

Vowel Harmony in Turkish and Turkmen
Gülsat Tosun
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In this paper, vowel harmony in Turkish and Turkmen, which are members of the Turkic language family are compared and contrasted. It will be argued that Turkish and Turkmen have a similar grammar accountable by the same constraint ranking where faithfulness dominates markedness, differing only in the markedness constraints that block rounding harmony. This difference is due to their choice of opaque vowels.

1. Turkish

Modern Standard Turkish belongs to the South-West branch of the Turkic language family.

1.1. Vowel System:

Turkish has a symmetric vowel system consisting of 8 vowels:

| | Front | | Back | |
|------|-----------|----------------|-----------|---------|
| | Unrounded | Rounded | Unrounded | Rounded |
| High | i | ü | ɨ | u |
| Mid | e | ö ¹ | a | o |

Although, /a/ is a low vowel, it is regarded as a non-high vowel. Its behaviour with respect to rounding patterns with mid vowels.

1.2. Vowel Harmony

Vowel harmony is based on the spreading of [back] and [round] features from stem initial vowel to the other stem vowels and to the suffix vowels (left to right).

Rounding harmony applies to [+HI] vowels; [-HI] vowels are opaque with respect to rounding.

1.3. Data

| | | | | | | | |
|------------|---------|---------|---------|----------|---------|-----------|---------|
| (1) ‘work’ | ‘girl’ | ‘face’ | ‘tour’ | ‘spouse’ | ‘horse’ | ‘village’ | ‘road’ |
| iş-in | kız-ın | yüz-ün | tur-un | eş-in | at-ın | köy-ün | yol-un |
| iş-ler | kız-lar | yüz-ler | tur-lar | eş-ler | at-lar | köy-ler | yol-lar |

2. Turkmen

Turkmen is spoken in Turkmenistan located in Central Asia. Data in this study is based on the Teke dialect of Turkmen which is assumed to be the standard Turkmen (Clark 1998).

2.1. Vowel System

Turkmen has sixteen vowels, eight of which are long. In Clark (1998), /a/ is assumed to be a low vowel yet it undergoes rounding harmony unlike low vowels, like mid vowels. Based on its behaviour with respect to rounding harmony, we can argue that it is a mid vowel.

¹ Orthography rather than IPA symbols are used consistently for front round vowels.

| | Front | | Back | |
|------|-----------|---------|-----------|---------|
| | Unrounded | Rounded | Unrounded | Rounded |
| High | /i, i:/ | /ü, ü:/ | /ɨ, ɨ:/ | /u, u:/ |
| Mid | /e/ | /ö, ö:/ | /a/ | /o, o:/ |
| Low | /ä:/ | | /a:/ | |

2.2. Vowel Harmony

Vowel harmony is based on the spreading of [back] and [round] features from stem initial vowel to the other stem vowels and to the suffix vowels (right to left).

Rounding harmony applies to [-LOW] vowels; [+LOW] vowels are opaque with respect to rounding.

/ɨ:/, which I will argue is derived by productive Vowel Lengthening rules in Turkmen never undergoes rounding;

/ɨ/ does not undergo rounding in open final syllables; i.e. word finally.

2.3. Data

(i) [Back] harmony

| | |
|------------------------------|-------------------------|
| dileg ~ request | at ~ horse |
| dilegde ~ in the request | atda ~ on the horse |
| dileglerde ~ in the requests | atlarda ~ on the horses |

(ii) [RD] harmony

| | |
|---------------------|----------------------|
| öy ~ house | gulok ~ ear |
| öydö ~ in the house | gulokdo ~ in the ear |
| öylör ~ houses | guloklor ~ ears |

(iii) Vowels opaque to rounding [+LOW] ; /ɨ:/ & /ɨ/ in final open syllables:

| |
|-------------------------|
| okoya:r ~ he reads |
| gülyä:rler ~ they laugh |
| uli ~ big |
| ululuk ~ bigness; size |
| yokori:k ~ upward |
| ukɨ:p ~ capability |

(iv) Vowel Lengthening

| |
|------------------------------------|
| gapI + Im ⇒ gapI:m ~ my door |
| gapI + InIð ⇒ gapI:nIð ~ your door |
| ber+ er ⇒ be:r ~ s/he's giving |
| otur +Ir ⇒ otI:r ~ s/he's sitting |

3. Analysis:

3.1. Assumptions and Constraints

In this analysis, I assume that only the initial vowel is fully specified underlyingly; non-initial vowels are partially specified for height in Turkish and for height and lowness in Turkmen.

