

GRASSMANN'S LAW AND RULE ORDERING PARADOX IN GREEK

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In present and future forms of the verbs with diaspirate roots in Greek, the order of rules between Grassmann's law and deaspiration before *s* is sometimes reversed, presenting phonological problems in rule ordering. In this paper these ordering paradoxes are explained under the interpretation of dissimilation as a process governed by two universal conditions: 1) the consonants (or consonant clusters) should be sufficiently similar and 2) they should be sufficiently different from what comes in between. In the past these examples have necessitated ad hoc rules of relexicalization and aspirate throw back but the regularity shown by resolution of these paradoxes renders them unnecessary.

Keywords: Grassmann's law, deaspiration, rule ordering paradox, dissimilation, sufficient similarity, regularity.

1. INTRODUCTION

A rule ordering problem exists between deaspiration and Grassmann's law(GL) in Greek. Consider the future forms of the following diaspirate verbs:

present	future
peuthomai	peusomai "learn" (cf. IE **bheudh-*, Skt *bodhami*)
ekhō	heksō "hold"

The two diaspirate roots, *°pheuth-* and *°hekh-*, give different reflexes of the initial aspirate in the future forms. Traditionally, future forms such as Gk *heksō*< *°hekh-sō* has been explained

ISBN: 0 08 043 438X

by assuming a rule that deaspirates an aspirate if it is followed by an *s*; this rule precedes Grassmann's law blocking its application as in

hekhō	hekh-sō	
"	heksō	1. deaspiration (_s)
ekhō	"	2. GL

This established rule order, however, does not work for the pair pres.*peuthomai* fut.*peusomai* where the reversed order rather obtains; consider

pheuthomai	pheuth-somai	
peuthomai	peuthsomai	1. GL
"	peutsomai	2. deaspiration (_s)
"	peussomai	assimilation
"	peusomai	degemination

The same problem is also observed in the future forms of the following verbs:

present	future
teukhō "make"	teuksō <*theukh-sō (IE **dheugh* Eng *doughty*)
trekhō "run"	threksō <*threkh-sō

The IE root in Gk *teukhō* is *°dheugh-* (cf. Eng *doughty*; Gk *tithemi* Skt *dadhami* Eng *do* from IE root **dha-*), which also occurs in Gk *tunkhanō* "hit", with however a nasal infix (cf. 1 sg. fut. *teuksomai*) as in Gk *lambanō* (aor. *elabon*), while the IE root in Gk *trekhō* is *°dhregh* (cf. fut. *threpsō*). The two diaspirate roots exhibit different reflexes of the initial aspirate in the future forms.

In *threksō <*threkh-sō* the deasperation rule that deaspirates an aspirate before *s* should precede Grassmann's law to block its application;

threkhō	threkh-sō	
"	threksō	1. deaspiration
trekhō	"	2. GL

This order is, however, reversed in *teuksō< °theuhk-sō* where deaspiration should follow Grassmann's law to allow its application;

theukhō	theukh-sō	
teukhō	teukhsō	1. GL
"	teuksō	2. deaspiration

In this paper, I consider resolution of these problems in rule ordering under the principles of Theoretical Phonology, the phonological theory proposed by Prof. James Foley (1977). First

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presented are the two preferential conditions on dissimilation as interpreted in Foley (1981). Next, to resolve the ordering paradoxes, the rules of Grassmann's law and their interaction with the deaspiration rule are considered in conjunction with the principle of rule interruption. This is followed by explanation of some apparent counterexamples and conclusion.

2. CONDITIONS ON DISSIMILATION

In Theoretical Phonology, dissimilation is interpreted as a phonological process in which two noncontiguous consonants (or consonant clusters) become dissimilar when they are sufficiently similar (Foley 1981, p85):

$$C \S K / C^{-} \S K^{+} \qquad \text{where } |C - K| \leq d \text{ and } |C - \S| \geq D$$

In other words, in dissimilation the first of two sufficiently similar consonants weakens, while the second consonant strengthens in consonance with the strength conservation principle. In dissimilation of consonant clusters such as, for example, Gk *tithemi* <°*thithemi*, the above rule will first weaken the resonant in the first of two sufficiently similar consonant clusters, followed by elision of the weakened element in consonance with the *Inertial Development Principle* (IDP; Foley 1977 chapter 5) that weakening occurs preferentially to weak elements, as in

thithemi	
$th^{-}ith^{+}emi$	dissimilation: $C \S K / C^{-} \S K^{+}$
tithemi	elision: $h^{-}/\emptyset$ but h^{+}/idem

There are two conditions on dissimilation: 1) the two consonants (or the consonant clusters) should be sufficiently similar ($|C - K| \leq d$) and 2) both must be sufficiently different from whatever comes in between ($|C - \S| \geq D$). Arguments for these conditions follow.

