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Titel: Morphophonological alternation in Turkish : where phonology and morphology meet

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Morphophonological alternation in Turkish: where phonology and morphology meet

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This study proposes an analysis for the morphophonological alternations involving suffix initial V~0 and C~0 alternations. Suffixes which undergo C~0 alternation all have an initial consonant from the set [n, s, ʃ, j]; [j] stands out by being a glide while the other three are true consonants. Furthermore, while suffixes that exhibit initial [j]~0 alternation comprise a large set, the other consonants are observed to be morpheme-specific. Thus, alternations involving the initial C of suffixes are handled by different rules, namely [j]-insertion and initial C-deletion rules. Suffixes which participate in initial V~0 alternation behave differently depending on the morphological category of the suffix. They, too, are argued to be subject to different phonological processes. The analysis is carried out in the co-phonology approach which is argued to account for the diverse patternings of the suffixes satisfactorily. Four co-phonologies are proposed to capture the dependencies between the morphological constructions and the associated phonological processes.

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1. Introduction

This study examines the phonology-morphology interaction observed in certain morphophonological alternations that Turkish suffixes undergo and argues for an analysis in the co-phonology approach.* Morphophonological alternations in suffixes are of the following types:

(i) alternations in the suffix vowel due to vowel harmony: suffix V agrees with the [+/-back] feature of the preceding vowel, and if the suffix vowel is a [+high] V (as the accusative case illustrated in (1)b), it also agrees with the [+/- round] feature of the preceding vowel.[1]

* An earlier and a slightly different version of this study was presented as a poster at the 8th Old World Conference in Phonology held in Marrakech, 2011.

1 This means that suffixes in Turkish fall into two groups: those with a [+high] vowel and those with a [-high] vowel. Adopting the archiphone representation for alternating suffix vowels, A is used to stand for a [-high] vowel and [I] a [+high] vowel. Thus, the non-specified frontness/backness feature of both types of suffix vowels and the rounding fea-

(1) a. *ev-ler* 'house-pl.' *at-lar* 'horse-pl.'
gül-ler 'rose-pl.' *yol-lar* 'road-pl.'
b. *ev-i* 'house-acc. *at-ı* 'horse-acc.'
gül-ü 'rose-acc.' *yol-u* 'road-acc.'

All suffixes, with the exception of a small set of invariant suffixes, exhibit alternations in their vowels conditioned by the above stated harmony rule.[2]

(ii) alternation in the voicing feature of the initial C due to consonant harmony: suffix initial [-cont.] consonants agree with the [+/-voice] feature of the immediately preceding segment.

(2) *ev-de* 'house-loc.' *yol-da* 'road-loc.'
sis-te 'fog-loc.' *at-ta* 'horse-loc.'

(iii) suffix initial C~0 or V~0 alternations, observed in a fairly large set of suffixes:

(3) *ev-im* 'house-poss.1sg. *kutu-m* 'box-poss.1sg.' (V~0)

(4) *ev-in* 'house-gen.' *kedi-nin* 'cat-gen.' (C~0)

This study is concerned with how to best account for alternations of type (iii) in synchronic grammar.[3] The presence or absence of a suffix initial C or V appears to be motivated by the vowel hiatus avoidance constraint across morpheme boundaries in Turkish.[4] A diachronic account of suffixes exhibiting such alternations in Turkish and other Turkic languages is presented in Johanson (2011), where he raises the

ture of suffixes with an [I]-vowel are filled in by the features of the immediately preceding vowel.

2 Suffixes with vowels that resist vowel harmony are the following:
-(y)ken (*yolda-yken* 'when on the road'), *-leyin* (*sabah-leyin* 'in the morning'), *-gil* (*turunç-gil* 'citrus family'), *-gen* (*altı-gen* 'hexagon'), *-Iyor* (*gel-iyor* 's/he is coming'), *-Imtrak* (*yeşil-imtrak* 'greenish').

3 It should be noted that alternations observed in *o* 's/he/it' ~ *on-da* 's/he/it-loc.' ~ *on-u* 's/he/it-acc.', *bu* 'this ~ *bun-dan* 'this-loc.'~ *bun-u* 'this-acc.', *kendi* 'self' ~ *kendin-de* 'self-loc.' ~ *kendin-i* 'self-acc.', etc. are not included in the analyzed set because they involve stems and not suffixes.

4 Morpheme internally, however, VV sequences are encountered typically in borrowed words such as *aile* 'family, *sual* 'question', *realize olmak* 'to be realized', etc., or as a result of segment deletion (e.g. *ta:hin* > [ta:in]). Furthermore, [k]-deletion which applies across morpheme boundaries (e.g. /inek-I / 'cow-acc' > [inei]) produces V+V sequences, too. See Kabak (2007) for an indepth analysis of the strategies for vowel hiatus resolution in the language.

interesting question of whether there was ever a V+V juncture to be resolved in the history of Turkic languages. Johanson's analysis shows how earlier morphological structures changed through consonant deletion giving rise to grounds for vowel contractions or assimilations.

