The evolution of medieval /ü/ and its dialectal variation

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Abstract

The medieval high, front, round vowel /ü/ was phonetically realized in Greek until the 10th century A.D. After that time a sound change took place, resulting in the phonetic realization of underlying /ü/ with two variants, namely as [i] in most dialects and as [u] in the dialects of Old Athenian Complex. We claim that the underlying /ü/ could not be realized anymore due to a phonological change that resulted in the promotion of the markedness constraint *[+front, +round], which is now undominated and forbids the realization of front, rounded vowels in the Greek phonological system. The variation among the output vowels [i] and [u] can be accounted for on the basis of co-phonologies or multiple grammars, namely by a single ranking where a set of unranked constraints obtain, giving multiple outputs. In the course of language evolution, however, it is the crucial ranking of the one constraint over the other that forces the activation of a distinct output vowel in every dialectal group.

Key words: opacity, variation, multiple grammars

1. Introduction

The present study examines the evolution of medieval /ü/ and its variable realizations as [i] or [u] after 10th century A.D in the Greek dialects, e.g. (1)

(1)		*Most dialects*		*Old Athenian Complex*	*Gloss*
	/ˊksülo/ :	[ˊksilo]	*vs*	[ˊksulo]	‘wood’

As Newton (1972:20) points out, the existence of an underlying /ü/ in the Old Athenian dialects is provided by the palatalization of velars, not only in the environment of front vowels, but also in the environment of [u], e.g. (2)

(2)		*Most dialects*		*Old AthenianComplex*	*Gloss*
	/ˊxüros/ :	[ˊçiros]	*vs*	[ˊçuros]	‘pig’

In this paper arise the following questions: What was the cause of this phonological change? How can we account for the dialectal variants [i] *vs* [u]? We claim that the underlying /ü/ could not be realized anymore due to a phonological change in the Greek phonological system, that resulted in the elimination of [+front, +round] vowels (section 3). The variation among the output vowels [i] and [u] can be accounted for on the basis of *co-phonologies* or *multiple grammars* (cf. Antilla 1998, 2002a, b; Antilla & Cho 1998; and Tzakosta 2004 for acquisition). The opacity of velar palatalization in the data from the dialects of Old Athenian Complex, e.g. [ˊçuros] ‘pig’, will be evaluated by means of the *Multi-Stratal Approach* (cf. Kiparsky 1982, 1998; McCarthy & Prince 1993; Inkelas & Orgun 1995; Sprouse 1997; Padgett 2003, among others) in section 4.

2. Brief presentation of the data

The medieval high, front, round vowel /ü/ was phonetically realized in Greek until the 10th century A.D. After that time a phonological change took place, resulting in the phonetic realization of underlying /ü/ with two variants as in (3), namely as [i] in most dialects and as [u] in the Old Athenian Complex i.e. the dialects of Megara, Aegina, Kimi, pre-Kingdom Athens and Mani (Newton 1972:20f). The corpus used in this study is based on data from Newton (1972: 19ff) and references therein.

(3)	/ü/	*Most dialects*		*Old Athenian Complex*	*Gloss*
	/ˊksülo/ :	[ˊksilo]	*vs*	[ˊksulo]	'wood'
	/züˊγos/:	[ziˊγos]	*vs*	[zuˊγos]	'yoke'
	/θüγaˊtera/:	[θiγaˊtera]	*vs*	[θuγaˊtera]	'daughter'
	/ˊsüκo/:	[ˊsiko]	*vs*	[ˊsuko]	'fig'
	/psüˊçi/:	[psiˊçi]	*vs*	[psuˊçi]	'soul'

3. Analysis

3.1 Generative Approach

Given that the underlying /ü/ is a high, front, round vowel, the serial derivation of classical generative phonology posits a Backing rule as in (4) in order to confront the data in the Old Athenian Complex (cf. Newton's analysis 1972:21). This approach does not offer any explanation why two variants may be realized, as in the data above in (3), e.g. [ˊksilo] vs. [ˊksulo] 'wood'.

