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It is common in all branches of linguistics, as indeed in all sciences, for two or more explanations of a given phenomenon to be proposed and to compete for recognition as "the correct" solution. This paper presents one such case, a phonological alternation for which two analyses have been put forward in the literature, and suggests on the basis of experimental evidence that not only is there no definitive way to choose between the two analyses, but that different native speakers actually have different rules, different morpheme structure conditions, and even different underlying forms.

1. The problem, and two solutions

There is, in certain morphemes in standard Turkish, an alternation between morpheme final k and \emptyset , which roughly parallels the alternation of voiced and voiceless non-continuant obstruents p/b, t/d, and ç/ğ created by terminal devoicing. This alternation can be seen by comparing the nominative and accusative case forms of nouns. The accusative definite suffix is a high vowel which agrees in backness and rounding with the preceding vowel; the second one of each pair below is accusative.¹

çöp/çöp-ü	'garbage'	kitap/kitab-ı	'book'
kat/kat-ı	'floor'	kurt/kurd-u	'wolf'
saç/saç-ı	'hair'	sevinç/sevinç-i	'joy'
ek/ek-i	'seam'	çocuk/çocu-u	'child'

Two approaches to the k- \emptyset alternation have been proposed, one by Lees 1961 and another by Zimmer 1975. Lees analyses those morphemes in which k deletes as containing an underlying g which never appears on the surface; it is devoiced word finally and before a consonant and deleted intervocally.² This has the effect of giving underlying g the same distribution as any other stop; the fact that phonetic g never occurs morpheme finally except after n and occurs intervocally only in a few loanwords is treated as a purely surface phonetic gap rather than a phonemic imbalance.³ The voiced-voiceless stop alternation is entirely symmetrical for all places of articulation, including velars.

Zimmer objects to Lees' analysis on the grounds that the posited underlying distinction between /k/ and /g/ is nothing more than a disguised diacritic: morphemes with final "/g/" could equally well be marked "[+k-Deletion]". In order to come up with an underlying /g/ in these words, a child would have to learn which morphemes have the k- \emptyset alternation, notice the defective distribution of phonetic g, and combine the two sets of facts, which is more complicated than simply marking the alternating morphemes.

Zimmer then points out a fact which is noted by many descriptive and pedagogical grammars (Jansky, Németh, Underhill, and Lewis, to name a few), but which is not mentioned by Lees, namely, that loss or retention of k is to a large extent predictable from the number of syllables in the word. Monosyllables almost always keep their final k when a vowel-initial suffix is added, while words of two or more syllables nearly always drop it. A dictionary check certainly confirms this as far as the native vocabulary is concerned, although not for the extremely numerous Arabic and Persian loanwords. In the Redhouse Turkish-English dictionary I was able to find only six monosyllables which lose their final k: ŷuk, ĉik, ĉok, gök, plâk, and yok. Of these, two (gök and yok) have alternate forms with k retained: gö-ü or gök-ü 'sky (ACC)', yo-u or yok-u 'non-existence (ACC)'; plâk 'phonograph record' is a borrowed word which may actually be pronounced in two syllables, as płlâk or pâlâk, since initial consonant clusters do not normally occur in Turkish.

Polysyllables that do not drop the final k are more numerous, but nearly all of them are foreign words. Arabic and Persian polysyllabic words are generally marked as k-retaining in the dictionary, but some of my Turkish informants stated that they would tend to drop the k in many of these words in casual conversation. Loanwords from English, French, and other European languages are usually fitted into the k-k or k-∅ patterns according to the number of syllables they contain: for example, fok/fok-u 'seal (animal)' but fizik/fizi-i 'physics' and aritimetik/aritmeti-i 'arithmetic', all from French. A particularly interesting case is birik/biri-i 'brig', from English, and brik/brik-i 'brig', from English through French. The same word was borrowed as a one-syllable word which does not undergo k-Deletion, and as a two-syllable word which does. Experimental evidence⁴ cited by Zimmer 1975 indicates that native speakers do use the number of syllables productively to determine which morphemes alternate. When asked to produce suffixed forms of nonsense words, the subjects tended to drop final k in polysyllables while retaining it in monosyllables. A similar experiment conducted by myself will be discussed in detail below.

