PIKE-SCOTT'S ANALYSIS OF FORE SUPRASEGMENTALS

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1. FORE AS A LANGUAGE WITH DISTINCTIVE STRESS

In their analysis of Fore suprasegmentals K.L. Pike and G. Scott[1] encounter the following difficulty: Fore words are characterized by different pitch patterns. There are three phonemically different pitch patterns. Each Fore word is characterized by exactly one of these three pitch patterns. There are minimal pairs which differ audibly by pitch only. Pike and Scott hesitate whether to categorize these pitch patterns as tone or stress. They should be stress, as they characterize words. However, as they are heard as pitch (not loudness), they should be tone (not stress). Pike and Scott avoid a decision by calling the phenomenon neither stress nor tone, but accent: "The reason for speaking of 'accent' is to soften an overemphasis on intensity"[2].

The root of the difficulty is in the expectation that stress should be represented acoustically as intensity, not as fundamental frequency. Inversely, fundamental frequency is expected to signal tone or intonation, but not stress. At the same time, stress is correlated with the word, tone with the syllable[3]. The underlying theory of suprasegmentals thus envisages a set of ternary relations:

Theory (1):

Linguistic Category	Linguistic Correlate	Auditory Parameter[4]
tone	syllable	pitch
stress	word	loudness
intonation	phrase[5]	pitch

Looking on this theory as a purely formal structure, we may wonder: Must the ternary relations always be one-one-one (in the horizontal dimension)? In fact, a one-two relation has already crept in between pitch (third column) and tone/intonation (first column). Why not generalize on this and assume a many-many relation between the linguistic categories (first column) and the phonetic parameters (third column), at the same time conserving the one-one relation between the first and second columns[6]? Then word-stress can be represented either by pitch or by loudness. In Fore, it is represented by pitch, as we see from Pike-Scott's report. Thus the contradiction between the linguistic theory (1) and the Fore suprasegmentals disappears. The modification here proposed makes the

theory more adequate to the Fore language. What Pike-Scott call 'accent' turns out to be stress manifested by phonetic parameters other than loudness.

Let us go one step further, proposing to allow in the third column not only pitch and loudness, but any phonetic feature whatever. In other words, let us sever the connection traditionally assumed between the suprasegmentals as categories of linguistics on the one hand, and, on the other, specific phonetic features under which they must be manifested in every language in which they occur[7]. Thus the ternary relations of theory (1) will be replaced by two sets of binary relations:

Theory (2)

(a) linguistic category	linguistic correlate
tone	syllable/more[8]
stress	morpheme/word[9]
intonation	phrase

(b) linguistic category	phonetic feature
tone	Υi
stress	Υi
intonation	Υi

Explanation of symbols: Υi is a bound variable for any subset of phonetic features which manifests the suprasegmentals in a specific language.

In plain words, we give up the assumption that the suprasegmentals must always be represented by specific "prosodic features". For us, stress characterizes morphological units such as the morpheme or the word. Tone characterizes high-level phonemic entities such as the syllable or the more - whatever their phonetic manifestation in a particular language. The relationship between the suprasegmentals of linguistic analysis and the "prosodic features" of phonetics, as we view it, is not one of definition (the suprasegmentals being "defined" by the prosodic features), but one of favoured phonetic representation, i.e. the prosodic features represent the suprasegmentals often, but not invariably. We see analogous relationships between many other linguistic categories and their favoured representations. For instance, syllable nuclei are often (but not invariably) represented by vocoids, syllable margins by contoids. But in some instances contoids represent syllable nuclei (e.g. in the German interjection pst), and vocoids represent syllable margins (e.g. the so-called semi-vowels of English). Similarly, tone and intonation favour pitch as their phonetic manifestation. But in some instances other phonetic features are involved

in their manifestation, such as glottalization (in one of the tones of Burmese and in two of the tones of Vietnamese[10]) or voice quality (in the fadeaway of English intonation).