Examining the phonological alternations in the suffixes under investigation reveals that an appeal simply to sound patterning or phonological processes is not adequate but that information about the type and function of the suffixes involved is also needed in capturing the regularities.[5] Thus, the study claims that a satisfactory account of the alternations with internal diversity necessitates a resort to morphology; this constitutes a clear case of phonology-morphology interface in Turkish. A recent approach which places primal importance on how to best account for morphologically conditioned phonological alternations is the co-phonology approach (Inkelas, 2008, 2011, Inkelas & Zoll, 2007).[6] Though this approach carries the spirit of level ordering advocated by lexical phonology to capture the ordering relation between morphological levels and phonological rules, its main concern is to link morphological constructions with the relevant phonological grammars. The scopal relations between co-phonologies where each co-phonology is a potential input to an outer co-phonology reflects the hierarchical layering of morphological constructions. For forms exhibiting exceptional patterning prespecification is used as a means to encode their idiosyncratic behaviour.[7]

After giving an overview of the data covered by the proposed analysis (section 2), previous analyses are briefly reviewed (section 3), followed by a proposal in the co-phonology approach showing how the alternations are handled more satisfactorily (section 4). Concluding remarks comprise section 5.

2. Overview of the data

Among suffixes which exhibit initial C~0 or V~0 alternations, we first look at those with an initial C. Turkish has a variety of consonants from all classes occurring as the initial member of a suffix, but the ones which participate in this alternation belong only to the [n, s, ʃ, j] set.[8] For example:

5 This point is also made in Kabak (2007), Taylan (2009), Erdal (2012), among others.

6 The co-phonology approach has been argued to capture the stress assignment facts of Turkish better (Inkelas, Orgun and Zoll, 1997). The analysis assigns the set of words known as NFS-words (non-final stress words) to which Sezer's rules (1981) apply to a different co-phonology than words receiving regular word final stress.

7 See Kabak & Vogel (2011) for a discussion of the various mechanisms for handling phonological exceptions.

8 Consonants observed in suffix initial position in Turkish fall into the following subclasses:

(5)	a. N+poss3sg.	*ev-i*	'his/her house'	*kedi-[s]i*	'his/her cat'
	b. N+gen.	*ev-in*	'of the house'	*kedi-[n]in*	'of the cat'
	c. Num.+distrib.	*bir-er*	'one each'	*iki-[ʃ]er*	'two each'
	d. N+dat.	*ev-e*	'to the house'	*kedi-[j]e*	'to the cat'
	e. V+gerund	*gel-erek*	'by coming'	*uyu-[j]arak*	'by sleeping'

The frequency of occurrence of these four segments in Turkish suffixes is very unequal. That is, while there is only one suffix with an initial [n] (i.e. the genitive) and initial [ʃ] (i.e. the distributive), there are half a dozen suffixes with an initial [s] but only one of them, i.e. the third person possessive, exhibits alternation.

The third person possessive morpheme has yet another variant *-sIn* which surfaces when there is a suffix following it, as illustrated below:

(6)	a. N+poss3sg+abl.	*kedi-sin-den*	'from his/her cat'
	b. N+poss3sg+acc.	*kedi-sin-e*	'to his/her cat'

Clearly the final [n] is part of the third person possessive suffix since the form of the dative in (6)b (i.e. [e]) is the form that appears on stems with a final consonant.[9] This makes the third person possessive morpheme *-sIn* homophonous with the second person singular agreement morpheme *-sIn*, seen in forms such as:

(i) Obstruents:
Oral stops: past *-DI*, locative *-DA*, ablative *-DAN*, derivational *-GAN* (adjective forming), *-GI* (noun-forming), agentive *-CI*, etc. Such suffixes exhibit alternation in the voicing feature of the plosive, as was shown in (2).
Fricatives: conditional *-sA*, possessive 3sg. *-sIn*, derivational *-sIz* (deprivative), *-sAl* (adjective forming), distributive *-şAr*, etc.
(ii) Sonorants:
nasals: negative *-mA*, genitive *-nIn*
liquids: derivational *-lI* (associative) , *-lA* (de-verbal), etc.
glide: dative *-yA* , accusative *-yI*, noun-forming *-yIş*, etc.

9 As pointed out by one of the reviewers, another possible analysis is one where [n] is taken to be part of the case suffix and a syllable restructuring rule then re-aligns the syllable initial [n] of *-nC* cluster when attached to stems ending with *-sI*. However, there doesn't seem to be any motivation for assuming that the dative and the ablative have an underlying illicit initial cluster (i.e. /-nDA/ and /-nDAn/, respectively). Such an analysis not only necessitates a re-alignment rule but also an additional rule of [n]-deletion when these suffixes are attached to any form without the third person possessive (e.g. /ev-Im-ndAn/). Furthermore, the question of whether the syllable initial [n] is present in other case endings comes up, too; that is, do the accusative and the dative have another variant *-nI* (e.g. *araba-sı-nı*) and *-nA* (e.g. *araba-sı-na*) which surface only following the third person possessive? The analysis where [n] is taken to be the coda of the third person possessive suffix does not face any of these problems and is much simpler.

(7) a. V+imperf.+2sg. *gel-iyor-sun* 'you are coming'
b. V+evid.+2sg. *gel-miş-sin* 'you have come'
c. V+optative+2sg. *gel-e-sin* 'may you come'

But, while the third person possessive *-sIn* has an alternant where the initial and the final consonant do not surface, the second person singular agreement *-sIn* always keeps its initial and final consonant. The only alternation both suffixes share is variation in the vowel due to vowel harmony. Hence initial [s]~0 and final [n]~0 alternation are a phonological property of just one specific morpheme.

It is evident, then, that the alternations observed in the genitive, distributive and third person possessive suffixes are instances of morphologically conditioned allomorphy. In other words, such phonological alternations are a peculiarity of specific morphological constructions; there is no general initial consonant deletion rule that suffixes undergo. It should further be noted that the genitive morpheme has another form that occurs only in two words, namely *su-yun* 'water-gen.' and *ne-yin* 'what-gen.'. These forms will have to be prespecified for their exceptional behaviour in selecting -yIn as their genitive form.

