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Epenthesis-Driven Harmony in Turkish

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0. Introduction

Describing one particular language requires only a subset of the Optimality Theoretic (Prince and Smolensky 1993) constraints necessary for the characterization of all phonological phenomena in all languages. Nonetheless, it is generally assumed that all grammars contain the same (universal) constraints, and differ only with respect to how those constraints are ranked relative to one another. The model therefore entails that individual grammars contain numerous latent or inactive constraints. This paper provides evidence that constraints which never play an active role in determining optimal outputs in native vocabulary are nonetheless available to speakers and may be invoked when novel phonological contexts are encountered, as in the case of loanwords. Several studies have reached similar conclusions for Tagalog (Ross 1996), Finnish (Ringen and Heinämäki 1999) and Tuvan (Harrison, this volume).

Words borrowed into Turkish from foreign sources typically undergo epenthesis to break up an initial consonant cluster. For instance, *steno* is realized as *sitenö*. These epenthetic vowels are always high, however their backness and rounding are contextually determined, as noted in Yavas (1980) as well as Clements and Sezer (1982). This paper reports on the findings of an experiment conducted to determine the range of harmonic patterning of such epenthetic vowels. The results indicate that as described in the earlier studies, regressive harmony does target epenthetic vowels. The harmony "facts" vary considerably from speaker to speaker, however, and within speakers it is frequently the case that more than one harmony pattern is judged to be acceptable for a given word. I present an account of the results of this experiment focusing in particular on cross-linguistic evidence for the existence of the relevant inactive constraints that subjects must recruit to accommodate the novel contexts introduced in loanwords.

1. Patterns of regressive rounding harmony

Regressive harmony targeting epenthetic vowels in loanwords is described in Yavas (1980) and Clements and Sezer (1982). Both demonstrate that the backness of an epenthetic vowel is contextually determined. Vowels as well as velar and lateral consonants serve as backness harmony triggers. Similarly, these studies also document regressive rounding harmony targeting epenthetic vowels. The focus of this paper is limited to the phenomenon of regressive rounding harmony (hereafter RRH).

Both Yavas (1980) and Clements and Sezer (1982) report RRH targeting epenthetic vowels, however the patterns described are somewhat different. For both studies, high rounded vowels consistently trigger rounding harmony, as shown in the examples in (1):

- (1) High vowels consistently trigger RRH
- | | | | |
|----|----------------------|-----------|-----------------------------|
| a. | f _u lüt | 'flute' | (Yavas) |
| b. | g _u rup | 'group' | (Yavas, Clements and Sezer) |
| c. | P _u rusya | 'Prussia' | (Clements and Sezer) |

Different patterns are reported when the potential trigger is non-high. Yavas' data and discussion indicate that RRH is never triggered by a non-high vowel. Examples are shown in (2):

- (2) Yavas: Non-high vowels do not trigger RRH
- | | | |
|----|--|----------|
| a. | b _i ronz (*buronz) | 'bronze' |
| b. | f _i lört (*f _u lört) | 'flirt' |

Clements and Sezer's data include some words in which a non-high vowel triggers RRH (3a-b), others in which a non-high vowel does not trigger RRH (3c-d), and one word (3e) for which two forms are listed, one containing a rounded epenthetic vowel and the other containing an unrounded epenthetic vowel:

- (3) Clements and Sezer: Non-high vowels sometimes trigger RRH
- | | | |
|----|---|-----------|
| a. | p _u rova | 'test' |
| b. | p _u rotesto | 'protest' |
| c. | b _i roč | 'brooch' |
| d. | k _i roki | 'sketch' |
| e. | b _u rom / b _i rom | 'bromide' |

The experiment described in the present paper was originally designed to resolve this discrepancy. As will be shown, however, both of the patterns cited above were documented in the experiment described here. Additional patterns were also observed.

