

## Another look at velar deletion in Turkish, with special attention to the derived environment condition

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### 1. Introduction

Turkish velar deletion is a textbook example of and at the same time a puzzling counterexample to the derived environment condition, the cross-linguistically robust pattern whereby morphophonemic alternations apply only when their conditioning environment is morphologically or phonologically derived.

Turkish velar deletion applies to /k/ and /g/ at the ends of stems, when rendered intervocalic by the addition of a suffix (e.g. Lewis 1967:10-11, Zimmer & Abbott 1978, Sezer 1981, Göksel & Kerslake 2005:14-17):

(1)

		(nominative)	Dative /-A/	Genitive /-In/
'baby'	/bebek/	[be.bek] <i>bebek</i>	[be.be.e] <i>bebeğe</i>	[be.be.in] <i>bebeğin</i>
'catalog'	/katalog/	[ka.ta.log] <i>katalog</i>	[ka.ta.lo.a] <i>kataloga</i>	[ka.ta.lo.un] <i>katalogun</i>
'mathematics'	/matematik/	[ma.te.ma.tik] <i>matematik</i>	[ma.te.ma.ti.e] <i>matematige</i>	[ma.te.ma.ti.in] <i>matematigin</i>

\* This paper is dedicated to Karl Zimmer, who has been my friend for 20 years and taught me that puzzling mysteries lurk inside even the most familiar things, if one just thinks hard enough about them.

Deleted velars are represented in the orthography as “ğ”. In some dialects they are pronounced as velar glides.<sup>1</sup> This paper documents the variety of Turkish represented in TELL (Turkish Electronic Living Lexicon), in which the velars are phonologically and phonetically deleted.<sup>2</sup> This is the pattern reported by Lewis 1967, Zimmer & Abbott 1978 and Sezer 1981, as well. The productivity of velar deletion is evidenced by its applicability to recent loans and confirmed by an experimental study by Zimmer & Abbott (1978), in which subjects were presented with a set of loanwords and asked to use them in an third person singular possessive context; the possessive suffix *-/I/* is a velar deletion trigger. Zimmer & Abbott observed a deletion rate of 80-90% in the made-up words meeting the conditions for velar deletion.

Velar deletion applies to stem-final consonants when rendered intervocalic by suffixation, as in (1), but not to consonants which are intervocalic within a root morpheme, as in (2).

(2)

‘lawyer’	<i>avukat</i>	/avukat/	[a.vu.kat]
‘motion’	<i>hareket</i>	/hareket/	[ha.re.ket]
‘railway car’	<i>vagon</i>	/vagon/	[va.gon]
‘insurance’	<i>sigorta</i>	/sigorta/	[si.gor.ta]

The pattern in which a stem-final consonant participates in an alternation which a stem-internal consonant does not, all else being equal, is the classic example of a morphologically derived environment effect.<sup>3</sup> Extremely familiar counterparts exist in Finnish and Polish.

In Finnish, the assibilation rule converting underlying /t/ to /s/ before /i/ applies to /t-i/ sequences that are heteromorphemic (3a,b), but not to those wholly contained within a root (3b, c) (Kiparsky 1982, 1993; Keyser & Kiparsky 1983, etc.).

<sup>1</sup> Even in standard Istanbul Turkish, “ğ” is sometimes reported to manifest as a weak labial glide between round vowels or as a weak palatal glide between front vowels (e.g. Lewis 1967:5, Göksel & Kerslake 2005:8). These glides are arguably excrement, the expected phonetic transitions between vowels rendered adjacent by velar deletion, as in *dığır* [dier] ‘other’.

<sup>2</sup> Except where otherwise noted, Turkish data cited in this paper come from TELL (Turkish Electronic Living Lexicon; <http://linguistics.berkeley.edu/TELL>). I am very grateful to Larry Hyman, Aylin Küntay, Anne Pycha, and the volume editors, Eser Taylan and Bengisu Rona, for discussion and feedback on both the data and the analysis in this paper.

<sup>3</sup> Trisyllabic laxing in English is one of the earliest examples cited in the literature on derived environments (Chomsky & Halle 1968, Kiparsky 1982), but its nonproductivity and reliance on abstract underlying representations make it less than ideal as the central example of the phenomenon.

(3)

a.	/halut-i/	→ halusi	'want-3P.SG.PRET'	
	/halut-a/	→ haluta	'want-INF'	
b.	/tilat + i/	→ tilasi	'order-3P.SG.PRET'	(*silasi)
	/tilat-a/	→ tilata	'order-INF'	(*silata)
c.	/æiti/	→ æiti	'mother'	(*æisi)

In Polish, palatalization of /k/ to [č], /x/ to [š] and /g/ to [ž] occurs when the target consonant and triggering /front/ vowel are separated by a morpheme boundary (4a), but not when target and trigger both belong to the same morpheme (4b) (Lubowicz 2002):

(4)

a.	'to step'	kro[k]-i-ć	→ kro[č]-i-ć
	'to frighten'	stra[x]-i-ć	→ stra[š]-i-ć
	'to weigh'	va[g]-i-ć	→ va[ž]-i-ć
b.	'kefir'	[ke]f'ir	
	'jelly'	[k'i]šel	
	'plaster'	[g'i]ps	
	'agent'	a[ge]nt	
	'hygienist'	[x'i]g'jeńistka	
	'chemist'	[xe]m'ik	