Following McCarthy 1997, the constraints responsible for spreading [RD] and [BK] features in Turkmen and Turkish are:

Align (+rd, R), Align (+bk, R)

Alignment constraints above are defined as “any instance of (+rd) aligned finally in Word” in Mc Carthy 1997 but I define them as a SPREAD constraint which spreads a feature in the domain until the feature is aligned with the word edge. Moreover, specification of the (+) on the feature to be spread will only ensure harmony with respect to (+back) not (-back). Therefore, to indicate that whatever the value (+/-) on the feature(s) is, that feature spreads, only the feature needs to appear on the constraint.

In an analysis where it is assumed that all vowels are fully specified in the input, these markedness constraints necessarily dominate faithfulness constraints {IDENT (rd), IDENT (bk)}, or else spreading would be impossible; any change in the features of non-initial vowels would violate faithfulness and lose.

Constraint Ranking 1:

$$\{\text{Align (rd, R) , Align (bk,R)}\} \gg \{\text{IDENT (rd), IDENT (bk)}\}$$

Such an assumption would run into trouble with preserving the features on the initial vowel whose features are the ones that spread. A possible solution is assuming a positional faithfulness constraint IDENT- σ_1 (proposed by Beckman 1997), and ranking it as the highest constraint to ensure faithfulness to the underlying specification of the initial vowel. Yet, restricting full specification to initial vowels and ranking faithfulness constraints above markedness constraints responsible for harmony, allows us both to preserve the feature specification of the initial vowel and to allow harmony to operate on non-initial vowels, at the expense of violating lower ranked feature markedness constraints. Ranking independently motivated constraints accordingly is much simpler than introducing a new constraint, therefore, the latter approach will be adopted in this analysis.

Constraint ranking 2

$$\{\text{IDENT (rd), IDENT (bk)}\} \gg \{\text{Align (rd, R) , Align (bk,R)}\}$$

Consider an input /köy -II/, a possible input in Turkish. Let’s assume that only the vowel of the first syllable is fully specified and the other vowels are only specified for height. Feature markedness constraints *[+RD] and *[-BK] ranks lower than the faithfulness constraints:

Tableaux I:

| | | | | |
|----------|---|----|----|----|
| /köy-II/ | $\{\text{IDENT (rd), (bk),}\} \gg \{\text{Align (rd, R) , Align (bk,R)}\} \gg *[\text{+RD}], *[\text{-BK}]$ | | | |
| ☞köylü | | | ** | ** |
| köyli | *! | | * | ** |
| köyli | *! | * | * | * |
| köylü | | *! | ** | * |
| keyli | *! | | | ** |
| koylu | | *! | ** | |

What determines the optimal output is the faithfulness and Alignment constraints. The first three non-optimal candidates violate Alignment constraints whereas the optimal candidate obeys them at the expense of violating feature markedness constraints. Note that because non-initial vowels are not specified with respect to roundness and backness, they do not violate faithfulness constraints. Due to the “richness of the base” we also have candidates that are unfaithful to the input with respect to the features of the first vowel. One of them violates IDENT(rd), the other violates IDENT (bk) and they lose. The constraint ranking

given above ensures that the first vowel of the optimal output is faithful to that of the input with respect to features round and back.² What about a candidate that is unfaithful to the input with respect to height? Consider such a candidate in tableaux II below:

Tableaux II

| | | |
|------------------------------|---|---------------------|
| /köy-II/ köylü ☞?kiyli | $\{ \text{IDENT (rd), IDENT (bk)} \} \gg \{ \text{Align (rd, R), Align (bk,R)} \} \gg \{ *[\text{+RD}], *[\text{-BK}] \}$ | **! ** ** |
|------------------------------|---|---------------------|

