

# Acquisition of Turkish vowel harmony in low-frequency and zero-frequency contexts: Evidence for Full Access in L2 phonology

Öner Özçelik & Rex A. Sprouse  
Indiana University

## Abstract

Heretofore, Universal Grammar (UG) involvement in second language phonology has received relatively little attention. We present evidence that (at least) one UG phonological principle, the No-Crossing Constraint (Hammond 1988), guides English-Turkish acquisition of vowel harmony (VH) in high-frequency, low-frequency, and, crucially, zero-frequency contexts. Despite the poverty of the stimulus and potentially misleading classroom instruction, English-Turkish L2ers exhibit sensitivity to the “No Crossing Constraint” of Universal Grammar when calculating non-canonical vowel harmony in the context of underlyingly pre-specified laterals in both low frequency (i.e. pre-specified “light” [l]) and zero frequency (i.e. pre-specified “dark” [ɫ]) contexts.

## 1. Introduction

One of the central questions in generative approaches to second language (L2) acquisition is the extent to which principles of Universal Grammar (UG) constrain (adult) L2 acquisition. There is a rich body of literature documenting the role of such principles in the (adult) L2 acquisition of asymmetries of morpho-syntax and the syntax-semantics interface, including empirical studies of the L2 acquisition of: the interpretation of overt vs. null pronouns in null-subject languages (Kanno 1997; Pérez-Leroux & Glass 1997), the acceptability of remnant scrambling vs. remnant topicalization (Hopp 2005; Schreiber & Sprouse 1997), the process vs. result interpretation of double genitives (Dekydtspotter, Sprouse & Anderson 1997), the multiple event requirement in floated vs. in situ quantifiers (Dekydtspotter, Sprouse & Thyre 1999/2000), scope asymmetries with pied piping vs. stranding of restrictions on quantifiers (Dekydtspotter & Sprouse 2001; Dekydtspoyter, Sprouse & Swanson 2001), and weak vs. strong movement violations (Martohardjono 1993).

While these studies (and others like them) examine a range of native languages (L1s) and target languages (TLs) and employ various tasks, they all rely on a three-fold poverty of the stimulus to make the argument that UG restricts, guides, or informs (adult) L2 acquisition: (1) the crucial TL generalization is underdetermined by primary linguistic data; (2) the generalization is not instantiated in the learners’ native languages (L1s); and (3) the generalization is not the object of explicit instruction. On the other hand, the argumentation in these studies does not require that learners’ performance on specific experimental tasks be statistically indistinguishable from the performance of native speakers. Consider first low-proficiency L2ers. UG principles restrict the analogical extension of generalizations, and there is no reason to suppose that one would find meaningful evidence for the restriction of such a

generalization before the basic generalization has been acquired. It is also naïve to suppose that advanced L2ers will necessarily perform “perfectly” (indistinguishably from native speakers of the TL), even once the relevant generalization has been acquired. For a host of reasons related to the difference in the cognitive demands associated with performing tasks in one’s native language versus a nonnative language (at least in part because of the extra cognitive resources required for access to nonnative vocabulary), we generally expect higher accuracy from native speakers. What is crucial is that there is evidence of the effect of the relevant principle of UG, once learners appear to have acquired the basic generalization.

In light of the body of research on morphosyntax and semantics discussed above, it is striking that there has been very little research on whether principles of UG constrain L2 phonological development. Although a large body of recent interlanguage research focuses on issues of category formation, perception, and production, including factors that render specific TL categories relatively easy or difficult for L2ers to acquire, the issue of whether adults bring the same innate knowledge to bear on the acquisition of new phonological systems as children acquiring their L1 has received extremely little attention. It is the goal of this study to contribute to filling this gap, as well as to investigate the level of abstraction exhibited by L2 phonological knowledge.

## 2. L1-TL Background

This study is a cross-sectional study of the knowledge of the principles underlying Turkish vowel harmony that develops in English-Turkish L2ers. The Turkish vowel system applies over the symmetrical eight-vowel system, sketched in (1).

(1) Turkish vowel system

	[-back]		[+back]	
	[-round]	[+round]	[-round]	[+round]
[+high]	i	y	ɯ	u
[-high]	e	ø	a	ɔ

As shown in (1), the eight phonemic vowels of Turkish readily lend themselves to cross-classification by three (3) binary features: [±back], [±round], and [±high].