In Hausa, coronal obstruents, including /t/, palatalize before front vowels across the stem-suffix boundary, but not within morphemes (Newman 2000):

(5)

a.	'steal'	[sa:t-a:]
	'steal (before noun object)'	[sa:tʃ-i]
	'steal (before pronoun object)'	[sa:tʃ-e:]
b.	'street'	[titi:]

Such examples abound cross-linguistically, and appear exactly parallel to the situation in Turkish. As shown in (6), velar deletion applies when the target /k/ or /g/ and the triggering intervocalic environment span a morphological boundary, but not when the /VKV/ sequence is wholly contained in a morpheme:

(6)

'street'	/sokak/	[so.kak]	[so.ka.a]	[*so.a.a]
'mechanics'	/mekanik/	[me.ka.nik]	[me.ka.ni.e]	[*me.a.ni.e]

'(weaver's) shuttle'	/mekik/	[me.kik]	[me.ki.e]	[*me.i.e]
'cuckoo's call'	/guguk/	[gu.guk]	[gu.gu.a]	[*gu.u.a]

The recurrence of this pattern in so many languages has inspired attempts to capture it in the form of a generalization about derived environments. However, the generalization has proved elusive on closer inspection. What environments count as 'derived'? How general is the condition within any given language?

## 2. Defining derived environments

As a working definition that is consistent with past approaches, we define an environment as derived if its elements are not present in the underlying representation of a single morpheme. In practice, researchers have divided environments into those which are morphologically derived, vs. those which are phonologically derived.

Morphologically derived environments are those in which the trigger and target belong to different morphemes. This is the case for the Turkish, Finnish and Polish examples above: the alternation in question applies to a consonant only when the triggering vowel belongs to the following morpheme.

To be phonologically derived, it is necessary for some component of the environment of an alternation to be nonidentical to the input (underlying representation). Either the trigger or the target (or both) could manifest the key non-identity.

In Finnish, for example, Kiparsky (1982, 1993) observes that assibilation is triggered not just by the underlying *i* vowel of a suffix but also by *i* vowels that result from word-final raising of underlying *e*: /vete/ 'water' → |veti| → [vesi]. The final [i] in [vesi] is tautomorphemic with the preceding [t], but is eligible to trigger Assibilation by virtue of being *phonologically* derived.

Lubowicz (2002), citing Rubach 1984, identifies another instance of a phonologically derived environment, in Polish (Lubowicz 2002:244). As seen above, the phonological rule of First Velar Palatalization applies at morpheme boundaries. Lubowicz argues that palatalization interacts with another process, Spirantization, which applies only to derived palatals. Stem-final /g/ is converted by Palatalization to [j], which Spirantization then turns into [ʒ], producing alternations like those in (7a). However, as shown in (7b), *underlying* stem-final /j/ does not undergo Spirantization. Lubowicz attributes this to a condition on Spirantization that it apply only in phonologically derived environments, i.e. only to palatals which are derived but not underlying.<sup>4</sup>

(7)

a.	Palatalization and Spirantization of underlying /g/:			
	'to weigh'	/va[g] + i + ć/	(→ va[j] + i + ć)	→ [va[ʒ] + i + ć]
	'pole (dim.)'	dron[g] + ik + ĩ	(→ dron[j] + ek)	→ drōw[ʒ] + ek
	'snow-storm'	śnie[g] + ĩc + a	(→ śnie[j] + ic + a)	→ śnie[ʒ] + ic + a

<sup>4</sup> The data for 'weigh', based on Hall 2006:806, correct an apparent typographical error in Lubowicz.

b.	No Spirantization of underlying /j/:	
	'bridge (dim.)'	br̩i[j] + ik + ĩ → bri[j] + ek
	'jam'	[j]em + ĩ → [j]em

McCarthy (2003) and Hall (2006) treat such cases as emergent unmarkedness (McCarthy & Prince 1994), i.e. the situation in which the grammar tolerates underlying structures of the same kind that it actively prohibits from being created via phonological alternations. In the terminology of McCarthy (2003), Polish tolerates 'old markedness' violations of the constraint against [j] in the Spirantization environment, but does not tolerate 'new markedness' violations; 'old', i.e. underlying, [j] survives but 'new', i.e. derived, [j] is not permitted.

There is, in sum, a clear intuition underlying both kinds of derived environment: phonological regularities can be flouted by underlying structures, but must be obeyed by new creations that do not yet exist in the lexicon<sup>5</sup>. This intuition rests on the common assumption in generative grammar that individual morphemes are memorized but complex words are not.

### 3. The claim

This paper calls into question the relevance of the basic, familiar intuition about derived environments. No matter how 'derived environment' conditioning is defined, Turkish velar deletion does not actually meet its description. When we look closely at the details, the alternation turns out to be highly morphologically and phonologically conditioned. The fact that environments in which the rule does apply are derived is a side effect of its other morphological and phonological conditioning, not the explanatory factor. This study raises the question of whether the same conclusions would apply to any other apparent derived environment effect that is explored to the same close degree.

### 4. Morphological conditioning factors in Turkish velar deletion

If velar deletion in Turkish were a general neutralizing alternation ( $K \rightarrow \emptyset / V\_V$ , where "K" = {/k/, /g/}) that was blocked from applying in morphologically nonderived environments, the expectation is that it should apply to any VKV sequence containing a morpheme boundary. While it is true that tautomorphemic VKV sequences (as in *sigara* 'cigarette') do not undergo velar deletion, there are two types of systematic morphological exception to the expectation that heteromorphemic VKV sequences are subject to the rule.

