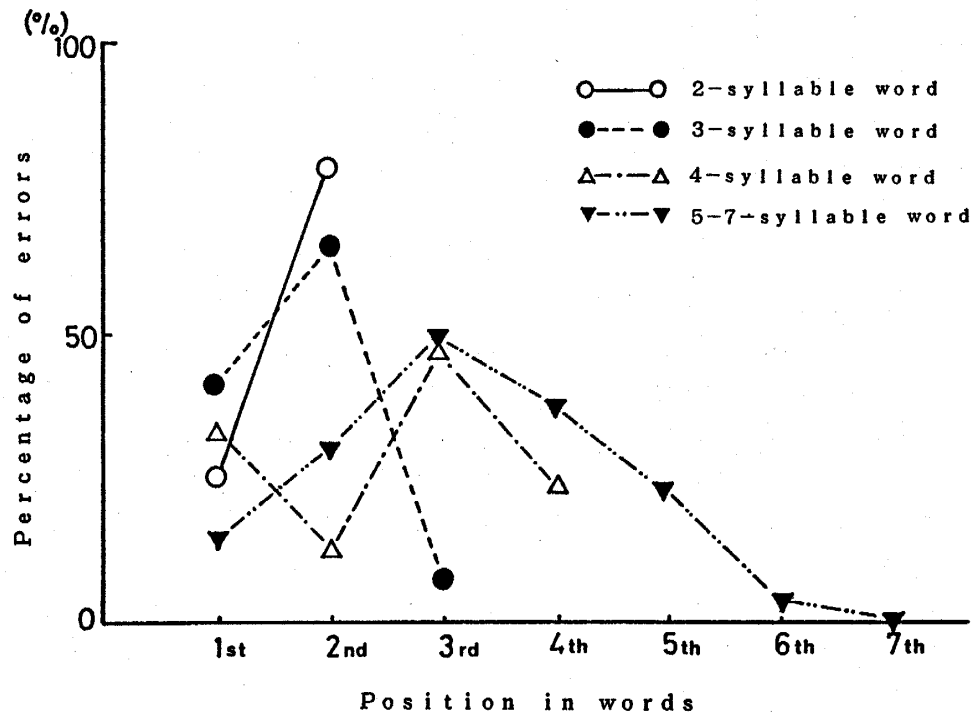


Fig. 5. Word positions difficult to articulate (non-Down).

