Bu yazının sahibi Prof. Robert B.Lees, 1961 yılında Amerikadaki Indiana Üniversi'esinin Ural ve Altay Dilleri yayın seris:nde The Phonology of Modern Standard Turkish *(Çağdaş Türk Yazı Dilinin Fonolojisi) adlı 76 sayfalık bir kitap yayımlamıştır. Bu defa da bize, ricamız üzerine* Turkish Harmony and the Phonological Description of Assimilation *başlığını taşıyan değerli bir yazı göndermiştir. Yepyeni bir dilbilim dalı olan fonolojinin terimleri bizde henüz işlenmemiş olduğu için, yıllığımıza bunun Türkçeye çevirisini koymadık, ancak İngilizce aslı ile yetinmek zorunda kaldık. Bundan ötürü İngilizce bilmeyen okurlarımızdan özür dileriz.*

TURKISH HARMONY AND THE PHONOLOGICAL DESCRIPTION OF ASSIMILATION *

ROBERT B. LEES

The main constraints on the pronunciation of vowels in Turkish sentences, that is, those which have come to be known as Vowel Harmony, are easily formulated and widely understood. Concisely they may be formulated in the following way: with a few simple exceptions, every suffix vowel assimilates to the preceding vowel in frontness and, if it is high, also in rounding. Thus, using Jakobson's distinctive-feature terms Gravity for frontness, Diffuseness for height, and Flatness for rounding, we may say that a vowel in the suffix need be marked only for Diffuseness, for its Gravity and Flatness will then be determined by general rule.[1]

As is sometimes overlooked, the vowels inside of native Turkish base morphemes also conform to this constraint in the same way as do the suffixes. Thus, full phonemic representations for the base morphemes in the lexicon would be redundant in just that way which originally motivated the notion of phonemic representation; thus, with Halle, we may suppose that the gram-

1 For a detailed discussion of distinctive-feature analysis vid. Jakobson, R., G.M. Fant, and M. Halle: *Preliminaries to Speech Analysis,* Massachusetts Institute of Technology, Acoustics Lab., Tech. Report No. 13 (Jan., 1952), 4th printing, Oct., 1961; MIT Press, 1963.

mar contains a set of so-called morpheme-structure rules to take advantage of these generalizations.[2]

Now, on the other hand, a huge number of loan-words, especially from Arabic and Persian, fail to obey these rules of pronunciation, and I therefore chose, in my *Phonology of Modern Standard Turkish*, to assign in the lexicon to each base morpheme a marker to distinguish harmonic from non-harmonic bases: the assimilation rules apply only to bases marked harmonic.[3] The assigment of this grammatical feature is, of course, not determined by the etymological history of the word, for there are a few non-harmonic Turkic words in use and many harmonic Arabic loans, namely, fully Turkified borrowings and morphemes which happen accidentally to conform to the Turkish rules. In other words, the grammatical feature of harmony is an unpredictable, *ad hoc* property of each morpheme which, along with its spelling, the native speaker must simply memorize.

Moreover, there is also a Gravity constraint on the pronunciation of consonants within words: Grave $/q\gamma\lambda/$ are used together with Grave vowels, but with non-Grave vowels only non-Grave $/k\ g\ l/$ are pronounced. And again in non-harmonic words the consonants may well fait to obey this constraint independently of the vowels. Thus, harmonic words might be:

(1)   kere   'a time'   qara   'black'
         kireç   'lime'   qıλıç   'sword'
         kütüp   'books'   qutup   'Pole'
         gölge   'shadow'   qarγa   'crow'

while the following are non-harmonic:

(2)   käse   'bowl'   qalem   'pen'
         kitap   'book'   qulüp   'club'
         gūya   'as if'

Although it is unlikely that any regularity will be founud which will permit an extensive prediction of palatalization in the velars and the lateral it is reasonable to expect that the rules of harmonic assimilation may be generalized to include these consonants in harmonic bases and suffixes.

If these were the only considerations there would be no reason to prefer an assimilation of consonants to vowels over an assimilation of vowels to consonants. On the other hand, it is traditional to formulate harmony as a progressive assimilation, probably because it is usually formulated only for suffixes though there may well be deeper reasons. If the rule determines the Gravity

2 On the notion of morpheme-structure rules see Halle, M.: *The Sound Pattern of Russian*, The Hague: Mouton and Co., 1959; Phonology in a Generative Grammar, Word 18 54–72 (1962); On the Bases of Phonology, Chapter 9 of Fodor and Katz: *The Structure of Language* (New Jersey: Prentice-Hall, 1964).

3 Volume 6 of the Indiana University Publications, Uralic and Altaic Series, 1961.

of the relevant consonants from that of the vowels, and if it is a strictly progressive assimilation, then it is impossible to formulate the constraint because of the cases of initial consonant harmony, as in:

(3)   kil   'clay'   qıλ   'bristle'

Either we must allow consonants to assimilate regressively as well, or else we must allow vowels to assimilate progressively to certain consonants in some cases. Mixing regressive and progressive assimilation in one rule is clumsy. Therefore, I chose in my monograph to spell all bases with fully specified features for only the first harmonic segment of the base and permit progressive assimilation of all following harmonic segments, whether vowel or consonant. At least one reviewer found ·this formulation very counterintuitive, though his reasons, if any, are not obvious.[4]

Next, let us note that there are also many Arabic loan-words with back-vowels which end in the palatal /1/ and take front-vowel harmony, as in:

(4)   qabul   'acceptance'   qabul-ü   'its acceptance'
             hayal   'spectre'   hayāl-i   'its spectre'
             usul   'system'   usūl-ü   'its system'

If we view this regularity as a part of the general harmony rules rather than as a set of special exceptions, then it strongly confirms the choice of a rule which progressively assimilates a following suffix vowel to a preceding base-consonant, in this case in a non-harmonic base, and no special additions need be made to the rule as formulated to this point.

On this view, harmony may be formulated with the following two rules, the first for Flatness assimilation of diffuse short vowels to the immediately preceding vowel, the second for Gravity assimilation of harmonic phonemes to the preceding harmonic gravity-bearing phoneme. The harmonic segment types which assimilate are short vowels, velar stops, and the lateral liquid, though low harmonic vowels are never round, and harmonic morphemes have /o ö/ only in the first syllable and only in a base.[5]
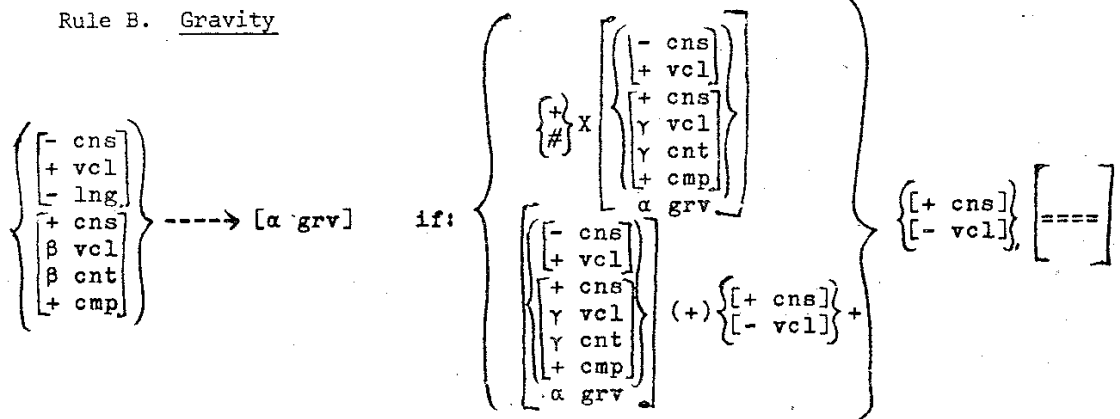
Rule A.   _Flatness_