A “pseudo-optimal” candidate like “kiyli” would win over the optimal candidate since it would only violate feature markedness *[-BK] twice but none of the higher constraints. The optimal candidate would lose since it violates another feature markedness constraint *[RD] twice which is not violated by the pseudo-optimal candidate. Ranking *[-BK] higher than *[RD] would cause a tie, and our optimal output could not avoid losing against the candidate which is unfaithful to height. Therefore, we have at least one motivation for ranking a faithfulness constraint IDENT (hi) higher than (at least) feature markedness constraints. When we deal with vowels opaque to rounding in section (3.2.1.), we will see further evidence to rank IDENT (hi) among the other faithfulness constraints higher than Alignment constraints.

Consider Tableaux II below where faithfulness over feature markedness eliminates the “pseudo-optimal” candidate (IDENT constraints are collapsed into IDENT (rd),(bk)).

Tableaux III

| | | |
|-----------------------------|---|--------------------------|
| /köy-II/ ☞köylü kiyli | $\text{IDENT (rd,bk),} \gg \{ \text{Align (rd, R), Align (bk,R)} \} \gg \text{IDENT (hi)} \gg \{ *[\text{+RD}], *[\text{-BK}] \}$ | ** ** *! ** |
|-----------------------------|---|--------------------------|

3.2. Harmony in Turkmen and Turkish and Opaque vowels

Consider an input /at+IEr+dE/ “on the horses”, which is a possible input in both Modern Turkish and Turkmen. (IDENT (hi) is excluded since it is not crucial for this tableaux):

Tableaux IV

| | | |
|--|--|---------------------------------|
| /at+IEr+dE/ atlerde atlarde atlerda ☞atlarda | $\{ \text{IDENT (rd), IDENT (bk)} \} \gg \{ \text{Align (rd, R), Align (bk, R)} \} \gg \{ *[\text{+RD}], *[\text{-BK}] \}$ | **! ** *! ** ** |
|--|--|---------------------------------|

The optimal output is the expected one in both languages. The candidate that satisfies Alignment constraints wins over those that violate them.

Now consider the inputs /öy + IEr+dE/ “in the houses” in Turkmen and /köy+IEr+dE/ “in the villages” in Turkish. Under the constraint ranking given above, the candidates which have undergone rounding at the expense of violating the feature markedness constraint *[-RD] will win; namely, “öylördö” in Turkmen and the ungrammatical “köylördö” in Turkish.

Tableaux V

| | | |
|-----------------------------------|--|-------------------------------|
| /öy+IEr+dE/ öylerde öylarda | $\{ \text{IDENT (rd), IDENT (bk)} \} \gg \{ \text{Align (rd, R), Align (bk, R)} \} \gg \{ *[\text{+RD}], *[\text{-BK}] \}$ | **! * **! * * |
|-----------------------------------|--|-------------------------------|

² There is no motivation to rank featural markedness constraints against each other. In fact *[-RD] and *[-BK] can be ranked. The fact that harmony requires rounding indicates that *[-RD] ranks lower and is more likely to be violated. This is not crucial for the analysis at this point so I’ll just keep relevant feature markedness constraints unranked against each other.

| | | | | |
|--------------|-----|-----|-----|-----|
| öylörde | *! | | ** | *** |
| ☞öylördö | | | *** | *** |
| /köy+lEr+dE/ | | | | |
| köylerde | **! | | * | *** |
| köylarda | **! | **! | * | |
| köylörde | *! | | ** | *** |
| ?☞köylördö | | | *** | *** |

The actual output is not “köylör” but “köyler” in Turkish because [-HI] vowels are opaque to rounding. This ranking ensures rounding harmony but does not account for the opacity of [-HI] vowels in Turkish. Therefore, a markedness constraint *[-HI/RD] must be dominating the markedness constraint Align (rd,R) (but not necessarily Align (bk-R) to prevent rounding of non-high vowels in Turkish. What prevents the spreading of the feature round, skipping over an opaque vowel?

