30. *Physico-Phonetical Studies of Dialects of the North-Eastern Districts of Japan.*¹⁾

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(Comm. by S. NAKAMURA, M.L.A., April 13, 1936.)

The dialect spoken in the North-Eastern districts of Japan is known for its remarkable difference in physical or acoustical properties compared with Standard Japanese. That is to say, nasalization of the vowel-sounds is very common, while the tone-colours of some vowels, even in their non-nasalized forms, differ considerably from those of Standard Japanese. Since, in such circumstances, physico-phonetical studies of these dialects by means of the recently developed electro-acoustical technique might be of considerable interest, the present investigation was undertaken.

The five vowels in Standard Japanese are usually expressed by *a*, *è*, *i*, *o*, *u*. It is, however, well known that the Japanese *う* (*u*) is produced quite differently from the English vowel *u*, such as in "put." In uttering the Japanese *う* (*u*), the lips are neither pushed forward nor rounded as in English, but merely drawn closer together, hence resulting in difference in tone-colour. For this reason, phoneticians and linguists usually employ a symbol *u* to denote the Japanese *う* (*u*); the five Japanese vowels being therefore *a*, *è*, *i*, *o*, *u*. In dialects spoken in the North-Eastern districts of Japan *i* and *u* are replaced by *î* and *û*. *î* is a mixed sound of *i* and *u*, and if *u* be considered as a sound similar to *u*, but lacking rounded lips in producing it, *û* may be regarded as a sound without rounded lips of *û*. Further, *æ* and *ε* are often used in the dialects. Another characteristic is that the voiceless consonants *k* and *t*, when they occur in the middle part of a word are very often changed to the voiced forms *g* and *d*, for example, "mekata" (weight), "kokoro" (mind), and "atama" (a head) change to "megada," "kogoro," and "adama" respectively.

The experimental procedure here differed in no way from those previously used in studying other languages. Some thirty words, specially selected as typical in showing the characteristic dialect-sounds, were carefully spoken in succession, and the sounds thus uttered recorded by means of a condenser microphone and an oscillograph, the analyses being made on the records, the necessary correction for the microphone-characteristic being applied.

In these investigations we had the kind participation of Dr. S. Ogura and Dr. K. Kindaichi of the Institute of the Science of Language, Faculty of Letters, Tokyo Imperial University, Mr. M. Yokoyama, a post-graduate of the same Faculty and Mr. N. Kitayama, Teacher of the Aomori Girls High School, to whom we express here our most sincere thanks. These gentlemen uttered the selected words as distinctly

1) An investigation carried out with the aid of the Prince Arisugawa Memorial Fund. Details will shortly be published in Japanese in the *Kwaishi* of the Physico-Mathematical Society of Japan.

as possible in the dialects of their native places, namely, the cities of Sendai and Morioka and the prefectures of Yamagata and Aomori respectively.

More than two hundreds and fifty records of all the vowel-sounds were analysed, and estimates made of the characteristic-frequency-regions

Frequency.
Characteristic-Frequency-Regions.

(Formanten in German) of the vowels $\ddot{i}$ and $\ddot{u}$. The results are shown in the annexed figure. The characteristic-frequency-regions of i , u , and the Korean eu , which is known to closely resemble $\ddot{u}$, are also given.

The degree of nasalization,¹⁾ as well as the nature of the consonants,

1) Nasalization of a vowel, say a , may be classified into three kinds: (1) pure nasalization of the vowel itself, such as is often found in French and expressed phonetically by $\tilde{a}$, the change in the tone-colour being produced in such a way that, in uttering the vowel, one part of the air goes out through the nasal cavity; (2) the sound n or m is inserted after the vowel as an or am ["mado" (a window) is often pronounced as "mando"]; (3) both these effects are combined such as $\tilde{a}n$ or $\tilde{a}m$. Further, it is found by analysis of the wave-form that for the purely nasalized vowel, say $\tilde{a}$, there are certainly different degrees of nasalization; thus, to denote a vowel which is somewhat less nasalized than $\tilde{a}$, the symbol $\hat{a}$ is here used.

were determined from the oscillographic records and the acoustical spectra of the vowel-sounds; the following being some of the results of these determinations.

Pronunciation given in the quotation mark is that
of Standard Japanese.

(A): Aomori dialect.

(S): Sendai dialect.

(Y): Yamagata dialect.

(M): Morioka dialect.

"tʃídzu" (a map)	"tsutʃi" (earth, soil)
(A) <i>tsĩndzi</i>	(A) <i>tsĩdzi</i>
(S) <i>tsĩdzü</i>	(S) <i>tsũdzi</i>
(Y) <i>tsĩtsü</i>	(Y) <i>tsiũndzü</i>
(M) <i>tsiũndzü</i>	(M) <i>tsiũdzi</i>
"bó: dzu" (a priest)	"adána" (a nick name)
(A) <i>bõndzi</i>	(A) <i>andána</i>
(S) <i>bó: dziũ</i>	(S) <i>ãndánã</i>
(Y) <i>bó: zü</i>	(Y) <i>ãndãnã</i>
(M) <i>bõndzü</i>	(M) <i>andana</i>
"mádo" (a window)	"mató" (a target)
(A) <i>mãndõ</i>	(A) <i>mãdõ</i>
(S) <i>mãndó</i>	(S) <i>mãndo</i>
(Y) <i>mãndo</i>	(Y) <i>mato</i>
(M) <i>mãndo</i>	(M) <i>mãdõ</i>
"çitóri" (one person)	"zabiúton" (a cushion)
(A) <i>Füütõri</i>	(A) <i>dzãmbiũndon</i>
(S) <i>hütõri</i>	(S) <i>dzãpuütõn</i>
(Y) <i>hütõri</i>	(Y) <i>zãmpiütõn</i>
(M) <i>çitõri</i>	(M) <i>dzãmbuudón</i>
etc.	etc.

Further, it is known among phoneticians and linguists that in the dialects of the North-Eastern districts of Japan *h* is often voiced. As a matter of fact, some oscillographic records of the words spoken by Dr. K. Kindaichi give evidences of the existence of such voiced *h*.¹⁾

1) *h* is a fairly regular high-pitched wavelet (approx. pitch 2500 hertz), in its voiced form the wave-form consists of a low-pitched wave (approx. pitch 160 hertz) superposed by high-pitched wavelet.