<sup>5</sup> The literature also attempts to characterize which types of phonological patterns are most prone to derived environment effects. Cyclic, structure-changing, and feature-filling rules have been nominated; see Kiparsky (1993) for a useful overview. It is generally agreed that contrast-neutralizing alternations are subject to derived environment conditioning, whereas syllabification and allophony are not. We skirt this issue in this paper because the focus is on the neutralization alternation of velar deletion in Turkish, which every approach would recognize as in the purview of generalizations about derived environment sensitivity.

In other words, the morphologically derived environment condition may be necessary, but is by no means sufficient, for the rule to apply.

#### 4.1. The part of speech condition

Turkish velar deletion is morphologically general in the sense that it applies to native and loan vocabulary and to monomorphemic and complex stems alike. As seen below, velar deletion applies regularly to velars at the ends of monomorphemic (8a) and complex stems (8b), with one systematic exception: it does not apply to verb roots (8c).

(8)

	UR		cf.	
a.	/bebek-A/	[be.be.e]	/bebek/	[be.bek]
	'baby-DAT'	<i>bebeğe</i>		<i>bebek</i>
	/arkeolog-I/	[ar.ke.o.lo.u]	/arkeolog/	[ar.ke.o.log]
	'archeologist-ACC'	<i>arkeoloğu</i>		<i>arkeolog</i>
b.	/gel-Ad <sub>3</sub> Ak-A/	[ge.le.dʒe.e]	/gel-Ad <sub>3</sub> Ak /	[ge.le.dʒek]
	'come-FUT-DAT'	<i>geleceğe</i>		<i>gelecek</i>
	/git-Tlk-I/	[git.ti.i]	/git-Tlk/	[git.tik]
	'go-REL-ACC'	<i>gittiği</i>		<i>gittik</i>
	/anla-mAk-A/	[an.la.ma.a]	/anla-mAk/	[an.la.mak]
	'understand-INF-DAT'	<i>anlamağa</i>		<i>anlamak</i>
	/badem-Clk-I/	[ba.dem.dʒi.i]	/badem-Clk/	[ba.dem.dʒik]
	'almond-DIM-ACC = tonsil (acc.)'	<i>bademciği</i>		<i>bademcik</i>
c.	/gerek-ljor/	[ge.re.ki.jor]	*[ge.re.i.jor]	
	'be necessary -PROGRESSIVE'			
	/burak-t/	[bu.raku.jor]	*[bu.ra.u.jor]	
	'drop out-AORIST'			
	/birik-en/	[bi.ri.ken]	*[bi.ri.en]	
	'gather-REL'			
	/gerek-Ad <sub>3</sub> Ak/	[ge.re.ke.ɟek]	*[ge.re.e.ɟek]	
	'be necessary-FUT'			

Standard descriptions of Turkish velar deletion state that it applies to substantives only. This statement is consistent with the data in (8b) if the /k/-final suffixes in (8b) are assumed to produced nominal forms; this is a reasonable assumption given that infinitival and participial forms inflect like nouns, despite their verbal semantics. From a synchronic perspective, the part of speech restriction is arbitrary. Both noun and verb roots combine with vowel-initial endings; both permit the full inventory of consonants and vowels; both exhibit a range of monosyllabic to polysyllabic size and permit both open and closed

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**Comment:** check on editorial suggestion that -ince is actually -in + -ce

syllables. Verb roots are on average much shorter than noun roots, due in large part to the many polysyllabic nominal loans, and exhibit almost no long vowels or geminate consonants, but these statistical differences cannot account for minimal pairs like *gerek* ‘need (n.)’ and *gerek* ‘be necessary (v.)’:<sup>6</sup>

(9)

Nominal	<i>gerek</i>	‘need’
	<i>gereğ-i</i>	‘need-ACC’
	<i>gereğ-e</i>	‘need-DAT’
	<i>gereğ-in</i>	‘need-2SG.POSS’
	<i>gereğ-in-ce</i>	‘need-2SG.POSS-ADV = in accordance with’
Verb	<i>gerek-mek</i>	‘be necessary-INF’
	<i>gerek-ir</i>	‘be necessary-AOR’
	<i>gerek-iyor</i>	‘be necessary-PROG’
	<i>gerek-en</i>	‘be necessary-REL = thing that is necessary’
	<i>gerek-ince</i>	‘be necessary-GER = when necessary’

As shown particularly by near-minimal pairs such as *gereğ-in* / *gerek-ir* and *gereğ-in-ce* / *gerek-ince*, velar deletion appears to be determined by part of speech.

#### 4.2. Suffix-initial velars

The environments /...VK-V.../ and /...V-KV/ are both morphologically derived. In each case, the VKV environment for velar deletion is heteromorphic. However, the /...V-KV/ environment — i.e. a velar-initial suffix combining with a vowel-final base — never triggers velar deletion. Turkish has a number of velar-initial suffixes, varying in productivity. Some, like *-(y)ken* ‘while being’, exhibit a palatal glide-initial allomorph when combining with vowel-final bases, e.g. *öğrenci* ‘student’, *öğrenci-yken* ‘while a student’. Others, however, combine directly with vowel-final bases, creating a V-KV environment. These never undergo velar deletion. Three of the quite productive *k-* and *g-*initial suffixes are illustrated below. (The suffix glossed as -GON combines with numbers and forms polygon names.)