(4)	SERIAL DERIVATION:	/ˊksülo/	(/ü/: high, front, round vowel)
	Backing rule	[ˊksulo]	'wood'

3.2 An OT Approach

For the data analysis we adopt the theoretical framework of Optimality Theory (Prince & Smolensky 1993; McCarthy & Prince 1995). We claim that the underlying /ü/ in the above data in (3) could not be realized anymore due to a phonological change that took place, resulting in the promotion of the (locally) conjoined markedness constraint [*[+front]&*[+round]] that forbids the realization of front, rounded vowels in the Greek phonological system.

(5) LOCAL CONJUNCTION: 'two simple constraints (in our case *[+front] and *[+round]) are conjoined as a single composite constraint $[C_1 \& C_2]_\delta$ which is violated if and only if both of its components are violated within some domain $\boldsymbol{\delta}$ (domain=segment, morpheme, etc.). For a violation of $[C_1 \& C_2]_\delta$ to occur, both separate violations must arise within a single domain.' (Smolensky 1993)

It is generally assumed that a conjoined constraint is universally ranked above the simple constraints, which constitute it (6).

(6) Universal Ranking Schema: $[C_1 \& C_2]_\delta >> C_1, C_2$

In the constraint ranking in (7), the highly ranked markedness constraint [*[+front]&*[+round]] outranks the faithfulness constraint IDENT-IO[[+front]&[+round]], which demands that 'correspondent Input-Output segments have identical values for feature(s) [F]'.

(7) [*[+front] & *[+round]] >> IDENT-IO [[+front] & [+round]]

/ü/	[*[+front] & *[+round]]	IDENT-IO [+front] & [+round]]
a. [ü]	*!	√
b. ☞ [i]	√	*
c .☞ [u]	√	*

In the above tableaux (7) the highly ranked markedness constraint [*[+front]&*[+round]] prevents the realization of the faithful candidate [ü] (a). Candidates (b) and (c) may be the optimal outputs because both satisfy the higher ranked constraint. The variation among the output vowels [i] and [u] observed in the data in (3) can be accounted for on the basis of *co-phonologies* or *multiple grammars* (cf. Antilla 1998, 2002a, 2002b; Antilla & Cho 1998; Tzakosta 2004), namely by a single ranking as in (8) where a set of unranked constraints obtain, (in our case the constraints *[+front], *[+round]) giving the multiple outputs (8b) and (8c) in the tableaux below.

(8) [*[+front]&*[+round]]>>IDENT-IO[[+front]&[+round]]>>*[+front], *[+round]

/ü/	[*[+front]&*[+round]]	IDENT-IO [[+front]&[+round]]	*[+front]	*[+round]
a. [ü]	*!	√		
b. ☞ [i]	√	*	*	√
c. ☞ [u]	√	*	√	*

e.g. /ˊksülo/ : outputs → [ˊksilo], [ˊksulo] 'wood'

In the course of language evolution, however, it is the crucial ranking of the one constraint over the other (namely *[+front] >> *[+round] or *[+round] >> *[+front]) that forces the activation of a distinct output vowel in every dialectal group, i.e. this crucial ranking activates different grammars that may differ 'minimally' with respect to the fact that the ranking between two constraints is crucial and results in different phonetic outputs. In most dialects the higher ranking of the markedness constraint *[+round] over the markedness constraint *[+front] (see (9)) outranks the [+round] variant [u] (9b) as an optimal output, while the candidate [i] (9c) being [-round] satisfies the higher ranked constraint *[+round] and it is selected as the optimal one.

(9) *[+round] >> *[+front] Output: Dialectal variant: [i]: [ˊksilo]

/ü/	[*[+front]& *[+round]]	IDENT-IO [[+front]&[+round]]	*[+round]	*[+front]
a. [ü]	*!	√		
b. [u]	√	*	*!	√
c. ☞ [i]	√	*	√	*

In the dialectal group of Old Athenian Complex the higher ranking of the markedness constraint *[+front] over the markedness constraint *[+round] as in (10) outranks the [+front] variant [i] in (10c) as an optimal output. The candidate [u] in (10b) satisfies the higher ranked constraint *[+front], therefore it is chosen as the optimal one.