$$
\begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ - \text{lng} \\ + \text{dif} \end{bmatrix} \longrightarrow [\alpha \text{ flt}] \quad \text{if:} \quad \left\{ \begin{matrix} \left\{ \begin{matrix} + \\ \# \end{matrix} \right\} X \begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ \alpha \text{ flt} \end{bmatrix} \\ \begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ \alpha \text{ flt} \end{bmatrix} (+) \left\{ \begin{matrix} + \text{cns} \\ - \text{vcl} \end{matrix} \right\}_{\bullet} (+) \end{matrix} \right\} \left\{ \begin{matrix} + \text{cns} \\ - \text{vcl} \end{matrix} \right\}_{\bullet} \begin{bmatrix} === \end{bmatrix}
$$

4 Zimmer, K.: Rev. of Lees, _Phonology of Modern Standard Turkish_, Word 21 123–36 (1965).
    5 The distinctive features we use here for our description of Turkish phonology in the representations of underlying segment types in the lexicon and in phological rules are chosen according to the following coding tree:

Rule B. <u>Gravity</u>

$$\left\{\begin{bmatrix}- \text{ cns}\\ + \text{ vcl}\\ - \text{ lng}\end{bmatrix}\begin{bmatrix}+ \text{ cns}\\ \beta \text{ vcl}\\ \beta \text{ cnt}\\ + \text{ cmp}\end{bmatrix}\right\} \longrightarrow [\alpha \text{ grv}] \quad \text{if:} \quad \left\{\begin{cases}+\\ \#\end{cases} X\begin{cases}\begin{bmatrix}- \text{ cns}\\ + \text{ vcl}\end{bmatrix}\\ \begin{bmatrix}+ \text{ cns}\\ \gamma \text{ vcl}\\ \gamma \text{ cnt}\\ + \text{ cmp}\\ \alpha \text{ grv}\end{bmatrix}\end{cases} \middle| \begin{bmatrix}- \text{ cns}\\ + \text{ vcl}\end{bmatrix}\begin{bmatrix}+ \text{ cns}\\ \gamma \text{ vcl}\\ \gamma \text{ cnt}\\ + \text{ cmp}\\ \alpha \text{ grv}\end{bmatrix} (+)\begin{cases}[+ \text{ cns}]\\ [- \text{ vcl}]\end{cases}+ \right\} \begin{cases}[+ \text{ cns}]\\ [- \text{ vcl}]\end{cases}\begin{bmatrix}====\end{bmatrix}$$

Or, using more familiar terms:

Rule A.   <u>Flatness</u>:   Short high V --> $\left\{\begin{array}{l}\text{Rounded if preceded by round V}\\ \text{Unrounded if preceded by non-rounded V}\end{array}\right\}$

Rule B.   <u>Gravity</u>:   Short V / Velar Stop / Lateral --> $\left\{\begin{array}{l}\text{Palatal if preceded by palatal}\\ \text{Non-palatal if preceded by non-palatal sound}\end{array}\right\}$
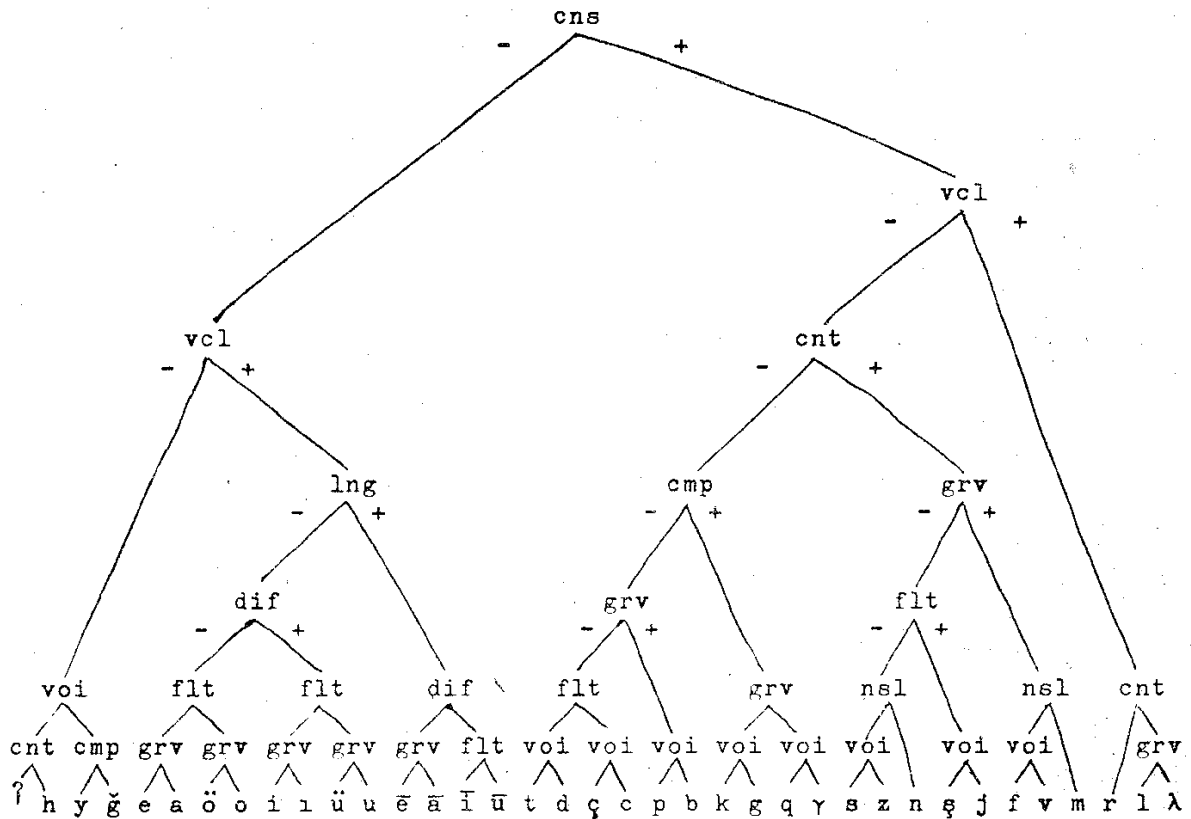
Features: cns = consonantal   grv = grave
             vcl = vocalic   dif = diffuse
             cnt = continuant   flt = flat
             lng = long   voi = voiced
             cmp = compact   nsl = nasal

Certain notational conventions are employed in the rules: features or combinations of features which co-occur in the same segment are enclosed in square brackets; features or com-

The conditions are so formulated that these assimilations occur within any base marked with /⊙/ or suffix marked with /+/, the two harmonic boundary markers, and also across harmonic morpheme boundary; various irrelevant consonants and boundaries may intervene. Rule A simply looks to the immediately preceding vowel, Rule B to the immediately preceding vowel, velar stop, or lateral which is marked for Gravity. This means, of course, that certain concomitant, or non-distinctive, features must have already been specified; for example, long /ū/ will have been marked [+ flt], the other long vowels, [—flt].

