

ON DIAGRAMMING VOWEL SYSTEMS

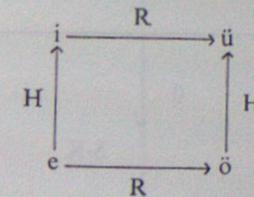
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The arrangements of vowel phonemes in two- or three-dimensional charts has long been a favorite pastime of linguists. We are all familiar with the traditional *phonetic* chart in which the sounds are displayed in half-empty rows and columns roughly reflecting the shape of the oral cavity. Since Trubetzkoy a different kind of vowel diagram has been attempted, in which the arrangements have been made in terms of distinctive features, and the resulting shapes have been seen as linguistically significant. In recent years this interest has extended also to American linguists, notably Chas. Hockett in his *Manual of Phonology* (1955), while Roman Jakobson and his associates have been developing and refining the Prague School doctrine of distinctive features.

Unfortunately it is not always clear just what principles have been adopted to arrive at the shapes established. Eli Fischer-Jørgensen has pointed out that vowel systems may be plotted in different ways, "according to the number of formants and the frequency scales employed".¹ She has further defined the purpose of such plotting to be "the establishment of an acoustic space in which the phonemes or phoneme variants of a given language can be placed". It is to the study of this "acoustic space" I would like to address myself in this paper. I suggest that we might well refer to such study as "phonemic topology". My suggestions concerning this topology grow out of my study of the Icelandic phonemic system, the results of which I published in 1958. My analysis was preceded by those of Einarsson and Malone, and followed by those of Hreinn Benediktsson and Steblin-Kamenskij, both of whom have thrown valuable new light on the problem.²

One of the first problems raised in any such discussion is that of symmetry. I regard it as an axiom that symmetry is merely a way of stating that the same dis-

tinctive feature occurs in more than one place in the system, or what we might call a kind of "phonetic redundancy." Further I would like to point out that a distinctive feature constitutes a proportion or ratio between neighboring phonemes. In Icelandic there is one indisputable case of such symmetry, which we may take as the starting point of our discussion. Here two features form a double proportion and can graphically be presented as a square.³ These are /e i ö ü/, which with respect to height (H) form the ratio /e : î=ö : ü/, and with respect to rounding (R) form the ratio /i : ü = e : ö/.



Here the vertical arrows represent height, the horizontal ones rounding. Each feature occurs twice, making a 2×2 system. In principle all four phonemes are identical except for these features, and in fact they do have much in common, e.g. that all are slightly relaxed when lengthened so that the end is more open than the beginning. In certain types of Icelandic the two higher ones tend to be confused with the lower ones. Whatever difference there may be between /i ü/ or /e ö/ in H, or between /e i/ or /ö ü/ in R, is negligible because it is proportional for both.

While all scholars agree on the four vowels so far presented, the rest are in question. We shall first consider low central unround /a/ vs. mid back round /o/. As the description shows, they differ in three phonetic features, and there is no agreement on their relation to the preceding four. In the articles cited above we find these patterns (diagrams on next page).

This just about exhausts the reasonable possibilities, and illustrates the problem. KM considered H alone relevant and placed them both in a "back" column; but /a/ is not back, and both of them are lower than their peers in the two other rows. HB considered R alone relevant and placed them both in a "low" row; but /o/ is not low, and both of them are farther back than their peers in the two columns. I tried out a new arrangement in which /o/ retained its mid feature (it also shares with /e ö/ a tendency to open), and I called them both "neutral" with respect to R (±), a procedure that has been somewhat misunderstood.⁴ S-K tried to make both

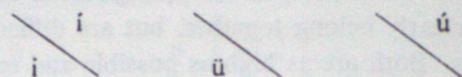
¹ "What can the new techniques of acoustic phonetics contribute to linguistics?" in *Proceedings 8th International Congress of Linguists* (Oslo, 1958), pp. 433-78, esp. p. 445; also *Phonetica* (Basel, 1959), 4, p. 15.

² Stefán Einarsson, *Icelandic* (Baltimore, 1945); Kemp Malone, "The Phonemes of Modern Icelandic", in *Studies in Honor of A. M. Sturtevant* (Lawrence, Kansas, 1952), pp. 5-21; Einar Haugen, "The Phonemics of Modern Icelandic", in *Language* 34, pp. 55-88 (1958); Hreinn Benediktsson, "The Vowel System of Icelandic", in *Word*, 15, pp. 282-312 (1959); M. I. Steblin-Kamenskij, "The Vowel System of Modern Icelandic", in *Studia Linguistica*, 14, pp. 35-46 (1960); cf. also Sveinn Bergsveinsson, "Isländische Ponetik", in *Phonetica*, 5, pp. 43-64 (1960), esp. p. 61.