3.2.1.Constraint ranking responsible for Turkish Vowel Harmony:

Consider an input where a high vowel follows an opaque vowel. Let’s see whether our constraint ranking can give a full account of the opacity of non-high vowels. (Alignment constraints are collapsed)

Tableaux VI

/köy-lEr-In/ { IDENT(rd),IDENT(bk) } » *[-HI/RD] » Align(rd,bk-R) » { * [+RD], [-BK] }

| | | | | |
|------------|----|-----|-----|-----|
| köylerin | | **! | * | *** |
| ☞?köylerün | | * | ** | *** |
| köylörün | *! | | *** | *** |

As we see in Tableaux VI, opacity of non-high vowels is not accounted for by our constraint ranking. We need to exclude [-RD] [+RD] sequences. Therefore, a markedness constraint * [-RD] [+RD] needs to be ranked above Alignment constraints that enforce harmony. It need not be ranked against *[-HI/RD].

Tableaux VII

/köy-lEr-In/ { IDENT(rd),(bk) } » { *[-HI/RD], * [-RD] [+RD] } » Align(rd,bk-R) » { * [+RD], [-BK] }

| | | | | | |
|-----------|----|----|-----|-----|-----|
| ☞köylerin | | | **! | * | *** |
| köylerün | | *! | * | ** | *** |
| köylörün | | *! | * | ** | *** |
| köylörün | | *! | | *** | *** |
| keylerin | *! | | | | *** |

Now our constraint ranking can account for the problem in Tableaux V as well:

Faithfulness constraints ensure that any feature specified on the vowels are not altered in order to satisfy markedness constraints responsible for opacity. IDENT (hi), which has not been included among the constraints up to this point for the sake of simplicity needs to be included, and ranked among the highest faithfulness constraints to exclude candidates like “köylördü” below. If we keep in the position proposed before (above Alignment below higher markedness), it can be violated to satisfy the higher markedness constraints responsible for blocking:

Tableaux VIII

/köy+lEr+dE/ { IDENT(rd),(bk),(hi) } » { *[-HI/RD], * [-RD] [+RD] } » Align(rd,bk-R) » { * [+RD], [-BK] }

| | | | | | |
|-----------|--|--|----|---|-----|
| ☞köylerde | | | ** | * | *** |
|-----------|--|--|----|---|-----|

| | | | | | | |
|----------|-----|-----|----|-------|-----|-----|
| köylarda | | | | ** ** | * | * |
| köylörde | | *! | | * | ** | *** |
| köylördö | | **! | | | *** | *** |
| köylürdü | **! | | | | *** | *** |
| koylerdo | | | *! | * | ** | *** |
| kiylerde | **! | | | | | *** |
| keylerde | *! | | | | | *** |

The optimal output satisfies markedness constraints responsible for opacity at the expense of violating Alignment constraint³. The candidates that do not respect opacity lose. Higher markedness constraints, *[-HI/RD] and *[-RD] [+RD] block the spreading of roundness feature at the expense of violating a lower constraint responsible for rounding but do not interact with backness harmony. Spreading of [-back] feature is ensured by Align (bk),R.

The constraint ranking we have posited for Turkish so far is the following:

$$\{IDENT(rd),(bk),(hi)\} \gg \{ *[-HI/RD], *[-RD] [+RD] \} \gg Align(rd,bk-R) \gg \{ [+RD],[-BK] \}$$

3.2.2. Constraint ranking in Turkmen

Note that low vowels and high back unrounded short and long vowels are opaque to rounding in Turkmen. Let's first consider the low vowels.

3.2.2.1. Opacity of Low Vowels

The higher markedness constraint that is responsible for preventing rounding of low vowels and that dominates the constraint responsible for harmony needs to be *[LO/RD]. In Turkmen, not only height but also lowness is relevant in faithfulness to the input to indicate opacity, therefore, IDENT (lo) needs to occur among the highest constraints. If we keep along the “underspecification” assumption, the non-initial vowels need to be specified underlyingly for this feature as well, for IDENT to be relevant.