2.1 The two consonants (or consonant clusters) should be sufficiently similar ($|C - K| \leq d$)

As the first argument for this condition, consider that in Greek, dissimilation occurs to identical consonants in preference to nonidentical consonants as in the reduplicated verb Gk *didraskō* <°*dri-dra-skō* but Gk *phratria*, although the first *r* drops in dialectal Gk *phatria* (Buck 1933, p38; Foley 1974, p142). This is because the extreme case of sufficient similarity is identity (i.e. $|C - K| = 0$); this preferential dissimilation rule as applying in standard Greek to identical *Cr* clusters then generalizes to include the less similar nonidentical *Cr* clusters in certain dialects of Greek, yielding Gk *didraskō* and Gk *phatria*. The universal rule is

$$C_1 r \, V \, C_2 r / C_1 \, V \, C_2 r \text{ where } |C_1 - C_2| \leq d$$

$d = 0$ for standard Greek
$d = 1$ for dialectal Greek

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In this rule the linguistic generalization from standard Greek to dialectal Greek occurs by increasing the value of the universal condition, $|C_1 - C_2| \leq d$, as in

$$d = 0 \rightarrow d = 1$$

Secondly, in certain compound words and in aor. pass. forms with *+then* and imperatives with *+thi* which are presumably of periphrastic origin (indicated here by the boundary +), Grassmann's law occurs to identical aspirates in preference to nonidentical aspirates. Examples of the former are: Gk *ekekheiria*<°*ekhe#kheiria*"holding of hands" but Gk *ekhethumos* "under self control" and Gk *ekhephron* "sensible", while the examples of the latter are: Gk *etéthen* <°*ethe+then* "was placed" (cf.*tithemi*), Gk *etúthen* <°*ethu+then* "was sacrificed" (cf.*thuo*) but *ekhú+then* and (in reversed direction) imper. Gk *sótheti* <°*so+the+thi*, Gk *lútheti* <°*lu+the+thi* but Gk *phá+thi*, Gk *gráphe+thi*. Grassmann's law in these examples occurs under a more restricted condition because one of the two aspirates occurs outside of the root, across the morpheme or word boundary.

The direction of dissimilation in the above aor. pass. and imperative constructions depends on the environment of the two similar consonants: of the two identical aspirates, the one that occurs after an unstressed vowel deaspirates by Grassmann's law as in *etéthen, etúthen* with deaspiration of the first aspirate but *sótheti, lútheti* with deaspiration of the second aspirate. This is because in consonance with the IDP that weakening occurs preferentially in weak environments, the aspirate after an unstressed vowel is more likely to weaken by the above dissimilation mechanism. In Gk *orthóthen* "was set upright", I assume that the rule does not occur because the first aspirate, though it occurs after an unstressed vowel, is not in post-vocalic position. Other anomalies of Grassmann's law in Greek aor pass. and imperative forms such as Gk *ekathárthen* "was purified" and Gk *tethnathi* where *th § th/idem* are explained under the second condition on dissimilation (see below).

