Greek fortition in Logical Phonology*

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Logical Phonology (henceforth, LP; e.g., Bale et al. 2014, Bale and Reiss 2018, Reiss 2021, Dabbous et al. 2024, Leduc et al. 2024, Reiss 2024, Gorman and Reiss 2025a,b,c) is a formally rigorous, rule-based, substance-free theory of phonology. LP posits that features are binary-valued and segments are sets of valued features linked to a X-slot. Segments must be *consistent*: if a segment ς is specified +F (where F is a feature) it cannot also be specified −F or vice versa. However, segments can be *underspecified*: ς need not contain any specification for the feature F at all. Following Poser (1982) et seq., the distinction between feature-filling and feature-changing rules is derived by decomposing feature-changing processes (e.g., voice assimilation) into separate, independently motivated feature insertion (*unification*) and deletion (*subtraction*) operations, as defined below:

(1) Unification: If A and B are feature specifications, then $A \sqcup B = A \cup \{c\text{F} \mid c\text{F} \in B \wedge -c\text{F} \notin A\}$.

(2) Subtraction: If A and B are feature specifications, then $A \setminus B = \{c\text{F} \mid c\text{F} \in A \wedge c\text{F} \notin B\}$.

In other words, $A \sqcup B$ is the feature specification containing every specified feature in A and all non-conflicting specified features in B, and $A \setminus B$ is the feature specification containing all specified features in A not found in B.

Unification provides a novel solution to the decades-old problem (e.g., Lees 1961:12–14, Lightner 1971:236, Archangeli 1988, Bonet 1995: fn. 28; Reiss 2003) of targeting relatively underspecified structures without also affecting more richly specified ones. It is also a principled way to implement Sharon Inkelas and colleagues' notion of *inalterability as prespecification* (IAP; e.g., Inkelas and Cho 1993, Kiparsky 1993, Buckley 1994, Inkelas 1995, Inkelas and Orgun 1995, Inkelas et al. 1997), according to which segments underspecified for some feature F are *mutable* with respect to feature-filling rules—implemented as unification rules in LP—adding +F or −F. IAP allows for many patterns to be generated by the narrow phonology which were previously analyzed using morphophonological rules, morpheme-specific constraints, cophonologies, lexical diacritics, and so on.

Modern Greek has a process of manner dissimilation in which certain labial fricatives, as in (3a,b), strengthen—and devoice—to [p] before /s/; they are realized as [f, v] before vowels and

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other consonants. However, other labial fricatives, as in (3c), resist fortition in this context.[1] There are no reported phonetic differences between the [v] in (3b) and (3c).

(3)

		IPFV.1SG /-o/	PST.1SG /-s-a/	1SG.PFV.PASS. /-θ-o, -t-o/	
a.	γράφω	[ˈɣrafo]	[ˈɣrapsa]	[ɣrafˈto]	‘write’
	βάφω	[ˈvafo]	[ˈevapsa]	[vafˈto]	‘paint (walls, etc.)’
	στέφω	[ˈstefo]	[ˈestepsa]	[stefˈθo]	‘crown’
b.	ράβω	[ˈɾavo]	[ˈeɾapsa]	[ɾafˈto]	‘sew’
	δουλεύω	[ðuˈlevo]	[ˈðulepsa]	[ðulefˈto]	‘work’
	παιδεύω	[peˈðevo]	[ˈpeðepsa]	[peðefˈto]	‘toil; torment’
c.	βραβεύω	[vraˈvevo]	[vraˈvefsa]	[vravefˈto]	‘give a prize to’
	ερμηνεύω	[ermiˈnevo]	[erˈminefsa]	[erminefˈto]	‘interpret (languages, etc.)’
	παιδεύω	[peˈðevo]	[peˈðefsa]	[peðefˈto]	‘educate; train’

Fortition is not specific to the past suffix; for example, it is also triggered by the nominalizing /-sim-o/ (e.g., [ˈɣrafsimo] ‘writing’) attaching to some verbs of type (3a,b). Note especially the partial homophone ⟨παιδεύω⟩ [peˈðevo], which means ‘torment’ or ‘toil’ if it undergoes fortition and stress shift in the past tense, and ‘educate’ or ‘train’ if it does not.

