Proc. 5th int. Congr. phon. Sci., Münster 1964, pp. 367–370
(S. Karger, Basel/New York 1965).

From the University of Illinois

Degrees of Difference of English Consonants

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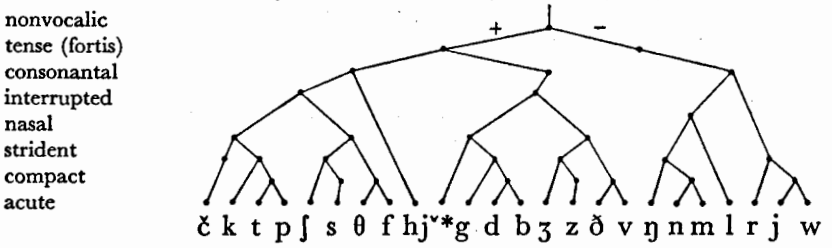
The ordering of features in the tree shown below was fixed for another purpose; here the tree serves to explain the assignment of features in the accompanying table. In the table the vocalic feature is reversed in sign and consonantal put next to vocalic to agree with the usual practice, and redundant features are marked ·, ○, and × to specify certain operations in calculating degrees of difference. In accord with the scheme used by *Sol Saporta* in 1955 (Language *31:* 25–30), which was based on the analysis by *Jakobson, Fant,* and *Halle* of 1952 (Preliminaries to Speech Analysis), the difference between

English Consonants (= Syllable Marginals)



	č	k	t	p	ʃ	s	θ	f	h	j	ˇ*	g	d	b	ʒ	z	ð	v	ŋ	n	m	l	r	j	w
vocalic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+
consonantal	+	+	+	+	+	+	+	+	–	+	+	+	+	+	+	+	+	+	+	+	+	+	–	–	–
tense (fortis)	+	+	+	+	+	+	+	+	+	–	–	–	–	–	–	–	–	–	○	○	○	○	○	○	○
interrupted	+	+	+	+	–	–	–	–		+	+	+	+	–	–	–	–								
nasal																			+	+	+	–			
strident	+	–	–	–	+	+	–	–		+	–	–	–	+	+	–	–								
compact	+	+	·	·	+	–	·	·		+	+	·	·	+	–	·	·	+	·	·		+	·	·	
acute	·	·	+	–	·	×	+	–		·	·	+	–	·	×	+	–	·	+	–		·	+	–	

* This symbol is used because the standard symbol for the lax-interrupted-strident (affricate) is not available.

+ and — for any feature may be counted as 2 and that bet een + or — and · counted as 1. The ○, which makes allowance for the non-distinctive phonetic–tense of sonorants and semivowels, is counted as 1 different from + and not different from —. The ×, for the phonetic acuteness of /s/ and /z/, is counted as 1 different from — and not different from · or +. It is obvious that I am assuming that the distinctive features have phonetic reference, i.e. are observable without or with the aid of instruments, which it seems to me they must be to be of any significance beyond mere coding.

In the main table, on this page, the degrees of difference between consonants are shown below and to the left of the diagonal line of symbols. The analysis is shown to the right and above in blocks of the eight features, ordered:

vocalic consonantal tense interrupted
nasal strident compact acute

The marks '', ', and · indicate two, one, and no difference counts for each feature.

Degrees of Difference

č																							
2	k																						
4	2	t																					
4	2	2	p																				
2	4	6	6	ʃ																			
4	6	5	6	2	s																		
6	4	2	4	4	3	θ																	
6	4	4	2	4	4	2	f																
2	2	2	2	2	2	2	2	h															
2	4	6	6	4	6	8	2	4	ǰ														
4	2	4	4	6	8	6	6	4	2	g													
6	4	2	4	8	7	4	6	4	4	2	d												
6	4	4	2	8	8	6	4	4	4	2	2	b											
4	6	8	8	2	4	6	6	4	2	4	6	6	3										
6	8	7	8	4	2	5	6	4	4	6	5	6	2	z									
8	6	4	6	6	5	2	4	4	6	4	2	4	4	3	ð								
8	6	6	4	6	6	4	2	4	6	4	4	2	4	4	2	v							
3	3	5	5	3	5	5	5	5	2	2	4	4	2	4	4	4	ŋ						
5	5	3	5	5	4	3	5	5	4	4	2	4	4	3	2	4	2	n					
5	5	5	3	5	5	5	3	5	4	4	4	2	4	4	4	2	2	2	m				
3	3	3	3	3	3	3	3	5	2	2	2	2	2	2	2	2	2	2	2	l			
5	5	7	7	5	7	7	7	3	4	4	6	6	4	6	6	6	2	4	4	2	r		
7	7	5	7	7	6	5	7	3	6	6	4	6	6	5	4	6	4	2	4	2	2	j	
7	7	7	5	7	7	7	5	3	6	6	6	4	6	6	6	4	4	4	2	2	2	2	w

While the analysis and the numbers are disputable, I do not intend to discuss them now. I want to comment on some situations in which the use of degrees of difference calls for the application of phonetic or distributional considerations which cannot get into the overall systematic array.

