Theoretical Implications of Lexical Strata in Turkish

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Abstract

This article proposes that cophonology is needed to account for stress patterns in Turkish. Many loanwords have their stress on a non-final syllable, unlike most native Turkish words, in which stress falls on the last syllable. The stress patterns of loanwords depend on their source languages, which also relate to other phonological phenomena, such as word-internal vowel harmony, syllable clustering, and stages of borrowing. Therefore, it is reasonable for Turkish, like Japanese, to have concentric lexical strata consisting of four layers. We analyze the lexical strata using Optimality Theory to compare cophonology and multiple indexed faithfulness constraints. The results show that only cophonology can explain all the stress patterns, including those of words that are composed of a French loanword and an irregular suffix. Moreover, cophonology and multiple indexed faithfulness constraints cannot predict hybrid words formed by loanwords borrowed from different source languages. This suggests that multiple indexed faithfulness constraints do not have any advantage over cophonology even in hybrid words, at least in Turkish.

Keywords: Turkish, stress, loanword, lexical strata, cophonology

1. Introduction

Turkish generally places word stress on the final syllable, as shown in (1a) and (1b), although some Turkish words, such as (1c) and (1d), place it on a non-final syllable.

(1)　a. oda [o.dá] "room"　　　　　　　b. çocuk [ʧo.dʒúk] "child"
　　　c. pasta [pás.ta] "pasta" ← It. p<u>a</u>sta[1]　d. Ankara [án.ka.ɾa] "Ankara" (place name)

When a suffix is added to a root, the stress moves onto the final syllable, as shown in (2a) and (2b). However, a few suffixes require the stress to fall on another specific syllable, such as the one just before the suffix, as shown in (2e). On the other hand, (2c), (2d), and (3) show that if a root has exceptional stress, a suffix preserves it (even an irregular suffix tends to do this).

(2) a. oda-da [o.da.dá] "in the room"   b. çocuk-tan [ʧo.dʒuk.tán] "from the child"
       room-LOC   child-ABL

     c. Ankara'-da [án.ka.ɾa.da] "in Ankara"   d. pasta-dan [pás.ta.dan] "from the pasta"
       Ankara-LOC   pasta-ABL

     e. çocuk-la [ʧo.dʒúk.ła] "with the child"
       child-INS

(3) İstánbul [is.tán.buł] "Istanbul" (place name)
     İstánbul-la "with Istanbul"
     Istanbul-INS   (Göksel & Kerslake 2005:33)

Although some studies, such as Sezer (1981) and Inkelas (1999), explore exceptional stress in Turkish, only a few examine loanwords in Turkish, many of which have exceptional stress. It is the stress patterns of loanwords in Turkish and their source languages that this article will highlight.

According to Inkelas (1999), who analyzes stress patterns in Turkish on the basis of cophonology, stem level and word level have different rankings under Optimality Theory (Prince & Smolensky 2004). By contrast, Özçelik (2014) and Yawney (2018) specify an edge or both edges of a foot in input, so that they explore the stress patterns using one grammar. The number of grammars needed to explain stress patterns is a matter of controversy in previous studies.

This article discusses whether cophonology or a single grammar is appropriate for the analysis of Turkish stress patterns, focusing on loanwords, many of which have exceptional stress.

In Section 2, we first describe the stress patterns and then consider other morphophonological phenomena. We propose lexical strata for Turkish in Section 3. Section 4 demonstrates the theoretical analysis of stress patterns for loanwords in Turkish, and Section 5 presents the conclusions.

2. Stress patterns of loanwords in Turkish

Aktaş (2015) analyzes the stress patterns of loanwords in Turkish. He considers phonological, morphological, syntactic, and semantic factors, classifying stress depending on the source languages. His basic criterion for classification is whether a loanword preserved its original stress or followed the Turkish stress pattern; consequently, he does not consider the stress position to be fixed. Moreover, the rules formulated are somewhat descriptive. Kuwabara (2020), who examines loanword stress in Turkish, collects loanwords and their source languages from Takeuchi (1989). The stress mentioned in Takeuchi (1989) is rather outdated, however, so we reexamine stress using the Turkish dictionary published by the Turkish Language Institute (Türk Dil Kurumu [TDK]; 2019) and illustrate the stress positions and source languages of 4,883 loanwords in Table 1. The

ratios in Total are rounded off from the second decimal place. In this article, we do not consider stress positions in the source language since Aktaş (2015) covers this.

Table 1. Stress positions for each source language[2]

Language	Final syllable	Penultimate syllable	Another syllable	Total (%)
Arabic	2,310	60	48	2,418 (49.5)
Persian	459	31	15	505 (10.3)
Italian	82	200	4	286 (5.9)
French	1,053	114	20	1,187 (24.3)
English	75	19	1	95 (1.9)
Other languages	266	111	15	392 (8.0)
Total (%)	4,245 (86.9)	535 (11.0)	103 (2.1)	4,883 (100.0)

Many Arabic, Persian, and French loanwords stress the last syllable, as shown in examples (4), (5), and (6), respectively. Table 1 shows that the ratios for stress on the last syllable are 89-95%.

