Nominal inflection in the morphosyntax-phonology interface: A comparative study of Greek and Hebrew*

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Περίληψη

Στο άρθρο αυτό εξετάζονται φαινόμενα αλλομορφίας που παρατηρούνται στην ονοματική κλίση της Ελληνικής και της Εβραϊκής. Αντίθετα από τις υπάρχουσες αναλύσεις, οι οποίες προσεγγίζουν την αλλομορφία είτε αποκλειστικά από μορφοσυντακτική σκοπιά είτε εστιάζοντας μόνο στις φωνολογικές πτυχές της, στην παρούσα ανάλυση αναδεικνύονται αξιοσημείωτες γενικεύσεις που αφορούν το διεπίπεδο φωνολογίας-μορφοσύνταξης-σημασιολογίας. Για τη συνδυαστική αυτή προσέγγιση αξιοποιούνται τα μοντέλα της Κατανεμημένης Μορφολογίας (Halle and Marantz 1993) και της Διαβαθμισμένης Αρμονικής Γραμματικής (Smolensky and Goldrick 2016).

Λέξεις-κλειδιά: θεματική αλλομορφία, ονοματική κλίση, Ελληνική, Εβραϊκή, Κατανεμημένη Μορφολογία, Διαβαθμισμένη Αρμονική Γραμματική

1 Introduction

Allomorphy is a widely attested phenomenon in inflectional languages that refers to the different forms in which a specific morpheme may manifest itself. The exact realization of the morpheme in question may be determined by many different factors. Typically, it is assumed to be conditioned by the lexical (1a), the phonological (1b), the morphological (1c), or the syntactic (1d) environment the morpheme appears in, as exemplified below:

(1)	a.	dog-[z]	~	ox-en	{PLURAL}	→	*-en* / {√OX, …}
						→	*-z* elsewhere
	b.	cat-[s]	~	dog-[z]	{PLURAL}	→	*-s* / $C_{[-voiced]}$
						→	*-z* elsewhere
	c.	man	~	men	√MAN	→	*men* in PL
						→	*man* elsewhere
	d.	I	~	me	$D_{\{PRN, 1SG\}}$	→	*I* in SBJ position
						→	*me* elsewhere

However, not all allomorphic phenomena are as straightforward as the ones presented in (1). There are namely cases where the motivation behind the process in question (lexical/phonological/morphological/syntactic) is not easy to identify. Consider for instance the Greek examples in (2):

(2)	a.	μανάβ**ης**	'grocer'	~	μανάβ**ηδ**ες	'grocers'
	b.	ναύτ**ης**	'sailor'	~	ναύτες	'sailors'

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Both nouns are masculine and have the same ending in NOM.SG (/-is/). Nevertheless, they exhibit different patterns for the formation of the plural: the insertion of the plural ending /-es/ is accompanied by the emergence of the consonant /ð/ in the noun *μανάβης* /manávis/ and by the deletion of the vowel /i/ in the noun *ναύτης* /náftis/. The question that arises at this point concerns the trigger of the attested alternations. Is it lexical (3a), phonological (3b), or morphological (3c)? In principle, one could argue in favor of all three answers.

(3) a. {PLURAL} → *-iðes* / {√GROCER, …}
→ *-es* / {√SAILOR, …}
b. √GROCER → *manávi-* / __C
→ *manávið-* / __V
√SAILOR → *náfti-* / __C
→ *náft-* / __V
c. √GROCER → *manávi-* in SG
→ *manávið-* in PL
√SAILOR → *náfti-* in SG
→ *náft-* in PL

In this paper, I discuss allomorphic phenomena of this kind that are attested in (Standard Modern) Greek and (Modern) Hebrew nominal inflection in order to show that a purely lexical, phonological or morphological account of allomorphy is inadequate in both empirical and theoretical terms. What I propose instead is a unifying theoretical model that draws from *Distributed Morphology* (Halle and Marantz 1993, Embick and Noyer 2007) and *Gradient Harmonic Grammar* (Smolensky and Goldrick 2016) and approaches allomorphy both from a morphosyntactic and a phonological perspective.

The paper is structured as follows. First, in Section 2, I present the allomorphic patterns under investigation, while in Section 3 I review and discuss some possible analyses one could offer based on the relevant literature. In Section 4 I provide a different analysis that overcomes the shortcomings of the alternatives highlighted in Section 3. Section 5 summarizes the gist and the merits of the proposed analysis.

