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## A MULTIPLE STRESS SYSTEM VERSUS A TONE SYSTEM

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0. The problem
1. Vowel length
2. Vowel quality
3. Voiceless vocoids
4. Allophones of consonants
5. Fluctuation of pitch
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0. We are presenting a problem. Given a language which has syllables with high pitch and syllables with lower pitches, on what do we base the decision that the high pitched syllables are part of a tone system, rather than a part of a stress system? This is especially pertinent when we are confronted with a language with more than one stress (or more than one high pitch) per word.

We might compare the problem with that of suspect high vocoids, [i] as /i/ or /y/, [u] as /u/ or /w/, for example. There are also suspect sequences, [ts] as /ts/ or /c/, for example. I would now add that I consider high pitch to be suspect.

A high pitch is suspect of being an *eme* in a tone language versus being the main contrastive feature which distinguishes a stressed syllable from a nonstressed syllable in a multiple stress system.

In a multiple stress system, all syllables of a word may be stressed, just some of them may be stressed, or there may be words with no stress at all. Therefore, in the initial stages of the analysis, the language may be thought to be a tonal

one.<sup>1</sup> About Waffa of New Guinea, Stringer and Hotz say, "A word is a rhythm unit containing one or more syllables. Words containing from one to twelve syllables have been recorded. None, or any, or all of the syllables may be stressed."<sup>2</sup>

How is a multiple stress system to be distinguished from a tone system? For a quick summary, I would say that a high pitch as a contrastive feature of stress affects its environment, whereas a high pitch as a contrastive feature of a tone system is affected by its environment.

First, we will study the characteristics of stressed syllables versus nonstressed syllables in languages already analyzed as having stress. We will compare these with syllables which have been analyzed as having high tone but not stress. Then by analogy, in a still different language, we will be able to place in their rightful category the syllables with the suspect feature of high pitch.

1. When high pitch is a contrastive feature of stress, the vowel of the stressed syllable is frequently lengthened. On the other hand, when high pitch is a feature of a tone system, the syllable with high tone is frequently shorter than a syllable with low tone even when they are in analogous environments.

<sup>1</sup> Kenneth L. Pike and Willard Kindberg, "A Problem in Multiple Stresses," *Word* 12 (1956): 415-28.

<sup>2</sup> Mary Stringer and Joyce Hotz, "Waffa Phonemes," *Te Reo* 14 (1971): 46.

A stressed syllable with high pitch is frequently lengthened.

Denes and Pinson say of English, "The experiment shows that duration, rather than the intensity, of the vowel segments can determine which syllable is heard stressed."<sup>3</sup>

Lehiste says of Polish, "In addition, Polish stressed vowels tended to be slightly longer than the same vowels in unstressed syllables..."<sup>4</sup>

Crawford says of Mixe, "Phonemically-short vowels occurring in the centers of phonemic-phrases are usually longer in actual duration than phonemically-long vowels in syllables with reduced stress."<sup>5</sup>

Swick says of Chuave that stressed syllables are "... characterized by stress, high pitch, slight intensity and lenis length."<sup>6</sup>

Rich says of Arabela, "A vowel in the nucleus of the stress group (the stressed syllable) may be slightly longer..."<sup>7</sup>

Even in a tone language the stressed syllable may be marked by length.

Pike and Scott say of the tone language Marinahua, "Each phonological word is a rhythm unit with a nuclear syllable which

is longer than other syllables of that word..."<sup>8</sup>

Lucht and James say of the tone language Siane, "Non-contrastive half-length often occurs on the vowel nucleus of a stressed syllable..."<sup>9</sup>

A syllable with a nonstressed high tone is frequently shorter than a syllable with a nonstressed low tone. Perhaps it is a universal that in a tone language a high tone is never longer than a low tone, when they occur in analogous environments. It should be understood, however, that not all tone languages have a high tone which is shorter than low. For example, no one has reported that to be so in the Mixtec languages.

Gill says of Panjabi, "The low tone is longer in duration than mid tone and mid tone is longer than high tone."<sup>10</sup>

Benedict says of Cantonese, "Some correlation exists with syllabic length, in that high tone in these syllables is usually associated with short vowel, while mid-high tone is associated with long (geminate) vowel..."<sup>11</sup>

Abramson says of Thai, "Generalizing from the last two tables, it can at least be said that the mid and low tones tend to be longer, and the high and falling tones shorter, than the rising tone."<sup>12</sup>

<sup>3</sup> Peter B. Denes and Elliott N. Pinson, *The Speech Chain* (Baltimore: Waverly Press, 1963), p. 136.