2.2 The two consonants (or consonant clusters) must be sufficiently different from what occurs in between ($|C - \S| \geq D$)

As an argument for this condition, note that the liquid differentiation in Latin, which converts the adjectival suffix °*-alis* (cf. Lt *regalis*) to *-aris* if the stem contains another *l*, occurs when a vowel intervenes between the two liquids as in Lt *regularis*<°*regul-alis*, when a nasal consonant intervenes as in Lt *lunaris* < °*lun-alis* (cf. Lt *luna* "moon"), but not when another liquid intervenes between them as in

Lt *floralis*, not ¢*floraris*
Lt *pluralis*, not ¢*pluraris*
Lt *liberalis*, not ¢*liberaris*

This is because the intervening liquid *r*, in its effort to dissimilate with one of the neighboring liquids under the first condition ($|C - K| \leq d$), interferes with dissimilation of the two identical liquids, blocking its application. It follows from this observation that the more dissimilar the

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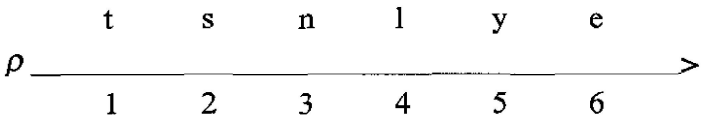
two consonants are to what occurs between them, the more likely they are to dissimilate. Hence the condition, $|C - \S| \geq D$. This condition stipulates that in dissimilation of consonants a dissimilation rule in a language would typically and preferentially occur when a vowel intervenes between the consonants (because consonants are more different from a vowel than another consonant), and then generalize to include cases where a consonant intervenes, the preferentiality of rule application in such cases being determined by the dissimilarity between the two consonants and the intervening consonant on phonological parameters. In the above Latin liquid differentiation, for example, since *l* and *r*, which are both liquids, are more similar than *l* and *n* or *l* and a vowel on the ρ phonological parameter (Foley1977, p48)



(*t* represents stops, *s* continuants, *n* nasals, *l* liquids, *y* glides, and *e* vowels)

the dissimilation of identical liquids occurs in Lt *regularis*, Lt *lunaris* but not in Lt *floralis*. Similarly, note that Grassmann's law as applying to identical aspirates in aor. pass. Gk *etéthen* <°*ethe*+*then* and imper. Gk *sótheti* <°*so*+*the*+*thi* is blocked in Gk *ekatharthen* and Gk *tethnathi,* for unlike the former, a consonant intervenes between the two identical aspirates in the latter examples.

3. RESOLUTION OF THE PARADOX

The above ordering paradoxes can be easily resolved if we consider preferential dissimilation under the above conditions on dissimilation, and the principle of rule interruption as proposed in Foley (1977), which says that partially identical rules can be interrupted by another phonological rule. For example, we can resolve the first paradox by referring to the similarity condition. Since Grassmann's law is essentially a dissimilation between two consonant plus glide clusters, such a rule would naturally apply first between two aspirated consonants (i.e. *Ch § Ch*), then generalize to include cases such as *h § Ch* where the two aspirates are less similar, in the order as stipulated by the above similarity condition $|C\text{-}K| \leq d$:

1) Ch § Ch / C § Ch (|C-K|=0)
2) h § Ch / Ø § Ch (|C-K|=1)

Between these two ordered rules, however, interrupts the rule that deaspirates an aspirate before an *s*

hekhō	hekh-sō	pheuth-somai	
"	"	peuthsomai	1)preferential GL: Ch § Ch/C § Ch
"	heksō	peutsomai	deaspiration

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ekhō	"	"	2)generalized GL: h § Ch/ Ø § Ch
"	"	peusomai	MR (miscellaneous rules)

which gives a theoretically well motivated solution to the above problem of rule ordering paradox.

Similarly, the second ordering paradox can be easily resolved under the above condition on dissimilation that the two consonants (or consonant clusters) be sufficiently different from what intervenes in between. Although Grassmann's law occurs in both Gk *teukhō* <°*theukhō* and Gk *trekhō* <°*threkhō*, it occurs earlier in the former than the latter under the above condition $|C\text{-}\S| \geq D$, because a consonant intervenes between the two aspirates in the latter

1) Ch § Ch / C § Ch where § contains vocalic elements only (°theukhō/teukhō)
2) Ch § Ch′/ C § Ch where § contains a consonant (°threkhō/trekhō)

As in the preceding derivation, interrupting the deaspiration rule between these two ordered rules of Grassmann's law yields the correct reflexes

theukhō	theukh-sō	threkhō	threkh-sō	
teukhō	teukhsō	"	"	1) preferential G. L.
"	teuksō	"	threksō	deaspiration
"	"	trekhō	"	2) generalized G. L.

again giving a well motivated solution to the problem of ordering paradox.