2 The data

To begin with Greek, our focus is on masculine nouns ending in *-is* (in NOM.SG). As already discussed in the introduction, these nouns fall under two inflection patterns: nouns like *μανάβης* retain the vowel /i/ in the plural form (4a–b), whereas in nouns like *ναύτης* the vowel /i/ deletes before the plural ending *-es* (4c–d).

(4) a.	μανάβ**ης**	~	μανάβ**ηδ**ες
	grocer.M.SG.NOM		grocer.M.PL.NOM/ACC
b.	σερίφ**ης**	~	σερίφ**ηδ**ες
	sheriff.M.SG.NOM		sheriff.M.PL.NOM/ACC
c.	ναύτ**ης**	~	ναύτες
	sailor.M.SG.NOM		sailor.M.PL.NOM/ACC
d.	πλανήτ**ης**	~	πλανήτες
	planet.M.SG.NOM		planet.M.PL.NOM/ACC

A somewhat similar picture is found in Hebrew feminine nouns. As shown in (5), nouns ending in *-ut* (in SG.C(ONSTRUCT)S(TATE)) do not drop the vowel /u/ in the plural form (5a–b), as opposed to nouns in *-at* (5c–d), which lose the vowel /a/ before the plural ending *-ot* (Bat-El 1989: 135).

(5)	a.	xaver**ú**t	~	xaver**u**jót
		friendship.F.SG.CS		friendship.F.PL
	b.	tarb**ú**t	~	tarb**u**jót
		culture.F.SG.CS		culture.F.PL
	c.	tikv**á**t	~	tikvót
		hope.F.SG.CS		hope.F.PL
	d.	gamad**á**t	~	gamadót
		dwarf.F.SG.CS		dwarf.F.PL

Note that in both languages we have two pairs of nouns patterning together with respect to their inflectional behavior (4a–b vs. 4c–d; 5a–b vs. 5c–d). The question that arises is what motivates this patterning. Is there a defining property in each one of these four pairs?

Let us zoom in on the semantic and morphosyntactic features of these nouns in terms of humanness, concreteness and grammatical gender. If we employ the binary features [±human], [±concrete] and [±feminine], we get the following classification:

(6)	a.	μανάβης	'grocer'	[+human]	[+concrete]	[–feminine]
	b.	σερίφης	'sheriff'	[+human]	[+concrete]	[–feminine]
(7)	a.	ναύτης	'sailor'	**[+human]**	[+concrete]	[–feminine]
	b.	πλανήτης	'planet'	**[–human]**	[+concrete]	[–feminine]
(8)	a.	xaverút	'friendship'	[–human]	[–concrete]	[+feminine]
	b.	tarbút	'culture'	[–human]	[–concrete]	[+feminine]
(9)	a.	tikvát	'hope'	**[–human]**	**[–concrete]**	[+feminine]
	b.	gamadát	'dwarf'	**[+human]**	**[+concrete]**	[+feminine]

Interestingly, the four pairs are not equally uniform: on the one hand, the two pair members in (6) and (8) share exactly the same semantic and morphosyntactic feature values, while, on the other hand, the two pair members in (7) and (9) exhibit differences with respect to humanness and/or concreteness. In other words, every Greek masculine noun that falls under the allomorphic pattern i ~ ið (6) is [+human], whereas the same does not apply for the allomorphic pattern i ~ Ø (7), which includes both [+human] and [–human] nouns. Likewise, all Hebrew feminine nouns in *-ut* (8) are [–human, –concrete] (see also Bat-El 1989, Bolozky and Schwarzwald 1992, Faust 2013), but nouns in *-at* may be either [+human] or [–human] (9). We thus conclude that a comprehensive analysis of these allomorphic patterns should address both the morphophonological and the semantic factors involved.

3 Possible analyses

In the relevant literature, one can find many different approaches that could be employed for the analysis of the allomorphic cases in question. In the following

subsections, I briefly review some of them and I discuss their merits and their shortcomings.