Many inflected words in Turkish exhibit what we refer to as canonical vowel harmony (CVH). Turkish is a strictly suffixing highly agglutinating language. Vowels in uninflected words (“roots”) can exhibit all 8 logically possible combinations of the features [±high], [±back], [±round]. Most vowels in suffixes are, however, specified only for [±high]. For these underspecified vowels, the value of [±back] spreads from the immediately preceding vowel. Again, for underspecified vowels, the value of [±round] spreads from the immediately preceding vowel, but only if the suffix vowel is [+high]. As such, for these underspecified vowels, [-high] implies [-round], i.e. /ø, o/ cannot arise through vowel harmony in Turkish. In these cases, [-round] is filled in, apparently by a Turkish-specific default process. The effects of CVH is illustrated in (2) for the third person singular possessive suffix, which is underlyingly specified only for the feature [+high], and in (3) for the dative suffix, which is underlyingly specified only for the feature [-high]. While (2) illustrates both backness and rounding harmonies as the underlying suffix vowel is [+high], (3) exemplifies backness harmony only, since the suffix vowel is underlyingly [-high].

(2) Suffix vowel underlyingly specified as [+high]: 3s possessive suffix /-I/<sup>1</sup>

		root vowel	suffix vowel
a. iş-i	[iʃi]	{[+high] [-back] [-round]}	{[+high] [-back] [-round]}
b. kız-ı	[kuzɯ]	{[+high] [+back] [-round]}	{[+high] [+back] [-round]}
c. ün-ü	[yny]	{[+high] [-back] [+round]}	{[+high] [-back] [+round]}

<sup>1</sup> We follow the standard Turkological practice of representing the underlying [+high] vowel of such suffixes as /I/. The gloss ‘his’ should be understood as ‘his or her.’



(6)	Canonical distribution of /l/			V	realization of /l/
a.	il-e	[ile]	'city.DAT'	[-back]	<b>"light" [l]</b>
b.	kıl-a	[kuɫa]	'hair.DAT'	[+back]	<b>"dark" [ɫ]</b>
c.	kül-e	[kyle]	'ash.DAT'	[-back]	<b>"light" [l]</b>
d.	kul-a	[kuɫa]	'servant.DAT'	[+back]	<b>"dark" [ɫ]</b>
e.	bel-e	[bele]	'back.DAT'	[-back]	<b>"light" [l]</b>
f.	bal-a	[baɫa]	'honey.DAT'	[+back]	<b>"dark" [ɫ]</b>
g.	göl-e	[gøle]	'lake. DAT'	[-back]	<b>"light" [l]</b>
h.	kol-a	[koɫa]	'arm.DAT'	[+back]	<b>"dark" [ɫ]</b>

This invites the analysis that the relevant feature ([±back] or [Coronal] in the case of "light" [l] and [Dorsal] in the cases of "dark" [ɫ]) is not specified underlyingly, but filled in through a process of spreading from the immediately preceding vowel.

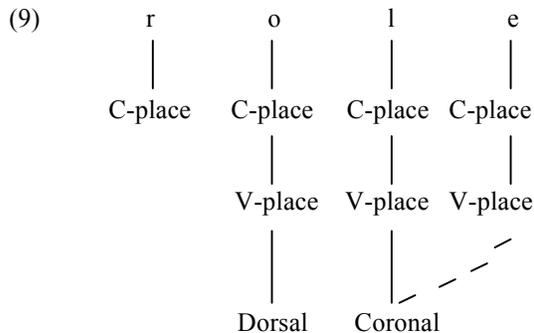
However, as the result of borrowings, some instances of the lateral are underlyingly pre-specified as "light" [l]. In other words, they occur in the environment of a [+back] vowel. Examples are given in (7).

(7)	[l] in the environment of [-back] vowel			
a.	rol	[rol]	'role'	[+back] "light" [l]
b.	petrol	[petrol]	'petroleum'	[+back] "light" [l]
c.	hal	[hal]	'situation'	[+back] "light" [l]

This non-canonical distribution of [l], where the lateral is pre-specified as [Coronal] for V-place leads us to the phenomenon of (actual) non-canonical vowel harmony (ANVH). Consider the environment of root-final /l/ in inflected words, as in (8). The immediately preceding V is [+back], but the adjacent [l] is [-back] (Coronal). As such, the *No Crossing Constraint* of UG (Hammond 1988) blocks the spreading of [+back] from the root vowel to the suffix vowel when there is a closer segment that can provide the relevant specification, in this case the "light" [l], as illustrated in (8).