<sup>6</sup> These forms were constructed on the basis of illustrations of individual suffixes in Lewis 1967, confirmed against a large corpus of Turkish internet newspapers and checked with an native speaker.

(10)

<i>-gen</i>	<i>altgen</i>	/altu-gen/ 'six-GON' ='hexagon'	[al.tu.gen]
	<i>yedigen</i>	/jedi-gen/ 'seven-GON' ='septagon'	[je.di.gen]
<i>-gil-ler</i>	<i>baklagiller</i>	/bakla-gil-lAr/ 'beans-group-plural' ='pulses'	[bak.la.gil.ler]
	<i>amcasıgiller</i>	/amca-sl-gil-lAr/ 'uncle-3POSS-group-plural' ='his/her uncle & family'	[am.ɕa.stu.gil.ler]
<i>-ki</i>	<i>seneki</i>	/sene-ki/ 'year-REL' 'this year's'	[se.ne.ki]
	<i>adadaki</i>	/ada-DA-ki/ 'island-LOC-REL' 'the one on the island'	[a.da.da.ki]

### 4.3. Lexical exceptions

There are some lexical exceptions to stem-final velar deletion; these vary somewhat by speaker. According to Zimmer & Abbott (1978), most exceptions are loanwords, but not all loanwords are exceptions. Loans from Persian or Arabic (e.g. *mahrek*, *mahreki* 'orbit(-ACC)', p. 36) are more likely to resist velar deletion than are loans from European languages, which tend to be adapted to the rule (e.g. *kartotek*, *kartoteği* 'card catalogue (-ACC)', p. 37). Zimmer & Abbott also noted a tendency for younger speakers to apply velar deletion to loans more regularly than older speakers. In the TELL database, about 90% of velar final nominal stems exhibit velar deletion, which is comparable to the rate at which speakers applied the rule in the experimental study by Zimmer & Abbott. The following forms are drawn from the 100 or so lexical exceptions that exist in the TELL database, representing just one speaker. Considerable variation across the population is expected with these forms:

(11)

orthography	(nominative)	accusative (/I/)	
<i>antartik</i>	antartik	antartiki	'Antarctic'
<i>lâik</i>	laik	laiki	'secular'
<i>orak</i>	orak	oraku	'sickle'
<i>patolog</i>	patolog	patologu	'pathologist'



<i>salacak</i>	saladçak	saladçaku	'slab for corpse'
<i>Selanik</i>	sela:nik	selamiki	'Salonika'
<i>sinagog</i>	sinagog	sinagogu	'synagogue'
<i>sitreptokok</i>	sitreptokok	sitreptokoku	'streptococcus'

In conclusion, when we take into account the part of speech condition, the fact that suffix-initial velars are immune, and the existence of lexical exceptions, it is clear that while being in a morphologically derived environment may be necessary for an intervocalic velar to undergo velar deletion, it is not sufficient.

## 5. Phonological conditioning factors

We turn next to an examination of phonological conditioning factors, to see whether the phonologically derived environment condition is necessary or sufficient.

Velar deletion is subject to two well-known conditions on its application: vowel length and prosodic size.

### 5.1. Vowel length

As noted by Sezer (1981), velar deletion does *not* apply when the preceding vowel is long:

(12)

	nominative	dative	gloss
/infi:la:k/	[in.fi.lak]	[in.fi.la:ka]	
	<i>infilak</i>	<i>infilaka</i>	
/mera:k/	[merak]	[me.ra:ka]	'curiosity'
	<i>merak</i>	<i>meraka</i>	

This is consistent with the finding of Zimmer & Abbott 1978, whose experimental subjects were more likely to preserve the final /k/ in the nonsense word *istsāk*, in which a long vowel preceded the *k*, than in comparable *k*-final words with a short vowel. We can only speculate as to the reason for the correlation between vowel length and velar deletion. Vowel length is an indicator of non-native origin, and Zimmer & Abbott found that nonsense words that resembled Arabic loans were less likely than other nonsense words to participate in velar deletion. In the TELL database, however, words with long vowels in syllables other than the final (e.g. *tarik* /tarik/ 'profession') undergo velar deletion at an 80% rate, suggesting that the connection is not simply etymological. Another possibility is that velar deletion is inhibited when the result would be a sequence of long vowel followed by short vowel. Turkish does have some words containing that configuration, e.g. *nihai* [niha:i] 'final', *vaiz* [va:iz] 'Muslim preacher', *Azrail* [az.ra:il] 'angel of death (Islam)', but it is possible that they are a closed, marked class.

## 5.2. Monosyllabism

Velar deletion is subject to a very robust condition that the participating stem be polysyllabic (Lewis 1967:10-11, Göksel & Kerslake 2005:16, Zimmer & Abbot 1981, Inkelas & Orgun 1995). Deletion is the norm for polysyllabic roots but the exception for CVC roots:

(13)

gloss		(nominative)	Dative (/-/A/)	1sg.possessive (/-/m/)
'root'	/køk/	[køk]	[kø.ke]	[kø.kym]
		<i>kök</i>	<i>köke</i>	<i>köküm</i>
'affix'	/ek/	[ek]	[e.ke]	[e.kim]
		<i>ek</i>	<i>eke</i>	<i>ekim</i>
'arrow'	/ok/	[ok]	[o.ka]	[o.kum]
		<i>ok</i>	<i>oka</i>	<i>okım</i>
'league'	/lig/	[lig]	[li.ge]	[li.gim]
		<i>lig</i>	<i>lige</i>	<i>ligim</i>
'fugue'	/fyg/	[fyg]	[fy.ge]	[fy.gym]
		<i>füg</i>	<i>füge</i>	<i>fügüm</i>

Only two CVC roots (*çok* 'a lot', *gök* 'sky') undergo velar deletion (*çoğ-u* 'a lot-ACC', *göğ-ü* 'sky-ACC').