Let us now assign a crude measure of generality to Rules A and B by assigning a unit to each boundary symbol, syntactic formative symbol, and distinctive-feature coefficient which had to be specified in the rule so that we shall be able later to compare these versions of the formulation with others for their descriptive power. Rule A requires 20 and Rule B 31 specifications.
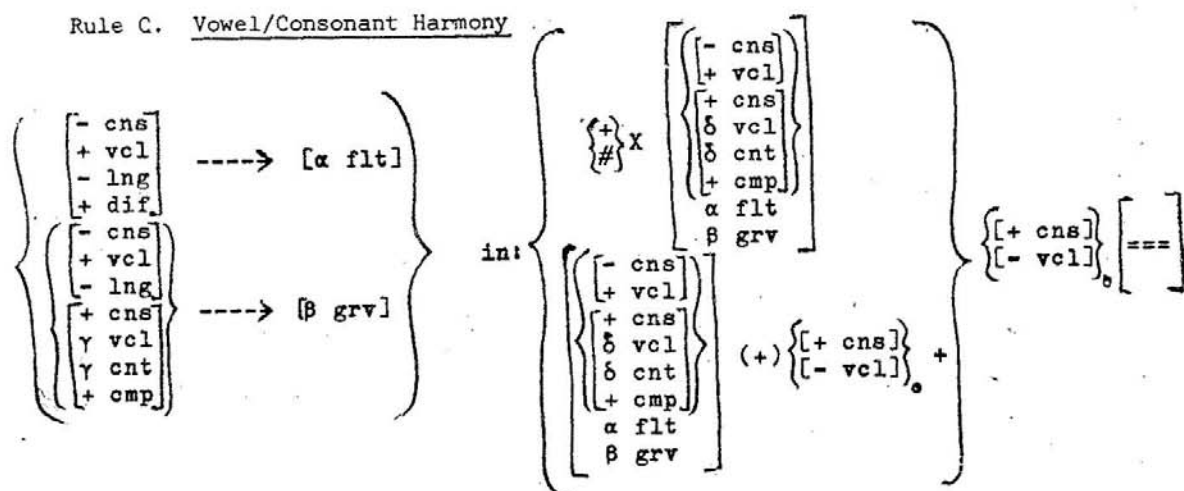
Unfortunately, this measure does not take into account the economy effected by the formulation by virtue of its original motivation, namely the deletion from a huge set of lexical representations of morphemes of those features which are predicted by these rules. This will not defeat our attempt to evaluate competing formulations so long as they do not differ greatly in the number of features in morpheme spellings which may be left unspecified in the lexicon to be supplied by general rule.

Since only vowels adjust for flatness, we might try to separate the rules for vowels and for consonants instead of the rules for flatness and gravity. We may then collapse environmental conditions, however, since these are the

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binations of features which may be chosen alternatively to define a class of segments are enclosed in rounded braces; all features are assumed to carry one of the two binary coefficients + or -; lower-case Greek letter coefficients are used as variables over these two coefficients and take on each the same value throughout a given rule; the specification of the environment within which a given rule is to apply, if it is context restricted, is given following the word "in:"; the position in the environment where the affected segment occurs is given by the bracket containing the double hyphens; subscript numerals on a segment indicate the minimum number of segments of the indicated type allowed to appear there in sequence--e.g., $\left\{ \begin{matrix} [+cns] \\ [-vcl] \end{matrix} \right\}_0$ means a sequence of zero or more non-vowels; /⊙/ is the harmonic word-boundary, /ıı/ the non-harmonic word-boundary, /+/ the harmonic internal morpheme-boundary, and /—/ the non-harmonic internal morpheme-boundary; and finally /×/ is used to represent an arbitrary sequence of segments containing no boundaries.
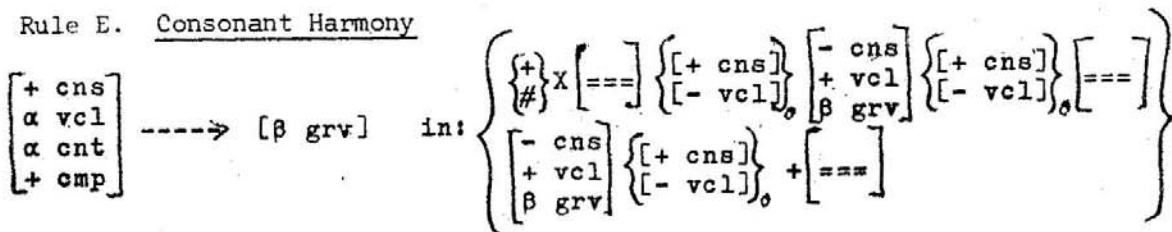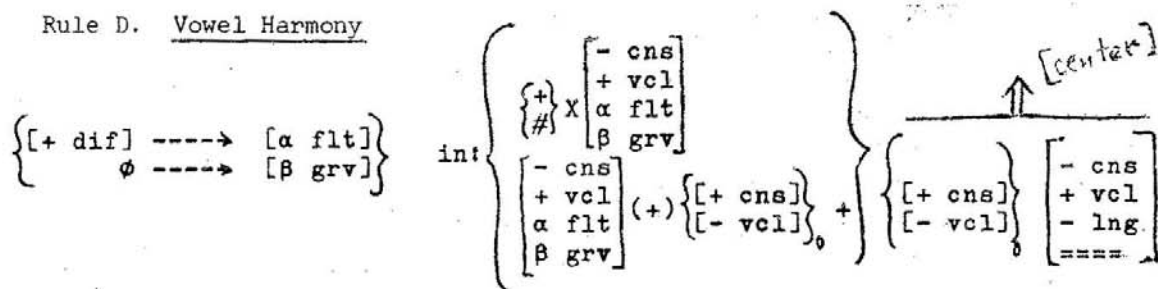
Incidentally, it might be supposed that the rule could be greatly simplified by merely assimilating each successive segment to its immediately preceding segment through the word rather than to the preceding harmonically relevant segment. We discuss later why this cannot be done.

same for vowels and consonants, and also, then, we shall collapse vowel gravity
and consonant gravity[6]:

Rule C. Vowel/Consonant Harmony

$$\left\{\begin{bmatrix}-\text{cns}\\+\text{vcl}\\-\text{lng}\\+\text{dif}\end{bmatrix}\longrightarrow[\alpha\ \text{flt}]\\\left.\begin{matrix}\begin{bmatrix}-\text{cns}\\+\text{vcl}\\-\text{lng}\end{bmatrix}\\\begin{bmatrix}+\text{cns}\\\gamma\ \text{vcl}\\\gamma\ \text{cnt}\\+\text{cmp}\end{bmatrix}\end{matrix}\right\}\longrightarrow[\beta\ \text{grv}]\end{matrix}\right\}\ \text{in:}\ \left\{\begin{matrix}\left\{\begin{matrix}+\\\#\end{matrix}\right\}X\begin{bmatrix}\begin{bmatrix}-\text{cns}\\+\text{vcl}\end{bmatrix}\\\begin{bmatrix}+\text{cns}\\\delta\ \text{vcl}\\\delta\ \text{cnt}\\+\text{cmp}\end{bmatrix}\\\alpha\ \text{flt}\\\beta\ \text{grv}\end{bmatrix}\\\begin{bmatrix}\begin{bmatrix}-\text{cns}\\+\text{vcl}\end{bmatrix}\\\left\{\begin{bmatrix}+\text{cns}\\\delta\ \text{vcl}\\\delta\ \text{cnt}\\+\text{cmp}\end{bmatrix}\right\}\\\alpha\ \text{flt}\\\beta\ \text{grv}\end{bmatrix}(+)\begin{Bmatrix}+\text{cns}\\-\text{vcl}\end{Bmatrix}_0+\end{matrix}\right\}\begin{Bmatrix}+\text{cns}\\-\text{vcl}\end{Bmatrix}_0\begin{bmatrix}===\end{bmatrix}$$

Since this one rule costs altogether 38 specifications, counting as before, we
save 13 by this reformulation.

Next, we try to separate vowel from consonant but assimilating conso-
nants to vowels only, whether *progressively* or *regressively*, as in the traditional
description of harmony:

Rule D. Vowel Harmony

$$\begin{Bmatrix}[+\text{dif}]\longrightarrow[\alpha\ \text{flt}]\\\phi\longrightarrow[\beta\ \text{grv}]\end{Bmatrix}\ \text{in:}\ \left\{\begin{matrix}\left\{\begin{matrix}+\\\#\end{matrix}\right\}X\begin{bmatrix}-\text{cns}\\+\text{vcl}\\\alpha\ \text{flt}\\\beta\ \text{grv}\end{bmatrix}\\\begin{bmatrix}-\text{cns}\\+\text{vcl}\\\alpha\ \text{flt}\\\beta\ \text{grv}\end{bmatrix}(+)\begin{Bmatrix}+\text{cns}\\-\text{vcl}\end{Bmatrix}_0+\end{matrix}\right\}\overset{\uparrow[\text{center}]}{\underline{\qquad\qquad}}\begin{Bmatrix}+\text{cns}\\-\text{vcl}\end{Bmatrix}_0\begin{bmatrix}-\text{cns}\\+\text{vcl}\\-\text{lng}\\====\end{bmatrix}$$

Rule E. Consonant Harmony

$$\begin{bmatrix}+\text{cns}\\\alpha\ \text{vcl}\\\alpha\ \text{cnt}\\+\text{cmp}\end{bmatrix}\longrightarrow[\beta\ \text{grv}]\ \text{in:}\ \left\{\begin{matrix}\left\{\begin{matrix}+\\\#\end{matrix}\right\}X\begin{bmatrix}===\end{bmatrix}\begin{Bmatrix}+\text{cns}\\-\text{vcl}\end{Bmatrix}_0\begin{bmatrix}-\text{cns}\\+\text{vcl}\\\beta\ \text{grv}\end{bmatrix}\begin{Bmatrix}+\text{cns}\\-\text{vcl}\end{Bmatrix}_0\begin{bmatrix}===\end{bmatrix}\\\begin{bmatrix}-\text{cns}\\+\text{vcl}\\\beta\ \text{grv}\end{bmatrix}\begin{Bmatrix}+\text{cns}\\-\text{vcl}\end{Bmatrix}_0+\begin{bmatrix}===\end{bmatrix}\end{matrix}\right\}$$

6 Note that in Rules A, B, and C two separate but partially similar environmental condi-
tions are required for the application of the rule in question; the first permits assimilation within
harmonic morphemes, the second, *across* harmonic morpheme-boundaries, even across whole
morphemes which happen at this point in the sequence of rules of the grammar to consist of
only harmonically irrelevant consonants.

Here we have introduced a new convention in Rule E to indicate that the assimilating consonant may undergo the rule in either one of two alternative contexts, one preceding, the other following, the controlling vowel.

Now, since the vowel and consonant environments differ, they are not collapsed, and the description costs 6 more specifications. Thus, I chose to assimilate only progressively.

Next, we must take note of two subsidiary regularities of which any adequate and complete description must give an account. First, there is a sizable number of disyllabic base morphemes with intervening labial consonant in which the first vowel is unrounded grave /a/ but the second is rounded /u/:

(5)				
avuç	'palm of hand'	havλu	'towel'
çabuq	'quick'	havruz	'chamberpot'
çamur	'mud'	havuç	'carrot'
çapuλ	'raid'	havut	'camel pack-saddle'
çaput	'rag'	havuz	'pond'
çavuş	'sergeant'	qabuq	'rind'
camus	'buffalo'	qaλbur	'seive'
davuλ	'drum'	qaλmuq	'Kalmuck'
gâvur	'infidel'	qambur	'hunchback'
hamuλ	'patient'	qamu	'all'
hamur	'dough'	qarmuq	'grappling iron'
hamut	'collar of horse'	qavuq	'hollow'
qavun	'melon'		
qavur-	'fry'		
qavuş-	'come together'		
qavut	'ground roasted wheat'		
marpuç	'tube of narghile'		
maymun	'monkey'		
pabuç	'skipper'		
pamuq	'cotton'		
sabuq	'astray'		
sabun	'soap'		
sabur	'patient'		
samur	'sable'		
samsun	'mastiff'		
şafuλ	'wooden honey tub'		

tabur	'battalion'
tabut	'coffin'
tambur	'guitar'
tamu	'hell'
tarbuş	'fez'
tavuq	'hen'
tavus	'peacock'
yarpuz	'pennyroyal'
yavru	'cub'
yavuq	'token of betrothal'
yavuz	'resolute'

This list contains both native and borrowed morphemes since the latter, even if only "accidentally" harmonic in this subsidiary sense, are still more economically described as if harmonic. There are also some exceptions to this "labial-attraction" harmony:

(6)   qamış   'reed'

         sabır   'patience'

         tavır   'mode'

but these are surprisingly rare. We are, then, justified in treating the flatness of 2nd-syllable /u/ after lst-syllable /a/ as regular, and we must formulate a subsidiary rule to effect it. Note that the medial labial consonant may appear optionally in a cluster with liquid, glide, or consonant. The new rule must follow the rule for vowel flatness and can be formulated thus:

Rule F.   Labial Attraction

$$
\begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ - \text{lng} \\ + \text{dif} \end{bmatrix} \longrightarrow [+ \text{flt}] \quad \text{in:} \quad \#\left\{\begin{matrix} [+ \text{cns}] \\ [- \text{vcl}] \end{matrix}\right\} \begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ - \text{lng} \\ - \text{dif} \\ - \text{flt} \\ + \text{grv} \end{bmatrix} \begin{bmatrix} \alpha \ \text{cns} \\ \alpha \ \text{vcl} \end{bmatrix} \begin{bmatrix} + \text{cns} \\ - \text{vcl} \\ - \text{cmp} \\ + \text{grv} \end{bmatrix} [= = =] \left\{\begin{matrix} [+ \text{cns}] \\ [- \text{vcl}] \end{matrix}\right\} \left\{\begin{matrix} + \\ - \\ \# \\ \| \end{matrix}\right\}
$$