Constraint ranking responsible for Turkmen Vowel Harmony might be the following by analogy to Turkish (Note that we assume that noninitial vowels are *not* specified for roundness and backness”

(Faithfulness constraints are collapsed into {IDENT (lo),(hi),(rd),(lo)} and I'll keep on representing { *[-RD] » * [+RD],[-BK] » [+BK] } as { * [+RD],[-BK] }):

$$\{IDENT (lo),(hi),(rd), (bk)\} \gg * [LO/RD] \gg Align (rd,bk R) \gg \{ * [+RD],[-BK] \}$$

Tableaux IX

| | |
|---------------|---|
| /gülyä:r+ler/ | { IDENT (lo),(hi),(rd),(bk) } » * [LO/RD] » Align (rd,bk R) » { * [+RD],[-BK] } |
| gülyä:rlər | **! * *** |
| ☞?gülyä:rlör | * ** *** |

³ The optimal candidate violates *[-RD] twice whereas candidates with round mid Vs violate it once or not violate at all. But this is not significant since they lose by violating higher constraints, therefore I'm disregarding *[-RD] violations.

| | | | | | |
|------------|----|------|---|-----|-----|
| gülyö:rler | *! | * | * | ** | *** |
| gülyö:rlör | *! | | | *** | *** |
| gülyä:rlar | | ***! | * | *** | |

The optimal candidate is not the expected grammatical one but an ungrammatical one because the grammatical candidate violates Align (rd,R) twice, whereas the pseudo-optimal one violates it only once. This ranking would be valid if low vowels were transparent to rounding. What we want to exclude is a [-RD] [+RD] sequences, as was the case in Turkish. If we rank a constraint forbidding such sequences above Alignment constraints and below the markedness constraint *[LO/RD], we can eliminate a pseudo-optimal candidate. Note that the constraint marks the (+/-) features; this is crucial because an alpha notation would rule out [+RD] [-RD] sequences which are outcomes of opacity.

Tableaux X

/gülyä:r+ler/ { IDENT (lo),(hi),(rd),(bk) } » { *[LO/RD], [-RD] [+RD] } » Align (rd,bk R) » { *[+RD],[-BK] }

| | | | | | |
|--------------|----|----|----|----|-----|
| ☞ gülyä:rlar | | | ** | * | *** |
| gülyä:rlör | | *! | * | ** | *** |
| gülyö:rlar | *! | | * | ** | *** |

The opacity of low vowels in Turkmen is accounted for by the constraint ranking above.

3.2.2.2. Opacity of HI BK -RD Vowels

Remember that speakers of Turkmen does not apply rounding to /i/ and /i:/ in certain environments. /i/ is not rounded in final open syllables.

- | | |
|----------|-----------------|
| /uli/ | ~ big |
| /ululuk/ | ~ bigness; size |
| /goli/ | ~ his arm |
| /okodi/ | ~ (s/he read) |

/i/ can not be rounded in word final position. Whether it is transparent or not is not detectable from the data available. A possible account for this behavior is that /i/ is actually a lower vowel than assumed with no rounded counterpart in the vowel inventory . This is very likely since there is no distinction between advanced and retracted unrounded high back vowels in the IPA. The distinction occurs between rounded advanced versus retracted high back vowels. In Turkmen, then, it cannot undergo rounding but is forced to raise and be rounded except in word final position.

According to Grounded Hypothesis (Archangeli 1995) there are phonetically motivated feature cooccurrence conditions. Tongue root position and tongue tongue body position influence each other. Tongue body raising and tongue root advancement correlate with each other (HI/ATR) and so do tongue body lowering and tongue root retraction (-HI/RTR). This correlation does not exclude the possibility of high retracted vowels . In fact, high retracted vowels are observed to occur in Kinande, Menomini, Lango and Javanese (Archangeli 1995). In Javanese (Archangeli 1995), they occur in restricted environments , i.e. open or closed final syllables. In Turkmen, it occurs in word final position.