3.1 Morphological conditioning

For a great body of research that includes both descriptive grammars (e.g. Triantafyllidis 2012 [1941]) and theoretical analyses (Ralli 1988, 1994, 2005, 2007, Booij 1997, Alexiadou and Müller 2008, Anastassiadis-Symeonidis 2012, among others), the component of the grammar that is responsible for the conditioning of these allomorphic phenomena is morphology. Putting aside the theoretical and methodological differences, the main idea all these analyses share –in one form or another– is that each of the nouns presented in §2 has two entries (i.e. stem allomorphs) in the mental lexicon, which are inherently specified for the morphological environments they can appear in. To exemplify, for the noun *μανάβης*, there are arguably two separate stems: /manavi-/$_{SG}$, /manavið-/$_{PL}$.

3.2 Syntactic conditioning

A different view is offered by syntactic analyses that are based on *readjustment rules* and are couched within the Distributed Morphology framework (Halle and Marantz 1993, Embick and Halle 2005, Harley and Tubino Blanco 2013, Arregi and Nevins 2014, Embick 2016, among others). These analyses argue in favor of a single underlying representation for each root/stem, which may undergo phonological reshaping in certain syntactic environments. For instance, the variation between the forms *manavi-* and *manavið-* is accounted for as follows: there is a single root √GROCER that manifests itself by default as *manavi-*, unless it is adjacent to a Number node specified as PL.

(10) √GROCER → *manávið-* / __Num[PL]
→ *manávi-* elsewhere

3.3 Phonological conditioning

Finally, a third option is to view these allomorphic phenomena as phonologically motivated alternations. This alternative may be pursued through *autosegmental* models that employ the notion of *floating segments* (e.g. Lowenstamm 1996, Faust 2014, Scheer 2016). More specifically, we could assume that the –single– underlying representation of each noun ends in a floating segment, namely a segment lacking an association line with the CV tier. This segment is not pronounced (11a), unless it is followed by a vowel-initial suffix that provides an empty C-slot (11b). In that case, the segment is associated with the available C-slot in order to yield a well-formed (i.e. CV) syllable:

(11) a.

C	V	C	V	C	V		
|	|	|	|	|	|		
m	a	n	a	v	i	ð	→ *manávi* (SG.ACC)

b.

C	V	C	V	C	V	C	V	C	V		
|	|	|	|	|	|	|	|	|			
m	a	n	a	v	i	ð	e	s		→	*manáviðes*

3.4 Discussion

Each of the above types of analysis runs into several problems. For example, morphological approaches that postulate two separately stored stem allomorphs entail a heavy burden for the mental lexicon. Syntactic approaches that posit a single underlying representation may overcome this drawback, but on the other hand they do not elaborate enough on the phonological factors that may play a role in allomorphic processes. And although phonological approaches succeed in addressing exactly this issue, they are not empirically adequate, since they cannot account for cases where the emergence of an allomorphic pattern does not comply with syllable well-formedness. An illustrative example comes from Hebrew, where the Free State form *víza* 'visa' has a CV.CV syllable structure, whereas the Construct State form in the compound *vízat diplomat* 'diplomatic visa' ends a marked closed syllable, despite the fact that it is followed by a consonant (Faust 2013: 410).[1]

The main shortcoming of all the approaches mentioned above, though, is that they disregard the fact that nouns patterning together in their allomorphic behavior usually share certain common sematic and morphosyntactic features (see §2). Therefore, what we need is a unifying analysis that takes into account all the relevant aspects and highlights the systematic patterns that emerge from the data.

4 The proposal

4.1 Morphosyntactic derivation

In section 2, we observed that certain allomorphic patterns are systematically associated with specific semantic and morphosyntactic features, whereas others may include nouns with different semantic/grammatical profiles. In particular, we noticed that (a) in Greek, the alternation *i* ~ *ið* is attested only in [+human, –feminine] nouns, while the *i* ~ *Ø* pattern has a much wider distribution (e.g. [–human]: *πλανήτης*, [+feminine]: *κόρη* 'daughter.F'); (b) in Hebrew, the vowel /u/ is related only with the feature bundle [–human, –concrete], while the vowel /a/ is found in a more heterogeneous group of nouns (e.g. [+human, +concrete]: *gamadá*, [–feminine]: *lájla* 'night.M'). In a nutshell:

(12) a. /ið/ → [+hum, –fem] e.g. *μανάβης*, *σερίφης*
b. /i/ → [±hum, ±fem] e.g. *ναύτης*, *πλανήτης, κόρη*