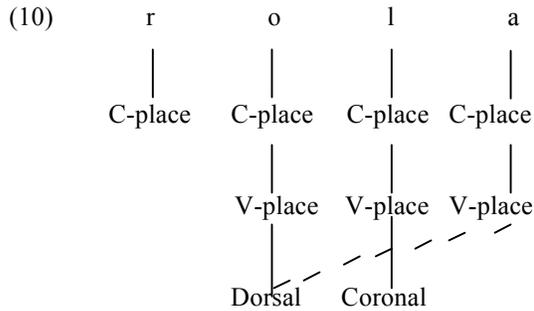
(8)	Examples of the No Crossing Constraint and ANVH				
a.	rol-e	[role]	'role.DAT'	[+back]	"light" [l] [-back]
b.	petrol-e	[petrole]	'gasoline.DAT'	[+back]	"light" [l] [-back]
c.	hal-e	[hale]	'situation.DAT'	[+back]	"light" [l] [-back]

In these examples, the dative suffix /-E/ is realized with the [-back] vowel /e/, instead of the [+back] vowel /a/, despite the [+back] specification of the root vowel. This is because of the [Coronal] feature of the intervening lateral. This phenomenon is illustrated in the condensed Feature Geometric representation in (9). (See Levi 2001 for a similar approach.)

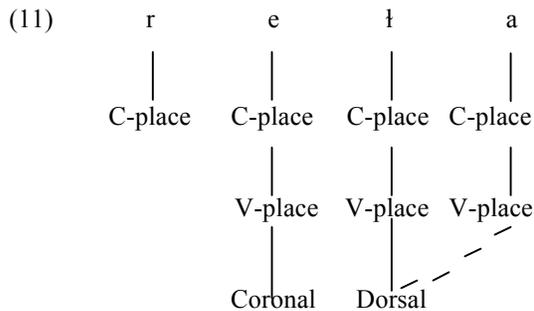


The No Crossing Constraint explicitly blocks the representation in (10), in which the V-place node of the second vowel is associated with the Dorsal node of the first vowel, crossing the direct line from the V-place of the intervening /l/ associated with Coronal (compare with (4) above, where the

intervening consonant is skipped, as it does not have a V-Place node, and cannot, thus, be pre-specified with vowel features or lead to blocking effects).



In actual Turkish, there are no cases of the mirror image, where a [-back] vowel is immediately followed by a velarized [ɫ]; however, were this to occur, the V-place node of the lateral would have to be pre-specified as [Dorsal] and the No Crossing Constraint should block the spreading of [Coronal] to a suffix vowel, as illustrated in (11).



We refer to this hypothetical extension of the No Crossing Constraint to a new constellation of features Hypothetical Non-canonical Vowel Harmony (HNVH).

Apart from the potential relevance of applications of the No Crossing Constraint at a rather abstract level, all of this is in stark contrast with the phonology of English. English does not have a VH system like that of Turkish at all. Furthermore, the distribution of the allophones of the single lateral phoneme is based primarily on position within the syllable, not on the quality of the surrounding vowels. Hence, English-Turkish L2ers have nothing obvious in their L1 to draw on when it comes to acquiring CVH, ANVH, or HNVH in Turkish. Furthermore, while classroom learners receive early and intensive instruction on CVH, they receive little input and no systematic instruction on ANVH, and clearly neither input nor instruction on HNVH. In fact, the instruction on CVH should lead the learners to make incorrect generalizations for ANVH and HNVH, as, according to classroom instruction, vowel harmony spreads from vowels to vowels only. Finally, Turkish orthography, which is generally a reliable representation of Turkish at the phonemic level, does not represent the difference between “light” [l] and “dark” [ɫ]. Orthographic representations like <rol> for [rol] are thus (potentially) misleading, and the “correct” computation of VH for ANVH and the hypothetically “correct” computation for HNVH involve directly violating what learners have been taught about the regularities of written Turkish. All of this suggests that if English-Turkish L2ers who have acquired CVH come to recognize the effects of non-canonical laterals and display knowledge of ANVH (with both actual and nonce words) and HNVH (which is restricted to only nonce words), their acquisition is guided by (some version of) the No Crossing Constraint.