It is clear that word length does have at least a strong statistical correlation with the k-∅ alternation and should be taken into account, however, this alone does not necessarily prove Zimmer right and Lees wrong. As Halle 1978 points out, the underlying g solution can be made to account for the data simply by adding a morpheme structure condition like the following:

$$\text{MSC 1: } \begin{bmatrix} \text{-son} \\ \text{-cor} \\ \text{-ant} \end{bmatrix} \rightarrow \left\{ \begin{array}{l} \text{[-voice] / \#C}_0\text{V}___+ \\ \text{[+voice] / VC}_0\text{V}___+ \end{array} \right\}$$

That is, velar obstruents are voiceless in final position in one-syllable morphemes and voiced in final position in morphemes of two or more syllables. The fact that polysyllables, but not monosyllables, exhibit the k-∅ alternation is thus "explained" by the

fact that polysyllables, but not monosyllables, contain underlying final /g/. Two rules (the second of which is independently necessary as we have already seen) are needed to produce the correct surface forms, given MSC 1:

g-Deletion: /g/ → ∅ / V__+V

Obstruent Devoicing: $\begin{bmatrix} \text{-son} \\ \text{-cont} \end{bmatrix} \rightarrow [-\text{voice}] / _ \begin{Bmatrix} \# \\ \text{c} \end{Bmatrix}$

The solution with no underlying /g/ can achieve the same descriptive adequacy with one rule and an MSC stating that all post-vocalic morpheme final velars are voiceless:⁵

k-Deletion: /k/ → ∅ / VC₀V__+V

MSC 2: $\begin{bmatrix} \text{-son} \\ \text{-cor} \\ \text{-ant} \end{bmatrix} \rightarrow [-\text{voice}] / V_+$

At first glance the analysis with abstract underlying /g/ appears to be formally more complex and therefore more costly, but this may in fact not be the case. Not only is Obstruent Devoicing independently necessary to account for the alternations of t, p, ç with d, b, ğ, but an intervocalic g-Deletion rule may also be required on independent grounds, in which case both of these rules would be available "free" or at least at minimal cost.

2. Available evidence

The evidence for g-Deletion is of several sorts. First, various dialects of Turkish have a voiced velar fricative alternating with k where standard Turkish has ∅; for example, in these dialects the accusative form of ayak 'foot' is ayağ-ı instead of aya-ı (between front vowels k alternates with y instead: inek/iney-i 'cow'). The fricative ğ also occurs morpheme-internally where the standard dialect has a long vowel or sequence of vowels: ağaç 'tree', ağz 'mouth' for standard aaç, aız. This constitutes quite good evidence for an underlying /g/ which is deleted in some dialects but merely fricativized in others. There is a fair amount of contact and geographical overlap between the k-∅ and k-ğ dialects: one of my informants from Istanbul (born in Isparta, in west-central Turkey) used ğ, while others from the same area did not. Thus it is not unreasonable to suppose that even speakers of ğ-less dialects are aware of its use in the speech of others. This awareness is presumably encouraged in literate speakers by the spelling of words such as ayağı and ağaç.

There may also be phonetic evidence for g-Deletion. Rudin 1980 suggests that long vowels derived by (morpheme internal) deletion of a presumed underlying g are significantly longer than underlying long vowels, and it is possible that derived and underlying long vowels also differ in stress pattern. If g-Deletion could be shown to be

independently necessary in environments other than the morpheme final $k-\emptyset$ cases, it would strongly support a Lees-type approach to the $k-\emptyset$ alternation, at least in terms of formal simplicity.

Another bit of evidence in favor of an underlying voice distinction in morpheme final velars comes from words like the following:

renk/reng-i	'color'	bank/bank-ı	'bank'
denk/deng-i	'bale'	zınk/zınk-ı	'thump'
frank/frang-ı	'franc'	gank/gank-ı	'vein' (of coal, e.g.; obs.)
ahenk/aheng-i	'harmony'		

The great majority of morpheme final velars after n have k alternating with g before a suffixal vowel, but there are a few (the examples on the right above are all I know of) that have no alternation. This appears to support the position that there are underlying voiced velars morpheme finally, especially given the contrast between apparent underlying /g/ in the first column and /k/ in the second. The evidence is less than overwhelming, however. The number of examples with k is so small that they might easily be considered exceptions, and the ng+ cases accounted for by a rule (or equivalently by an MSC) stating that velars become (or are) voiced morpheme finally after n:

MSC to be added to Lees: $\begin{bmatrix} -\text{son} \\ -\text{cor} \\ -\text{ant} \end{bmatrix} \rightarrow [+voice] / n _ +$

Rule to be added to Zimmer: $\begin{bmatrix} -\text{son} \\ -\text{cor} \\ -\text{ant} \end{bmatrix} \rightarrow [+voice] / n _ +V$

Some supporting or disconfirming evidence for underlying /g/ ought to be available in prefixed forms. If one-syllable words with final non-alternating k had prefixed forms with k alternating with \emptyset , it would cause serious problems for any analysis which posited an underlying voice contrast in morpheme final velars. The same morphemes would have to have underlying g AND underlying k, depending on whether they had anything prefixed to them or not. Schematically:

$(C)Vk / (C)Vk+V =$ underlying k } where (C)Vk is the
 $\text{prefix}+(C)Vk / \text{prefix}+(C)V\emptyset+V =$ underlying g } same morpheme in both

A syllable-based k-Deletion rule à la Zimmer would handle this situation automatically.