My scheme shows differences of 6, 5, and 2 between /t/ and /ʃ/, /s/, and /θ/ respectively. *Saporta* has 7, 4, and 2. Either set of numbers applies well enough for what might be a useful application to contrasts of *tie* with *shy*, *sigh*, or *thigh* in neutral context. Neither scheme will work when the question is on successive segments in a text, as in *Saporta's* article. A /t/ is as completely homorganic with an adjacent /ʃ/ or /s/ as it is with an adjacent /θ/, and there can be no difference among the degrees of difference except for stridency, where /ʃ/ and /s/ are each two degrees farther from /t/ than is /θ/. The counts must be 4, 4, and 2 here.

A similar adjustment must sometimes be made when the contrast between words is in question, perhaps the most generally useful application of the scheme. The feature of voicing is now almost universally considered to be nondistinctive in English, but one cannot deny that in most cases it plays a part in the distinction in perception, and perception is as much a factor in evaluating the usefulness of degrees of difference as is economy of production. In *tray* the /r/ is voiceless, in *dray* voiced. The difference between *tray* and *dray* may be no greater than that between *Tay* and *day*, where the equivalent supplementary differentiation in the aspiration of the /t/ is also not taken care of in the table. It is, however, surely greater than that between *rate* and *raid* before pause with /t/ not aspirated, and /d/ mostly devoiced, where the difference in the length of the vowel is the conspicuous realization of the 2-point fortis-lenis opposition. In the notorious *writing* versus *riding*, the voicing of the /t/ greatly reduces the reliability of perception of the /t/ – /d/ contrast. The degrees of difference should certainly be reduced from the 2 shown in the table to 1.

For *tray* or *dray* versus *ray*, it will hardly do to count up the number of distinctive features in /t/ or /d/ and call that the difference. In this case I think the best count is the difference between /t/ or /d/ and /r/, *tray* no more different from *ray* than is *Tay*, and *dray* – *ray* equal to *day* – *ray*. Note from the table that the first difference is greater than the second. In not quite the same way, *stray* cannot be more than 2 degrees of tension different from *dray* because the /s/

and the phonetic structure of the syllable are predictable; all one needs to perceive is that there is more to the former. Some such operation will, I think, do for all cases where the –l consonant, that next to the vowel, is the same for both words, and perhaps also for contrasts of the shape CV– versus V–.

For such a prevocalic contrast as *black* versus *track*, from an actual list (given by *J. W. Black* in Journal of Speech and Hearing Disorders *28:* 81), the difference can be no more than that between /b/ and /t/ for another reason: in /'b–æk/ only /l/ occurs in an available English word and in /'t–æk/ only /r/. For *stubble* versus *trouble*, from the same list, the orthographically apparent difference in tension for the –l consonants is of course cancelled by the phonetic structure and the other possible differences by occurrence, leaving only the /s/ – /t/ difference effective.

I make only two comments on postvocalic clusters. The difference between *things* /'θɪŋz/ and *thinks* /'θɪŋks/ is only that between /z/ and /s/, because the /k/ is predictable. No two clusters can have more than 2 degrees of difference in tension, i.e. one +—, because such difference must be fixed by the first or second consonants and beyond that is invariable, exx.: /–vdz/ – /–fts/ (words?), /–ndz/ – /–lts/.

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Discussion

Black (Columbus): May I elaborate on the 4-word group Mr. *Hultzén* has put on the board: fair, bare, care, and pair, and the respective scores 40, 76, 47, and 57. These words appear together because when one of them was used as a stimulus the other three occurred most frequently among the error responses. Later, and purely for experimental purposes, each of these three words was used as a stimulus and auditors were asked to identify from the 4-word group which one had been spoken. Thus, when *fair* was the stimulus it was reorganized correctly by 40% of the listeners; when *bare* was spoken it was reorganized by 76% of the listeners, etc.

Now with respect to predicting the foregoing outcomes, I would only call attention to the characteristically low scores that attend [f] and thus would expect *fair* to be the least identifyable of the 4 words, in keeping with the obtained results. I wonder whether or not Mr. *Hultzén* has tried other predictive formulas, for example ones that give weightings to sound pressure level.