### 3. Participants, Methods and Materials

To test whether English-Turkish L2ers acquire knowledge of CVH, and if so, of ANVH and HNVH, we recruited 34 L1 English-L2 Turkish learners at Indiana University, which is the host of an

undergraduate Turkish Flagship Program (for superior/advanced learning of Turkish) as well as a graduate-level program in Turkish Studies. On the basis of course enrollment and a cloze test, we assigned them to three proficiency groups: Beginner (n=13), Intermediate (n=10), and Advanced (n=11). Participants had both classroom instruction in Turkish and various sorts of naturalistic exposure to Turkish, but none would be considered heritage speakers of Turkish. There was also a Control Group of 14 Turkish native speakers.

Participants completed a language background questionnaire. We then administered a task that involved selecting vowel-harmonically correct suffixes on the basis of (i) simultaneous auditory and orthographic stimuli as well as on the basis of (ii) auditory stimuli alone. To this aim, participants were presented with a Turkish word or pseudoword (i.e. the root), and asked to choose the correct variant of a suffix, from among two or four options. All of the words were nouns, and the pseudowords were presented as if they were nouns. The suffixes were four common suffixes introduced early in the first semester of Turkish language instruction. The suffixes from which participants chose were the actual allomorphs of the relevant suffixes. For example, presented with the noun *öküz* ‘ox’, participants were given the options *-de* and *-da* (the two allomorphs of the locative suffix); presented with the noun *top* ‘ball’, participants were given the options *-um*, *-üm*, *-im*, and *-im* (the four allomorphs of the first person singular possessive suffix). The other two suffixes used were *-ler* ‘PLURAL’ (two allomorphs: *-ler* and *-lar*) and *-siz* ‘without’ (four allomorphs: *-siz*, *-süz*, *-suz*, *-süz*). Participants were presented with 256 semi-randomized items, all presented on a computer screen. 128 were experimental (i.e. ending in a lateral), and 128 fillers (i.e. ending in a variety of consonants other than a lateral). The fillers ended in consonants not affecting vowel harmony and did not involve any other type of exceptionality. This helped us ascertain if participants knew several linguistic structures involved in the experimental stimuli and ensured that the number of words ending in [l] and [ɫ] vs. other consonants was somewhat balanced. Further, 128 (both experimental and fillers) were real words; 128 pseudowords. 128 (both experimental and fillers) were presented auditorily only, and 128 both auditorily and in standard Turkish orthography. Each of the 8 phonemic vowels of Turkish was represented in the root vowel of exactly 32 of the test items, equally distributed across the conditions.

#### 4. Results

The results are presented as percentages of target-like choice of suffix (with standard deviations in parentheses) in Table 1. Each column represents a different proficiency level, whereas each row is organized based on the type of VH

**Table 1. Results** (in percentage; standard deviations are given in parentheses):

	<b>Beginner (n=13)</b>	<b>Intermediate (n=10)</b>	<b>Advanced (n=11)</b>	<b>Native (n=14)</b>
<b>Canonical VH (excluding /l/)</b>				
Auditory only	82.26% (5.62)	93.75% (5.80)	97.02 (2.83)	98.99 (1.69)
Auditory + visual	97.07% (3.29)	99.06% (1.09)	97.16 (3.19)	98.44% (2.12)
<b>Canonical VH with canonical /l/</b>				
Auditory only	74.04% (5.62)	88.44% (8.97)	95.87% (2.80)	99.33% (1.81)
Auditory + visual	96.31% (3.82)	98.00% (2.11)	98.55% (2.70)	98.86 (1.88)
<b>Noncanonical VH: [+back] V + light /l/</b>				
Auditory only	47.69% (9.92)	61.00% (27.26)	66.81% (30.52)	83.21% (18.77)
Auditory + visual	5.59% (4.96)	28.18% (37.71)	47.93% (33.54)	75.32% (16.02)
<b>Hypothetical noncanonical VH: [-back] V + dark /ɫ/</b>				
Auditory only	58.65% (13.14)	63.13% (25.93)	72.73% (21.70)	82.59% (13.69)
Auditory + visual	4.81% (6.33)	37.50% (35.36)	50.57% (32.05)	53.57% (36.67)

A two-way ANOVA revealed significance for both mode of presentation and proficiency. There is no significant difference between words vs. pseudowords. With both auditory and visual presentation,

even the Beginners are near ceiling on canonical VH, regardless of whether the root ends in a lateral. It is in the domain of non-canonical VH where we see that the learners are challenged. The contrast in the results table between rows 1 and 2 vs. rows 3 and 4 is rather striking: Presenting stimuli visually (in addition to auditorily) positively influenced correct responses on CVH by Beginners and Intermediates, while the same factor negatively influenced all participants' proportion of correct answers on ANVH and HNVH, including even that of Turkish native speakers.

