ACOUSTICAL SUPPORT FOR AFRICAN FIELD WORK

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This paper will survey some areas of phonological structure of some West African languages which were submitted to spectrographic analysis, and will discuss in some detail the analysis of one phonological problem.

While directing two linguistic workshops in Ghana and in Nigeria[1] Kenneth L. Pike recorded data in which various phonological problems occurred, and sent the recordings to be subject to spectrographic analysis[2] in the hopes that his on-the-field analyses would thereby be confirmed or refuted. The author of this paper provided Pike with spectrographic measurements and comments thereon.

In general, the spectrographic analysis was of greatest value in the confirmation (or refutation) of the on-the-field, subjective and rather impressionistic justments which had been made, rather than in suggesting completely new avenues of analysis. The measurements of the pitch heights of Izi,[3] for example, corresponded exactly, in almost all cases, with the perception of tone heights on the field. The four pitch levels postulated for Igede, similarly, were clearly confirmed by measurements of the corresponding spectrograms, but, for the Bette, Mbembe, and Abua recordings, consistent confirmation of 'down-step' levels was not available. It seems clear that in such cases, the spectrograph is of little value to the linguistic analyst. Although the 'normal' levels of high and low (and, in some cases mid) tones were quite readily confirmed, a complicated tonal morphophonemics would have to be well analyzed, and then special controlled utterances carefully lined up for recording before spectrographic analysis would be useful. On the other hand, the postulated extra-high

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[2] Charles Peck of the Communication Sciences Laboratory of the University of Michigan made the spectrograms.

[3] A language of Nigeria. Of the languages reported on here, Izi, Mbembe, Abua, Igede and Bette are languages of Nigeria; Basare and Twi are languages of Ghana.

pitch syllable of the negative in Abua was easily substantiated by frequency measurements.

In a study of Twi vowels, Pike found that he agreed with J. M. Stewart[4] in his analysis of tongue-root position being an important feature contrasting the two sets of 'tense and lax' vowels. The spectrograph here was most valuable since, as would be necessary for the hypothesis to stand, a consistent lowering of the first formant for the set of 'tense' (or tongue-root front) vowels was found. (For example. the measurement of the first formant of several utterances of the root-front vowel /e/ was consistently about 200 cps., while the measurements of the first formant of the root-neutral vowel /ɛ/ ranged from 400 to 450 cps.) The implications of this analysis, with its support by the spectrograph, are considerable, not only for Twi. but for other African languages where a similar type of vowel harmony between two sets of vowels has been discovered, but which has been rather impressionistically described previously in vague terms such as 'wide-narrow', 'tense-lax', 'raised-lowered', etc.[5] From preliminary measurements, it seems that Abua also has two sets of vowels, differentiated by tongue-root position.

Interesting instrumental results were found in the study of Basare rhythm patterns. On the field, Pike and M. Cox postulated a unit occurring in the phonological hierarchy on a level between the syllable and the stress-group (or phonological word) which they called a 'foot'. Feet, within one utterance, seemed to be isochronic, regardless of the number of syllables each foot contained.

They found, for example, that the first feet of the utterances

(1)	*a ˡñi*	*tuˡwan*	*tuˡminee*	
	you know	thing	which-is-here	'you know this thing'
(2)	*a ˡčaa*	*tuˡwan*	*tuˡminee*	
	you have	thing	which-is- here	'you have this thing'
(3)	*a ˡbati*	*tuˡwan*	*tuˡminee*	
	you carve up	thing	which-is-here	'you carve up this thing'
(4)	*a ˡdakafi*	*tuˡwan*	*tuˡminee*	
	you taste	thing	which-is-here	'you taste this thing'

that is, [a ni] in utterance (1), [a caa] in utterance (2), [a bati] in utterance (3) and [a dakafi] (actualized in this utterance as [a dauf]) in utterance (4) were perceptually of the same length as were the other feet in the utterance in which each occurred. This analysis was confirmed by spectrographic measurements, with the exception that utterance-final feet of most utterances measured slightly longer than utterance-initial and utterance-medial feet—thus suggesting that utterance-final feet (i.e.. feet which occur before pause or silence) are predictably longer than feet occurring in other utterance positions. Measurements of spectrograms of utterances (1) through (4), above, are given below. (An average measurement—in seconds—is given to represent several pronunciations of each utterance.)

a ˡñi	*t.uˡwan*	*tumˡminee*
.32	.34	.4
a ˡčaa	*tuˡwan*	*tumˡminee*
.32	.31	.39
a ˡbati	*tuˡwan*	*tuˡminee*
.38	.36	.4
a ˡdakafi	*tuˡwan*	*tuˡminee*
.4	.34	.41

On the field, when making tapes for spectrographic analysis, the informant was asked to tap his spoken utterances. Measurements of the tapped segments, however. did not coincide with the measurements of feet in the spoken utterances. It seems that the informant tapped out in syllables, rather than maintaining the regular foot-timing which was so evident in the spoken utterances. It should be noted, in the spoken utterances, whole syllables disappear in order to maintain the isochrony of the feet (e.g., [*a dauf*] instead of [**a dakafi*] in utterance [4]). This collapsing or disappearance of syllables did not occur when the utterances was tapped—dakafi, for instance, regularly received three taps. The full implications of these differences between the spoken and tapped utterances are not yet clear.

The isochrony of feet also seemed to occur in longer, more complicated utterances, but considerably more analysis needs to be done before the conditioning of feet length can be fully described.[6]

The measurements just described seem to indicate that length in Basare must be treated as a distinctive feature of both feet and individual phonemes (with vowel length marked above as two vowels, etc.). One linear analysis of length as a phoneme would not be sufficient to describe these data. For further discussion of this type of problem see my paper entitled 'Distinctive Features of High-Level Phonological Units'.[7]

[4] See his 'Tongue-Root Position in Akan Vowel Harmony' and Pike's 'Tongue-Root Position in Practical Phonetics' to appear in Phonetica, 1967,

[5] See Stewart, op. cit.

[6] In addition, whenever extra heavy utterance (or sentence) stress had been marked on the field data by Pike and Cox, the spectrographic measurements showed the highest level of pitch (cps.) at that point, thus confirming the prominence of that point of the utterance. In general, also, the foot which occurred with the extra-heavy stress was either the longest in the utterance, or was slightly shorter than the utterance-final foot—thus showing another element in the conditioning of length.

[7] Paper presented to the Xth International Congress of Linguistics, August, 1967—to appear in proceedings of that Congress.