Interestingly, CVC monosyllabic roots are also systematic exceptions to voicing alternations which affect plosives (e.g. *sahip*, *sahib-e* 'owner(-DAT)', but *ip*, *ip-e* 'string(-DAT)') (see e.g. Lewis 1967:11, Göksel & Kerslake 2005:10, Inkelas & Orgun 1995). As expected, the monosyllable-final, nondeleting velars in (13) do not show voicing alternations.

## 5.2. Epenthesis

Turkish exhibits high vowel epenthesis to break up consonant clusters which cannot be syllabified (see e.g. Lewis 1967:9-10, Göksel & Kerslake 2005:18, and the papers by Taylan and Hankamer in this volume). Except in some unassimilated loans, onset clusters are prohibited in Turkish, and the only possible tautosyllabic clusters are codas. Lists of possible and impossible coda clusters can be found in the literature (e.g. Clements & Sezer 1982); essentially, sonorant-obstruent clusters are permitted but sonorant-final clusters are not, nor are fricative-fricative or plosive-plosive clusters. Final clusters that cannot occur as codas are broken when no vowel-initial suffix is available with which the stem-final consonant can syllabify:

(14)

Underlying representation	(nominative)	Locative (/ -DA/)	Accusative (/ -I/)	gloss
/nesr/	[ne.sir]	[ne.sir.de]	[nes.ri]	'prose'
/film/	[fi.lim]	[fi.lim.de]	[fil.mi]	'film'
/kajp/	[ka.juip]	[ka.juip.te]	[kaj.buu]	'loss'
/keʃf/	[ke.ʃif]	[ke.ʃif.te]	[keʃ.fi]	'exploration'
/kutB/	[ku.tup]	[ku.tup.ta]	[kut.bu]	'pole'

Epenthesis can create VKV environments. Whether velar deletion applies in these is a test of whether the phonologically derived environment condition is applicable to Turkish velar deletion. The answer is mixed: epenthetic vowels trigger velar deletion when epenthesis itself applies in a morphologically derived environment, but not when epenthesis splits up consonants belonging to the same root.

As seen in (15), epenthesis into root consonant clusters does not trigger velar deletion, even though the resulting velar is intervocalic and the environment is derived, not underlying.<sup>7</sup>

(15)

Underlying representation	(nominative)	Locative (/ -DA/)	Accusative (/ -I/)	gloss
/akl/	[a.kuul]	[a.kuul.da]	[ak.lu]	'intelligence'
	<i>akıl</i>	<i>akılda</i>	<i>aklı</i>	
/aks/	[a.kis]	[a.kis.te]	[ak.si]	'reflection'
	<i>akıs</i>	<i>akiste</i>	<i>aksi</i>	
/fikr/	[fi.kir]	[fi.kir.de]	[fik.ri]	'idea'
	<i>fikir</i>	<i>fikirde</i>	<i>fikri</i>	
/hükm/	[hy.kym]	[hy.kym.ler]	[hyk.my]	'judgment'
	<i>hüküm</i>	<i>hükümde</i>	<i>hükümü</i>	

By contrast, epenthesis *does* trigger velar deletion when it applies as a result of the suffixation of consonantal suffixes to consonant-final stems, as seen in (16).

(16)

Underlying representation	(nominative)	1sg.possessive (/ -m/)	(cf. accusative (/ -I/))	gloss
/bebek/	[be.bek]	[be.be.im]	[be.be.i]	'baby'
	<i>bebek</i>	<i>bebeğim</i>	<i>bebeği</i>	

<sup>7</sup> For arguments that this vowel is epenthetic, see Hankamer (this volume).

/inek/	[i.nek]	[i.ne.im]	[i.ne.i]	‘cow’
	<i>inek</i>	<i>ineğim</i>	<i>ineği</i>	
/sokak/	[so.kak]	[so.ka.um]	[so.ka.u]	‘street’
	<i>sokak</i>	<i>sokağim</i>	<i>sokağı</i>	
/bak-açgak/	[ba.ka.çgak]	[ba.ka.çga.um]	[ba.ka.çga.u]	‘look-FUTURE’
	<i>bakacak</i>	<i>bakacağim</i>	<i>bakacağı</i>	
/gel-me-dik/	[gel.me.dik]	[gel.me.di.im]	[gel.me.di.i]	‘come-NEG-PPL’
	<i>gelmedik</i>	<i>gelmediğim</i>	<i>gelmediği</i>	

In a form like /bebek-m/, a rule ordering account would posit the following derivation:

- (17)
- |                |           |
|----------------|-----------|
|                | /bebek-m/ |
| Epenthesis     | bebekim   |
| Velar deletion | bebeim    |

The interaction of epenthesis and velar deletion is interesting in its own right, as it produces a situation of rather notable twofold derivational opacity: velar deletion eliminates the environment for epenthesis, rendering epenthesis opaque on the surface (overapplication), and velar deletion produces the environment that normally would trigger glide epenthesis (underapplication). What is important for our purposes here, however, is that the same vowel epenthesis process triggers velar deletion when the target consonant is absolutely stem-final (16) but not when the target velar is root-internal (15). This suggests that the condition of being a phonologically derived environment is not sufficient to trigger velar deletion.