(10) *[+front] >> *[+round] Output: Dialectal variant: [u]: [ˊksulo]

/ü/	[*[+front]&*[+round]]	IDENT-IO [[+front]&[+round]]	*[+front]	*[+round]
a. [ü]	*!	√		
b. ☞ [u]	√	*	√	*
c. [i]	√	*	*!	√

The existence of an underlying front vowel /ü/ in the Old Athenian dialectal complex is provided by the phonetic realization of palatalized Velars, not only in the environment of front vowels (11a), but also in the environment of the back vowel [u], as in the data in (11b) (cf. Newton 1972: 20).

		Most dialects		*Old Athenian Complex*	*Gloss*
(11a)	/ˊγeros/ :	[ˊγˊeros]		[ˊγˊeros]	'old'
(11b)	/ˊxüros/ :	[ˊçiros]	*vs*	[ˊçuros]	'pig'
	/ˊγüro/:	[ˊγˊiro]	*vs*	[ˊγˊuro]	'around'
(12)		compare /ˊγuna/:		[ˊγuna]	'fair'

In the above example in (12) the dorsal /γ/ is not palatalized, because the following vowel /u/ is underlyingly [+back]. In a rule-based serial derivation along the lines of generative phonology the surface representations like the word [ˊçuros] of the Old Athenian Complex can be explained by means of ordered rules as in (13): the dorsal /x/ is palatalized in the environment of the front vowel /ü/ and then the output of palatalization rule undergoes the backing rule (Newton 1972:21). The two rules are in a *Counterbleeding order*, i.e. the application of the backing rule deletes the structural context of the palatalization rule, but due to the ordering both rules apply. The surface representation [ˊçuros] is *opaque* with respect to palatalization (for 'opacity' see section 4).

(13) SERIAL DERIVATION: /ˊxüros/
1. Palatalization [ˊçüros]
2. Backing rule [ˊçuros]
Surface representation: [ˊçuros]

4. Opacity of Velar Palatalization

In the dialects of Old Athenian Complex the outputs like [ˊçuros], [ˊγˊuro] etc. are *opaque* with respect to palatalization rule because the environment of rule application is not recoverable at the surface level. The result is an *overapplication* of palatalization. Such opaque outputs cannot be evaluated by means of the classical, surface-oriented Optimality Theory (OT), which forbids any levels mediating between the input and the output form. In the following sections we will attempt to give a theoretical analysis for the surfacing of such opaque forms by means of the *Sympathy Theory*, §4.1 and the *Multi-Stratal Approach,* §4.2.

4.1 A Sympathy based Approach

The 'Sympathy' theory was developed by McCarthy (1997) in order to confront the 'opacity' problem. This theory preserves the crucial tenets of classical OT, i.e. that inputs and outputs are directly mapped and that the well-formedness constraints refer only to the output. McCarthy proposes a correspondence relation on pairs of output candidates, where the opaque candidate is faithful to another candidate, the *sympathetic* one, which is closer to the Input form. This is a type of correspondence candidate-to-candidate faithfulness.

In the case of data from the Old Athenian Complex (see (11b)) the output candidates will be evaluated by means of the following constraints in (14-16):

(14) *Context-free Markedness Constraints*
[*[+front]&*[+round]]: 'Front, round vowels are not permitted'.
*[+front]: 'Front vowels are not permitted'.
*[+round]: 'Round vowels are not permitted'.

(15) *Context-sensitive Markedness Constraints*
PAL(ATALIZATION)**[**+front**]:** 'CV-sequences headed by front vowels are articulatorily linked' (Itô & Mester 2003).