As a corollary of theory (2) we allow yet another current assumption to lapse, namely the assumption that while tone is distinctive, stress is not distinctive, but culminative[11]. In some languages (such as Russian, Spanish, and Welsh) stress is indeed only culminative, but not distinctive. There are minimal pairs with different places of stress, such as

Russ. vjaž̌u 'I knit' ≠ vǐžu 'I see'

Span. pasó 'he went' ≠ páso 'I go'

Welsh yntế 'is it not so?' ≠ ỹnteu 'he, too'

But there are no minimal word-pairs in these languages in which different degrees of stress commute with each other in the same place. Thus different stress phonemes do not form oppositions in the way in which phonemically different tones do.

However, if we categorize the Fore 'accent' as stress, then Fore is a language with distinctive word-stress; witness the minimal pairs adduced by Pike and Scott. We are not accustomed to thinking of word-stress as distinctive. This is probably another reason why Pike and Scott find it so difficult to categorize the suprasegmentals of Fore. Still, even though stress has generally been regarded as non-distinctive in the European languages, why should it not be distinctive in some other languages? Fore is one such language.

2. OTHER LANGUAGES WITH DISTINCTIVE STRESS

We claim that theory (2) is more adequate to the analysis of suprasegmentals than theory (1). In order to substantiate this claim, we shall try to show that

(i) contradictions analogous to the ones for Fore arise in other languages under theory (1), but not under theory (2),

(ii) theory (1) implies certain hypotheses which can be refuted when checked against the empirical evidence of certain languages.

A parallel to Fore is offered by Swedish and Norwegian. Both languages have two different kinds of word-stress (under our definition). As in the case of Fore, linguists teeter whether to categorize them as stress or tone, and they are commonly known as 'accent 1' and 'accent 2', both together under the Norwegian word 'tonelag'[12]. There are very many minimal pairs, e.g.

Norw. ^{1}været 'weather' ≠ ^{2}væ re 'to be'

Swed. ^{1}buren 'cage' ≠ ^{2}buren 'carried'

The distinction is neutralized for words with the place of stress on the ultimate

syllable. All other words have either 'accent 1' or 'accent 2'. Several phonetic parameters are involved in the distinction, notably pitch and duration, but also overall acoustic intensity[13]. The situation in Swedish and Norwegian is, to this extent, analogous to the situation in Fore. All three languages have distinctive word-stress manifested phonetically (inter alia) by pitch.

The Danish cognate of the Swedo-Norwegian 'tonelag' is technically known as 'stød'. Every Danish word either has the stød, or it has not. Presence of stød is cognate with 'accent 1' of Swedo-Norwegian, absence of stød is cognate with 'accent 2'. There is, however, no neutralization in Danish for words with ultimate stress. The stød is manifested phonetically by glottal stricture, either by glottal friction or by an ingressive glottal stop. The stød has been analyzed as suprasegmental by A. Martinet[14].

Certain varieties of English, notably in the United States and in Scotland, also have distinctive word-stress. A minimal pair known to Floridian speakers of English interested in fishery and marine biology is permit 'authorization' ≠ permit 'baby pompano'. The distinction is heard as the lower pitch and the shorter duration of the second syllable -mit in the name of the fish as compared with the deverbative noun. The distinction is strictly observed in all styles of speech. Speakers who do not have the fishname permit in their vocabulary have a similar opposition between permit 'authorization' ≠ hermit 'anchorite', starlit ('a starlit sky') ≠ starlet, cuckoo 'crazy' ≠ cuckoo (bird name). This distinction is observed not only by Americans, but also by some Australian and New Zealand speakers[15].

German has distinctive stress on nominal compounds such as

steinreich 'very rich' ≠ steinreich 'rich in stones'.
Riesenspielzeug 'very tall toy' ≠ Riesenspielzeug 'toy for giants'.

The audible difference is in the falling pitch on the first syllables of steinreich, Riesenspielzeug, compared to a level pitch on the first syllables of steinreich, Riesenspielzeug.