1.1. Experimental procedure

The data were collected in the following manner. Nine native speakers of Turkish, ranging in age from 18-35 years, were interviewed. All subjects had been raised in urban settings including Ankara, Istanbul and Izmir. Each subject was presented with a list of 107 words of foreign origin taken from Özgüler (1989). Each word contained an initial two-consonant cluster. Subjects were asked to determine the appropriate epenthetic vowel quality (or qualities). The task presented little difficulty for the subjects, and responses were supplied with what appeared to be a high degree of confidence. Certain subjects reported two vowel qualities to be appropriate for certain words.

The results of this survey were all consistent with Yavas (1980) and Clements and Sezer (1982) in one respect: High rounded vowels always triggered RRH. When the potential trigger was non-high, however, considerable subject-to-subject variation was observed.

1.2. Results

Six patterns of RRH emerged from the results of this experiment. Of these, three involve intra-speaker variation, i.e., patterns in which certain vowels trigger RRH only optionally. The six patterns are given below in (4). In this table, solid lines enclose consistent RRH triggers, while dashed lines enclose optional triggers. Un-enclosed vowels never trigger harmony for the pattern in question. The number of subjects instantiating each pattern is indicated in parentheses:

(4) Six rounding harmony patterns

Group A	(1)	ü u ö o
Group B	(1)	ü u ö o
Group C	(2)	ü u ö o
Group D	(1)	ü u ö o
Group E	(2)	ü u ö o
Group F	(2)	ü u ö o

So in group B, for example, RRH is consistently triggered by the high vowels, is optionally triggered by the non-high front vowel [ö], and is never triggered by the non-high back vowel [o]. (5) shows some of the words used in the experiment:

(5) Sample Words

	'flute'	'blouse'	'diploma'	'block'
Group A	<u>f</u> ü <u>l</u> üt	<u>b</u> u <u>l</u> uz	<u>b</u> irö <u>v</u> e	<u>b</u> l <u>o</u> k
Group B	<u>f</u> ü <u>l</u> üt	<u>b</u> u <u>l</u> uz	<u>b</u> irö <u>v</u> e/ <u>b</u> ürö <u>v</u> e	<u>b</u> l <u>o</u> k
Group C	<u>f</u> ü <u>l</u> üt	<u>b</u> u <u>l</u> uz	<u>b</u> ürö <u>v</u> e	<u>b</u> l <u>o</u> k
Group D	<u>f</u> ü <u>l</u> üt	<u>b</u> u <u>l</u> uz	<u>b</u> irö <u>v</u> e/ <u>b</u> ürö <u>v</u> e	<u>b</u> l <u>o</u> k/ <u>b</u> u <u>l</u> o <u>k</u>
Group E	<u>f</u> ü <u>l</u> üt	<u>b</u> u <u>l</u> uz	<u>b</u> ürö <u>v</u> e	<u>b</u> l <u>o</u> k/ <u>b</u> u <u>l</u> o <u>k</u>
Group F	<u>f</u> ü <u>l</u> üt	<u>b</u> u <u>l</u> uz	<u>b</u> ürö <u>v</u> e	<u>b</u> u <u>l</u> o <u>k</u>

From these patterns we may draw two conclusions. First, high vowels are clearly more popular RRH triggers than non-high vowels. Second, of the non-high vowels, the front vowel [ö] is more likely to trigger RRH than the back vowel [o] is. These asymmetries are implicational: Whenever a non-high vowel may trigger RRH, high vowels may also trigger RRH. Similarly, whenever a back vowel serves as a RRH trigger, the corresponding front vowel does so as well.

These generalizations cannot be predicted on the basis of the progressive rounding harmony pattern of native Turkish words. In native rounding harmony, vowel height does play a role in determining the applicability of harmony, however it is the target whose height is relevant, rather than the trigger. Moreover, backness never serves to restrict the applicability of native rounding harmony. If we look beyond standard Turkish, however, we observe patterns of rounding harmony rather similar to those obtained in the experiment described here.

