141. The Characteristic Pattern of the Cerebral Dominance for Vowel Sound Found in Japanese Second-Generations*

By Tadanobu TsUNODA
Tokyo Medical-Dental College, Medical School
Institute for the Deaf Tokyo

(Comm. by Yasuji KATSUKI, M. J. A., Oct. 12, 1973)

The author reported previously that the cerebral dominance test by means of auditory examination (Tsunoda—1, 5, and 7) showed a difference between the central transacting mechanism of steady-state vowel sounds in the Japanese and that in the Westerner. In the Japanese the dominant hemisphere acts mainly without distinction of vowel and consonant sounds, while in the Westerner (the American, French, and Australians) the dominance of steady-state vowel sounds exist in the non-dominant hemisphere.1

In other words, the Westerner transacts vowel sounds as non-verbal sound, but the Japanese takes it for verbal sound categorically. In this report, the author has studied first, the dominant side of vowel sounds in second generation Japanese who were born in Brazil, Peru, and in the United States. The native languages of this group were: Portuguese, Spanish, and American English. Later studied were those whose native languages were Spanish, Italian, English, and that of Bangladesh. This study was done in addition to the previous report. This is to say that the aim of this study is to obtain evidence of whether or not the difference of the dominance for steady-state vowel sounds in the Westerner and Japanese results from genetic factors or disparity of the languages.

Materials and methods. The subjects for the experiment are classified into the following two groups of 35 members according to their linguistic environments.

(1) The 25 members of the first group spent the periods of acquiring languages in their native countries and speak in native languages as their first language. In detail, this group consists of: 6 French, 7 Americans, 3 Australians, 1 English, 2 Swedish, 2 Italians, 1 Venezuelan, 1 Spanish, 1 Austrian, and 1 from Bangladesh.

(2) The second group consists of 9 members whose parents were pure blooded Japanese. All of these studied grew up in the

---

* This research was supported in part by Scientific Research Grant 73-002-1 (Ministry of Education).
particular linguistic environments such as: Portuguese (Brazil), Spanish (Peru and Columbia), and American. Itemized, they are: 4 Brazilians, 3 Peruvians, 1 Columbian, and 1 American. Another half-blood whose father is Finnish/American and whose mother is Japanese was added. All of them have had no previous history of ear diseases and were confirmed normal in hearing by an auditory examination.

The source of the steady-state vowel sound /a/ for the examination of members of each nationality was in principle pronounced by a person of the same nationality.

The tests were carried out on each member more than three times each on different occasions and except for special purposes they were not told about the nature of the sound sources. Dr. Tsunoda’s method was used for the dominance test, sound sources of which were a steady-state vowel sound /a/ and a pure tone of 1 KHz (refer to ref. 5 and 7). Before the tests, it was determined whether the subjects were right or left handed and they were instructed to use their dominant hand for the tapping tests.

Results and conclusions. 1. The pattern of the cerebral dominance for the vowel sound /a/ and a pure tone 1 KHz for West-Europeans (First Group).

The pattern of the cerebral dominance for the vowel sound /a/ coincided with that of pure tones as shown in Fig. 1, and no Japanese were found to be of this type (refer to Japanese patterns in Fig. 2). In 17 cases out of 25 members, the dominant sides for both sounds (P and A) existed in the right hemisphere, and in 8 cases it was in the left.

Even in Spanish and Italian vowel sounds (which resemble those in Japanese) there was no similarity of the pattern found in Japanese.

A: Vowel /a/, a: Japanese vowel /a/, P: IK Hz Pure tone.

Fig. 1. The pattern of the cerebral dominane for west-Europeans.
2. Cerebral dominance for vowel sounds and the pure tone of 1 KHz in the group of Japanese second generations (Second Group) Fig. 3.

The 9 hereditary Japanese, which included: Japanese/Brazilians, Peruvians, Columbians, and Americans—showed typical western patterns as observed in the first group, except No. 4S. This subject fell into the typical Japanese pattern. The half-blooded American showed a typical western patterns.