(16) *Faithfulness Constraints*
IDENT-IO[[+front]&[+round]: 'Correspondent Input-Output segments have identical values for feature(s) F'.
IDENT-☺PLACE[COR]: 'The Coronal Place of Articulation of the sympathetic form must be preserved in the output form'.
IDENT-IO-PLACE[F]: 'Correspondent Input-Output segments have identical values for the Place of Articulation feature F'

In (17) we illustrate the constraint ranking that is crucial in selecting the optimal candidate in the dialects of Old Athenian Complex, as well as the relevant tableaux.

(17) CONSTRAINT RANKING:
[*[+front]&*[+round]]>>IDENT-IO[[+front]&[+round]]>>*[+front]>>*[+round]
>>IDENT-IO-PLACE

(e.g. /ˊxüros/: [ˊçuros], opaque surface form)

/ˊxüros/	[*[+front] &*[+round]]	IDENT-IO [[+front] & [+round]]	*[+front]	*[+round]	PAL [+front]	IDENT-☺PLACE [COR]	IDENT-IO PLACE
a. [ˊxüros]	*!	√	*	*	*	*	√
b. [ˊçiros]	√	*	*!	√	√	√	*
c. [ˊçüros] ☺	*!	√	*	*	√	√	*
d.☞[ˊçuros]	√	*	√	*		√	*
e. [ˊxuros]	√	*	√	*		*!	√

☺: the *sympathetic* form, which is closer to the Input form /ˊxüros/.

The output candidate (17a) fails to be chosen as the optimal one, because it fatally violates the undominated markedness constraint [*[+front] &*[+round]], that forbids

the realization of the vowel [ü]. The candidate (17b) –although it satisfies the undominated markedness constraint- fails to be chosen as the optimal one, because the [+front] vowel [i] fatally violates the high ranked markedness constraint *[+front]. The crucial ranking of *[+front] >> *[+round] decides in this dialectal group for the optimal output vowel, which must be [-front] (see section 3.2, especially tableaux (10)). The candidate (17c) fails to be realized as the optimal one, because it fatally violates the undominated markedness constraint [*[+front] &*[+round]]. Among the output candidates (17b - 17e), candidate (17c) is closer to the input form. In an OT analysis the output candidate [ˊçüros] (17c) is more faithful to the input /ˊxüros/ than the opaque form [ˊçuros] (17d), taking an intermediate position between both. Candidate (17c) -the sympathetic one- matches the intermediate form in the serial analysis in (13.1). The candidate [ˊxuros] (17e) is a transparent (possible) output, where no palatalization occurs. This candidate also preserves in the output the (dorsal) Place of Articulation of the input segment. In order to outrank candidate (17e) we need a higher ranked correspondence constraint demanding faithfulness to the sympathetic candidate (17c), a constraint militating against Depalatalization. The fact that palatalization remains in the optimal output form (17d) has to do with a constraint that disprefers the change in place of articulation of a single segment. This is a constraint of IDENT Family, i.e. IDENT-☺PLACE[COR], namely the Coronal Place of articulation of the sympathetic form (17c) must be preserved in the optimal output. The output candidate [ˊxuros] (17e) violates this constraint therefore it is not selected as the optimal output. On the other hand, the constraint IDENT-☺PLACE[COR] is satisfied by the opaque candidate [ˊçuros] (17d), since it surfaces palatalized and it is faithfull to the palatalized 'sympathetic' candidate (17c), i.e. the opaque form [ˊçuros] (17d) is more faithful to a form that is neither an Input nor an Output, but it is an output-candidate itself (17c).

Thus the rule-based serial analysis in (13) and the OT-Sympathy analysis in (17) share the following insight: Both set up an abstract intermediate form [ˊçüros] which connects the opaque output [ˊçuros] to the input /ˊxüros/.