The situation concerning suffixes where the alternating initial segment is [j] is quite different; of the two score or more such suffixes (only two illustrated in (5)d–e) all of them behave uniformly and have an alternant without the initial glide.[10]

Looking at the suffixes exhibiting initial V~0 alternation, we observe that not only are they quite numerous but that the initial vowel can be a high vowel as well as a non-high vowel, as seen in the examples below:

(8) a. N+poss1sg. *ev-im* 'my house' *kedi-m* 'my cat'
b. Num.+ord. *bir-inci* 'first' *iki-nci* 'second'
c. V+der. *dur-ak* '(bus)stop' *tara-k* '(a) comb'
d. Adj.+der. *mor-ar-* 'to become purple' *kara-r-* 'to be blackened'

The question that emerges here is whether the initial segments of these suffixes are inserted or deleted in the relevant environment. Both possibilities have been argued for in the different analyses proposed so far; these are presented briefly in the next section.

3. Previous analyses

3.1. Traditional grammar analysis

In the traditional grammars of Turkish, suffixes exhibiting initial C~0 alternation have been treated as V-initial suffixes. A consonant from the set [n, s, ʃ, j], termed as 'buffer consonants', specified for the suffix it is associated with is then inserted

10 See Göksel & Kerslake (2005) for a complete list of suffixes exhibiting [j]~0 alternation.

when the suffix is attached onto a stem with a final vowel. In this analysis the accusative and the third person possessive suffixes turn out to be underlyingly /-I/.[11]

(9) a. N-acc. /kedi-I/ [j]-insertion > *kedi-yi*
b. N-poss3sg. /kedi-I/ [s]-insertion > *kedi-si*

In the insertion analysis the consonants chosen are specific to the particular suffix and hence conditioned by the morphological construction. Suffixes with initial V~0 alternation, on the other hand, are given as a list, which could be interpreted to mean that the initial vowel of the suffix is deleted when it is attached to as stem with a final vowel.

3.2. Standard generative analysis

Lees (1961), who offered the first generative analysis of Turkish phonology, took the opposite view and assumed that all suffixes which exhibit initial C~0 alternation have the initial C present in their underlying representation. In this approach the accusative and the third person possessive suffixes, which are identical forms in the traditional grammar account, have different underlying representations: the accusative is /-jI/ and the third person possessive /-sIn/.

Lees proposed a rule for deleting the initial C of the suffix when the attached stem ends in a consonant:

(10) a. N+dat. /ev-jA/ initial C-deletion > *ev-e* 'to the house'
b. N+gen. /ev-nIn/ initial C-deletion > *ev-in* 'of the house'
c. N+poss.3sg. /ev-sIn/ initial C-deletion > /ev-In/
final [n]-deletion > *ev-i* 'his/her house'

Note that there is another deletion rule which applies to the final [n] of the third person possessive when there is no further suffixation.

Suffixes undergoing initial V~0 alternation have their initial V as part of the underlying representation. The initial vowel of the suffix gets deleted when the attached stem ends in a vowel:

(11) a. N+poss.1sg. /kedi-Im/ initial V-deletion > *kedi-m* 'my cat'
b. num+ord. /iki-IndʒI/ initial V-deletion > *iki-nci* 'second'
c. V+der. /tara-AK/ initial V-deletion > *tara-k* '(a) comb'

11 The [n] which surfaces on the third person possessive when there is a following suffix is also not part of any suffix but is epenthesized.

3.3. More recent analyses

In Underhill's (1988) work on a lexical account of Turkish accent, evidence from Turkish morphophonology is given to justify the existence of different levels where suffixes are classified into different strata with respect to their behaviour to phonological rules. Underhill basically adopts the analysis of Lees but differs from him in one respect; he takes suffixes with an inital palatal glide to be underlyingly vowel initial suffixes which undergo [j]-insertion when attached to a stem ending in a vowel. Furthermore, he contends that the general principle which has gone unnoticed is that suffixes which delete their initial vowel precede those which epenthesize [j] (1988: 390). Therefore, in his lexical phonology analysis of Turkish, Underhill assigns suffixes which exhibit initial V~0 to level 1:

(12) N+poss.1sg. /-Im/: /kutu-Im / 'my box' initial V-deletion > *kutu-m*

Those suffixes with an initial V which are subject to [j]-insertion, on the other hand, belong to level 2:

(13) N+ dative /-A/: /kutu-A/ 'to the box' [j]-insertion > *kutu-ya*

That level 2 suffixes follow level 1 suffixes is exemplified in the form *ev-im-e* 'to my house' (N+Poss.1sg.+dat.).[12]

Underhill's analysis of [j]-epenthesis has found support in recent analyses as well (Inkelas & Zoll 2007, Kabak 2007). Thus, it is only suffixes with an initial consonant from the set [n, s, ʃ] which participate in initial C~0 alternation; these Cs are specified in the underlying representation of the affix. Those suffixes which exhibit initial [j]~0 alternation are all underlyingly V-initial and are subject to [j]-insertion when attached to a stem with a final vowel. Hence, V-initial suffixes fall into two categories: (i) those that are subject to [j]-insertion, and (ii) those that get their initial V deleted. The question now is how do we know which category a V-initial suffix belongs to? While a lexical phonology account by assigning V-initial suffixes which undergo V-deletion to level 1 and those which undergo [j]-insertion to level 2 answers the question, other approaches are faced with this critical question. Hankamer's (2011) proposal where he accepts Lees's analysis for suffixes with C~0 alternation but argues for a high vowel insertion rather than vowel deletion to account for suffix initial V~0 alternations, seems to offer one solution. Thus, the first person possessive suffix which is taken to be underlying /-Im/ by both Lees and Underhill,

12 Besides the possessive suffixes, the four voice suffixes also belong to level 1. Level 2 includes case suffixes from among the nominal inflections and tense, participle, gerund suffixes from among the verbal inflections (Underhill 1988: 390).

in Hankamer's analysis has no vowel but simply consists of a single consonant and is /-m/.[13]

(14) /ev-m/ 'house-poss1sg.' > V-insertion > *ev-im* 'my house'.