On the other hand, if final k did not alternate in such prefixed forms in spite of their polysyllabicity, an underlying g/k distinction would be supported, and syllable-based deletion would be, if not disproved, at least put on the defensive. Unfortunately, to test this one needs prefixes, which are difficult to find in Turkish, to say the least.

The only Turkish prefix that I am aware of is a quasi-reduplicative intensifier (C)VC₂ (C₂ = m, s, k, p), which is commonly prefixed to adjectives: kara 'black' kapkara 'pitch black', bütün 'all, whole', büsbütün 'absolutely all'. There are a few monosyllabic adjectives ending with k which can take an intensive prefix; all that I have been able to find are shown below, with their accusative forms.

bok/bok-u	'excrement'	bombok/bombok-u	'totally rotten'
gök/{gök-ü}	'blue'	gömgök/gömgö-ü	'intensely blue'
{gö-ü}			
ak/ak-ı	'white'	apak/apa-ı	'snow white'
dik/dik-i	'upright'	dimdik/dimdik-i(?)	'bolt upright'
?(pak/pak-ı	'clean'	akpak/akpak-ı	'very clean'

These examples are obviously not conclusive. Akpak may be a compound of 'white' and 'clean' and not an example of the intensifying prefix at all. The accusative of dimdik is not given in any dictionary I could find; a native speaker's first reaction was dimdi-i, but he later changed his mind and insisted on dimdik-i. Gömgö-ü really does not prove anything, since gök itself is exceptional; it has two accusative forms, gök-ü and gö-ü, one with k and the other with ∅. This leaves only apak and bombok: the first has k-∅, the second, k-k.⁶

Sezer 1981 argues convincingly that a k-Deletion analysis along the lines proposed by Zimmer can account for certain facts which an underlying g analysis has major problems with, primarily the interaction of the k-∅ alternation with vowel length in Arabic and Persian loanwords and the retention of k before some non-native V-initial suffixes. Sezer's data is impressive, however, it deals for the most part with vocabulary of a type that would be learned very late (perhaps not at all by uneducated speakers) and would presumably have little effect on a child's grammar construction.

In short, then, evidence either for or against an analysis with both voiced and voiceless underlying morpheme final velar stops as opposed to one with only voiceless /k/ is scarce, difficult to find, and inconclusive. Certain phonetic and dialectal evidence, as well as the existence of ngt clusters appear to support the existence of /g/, while Sezer's work on non-native vocabulary supports k-Deletion.

3. The Experiment

An experiment was conducted with the purpose of determining whether and to what extent the connection between number of syllables and alternating versus non-alternating k is psychologically real to native speakers, that is, whether a "real" MSC or rule exists which is dependent on the number of syllables in a word. It was hoped that the test would also provide some evidence for or against a voicing distinction in morpheme final velars.

The subjects were fourteen native speakers of Standard Turkish, most of whom were students at Indiana University; all of them are

highly educated and know English. Each subject was tested individually. The test consisted of a list of made-up "plausibly Turkish" words, ending in k, t, or p, to which the subjects were asked to add the accusative definite suffix. They were told that the words were not real words, but to pretend that they were; that is, to treat them as if they were the name of some object that they had not previously been familiar with. An example of the accusative definite suffix was given with an existing Turkish word: "If I say mendil ('handkerchief') you tell me mendil ver ('give me the handkerchief') or just mendili." After practicing with a couple of real Turkish words, none of the subjects had any difficulty carrying out the suffixing task. The test words were presented orally in a random order.

The results are given in Table 1. Responses were recorded as "k" in sections I and II if the speaker kept the final k before a suffix vowel (for instance, kavık-ı) and as "∅" if k was dropped (kavı-ı). In sections III and IV "p/t" means that the final consonant was kept unchanged (kelet-i) while "b/d" means it was voiced when a suffix was added (keled-i). In a few cases a speaker could not make up his or her mind, refused to answer at all, or went back and changed an answer; all of these were recorded as "both or neither". It is worth noting, however, that in all cases where an answer was changed, the change was in the direction of deletion or voicing in polysyllables and retention of the voiceless stop in monosyllables, never the reverse.