But now note that the *suffixes* which follow such base morphemes as are affected by Rule F must also be adjusted to the roundness of this new /u/. Therefore, the flatness rule must be split up into two rules, one preceding Rule F for bases only and one for suffixes only, following Rule F. But in *that* case we can see that to split all of Rule C this way will require more repetition of environmental specifications than to split up Rule D of the alternative analysis, since Rule E of that otherwise more redundant description does not

involve vowel flatness at all and can safely follow Rule F. Thus we would have, in place of Rules D and E:

Rule G. Flatness and Gravity of Vowels in Bases

$$\left\{\begin{array}{l} [+\ \text{dif}] \longrightarrow [\alpha\ \text{flt}] \\ \emptyset \longrightarrow [\beta\ \text{grv}] \end{array}\right\} \quad \text{in:} \quad \#X \begin{bmatrix} -\ \text{cns} \\ +\ \text{vcl} \\ \alpha\ \text{flt} \\ \beta\ \text{grv} \end{bmatrix} \left\{\begin{array}{l} [+\text{ccns}] \\ [-\ \text{vcl}] \end{array}\right\}_{\emptyset} \begin{bmatrix} -\ \text{cns} \\ +\ \text{vcl} \\ -\ \text{lng} \\ ==== \end{bmatrix}$$

Rule F. Flatness of 2nd Vowels in Bases with Medial Labial

Rule H. Flatness and Gravity of Vowels in Suffixes

$$\left\{\begin{array}{l} [+\ \text{dif}] \longrightarrow [\alpha\ \text{flt}] \\ \emptyset \longrightarrow [\beta\ \text{grv}] \end{array}\right\} \quad \text{in:} \quad \left\{\begin{array}{l} +X \begin{bmatrix} -\ \text{cns} \\ +\ \text{vcl} \\ \alpha\ \text{flt} \\ \beta\ \text{grv} \end{bmatrix} \\ \begin{bmatrix} -\ \text{cns} \\ +\ \text{vcl} \\ \alpha\ \text{flt} \\ \beta\ \text{grv} \end{bmatrix} (+) \left\{\begin{array}{l} [+\ \text{cns}] \\ [-\ \text{vcl}] \end{array}\right\}_{\emptyset} + \end{array}\right\} \left\{\begin{array}{l} [+\ \text{cns}] \\ [-\ \text{vcl}] \end{array}\right\}_{\emptyset} \begin{bmatrix} -\ \text{cns} \\ +\ \text{vcl} \\ -\ \text{lng} \\ ==== \end{bmatrix}$$

Rule E. *Gravity of Consonants*

The whole description now costs 83 specifications (where, incidentally, splitting Rule C instead would have cost 88). Moreover, we no longer require the new convention of Rule E which does not seem to be independently motivated.

The other subsidiary regularity we shall have to take account of is the already mentioned peculiar behavior of suffixes after the final palatal /l/ of certain loan-words, mainly from Arabic:

(7)   misal   'model'   misal+i   'its model'
                                 misal+ler+i   'their model'
        usul   'method'   usūl+ünüz+e   'to your method'
                                 usul+den   'from the method'
        petrol   'petroleum'   petrol+ün+ü   'its petroleum (obj.)'

That is, after this acute /l/ the subsequent suffixes all have acute harmony even though the preceding vowel is grave, though they continue to take their flatness from the preceding vowel.

Thus, we must insert a rule after Rules G and H to adjust this new gravity effect. But again the suffix vowels which follow must also accommodate, and we shall therefore have to include in the rule a repetition of the environmental

conditions which allow transport of the new case of acuteness to all the subsequent suffix vowels:

Rule I. <u>Acute Suffix Harmony after·Palatal /1/</u>

$$
\begin{bmatrix} - \text{ cns} \\ + \text{ vcl} \\ - \text{ lng} \end{bmatrix} \longrightarrow [- \text{ grv}] \quad \text{if:} \quad
\left\{ \left(\left\{ \begin{matrix} \begin{bmatrix} + \text{ cns} \\ + \text{ vcl} \\ + \text{ cnt} \\ - \text{ grv} \end{bmatrix} \\ \begin{bmatrix} - \text{ cns} \\ + \text{ vcl} \\ - \text{ grv} \end{bmatrix} (+) \left\{ \begin{matrix} [+ \text{ cns}] \\ [- \text{ vcl}] \end{matrix} \right\}_{\theta} \\ +X \begin{bmatrix} - \text{ cns} \\ + \text{ vcl} \\ - \text{ grv} \end{bmatrix} \end{matrix} \right\} + \right) \right\} \left\{ \begin{matrix} [+ \text{ cns}] \\ [- \text{ vcl}] \end{matrix} \right\}_{\theta} \begin{bmatrix} = = = = \end{bmatrix}
$$

This final formulation, which includes the two subsidiary regularities, now costs a total of 105 specifications. Its rules fulfill the following functions:

Rule G. Flatness and Gravity of Short Vowels in Harmonic Bases

Rule F. Flatness of 2nd Vowel in Bases with Medial Labial

Rule H. Flatness and Gravity of Short Vowels in Suffixes

Rule I. Gravity of Short Vowels in Suffixes in Suffixes after Final Loanword Acute /1/

Rule E. Gravity of Harmonic Consonants

Some of its internal parts may be rearranged, but there is nothing saved thereby in the generality of the formulation of these constraints on pronunciation.

Finally, let us now return to our first analysis with a strictly *progressive* assimilation, requiring some cases of vowel gravity to be determined by the gravity of a preceding harmonic consonant. But this time we shall include the subsidiary regularity of *tavuq* and its congeners:

Rule P. <u>Vowel/Consonant Harmony in Harmonic Base</u>

$$
\left\{ \begin{matrix} \begin{bmatrix} - \text{ cns} \\ + \text{ vcl} \\ - \text{ lng} \\ + \text{ dif} \end{bmatrix} \longrightarrow [\alpha \text{ flt}] \\ \left\{ \begin{matrix} \begin{bmatrix} - \text{ cns} \\ + \text{ vcl} \\ - \text{ lng} \end{bmatrix} \\ \begin{bmatrix} + \text{ cns} \\ \gamma \text{ vcl} \\ \gamma \text{ cnt} \\ + \text{ cmp} \end{bmatrix} \end{matrix} \right\} \longrightarrow [\beta \text{ grv}] \end{matrix} \right\} \quad \text{in: } \#X \quad \left[\left\{ \begin{matrix} \begin{bmatrix} - \text{ cns} \\ + \text{ vcl} \end{bmatrix} \\ \begin{bmatrix} + \text{ cns} \\ \delta \text{ vcl} \\ \delta \text{ cnt} \\ + \text{ cmp} \end{bmatrix} \end{matrix} \right\} \begin{matrix} \alpha \text{ flt} \\ \beta \text{ grv} \end{matrix} \right] \left\{ \begin{matrix} [+ \text{ cns}] \\ [- \text{ vcl}] \end{matrix} \right\}_{\theta} \begin{bmatrix} = = = = \end{bmatrix}
$$