4.2 The Multi-Stratal Approach

The Multi-Stratal approach originates from Lexical Phonology (cf. Kiparsky 1982; Mohanan 1986). The Multi-Stratal approach was also adopted by various linguists working in a constraint-based model like OT (cf. McCarthy & Prince 1993; Inkelas & Orgun 1995; Sprouse 1997; Padgett 2003, among others). In this approach, the Grammar is organized in ordered Strata; every Sratum has its own constraint ranking and there is a direct mapping between the Input and the Output: In Stratum I the Input corresponds to the lexical form. The Output of each Stratum constitutes the Input of the next Stratum. Some works on sound change in OT claim that '*the input at each historical change is the output of the previous stage*'. This is the so-called *Synchronic Base Hypothesis*, henceforth SBH (cf. Holt 1997). An OT model that distinguishes lexical and postlexical derivations is proposed by Kiparsky (1998). In this model '*the appearance of the SBH can emerge as a sequence, because the Richness of the Base holds only for Inputs to the lexical stratum*' (cited in Padgett 2003:63).

(18)

	STAGE I	
STRATUM I:	I_1 /ˊxüros/	(Lexical Phonology)
	↓	
	O_1 [ˊçüros]	(Postlexical Phonology)

In the postlexical Stratum I, the underlying vowel /ü/ is faithfully realized as [ü] due to the undominated faithfulness constraint IDENT-IO[[+front]&[+round]] (19), which demands that 'correspondent Input-Output segments have identical values for feature(s) [F]' and the input dorsal segment /x/ surfaces palatalized due to the action of the context sensitive constraint PAL[+front].

(19) CONSTRAINT RANKING:
IDENT-IO[[+front]&[+round]]>>[*[+front]&*[+round]]>>*[+front]
>>*[+round]>>PAL[+front]>> IDENT-IO-PLACE

(20) Stratum I: $Input_1$ /´xüros/ $Output_1$ [´çüros] 'pig'

/´xüros/	IDENT-IO [[+front] &[+round]]	[*[+front] &*[+round]]	*[+front]	*[+round]	PAL [+front]	IDENT-IO PLACE
a. [´xüros]	√	*	*	*	*!	√
b. [´çiros]	*!	√	*	√	√	*
c.☞[´çüros]	√	*	*	*	√	*
d. [´çuros]	*!	√	√	*		*
e. [´xuros]	*!	√	√	*		√

The output candidates (20b, 20d, 20e) are outranked, because they fatally violate the undominated faithfulness constraint IDENT-IO[[+front]&[+round]]. The higher ranking of the context sensitive constraint PAL[+front] over the faithfulness constraint IDENT-IO-PLACE is crucial for the selection of the optimal output among the output candidates [´xüros] (20a) and [´çüros] (20c). The candidate (20a), although identical to the input form, fails to be chosen as the optimal output form, because it violates the higher PAL[+front] constraint, while the palatalized candidate [´çüros] (20c) satisfies this constraint and it is selected as the optimal output (surface) form.

In the course of language evolution (Stage II), the palatalized $Output_1$ [´çüros] is fed as lexical $Input_2$ in Stratum II (21), i.e. the palatalization, that took place in the postlexical phonology of Stratum I, is incorporated into the Lexical Phonology of the Stratum II.

(21) **STAGE II**

STRATUM II: I_2 /´çüros/ (Lexical Phonology)
↓
O_2 [´çuros] (Postlexical Phonology)

In the postlexical Stratum II, the underlying vowel /ü/ does not surface as a [[+front]& [+round]] vowel, but it is phonetically realized as [u] (after 10^{th} century A.D.). This happens due to a sound change that resulted in the promotion of the markedness constraint [*[+front]&*[+round]], which outranks the faithfulness constraint IDENT-IO[[+front]&[+round]] (22). The context sensitive constraint PAL[+front] is not included in the constraint ranking in (22), because it does not play any role in the selection of the optimal output.

(22) CONSTRAINT RANKING:
[*[+front]&*[+round]]>>IDENT-IO[[+front]&[+round]]>>*[+front]>>*[+round]
>>IDENT-IO-PLACE

(23) Stratum II: $Input_2$ [´çüros] $Output_2$ [´çuros] 'pig'

/´çüros/	[*[+front] &*[+round]]	IDENT-IO [[+front]&[+round]]	*[+front]	[+round]	IDENT-IO PLACE
a. [´xüros]	*!	√	*	*	√
b. [´çiros]	√	*	*!	√	*
c. [´çüros]	*!	√	*	*	*
d. ☞ [´çuros]	√	*	√	*	√
e. [´xuros]	√	*	√	*	*!