Distinctive word-stress represented phonetically (inter alia) by pitch has also been reported for Latvian, Lithuanian, Serbocroat, Japanese, and for some languages of Papua-New Guinea other than Fore. It is fairly safe to predict that it will be found to exist in a few more languages. The same contradictions as for Fore arise for all these languages, if we analyze their suprasegmentals under theory (1) rather than under theory (2). No contradictions absent from theory (1) arise under theory (2). In this sense theory (2) is more adequate to the analysis of languages than theory (1), i.e. a larger number

of languages can be described in terms of theory (2) than of theory (1). The correlation between stress and loudness/intensity in theory (1) may not be adequate to any language at all - witness the phonetic parameters of word-stress as studied experimentally for a few languages[16]. It is equally safe to predict that even theory (2) will be found to be inadequate for some languages whose suprasegmentals I have not studied[17]. Therefore all we claim is that theory (2) is a better linguistic theory than theory (1). We do not claim "universal validity" for theory (2). Such a claim would be absurd.

3. FALSIFICATION OF CURRENT THEORIES OF STRESS

Theory (1) creates further insoluble problems for the categorization of distinctive 'pitch-accent'. If pitch, loudness and duration are all three involved in the tonelag of Swedish and Norwegian, it would follow under a widespread version of the distinctive feature theory that one of these three prosodic features must be distinctive, the other two redundant[18]. If pitch is distinctive (so the argument runs on), then tonelag is tone or intonation. If loudness is distinctive, then it is stress. If duration is distinctive, then it is quantity, etc. Appropriate psycho-acoustic experiments can be conducted. Let us use synthetic speech in which fundamental frequency, intensity and duration can be controlled separately. We play minimal pairs to an audience suppressing all prosodic parameters except the fundamental frequency. We find that the listeners can still discriminate between the minimal pairs. We conclude that fundamental frequency is distinctive for the Swedo-Norwegian tonelag, but intensity and duration are redundant.

This type of inference is unwarranted. If we suppress all prosodic features except length, the listeners will also be able to discriminate between the members of the minimal pairs, and similarly for overall intensity. This makes the contradiction complete. Any one of the phonetic parameters involved in the distinction can be "proved" distinctive under this procedure. Consequently, the Swedo-Norwegian tonelag can be "proved" to be both tone (not stress) and stress (not tone) and even quantity (neither tone nor stress). This is contradictory.

Another contradiction which arises under theory (1), but not under theory (2) concerns the theory of universals. Assuming that for all languages voice is used in speech, we infer that all languages must have pitch and loudness, as these two parameters are essential attributes of voice. On the strength of theory (1) we further infer that all languages have intonation and stress. In other words, stress and intonation are "universal". In fact one frequently comes across statements to this effect[19].

However, there are some languages which have no stress correlated with the morpheme or the word, although this correlation is stipulated by theory (1). One such language is French. French has (in non-emphatic utterances) a rise-fall in pitch at the end of phrases, but no special phonetic characterization of words or morphemes. French has phrasal intonation, but no word-stress[20].

Another such language is (probably) Finnish. In Finnish every syllable has its specific pitch pattern which is correlated with the phonemic structure of the syllable. This syllable-specific pitch pattern makes Finnish appear similar to a tone language. However, the syllable pitch is not distinctive in Finnish. It depends on the syllable type -V, -V̄, -VK, -V̄K̄, -Vh etc. There is no audible distinction in Finnish between syllable sequences containing the same phonemes in the same order, but with different word-boundaries. For instance juustoleipä ja maito 'the cheese-sandwich and the milk' is, in current speech, homophonous with juusto, leipä ja maito 'the cheese, the bread and the milk'. In over-differentiated speech[21], a pause is introduced after juusto in the second instance.

I do not personally know of any language without intonation. However, K.L. Pike at least suggests that some tone languages have no intonation correlated with phrases, but only "intonation" in the sense of expressive voice characteristics[22]. These two kinds of "intonation" are separate linguistic categories[23], even if pitch should be involved in both of them in some languages.