TABLE 1: POOLED RESULTS OF SUFFIXING TEST

"word"	k	∅	both or neither
I.			
kavık	1	13	0
istik	2	11	1
büsük	3	10	1
göçek	2	11	1
TOTAL:	8	45	3
II.			
bık	10	1	3
gok	9	2	3
mek	11	2	1
sük	12	2	0
fuk	11	3	0
TOTAL:	53	10	7
	<u>p/t</u>	<u>b/d</u>	
III.			
müdep	3	11	0
çapat	11	2	1
kelet	12	2	0
ağat	9	4	1
TOTAL:	35	19	2
IV.			
pet	14	0	0
göp	12	2	0
TOTAL:	26	2	0

The results for words with a final k were much as expected: \emptyset was preferred in polysyllables by a ratio of approximately 6/1, while in monosyllables k was strongly preferred. Final t tended to be retained in all words, but less regularly in polysyllables, where it sometimes was voiced to d. p was usually kept in the single monosyllabic example, but almost always voiced to b in the polysyllabic one.

More interesting than the overall results, which were more or less expected on the basis of Zimmer's experiments, was the fact that each individual speaker followed a consistent pattern or strategy in answering, and not all subjects had the same strategy. At least four distinct strategies were manifested by the fourteen subjects tested:

- | | | |
|---|--|--|
| 1. $k \rightarrow \left\{ \begin{array}{l} k \text{ (1 syll)} \\ \emptyset \text{ (2 syll)} \end{array} \right\}$ | $t \rightarrow t$ | $p \rightarrow \left\{ \begin{array}{l} p \text{ (1 syll)} \\ b \text{ (2 syll)} \end{array} \right\}$ |
| 2. $k \rightarrow \emptyset$ | $t \rightarrow t$ | $p \rightarrow \left\{ \begin{array}{l} p \text{ (1 syll)} \\ b \text{ (2 syll)} \end{array} \right\}$ |
| 3. $k \rightarrow k$ | $t \rightarrow t$ | $p \rightarrow \left\{ \begin{array}{l} p \text{ (1 syll)} \\ b \text{ (2 syll)} \end{array} \right\}$ |
| 4. $k \rightarrow k$
$t \rightarrow t$
$p \rightarrow p$ } (1 syll) | $k \rightarrow \emptyset$
$t \rightarrow d$
$p \rightarrow b$ } (2 syll) | |

Strategy (1) was by far the most common; 10 out of 14 subjects followed this pattern, although not all were totally consistent. A couple of speakers followed the "normal" pattern for velars, but hesitated and appeared to respond more or less randomly for labials and dentals; these speakers could in fact be classified as belonging to group (4) rather than group (1). Strategy (2) was employed by two subjects, and (3) and (4) by one subject each. All speakers tended to voice p to b in müdep (müdebi), regardless of overall strategy: since this was the only example of a polysyllable ending in p, it is possible that some other factors (resemblance to an existing word?) may have interfered. With the exception of p in müdep, strategies (2) and (3) show no syllable-counting effect at all. Assuming that test-taking strategies actually reflect rules, the (2) speakers apparently have a general k-Deletion rule and treat all words in which k does not delete as exceptional, while for the (3) speaker words in which k does delete are exceptions. Strategy (1) has either syllable-based k-Deletion or an MSC limiting the distribution of voicing in velars and perhaps also labials. Strategy (4) appears to have a similar MSC for all places of articulation:

$$\begin{array}{l} \text{MSC} \\ \text{(strategy (4):} \end{array} \left[\begin{array}{l} \text{-son} \\ \text{-cont} \end{array} \right] \rightarrow \left\{ \begin{array}{l} \text{[-voice]} / \#(C_0)V____ \\ \text{[+voice]} / VC_0V____ \end{array} \right.$$

$$\begin{array}{l} \text{MSC} \\ \text{(strategy (1):} \end{array} \left[\begin{array}{l} \text{-son} \\ \text{-cont} \\ \text{-cor} \end{array} \right] \rightarrow \left\{ \begin{array}{l} \text{[-voice]} / \#(C_0)V____ \\ \text{[+voice]} / VC_0V____ \end{array} \right. \quad (\text{or: } \left[\begin{array}{l} \text{-son} \\ \text{-cor} \\ \text{-ant} \end{array} \right])^7$$

These constraints are violated by a large number of words in the language, however, there is some justification for regarding them as at least describing the least marked case. Morpheme final p and ç and, to a lesser extent, t, do tend to alternate with the corresponding voiced segments in polysyllables but not in monosyllables in the existing vocabulary, although the correlation is not as close as for k. Lewis (1967:10) states that final p,ç,t become b,y,d "regularly in polysyllables, occasionally in monosyllables" when followed by a vowel, and Nemeth (1962:29) basically agrees; he says that alternation is the rule but "monosyllabic words sometimes retain t" and "mostly retain their p and ç." Some speakers appear to have included this fact in their grammars as a "morpheme structure preference" at least, while others seem not to be aware of it.