<sup>4</sup> Ilse Lehiste, *Suprasegmentals* (Cambridge, Mass.: M.I.T. Press, 1970), p. 135.

<sup>5</sup> John C. Crawford, *Totontepec Mixe Phonotagmemics*, Summer Institute of Linguistics Publications in Linguistics and Related Fields, no. 8 (Norman, Okla.: Summer Institute of Linguistics, 1963), p. 47.

<sup>6</sup> Joyce Swick, "Chuave Phonological Hierarchy," *Linguistic Circle of Canberra Publications, Occasional Papers* 7 (1966): 37.

<sup>7</sup> Furne Rich, "Arabela Phonemes and High-Level Phonology," in *Studies in Peruvian Indian Languages I*, ed. Benjamin F. Elson, Summer Institute of Linguistics Publications in Linguistics and Related Fields, no. 9 (Norman, Okla.: Summer Institute of Linguistics, 1963), pp. 197-98.

<sup>8</sup> Eunice V. Pike and Eugene Scott, "The Phonological Hierarchy of Marinahua," *Phonetica* 8 (1962): 2.

<sup>9</sup> R. Lucht and D. James, "Phonemes of Siane," *Te Reo* 5 (1962): 15.

<sup>10</sup> Harjeet Singh Gill, "Panjabi Tonemics," *Anthropological Linguistics* 2, no. 6 (1960): 11.

<sup>11</sup> Paul K. Benedict, "Tonal Systems in Southeast Asia," *Journal of the American Oriental Society* 68 (1948): 186.

<sup>12</sup> Arthur S. Abramson, *The Vowels and Tones of Standard Thai: Acoustical Measurements and Experiments*, Indiana University Research Center in Anthropology, Folklore and Linguistics Publication no. 20 (Bloomington: Indiana University, 1962), p. 108.

May and Loeweke say of Fasu, "When a high tone falls on the nuclear syllable of the word, it has extra intensity and the marginal syllables are quick in tempo. When a low tone falls on the nuclear syllables, it has extra length and the marginal syllables are slower in tempo."<sup>13</sup>

Pike says of Zapotec, "There is a tendency for a vowel with a tone /1/ [high] to have a slightly shorter allophone than does a vowel with tones /2/ or /3/."<sup>14</sup> That is, a high tone is shorter than a mid or low tone.

Pike says of Soyaltepec Mazatec, "Glides rising from tone 4 [low], furthermore, tend to be longer than glides rising from other tones."<sup>15</sup>

Upton says of Chatino, "The allophones of length are heavily conditioned by the tone or tone sequence with which they co-occur."<sup>16</sup> My field notes say that the high tones of Chatino are shorter than low tones.

It is important to recognize the tendency for a syllable with high tone to be shorter than a syllable with low tone. If that tendency is not recognized, and a syllable which has emic length as well as high tone is compared with a syllable with low tone (which is emically short), contrastive length may be overlooked.

In Popoloca, for example, a long high is no longer than a short low. Williams and Pike say of Popoloca, "Vowels have medium length allophones when mid tone,

short when high tone, and long when low tone . . ."<sup>17</sup>

2. When high pitch is a contrastive feature of stress, vowel quality is frequently conditioned by distribution into that stressed syllable versus distribution into a nonhigh syllable. On the other hand, when high pitch is a feature of a tone system, vowel quality is unaffected by distribution into a high versus a nonhigh syllable.

In a stress system, vowel quality is frequently conditioned by distribution in stressed syllables versus nonstressed syllables.

Lehiste notes, "In languages like English, there is a tendency for most vowels in weakly stressed syllables to approach schwa in quality."<sup>18</sup>

Stockwell says of English, "The distinction between weak and tertiary stress is shown entirely by vowel quality . . ."<sup>19</sup>

Lehiste quotes Fant as saying, ". . . that in Swedish, a decrease in stress, which is in most cases associated with a decrease in the duration of the vowel, shifts the formant pattern of the vowel toward that of the schwa . . ."<sup>20</sup>

Crawford says of Mixe, "Allophones of vowels vary somewhat between stressed and unstressed syllables."<sup>21</sup>

In Arabela, there are many vowel variants conditioned by their distribution in stressed versus unstressed syllables.<sup>22</sup>

In the tone systems which I have studied, vowel quality is not conditioned by

<sup>13</sup> Jean May and Eunice Loeweke, "The Phonological Hierarchy in Fasu," *Anthropological Linguistics* 7, no. 5 (1965): 94.