(4) a. insan [in.sán] "human" ← Ar. i̲nsān إنسان

b. kalem [ka.lém] "pencil" ← Ar. qa̲lam قلم

c. muazzam [mu.az.zám] "enormous" ← Ar. muˤa̲z̲z̲am معظّم

d. cümle [dʒym.lé] "sentence" ← Ar. ju̲mla(t) جملة

(5) a. destek [des.téc] "support" ← P. dasta̲k دستك

b. pirinç [pi.rínʧ] "rice" ← P. bri̲nj/biri̲nj برنج

c. şirin [ʃi.rín] "cute" ← P. šīrī̲n شيرين

d. taze [ta:.zé] "fresh" ← P. tād̲e تازه

(6) a. makyaj [mak.jáʒ] "makeup" ← Fr. maquilla̲ge

b. sezon [se.zón] "season" ← Fr. saiso̲n

c. etüt [e.týt] "research" ← Fr. étu̲de

d. tire [ti.ré] "hyphen" ← Fr. tire̲t

On the other hand, for Italian and English loanwords, the ratios of loanwords that stress the last syllable are lower, as shown in (7) and (8).

(7) a. opera [opé.ɾa] "opera" ← It. o̲pera

b. arya [áɾ.ja] "aria" ← It. a̲ria

c. koro [kó.ro] "choir" ← It. c̲oro

d. korsan [koɾ.sán] "pirate" ← It. cors̲aro

      e. çaçaron [ʧa.ʧa.rón] "chatterbox" ← It. ciaciar<u>o</u>ne

      f. iskandil [is.kan.díl] "plumbing" ← It. scand<u>a</u>glio

(8)   a. doping [do.píng] "doping" ← E. d<u>o</u>ping

      b. egzoz [eg.zóz] "exhaust" ← E. exh<u>au</u>st

      c. boykot [boj.kót] "boycott" ← E. b<u>oy</u>cott

      d. hokey [ho.kéj] "hockey" ← E. h<u>o</u>ckey

      e. viski [vís.ci] "whiskey" ← E. wh<u>i</u>skey

      f. veranda [ve.rán.da] "veranda" ← E. ver<u>a</u>nda

Arabic, Persian, and French loanwords have final stress even when the last syllable is light. As shown in (7a)-(7c) and (8e)-(8f), however, Italian or English loanwords have penultimate stress when the last syllable is light. Therefore, as shown in Tables 2 and 3, we can classify Italian or English loanwords according to the weight of their final syllables.

Table 2. Stress positions and weights of the final syllables of Italian loanwords

Weight of a final syllable/ Stress position/	Final syllable	Penultimate syllable	Another syllable	Total
Heavy final syllable	44	0	0	44
Light final syllable	38	200	4	242
Total	82	200	4	286

Table 3. Stress positions and weights of the final syllables of English loanwords

Weight of a final syllable/ Stress position/	Final syllable	Penultimate syllable	Another syllable	Total
Heavy final syllable	72	11	1	84
Light final syllable	3	8	0	11
Total	75	19	1	95

Table 4. Stress patterns of loanwords and native words

	Weight of a final syllable	Syllable with stress
Loanwords from English	Light	Penultimate syllable
	Heavy	Final syllable
Loanwords from French	Light	Final syllable
	Heavy	Final syllable
Loanwords from Italian	Light	Penultimate syllable
	Heavy	Final syllable
Loanwords from Arabic or Persian Native words	Light	Final syllable
	Heavy	Final syllable

Although the pattern is not strict for English loanwords, the stress generally falls on the final syllable if the syllable is heavy and on the penultimate syllable otherwise. In other words, the weight of the final syllables affects the stress position.

Table 4, which summarizes the generalizations above, shows that a source language and the weight of the last syllable largely determine the stress position.

3. Other phonological phenomena related to source languages

So far, we have examined the stress patterns of loanwords in Turkish, but differences in source languages influence other phonological or morphological phenomena, and we refer to some of them below.

Vowel harmony is a well-known Turkish phonological phenomenon. One type of harmony is back harmony, and the other is back and round harmony. Vowel harmony applies not only to vowels between a root and a suffix but also to word-internal vowels in native Turkish words; for example, both vowels in (9a) are [+back] and those in (9b) are [+back] and [+round]. Some loanwords, however, breach vowel harmony rules to preserve the original sounds in their source languages, as shown in (10):

(9)   a. koca [ko.dʒa] "husband"   b. çocuk [ʧo.dʒuk] "child"

(10)   a. kâtip [ka.tip] "clerk" ← Ar. kātib كاتب *[ka.tup], *[ka.tɯp]

          b. komik [ko.mik] "comic" ← Fr. comique *[ko.mɯk], *[ko.muk]