3. Linguistic environment of case No. 4S—24 years old. This is an exceptional case of second generation Japanese and has had an interesting language history as follows:

S was born in a Japanese family of the “successful group”* in Brazil in 1948. She was educated in a strict Japanese way of life all

* During a certain period after the second World War, Japanese/Brazilians were divided into two groups. These were: “successful ones,” and “Beaten ones.” The former group wanted to believe that Japan won the war and they kept on living in a totally Japanese way of life. The later group (beaten ones) adapted to the customs and life style of Brazil.
through her infancy by her father. He employed a Japanese tutor at his home and she was forced to speak only Japanese and was limited to correspond with only Japanese people. She studied in a Japanese kindergarten and was taught Japanese folk dancing from infancy. Even at school age she could hardly understand Portuguese and put off entering school, preferring to speak only Japanese. Later at the age of 10, she was forced to enter a primary school as a first year student and could, at that time, understand no Portuguese at all. On the other hand, she could read a Japanese magazine named “The Girl’s Friend” easily. Her father had been put in prison several times because he refused to give up the Japanese life style. When she finished primary school, she was familiar with Portuguese, and gradually forgot her Japanese. Eventually she graduated from a university in Brazil. At present she communicates smoothly with the Portuguese, but according to her friends, her pronunciation of Portuguese remains imperfect.

After graduation from the university she visited Japan for training. On the 40th day, when examined, she spoke quite natural Japanese, but had troubles in communication due to poor vocabulary. Reading ability enabled her to read the textbooks of the third and fourth year primary schools with ease.

As mentioned above, the linguistic environment of No. 4S in infancy completely differs from those of the other second generation Japanese. Her dominance pattern is similar to the Japanese type and could be attributed to the linguistic environment—artificially produced in a foreign country. This fact will suggest that the pattern of dominance for the vowel sound /a/ and pure tone sounds are established while learning the native language spoken up to the age of 10 and when strengthened by the learning of reading and writing the language. This pattern will be maintained throughout life—even the learning of a second language will not enable a person to change the original pattern of dominance.

As mentioned above, and from the above-mentioned results, it may be concluded that the characteristic pattern of the dominance found in the Japanese is due to the peculiarity of the Japanese and any genetic factors can be denied.

4. The characteristic pattern of the dominance for vowel sounds found in the Japanese: As for the sensory mode of speech perception in the Japanese, both vowel and consonant sounds were processed in the same way by the dominant hemisphere. However, in the Westerner, steady-state vowel sounds were transacted in the non-dominant cerebral hemisphere. A qualitative difference between Western and Japanese Ss must therefore exist in the mode of central processing
Cerebral Dominance for Vowel in Niseis

of vowel sounds.

A complete explanation for the findings that Japanese vowel sounds are dominantly perceived in the verbal hemisphere has not been obtained at this time; however, the author strongly stresses that Japanese vowel sounds are meaningful mono-syllabic sounds such as: /a/ (mute, a!), /i/ (stomach, medicine), /u/ (a cormorant), /e/ (picture, food, handle), and /o/ (tail) and these are easily perceived categorically in the dominant hemisphere.

Acknowledgement. The author is most grateful to Prof. Y. Katsuki for his helpful comments and encouragements for this study.

References

1) Tsunoda, T.: The difference of the cerebral dominance of vowel sounds among different languages. J. And. Res. (1971) (in press). The qualitative differences in cerebral dominance for vowel sounds between Japanese and European languages. Medicine and Biology, 85(4), 157–162 Oct. 10 (1972).
2) Liberman, A. M., Cooper, F. S., Shankweiler, D. P., and Kennedy, M. S.: Perception on the speech code. Psychol. Review, 74, 431–461 (1967).
3) Kennedy, M. S., and Shankweiler, D. P.: Hemispheric specialization for speech perception. J. Acous. Soc., Amer., 48, 579–594 (1970).
4) Fujisaki, H., and Kawashima, T.: A model of the mechanisms for speech perception based on discrimination of synthetic speech sounds. J. Acous. Soc., Japan, 27, 453–462 (1971).
5) Tsunoda, T.: Contralateral shift of cerebral dominance for non-verbal sounds during speech perception. J. And. Res., 3, 221–229 (1969).
6) Tsunoda, T.: The influence of speech environments on the cerebral dominance of vowel sounds. Report of the 1973 Spring Meeting. The acoustical society of Japan, May 1973.
7) Tsunoda, T.: An audiological difference between right-left cerebral hemispheres. Otologia (Fukuoka), 18, 56–66 (1972).
8) Tsunoda, T., and Watanabe, K.: Cerebral dominance of complex sounds. J. Oto-Rhino-Laryng. Soc., Japan, 73, 1018–1019 (1970).