Markopoulos and Revithiadou (2023), henceforth M&R, propose an analysis of these data using Gradient Harmonic Grammar with Gradient Symbolic Representations (Smolensky and Goldrick 2016). In this theory, phonological elements, including feature specifications, are assumed to have an underlying “strength”, an *activity level* denoted by a numerical value in the range [0, 1]. Simplifying somewhat, M&R posit differential levels of activity for the CONTINUANT specification of the stem-final labials in (3) to account for their differential behavior.

However, this data can also be generated using the more modest architectural assumptions of LP. Let us suppose that (manner-*inalterable*) /v/ is underlyingly +CONTINUANT, whereas (manner-*mutable*) /F, V/ denote labial fricatives underspecified for this feature.

(4) Feature specification (partial):

	/F/	/V/	/v/
CONTINUANT			+
VOICE	−	+	+

(5), a unification rule, maps /F, V/ followed by the strident /s/ to /p, b/, respectively. As formulated, it also targets dorsal continuants not specified for CONTINUANT. However, because unification (as defined) does not overwrite existing feature specifications, it applies vacuously to /v/ and any other segment which already has a CONTINUANT specification. A later context-free redundancy rule, (6), specifies /F, V/ not targeted by (5) as fricatives, and similarly applies vacuously to fully-specified segments. For completeness, the voice assimilation rules (implemented as a subtraction followed by a unification), critical orderings, and sample derivations are also provided.

(5) Fortition: $[\ ] \sqcup \{-\text{CONTINUANT}\} \ / \ \_\_ \ [+\text{STRIDENT}]$

[1]Abbreviations used: IPFV: imperfective; PFV: perfective; PASS: passive; PST: past; 1SG: first-person singular. Note that some past-tense forms also show a prothetic [e] and/or stress shift in the past tense.

(6) Default frication: $[\ ] \sqcup \{+\textsc{Continuant}\}$

(7) Voice assimilation (part 1): $[-\textsc{Sonorant}] \setminus \{+\textsc{Voice}\} / \_\_ \begin{bmatrix} -\textsc{Voice} \\ -\textsc{Sonorant} \end{bmatrix}$

(8) Voice assimilation (part 2): $[-\textsc{Sonorant}] \sqcup \{-\textsc{Voice}\} / \_\_ \begin{bmatrix} -\textsc{Voice} \\ -\textsc{Sonorant} \end{bmatrix}$

(9) Critical orderings: (5) ≪ (6); (7) ≪ (8)

(10) Sample derivations (stress omitted):

UR:	ɣraF-o	ɣraF-s-a	ɾaV-o	ɾaV-s-a	vravev-o	vravev-s-a
Rule (5):		ɣrapsa		ɾabsa		
Rule (6):	ɣrafo		ɾavo			
Rules (7–8):				ɾapsa		vravefsa
SR:	ɣrafo	ɣrapsa	ɾavo	ɾapsa	vravevo	vravefsa

While M&R limit their discussion to labial fricatives, let us briefly consider other places of articulation. Stem-final coronal fricatives do not undergo fortition; rather, they delete before /s/ (e.g., [aˈleθo] 'I grind' vs. [ˈalesa] 'I was grinding'). However, dorsal fricatives undergo fortition before /s/.[2]

(11)

		IPFV.1SG /-o/	PST.1SG /-s-a/	
a.	τρέχω	[ˈtrexo]	[ˈetreksa]	'run'
	προσέχω	[proˈsexo]	[ˈproseksa]	'watch out'
b.	ανοίγω	[aˈniɣo]	[ˈaniksa]	'open'
	λήγω	[ˈliɣo]	[ˈeliksa]	'terminate'

Under the assumption that these alternating dorsal segments are underlyingly underspecified for Continuant, their surface forms derive from the same sequence of rules given above, which make no reference to place. There are no manner-inalterable dorsal fricatives parallel to (3c).

LP provides sufficient representations and operations to generate the "exceptional" fortition pattern of Modern Greek, within the narrow phonology and without reference to morphemic identity. This approach treats the UR as the locus of form-based idiosyncrasy, exploiting the lexicon's existing mandate as the storehouse for Saussurean arbitrariness. Like M&R's analysis, LP analysis implements a form of IAP, but it does so by rejecting the commonly-adopted stipulation against underspecified segments—resulting in a formally simpler model of phonological computation—rather than introducing the novel notion of activity level.

[2]Thanks to an anonymous reviewer for drawing attention to the behavior of coronal and dorsal fricatives.

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