In native Turkish words, only three types of coda cluster (sonorant + obstruent, voiceless fricative + oral stop, and *k* + *s*) are allowed, according to Clements & Sezer (1982: 245). Whereas the clusters in loanwords from Arabic (11a), Persian (11b), or Italian (11c) are generally resolved by vowel epenthesis or prothesis, some loanwords from French (12a) or English (12b) keep their clusters orthographically:

(11)   a. sabır [sa.bɯɾ] "patience" ← Ar. ṣabr صبر

          b. şehir [ʃe.hiɾ] "town" ← P. şahr شهر

          c. ispirto [is.piɾ.to] "alcohol" ← It. spirito

(12)   a. tren [ti.ɾen] "train" ← Fr. train

          b. skor [sɯ.kɒr] ~ [skɒr][3] "score" ← E. score (Yildiz 2005: 175)

Except for a small number of words, such as *ad,* "name," Turkish phonotactics do not allow word-final voiced stops and affricates. The consonant [ʧ] in (13a) and (13b) changes into [dʒ] when

a vowel-initial suffix is added to the root in (13c). Some French and English loanwords, however, always keep voicedness, as illustrated in (14):

(13) a. kılıç-Ø [kɯ.ɫɯʧ] "sword"   b. kılıç-tan [kɯ.ɫɯʧ.tan] "from the sword"
        sword-NOM   sword-ABL

      c. kılıc-ın [kɯ.ɫɯ.ʤɯn] "of the sword"
         sword-GEN

(14) a. ring-Ø [ɾing] "ring" ← E. ring   b. ring-den [ɾing.den] "from the ring"
        ring-NOM   ring-ABL

      c. ring-in [ɾin.gin] "of the ring"
         ring-GEN

Arabic or Persian loanwords, as well as native Turkish words, take an emphatic reduplicative form, which intensifies the meaning of a base word, whereas other languages' loanwords rarely have this form:

(15) a. dipdiri [dip.di.ɾi] "full of life" ← reduplicant *di* (the initial syllable)
                              + linking consonant *p* + base *diri* [di.ɾi] "alive"
      b. bembeyaz [bem.be.jaz] "very white" ← reduplicant *be* + linking consonant *m*
                              + base *beyaz* "white" ← Ar. bayāḍ بياض

Arabic and Persian loanwords were borrowed via Islam around the tenth century (Göksel & Kerslake 2005; Iskender 2015). The advance of the Ottoman Empire to the Black and Mediterranean Seas in the fourteenth century and the migration of Jewish people in the sixteenth century introduced Italian loanwords (Özön 1962). After the Tanzimat reforms commenced in 1839, and newspapers and books started to be published, French loanwords were borrowed (Özön 1962). After the middle of the twentieth century (especially after 1980), the number of English loanwords increased (Sezgin 2006).
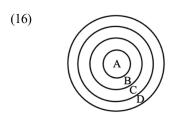
Consequently, the newer loanwords tend to preserve their original form. In the next section, we propose lexical strata in Turkish based on the observations discussed in this section.

4. Lexical strata in Turkish

Considering the stress patterns of loanwords, phonological phenomena, and historical background, as shown above, Turkish words are likely to have lexical strata (Itô & Mester 1995a, 1995b, 1999). Arabic and Persian loanwords, which are relatively older than other loanwords, are

like native Turkish words in terms of their phonological phenomena, but French and English loanwords, which were borrowed relatively recently, tend to keep the original sounds of their source languages.

Suganuma (2017) suggests non-concentric lexical strata for Turkish. According to him, Turkish words are classified depending not on the source language but on whether rules are applied to each word or not. However, the rules may be insufficient because they do not include some phenomena, such as clusters and emphatic reduplication. Considering various phenomena introduced in Section 2, Turkish may have the strata classified depending on the source language, as illustrated in (16). These strata have a core-periphery structure like the Japanese strata in Itô & Mester (1995a, 1995b, 1999), which means that they consist of a core and peripheries surrounding the core. The native words are included in Stratum A. The loanwords from Arabic and Persian, which were generally older than Italian lie in Stratum B. The loanwords from French English stand in the most exterior stratum since they were borrowed more recently than those from Italian. Table 5 illustrates the different phonological or morphological properties depending on the strata.