Rule F. Flatness of 2nd Vowel in Bases with Medial Labial

Rule Q. Vowel/Consonant Harmony in Suffixes
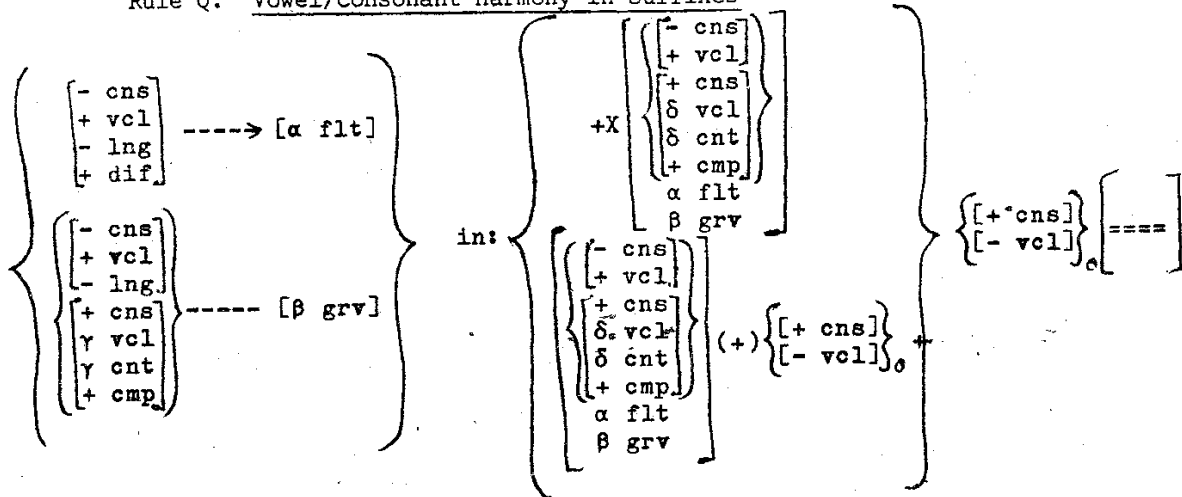
Note that in this analysis no split is required in the rules for the case of *misal-i*
and its congeners, since Gravity is assimilated to the preceding consonant in
all cases now, and furthermore, that no Rule E is required at all.[7]

Thus we see that the strictly progressive assimilation of harmonic sounds
to the immediately preceding harmonic sound, whether vowel, velar stop,
or lateral liquid, requires 17 fewer specifications than the traditional descrip-
tion, and my unusual analysis was not unmotivated!

This does not exhaust the generalization which may be incorporated into
our description of harmony, nor the special phenomena which may be included
in the description. Thus, e.g., there is also the case of palatal umlaut, mentio-
ned by many authors especially in the case raising of vowels before certain
occurrences of /y/. A more widespread regularity has been noted by Kum-
baraci for the Istanbul dialect, and it may be easily incorporated into this
analysis in the manner suggested in my note on her article.[8]

The essence of the palatal umlaut of the Istanbul dialect is the following:
a harmonic short vowel is unrounded immediately before a palatal /y ş /j ç c/

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7 Incidentally, since Rules P and Q share so much, it might be supposed that a separate
rule for gravity harmony could profitably be isolated and placed first, to be followed by a rule
of base flatness, then Rule, F, and finally a rule of suffix flatness. However, such a formulation
requires 100 specifications as agains our 88.

8 Lees, R. B.: "On the Interpreration of a Turkish Vowal Alternation," *Anthropological
Linguistics* (to appear); Kumbaraci, Turkan E.: Consonautally Conditioned Alternation of
Vocalic Morphophonemes in Turkish, Anthropological Linguistics 8 No. 1 11–24 (1966).

within word boundaries if morpheme-final or if not in the first syllable of the word and is, moreover, also raised there if that palatal is followed immediately by a vowel. Thus, we would have the following pronunciations:

/ye+yen/	[yiyen]
/oqu+muş/	[oqumış]
/üşü+yüş/	[üşiyiş]
/üşü+me+yiş/	[üşümiyiş]
/gümüş+tür/	[gümiştir]

From the last example we see that the regular vowel-harmony rules assimilate vowels to a preceding vowel after the latter has already undergone the palatal assimilation, and therefore that the rule for rounding must follow the palatal umlaut rule. Moreover, the labial attraction rule produces a new vowel which is subject to palatal assimilation, and therefore the umlaut rule must follow the labial attraction. Since neither of these special rules involve gravity, the rule for frontness harmony can safely precede the three rules which affect rounding.

A special problem now arises when we try to incorporate this new rule of assimilation before alveopalatal consonants. Formerly we were able to include a rule which affected the last vowel of certain bases and then determined a new harmony assimilation in the subsequent suffix vowels but only by splitting the regular harmony rules into two, one for bases, the other for suffixes. This time the special palatal umlaut can affect vowels in *any* position in bases and suffixes in general; thus, though it affects only subsequent rounding of harmonic vowels, and not their gravity, somehow the rules must again be split to permit regular harmonic assimilations before such an affected vowel and, *after* the application of the umlaut rule, another harmonic assimilation of subsequent vowels for rounding. But in this case there is no standard *position* where the split can be specified to take place in words.

There is a very natural remedy for this difficulty, though it is one which requires a novel device in linguistic theory. We have already argued that individual morphemes in Turkish must be marked for whether they are subject to harmony rules. What we must now do is focus our attention upon individual segments of the phonological description of morphemes rather than upon the morpheme as a whole.

If palatal umlaut precedes rounding harmony, the latter will simply undo what the former effected. If palatal umlaut follows rounding harmony, then the vowels subsequent to an umlauted vowel will be assimilated in rounding

to the vowels preceding the umlauted one instead of being assimilated to the umlauted vowels itself. Thus, it is natural to think of the process rather as consisting first of palatal umlaut followed by rounding harmony in which the assimilation proceeds backward only to an umlauted vowel or to an initial wordboundary. But then the umlauting process must leave the affected vowel incapable of rounding assimilation without affecting any other vowels. This just means that for the operation of the rounding-harmony rule each individual vowel segment is marked for harmonicness. Generalizing from this special case, we can suppose that every segment potentially capable of harmonic assimilation, that is, every velar stop, lateral liquid, or short vowel, is marked either plus harmonic or minus harmonic. Then, we further suppose that the palatal umlaut rule, when it applies, changes this feaute coefficient to [—hmc]. The subsequent rounding-harmony rule will then cause every vowel marked [+ hmc] to assimilate in rounding to the immediately preceding vowel, but it can no longer affect the umlauted vowels!

But now we achieve an unexpected bonus in the description; it is no longer necessary to split the harmony rules at all, for we can formulate the labial attraction rule so that it too leaves an affected vowel marked [— hmc] the rule for gravity harmony can safely precede all the rules affecting rounding; and, incidentally, the distinction between harmonic and non-harmonic boundaries may be dropped.