Some other suffixes which are subject to high vowel epenthesis in his analysis are:

second person possessive /-n/
passive : /-l/
reflexive : /-n/
reciprocal : /-ʃ/
aorist : /-r/

However, this proposal is not problem-free. The imperfective *-Iyor*, which interacts with vowel raising and vowel harmony rules, poses problems for all accounts, that is, whether the affix is taken as /-Ijor/ and hence undergoes vowel deletion or is taken as /-jor/ and undergoes high vowel insertion. Hankamer accepts *-Iyor* as the only productive suffix that begins with a vowel which needs to be specified for its special patterning.[14] The problem with the aorist, which surfaces as either *-Ar* or *-Ir* on monosyllabic verb roots, is overcome by claiming that the aorist has two underlying forms, namely /-r/ and /-Ar/.

The high vowel insertion analysis has yet to handle suffixes where the alternating initial vowel is not a high vowel:

(15) a. *gör-ev* 'duty'
b. *ölç-ek* 'a measure'
c. *az-al* 'to decrease'
c. *dik-ey* 'perpendicular'

Hankamer's solution is to treat these derived words as essentially monomorphemic based on the understanding that the derivational suffixes involved are not productive.

A final point about Hankamer's view of the organization of Turkish phonology is that vowel epenthesis is motivated by the pressure to legitimize the otherwise il-

13 Hankamer acknowledges the fact that suffixes with initial V~0 alternation have been assumed in Inkelas & Orgun (1995: 785) to be consonant initial undergoing a vowel epenthesis rule in the specified context. In Johanson (2011) it is indicated that this assumption has also been one of the well-received views in historical Turkic linguistics. However, Hankamer's analysis remains as the first which offers a systematic account of the alternations involving all V-initial suffixes in synchronic Turkish phonology.

14 See Hankamer (2011) for a detailed, step-by-step presentation of the earlier treatments of the *-Iyor* where both their strengths and weaknesses are discussed.

licit consonant clusters, as seen in /ev-m/ in (14), and that it has to be applied cyclically.[15]

3.4. Some problems

Attractive as it looks, the high vowel insertion analysis runs into some problems especially in cases where the alternating initial vowel is a non-high vowel, examples of which were given in (15). Hankamer's claim, which seems to be based on these four examples, is that such derived forms are monomorphemic. However, this claim doesn't seem to be warranted when Turkish derivational affixes are examined more closely. Firstly, some of the suffixes exemplified in (15) are rather productive; for example, there are many nouns derived from verbs with the use of *-AK*:

(16)	a. *dur-ak*	'a (bus) stop'	(*dur-* 'to stop')
	b. *bat-ak*	'bog'	(*bat-* 'to sink')
	c. *yat-ak*	'bed'	(*yat-* 'to go to bed, lie down')
	d. *ele-k*	'sieve'	(*ele-* 'to filter, to screen)
	e. *dene-k*	'subject'	(*dene-* 'to try, to experiment')

Secondly, there are numerous other suffixes besides these four, varying in their degree of productivity. Below are examples of other derivational suffixes forming nouns from verbs:[16]

(17)	a. *dön-em*	'period, era'	(*dön-* 'to revolve, turn')
	b. *anla-m*	'meaning'	(*anla-* 'to comprehend')
(18)	a. *say-aç*	'(a) meter, counter'	(*say-* 'to count')
	b. *bağla-ç*	'conjunction'	(*bağla-* 'to tie together')
(19)	a. *bas-amak*	'step'	(*bas-* 'to step')
	b. *tut-anak*	'minutes'	(*tut-* 'to write down (notes), hold')

The following are some examples of suffixes which derive verbs from nouns:

15 His example to illustrate the cyclic nature of vowel-epenthesis is given below (65–66):
/ev+m+z/ (*ev* 'house' /-m/ poss.1sg., /-z/ pluralizer)
evim+z
evimiz.

16 The examples and the list of derivational suffixes given here are by no means exhaustive. See Göksel and Kerslake (2005: 53-67) for the complete listing.
Some other examples of words derived with *-Am* are: *tut-am* 'handful', *düzle-m* 'plane/ surface', *gözle-m* 'observation', *kur-am* 'theory', *önle-m 'precaution'*, etc. and those derived with *-Aç* are: *gül-eç* 'cheerful/smiling', *sür-eç* 'process', etc.