2. Rounding harmony beyond Turkish

In Kaun (1994), I showed that clear patterns emerge when the typology of rounding harmony is submitted to cross-linguistic examination. That study attempted to explain the fact that most attested rounding harmony systems cannot be described by a simple statement such as "a vowel is rounded when it occurs in the vicinity of a rounded vowel." Rather, in nearly all documented cases, conditions referring to the height and/or backness of the participating vowels are imposed on the application of harmony. These include the following:

- (6) Cross-linguistically observed conditions on rounding harmony
 - a. The target must be high.
 - b. The trigger must be front.
 - c. The trigger and target must agree in height.

In Nawuri (Casali 1993) and Tuvan (Harrison, this volume), for example, rounding harmony is subject to condition (6a). In Yakut (Krueger 1962), rounding harmony applies as long as condition (6a) or condition (6c) is met. In Tsou (Hsu 1993), rounding harmony obtains as long as conditions (6a) and (6c) are met, while Karakalpak (Menges 1947) requires either (6a) or (6b). Other combinations of these conditions describe other attested rounding harmony patterns.

2.1. A formal account of the typology

We may formalize the general tendencies described above as Optimality Theoretic constraints (Prince and Smolensky 1993). Elsewhere (Kaun 1994, forthcoming), I discuss the phonetic motivation of these constraints. In the present paper, however, the constraints are posited with at most only general remarks regarding their functional underpinnings.

First, many languages exhibit rounding harmony. Following Smolensky (1993) and others, I will assume that the phenomenon of harmony is encoded grammatically by means of constraints which call for the alignment of the harmonic feature with the edge of some domain, typically the prosodic word. For rounding harmony, then, two general alignment constraints will be posited:

(7) General alignment constraints for rounding harmony

- ALIGN-R([RD]) *The feature [round] is aligned with the right edge of the prosodic word.*
- ALIGN-L([RD]) *The feature [round] is aligned with the left edge of the prosodic word.*

We noted above that front rounded vowels are preferred over back rounded vowels as harmony triggers. This suggests the need for the more specific constraints listed in (8):

(8) Specific alignment constraints for rounding harmony

- ALIGN-R([RD]/[-BK]) *The feature [round], when co-occurring with the feature [-back], is aligned with the right edge of the prosodic word.*
- ALIGN-L([RD] /[-BK]) *The feature [round], when co-occurring with the feature [-back], is aligned with the left edge of the prosodic word.*

The tendency for high vowels, rather than non-high vowels, to be targeted by rounding harmony may be attributed to the general markedness dispreference for non-high rounded vowels. We encode this dispreference formally in a constraint banning the combination of [round] and [low]:

- (9) *ROLO *The combination [round]+[low] is dispreferred.*

Finally, we noted above that rounding harmony is favored in an environment in which the trigger and target agree in height. That is, cross-height harmony is disfavored. Citing work by Goldstein (1991), which demonstrates that the lip-rounding gesture associated with high vowels differs substantively from that associated with non-high vowels, I have attributed this phenomenon to a constraint on *gestural uniformity*. Gestural uniformity constraints state that in the phonological representation, a single instance of a feature should correspond to a uniform execution mechanism for the corresponding gesture. A single instance of [round] associated to vowels of differing heights will incur a violation of the following gestural uniformity constraint:

- (10) Gestural uniformity
GESTUNI[RD] *The feature [round] should be realized with a uniform mechanism of articulation.*

2.2. Native Turkish rounding harmony

For native Turkish rounding harmony, only a subset of the constraints proposed in section 2.1 plays a decisive role in determining surface forms. High vowels undergo rounding harmony triggered by both high and non-high vowels,

as shown in (11). Non-high vowels do not undergo rounding harmony, as shown in (12). Note that these suffixes (as well as epenthetic vowels) also undergo backness harmony. No formal account of backness harmony is proposed here.