One possible explanation for the inapplicability of velar deletion in the root-internal epenthesis environments in (15) is that the target velar follows the first root vowel. It may be that whatever exempts velars at the ends of monosyllabic CVC roots from undergoing velar deletion (and voicing alternations) may be protecting these internal velars as well. We note that no plosives in this same position (/CV\_C/) participate in voicing alternations, thus patterning with plosives at the ends of CVC roots:

(18)

Underlying representation	(nominative)	Accusative (/-/)		gloss
/kibr/	[ki.bir] <i>kibir</i>	[kib.ri] <i>kibri</i>	*[kip.ri]	'arrogance'
/haḏm/	[ha.ḏim] <i>hakim</i>	[haḏ.mi] <i>hakmi</i>	*[hatf.mi]	'volume'
/sabr/	[sa.bur] <i>sabır</i>	[sab.ru] <i>sabrı</i>	*[sap.ru]	'patience'
/kabr/	[ka.bir] <i>kabir</i>	[kab.ri] <i>kabri</i>	*[kap.ri]	'grave'
/hicv/	[hi.ḏiv] <i>hiciv</i>	[hiḏ.vi] <i>hicvi</i>	*[hitf.vi]	'satire'
/nabz/	[na.buz] <i>nabız</i>	[nab.zu] <i>nabzı</i>	*[nap.zu]	'pulse'

Inkelas & Orgun (1995) posit that a cycle of root syllabification captures the final C of CVC roots into coda position, while leaving the final C of longer roots extrasyllabic, and that root-cycle syllabification spares CVC roots from later voicing alternations or velar deletion. If, in a root like /CVCC/, the second C (C2) were syllabified as a coda on the root cycle, the Inkelas & Orgun analysis would predict C2 to resist voicing alternations and/or velar deletion. Syllabifying /CVCC/ roots as [CVC]C on the root cycle would also predict the absence of long vowels preceding the underlying clusters, since such vowels would be shortened on the root cycle (hypothetical /CV:CC/ → [CVC]C). The TELL database reveals no such forms, which is consistent with this analysis.

It is true that some of the epenthetic vowels in (15) and (18) are disharmonic (front, even though the stem-final vowel is back). Normally, epenthetic vowels harmonize with the preceding vowel. One could possibly argue that the disharmony in forms like *kabir*, *kabr-i* is evidence that the vowels in question are underlying, not epenthetic, since their quality is not predictable. There are two reasons that this argument would not bear on the issue at hand, however. First, it is not practicable to treat the vowels which alternate with zero as underlying, for the simple reason that roots exhibiting the vowel-zero alternation contrast with roots whose vowel is fixed. The distinction between *koyun* 'bosom' and *koyun* 'sheep' would be impossible to represent unless the underlying representations are allowed to differ in the presence vs. absence of the second root vowel:

(19)

	(nominative)	Accusative	gloss
/kojn/	[ko.jun] <i>koyun</i>	[koj.nu] <i>koynu</i>	'bosom'
/kojun/	[ko.jun] <i>koyun</i>	[ko.ju.nu] <i>koyunu</i>	'sheep'

Second, suffix disharmony is a property of some roots even when epenthesis is not in the picture. As noted by Lewis (1967:19-20) and Clements & Sezer (1982), inter alia, a number of Turkish roots, mainly loans from Arabic and Persian, exceptionally take front vowel harmony on suffixes even though the root vowels are all back. This behavior traces back to a front-back distinction on root-final consonants, long since lost, whose only synchronic reflex is in the vowel quality of suffixal (or epenthetic) vowels (20a). Turkish does maintain a synchronic palatality contrast in laterals, and underlyingly palatal /l/ triggers front harmony on following vowels in a transparent way (20b). A sampling of back-vowel roots taking front-harmonic suffixes is given below. Note the front harmony exhibited by underlying suffix vowels and epenthetic vowels, alike:<sup>8</sup>

(20)

		nominative	accusative (-I/) (underlying vowel)	1sg possessive (-/m/) (epenthetic vowel)	
a.	/saat/	[sa.at]	[sa.a.ti]	[sa.a.tim]	'hour'
		<i>saat</i>	<i>saati</i>	<i>saatim</i>	
	/hadd/	[had]	[had.di]	[had.dim]	'limit'
		<i>had</i>	<i>haddi</i>	<i>haddim</i>	
	/tak <sup>l</sup> at/	[ta.k <sup>l</sup> at]	[ta.k <sup>l</sup> a.ti]	[ta.k <sup>l</sup> a.tim]	'strength'
		<i>takat</i>	<i>takati</i>	<i>takatim</i>	
b.	/mento <sup>l</sup> /	[men.to <sup>l</sup> ]	[men.to.ly]	[men.to.lym]	'menthol'
		<i>mentol</i>	<i>mentolü</i>	<i>mentolüm</i>	
	/sosja <sup>l</sup> /	[sos.ja <sup>l</sup> ]	[sos.ja.li]	[sos.ja.lim]	'social'
		<i>sosyal</i>	<i>sosyali</i>	<i>sosyalim</i>	

Disharmony is clearly a property of individual roots. Clements & Sezer (1982) handled disharmony by associating a [-back] feature to the final consonant of roots like *saat*. Zimmer (1992) argued against this analysis and in favor of a floating autosegmental [-back] feature that would link to any underspecified vowels, whether epenthetic or underlying. We assume the correctness of the latter account, but regardless of how disharmony is analyzed, it clearly exists independently of epenthesis. In a form like /kabr/ (18), the floating [-back]

<sup>8</sup> Laterals, like velars, are predictably palatal in the environment of front vowels; here, palatality is transcribed only when not predictable, i.e. when in the environment of back vowels.

feature, on Zimmer's analysis, associates to a suffix-initial vowel in words like *kabr-i*, and to the epenthetic vowel in words like *kabir*.