(20) a. *dar-al-* 'to become narrow' (*dar* 'narrow')
b. *kısa-l-* 'to become shorter' (*kısa* 'short')

(21) a. *ağ-ar-* 'to turn white' (*ak* 'white')[17]
b. *kara-r-* 'to turn black' (*kara* 'black')

Thus, the abundance of derivational suffixes which exhibit initial A~0 alternation and their varying degrees of productivity suggest that words derived with such suffixes are not monomorphemic and that the alternation in these suffixes needs to be accounted for. Assuming that the words in (16)–(21) are morphologically complex, we have to determine the underlying form of the suffixes. Do these suffixes have an initial low vowel which gets deleted when attached to a stem with a final vowel (i.e. /ele + -Ak/ low V-deletion > *ele-k*), or do they start with a consonant and have a low vowel epenthesized when the stem ends in a consonant (i.e. /dur+ -/k/ low V-insertion > *dur-ak*)? This question, being part of the general issue of how to account for all suffixes exhibiting initial V~0 alternation, is addressed in detail in section 4. It should not be concluded from the examples above that all derivational suffixes which are vowel initial have a [-high] initial vowel. There are numerous derivational suffixes with an initial [+high] vowel, again varying in their degree of productivity. For example:

(22) a. *yeşil-imsi* 'green-like' (*yeşil* 'green')
b. *kırmızı-msı* 'red-like' (*kırmızı* 'red')

(23) a. *yeşil-imtrak* 'greenish' (*yeşil* 'green')
b. *kırmızı-mtrak* 'reddish' (*kırmızı* 'red')

(24) a. *bir-inci* 'first' (*bir* 'one')
b. *yedi-nci* 'seventh' (*yedi* 'seven')

(25) a. *sars-ıntı* 'tremor' (*sars-* 'to shake')
b. *kaşı-ntı* 'itch' (*kaşı-* 'to scratch')

(26) a. *del-ik* 'hole, perforated' (*del-* 'to make a hole')
b. *yan-ık* '(a) burn, burnt' (*yan-* 'to burn')

Hankamer has no derivational affixes in his list of suffixes exhibiting initial high vowel~zero alternation which he claims to be underlyingly consonant initial. So we do not know whether he would treat derived words such as those in (22)–(26) as monomorphemic or whether these suffixes would also be analyzed as underlyingly

17 *Ak* is one of the exceptional monosyllabic forms which undergoes stem final [k]-deletion when followed by a vowel initial derivational suffix.

consonant initial (i.e. /-msI/, /-ntI/ and /-k/, etc.). If the words in (22)–(26) are to be accepted as monomorphemic, then their productive aspect would be missed. For example, *-ImsI*, *-Imtrak* can be used with any colour term and *-IncI* attaches onto any numeral to give the ordinal number.[18] If, on the other hand, we accept that the words in (22)–(26) are morphologically complex forms, then we are faced with the question of whether the initial vowel is part of the underlying representation or not. Following Hankamer's analysis, derivational suffixes which undergo initial high V~0 alternation can be analyzed as C-initial suffixes; they would then have the high vowel supplied through the high V-insertion rule (e.g. /yeʃil+ -msI/ high V-insertion > *yeşil-imsi* etc.). However, the derivational suffixes which show initial V~0 alternation where the initial vowel is [-high] (e.g. *dur-ak*) still need to be accounted for. Are they underlyingly consonant initial, too, (i.e. /dur-k/), in which case the question of how we know when a high or a non-high vowel is epenthesized needs to be answered. The next section presents an analysis in the co-phonology approach which addresses all these issues and handles them in an intuitive way.

4. Co-phonology analysis

A discussion of the previous analyses on suffix initial V~0 and C~0 alternation in Turkish points to the following central issues that need to be accounted for:

(i) For suffixes which participate in C~0 alternation, is it C-deletion or C-epenthesis that is at work? Do all initial consonants pattern the same way?

(ii) For suffixes which participate in V~0 alternation, is it V-insertion or V-deletion that is at work? Do initial [+high] vowels pattern the same way as [-high] vowels; that is, are they subject to the same process or different processes?

As is well known, morphemes may have different phonological variants conditioned by general phonological rules (e.g. vowel harmony in Turkish) or by more specific rules restricted to certain types of constructions (e.g. reduplication). As was also acknowledged in the earlier accounts, most of the morphophonological alternations that fall into (i) and (ii) above are not governed by general phonological rules since they are morphologically conditioned. Two current theoretical approaches to morphologically conditioned allomorphy are the co-phonology and the indexed-constraints approaches. While the co-phonology model assumes that several sub-grammars can co-exist in a language, each associated with a certain morphological construction or a set of constructions, in the indexed-constraints approach there is only one grammar with constraints specified in relation to morphological structure (Inkelas & Zoll, 2007, Inkelas, 2011, Inkelas 2008, Downing 2011). In this study, a co-phonology analysis is opted for, going along with Inkelas's arguments that it has advantages over the other in terms of substance, scope and layering (2008). One of

18 *-(I)msI, -(I)mtrak* can be attached to many other adjectives and some nouns, as well, such as *acı-mtrak* 'bitterish' (acı 'bitter') *bahçe-msi* 'garden-like' (*bahçe* 'garden'), etc.

her main criticisms is that the connection between morphological embedding and constraint ranking is not captured adequately in the indexed-constraints approach (2011: 73–75).

Looking at the morphological constructions in which the phonological processes mentioned in (i)–(ii) above are observed, it is clear that certain processes are indexed to certain types of suffixes. Furthermore, the indexing of suffixes also reveals the existence of a layered morphological structure, a concept advocated earlier by lexical morphology and phonology.[19] The phonological processes and the morphological constructions with which processes of (i)–(ii) are associated are repeated below:

a) Suffixes undergoing C~0 alternation all have an initial consonant from the set [n, s, ʃ, j]. [j] stands out in the set by being a glide while the other three are true consonants. Indeed, the distribution of these four segments shows heterogeneous behaviour; that is, only the genitive morpheme in the language starts with [n] and the distributive with [ʃ]. Of the half a dozen affixes with an initial [s], only the third person possessive participates in the alternation. Thus, there is only one suffix each with an initial [n, s, ʃ] which has an alternant, constituting a clear case of morpheme specific conditioning. Hence, these suffixes with an initial [n], [s] and [ʃ] must have these consonants specified in their underlying representation and undergo initial C-deletion as proposed by Lees.