Thus, we achieve the following analysis:

    (i)   Gravity Harmony
    (ii) Labial Attraction
    (iii) Palatal Umlaut
    (iv) Flatnes Harmony

and the rules themselves can be formulated as follows:[9]

1. <u>Gravity Harmony</u>

$$
\left\{
\begin{matrix}
\begin{bmatrix} - \text{ cns} \\ + \text{ vcl} \\ - \text{ lng} \end{bmatrix} \\
\begin{bmatrix} + \text{ cns} \\ \beta \text{ vcl} \\ \beta \text{ cnt} \\ + \text{ cmp} \end{bmatrix}
\end{matrix}
\right\}
\dashrightarrow [\alpha \text{ grv}] \quad \text{if:} \quad
\begin{bmatrix}
\left\{
\begin{matrix}
\begin{bmatrix} - \text{ cns} \\ + \text{ vcl} \end{bmatrix} \\
\begin{bmatrix} + \text{ cns} \\ \gamma \text{ vcl} \\ \gamma \text{ cnt} \\ + \text{ cmp} \end{bmatrix}
\end{matrix}
\right\} \\
\alpha \text{ grv}
\end{bmatrix}
\left\{ \begin{matrix} [+ \text{ cns}] \\ [- \text{ vcl}] \end{matrix} \right\}_0
\begin{bmatrix} + \text{ hmc} \\ ==== \end{bmatrix}
$$

---

2. Labial Attraction

$$\begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ - \text{lng} \\ + \text{dif} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{flt} \\ - \text{hmc} \end{bmatrix} \quad \text{if:} \quad \#\left\{\begin{matrix}[+ \text{cns}] \\ [- \text{vcl}]\end{matrix}\right\}_0 \begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ - \text{lng} \\ - \text{dif} \\ - \text{flt} \\ + \text{grv} \end{bmatrix} \begin{bmatrix} \alpha\ \text{cns} \\ \alpha\ \text{vcl} \end{bmatrix}_0 \begin{bmatrix} + \text{cns} \\ - \text{vcl} \\ - \text{cmp} \\ + \text{grv} \end{bmatrix} \left\{\begin{matrix}[+ \text{cns}] \\ [- \text{vcl}]\end{matrix}\right\}_0 \begin{bmatrix} \ \\ === \\ \ \end{bmatrix} \left\{\begin{matrix}[+ \text{cns}] \\ [- \text{vcl}]\end{matrix}\right\}\#$$

3. Palatal Umlaut

$$\begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ - \text{lng} \\ + \text{hmc} \end{bmatrix} \longrightarrow \left\{\begin{matrix}[+ \text{dif}] \\ \\ \begin{bmatrix} - \text{flt} \\ - \text{hmc} \end{bmatrix}\end{matrix}\right\} \quad \text{if:} \left\{\begin{matrix} \#\left\{\begin{matrix}[+ \text{cns}] \\ [- \text{vcl}]\end{matrix}\right\}_1 \begin{bmatrix} ==== \end{bmatrix} + \\ \begin{bmatrix} - \text{cns} \\ + \text{vcl} \end{bmatrix}\left\{\begin{matrix}[+ \text{cns}] \\ [- \text{vcl}]\end{matrix}\right\}_1 \begin{bmatrix} ==== \end{bmatrix} \end{matrix}\right\} \left[\left\{\begin{matrix} \begin{bmatrix} - \text{cns} \\ + \text{voi} \end{bmatrix} \\ \begin{bmatrix} + \text{cns} \\ - \text{grv} \\ + \text{flt} \end{bmatrix} \end{matrix}\right\} \begin{matrix} - \text{vcl} \\ - \text{cmp} \end{matrix} \right] \left\{\begin{matrix}\begin{bmatrix} - \text{cns} \\ + \text{vcl} \end{bmatrix} \\ \\ --- \end{matrix}\right\}$$

4. Flatness Harmony

$$\begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ + \text{dif} \\ - \text{lng} \\ + \text{hmc} \end{bmatrix} \longrightarrow [\alpha\ \text{flt}] \quad \text{if:} \quad \begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ \alpha\ \text{flt} \end{bmatrix} \left\{\begin{matrix}[+ \text{cns}] \\ [- \text{vcl}]\end{matrix}\right\}_0 \begin{bmatrix} ==== \end{bmatrix}$$

Putting these rules into the ordinary technical terms of linguistics, they would read:

1. Frontness Harmony: a harmonic segment, i.e., an assimilable short vowel, velar stop, or lateral, assimilates in frontness to an immediately preceding vowel, velar or lateral within word-boundaries.

2. Labial Attraction: a high, short harmonic vowel is rounded in the second syllable of a disyllabic word whose first vowel is /a/, and whose medial consonant cluster contains a labial /p,b,m,v/, and it is then de-harmonified.

3. Palatal Umlaut: a harmonic short vowel is unrounded and de-harmonified immediately before a palatal /y,ş,j,ç,c/ within word-boundaries if morphemefinal or if not in the first syllable and is moreover also raised there if that palatal consonant is followed immediately by a vowel.

introduced between any two segments without affecting the applicability of the rule, for it is "normal" for phonological processes which occur inside of morphemes also to occur at word-medial morpheme / boundaries ,though *not* at word-boundary.Perhaps one could also relegate to convention the optional choice of a consonant cluster between successive vowels in any rule, though I have not adopted that view here.

4. Rounding Harmony: a high, short, harmonic vowel assimilates in rounding to an immediately preceding vowel within word-boundaries.

There is, of course, no longer any point in estimating the relative generality of these rules to compare with the other versions given above, since a new regularity has been incorporated in them, and the representation of many individual segments has also been made slightly more complicated by the addition of a new "feature" [+ hmc].

There is just one last consideration we must look into before settling upon a definitive formulation. We have treated the specification of susceptibility to harmony assimilation as though it is properly construed as a phonological distinctive feature, marked either + or — in the the lexicon for each segment in which it eventually functions but which is unpredictable by general rule. While it is true that the traditionally accepted phonological features in terms of which pronunciation is insightfully described are in part motivated just by the capability of every segment marked for a given feature of undergoing certain phonological processes, these features are also justified in some large part by their more or less direct connection with physically specifiable parameters in terms of which speech noices are described. In fact, as Chomsky and Halle have pointed out, although there is no obvious reason to expect that the features we would choose on the basis of the one motivation would coincide so largely with those grounded upon the other, yet it is just the phonetically "natural classes" of speech sounds which we find to undergo in common each of the salient phonological rules of the linguistic description of pronunciation.

The "feature" we have just proposed is, of course, not at all motivated phonetically and is entirely unrelated to the notion of natural class of sounds (such as, e.g., stops, labials, vowels, etc.). Differently put, it does not serve to distinguish one segment from another in a pair said to be in phonological "contrast"; it is an adventitious character borne by certain segments for the most part in loan-words.

Thus, we might suppose that failure to undergo the flatness-harmony rule is marked, not for every potentially harmonic segment, but only negatively for every segment which must be withheld from that rule. On this view there is no longer any reason for the Gravity Harmony rule to precede, and it can therefore be combined with the Flatness rule to yield still greater generality, for these two rules share a few features. Here then is our final version; we see that now there is a clear separation of the special assimilations on the one hand and the rules of vowel and consonant harmony on the other.