In conclusion, Turkish phonology and morphology conspire to produce the situation in which phonology could, in a morphologically *nonderived* environment, produce a phonologically derived environment; in this situation, velar deletion is not triggered. The phonologically derived environment condition is neither necessary nor sufficient for the application of velar deletion.

## 6. Derived environments revisited

A close inspection of velar deletion in Turkish shows that there is little evidence to support the intuition that neutralization alternations should apply in derived environments but not in nonderived environments. In Turkish, all of the environments in which velar deletion applies are morphologically derived, but velar deletion does not apply in all morphologically derived environments. Some of the environments are phonologically derived, but velar deletion does not apply in all phonologically derived environments. The derived environment condition both undergenerates and overgenerates predictions of velar deletion applicability; it is simply not a useful principle in this case.

### (21) Conclusions re velar deletion

1.	Is morphological derivedness necessary, for velar deletion to apply?	Yes
2.	Is phonological derivedness necessary?	No
3.	Is morphological derivedness sufficient?	No
4.	Is phonological derivedness sufficient?	No

In studying the broader implications of this finding for Turkish, we pose two general questions. First, the broad derived environment question: is there *any* phonological pattern whose morphological conditioning can be captured perfectly by the generalization that the environment must be morphologically derived? Second, the phonological derived environment question: are there any phonological patterns for which a derived phonological environment condition is necessary? If the derived environment generalization is just a weak, leaky way of generalizing cross-linguistically over all rules that happen to have any kind of idiosyncratic morphological conditioning, then it is not a useful condition to apply in the analysis of any given language.

Is it possible that Turkish, apocryphally characterized by Edward Sapir as a 'soberly logical' language, is simply idiosyncratic in the complexity underlying a superficially simple illustration of derived environments?<sup>9</sup> We suspect that the opposite is true. Rather than being a bug in the ointment, Turkish is showing us what languages are really like. In support of this conclusion, we observe that even Finnish turns out to be more like Turkish than like a poster child for pure derived environment effects.

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<sup>9</sup> In note 2 to Chapter 6, Sapir (1921), with a touch of irony, compares the 'sober logic of Turkish or Chinese' favorably to that of Latin and Greek, touted as superior systems by some writers of his time. Sapir (1949:23) applies the terms 'antiquated' and 'subjective' to the idea that Turkish could be characterized as 'soberly mechanical'.

Finnish assibilation, while exemplified by many words, is actually highly morphologically constrained. Both Andrew Dolbey and Paul Kiparsky have observed (pc, 1998) that the assibiling /t/ consonant cited in most examples is actually a single, very productive morphological formative used in denominal and onomatopoeic verb derivation and in the adaptation of loan words. Examples provided to us by Dolbey include [[tila-T]-i] *tilasi* ‘ordered’, [[töppä-T]-i] *töppäsi* ‘behaved stupidly’, and [[digga-T]-i] *diggasi* ‘thought was really cool’ (see also Inkelas 2000). Anttila (2006), citing work published in Finnish by Fred Karlsson, notes that Assibilation is triggered by three suffixes: “plural /-i/, e.g. /vuote-i-nA/ → *vuosina* ‘year-PL-ESS’, past tense /-i/, e.g. /huuta-i-vAt-kO/ → *huusivatko* ‘shout-PAST-3P.PL-QUE’, and superlative /-impA/, e.g. /uute-impA-nA/ → *uusimpana* ‘new-SUP-ESS’” (p. 900). But Assibilation does not apply generally before all *i*-initial suffixes, e.g. *-ist* and *-iiv*. For example, Kiparsky (2003) cites the forms *vokat-iiv-i-lla* ‘vocative’ and *nominat-iiv-i-lla* (p. 116), in which a morphologically derived /t-i/ sequence does not undergo Assibilation. To this list of exceptions Anttila (2006) adds several others: “the derivational suffix /-ime/ ‘instrument’, e.g. /lentä-ime-n/ → *lentimen* / \**lensimen* ‘fly-instrument-GEN’, and the signature /-isi/ ‘conditional’, e.g. /tunte-isi/ → *tuntisi* (\**tunsisi*) ‘feel-COND.’” Anttila also notes that “the derivational suffix /-inen/ only triggers Assibilation optionally, e.g. /vete-inen/ → *vesinen* ~ *vetinen* ‘watery’” (p. 901). Anttila concludes that Assibilation is a stem-level process. The broader point, however, is that even in this parade example of a morphologically derived environment condition, it is not enough to say that the environment must be morphologically complex. Once a sufficiently precise listing of morphological contexts has to be provided, the overarching derived environment generalization becomes extraneous at best.