However, suffixes that exhibit initial [j]-0 alternation comprise a large set. These are predominantly nominal and verbal inflectional suffixes or structure-building (such as gerund and participle constructions) suffixes listed below:

(27) case markers: dative -(y)A, accusative -(y)I
tense-aspect-mood/modality markers: future -(y)AcAK, optative -(y)A, ability (-y)Abil, aspectual -(y)Iver , -(y)Adur, -(y)Agel, etc.
gerunds: -(y)Ip, -(y)IncA, -(y)Arak, -(y)AIl, -(y)Ana kadar
participle: -(y)An
agreement: -(y)Im (1sg.), -(y)Iz (1pl.), -(y)In (imp.2p)[20]
nominal der.: -(y)Iş, -(y)IcI, -(y)Im

The nominal deriving suffixes *-(y)Iş, -(y)IcI* and *-(y)Im* not being on a par with the grammatical suffixes in this set deserve some attention; their patterning will be discussed later on in this section. The predominance of a palatal glide in such a large number of alternating suffixes suggests that the [j] is epenthesized to prevent an oth-

19 In addition to Underhill (1988), see Inkelas and Orgun (1995), Kaisse (1986) for a lexical phonology analysis of Turkish and the number of levels needed.

20 It should be noted that the agreement markers, though they exhibit the same kind of alternations with the other suffixes in this group, differ from the rest because the initial *y-* of the agreement suffixes is a form of the copula. This point is discussed later in this section.

erwise V+V sequence, a rather natural process observed in other languages as well. Recall that this was the position taken in Underhill (1988), Inkelas & Zoll (2007) and Kabak (2007), too. The [j]-epenthesis analysis, then, treats suffixes which show [j]~0 alternation as belonging to a different category than those which show initial [n, s, ʃ]~0 alternation. While the members of the latter group have the initial consonant as part of the affix and are subject to C-deletion, the members of the former group are underlyingly V-initial and are subject to a glide epenthesis rule.

b) Suffixes which participate in initial V~0 alternation fall into two groups depending on whether the vowel is [+high] or [-high]. The major suffixes with an initial [+high] vowel are:

(28) possessive: *-(I)m* (1sg.), *-(I)n* (2sg.)
voice: *-(I)ş* (reciprocal), *-(I)n* (reflexive), *-(I)l* (passive), *-(I)t* (causative)
tense/aspect: *-(I)yor* (imperfective), *-(I)r* (aorist)
derivational: *-(I)msI*, *-(I)mtrak*, *-(I)ncI*, *-(I)ntI*, *-(I)k*

The major suffixes with an initial [-high] vowel are:

(29) derivational: *-(A)k*, *-(A)ç*, *-(A)v*, *-(A)y*, *-(A)l*, *-(A)m*, *-(A)r*[21]

Suffixes that have an initial [+high] vowel, listed in (28), comprise both derivational suffixes and grammatical function marking suffixes.[22] It should be recalled that Hankamer's proposal of high vowel epenthesis applied only to the suffixes which mark grammatical function; there was no mention of derivational suffixes having an initial high vowel. Furthermore, the imperfective and the aorist were shown to behave in more diverse ways that necessitated their being specified for their idiosyncracies. If, accepting Hankamer's analysis, we take the grammatical suffixes to be underlyingly consonant initial, then how do we account for the derivational affixes showing the same kind of alternation? Given that there are also derivational suffixes with an initial [-high] vowel, listed in (29), exhibiting the same behaviour, the following generalization emerges: derivational suffixes creating new lexical items have alternating initial vowels which can be [+high] or [-high], whereas grammatical function marking suffixes (e.g. possessive, voice morphemes) always have an alter-

21 There are other derivational suffixes with an initial [-high] vowel such as *-AnAk* in *basamak* '(a)step' (*bas-* 'to step) for which I have not been able to find an example where the suffix occurs on a stem with a final vowel. Therefore, such suffixes have not been included in the list of alternating suffixes.

22 In general terms, derivational suffixes generate new lexical items to be stored in the lexicon while grammatical function marking suffixes take part in the generation of phrasal structures.

nating high vowel. Thus, since the height of the initial vowel of the derivational suffixes is not predictable, the vowel has to be specified in the underlying representation. This means that an initial vowel deletion rule is now needed to apply when a derivational suffix is attached to a stem with a final vowel. Treating the suffixes which mark grammatical functions as underlyingly consonant initial and undergoing high vowel epenthesis now works well. We are faced with a situation where the different morphological categories the vowel initial suffixes belong to are associated with different phonological processes. This is precisely the intuition captured by the co-phonology approach: namely, that phonological processes are sensitive to morphological constructions. Thus, examining the suffixes exhibiting initial C~0 and V~0 alternation in terms of the morphological constructions of which they are a part has revealed that certain phonological processes are, indeed, observed only in relation to certain morpheme types. We propose, then, that Turkish has the following co-phonologies where each sub-grammar is defined in terms of the morphological constructions and the associated phonological processes:

Co-phonology A	word formation	V-deletion C-deletion	*kapa-k* (/-Ak/) *yedi-nci* (/-IndʒI/) *bir-er* (/-ʃer/)
Co-phonology B	inner phrasal marking (N+poss., V+voice)	V-epenthesis C-deletion	*ev-im* (/-m/) *gez-il* (/-l/) *ev-i* (/-sIn/)
Co-phonology C	outer phrasal marking (N+case, V+TAM, gerund, etc.)	Glide epenthesis C-deletion	*kedi-yi* (/-I/) *uyu-yunca* (/-IndʒA/) *ev-in* (/-nIn/)

Co-phonology A comprises derivational suffixes creating new lexical items and the more general phonological process that is peculiar to this sub-grammar is initial vowel deletion. Consonant deletion is indexed to just the distributive affix (/-ʃer/), the only suffix in the language with an initial alveoplatal fricative. Co-phonology B spans over the inner grammatical marking (possessive, voice) of phrasal structures; the phonological process operative is high vowel epenthesis. There is consonant deletion in this sub-grammar which is indexed to just one affix, namely the possessive 3sg. /-sIn/.[23] Co-phonology C covers the outer grammatical marking (case, tense-aspect-mood/modality, gerunds, participles, etc.) of phrasal structures where

23 In fact, there are two deletion processes operative on the same suffix:
initial [s] is deleted when the attached stem ends in a consonant
final [n] is deleted when there is no other suffix after the third person possessive.