Like pres.*trekhō*, fut.*threksō* in Greek are

pres. *trephō* fut. *threpsō* "nourish"
gen. *trikhos* nom. *thriks* "hair"

whereas examples like pres. *teukhō* fut. *teuksō* are

pres. *peithō* fut. *peisō* "persuade" (IE **bheidh*-, cf. Lt *fidō*, Eng *bide*)
pres. *peuthomai* fut. *peusomai* "learn" (IE**bheudh*-, cf.Skt *bodhami*)

An alternative form of Gk *peuthomai* with the same meaning is Gk *punthanomai*, occurring with a recent vocalism and a nasal infix as in Gk *tunkhanō* (cf.*teukhō*). Since these nasal infixed presents are derived by metathesis of the nasal increment as in Lt *tangō* <°*tag-n-ō* (cf.Lt *tactus* <°*tag-tos*), whether the application of Grassmann's law in these forms is preferential or generalized is a moot question; but their future forms are like the above fut. *peisō* and fut.*teuksō* because they occur without the nasal infix:

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present	future
punthanomai	peusomai "learn"
tunkhanomai	teuksomai "hit"

On the other hand, since early assibilation of the aspirate before yod in Greek (Buck 1933, p140; Foley 1977, p94) as in Gk *glotta* <°*glokh-ia* (cf. Gk *glokhis*) blocks (generalized) Grassmann's law, the diaspirate roots that occur with the suffixal yod generally retain the initial aspirate in Greek. If such roots contain a consonant between the two aspirates, they will also retain the initial aspirate in the forms with the suffixal *s* as in the above fut.*threpsō* <°*threph-sō*, while their first aspirate will deaspirate by the generalized Grassmann's law in the forms without such suffixal yod or *s*. Consider

pres. *thruptō* "enfeeble"	fut. *thrupsō* beside *truphé* "delicacy"
pres.*thrattō* "disturb"	aor. *ethraksa* beside *trakhus* "rough"

4. APPARENT COUNTEREXAMPLES

In view of the above analysis, the following diaspirate verbs are problematic in Greek:

pres. *thaptō* "enfeeble"	fut. *thapsō* (cf.*taphos* "tomb")
pres. *tuphō* "smoke"	fut. *thupsō*, aor. pres. *thupsai*
pres. *ekhō* "have"	fut. *heksō*

Although these verbs appear to be like the pair pres.*teukhō*, fut.*teuksō* in that no consonant intervenes between the two aspirates, their future forms (and also aor. pres. *thupsai*) behave like the pair pres.*trekhō*, fut.*threksō* in that they all retain the initial aspiration.

Of the above three, fut.*heksō* had already been explained while discussing the first condition on dissimilation (*i.e.* $|C - K| \leq d$). We only need to mention in addition that since the IndoEuropean root in this verb is **segh-* as occurring in its reduced form in the reduplicated present Gk *iskhō* <°*si-skh-ō*, the anomalous retention of the initial aspirate in fut.*heksō* can also be explained by ordering preferential Grassmann's law before the asperation rule; the subsequent deaspiration of the second aspirate by the following *s* would then block the generalized Grassmann's law in fut.*heksō*, though not in pres.*ekhō* and pres.*iskhō* as in

sekh-ō	si-skh-ō	sekh-sō	
"	"	"	preferential G. L.
hekhō	hiskhō	hekhsō	aspiration: s/h (#__)
"	"	heksō	deaspiration
ekhō	iskhō	"	generalized G. L.

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The generalization here is two-fold; First the preferential Grassmann's law that applies between two consonant clusters (i.e. aspirated consonants) under the condition $|C - K| \leq d$, generalizes by increasing the value of the condition so that *h* and *Ch* (which are not as similar to each other as consonant clusters than *Ch* and *Ch*) could undergo dissimilation as well. Second, the preferential Grassmann's law that applies when a vowel intervenes between the two aspirates (because a vowel and a consonant are sufficiently different from each other) under the condition $|C - \S| \geq D$, generalizes by decreasing the value of the condition so that the two aspirates could also undergo dissimilation when a consonant intervenes between them. Note that both of these generalizations are applicable to Gk *iskhō* <°*hiskhō* as well as to Gk *ekhō* <°*hekhō*, because the value of a universal condition set for a generalized application of a phonological process always includes the value of the same condition that would be set for its preferential application, due to the inclusive nature of universal inequality conditions. For example, $d = 2$ set for the condition $|C - K| \leq d$ would automatically include the smaller values $d = 1$ and $d = 0$, while $D = 2$ set for the condition $|C - \S| \geq D$ automatically includes any values greater than the set value, i.e. $D = 3$, $D = 4$, etc.