(11) High vowels undergo rounding harmony

pul	pul- <u>u</u> m	'stamp-1.singular'
kol	kol- <u>u</u> m	'arm-1.singular'
süs	süs- <u>ü</u> m	'ornament-1.singular'
söz	söz- <u>ü</u> m	'word-1.singular'

(12) Non-high vowels do not undergo rounding harmony

pul	pul-lar (*pul-lor)	'stamp-plural'
kol	kol-lar (*kol-lor)	'arm-plural'
süs	süs-ler (*süs-lör)	'ornament-plural'
söz	söz-ler (*söz-lör)	'word-plural'

The native pattern of rounding harmony is progressive, and targets only high vowels. This pattern reflects the interaction of the two constraints in (13), where (a) outranks (b):

(13) Active constraints for Turkish

- a. *ROLO
- b. ALIGN-R([RD])

The remaining constraints play no active role in native Turkish: No regressive harmony is exhibited (14a), front vowels are not preferred over back vowels as harmony triggers (14b-c), and cross-height harmony is freely permitted (14d):

(14) Inactive constraints for Turkish

- a. ALIGN-L([RD])
- b. ALIGN-R([RD]/[-BK])
- c. ALIGN-L([RD]/[-BK])
- d. GESTUNI[RD]

The typological facts suggest that rounding harmony can be characterized cross-linguistically with a collection of potentially interacting constraints. A particular rounding harmony system will typically be describable with just a subset of those constraints. My interest lies in the remaining constraints; those which play no active role in determining the native patterns of the language in question. While the inactive constraints listed in (14) are not actively invoked in the general native pattern of rounding harmony, they are indeed available to Turkish speakers, and are recruited when a novel phonological context is

presented, as in the case of loanwords. This claim is substantiated in the analysis proposed in section 3.

3. Analysis

The loanword context described here sets up the environment for *regressive* harmony, rather than the natively observed progressive harmony. This domain of borrowing thus constitutes a laboratory for observing the accessibility of the (natively inactive) left-alignment constraints. Moreover, if regressive harmony and progressive harmony result from distinct alignment constraints, we might expect to find that the constraint interactions exhibited in RRH are different from those associated with native progressive harmony. Since epenthetic vowels are always high in Turkish, the cluster-initial loans do not allow us to observe the interaction of the feature co-occurrence constraint *ROLO with the regressive harmony constraints. However, Turkish has borrowed heavily from French, a language possessing both front and back rounded vowels. Thus, the typologically observed front-back trigger asymmetry could in principle interact with RRH in Turkish. By the same token, it is in principle possible for gestural uniformity effects to be observed under Turkish RRH. Both of these possibilities are in fact borne out.

Regressive rounding harmony clearly exists. All subjects exhibited RRH when the potential trigger was a high vowel. From this we conclude that while not natively active, left-alignment constraints are indeed accessible to speakers. This observation might not in itself constitute conclusive proof that grammars contain inactive constraints that can be accessed when the need arises. It could be the case that, contrary to the analysis proposed here, rounding harmony is encoded in a single "bi-directional" constraint. Under this view, the loanword patterns would be the expected consequence of the fact that loanwords, but not native words, introduce a potential RRH environment. I will show that the interaction of RRH with backness and gestural uniformity demonstrates that latent constraints do exist and that speakers access them readily.

3.1. The accessibility of inactive constraints

As described in section 1, subjects differ with respect to the application of RRH when the potential trigger is a non-high vowel. For one group (group F), non-high rounded vowels consistently trigger RRH, whereas for another group (group A), non-high rounded vowels consistently *fail* to trigger RRH. This difference reflects two distinct rankings of the constraint which favors RRH (left-alignment) vis-à-vis that which expresses a dispreference for cross-height harmony (gestural uniformity). Group A assigns a higher rank to gestural uniformity, whereas group F assigns a higher priority to left-alignment:

- (15) Permitting vs. prohibiting cross-height harmony
- | | | | |
|---------|---------------|----|---------------|
| Group A | GESTUNI[RD] | >> | ALIGN-L([RD]) |
| Group F | ALIGN-L([RD]) | >> | GESTUNI[RD] |

Group D shows a "compromise" pattern—one in which the non-high vowels optionally trigger RRH. We return to optionality in section 3.2.