<sup>14</sup> Eunice V. Pike, "Problems in Zapotec Tone Analysis," *IJAL* 14 (1948): 167.

<sup>15</sup> Eunice V. Pike, "Tonally Differentiated Allomorphs in Soyaltepec Mazatec," *IJAL* 22 (1956): 71.

<sup>16</sup> Jessamine Upton, "Chatino Length and Tone," *Anthropological Linguistics* 10, no. 2 (1968): 1.

<sup>17</sup> Ann F. Williams and Eunice V. Pike, "The Phonology of Western Popoloca," *Lingua* 20 (1968): 379.

<sup>18</sup> Lehiste, p. 139.

<sup>19</sup> Robert P. Stockwell, "Review of *English Intonation: Its Form and Function* by Maria Schubiger," *Language* 36 (1960): 545, n. 2.

<sup>20</sup> Lehiste, p. 140.

<sup>21</sup> Crawford, p. 47.

<sup>22</sup> Rich, p. 198.

occurrence in a nonstressed syllable with high tone. Allotones, however, are frequently conditioned by the quality of the vowel with which the tone occurs.

Pike and Ibach say of Mixtepec Mixtec, "Tone variants may be conditioned by the vowel with which the tone occurs. The vowel /i/ usually has a higher pitch than the other vowels in the same environments . . ." <sup>23</sup>

Pankratz and Pike say of Ayutla Mixtec, "When in analogous environments, syllables with /i/ or /u/ frequently have higher allotones than syllables with /a/ or /o/." And, "When prepause, syllables with nasalized vowels frequently have lower allotones than syllables with oral vowels." <sup>24</sup>

Lehiste states, "If pitch level is considered phonemic, it must be kept in mind that its realization is determined to some extent by the segmental quality of the syllable nucleus over which it is realized." <sup>25</sup> (But Lehiste also says that in the Foochow dialect of Chinese, and in Vietnamese, vowel quality might have been influenced by tone.) <sup>26</sup>

Hari says of Thakali, ". . . the pitch of the breathy vowel is lower than the pitch of the clear one in the same stress position." <sup>27</sup>

<sup>23</sup> Eunice V. Pike and Thomas Ibach, "The Phonology of the Mixtepec Dialect of Mixtec," in *Hill Festschrift*, ed. Edgar C. Polome (Austin: University of Texas Press, in press).

<sup>24</sup> Leo Pankratz and Eunice V. Pike, "Phonology and Morphotoneemics of Ayutla," *IJAL* 33 (1967): 291-92.

<sup>25</sup> Lehiste, p. 70.

<sup>26</sup> Lehiste, p. 79.

<sup>27</sup> Maria Hari, "Thakali Tone and Higher Levels," in *Studies on Tone and Phonological Segments*, pt. 1 of *Tone Systems of Tibeto-Burman Languages of Nepal*, pts. 1-4, ed. Kenneth L. Pike and Austin Hale, Occasional Papers of the Wolfenden Society on Tibeto-Burman Linguistics, vol. 3 (Urbana: University of Illinois, 1970), p. 129.

3. In nontonal languages, voiceless vocoids may occur in nonstressed syllables as allophones of voiced vowels. In tone languages, however, voiceless vocoids seldom occur as allophones of vowels.

There are examples of nontonal languages which have voiceless vowel allophones. Spanish may have voiceless vocoids in nonstressed word-final syllables, especially in emphatic speech.

Rich, speaking of a stress group in Arabela, says, "This decrescendo may optionally go to voicelessness . . ." <sup>28</sup>

K. Pike and Kindberg say that in Campa there is "phrase-final optional unvoicing of many of the vowels . . ." and "The final phoneme, and sometimes the complete final syllable or even the last two syllables of words may be voiceless . . ." <sup>29</sup>

Concerning voiceless vocoids within tone systems, if there is emic tone on a syllable, that tone is seldom lost. The vowels may be lost, the consonant may be lost, but the tone is usually retained.

Westerman and Ward state, ". . . we find that generally speaking the tone of the elided vowel is not dropped entirely, but is often combined with that of the vowel which is retained and forms a new tone. This new tone keeps some characteristic of both tones . . ." <sup>30</sup>

K. Pike says that in San Miguel Mixtec there is a zero word which has lost its consonants and vowels but which still causes tone sandhi changes. <sup>31</sup>

Huautla Mazatec has about a dozen morphemes which have tone as the only remnant of one of its syllables. This tone is manifested only when it is preceded by a

<sup>28</sup> Rich, p. 202.