(16)

A: native Turkish words

B: loanwords from Arabic or Persian[4]

C: relatively assimilated loanwords from Western languages such as Italian

D: relatively unassimilated loanwords from Western languages such as French or English

Table 5. Morphophonological properties of each stratum

	Stratum A	Stratum B	Stratum C	Stratum D[5]	
	Native Words	Arabic, Persian loanwords	Italian loanwords	French loanwords	English loanwords
Root-internal vowel harmony	Effective	Ineffective	Ineffective	Ineffective	Ineffective
Cluster	Only certain kinds of coda cluster	Resolved by epenthesis	Partially resolved by epenthesis	Preserved	Preserved
Word-final voiced stop and affricate	Impossible except a few exceptions	Impossible except a few exceptions	Impossible	Partially exist	Partially exist
Emphatic reduplication	Possible	Possible	Impossible	Hardly impossible	Impossible
Stress	Final syllable	Final syllable	Preserved / Weight-sensitive	Final syllable/ Preserved	Weight-sensitive

The more internal a layer is, the more strictly the phonological or morphological rules apply to it; for example, only Stratum A, which is the innermost layer, obeys the root-internal vowel

harmony rules. Stratum A allows only a few types of coda clusters. Strata B and C resolve clusters by vowel epenthesis, while Stratum D retains the clusters in their original form. Strata A, B, and C do not allow word-final voiced stops and affricates; however, Stratum D includes some loanwords that end with such a consonant. Evidence that Stratum C prohibits word-final voiced stops and affricates is limited because the final syllable in most Italian loanwords is open. Nişanyan (2002) states that *akort* [a.koɾt] "accord" was borrowed from the Italian word *accordo*, but in Takeuchi (1989) and TDK (2019), it is classified as a French loanword. Furthermore, for a Turkish native speaker, *formaç* [foɾ.matʃ] would be more natural than *formac* [foɾ.madʒ] if Turkish borrowed the word from the Italian word *formaggio* [for.madʒ.dʒo] "cheese" (p.c. Barış Kahraman).

The words that take an emphatic reduplicative form belong predominantly to Strata A and B. With regard to stress patterns, the final syllables are stressed in Strata A and B. In Strata C and D, stress is basically weight sensitive, although French loanwords stress the final syllable. The loanwords are divided into strata depending on the ranking that the loanwords have, as shown in the next section, so French loanwords belong to the same stratum as English ones. It is the stress of the source language that causes the same stress patterns of French, Arabic, and Persian loanwords, despite the different rankings.

5. Theoretical analyses of the lexical strata in Turkish

In this section, we theoretically analyze the stress patterns of loanwords in Turkish on the basis of the lexical strata proposed in the previous section using Optimality Theory. The five constraints listed below are relevant to the analysis.

(17) a. FAITH (Stress): The stress in the input coincides with that in the output.
      b. ALIGN (Domain, R, ś, R) (FINAL-STR): The rightmost syllable of the domain is stressed (Inkelas 1999: 151)[6].
      c. ALIGN (Domain, R, Foot, R) (FINAL-FT): The domain end coincides with a foot end (Inkelas 1999: 144).
      d. MORAIC TROCHEE (MT): Feet are (H), (LL), and (L), violated by iambs (LL, LH, HL, and HH) and trochees > 2µ (LH, HL, HH; Ito & Mester 2016: 492).
      e. FT-BIN: Feet must be binary.

5.1 Cophonological approach

We use cophonology to analyze the patterns in this subsection. If we follow this approach, Turkish has multiple phonological grammars, each of which has a different ranking of constraints. In contrast, single grammatical approaches consider that a language has one phonological grammar.

The rankings of these constraints differ between strata, as illustrated in (18), and we briefly show an example below:

(18) a. English, French, and Italian loanwords (Strata C and D)
      FAITH (Stress), FINAL-STR ≫ MT ≫ FT-BIN ≫ FINAL-FT
   b. Arabic and Persian loanwords and native Turkish words (Strata A and B)
      FINAL-STR ≫ FAITH (Stress), MT ≫ FT-BIN ≫ FINAL-FT

If an English or Italian loanword ends with a light syllable, the stress falls on the penultimate syllable, as illustrated in Table 4. *Viski* in Tableau 1 is an example of such an English loanword.

Tableau 1. *Viski* (Stratum D)

whískey	FAITH (Stress)	FINAL-STR	MT	FT-BIN	FINAL-FT
a. (vís.kì)		*	*!		
b. (vis.kí)	*		*!		
☞ c. (vís).ki		*			*
d. vis.(kí)	*			*!	

MT does not allow "the foot," which consists of a heavy syllable and a light syllable since such a foot is larger than bimoraic. The candidate (d) violates FT-BIN because it has a unary foot, while the candidate (c) satisfies FT-BIN because it is the bimoraic foot; therefore, candidate (c), which stresses the penultimate syllable, is applied.

When an English or Italian word has a heavy final syllable, however, it stresses this syllable, as in the example of *korsan* illustrated below:

Tableau 2. *Korsan* (Stratum C)

corsáro	FAITH (Stress)	FINAL-STR	MT	FT-BIN	FINAL-FT
a. (kór.san)	*!	*!	*		
b. (koɾ.sán)			*!		
c. (kóɾ).san	*!	*!			*
☞ d. koɾ.(sán)					

Tableau 3. *Cümle* (Stratum B)

cúmla(t)	FINAL-STR	FAITH (Stress)	MT	FT-BIN	FINAL-FT
a. (dʒým.le)	*!		*		
b. (dʒym.lé)		*	*!		
c. (dʒým).le	*!				*
☞ d. dʒym.(lé)		*		*	

Candidates such as (a) and (c), which stress the final syllable, violate FAITH (Stress) and FINAL-STR. Only (d) satisfies these constraints and MT, so it is optimal.