ROBERT B. LEES

1. L A B I A L   A T T R A C T I O N

$$\begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ - \text{lng} \\ + \text{dif} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{flt} \\ - \text{FH} \end{bmatrix} \quad \text{if:} \quad \#\left\{\begin{matrix}[+ \text{cns}]\\ [- \text{vcl}]\end{matrix}\right\}_0 \begin{bmatrix} - \text{cns} \\ + \text{vcl} \\ - \text{lng} \\ - \text{dif} \\ - \text{flt} \\ + \text{grv} \end{bmatrix} \begin{bmatrix} \alpha\ \text{cns} \\ \alpha\ \text{vcl} \end{bmatrix}_0 \begin{bmatrix} + \text{cns} \\ - \text{vcl} \\ - \text{cmp} \\ + \text{grv} \end{bmatrix} \left\{\begin{matrix}[+ \text{cns}]\\ [- \text{vcl}]\end{matrix}\right\}_0 \begin{bmatrix} === \end{bmatrix} \left\{\begin{matrix}[+ \text{cns}]\\ [- \text{vcl}]\end{matrix}\right\}_0 \#$$

2. P A L A T A L   U M L A U T

3. H A R M O N Y

We have, then, given some, albeit weak, evidence that a correct formulation of Turkish pronunciation must include a specification of vocalic and consonantal assimilation in gravity and flatness(i.e.,vowel and consonant harmony) in certain segments unless distinguished, at least in certain cases, from all other segments by an abstract, "non-phonetic" segmental feature. This implies that harmony itself is a feature distinctive of individual segments. But then why are these phonological constraints singled out from all other assimilations by the special technical term "harmony"? Wherein lies the difference between

harmonic assimilation and others such as the progressive assimilation of the English plural suffix to the voicing of the noun-final segment?

It seems reasonable to say that the term "harmony" has been used only in cases where the assimilation affects a number of segments within each *word* so as to lend to them some common phonological feature and where, moreover, this is done in two or more differering ways so as to reshape *words* into contrasting phonetic classes (e.g. rounded words vs. unrounded words).

In the Turkish case the choice of class can plausibly be construed as an inherent feature of the base morpheme since each base appears in only one class, while each suffix appears in every class, depending upon which kind of base it is appended to. Thus, the reason we say that the assimilation is *progressive* is just that Turkish is an exclusively suffixing language.

The latter conclusion is obscured slightly by the fact that the bases are themselves internally harmonic. But that just means that if we choose to analyze harmony by means of rules of progressive assimilation of suffixes, then we must either analyze base-medial harmony also as a progressive assimilation or else introduce separate rules for bases and for suffixes, obscuring an obvious generalization.

The foregoing argument answers a possible objection to the analysis given above, namely, that it requires in ecah harmonic base the "arbitrary" choice and marking for gravity of the first harmonically relevant segment, sometimes a vowel, sometimes a velar stop, sometimes a lateral liquid.

The analysis is, however, still not entirely free from such objections. For example, as given it requires that intervening non-harmonically relevant segments be mentioned between the determining and the determined segments

in our rules specified as $\left\{ \begin{array}{c} [+ \text{ cns}] \\ [- \text{ vcl}] \end{array} \right\}_0$, i.e.,a sequence of zero or more non-

vowel segments. But that formulation is, strictly speaking, both ambiguous and redundant: e.g., the progressive assimilations through a word such as /siL+GI/ 'silgi' can be derived in six different ways, viz., in the following sequences of pairs:

1. iL – LG – GI   4. İL – İ(L+)G – GI
2. İL – LG – L(+G)I   5. İL – İ(L+)G – L(+G)I
3. İL – LG – İ(L+G)I   6. İL – İ(L+)G – İ(L+G)I

all allowed by the environmental condition in Rule 3.

Thus, there is formal motivation for re-interpreting the harmony assimilation slightly as an accommodation of a segment to only the *immediately* preceding segment rather than as an "action at a distance". But that is exactly what we might otherwise expect on purely phonetic grounds.[10] In other words, we could construe the harmonic assimilations as progressing from segment to successive segment through the word, the unpredictable choice for each base being specified only in the word-initial segment, whether the latter is harmonically relevant or not.

In this case we must then assume that the lowest-level phonetic rules of our description would specify for harmonically relevant segment types the usual, large, easily perceived phonetic characteristics we associate with frontness or backness and with roundedness or unroundedness; but for all the other segments these phonetic rules would specify only relatively minor pronunciation differences, in some cases barely perceptible.

Unfortunately, such a natural formulation of our harmonic assimilations is not feasible with the chosen distinctive-feature analysis, for in a word in which, say, [a] is chosen rather than [e] because of [+ grv]-harmony, each /t/ would become [p], each /s/ and /ş/ would become [f], etc., as the wave of [+ grv]-assimilation passed over them on its way from the initial segment through the word.

We can, of course, still think of the harmonic feature as marked not in the initial segment, nor in the first harmonically relevant segment, but rather in the form of a morpheme-feature, like our original harmonic vs. nonharmonic word-boundary symbols. But then we would have to introduce a rule to distribute this feature down onto the relevant segments; and such a rule could not be construed as a general linguistic convention, for it would have to differ in detail for various languages and for various features (e.g., gravity must be distributed to both short vowels and the harmonic consonants, but flatness to only the short vowels).

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10 It has also been assumed by others quite traditionally, as in case of the so-called "emphatic," or pharyngealized, consonants of Arabic, which color *all* (or most) of the surrounding segments not paired similarly for "emphaticness." The British tradition of "prosodic" phonological description strongly emphasizes the notion of linear domain within which a certain phonological feature is determined by rule; but by stressing a narrowly phonetic, quasi-musical *notation* rather than the concept of description as a sequence or cycle of *rules*, the British phonologists have never been led to raise the theoretical issues considered here. Their notations can represent non-contiguous domains just as easily as contiguous ones, *but* a notation can be used to formulate only individual, isolated *instances* of a general behavior, not the rule itself.

Thus, we are, in a sense, back where we started-viz., with our lastformula-ted Rules 1, 2, and 3. As for the ambiguity in the derivations derivable from applications of Rule 3, since such phonological rules are, in any case, merely interpretive and do not assign grammatical structures to utterances, we can safely leave the rule ambiguous, for no incorrect pronunciations result from its application.

Our general conclusion, namely that phonological description requires specification of non-phonetic features for individual segments, will no doubt strike many as implausible, and I therefore append one final corroboratory consideration. In a sense it may well be the heart of the entire matter.

When words are borrowed into a language they may be pronounced for some time in special ways, so differently from the native vocabulary that a simple division of the lexicon into native vs. foreign may afford considerable simplicity in the overall description of pronunciation. But inevitably, even in cases where the inherited phonological system is itself altered to accommodate the loan-words to some extent, certain phonological features of the exotic words will begin to assimilate to the native rules of pronunciation. However, of all the contrasts between native and foreign some will accommodate sooner than others, and there will come a time when the simple dichotomy native / foreign no longer serves. Thus, in our case, there are *partially Turkified* loans from Arabic, Persian, French, Greek, etc. A word might have non-native stress but harmonified vowels, or it might contain inherent long vowels not native to Turkish but its consonants might be much altered to fit the Turkish system. An example of the first is the name of the capitol city itself, *Ânkara*, of the second, the word *farize* 'religious duty' from Arabic *farīḍat*, or also *ihtār* 'remin-der' from *ixṭār*.

Such cases of partial naturalization of loan-words, no doubt to be found in all languages in all stages of adaptation, strongly suggest that the phono-logical description must ultimately be couched in terms of abstract features attached each to individual segments, though there may, of course, also have to be features characterizing whole morphemes.