<sup>29</sup> Pike and Kindberg, p. 425.

<sup>30</sup> D. Westermann and Ida C. Ward, *Practical Phonetics for Students of African Languages* (London: Oxford University Press, 1933), p. 149.

<sup>31</sup> Kenneth L. Pike, *Tone Languages* (Ann Arbor: University of Michigan Press, 1948), p. 82.

morpheme ending in a higher tone. For example, there is the word  ${}^4\check{\text{sti}}^{3-4}$  *children*. In isolation it is heard as  $\check{\text{sti}}^{3-4}$ . But,  $\text{thi}^1$  *there are* +  ${}^4\check{\text{sti}}^{3-4}$  *children* becomes  $\text{thi}^{1-4}$   $\check{\text{sti}}^{3-4}$  *there are children*. (A nearby dialect has  $\text{ha}^4\check{\text{sti}}^{3-4}$  *children*.)

I do, however, know of three tone languages which may have voiceless vowels in restricted environments. In Molinos Mixtec, the vowel /i/ with low tone fluctuates to voicelessness when prepause and following a voiceless consonant.<sup>32</sup> In Coatzospan Mixtec, syllables with low tone and voiceless consonants fluctuate to voicelessness when prepause.<sup>33</sup> In Isthmus Zapotec, a declarative sentence with general downdrift and relaxation may end with voiceless unstressed final syllables.<sup>34</sup>

4. Allophones of consonants may be conditioned by their proximity to stress, whether that language be a tone or a non-tone language. On the other hand, allophones of consonants are not conditioned by their proximity to a syllable which is not stressed, even though that syllable may have high tone.

Following are some examples of languages with consonants conditioned by proximity to stress.

In Arabela, decrescendo occurs progressively throughout the pause group. The phoneme /k/ has fortis and lenis allophones [k, x, g, ɣ] which occur in accord-

<sup>32</sup> Georgia G. Hunter and Eunice V. Pike, "The Phonology and Tone Sandhi of Molinos Mixtec," *Linguistics* 47 (1969): 31.

<sup>33</sup> Eunice V. Pike and Priscilla Small, "Down-Stepping Terrace Tone in Coatzospan Mixtec," in *Advances in Linguistics*, ed. Ruth M. Brend (Amsterdam: North-Holland Publishing Co., 1973).

<sup>34</sup> Velma B. Pickett, "Isthmus Zapotec," in *Handbook of Middle American Indians*, vol. 5, ed. Robert Wauchope and Norman A. McQuown (Austin: University of Texas Press, 1967), pp. 297-98.

ance with that decrescendo. When a stressed syllable occurs within the pause group, a more fortis allophone will occur. Also, consonants are lengthened when contiguously following a stressed syllable.<sup>35</sup>

In Huajuapán Mixtec, /ʒ/ had [y] when noncontiguously following a stressed syllable.<sup>36</sup>

In Jicaltepec Mixtec, /č, k/ may be voiced when poststress, and /kʷ/ may be voiced in both prestress and poststress positions.<sup>37</sup>

In Apinayé, voiceless stops have voiced allophones when occurring prestress.<sup>38</sup>

From Hyman we get a summary of the relationship between consonants and tone. "From this cross-linguistic investigation of consonant types and tone rules, one clear generalization emerges: *consonants affect tone, but tone does not affect consonants.*"<sup>39</sup>

For example, Cheng says that in Taiwanese there are allotones conditioned by their occurrence in syllables ending with /p, t, k, h/ versus those ending with /b, l, g/.<sup>40</sup>

<sup>35</sup> Rich, pp. 194-96.

<sup>36</sup> Eunice V. Pike and John H. Cowan, "Huajuapán Mixtec Phonology and Morphophonemics," *Anthropological Linguistics* 9, no. 5 (1967): 3.

<sup>37</sup> C. Henry Bradley, *A Linguistic Sketch of Jicaltepec Mixtec*, Summer Institute of Linguistics Publications in Linguistics and Related Fields, no. 25 (Norman, Okla.: Summer Institute of Linguistics, 1970), p. 5.

<sup>38</sup> Eunice Burgess and Patricia Ham, "Multi-level Conditioning of Phoneme Variants in Apinayé," *Linguistics* 41 (1968): 13.

<sup>39</sup> Larry M. Hyman, "The Role of Consonant Types in Natural Tonal Assimilations," in *Consonant Types and Tone*, ed. Larry M. Hyman, Southern California Occasional Papers in Linguistics, no. 1 (Los Angeles: Linguistics Program, University of Southern California, 1973), p. 171.