Phonologically derived environment conditioning is equally hard to pin down. In Finnish, as noted earlier, word-final raising of /e/ to [i], a phonological alternation, creates a derived environment for Assibilation: /vete/ ‘water’ → [veti] → [vesi]. But it is not the case that just any phonologically derived /ti/ sequence is subject to Assibilation. Consonant gradation, which degeminates inter-sonorant voiceless plosives in closed syllables, can convert /...tti.../ strings to /...ti.../, meeting the structural description for Assibilation. However, examples like *ott-i-n* → *otin* (\**osin*) ‘take-PAST’ show that Assibilation is not triggered in this environment (Anttila 2006:896).

Miller (1975) raises the interesting example of West Greenlandic, which has an assibilation alternation that on first inspection presents a better case of a derived environment rule than does Turkish velar deletion. In West Greenlandic, /t/ assibilates to /s/ intervocalically after /i/ in morphologically derived environments, both stem-finally (22a) and suffix-initially (22b). While epenthetic [i] can create the intervocalic environment required for assibilation to apply (22c), an epenthetic [i] cannot serve as the immediate, pre-consonantal trigger for epenthesis (22d):

(22)

a.	/tikit-aq/	tikisaq	‘come-pass.ppl’	
	cf. /tikit-li/	tikitli	‘come-3sg.opt’	
	cf. /titit-tuq/	tikittuq	‘come-act.ppl’	
b.	/iki-tit/	ikisit	‘your (sg.) wounds’	
	cf. /iga-tit/	igatit	‘your (sg.) cooking pots’	



c.	/sillit-tit/	sillišjtit	‘your (sg.) whetstones’	
	cf. /sillit/	sillit	‘whetstone’	
d.	/siut-tit/	siutištit	‘your (sg.) ears’	*siutisit
	cf. /siut/	siut	‘ear’	

The difference between (22c) and (22d) is particularly instructive. In both (22c) and (22d), epenthesis produces an intervocalic environment for suffixal [t]; in (22c), epenthesis also renders the root-final consonant intervocalic. However, Assibilation applies only when the [t] is preceded by an underlying [j]. Miller concludes on the basis of this idiosyncratic sensitivity that matters are not as simple as a ‘derived environment’ condition would predict.<sup>10</sup>

Earlier, we mentioned Polish spirantization as a case of a phonologically derived environment. Recall that, according to Lubowicz (2002), derived [j] is subject to spirantization, but underlying /j/ is not. However, this is an abstract analysis in the sense that the [j]’s which undergo spirantization never actually surface; spirantization applies in the same environments as the palatalization rule ostensibly deriving [j]. The observed alternation is /g/ → [ž]; the derived environment effect exists only on the assumption that there is an intermediate stage of [j]. If instead the rule posited converted /g/ directly to [ž], there would be no motivation for positing a phonological derived environment condition in the first place.<sup>11</sup> So this case of a phonologically derived environment condition relies heavily on assumptions about representations and rule ordering.

Perhaps the most convincing case of a phonologically derived environment alternation of which we are aware comes from Romanian, in which /a/ reduces to [ʌ] if and only if stress shifts away from it under suffixation, which can cause stress to shift to the right (Steriade 2008):

(23)

a.	‘poor’	sarák	→ sarAk-úts	‘poor-DIM’	
b.	‘slipper’	papúk	→ papuʃ-él	‘slipper-DIM’	*pApuʃ-él

<sup>10</sup> A similar case is presented by Icelandic, in which underlying /u/ umlauts a preceding /a/ if they are in different morphemes, but not if they are tautomorphemic or if the /u/ is epenthetic (e.g. Anderson 1969, Kiparsky 1984, 1993).

<sup>11</sup> Lubowicz (2002) presents a second example of a phonologically derived environment condition from Campidanian Sardinian which has a similar quality. In CS, postvocalic voiceless plosives spirantize and voice (*s:u [tʃ]ɛlu* → *s:u [ʒ]ɛxu* ‘the heaven’) in morphologically derived environments, while fricatives voice (*s:a [f]amil:ia* → *s:a [v]amil:ia* ‘the family’). Lubowicz observes that underlyingly voiced plosives do not spirantize in the same environment, and attributes this to a phonologically derived environment condition on Spirantization: only plosives whose [+voice] feature is derived, not those which are underlyingly voiced, are subject to Spirantization. As with Polish, though, this analysis is abstract, depending on the assumption that /t/ → |d| → [ð] (etc.) rather than /t/ → [ð] (etc.) directly. On the latter account, accounting for the immunity of voiced plosives would not require reference to a derived environment condition.

Even this case, however, is not pure in the sense that it has a highly morphological character. According to Steriade, the effect is due to correspondence between morphologically related forms, rather than to a phonologically derived environment condition *per se*.

## 7. Broader implications

The result of this study, and indeed the consensus emerging from attempts to formalize derived environment effects (e.g. Kiparsky 1993, Inkelas 2000, McCarthy 2003, Anttila 2009) is that 'derived environment effects' are not a unitary phenomenon. In the absence of any direct evidence for a pure derived environment condition, one might wonder why the intuition behind the derived environment condition was so attractive in the first place. Our suspicion is that derived environment effects boil down to something very basic: WYHIWYG (What You Hear Is What You Get). The so-called 'Derived Environment' condition may be no more than the simple inhibition against changing structures for which there is independent evidence. In Turkish, a learner who hears [so.kak] is not going to delete the internal /k/ in his/her next production, even while that same learner has no similar inhibition against deleting the /k/ before a suffix. Karl Zimmer has always been interested in what kind of generalizations speakers are able to come up with on the basis of observed data. Turkish velar deletion shows that this is the right question to pursue.

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