A faithfulness constraint IDENT [ATR] is violated when a higher constraint forbids word final vowels to be [+ATR]. A markedness constraint ranked above faithfulness yet below the *[+ATR]_w would ensure the -raising and- rounding of /i/ elsewhere; this is a typical ranking for complementary distribution instances in OT.

Consider the constraint ranking and the Tableaux XI below:

*[+ATR]_w » *[+HI/-ATR] » IDENT (ATR)

Tableaux XI

/uli/ *[+ATR]_w » *[+HI/-ATR] » IDENT (ATR)

| | | | |
|------|----|---|---|
| ☞uli | | * | |
| ulu | *! | | * |

The higher markedness constraint rules out the candidate with a ATR vowel in word final position and the optimal candidate wins at the expense of violating a lower markedness constraint.

/uli-lik/ *[+ATR]_w » *[+HI/-ATR] » IDENT (ATR)

| | | | |
|---------|----|-----|----|
| ulilik | | **! | |
| ululik | *! | | * |
| uliluk | *! | | * |
| ☞ululuk | | | ** |

The optimal candidate is the one that satisfies markedness at the expense of violating faithfulness.

How would these constraints be ranked in the constraint ranking posited for Turkmen vowel harmony? Well, definitely below Align (rd-R) since not rounding but only raising could satisfy *[+HI/-ATR] unless ranked below Alignment constraint which forces rounding.

{IDENT (lo),(hi),(rd),(bk)} » {*[LO/RD], [-RD]⊃[+RD]} » Align (rd,bk R) » {*[+ATR]_w » *[+HI/-ATR] » IDENT (ATR)} » {*[+RD],[-BK]}

It is worth noting that a similar phenomenon is found in Yoruba (Fresco 1970). In Yoruba, nouns are always of the form VCV but none with an initial /u/. The vowel system consists of four +ATR and three -ATR vowels. [-ATR] feature spreads bidirectionally to non-high vowels; high vowels do not have a -ATR counterpart; harmony is not effected by this peculiarity if /i/ in Yoruba because vowel harmony is influential on non-high vowels only. In Turkmen, /i/ does not undergo rounding in *word final* position, and in Yoruba /i/ does not undergo rounding in *word initial* position; but harmony is blocked in Turkmen because high vowels are subject to harmony. Word final position is on the path of left to right, that is root to suffix harmony.

The observation that there is no -ATR counterpart of /i/ in Yoruba, and that there is no round counterpart of /i/ in Turkmen accounts for the opacity of these vowels. The relevant environment, word edge in both languages seems to be a position where faithfulness with respect to ATR features needs to be respected.

3.2.2.3. Opacity of /i:/

The long high back unrounded vowel in Turkmen is never rounded. Except for stems, it is derived by Vowel Lengthening. Turkmen has a variety of vowel lengthening operations. First, when a vowel initial suffix is attached to a vowel final stem, vowels are fused to form a long vowel. Second, a consonant (actually /l/ and /r/) between identical vowels is deleted and the vowels unite to form a long vowel.

Consider the examples below (Clark 1998):

(2) gapI + Im ⇨ gapI:m ~ my door

- (3) gapI + InIð ⇒ gapI:nIð ~ your door
 (4) ber+ er ⇒ be:r ~ s/he's giving
 (5) otur +Ir ⇒ otI:r ~ s/he's sitting
 (6) al+ar ⇒ a:r ~ s/he's taking

(2&3) are instances of identical vowels fusing into a long vowel. (4&5) are instances of a consonant deletion and fusion of vowels which are identical in (4) but not in (5). Interestingly in (5), when they fuse the vowel of the suffix seems to win. There might be some other phonological processes going on since the assumption that the underlying form of the attached suffix is high in (5) and low in (6) is not attested. This is the infamous aorist that also occurs in Turkish and behaves irregularly when it appears after /l/ and /r/, the consonants deleted in Turkmen.