The final example is the Arabic loanword *cümle*. As shown in (18b), FINAL-STR is ranked above FAITH (Stress) in Strata A and B. Both candidates (a) and (c), which stress the penultimate syllable, violate FINAL-STR, but (d), with stress on the final syllable, satisfies it, so this candidate is optimal.

5.2 Single grammar approach

If we follow Özçelik (2014) and Yawney (2018), we can presume that the English or Italian loanwords which have non-final stress specify one or both foot edges in input, while the English or Italian loanwords which have final stress specify no foot edges in input. We cannot find independent evidence for hypothesizing different inputs. It would be more natural to suppose that the differences in the patterns result from the Turkish grammar, that is, ranking of constraints. Therefore, we adopt multiple indexed faithfulness constraints (e.g., Fukazawa et al. 1998, Itô & Mester 1999, Fukazawa 1999), which are used to explain phonological differences among lexical strata based on a single grammar. This approach does not need reranking because the constraints have an index, and each indexed constraint applies only to the stratum that the index indicates.

The indexed faithfulness constraints in Turkish and the ranking that we suppose are shown in (19) and (20).

(19) FAITH (Stress)-E, FAITH (Stress)-F, FAITH (Stress)-I, FAITH (Stress)-A/P,

FAITH (Stress)-T

(20) FAITH (Stress)-E, FAITH (Stress)-F, FAITH (Stress)-I, FINAL-STR
 ≫ FAITH (Stress)-A/P, FAITH (Stress)-T, MT ≫ FT-BIN ≫ FINAL-FT

We can analyze the stress patterns of loanwords in Turkish-like cophonology by such constraints and ranking.

Tableau 4. *Viski* (Stratum D)

whískey	FAITH (Stress)-E FAITH (Stress)-F FAITH (Stress)-I	FINAL-STR	FAITH (Stress)-A/P FAITH (Stress)-T	MT	FT-BIN	FINAL-FT
a. (vís.ki)		*		*!		
b. (vis.kí)	*			*!		
☞ c. (vís).ki		*				*
d. vis.(kí)	*				*!	

Tableau 4 shows an example of English loanwords, which belong to Stratum D. FAITH (Stress)-E excludes the candidates with final stress. Only candidate (c) is optimal because it satisfies both FAITH (Stress)-E and MT.

In Stratum B, FAITH (Stress)-A/P and FAITH (Stress)-T are ranked below FINAL-STR, so that the optimal candidate has final stress even if it violates FAITH (Stress)-A/P or FAITH (Stress)-T, as shown in Tableau 5.

Tableau 5. *Cümle* (Stratum B)

cúmla(t)	FAITH (Stress)-E FAITH (Stress)-F FAITH (Stress)-I	FINAL-STR	FAITH (Stress)-A/P FAITH (Stress)-T	MT	FT-BIN	FINAL-FT
a. (ʤým.le)		*!		*		
b. (ʤym.lé)			*	*!		
c. (ʤým).le		*!				*
☞ d. ʤym.(lé)			*		*	

As discussed in 5.1 and 5.2, cophonology and multiple indexed faithfulness constraints are tied thus far. When we analyze the stress patterns in which a suffix is added to a root, however, there is a difference between them. We show this difference in the next section.

5.3 Comparison between cophonology and a single grammar

We summarize the Turkish stress patterns composed of a root and a suffix in (21).

(21) Stress patterns of a root with a suffix in Turkish

a. regular root + regular suffix → stress on the final syllable

b. irregular root + regular suffix → preserves the stress of the irregular root

c. regular root + irregular suffix → respects the stress of the irregular suffix

d. irregular root + irregular suffix → preserves the stress of the irregular root

5.3.1 Cophonology

We introduce the constraint LEFTMOST to analyze the stress patterns in (21). This is analogous to STR-INITIAL, which Inkelas (1999: 170) defines as "[e]ach stressed syllable is initial in the domain," and ENDRULE-L, which Özçelik (2014: 245) defines as "[a]ssign primary stress to the leftmost foot." The constraint is crucial when both the root and suffix are irregular.

(22) LEFTMOST: If more than one stress is specified in the input, the output reflects the leftmost one.

The constraints, including LEFTMOST, are ranked depending on whether the root has final or non-final stress, as shown in (23). Note that this constraint activates only for an irregular root

because of its multiple underlying stress and is necessary for either the following cophonology analysis or the indexation analysis discussed later. The cophonology analysis proposed here involves the reranking of FINAL-STR and FAITH (Stress), as shown in (23), where the dominance of FINAL-STR depends on whether the root concerned is regular or irregular. The regular root has final stress. For convenience, we omit the lower constraints that are relatively less relevant after this.