The remaining patterns exhibit asymmetric treatment of front versus back triggers, suggesting a higher ranking of the backness-specific left-alignment constraint relative to the more general left-alignment constraint. In the group C pattern, [ö] consistently triggers RRH, whereas [o] consistently does not. For speakers exhibiting this pattern, we may suppose that the general left-alignment constraint is ranked low relative to gestural uniformity, while that favoring front vowel-triggered harmony is ranked higher:

- (16) The front-back trigger asymmetry
 Group C Align-L([rd]/[-bk]) >> GestUni[rd] >> Align-L([rd])

Recall that native Turkish does not, in itself, provide evidence for the existence of a special constraint calling for the alignment of [round] when it occurs with [-back]. The behavior of group C (and others) in the present experiment demonstrates that the grammar of Turkish must include both sets of alignment constraints despite the fact that native patterns supply positive evidence for only the more general [round]-alignment.

The remaining patterns involve optionality and are discussed in section 3.2.

3.2. Optionality as *indeterminate ranking*

Let us begin with group B speakers, for whom the non-high front rounded vowel [ö] optionally triggers RRH. To account for this pattern, suppose that two distinct constraint hierarchies are available to this subset of speakers: one in which gestural uniformity outranks left-alignment, and the other in which left-alignment outranks gestural uniformity. Expressed formally, we may posit an *indeterminate ranking* of GESTUNI[RD] and ALIGN-L([RD]/[-BK]) and, as shown in (17). Indeterminate ranking is denoted with the symbol (><):

- (17) Indeterminate ranking: group B
 ALIGN-L([RD]/[-BK]) >< GESTUNI[RD]

For group B speakers, the indeterminately ranked constraints in (17) must outrank the more general left-alignment constraint. The indeterminate ranking relation established in (17) yields a grammar in which two constraint hierarchies are possible. These are shown in (18):

(18) Two hierarchies for group B

	ALIGN-L([RD]/[-BK])	GESTUNI[RD]	ALIGN-L([RD])
→ büröve		*	
biröve	*!		*
bulok		*!	
→ bilok			*

	GESTUNI[RD]	ALIGN-L([RD]/[-BK])	ALIGN-L([RD])
büröve	*!		
→ biröve		*	*
bulok		*!	
→bilok			*

For group E speakers, for whom [ö] is a consistent RRH trigger, while [o] is an optional trigger, we may posit an indeterminate ranking of the general ALIGN-L([RD]) relative to gestural uniformity:

(19) Indeterminate ranking: group E
GESTUNI[RD] >< ALIGN-L([RD])

For this pattern, the more specific alignment constraint referring to front rounded vowels will rank higher than the two indeterminately ranked constraints, as given in (20). For the sake of brevity, tableaux are not included, however they would be analogous to those shown in (18).

(20) Two alternative hierarchies for group E

ALIGN-L([RD]/[-BK]) >> GESTUNI[RD] >> ALIGN-L([RD])

ALIGN-L([RD]/[-BK]) >> ALIGN-L([RD]) >> GESTUNI[RD]

Finally, let us consider group D speakers, for whom both [ö] and [o] optionally trigger RRH. To account for this pattern, we again posit an indeterminate ranking of general left-alignment and gestural uniformity. This pattern differs from the group E pattern however, in that the indeterminately ranked constraints will outrank the backness-specific left-alignment constraint, as given in (21):

(21) Two alternative hierarchies for group D

GESTUNI[RD] >> ALIGN-L([RD]) >> ALIGN-L([RD]/[-BK])

ALIGN-L([RD]) >> GESTUNI[RD] >> ALIGN-L([RD]/[-BK])