The remaining two verbs are similarly explained, by considering the historical development of these forms from IndoEuropean. For example, the IE root in pres.*thaptō* and fut.*thapsō* is **dhembh-* (cf.Armenian *damban* "grave") where the nasal intervenes between the two aspirates. This radical nasal is to be distinguished from the suffixal nasal that also often occurs between aspirates as in Gk *tunkhanō* <°*theukh-nan-ō*; the former disappears within the root by nasalization with the preceding vowel followed by denasalization as in Gk *hekaton* <°*he-kentom* (cf. Lt *centum* "hundred"; see Foley 1977, Chap 4 for explanation of nasalization) but the latter moves inside the root (after the above nasal loss because the nasal remains in Gk *tunkhanǭ*) by metathesis with the preceding consonant as in Lt *tangō* <°*tag-n-ō*. The preferential Grassmann's law which precedes the above nasal loss cannot occur in Gk *thapsō* <°*themph-sō* because the second condition $|C - \S| \geq D$ is not met, while the generalized Grassmann's law is blocked by deaspiration of the second aspirate by the following *s*. Compare the following derivation;

theukh-sō	themph-sō	
teukhsō	"	preferential GL
"	thaphsō	nasal loss (by nasalization and denasalization)
teuksō	thapsō	deaspiration
"	"	generalized GL

Perhaps presence or absence of the same internal nasal is responsible for the different reflexes of the initial aspirate and the following vowel length in *thāsson* < °*thaŋkh-ion* "swifter" (cf. Gk *takhus*) but *păsson* < °*phakh-ion* "thicker" (cf. Gk *pakhus*), even though more work needs to be done to justify the underlying form of the latter. The radical nasal which blocks preferential GL in the former lengthens the preceding vowel when it is followed by *s*, as in *pāsa*< °*pantia* "whole" (cf. Lt *dens*[dēs] "tooth"; Buck 1933, p141; Foley 1977, p62).

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Unlike Gk *thapsō*<°*themph-sō*, the failure of preferential Grassmann's law in Gk *thupsō* (and also Gk *thupsai*) cannot be attributed to a similar intervening nasal, for there is no convincing comparative evidence that its IE root had an underlying inherent nasal between the aspirates. Rather, we seek its explanation by considering the derivational history of the diaspirate root. Traditionally, the IE root in pres.*tūphō*, fut.*thūpsō*, and aor.pres.*thūpsai* is considered to be **dhū-bh* (or **dheu-bh* in some etymological dictionaries), extended from the IE root **dhū-* (or *dheu-*) as occurring in, for example, Gk *thūmos*<°*dhū-mos* "soul" (cf. Lt *fūmus* "smoke"). In terms of word formation, this means that the extended root **dhū-bh* has joined the class of diaspirate roots late, certainly later than those such as **dheugh-* (cf. pres. *teukhō* fut.*teuksō*) where both aspirates are of radical origin, and presumably after the preferential Grassmann's law had already occurred in Greek as in

theukh-sō	thū-ph-ō	thū-ph-sō	
teukhsō	"	"	preferential GL
teuksō	"	thupsō	deaspiration
"	tūphō	"	generalized GL

5. CONCLUSION

The above analysis covers just about all the examples of GL in Greek that have previously been considered to be problematic. As Collinge (1985) has noted, presence of such examples has baffled linguists for many years and some were forced to deny the very existence of the law. Others like Kiparsky (1973) have resorted to separate rules of aspirate throw back and relexicalization. The above analysis shows that at least in Greek there is no need to assume such ad hoc rules since application of Grassmann's law can be analyzed as perfectly regular, as observing the same preferential conditions that constrain the phonological process of dissimilation universally.

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