(23) Regular root: LEFTMOST, FINAL-STR ≫ FAITH (Stress), MT ≫ FT-BIN ≫ FINAL-FT
    Irregular root: LEFTMOST, FAITH (Stress) ≫ FINAL-STR ≫ MT ≫ FT-BIN ≫ FINAL-FT

Tableau 6. *Tirede* (regular root + regular suffix)

tiré-de	LEFTMOST	FINAL-STR	FAITH (Stress)
a. ti.ré.de		*!	
☞ b. ti.ɾe.dé			*

When both root and suffix are regular, candidate (b), which has stress on the final syllable, is optimal, as illustrated in Tableau 6. It satisfies FINAL-STR, which the candidate (a) violates.

Tableau 7. *Vikiyle* (irregular root + irregular suffix)

(* .)⁷ víski-y-le	LEFTMOST	FAITH (Stress)	FINAL-STR
☞ a. vís.kij.le		*	*
b. vis.kíj.le	*!	*	*
c. vis.kij.lé	*!	**!	

Tableau 7 shows the pattern in (21d). FAITH (Stress) is ranked above FINAL-STR since the root is irregular. The stress that the root specifies is leftmost, with LEFTMOST excluding the candidates that do not preserve it.

5.3.2 Multiple indexed faithfulness constraints

We need LEFTMOST to analyze the patterns in (21) even when based on multiple indexed faithfulness constraints. The ranking in which LEFTMOST is included is shown in (24).

(24) LEFTMOST ≫ FAITH (Stress)-E, FAITH (Stress)-F, FAITH (Stress)-I, FINAL-STR
    ≫ FAITH (Stress)-A/P, FAITH (Stress)-T, MT ≫ FT-BIN ≫ FINAL-FT

Multiple indexed faithfulness constraints can also account for almost all the patterns in (21). Tableau 8 illustrates the pattern in (21d). The highest constraint, LEFTMOST, requires candidates to keep the stress that a root specifies in input.

Tableau 8. *Vikiyle* (irregular root + irregular suffix)

(* .) víski-y-le	LEFTMOST	FAITH (Stress)-E FAITH (Stress)-F FAITH (Stress)-I	FINAL-STR	FAITH (Stress)-A/P FAITH (Stress)-T
☞ a. vís.kij.le		*	*	
b. vis.kíj.le	*!	*	*	
c. vis.kij.lé	*!	**!		

On the other hand, multiple indexed faithfulness constraints cannot explain the case in which an irregular suffix adds to a French loanword. It should have final stress, as shown in (21a), but instead the constraints lead to penultimate stress, as shown in Tableau 9. The inverse finger (☜) indicates a suboptimal candidate which should be optimal considering the actual data.

Tableau 9. *Tirede* (regular root + regular suffix)

ti(ré)-de	LEFTMOST	FAITH (Stress)-E FAITH (Stress)-F FAITH (Stress)-I	FINAL-STR	FAITH (Stress)-A/P FAITH (Stress)-T	MT	FT-BIN	FINAL-FT
☜ a. ti.(ɾé.de)			*				
☞ b. ti.(ɾe.dé)		*			*!		
c. ti.(ɾé).de			*			*!	*
☞ d. ti.ɾe.(dé)		*				*!	

Adding new indices to FAITH (Stress) depending on stress positions of roots to resolve the problem results in an unnecessary increase in indices. Moreover, we need reranking, regardless of cophonology or multiple indexed faithfulness constraints, to explain variations such as *pli* [pli] ~ *pili* [pili] "pleat" ← Fr. *pli*. Cophonology is suitable for analyzing variations (e.g., Anttila 2002, Tanaka 2004). It would be more economical than using both multiple indexed faithfulness constraints and reranking.

5.4 Hybrid words

We now briefly introduce some hybrid words consisting of two words that differ in their source languages and which seem to have similar stress patterns to Arabic, Persian, or French loanwords, although the sample of hybrid words is too small to generalize stress patterns:

(25) a. birahane [bi.ɾa.ha:.né] "beer hall"

bira [bí.ɾa] "beer" ← It. bi̱rra + hane [ha:.né] "house" ← P. khān<u>e</u> خانه

b. takdirname [tak.diɾ.na:.mé] "testimonial"

takdir [tak.díɾ] "appreciation" ← Ar. t̲aqdīr تقدیر

+ name [na:.mé] "letter" ← P. nām<u>e</u> نامه

Tableau 10. A hybrid word, *birahane*

bíra + hané	FAITH (Stress)-E FAITH (Stress)-F FAITH (Stress)-I	FINAL-STR	FAITH (Stress)-A/P FAITH (Stress)-T
☞ a. bi.ɾa.ha:.né	*		
b. bí.ɾa.ha:.ne		*	*!

Multiple indexed faithfulness constraints can explain the stress of such hybrid words. It is an advantage of this approach, as Fukazawa et al. (1998) point out. Candidate (b) in Tableau 10 violates FAITH (Stress)-A/P as well as FINAL-STR because the head, *hane,* is a Persian loanword.