(13) a. /u/ → [–hum, –con, –fem] e.g. *xaverút*, *tarbút*
b. /a/ → [±hum, ±con, ±fem] e.g. *tikvá*, *gamadá*, *lájla*

In order to formalize these empirical observations, I will employ the theoretical framework of Distributed Morphology (DM; for an overview see, among others, Halle

[1] For various analyses of this alternation, which is out of the scope of this article, see Bat-El (1989), Faust (2013), Faust and Smolensky (2017), Markopoulos (2018).

and Marantz 1993, 1994, Harley and Noyer 1999, Embick and Noyer 2007, Siddiqi 2010). DM is a realizational model that dissociates the grammatical structure of a nominal or verbal form from its phonological manifestation. It maintains that what is traditionally called a "word" is a syntactic structure that includes (a) an *a-categorial root*, (b) a *categorizer*, i.e. *n*/*v*/*a*, which attributes to the root a nominal/verbal/adjectival status, and (c) a number of functional heads, which assign the relevant morphosyntactic features.

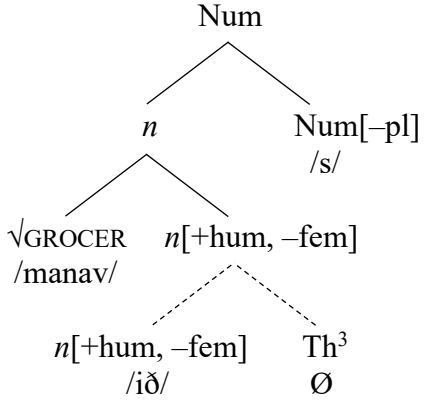
Furthermore, building on earlier work within the DM framework (Kihm 2005, Lowenstamm 2007, Kramer 2015, among others), I argue that, in nominal forms, gender does not head its own projection but instead it is hosted on the *n* node.[2] This means that different gender values are encoded as different featural specifications of *n* (e.g. *n*[+feminine], *n*[–feminine], etc.). What is different in the proposed analysis is that these featural specifications of *n* may also include semantic features such as [±human] and [±concrete]; as a result, *n* heads may combine both morphosyntactic and semantic information, e.g. *n*[+human, –feminine], *n*[–human, –concrete, +feminine], etc.

Finally, in line with Embick and Noyer (2007), I assume that, due to language-specific well-formedness restrictions, a *Theme* (Th) node may be inserted into the structure post-syntactically and attach to the *n* head. Crucially, this Th node concerns only the PF level and bears no morphosyntactic features whatsoever.

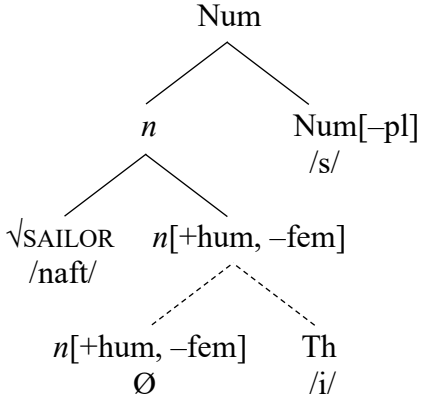
Based on the above, I take the segments/sequences /ið/, /i/, /u/ and /a/ to be the phonological exponents of *n* heads or Th nodes. More specifically, I put forth the claim that, as far as Greek is concerned, /ið/ is one of the exponents of the *n*[+human, –feminine] head, while /i/ is the realization of a Th node, given that it does not attribute to the noun any particular semantic or morphosyntactic features. Similarly, in Hebrew, /u/ is one of the phonological instantiations of *n*[–human, –concrete, +feminine], whereas /a/ is a Th exponent (see Faust 2013, cf. Schwarzwald 1982, Markopoulos 2018).

To exemplify, I posit the following syntactic structures (after head movement) for the singular forms *manávis* (14a) and *náftis* (14b):

(14) a.



b.



According to (14a–b), the linearized outputs of the morphosyntactic derivation in each case are /manav-ið-Ø-s/ and /naft-Ø-i-s/ respectively. On the one hand, with respect to /náft-Ø-i-s/, the analysis seems to accurately predict the attested form, but, on the other, in the case of /manav-ið-Ø-s/, the postulated representation contains phonological

[2] For further discussion on the representation of gender within the DM framework, see Markopoulos (2018) and references therein.