Going back to the contrast in (4&5), note that we have assumed full specification of initial vowels only; non-initial vowels are specified only for height. Therefore the input for (5) should actually be represented as /otIr+Ir/, which is simply another instance of two identical vowels fusing into a long vowel.

“Oturor “ (S/he'll sit) is a possible surface form in Turkmen, therefore it cannot be the case that Turkmen does not allow two identical consonants, i.e. laterals in the same syllable and that deletes one. Vowel lengthening of this type in Turkmen is an outcome of a deletion for a reason I will not investigate further and a resolution of the hiatus formed as a consequence of this deletion. The relevant point for our discussion is that long hi back unrounded vowel is a derived vowel. As a derived vowel it does not undergo rounding, that is, it is opaque to rounding. Why would that be? How would our constraints distinguish between derived and non-derived long vowels since both of them are bimoraic?

To account for the Turkmen data, we could assume a constraint such as *[hi, bk, rd, long] but it would eliminate all candidates with this vowel specified underlyingly. Remember that, all through the analysis on Turkish and Turkmen, we have assumed that noninitial vowels are not specified except for height. In this approach there is nothing to prevent rounding of an underlyingly high vowel which surfaces as a long high back vowel to satisfy a constraint forbidding hiatus (ONSET).

What if we assume that all vowels are *fully specified*? With an input like / gapi+im/, the optimal output would be violating IDENT (long) and *[LONG] to satisfy a higher ranking ONSET. Rounding would also violate IDENT (rd) and *[RD]. We have formerly argued that IDENT (rd) outranks feature markedness constraints.

If we assume full specification of all vowels, Faithfulness constraints IDENT (rd,bk) needs to be ranked below Alignment, or else rounding would be blocked by faithfulness constraints. (Also remember that if we do that, we would need a positional constraint to ensure that the initial vowel is not subject to vowel harmony.)

Align (rd,bk R) » { IDENT (rd), IDENT (bk) } » *[-RD] » *[+RD] » [-BK] » [+BK]

If the constraints responsible for lengthening (possibly ONSET » IDENT (long) » *[LONG]) is ranked lower than IDENT (rd) the optimal candidate would lose by violating Align (rd) and a candidate which has a rounded long high back vowel would win although it violates IDENT (rd) as well.

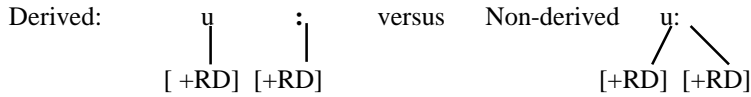
If we rank *[+RD] higher than Align (rd) to save our optimal candidate, vowel harmony would be blocked as well.

Apparently, full specification of vowels does not help. If we follow our former assumption that only initial vowels are fully specified, the only way out is to assume a constraint that would eliminate a non-optimal candidate with a derived long round vowel and rank it higher than IDENT (rd) and hence above Align (rd). Let's call it *[DR LG,RD] for No derived long round vowels.

{ IDENT (lo),(hi),(rd),(bk) } » { *[LO/RD] » *[DR LG,RD] » [-RD] ^ [+RD] } » Align (rd,bk R) » { * [+ATR]_w » * [+HI/-ATR] » IDENT (ATR) } » { * [+RD], [-BK] }

But this is no more than a description of the facts at the expense of complicating our grammar. Moreover, in OT, constraint ranking evaluates all possible candidates at their surface forms without making resort to their derivation, and chooses the optimal candidate. Positing a constraint like No Derived long vowels violates the very essence of OT!

What if derived long vowels differ from primary long vowels in the “linking of features”? Suppose a non-derived long round vowel is linked to the feature [+RD] with a double link whereas a derived one is linked separately:



Then the rounded derived long vowel would be violating *[+RD] once more than a non-derived one. Yet, I don't have a real account for this behavior of derived /i:/.

IV. Differences and similarities in Turkish and Turkmen Vowel Harmony

4.1. Similarities

So far, we have seen that the constraint ranking given below accounts for the basic pattern in both Turkish and Turkmen Vowel Harmony. Faithfulness outranks Alignment constraints and ensures faithfulness to the specification of the initial vowel; harmony takes place to satisfy Alignment constraints at the expense of violating feature markedness constraints.