<sup>40</sup> Robert L. Cheng, "Tone Sandhi in Taiwanese," *Linguistics* 41 (1968): 23, 38.

5. In a multiple stress language, the nonstressed syllables have considerable fluctuation of pitch, although they are usually (but not in all speech styles) lower in pitch than the stressed syllables.

In their initial stages of the analysis of Campa, K. Pike and Kindberg had thought that tone contrasts were pertinent.<sup>41</sup> One reason they abandoned that theory was because the pitch variations of the nonhigh syllables were so great.

Swick notes variation in the nonhigh syllables of Chuave, saying that in normal speech they vary from low to mid.<sup>42</sup> But in the speech styles of anger or panic the nonstressed syllables may have a pitch as high as that of the stressed syllable. The contrast between the stress and nonstress is maintained, however, by intensity and length.<sup>43</sup>

In Auca also—especially in fast speech—a nonstressed syllable may have a variant with a pitch as high as the stressed syllables.<sup>44</sup>

In a language in which tone is contrastive on the syllable level, the key at which the utterance is spoken may vary, and the spread between registers may vary, but when the same utterance is repeated in the same speech style, the sequence of pitches is relatively the same.

6. In a multiple stress system, since the stresses within a word all have high pitch, it may be impossible to identify one of the syllables as the nucleus of the word. The phonological word can be identified as a unit, however, if the borders are clearly audible.<sup>45</sup>

<sup>41</sup> Pike and Kindberg, pp. 418–20.

<sup>42</sup> Swick, p. 37.

<sup>43</sup> Swick, p. 41.

<sup>44</sup> Kenneth L. Pike, "Stress Trains in Auca," in *Kenneth L. Pike: Selected Writings*, ed. Ruth M. Brend (1964; reprint ed., The Hague: Mouton, 1972), p. 190.

<sup>45</sup> Kenneth L. Pike and Graham Scott, "Pitch

In a tone system, the nucleus of a word is often more easily identified than the borders, even though that nucleus may not have high tone. For example, in Amuzgo<sup>46</sup> and in Western Popoloca<sup>47</sup> the stem-final syllable is the nucleus. In Marínahua,<sup>48</sup> the nucleus is the first syllable of the stem. In Palantla Chinantec,<sup>49</sup> the minimal word may be one stressed syllable, or the word may have as many as four unstressed syllables preceding and/or following the nucleus.

7. A language with high-pitched syllables versus those which are nonhigh should be checked using the characteristics discussed above, for the possibility of a multiple stress system (with stressed and nonstressed syllables) versus a tone system (with high and low tones).

It is important for various reasons for the outsider to know whether or not the language has a stress system or a tone system.

(1) If the outsider thinks stress when he starts talking the language, he automatically makes the syllable the nucleus of a rhythm unit, probably lengthening the vowel in the stressed syllable, and perhaps changing the quality of the nonstressed vowels, etc. If the high-pitched syllables are not stressed in that language, he will have used wrong allophones.

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Accent and Non-Accented Phrases in Fore (New Guinea)," *Zeitschrift für Phonetik, Sprachwissenschaft und Kommunikationsforschung* 16 (1963): 185; and Kenneth L. Pike, *Language in Relation to a Unified Theory of the Structure of Human Behavior* (The Hague: Mouton, 1967), p. 420.

<sup>46</sup> Amy Bauernschmidt, "Amuzgo Syllable Dynamics," *Language* 41 (1965): 472.

<sup>47</sup> Williams and Pike, p. 379.

<sup>48</sup> Pike and Scott, p. 2.

<sup>49</sup> William R. Merrifield, "Palantla Chinantec Syllable Types," *Anthropological Linguistics* 5, no. 5 (1963): 2.

(2) Another reason for differentiating the two systems is that drills made for the teaching of reading will differ according to the system.<sup>50</sup> In drills for a tone language, a high syllable can be contrasted with a low syllable, but in a multiple stress language, stress versus nonstress must be taught as part of a rhythm group.

(3) In recording the tones of a tone

language, it is perhaps easiest to start listening for contrast by using a frame and a substitution list of words with one or two syllables. On the other hand, when recording the stresses of a multiple stress language, it may be easiest to start recording the contrasts by listening to words which have four or five syllables. With these words the investigator listens not for pitch, but for rhythm, and he separates the words into like rhythm groups.

<sup>50</sup> Sarah Gudschinsky, private communication, 1973.