[3] The dotted lines indicate that Th is not part of the syntactic derivation and is inserted at the PF level after Spell-Out.

material (the consonant /ð/) that is not present in the surface form *manávis*. This raises the question what happens after the representation is delivered by morphosyntax to phonology.

4.2 Phonological computation

A recent grammatical model that simulates phonological computation and is suitable for capturing allomorphic phenomena is Gradient Harmonic Grammar (GHG; Smolensky and Goldrick 2016, Faust and Smolensky 2017, Zimmermann 2018, Revithiadou et al. 2019, among others). Like other Harmonic Grammar models (e.g. Legendre et al. 1990, Smolensky and Legendre 2006), GHG assumes that, for any given phonological input, the grammar generates an infinite number of outputs, which are evaluated by a set of *weighted constraints*, i.e. constraints bearing a specific weight value that determines their significance for the evaluation process.

What is different though in GHG is the hypothesis that the phonological input may include elements with a partial degree of presence in the underlying structure. This kind of gradient presence is formalized by means of *Activity Level* (AL), a numerical value that may range between 0 and 1 ($0<AL\leq1$). More precisely, there may be segments that are fully active and therefore have an AL equal to 1 and others that are only gradiently active and have an AL below 1 (e.g. 0.8). An example of such a "weak" segment is the consonant /$ð_{0.8}$/ in the underlying representation /manavi$ð_{0.8}$s/.

In order for an element to be pronounced, it must have (or reach) an AL value equal to 1. This means that fully active elements are always pronounced, whereas "weak" elements with AL<1 need to be provided with extra activity. This extra activity, however, comes at a certain cost, which is formalized as a violation of the faithfulness constraint DEP ('any amount of activity in the output must have a correspondent in the input'). Therefore, the phonological grammar needs to evaluate in each case whether it is preferable to "pay the price" and violate DEP or to leave the weak element unpronounced. Given that the latter option entails an additional penalty due to the violation of MAX ('any amount of activity in the input must have a correspondent in the output'), the choice may differ according to which constraint is violated in each environment. As an indicative example, the tableau in (15) illustrates the computation of the input /manavi$ð_{0.8}$s/:

(15)		/manavi$ð_{0.8}$s/	DEP	MAX	*CC]$_ω$	H
			weight: –5	*weight*: –3	*weight*: –3	
	a.	manaviðs	0.2 × (–5) = –1	0	1 × (–3) = –3	–4
☞	b.	manavis	0	0.8 × (–3) = –2.4	0	–2.4

The output *manaviðs* in (15a) violates DEP, since it requires 0.2 of extra activity for the realization of /$ð_{0.8}$/. This number is multiplied by the weight of the constraint (i.e. –5), yielding the penalty score –1. MAX is not violated, as opposed to the constraint *CC]$_ω$, which disallows consonant clusters at the right edge of the phonological word. The two penalty scores are added up to form a total well-formedness score called *Harmony* (H). The output with the highest H value is the one that is eventually selected. In this case, the output *manavis*, in which /$ð_{0.8}$/ is silenced, is preferred over *manaviðs*, because it receives a considerably lower penalty for violating MAX.

On the other hand, in environments where /$ð_{0.8}$/ is followed by a vowel, e.g. in the plural form /manavi$ð_{0.8}$es/, the realization of /$ð_{0.8}$/ is the most preferable option (16a),

because, among others, the resulting VV /ie/ sequence in the alternative output *manavies* would violate the constraint *VV, which militates against hiatus (16b):

(16)		/manaviðθ.8es/	DEP	MAX	*VV	H
			weight: –5	*weight*: –3	*weight*: –1	
☞	a.	manaviðes	0.2 × (–5) = –1	0	0	–1
	b.	manavies	0	0.8 × (–3) = –2.4	1 × (–1) = –1	–3.4

The same analysis applies to the other Greek and Hebrew cases. Th exponents are weak and are thus silenced in hiatus environments (e.g. /naft-Ø-$i_{0.7}$-es/ → *náftes*; /tikv-Ø-$a_{0.7}$-ot/ → *tikvót*), as opposed to the Hebrew *n* exponent /u/, which has an AL equal to 1 and, therefore, is pronounced in any environment (e.g. xaver-Ø-u_1-ot/ → *xaverujót*).[4]