Constraint Ranking responsible for rounding and backness harmony in Turkish and Turkmen:

$$\{ \text{IDENT (rd), IDENT (bk), IDENT(hi)} \} \gg \{ \text{Align (rd, R), Align (bk, R)} \} \gg \{ *[-RD] \gg [+RD], [-BK] \gg [+BK] \}$$

4.2. Differences:

Turkish and Turkmen differ with respect to their opaque vowels:

1. In Turkish, [-HIGH] vowels are opaque to rounding; therefore markedness constraints *[-HI/RD] and *[-RD] \wedge [+RD] dominate Alignment constraints, and a feature faithfulness constraint IDENT(hi) dominates markedness to prevent change in height to satisfy harmony.

2. In Turkmen, low vowels, /i:/ are opaque to rounding. /i/ is opaque in word final position.

Markedness constraints *[+LO/RD] and *[-RD] \wedge [+RD] dominate Alignment constraints to block rounding; IDENT(lo) as well as IDENT(hi) are among the highest ranking constraints to ensure that optimal output is faithful to the input with respect to these features. For the opacity of /i/ in word final position the following constraints are ranked below Alignment constraints responsible for harmony:

$$\text{Align (rd,bk-R)} \gg \{ * [+ATR] \}_w \gg * [+HI/-ATR] \gg \text{IDENT (ATR)} \}$$

For the opacity of /i:/ derived by vowel lengthening, I don't have an account.

4.3. Another difference

In Turkish, mid round vowels do not occur in non-initial syllables. Note that non-high are opaque to rounding and round vowels created by vowel harmony are only high ones. But mid round vowels *do* occur in initial syllables, which means that the markedness constraint *[-HI/RD] which prevents rounding of non-high vowels is constantly violated in initial syllables in Turkish, but not in Turkmen. There can be constraint ranked higher than all the other constraints so that not to violate that highest constraint *[-HI/RD] is violated. But do we really need such a constraint? The faithfulness constraint IDENT (rd,bk,hi) that preserves all the specifications of the initial vowel accounts for this fact. The markedness constraint is violated to satisfy the highest ranking faithfulness constraint. This markedness constraint is not *[-HI/RD] but *[LO/RD], and is not violated in initial syllables.

4.4. Turkish and Turkmen Vowel Harmony

Turkish vowel harmony is accounted for by the following constraint ranking:

$$\text{IDENT (hi,bk,rd)} \gg \{ *[-HI/RD], *[-RD] \wedge [+RD] \} \gg \text{Align (rd,bk R)} \gg \{ * [+RD], *[-BK] \}$$

Turkmen vowel harmony is accounted for by the following constraint ranking:

$$\text{ID(lo,hi,bk,rd)} \gg \{ * [+LO/RD], *[-RD] \wedge [+RD] \} \gg \text{Align (rd,bk R)} \gg \{ * [+RD], *[-BK] \}$$

Note that the general schema of these two constraint rankings is similar.

F» M_O »M_H » M_F

Faithfulness dominates all the constraints and ensures faithfulness to the input with respect to full specification of the initial vowel and with respect to height in Turkish, height & lowness in Turkmen non-initial vowels..

M_O, that is markedness constraints responsible for blocking rounding harmony dominate constraints responsible for harmony, that is M_H.

M_H dominates featural markedness constraints that are violated to satisfy harmony.

5. Conclusion:

Vowel harmony in Modern Turkish and Turkmen can be accounted for by the same constraint ranking, by ranking the markedness constraints responsible for the spreading of features [RD] and [BK] lower than faithfulness constraints IDENT (rd) ,IDENT (bk) and IDENT (hi). What differs in these two languages is their choice of vowels that are opaque to rounding. This difference can be accounted for by a markedness constraints ranked higher than Alignment constraints, therefore blocking rounding. In both languages spreading of backness feature is ensured by Align (bk),R because it is not dominated by a constraint blocking backness harmony.

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