3.3. An alternative to indeterminate ranking

An alternate analysis would be simply to state that optionality results from certain constraints being unranked relative to one another. This approach is developed in Ringen and Heinämäki 1999 to account for variability in the choice of suffix vowels following disharmonic loanwords in Finnish. An account involving unranked constraints works well to characterize the group E pattern, in which [o] triggers RRH only optionally. Consider the tableau in (22), in which forms containing both a rounded and an unrounded epenthetic vowel are selected when the potential trigger is [o]:

- (22) Group E: GESTUNI[RD] unranked with respect to ALIGN-L([RD])

	ALIGN-L([RD]/[-BK])	GESTUNI[RD]	ALIGN-L([RD])
→ büröve		*	
biröve	*!		*
→ bulok		*	
→ bilok			*

For the remaining groups exhibiting optionality, however, an analogous analysis is not workable. This is due to the fact that in the event of a tie, the decision will be left to the next constraint in the hierarchy. Consider the tableau in (23), which is meant to characterize the group B pattern. Recall that in group B, [ö] optionally triggers RRH, while [o] consistently fails to trigger RRH. As shown, the hierarchy in which the two relevant constraints are unranked fails to select one of the two acceptable forms, as indicated with (←):

- (23) Group B: GESTUNI[RD] unranked with respect to ALIGN-L([RD]/[-BK])

	ALIGN-L([RD]/[-BK])	GESTUNI[RD]	ALIGN-L([RD])
→ büröve		*	
← biröve	*		*!
bulok		*!	
→ bilok			*

When the unranked constraints yield a tie, the decision goes to the more general alignment constraint which follows in the hierarchy, and no optionality is predicted. The unranked analysis confronts the same problem when trying to characterize group D. Since two constraints conspire to yield harmony and only one has the effect of blocking harmony, the unranked analysis offers no means of characterizing optionality when the potential trigger is a front vowel.

Of course, if an additional anti-harmony constraint were to be posited above the general left-alignment constraint, an unranked constraint analysis of optionality could be maintained. For the data under analysis in the present paper, however, there is another sense in which the unranked analysis is less plausible than the indeterminate ranking analysis proposed here. For words with two "correct" forms (e.g., *bulok* and *bilok* 'block' for group E speakers), we would expect both forms to be equally acceptable *at all times*. This prediction is not consistent with the subjects' performance, however.

When subjects from groups B, D, and E performed the task in the experimental setting, they often supplied only one of the possible forms for a given word. That is, for certain tokens they supplied harmonic forms, for others they supplied non-harmonic forms, and for still others they supplied two forms. Excerpts from one data sheet of a group E subject are given in (24):

- (24) Partial results: one group E speaker

- /plörit/ [pülörit]
- /bröve/ [biröve]
- /blöf/ [bülöf] or [bilöf]

We can model this type of behavior by positing indeterminate ranking as proposed above. On the occasion when (24a) was produced, the subject applied the ranking in which left-alignment outranks gestural uniformity. By contrast, when (24b) was produced, the alternate ranking was used. When two responses were given, the speaker made use of each hierarchy in turn. If the relevant constraints were analyzed as being unranked relative to one another, we would expect consistently to encounter responses like that given in (24c), in which both of the tied candidates are judged to be acceptable.

4. Discussion

In this paper, I have argued that the facts of RRH in Turkish loanwords demonstrate that speakers access inactive constraints when confronted with a phonological environment that does not arise in the structures native to their language. The cross-linguistic patterning of the phenomenon under investigation suggests the existence of a collection of potentially interacting constraints, only two of which are decisive in the native structures of Turkish. The remaining constraints, despite their inertness in the native phonology, must nonetheless be present in the grammar of Turkish speakers. These results support the standard Optimality Theoretic claim that languages share a common set of constraints and distinguish themselves idiosyncratically only with respect to how those constraints are ranked.

I have also sketched a formal account of optionality consistent with the experimental results described here. As Ross (1996) has pointed out, it is not surprising that speakers should exhibit variability with respect to the ranking of inactive constraints. Such constraints come into play only when non-native phonological contexts are encountered—anomalous phonological circumstances for which no conventions have as yet been firmly established within the speech community.

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