[j]-epenthesis stands out as the major operative process. It should be noted that the imperfective *-Iyor* and the aorist *-Ir/-Ar* which fall into the same paradigmatic slot as the other tense-aspect-mood/modality suffixes do not undergo [j]-epenthesis (e.g. **yürü-yüyor*, **yürü-yür)* and exhibit irregular patterning. One way to handle this situation would be to assign these two suffixes to a separate co-phonology as suggested in Inkelas & Zoll (2007), but this would introduce an additional co-phonology to the system and each affix would still need further specifications to handle their complex allomorphic distributions. Therefore, we prefer to include these two suffixes in co-phonology C and capture their paradigmatic patterning but resort to the mechanism of prespecifying them for their irregular behaviour of not undergoing [j]-epenthesis. /-Ijor/ has to be further specified for its rather complex interaction with vowel raising and vowel harmony rules (Hankamer 2011), and the aorist for its idiosyncratic variants.[24]

In this co-phonology there is one consonant deletion process (i.e. the initial [n] of the suffix) which is indexed to the genitive morpheme. Furthermore, the unexpected form of the genitive morpheme in *su-yun* 'water-gen.' and *ne-yin* 'what-gen.' where the genitive surfacing with an initial [j] instead of the expected [n] has to be prespecified for this exceptional behaviour. Now we look into the patterning of the three nominal deriving suffixes which show an unexpected initial [j]~0 alternation and appear to pattern along with the grammatical suffixes of co-phonology C. These suffixes derive nominals from verbs but yet behave differently from other such derivational suffixes of co-phonology A by being able to combine with the voice suffixes of co-phonology B:

(30) a. *tara-yıcı* 'scanner' (*tara-* 'to comb')
yap-ıcı 'constructive' (*yap-* 'to do')
b. (*iş*) *bit-ir-ici* '(a) doer' (*bit-* 'end-caus.-der.')
c. *uyu-ş-tur-ucu* 'sedative' (*uyu-* 'sleep-recip.-caus.-der.').

(31) a. *de-yim* '(a) saying' (de- 'to say')
seç-im 'election' (*seç-* 'to choose')
b. *anla-t-ım* '(self)-expression' (*anla-* 'understand-caus.-der.')
c. *dön-üş-üm* 'change, transformation' (*dön-* 'turn/revolve-recip.-der.')

24 In addition to the *-Ar* form of the aorist which is specific to certain monosyllabic verbs with a final sonorant (*kal-ır* 'he/she stays' but *dal-ar* 's/he dives'), this suffix has the variants *-z, -O* which surface under negation:
gel-ir-sin 'you will come' but *gel-me-z-siniz* 'you will/do not come';
gel-ir-im 'I will come' but *gel-me-O-m* 'I won't come'.
Recall that Hankamer treats the aorist as having two underlying forms /-r/ and /-Ar/; he does not mention the allomorphs *-z* and *-O*.

The (b) and (c) examples illustrate that these suffixes follow the voice suffixes; thus they belong to an outer co-phonology than A. However, the fact that possessive suffixes, also from co-phonology B, can follow the nominal deriving suffixes, suggests that they can't belong to co-phonology C:

(32) *yarat-ıl-ış-ımız-ı* 'our genesis (DO form)' ('create-pass.-der.-poss1pl.-acc')

The three nominalizing suffixes, thus, show properties of co-phonology B as seen in the layered structure of (32).[25] Due to the morphotactic properties of the nominalizing suffixes they are assigned to co-phonology B and specified for their alternation type.

The proposed co-phonologies then capture the distributional differences between grammatical function marking suffixes versus derivational suffixes as well as the phonological processes associated with each type of suffix. The co-phonologies also reflect the hierarchical layering of the morphological constructions in Turkish with the outer co-phonology applying to the output of the inner co-phonology. For example:

(33) /iʃle-Av-m-nIn/	'of my function'	('operate-der.-poss1sg.-gen.')
işle-v-m-nIn	initial V-deletion	(co-phonology A)
işle-v-im-nIn	high V-epenthesis	(co-phonology B)
işle-v-im-in	initial [n]-deletion	(co-phonology C)

A construction can contain multiple suffixes belonging to the same co-phonology. The co-occurring voice suffixes of co-phonology B, the tense-aspect-mood/modality and gerund markers of co-phonology C in the example *topla-t-ıl-abil-ecek* '(it) will be possible (for sth.) to be collected' ('collect-caus.-pass.-possib.-fut.') are represented as:

(34) [[*topla* /-t/ /-l/]B /-Abil/ /-AcAK/]C

Finally, the alternations in the predicate agreement forms given in (27) and those observed in the forms of the clitics *idi* 'past copula', *imiş* 'evidential copula', *ise* 'conditional copula', *iken* 'temporal clause marker' and the comitative/instrumental clitic *ile* need to be addressed.[26] These clitics, in addition to their free forms, have bound forms where the initial [i] surfaces as the palatal glide when attached to a