In conclusion, let me report about an experiment which Dr. I.H.M. Truby (presently of the University of Arizona) conducted with me in Stockholm in 1958. Assuming that stress was correlated with acoustic intensity, we recorded the English noun pérmit. At the beginning of the second syllable, we turned up the volume. If stress is loudness, we reasoned, then the word should now sound like the verb permít. In fact, it did not. It was still unmistakably the noun pérmit, but with the second syllable shouted out loud. We had to conclude, reluctantly at that time, that stress and shouting were linguistically different. Subsequent investigation has shown that pitch is one of the major phonetic parameters of stress in English[24], but length, vowel quality, aspiration and many other phonetic features are also involved.

Footnotes

1. Zf phonetik 16 (1963), 179 - 189. The present paper owes much to discussion by Professor G. H. Hammarström of Monash University.
2. ib. fn.2. Such views are shared by many other linguists, cf. "The difference between stress and accent, then, is based on which of the attributes of sound is the perceptually most dominant feature of utterance: in the case of stress, the dominant perceptual component is loudness, in the case of accent, the dominant perceptual component is pitch" (D. Crystal, Prosodic Systems and Intonation in English, Cambridge 1969, 120). Neo-grammarian phonetics analogously distinguishes between the musical accent of Greek and Lithuanian (said to be correlated with pitch) and the expiratory accent of English and German (said to be based on expiratory force).
3. Cf. "L'accent est la mise en valeur d'une syllabe et d'une seule dans ce qui represente, dans une langue determinee, l'unite accentuelle. Dans la plupart des languages, cette unite accentuelle est ce qu'on appelle couramment le mot" (A. Martinet, Elements de linguistique generale, Paris ^{3}1967, 89, italics mine). "A tone language may be defined as a language having lexically significant, contrastive, but relative pitch on each syllable" (K. L. Pike, Tone Languages, Ann Arbor 1947, 3, italics mine).
4. The corresponding acoustic parameters are fundamental frequency and intensity, the corresponding articulatory parameters are frequency of vocal chord vibration and expiratory force. We take this correspondence (which is not always one-one) for granted in the present discussion.
5. Cf. "Intonations are distributed over phrases, rather than being completed on single syllables" Pike, op. cit. 15; italics mine). The word intonation is also used in the wider sense of pitch changes correlated with the speaker's mood, feelings or biography, cf. fn.23 below.
6. The one-one relation between the first and second columns will, in the revised theory, "define" the suprasegmentals as linguistic categories. This can no longer be done by the relation between the first and third columns, as this is many-many.
7. We are not the first to advance this idea. A similar revision of theory (1) has been proposed by G. H Hammarström, Linguistische Einheiten im Rahmen der modernen Sprachwissenschaft, Berlin 1965, 33-37; Phonetica 10 (1963), 194-202. Dissatisfaction

with theory (1) has also been expressed by the linguists around A. Martinet, cf. "mais ces distinctions sont fondees plus sur les differences physiques que sur les differences de fonction, et, a ma connaissance, personne n'a ose jusqu'ici faire, de la fonction, le principe de base dans la classification des faits prosodiques" (Martinet, quoted by J.W.F. Mulder, Sets and relations in phonology, Oxford 1968, 209, italics mine. Neither author is aware of Hammarström's work nor of my paper "Intonation: experimentelle und strukturelle Daten", Cahiers de linguistique theorique et appliquee, Bukarest 1966, 131-136).