The output candidates (23a, c) are outranked, because they fatally violate the undominated faithfulness constraint [*[+front]&*[+round]]. Candidate (23b), although it has identical Place of Articulation with the input form, fails to be chosen as the optimal output form, because the vowel [i] being [+front] fatally violates the high ranked constraint *[+front] (recall that in the dialects of Old Athenian Complex the crucial ranking of *[+front] >>*[+round] 'decides' for the optimal output vowel, i.e. a [+round] vowel). Both output candidates (23d) and (23e) violate or satisfy likewise the markedness constraints and the faithfulness constraint IDENT-IO[[+front]&[+round]]. The only difference between these candidates is the place of articulation. The violation/satisfaction of the lower ranked constraint IDENT-IO-PLACE decides for the selection of the optimal output. In the output candidate (23e) the dorsal [x] fails to match its coronal correspondent /ç/ in the input. In Stratum II, although the context for palatalization is not anymore attested in the postlexical phonology, the input segment /ç/ is faithfully realized in the output [´çuros] (23d), due to the action of faithfulness constraint IDENT-IO-PLACE, which prevents the output form from depalatalization.

Both Strata have in the postlexical level minimally different rankings, involving only the reranking of the markedness constraint [*[+front] & *[+round]] and the faithfulness constraint IDENT-IO[[+front]&[+round]] (24). This reranking is crucial for the quality of the optimal output vowel in each Stratum, i.e. Stratum I: [ü], Stratum II: [u]

(24) Stratum I: IDENT-IO [[+front] & [+round]] >> [*[+front] &*[+round]]
Stratum II: [*[+front] &*[+round]] >> IDENT-IO [[+front] & [+round]]

5. Conclusions

In the above sections we claimed that the underlying /ü/ of the medieval Greek phonological system could not be realized faithfully after 10th century A.D., due to a phonological change that resulted in the promotion of the markedness constraint *[+front, +round] that excludes the front, rounded vowels from the Greek phonological system. This sound change resulted in two variants, namely as [i] in the most dialects and as [u] in the dialects of Old Athenian Complex. We claimed that this variation can be accounted for on the basis of multiple grammars, namely by a single ranking where a set of unranked constraints may obtain (*[+front], *[+round]), giving multiple output vowels, while the crucial ranking of the one constraint over the other results in a distinct output vowel in every dialectal group (output vowel [u]: *[+front] >>*[+round] and output vowel [i]: *[+round] >>*[+front]).

Two approaches were adopted in order to provide an analysis for the opacity effects observed in surface forms like [´çuros] 'pig', i.e. the Sympathy Theory in §4.1 and the Multi-Stratal Approach in §4.2. The Sympathy Theory implies an abstract intermediate

form which connects the opaque output to the input, in a way similar to the classical generative approach (as in the serial derivation in (13)). This contradicts the tenets of the surface-oriented Optimality Theory that forbids any intermediate levels between the lexical input and the actual output form (see Kager 1999:392, for a critical discussion of the problematic aspects of the Sympathy approach). By the Multi-Stratal approach we may provide a better treatment of the observed opacity effects, avoiding any intermediate forms between the input and the output form in each Stratum. We propose that the phonological change of palatalization of the input /x/ that took place in the postlexical Stratum I, before 10th century A.D. is fed later as lexical input /ç/ in the next Stratum II and that this input is realized faithfully in the postlexical level. Adopting the Multi-Stratal approach we imply that the palatalized forms like [΄çüros] entered the Stratum II as lexicalized ones. The only phonological change that took place in Stratum II, due to language evolution, concerns the quality of the input vowel /ü/, which lost its feature [+front], therefore it surfaces as [u] after 10th century A.D. Concluding, both Strata have minimally different constraint rankings, involving only the reranking of a markedness constraint and a faithfulness constraint that affects only the quality of the output vowel in every Stratum.

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