25 The representation of this layered structure is [[*yarat* /-l/ /-ʃ/ /-mız/]B /-I/]C

26 I thank the anonymous reviewer for suggesting to include in the discussion the alternations observed in the clitic forms.

stem with a final vowel and where it does not surface at all when attached to a stem with a final consonant.[27]

(35) *idi/imiş/ise/iken*		*-ydI/-ymIş/-isA/-yken*	*-dI/-mIş/-sA/-ken*
a. *gel-di idi*	'he had come'	*gel-di-ydi*	
b. *hasta idi*	'he/she was sick'	*hasta-ydı*	
c. *gel-iyor idi*	'he/she was coming'		*gel-iyor-du*
d. *avukat idi*	'he/she was a lawyer'		*avukat-tı*

(36) *ile*		*-ylA*	*-lA*
a. *Ali ile*	'with Ali'	*Ali-yle*	
b. *kitap ile*	'with a/the book'		*kitap-la*

Taking the free forms of the clitics as their underlying representation, the affixed forms undergo two rules: initial [i] becomes [j] when the stem ends in a vowel or it is deleted when the stem ends in a consonant. Note that vowel and consonant harmony rules operate once the clitic surfaces as a suffix:

(37) a. /hasta idi/	[j]-formation	>	/hasta-ydI/	V-harmony > *hasta-ydı*
b. /avukat idi/	[i]-deletion	>	/avukat-dI/	V-harmony > *avukat-dı*
				C-harmony > *avukat-tı*

The three-way alternation of these clitics warrants a different co-phonology, that is co-phonology D, which has in its domain cliticized structures. Another property of clitics that differentiates them from the stress bearing tense-aspect-mood/modality suffixes of co-phonology C is that clitics are never stressed. Again, constructions containing clitics have as their input, the output of the inner co-phonologies; this is illustrated in the representation of *kaz-ıl-mış-ken* 'while it has been dug' (dig-pass.-evid.-temp.):

(38) [[[kaz /I/] $_B$ /mIʃ/] $_C$ /iken/] $_D$

The other set of suffixes associated with co-phonology D is the predicate agreement suffixes which follow tense-aspect-mood/modality markers, clitics or nominal predicates as exemplified in (38)a-b, (38)c and (38)d respectively.

(39) a. *gel-meli-yim*	'I must come'	(come-necess.-1sg.)
b. *gel-iyor-um*	'I am coming'	(come-imperf.-1sg.)
c. *gel-meli-ydi-m*	'I should have come'	(come-necess.-cop.past-1sg.)
d. *ev-de-yim*	'I am at home'	(house-loc.-1sg.)

27 Excluding *ile,* the initial vowel [i] in these clitics is a residue of an earlier verb form which functions as a copula.

The variants *-yIm* and *-Im* of the first person agreement suffixes are not handled by the [j]-insertion process operative in co-phonology C because the *-y-* which surfaces in the agreement suffixes is an instantiation of the copula form.[28] Therefore, a [j]-deletion rule is needed to ensure that the palatal glide does not surface when the suffix follows a consonant final stem, shown below:

(40) /gel-Ijor-j-Im/ glide deletion > *gel-Iyor-Im* V-harmony > *gel-iyor-um*

The third variant of this suffix, namely [m] seen in (38)c, has to be prespecified for selecting only past and conditional suffixes or clitics.

The morphological constructions and the associated phonological processes of this outermost co-phonology are:

Co-phonology D	clitic phrase marking (copula clitics, temporal clitic, comitative clitic)	[i] -> glide [i]-deletion glide deletion	*hasta-ydı* (/idi/) *avukat-tı* (/idi/) *geliyor-um* (/-jIm/)

5. Concluding remarks

The analysis of alternations that are specific to certain morphemes (affixes or stems) and do not result from a general phonological rule have given rise to different approaches while searching for a satisfactory theoretical account. This study examined the patterning of a set of suffixes exhibiting initial V~0 and C~0 alternations in Turkish and illustrated that the phonological processes identified in these alternations are associated with particular types of morphological constructs. The analysis proposed within the co-phonology approach argued that the suffixal alternations observed and the phonological processes they are associated with can be neatly handled, overcoming the weaknesses of earlier analyses, once the existence of different co-phonologies is recognized. By linking the restricted phonological processes with the relevant morphological structures, the co-phonology approach is able to account for the patterning of morphologically conditioned allomorphic variations and their defined environments. Any remaining idiosyncratic behaviour of suffixes is taken care of by the mechanism of prespecification. This limited study, however, doesn't claim to have addressed some of the significant theoretical issues such as how to determine or constrain the number of co-phonologies, the correspondence between

28 See Kornfilt's analysis (1997: 77–81) for why the palatal glide which surfaces in predicate agreement suffixes is one of the copular forms in Turkish.

co-phonologies and constraint ranking, nature of exceptions, effects of language change or dialectal variation on cophonology, etc., each constituting a major topic deserving further investigation.

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Abbreviations

1sg.	first person singular
2sg.	second person singular
3sg.	third person singular
abil.	abilitative
abl.	ablative
acc.	accusative
caus.	causative
dat.	dative
der.	derivational
distrib.	distributive
evid.	evidential
gen.	genitive
imp.	imperative
imperf.	imperfective
loc.	locative
necess.	necessitative
num.	number
ord.	ordinal
pass.	passive
pl.	plural
poss.	possessive
possib.	possibility
recip.	reciprocal
refl.	reflexive
temp.	temporal (suffix)