8. The one-two relation between tone and syllable or more is required by some languages with a gliding tone system (in Pike's analysis). In some such languages, the more (not the syllable) may be considered the carrier of tone, cf. Martinet, Elements 88.
9. In some languages (such as Russian and Old English), it is appropriate to regard the morpheme (rather than the word) as the carrier of stress, in order to account for the stress placement (cf. P. Garde, Slavia 34 (1959, 529 - 559) and for the subsidiary stresses on some affixes (cf. my Altenglische Grammatik, Munich 1970, Section 12).
10. Cf. Martinet, Elements 87, and my article quoted fn.7.
11. Cf. Martinet, Elements 91 f.
12. K. L. Pike, op. cit. 14 categorizes Swedish and Norwegian as languages with a 'word-pitch system'. A. Martinet, op.cit. 87 and E. Sivertsen, Fonologi, Copenhagen 1967, 126 fn.1, regard the distinctive stress of Swedish and Norwegian as tone (because of its pitch component). Our interpretation is closest to Pike's. The difference is that Pike's 'word-pitch' or 'accent' is not integrated into an overall theory of the suprasegmentals, but our 'distinctive word-stress' is. Otherwise the two terms appear synonymous.
13. In this instance, we invoke the acoustic parameter rather than its auditory correlate 'loudness', as the relationship between the two is not one-one and the experimental data available refer to the acoustic rather than to the auditory level.
14. La phonologie du mot en danois, Paris and Copenhagen 1937.
15. Cf. my article, "English Intonation: A phonemic analysis," Phonetica (to appear).
16. Under the pressure of phonetic data, some linguists have substituted 'prominence' for 'loudness' in theory (1) as the auditory correlate of stress. However, 'prominence' is no phonetic parameter at all, neither acoustic nor auditory. At least, it is not

specified in phonetic terms. Thus 'prominence' remains, at best, a mere synonym for 'stress'.

17. Hammarström, op.cit. 39-46 offers more elaborate theoretical equipment correlating special prosodic categories with a long list of linguistic correlates (syllable, morpheme, lexeme etc), but this apparatus has not been used so far.

18. This popular version of the distinctive feature theory has been rejected by Hammarström, op.cit. 35. B. Malmberg, Structural Linguistics and Human Communication, Berlin 1963, chapters 5 and 6, interprets distinctive features as successively higher levels of abstraction. The present writer, Phonemtheorie I, Basel and New York ^{2}1968, 57, has sought to make the theory more adequate by dichotomizing between distinctive features (the minimum of phonetic features present in a distinction) and relevant features (the set of features present in all variants of a given phoneme).

19. D. L. Bolinger, "Intonation as a universal", Proceedings of the 9th International Congress of Linguists, The Hague 1964, 833-848, uses a more sophisticated approach, claiming universality for the final low pitch on statements and the final high pitch on yes-or-no questions. However, as this does not even hold for English, one may wonder how true it is for the host of little-known languages which Bolinger invokes. Noting "how much the intonation of Western Desert in Australia is like that of English" (op.cit. 839f), I should suspect that there is something wrong with the analysis. Has the analyst, perhaps, interpreted his auditory impressions as though they were English? Do not some grammarians find the cases of Latin (or German) in whatever language they study? At the present conference, a tape was presented purporting to teach foreign students how to say: "Do you want tea? or coffee?" The intonation on the tape diverges radically from the intonation used on this question by the air hostesses whom I have observed. Yet the tape has been approved by many competent native speakers. Again, I should suspect that this specimen of interrogative intonation is "universal" rather than English. Professor A. Delbridge has presented similar evidence at this conference. If linguists are so easily misled even when describing the intonation of a language which they hear every day, how far can we trust their reports that they heard the same thing in the Western Desert?

Ch. Hockett, "The Problem of Universals in Language", in Universals of Language, ed. J. Greenberg, Cambridge (Mass.) and London ^{2}1966, 19 (in our opinion, correctly) rejects this type of "universal".

20. Cf. the analysis of B. Malmberg, Cahiers de linguistique theorique et appliquee 3 (Bukarest 1966) 99 - 107.
21. The term is borrowed from K. L. Pike, Language in relation to a unified theory of the structure of human behaviour, The Hague ^{2}1967, 324.
22. Cf. "All tone languages have intonation of the emotional type, but I have not seen reported for them....intonations that carry shades of meaning" (Tone languages 16f).
23. Hammarström, op.cit. 6-13 and Phonetica 10 (1963), 194-202, is, to my knowledge, the first sharply to draw this distinction, correlating it with different levels of linguistic analysis. He envisages suprasegmentals on the α-level (correlated with linguistic units), β-level (correlated with the speaker's mood or feelings), γ-level (correlated with the speaker's biography, i.e. with his personality, social background, etc. In the present article, we limit ourselves to the α-level.
24. Cf. D. Bolinger, "A theory of pitch-accent in English," Word 14 (1958), 109-149.