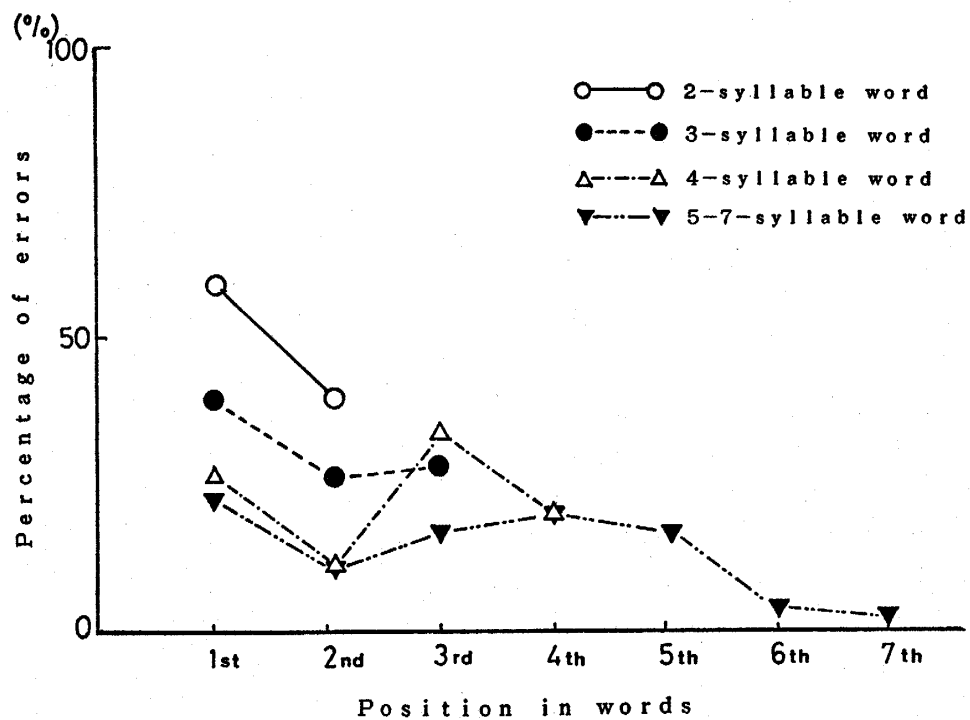


Fig. 6. Word positions difficult to articulate (Normal).

syllables, and more errors in the middle syllables in words with more than 4 syllables (Fig. 6). As a whole, there is little distinctive tendency in Normal, and it seems that the error percentage of Normal was not affected by which position in words is difficult to articulate. Among Normal, however, there were also those who exhibited the same tendency as non-Down.

### Discussion

In each group, the more syllables there were in words, the more errors were made, such a tendency was especially more conspicuous among DC and non-Down than Normal (Fig. 1, 2, 3). It is possible that the combination between some syllables in words, for example, the combination between [ku] and [ru] in [kuruma] ("car" in Japanese), may make it difficult for children to articulate. However, DC and non-Down made more errors, especially in long words, and it should be considered that such a tendency among them isn't due to the combination between some syllables but the functional deficiency affecting articulatory skills or the anomalies of memory span, because articulation of long words requires many articulatory movements and a capacity for storing long words.

Regarding the position in words which is difficult to articulate, most DC made more errors in the initial syllables in words, and fewer errors in the middle and the final syllables regardless of the length of words (Fig. 4), compared to non-Down and Normal (Fig. 5, 6). Articulating the initial syllables in words may more require a straining of the muscles affecting articulation in general. Excessive strain of this nature may cause stuttering people to stutter in the initial syllables; DC, who have organic or functional deficiency in articulatory skills, may thus exhibit more strain when articulating the initial syllables, and so may be unable to articulate correctly. However, this cannot explain why DC could articulate most monosyllables in Test (1). Though articulatory movements are voluntary movements in peripheral organs, they have a close relationship to the central nervous system when speech is produced. It is also necessary that this deviation of DC should be considered from cognitive aspects.

Many non-Down and Normal made more errors in the middle syllables, and fewer errors in the initial and the final syllables, though such a behavior is less remarkable among Normal than among non-Down. If these results are discussed in terms of their cognitive aspects, this feature of non-Down may be similar to "primacy effect" and "recency effect" in "short term memory". However it seems that "memory" regarding speech production and "short term memory" should not be considered as the same; such a tendency of non-Down may be understandable

if the existence of a "serial position effect" in speech production can be acknowledged.

The fact that DC made more errors in the initial syllables, and fewer errors in the middle syllables runs counter to the "primacy effect." This finding indicates that the mechanism in speech production of DC may differ from that of non-Down and Normal. It is possible that DC lack the ability to pay attention to the stimuli presented, or they may be behind in attending to such stimuli, so the initial syllables in words may be mistaken.

Another possibility is that DC are deficient in their ability to program the sequences of articulatory movements, or to store the programming of them.

This study has taken a first step toward investigating some features of articulation by DC from cognitive aspects. It is necessary, however, that the number of subjects, method of examination, and relationship between imitation task and spontaneous task are reviewed in the future.

### Summary

This study investigated some features of articulation of 9 Down's syndrome children (DC) in terms of cognitive aspects, comparing them to those of 5 retarded non-Down's syndrome children (non-Down) and 9 normal infants (Normal). The relation between the errors and the length of words, and the position in words which is difficult to be articulated were analyzed. The results indicated that most DC made more errors in the initial syllables in words, and fewer errors in the middle and the final syllables, whereas non-Down and Normal made more errors in the middle syllables, and fewer errors in the initial and the final syllables. The findings suggested that the cognitive mechanism of DC differed from that of other children. DC have some complicated problems in their articulatory disorders, and so require consideration from various angles.

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