Cophonology can also analyze stress. We choose the ranking in (18b) because the head of the hybrid word is a Persian loanword. Although Zamma (2001) considers the native element as the head of Japanese hybrid words, which consist of a Japanese name and a foreign one, we have no evidence that the native stratum is also the head in Turkish. As shown in Tableau 11, optimal candidate (a) satisfies the highest constraint, FINAL-STR.

Tableau 11. A hybrid word, *birahane*

bíra + hané	FINAL-STR	FAITH (Stress)
☞ a. bi.ɾa.ha:.né		*
b. bí.ɾa.ha:.ne	*!	*

However, neither approach explains stress when the head of a hybrid word belongs to strata other than Arabic or Persian loanwords or native words. Unable to find any appropriate hybrid word in dictionaries, we have coined the hybrid word *hanebira,* in which the elements of *birahane* are reversed. This nonce word would be pronounced [ha:.né.bi.ɾa] (p.c. Barış Kahraman).

Tableau 12. Imaginary hybrid word *hanebira*

hané + bíra	FAITH (Stress)-E FAITH (Stress)-F FAITH (Stress)-I	FINAL-STR	FAITH (Stress)-A/P FAITH (Stress)-T	MT	FT-BIN	FINAL-FT
a. ha:.ne.(bi.ɾá)	*		*	*!		
b. ha:.ne.bi.(ɾá)	*		*		*!	
☞ c. ha:.ne.(bí.ɾa)		*	*			
☞ d. ha:.(né.bi).ɾa	*!	*				*

When we use multiple indexed faithfulness constraints, candidate (d) violates both FAITH (Stress)-I and FINAL-STR, and candidate (c), with penultimate stress, mistakenly wins, as illustrated in Tableau 12.

The head of this hybrid word, *bira,* is an Italian loanword, so we select the ranking in (18a) if we adopt cophonology. Candidate (d), which should be optimal, loses to candidate (c) because it

does not satisfy FINAL-FT, as shown in Tableau 13. Neither multiple indexed faithfulness constraints nor cophonology can explain the stress of *hanebira*. Both approaches would be even at this point.

Tableau 13. Imaginary hybrid word *hanebira*

hané + bíra	FAITH (Stress)	FINAL-STR	MT	FT-BIN	FINAL-FT
a. ha:.ne.(bi.ɾá)	**		*!		
b. ha:.ne.bi.(ɾá)	**			*!	
☜ c. ha:.ne.(bí.ra)	*	*			
☞ d. ha:.(né.bi).ɾa	*	*			*!

6. Conclusion

This article has argued that we need to adopt cophonology to explain the stress patterns in Turkish, focusing on loanwords, many of which have non-final stress.

We showed that the stress patterns of loanwords in Turkish depend on their source languages and the weight of the last syllable. The source language also relates to other phonological phenomena, such as word-internal vowel harmony. We also assumed that Turkish has concentric lexical strata consisting of four layers. In Section 5, we analyzed the stress patterns on the basis of Optimality Theory. Both cophonology and multiple indexed faithfulness constraints can resolve the stress patterns of roots. When we consider the words that are composed of a root and a suffix, however, cophonology is more appropriate than multiple indexed faithfulness constraints in terms of economy. Moreover, in Section 6, we demonstrated that multiple indexed faithfulness constraints tied with cophonology for hybrid words in Turkish.

In future studies, it would be useful to research loanwords borrowed from other languages to which we did not refer in this article, or intermediate stages of loanwords.

Notes

[1] It, Ar, P, Fr, and E stand for Italian, Arabic, Persian, French, and English, respectively. Underlines in the original forms show stress in their source language. All the origins of loanwords in this article are cited from Nişanyan (2002), although the author has partially changed their transcription (e.g., ق ḳ → q).

[2] Someone may consider Germany as a country closely connected with Turkish, but we did not find sufficient

German loanwords to generalize stress patterns, so this article leaves out them. Likewise, we omit a few loanwords borrowed from a tone language, such as *inci* [in.dʒí] "pearl" ← Chinese 珍珠.

3 Yildiz (2005) does not originally address syllable boundaries.

4 Strictly speaking, the strata in (16) are classified depending not on etymology but on recognition by native Turkish speakers. Nevertheless, the recognition generally accords with etymology, so for convenience the strata used the source language as a criterion for the classification.

5 In Table 4, French and English loanwords both belong to Stratum D, although they have different stress patterns. According to Itô & Mester (1995a), reranking of faithfulness constraints results in differences in phonological properties between strata. As shown in Section 4, French and English loanwords have the same ranking for stress patterns, so we assigned both to Stratum D. Further research may offer evidence that they should be categorized in different strata.

6 Although this definition does not strictly agree with that of Inkelas (1999), both definitions describe the same FINAL-STR.