5 Conclusion

To conclude, in this article I have argued that allomorphy is a complex phenomenon that, more often than not, concerns multiple levels of language processing. Therefore, any purely morphological, syntactic or phonological account is not able to capture all the relevant aspects. What I have proposed instead is an analysis that sheds light on both the morphosyntactic and the phonological operations that give rise to allomorphic phenomena. In particular, I have posited that the common allomorphic behavior of certain nouns stems from the fact that they share the same morphosyntactic structure, which, in some cases, is realized by phonological elements with a weak underlying representation. Due to their weak nature, these elements exhibit a ghost-like behavior, which yields the attested variation at the surface level.

References

Alexiadou, Artemis, and Gereon Müller. 2008. "Class Features as Probes." In *Inflectional Identity*, edited by Asaf Bachrach and Andrew Nevins, 101–155. Oxford: Oxford University Press.

Anastassiadis-Symeonidis, Anna. 2012. "Το Νεοελληνικό Κλιτικό Σύστημα των Ουσιαστικών και οι Τάσεις του [The Noun Inflectional System of Modern Greek and its Tendencies]." In *Selected Papers of the 10th International Conference of Greek Linguistics*, edited by Zoe Gavriilidou, Angeliki Efthymiou, Evangelia Thomadaki, and Penelope Kambakis-Vougiouklis, 23–40. Komotini: Democritus University of Thrace.

Arregi, Karlos, and Andrew Nevins. 2014. "A Monoradical Approach to Some Cases of Disuppletion." *Theoretical Linguistics* 40:311–330.

Bat-El, Outi. 1989. "Phonology and Word Structure in Modern Hebrew." PhD diss., University of California, Los Angeles.

Bolozky, Shmuel, and Ora Rodrigue Schwarzwald. 1992. "On the Derivation of Hebrew Forms with the +*ut* Suffix." *Hebrew Studies* 33:51–69.

Booij, Geert. 1997. "Allomorphy and the Autonomy of Morphology." *Folia Linguistica* XXXI:25–56.

[4] The intervocalic [j] that appears in the surface form should be considered epenthetic. The same hiatus resolution mechanism is attested also in other cases, e.g. *jaldutí* 'childish' → *jaldutijút* 'childishness' (Bat-El 1989: 139).

Embick, David. 2016. “On the Distribution of Stem Alternants: Separation and its Limits.” In *The Morphome Debate: Diagnosing and Analyzing Morphomic Patterns*, edited by Ana R. Luís and Ricardo Bermúdez-Otero, 276–305. Oxford: Oxford University Press.

Embick, David, and Morris Halle. 2005. “On the Status of Stems in Morphological Theory.” In *Romance Languages and Linguistic Theory 2003: Selected Papers from ‘Going Romance’ 2003*, edited by Twan Geerts, Ivo van Ginneken, and Haike Jacobs, 37–62. Amsterdam: John Benjamins.

Embick, David, and Rolf Noyer. 2007. “Distributed Morphology and the Syntax-Morphology Interface.” In *The Oxford Handbook of Linguistic Interfaces*, edited by Gillian Ramchand and Charles Reiss, 289–324. Oxford: Oxford University Press.

Faust, Noam. 2013. “Decomposing the Feminine Suffixes of Modern Hebrew: A Morpho-Syntactic Analysis.” *Morphology* 23:409–440.

Faust, Noam. 2014. “Where it’s [at]: A Phonological Effect on Phasal Boundaries in the Construct State of Modern Hebrew.” *Lingua* 150:315–331.

Faust, Noam, and Paul Smolensky. 2017. “Activity as an Alternative to Autosegmental Association.” Ms., Université Paris 8 and John Hopkins University.

Halle, Morris, and Alec Marantz. 1993. “Distributed Morphology and the Pieces of Inflection.” In *The View from Building 20: Essays in Linguistics in Honor of Sylvain Bromberger*, edited by Kenneth Hale and Samuel Jay Keyser, 111–176. Cambridge, MA: MIT Press.

Halle, Morris, and Alec Marantz. 1994. “Some Key Features of Distributed Morhology.” *MIT Working Papers in Linguistics* 21:275–288.