## 5. Discussion

When the potentially misleading effect of Turkish orthography (which does not distinguish [ɫ] and [l]) is removed, the learners display emerging knowledge of both ANVH and HNVH. This is despite the fact that classroom instruction alone (which is exclusively on CVH) leads learners to a completely different hypothesis, one where target-like behavior on NVH should be around 0%, or mirror image of their performance on CVH. Nevertheless, this is not what we find, despite limited input being available for ANVH, and crucially, zero input on HNVH. In light of the severe poverty of the stimulus problem outlined above, we conclude that Interlanguage phonologies are constrained by (some version of) the No Crossing Constraint of UG.

In addition, we find clear evidence that the challenge of adopting to orthography in a new language can facilitate or inhibit TL phonological processing, and thus can have measurable effects on Interlanguage phonological acquisition. In fact, the need to adapt to a new orthography is an intriguing potential source of explanation for observational differences in development between L1 and L2, given the acquisition, given the difference in timing of the introduction of literacy development. Nevertheless, the results reported in Table 1 also show that orthography can significantly influence the phonological processing of native speakers as well. Furthermore, the results suggest that whatever the impact of orthography on phonological processing may be, L2ers can bypass this effect when it comes to the abstract phonological development.

Finally, we see additional phonological principles of UG in L2 development as a potentially fruitful, but as yet under-investigated area for exploring both the role of UG in L2 acquisition and the level of abstraction exhibited by Interlanguage grammars.

## References

- Dekydtspotter, Laurent & Sprouse, Rex. A. 2001. Mental design and (second) language epistemology: Adjectival restrictions of *wh*-quantifiers and tense in English-French interlanguage. *Second Language Research* 17: 1-35.
- Dekydtspotter, Laurent, Sprouse, Rex A. & Anderson, Bruce (1998) Interlanguage A-bar dependencies: Binding construals, null prepositions and Universal Grammar. *Second Language Research* 14: 341-358.
- Dekydtspotter, Laurent, Sprouse, Rex A. & Swanson, Kimberly A. B. 2001. Reflexes of the mental architecture in second language acquisition: The interpretation of discontinuous *combien* extractions in English-French interlanguage. *Language Acquisition* 9: 175-227.
- Dekydtspotter, Laurent, Sprouse, Rex A. & Thyre, Rachel (1999/2000) The interpretation of quantification at a distance in English-French interlanguage: Domain-specificity and second language acquisition. *Language Acquisition* 8: 265-320.
- Hammond, Michael. 1988. On deriving the well-formedness condition. *Linguistic Inquiry* 19: 319-325.
- Hopp, Holger (2005) Constraining second language word order optionality: Scrambling in advanced English-German and Japanese-German interlanguage. *Second Language Research* 21: 34-71.
- Kabak, Barış. 2011. Turkish vowel harmony. In *The Blackwell Companion to Phonology*, Marc van Oostendorp, Colin J. Ewen, Elizabeth V. Hume & Keren Rice (eds.), 2831-2854. Dordrecht: Foris.
- Kanno, Kazue. 1997. The acquisition of null and overt pronominals in Japanese by English Speakers. *Second Language Research* 13: 265-287.
- Levi, Susannah V. 2001. Glides, laterals and Turkish vowel harmony. *Papers from the Annual Meeting of the Chicago Linguistic Society* 37: 379-393.
- Martohardjono, Gita (1993) *Wh-movement in the Acquisition of a Second Language: A cross-linguistic Study of Three Languages with and without Overt Movement*. Unpublished doctoral dissertation, Cornell University.
- Nevins, Andrew. 2010. *Locality in Vowel Harmony*. Cambridge, MA: The MIT Press.
- Özçelik, Öner. 2012 *Representation and Acquisition of Stress: The Case of Turkish*. Unpublished doctoral

dissertation, McGill University.

- Pérez-Leroux, Ana Teresa. & Glass, William R. 1997. OPC effects in the L2 acquisition of Spanish. In *Contemporary Perspectives on the Acquisition of Spanish, Volume 1: Developing Grammars*, ed. by Ana Teresa Pérez-Leroux and William R. Glass, 149-165. Somerville: Cascadia Press.
- Schreiber, Timothy and Sprouse, Rex A. (1998) Knowledge of topicalization and scrambling in English-German Interlanguage. *McGill Working Papers in Linguistics* 13: 162-172.