Zimmer (1969) has presented experimental evidence that speakers of Turkish differ considerably in their treatment of several morpheme-internal vowel harmony MSCs. He concludes that speakers do not necessarily "know" all the storable MSCs of their language, and that different speakers have different versions of the constraints, particularly if these are not fully productive. The various syllable-based constraints on underlying voicing of stops shown above provide additional support for his hypothesis. For example, speakers with grammars along the lines of strategies (2) and (3) do not make use of the statistically valid relation between number of syllables and the k-ø alternation in their internalized grammars.

The facts presented here contradict the usual assumption that all speakers of a given dialect have the same grammar. King (1977) argues for the possibility of what he calls "Ambiguous Projection", that is, that based on the same data different speakers may construct different grammars; their surface production would be identical except in "boundary situations" when the effects of the different rules would become visible. The present case is a good example of such a situation. All of the speakers studied here speak essentially the same dialect of Turkish; they have the same surface forms. However, when they are pushed to apply their grammars to unfamiliar forms it becomes evident that some of them have different MSCs than others, and perhaps also different rules and even different underlying forms for certain morphemes. Since the surface forms produced by a Lees-type and a Zimmer-type grammar would be different in extremely few cases, it should not be particularly surprising to find that some speakers have one and some have the other. Similarly the difference between predicting which morphemes have voicing alternations by an MSC (which could have exceptions) and simply memorizing which forms alternate would not be visible in surface productions.

The question of how individualized grammars can be, and how and why different speakers internalize different sets of rules (if indeed they do) has not received much attention, although it has been widely recognized that something like ambiguous projection probably plays an important role in historical change: children's grammars, though based

on the production of older speakers, may not be identical to those older speakers' grammars. The material presented in this paper indicates that the topic of individual grammars deserves further investigation, not only in diachronic studies, but also in synchronic description.

NOTES

¹ Examples are given in standard Turkish orthography except for the following phonetic symbols: ɨ = high back unrounded vowel (standard spelling *i*), ç and j = voiceless and voiced affricates respectively (standard spelling *ç* and *c*). The letter ğ , which has no phonetic realization except sometimes vowel length, is omitted. Long vowels are represented as a sequence of two vowels.

² Lees actually sets up two underlying voiced velar stops: ɟ "back velar" and g "front velar", which devoice to q and k respectively. Between vowels both ɟ and g become g , a voiced velar fricative, which then deletes in all environments, with or without lengthening of the preceding vowel. So far as I can tell this is unnecessary: front and back velars are allophonic variants (determined by the surrounding vowels) and there is no reason in standard Turkish to posit a velar fricative.

³ g does occur and contrasts with k initially and medially after consonants: kök 'root', gök 'sky'; karga 'crow', arka 'back'.

⁴ Zimmer does not give any details about his experiment, only a general conclusion.

⁵ The specification "postvocalic" is necessary because a voiced velar does occur after *n* in words such as renk/reng-i 'color'. An alternative to this MSC would be to have morpheme final velars underlyingly unspecified for voice and assign voicing to them by rule:

$$\begin{array}{|l} \text{-son} \\ \text{-cor} \\ \text{-ant} \end{array} \rightarrow \begin{cases} [+voice] / \text{ n } _ +V \\ [-voice] / (\text{elsewhere morpheme finally}) \end{cases}$$

But the environment for [-voice] is not easy to state formally.

⁶ It should be noted that monosyllabic suffixes with final *k* all alternate with \emptyset : çok 'much', -luk (noun forming suffix); çokluk/çoklu-u 'abundance'; git 'go', -mek (infinitive marker); gitmek/gitme-i 'to go,going'. These and several other similar suffixes are very productive and provide a huge number of examples of one-syllable morphemes at the end of polysyllabic words. However, since they never occur alone, the suffixes cannot be expected to behave like "normal" monosyllables.

⁷ The feature [-cont] is implied by [-cor], [-ant] in the standard dialect.

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