Harley, Heidi, and Rolf Noyer. 1999. Distributed Morphology. *Glot International* 4:3–9.

Harley, Heidi, and Mercedes Tubino Blanco. 2013. “Cycles, Vocabulary Items and Stem Forms in Hiaki.” In *Distributed Morphology Today: Morphemes for Morris Halle*, edited by Ora Matushansky and Alec Marantz, 117–134. Cambridge MA: MIT Press.

Kihm, Alain. 2005. “Noun Class, Gender, and the Lexicon-Syntax-Morphology Interfaces.” In *The Oxford Handbook of Comparative Syntax*, edited by Guglielmo Cinque and Richard S. Kayne, 459–512. Oxford: Oxford University Press.

Kramer, Ruth. 2015. *The Morphosyntax of Gender*. Oxford: Oxford University Press.

Legendre, Géraldine, Yoshiro Miyata, and Paul Smolensky. 1990. “Harmonic Grammar – A Formal Multi-Level Connectionist Theory of Linguistic Well-Formedness: Theoretical Foundations. In *Proceedings of the 12th Conference of the Cognitive Science Society*, 388–395. Cambridge, MA: Lawrence Erlbaum.

Lowenstamm, Jean. 1996. “CV as the Only Syllable Type.” In *Current Trends in Phonology: Models and Methods*, edited by Jacques Durand and Bernard Laks, 419–442. Salford: European Studies Research Institute.

Lowenstamm, Jean. 2007. “On Little *n*, Root, and Types of Nouns.” In *Sounds of Silence: Empty Elements in Syntax and Phonology*, edited by Jutta Hartmann, Veronika Hegedus, and Henk van Riemsdjik, 105–144. Amsterdam: Elsevier.

Markopoulos, Giorgos. 2018. “Phonological Realization of Morphosyntactic Features.” PhD diss., Aristotle University of Thessaloniki.

Ralli, Angela. 1988. “Eléments de la Morphologie du Grec Moderne.” PhD diss., University of Montreal.

Ralli, Angela. 1994. “Feature Representations and Feature-Passing Operations in Greek Nominal Inflection.” In *Proceedings of the 8th Symposium on English and Greek Linguistics*, 19–46. Thessaloniki: Aristotle University of Thessaloniki.
Ralli, Angela. 2005. *Μορφολογία* [Morphology]. Athens: Patakis.
Ralli, Angela. 2007. “On the Role of Allomorphy in Inflectional Morphology: Evidence from Dialectal Variation.” In *Open Problems in Linguistics and Lexicography*, edited by Giandomenico Sica, 123–155. Milano: Polimetrica.
Revithiadou, Anthi, Giorgos Markopoulos, and Vassilios Spyropoulos. 2019. “Changing Shape According to Strength: Evidence from Root Allomorphy in Greek.” *The Linguistic Review* 36:553–574.
Scheer, Tobias. 2016. “Melody-Free Syntax and Phonologically Conditioned Allomorphy.” *Morphology* 26:341–378.
Schwarzwald, Ora Rodrigue. 1982. “Feminine Formation in Modern Hebrew.” *Hebrew Annual Review* 6:153–178.
Siddiqi, Daniel. 2010. Distributed Morphology. *Language and Linguistics Compass* 4:524–542.
Smolensky, Paul, and Géraldine Legendre. 2006. *The Harmonic Mind: From Neural Computation to Optimality-Theoretic Grammar*. Cambridge, MA: MIT Press.
Smolensky, Paul, and Matthew Goldrick. 2016. “Gradient Symbolic Representations in Grammar: The Case of French Liaison.” [ROA-1286]. Accessed April 21, 2020. http://roa.rutgers.edu/content/article/files/1552_smolensky_1.pdf
Triantafyllidis, Manolis. 2012 [1941]. *Νεοελληνική Γραμματική (της Δημοτικής)* [Modern Greek Grammar (of Demotic)]. Thessaloniki: Institute of Modern Greek Studies.
Zimmermann, Eva. 2018. “Symbolic Representations in the Output: A Case Study from Moses Columbian Salishan Stress.” In *Proceedings of NELS 48*, edited by Sherry Hucklebridge and Max Nelson, 275–284. Amherst: GLSA.