³ The symbols here used for Icelandic phonemes are those of the Icelandic alphabet except that *u* is written /ü/ to mark its quality and that the diphthongs are broken up into their elements: *á* /aú/, *au* /öi/, *ei* /eí/, *ó* /oú/, *æ* /ái/.

The argument for these writings will be found in Einarsson.
⁴ It was not my intention to suggest that "the feature of lip-rounding is considered ternary" as stated by HB; I merely intended it to be irrelevant, a procedure which is well-known even among adherents of binary analysis. As for a ternary distinction in rounding, the fact that it has been proposed for Swedish /i y u/ by Malmberg (in *For Roman Jakobson*) shows that it is not as absurd as HB thought. In spite of Fant's rejection of it (*Proceedings 8th Congress*, p. 301), I think it has some

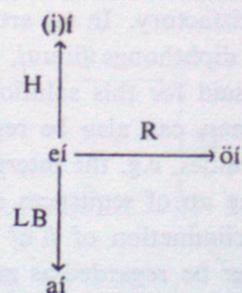
rection and in clear phonemic contrast.⁶ Furthermore, his diagram provides for an asymmetrical relation:



I find this unsatisfactory, not because I wish to find symmetry where there is none (heaven forbid), but because it neglects the congruence with respect to R of /i ú/ and /i ü/. It is striking that Icelandic vowels come in pairs, as we have seen, one unrounded and one rounded; if possible, we should try to preserve this proportion in our description.

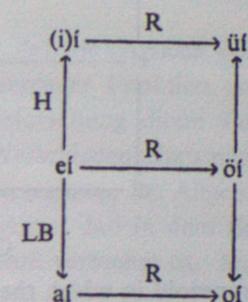
The phonetic data strongly suggest that the two pairs do not belong to the same subsystem and are related in a different way from those we have considered before. /i ú/ are what Hockett (somewhat confusingly) calls "semivowels", which occur both as *syllabic peaks* where they are in contrast with /i ü/, and as *satellites* (second members of diphthongs, e.g. /aí aú/), where they are not in contrast with /i ü/. Even as syllabic peaks they have the privilege of occurring before /ŋ j/, whereas /i ü/ do not.⁷ This coincidence of phonetic features and distribution is such as to make it clear that /i ú/ are members of a phonemic paradigm, to use Hjelmslev's term, that also includes the diphthongs, but not the vowels previously treated. We can also put it in another way: the *maximum* nucleus has two positions: in *position 1* occur /e ö a o/, in *position 2* /i ú/.⁸ But there may also be a *minimum* nucleus, containing either position 1, with the above or /i ü/, or position 2, with /i ú/ alone. One could also say that /i ú/ are diphthongs with a zero first member. In the following we shall write them /i)í (u)ú/ and call them "complex," a term in which we comprise both HB's "tense" and S-K's "rising".

The complex vowels in /i) fall into a pattern which may be related to that of the simple ones as follows:

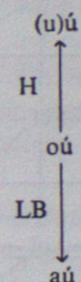


⁶ S-K's argument that all the nuclei are unitary because they occur both long and short is not acceptable if it means that no distinction is to be made between monophthongs and diphthongs. The fact that the latter can be decomposed into specific sequences of vowels which are in contrast with one another (e.g. /aí aú/ or /oí ou/) shows that a distinction must be made. This cannot be done with the lengthened monophthongs when these become diphthongal, which they do not always do. Nor is it true that shortened diphthongs are confused with monophthongs, except in a historical sense

The two missing diphthongs are easily supplied. They are the ones dismissed by KM and S-K as "allophones" of /ü o/, viz. /üi oi/ as in *hugi* and *bogi*. These are not allophones, but full members of the vowel system of standard Icelandic. For those who use them at all, they are in minimal contrast with the three diphthongs, listed above, which everyone recognizes. Examples are *bogi* ~ *bæi* ~ *beygji* ~ *baugi*: *hugi* ~ *hæi* ~ *heyi* ~ *haugi*. They are structured phonetically in exactly the same way. The fact that /üi oi/ occur only long, of which S-K makes much, is merely an inevitable consequence of their being limited to the position before /j/.⁹ This completes our double square:



The complex vowels ending in /ú/ clearly fit into a pattern that includes the simple vowels /a o/:



The H feature is the same as in the preceding columns. The LB feature is here a lowering, since /o/ cannot be further backed: in this position /a/ is low back round. This column may be placed in relation to the preceding ones by a feature RB, which implies both rounding and backing, or only one of these if the other is inapplicable. Like LB it is a complex feature; it is possible that both of them could be combined into a single feature B, implicating lowering and rounding as the case may be. B is

(e.g. in a word like *austur*, which has the allomorph *ustur*). Icelandic informants whom I have tested with tape-recorded short diphthongs had no difficulty distinguishing them from monophthongs.

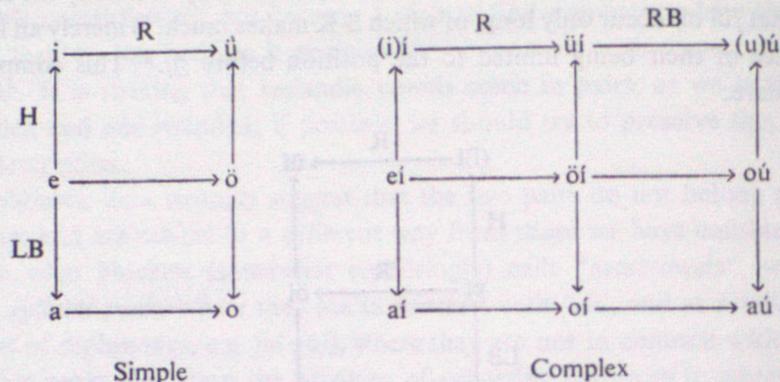
⁷ It may be that position before /j/ should be defined as position before unstressed vowel, but this will not affect the argument presented here.

⁸ The [y] of [öy] is an allophone of /i/ after a rounded vowel.

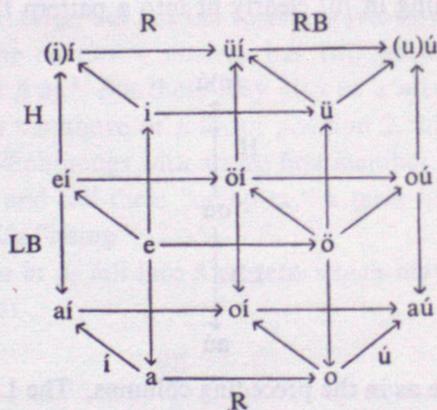
⁹ Note that /üi/ is not limited to the position before /j/, as implied in the textbooks, but occurs also before /ja/ in the nickname *Guja* /güija/, a variant of *Gauja* /göija/, from *Guðrun* (confirmed by two informants in Iceland).

thus usable in two dimensions, implying either backing or lowering or both according to circumstances.

Our final system, then, is a compound structure involving a distinction into *simple* (lax, falling) and *complex* (tense, rising) vowels, among which the features of height (H), rounding (R), lowering (L), and backing (B) provide a necessary and sufficient distinction. In its topological form, the two major subsystems will look like this:



These can be combined into a trapezoid in which the connecting lines mean either /i/ or /ú/, which in the latter case also implies B:



In this paper I have tried to demonstrate these points: (1) that symmetry implies a recurrence of features; (2) that a feature is best regarded as a proportion between two phonemes; and (3) that a vowel system is not necessarily describable in simple two-dimensional models, but may require two or more subsystems for its adequate topological description.¹⁰ University of Wisconsin

¹⁰ Thanks to the efforts of my students Vilhjálmur Bjarnar and Haukur Erlendsson it has been possible to fill in Table 2 (p. 80) in my article so that practically all the holes below the middle line now have words in them: /ú/ *húkti, hjúfra, púðra, rúmt, dúns, búrs*; /í/ *dýpt, ýfði*; /óú/ *ónógt, frjóvgun, óms*; /aú/ *glápti, lágt, ráðs, ráms, ráns*; /öí/ *baugs, laufgað, kauns, rauls, aurs*; /ái/ *æðra*. Above the line the only addition so far has been /ú/ *púkka*. In this connection it is interesting that /i ú/ are distributed exactly like the diphthongs and differently from the monophthongs. In Table 5 (p. 83) *grenja* should be added below *leggja*, and in Table 3 (p. 81) there should be a line with /j/ at the right containing such words as *grenj, emj, belj* in the appropriate spaces.