7 (*   .) is used to represent a foot and stress specified by a suffix.

References

Aktaş, E. (2015). Türkçe alıntı sözcüklerde vurgu görünümleri [Stress profiles in Turkish loanwords]. Unpublished master's thesis, Ankara University, Ankara.

Anttila, A. (2002). Morphologically conditioned phonological alternations. *Natural Language & Linguistic Theory, 20*(1), 1-42.

Clements, G. N., & Sezer, E. (1982). Vowel and consonant disharmony in Turkish. In H. van der Hulst and N. Smith (eds.), *The Structure of Phonological Representations (Part II),* 213-255. Dordrecht: Foris publications.

Fukazawa, H. (1999). Theoretical implications of OCP effects on features in optimality theory. Doctoral dissertation, University of Maryland, College Park. ROA-260-0598.

Fukazawa, H., Kitahara, M., & Ota, M. (1998). Lexical stratification and ranking invariance in constraint-based grammars. In *Proceedings of the Chicago Linguistic Society, 34*, 47-62.

Göksel, A., & Kerslake, C. (2005). *Turkish: A Comprehensive Grammar*. London: Routledge.

Inkelas, S. (1999). Exceptional stress-attracting suffixes in Turkish: representations versus the grammar. In R. Kager, H. van der Hulst, and W. Zonneveld (eds.), *The Prosody-Morphology Interface*, 134-187. Cambridge: Cambridge University Press.

Iskender, H. I. (2015). The phonology of Arabic loanwords in Turkish: the case of t-palatalisation. Doctoral dissertation, SOAS, University of London.

Itô, J., & Mester, A. (1995a). The core-periphery structure of the lexicon and constraints on reranking. In Beckman, J. N., Dickey, L. W., & Urbanczyk, S. (eds.), *Papers in Optimality Theory,* 181-210. Amherst: GSLA Publications.

Itô, J., & Mester, A. (1995b). Japanese phonology. In Goldsmith, J. (ed.), *A Handbook of Phonological Theory,* 817-838. Cambridge, MA: Blackwell.

Itô, J., & Mester, A. (1999). The phonological lexicon. In Tsujimura, N. (ed.), *The Handbook of Japanese Linguistics,* 62-100. Oxford: Blackwell.

Ito, J., & Mester, A. (2016). Unaccentedness in Japanese. *Linguistic Inquiry*, *47*(3), 471-526.

Kuwabara, S. (2020). Torukogo no gairaigo akusennto to shakuyoumoto gengo no kankei [Loanword accent in Turkish and its relation to source languages]. Oral presentation, Kotonoha kenkyuukai, April 25, 2020.

Nişanyan, S. (n.d.). *Nişanyan Sözlük Çağdaş Türkçenin Etimolojisi* [Nişanyan Contemporary Dictionary Turkish Etymology]. Retrieved October 21, 2020, from https://www.nisanyansozluk.com

Özçelik, Ö. (2014). Prosodic faithfulness to foot edges: the case of Turkish stress. *Phonology, 31*(2), 229-269.

Özön, M. N. (1962). *Türkçe-Yabancı Kelimeler Sözlüğü* [Turkish-Loanwords Dictionary]. İstanbul: İnkılâp Kitabevi.

Prince, A., & Smolensky, P. (2002). *Optimality Theory: Constraint Interaction in Generative Grammar.* Hoboken, NJ: John Wiley & Sons.

Sezer, E. (1981). On non-final stress in Turkish. *Journal of Turkish Studies*, *5*, 61-69.

Sezgin, F. (2006). Density of Western loan-words in Turkish. *Türklük Bilgisi Araştırmaları* [Turkology Research Journal] (TUBA), *30*(3), 147-174.

Suganuma, K. (2017). *Torukogo to Gendai Uigurugo no On-in Rekishikon* [Phonological Lexicons in Turkish and Modern Uighur]. Kyuushuu daigaku shuppannkai.

Takeuchi, K. (1989*). Torukogo Jiten Poketto Ban* [Turkish Dictionary a Pocket Edition]. Daigaku shorin.

Tanaka, S. (2004). Variation and change in the accentual system of Japanese compounds: implications for the debate over indexing vs. reranking. *Tsukuba English Studies*, 22, 359-369.

Türk Dil Kurumu. (n.d.). *Türkçe Sözlük* [Turkish Dictionary]. Retrieved October 21, 2020, from https://sozluk.gov.tr

Yawney, H. L. (2018). On the right to be faithful: the irregular stress of Turkish adverbials with -En. *Toronto Working Papers in Linguistics*, *40*(1), 1-16.

Yildiz, Y. (2005). The structure of initial/s/-clusters: evidence from L1 and L2 acquisition. Developmental Paths in Phonological Acquisition. Special issue of *Leiden Papers in Linguistics, 2,* 163-187.

Zamma, H. (2001). Accentuation of person names in Japanese and its theoretical implications. *Tsukuba English Studies*, *20*, 1-18.