Metathesis, Deletion, Dissimilation and Consonant Ordering in Proto-Greek

Betsy McCall, Cleveland State University

Abstract

This paper examines changes that occurred in sequences of stops and sequences of nasals, including metathesis, deletion, assibilation and assimilation. These changes in the development of Proto-Indo-European into the dialects of Ancient Greek are shown to be unified through the influence of two processes. The first of these processes is the ordering of stop-stop and nasal-nasal clusters in terms of their place features, so that only those in which the jaw height rises through the cluster are permitted: dorsal-labial, dorsal-coronal, and labial-coronal. The second process is one of morphological identity, whereby features of a stem morpheme are favored and preserved over affixal features, particularly as this regards place assimilation processes. Beginning with the historical, reconstructed changes of Proto-Greek, this paper will follow these processes through time and examine the synchronic impact on various stages of Greek, and the status of the consonant-ordering process into the Modern language.

Metathesis, Deletion, Dissimilation and Consonant Ordering in Proto-Greek[*]

Betsy McCall, Cleveland State University
ejuliam@hotmail.com

1 Introduction

Greek is one of the longest attested languages on Earth and belongs to the Indo-European family of languages. Proto-Indo-European is the most widely reconstructed proto-language, and while some problems yet remain, meaningful comparisons between parent and daughter languages are possible. Several changes in sequences of stops and nasals have taken place between the reconstructed parent language (Proto-Indo-European) and the daughter language Greek. These changes include the resequencing of the consonants (metathesis), loss of one of the consonants (deletion), regressive assimilation of one of the consonants, or the change of one of the consonants into a consonant of a different type (assibilation). Seemingly, these changes are unrelated, but I will show that the various changes in sequences of stops or nasals in the evolution of Greek are related to each other, and result largely from the interaction of a constraint on the sequence of place features in such a cluster, and morphological identity properties of stems. I will show how these processes affected the evolution of Proto-Greek into Ancient Greek as well as how these processes affected the Ancient dialects in different ways. I will finally show how the constraint on sequences of stops or nasals is still at work in the modern language.

In previous descriptions of Ancient Greek, typically, there two possible approaches. One approach common in diachronic treatments of Ancient Greek is the description of changes that separate Greek from Proto-Indo-European. Here, the changes in these sequences of stops or nasals have been noted, as in Sihler (1995), but have been given as separate changes. In some cases determined by place features or by a certain amount of randomness, having no connection to each other whatever. An approach used in synchronic accounts of the Ancient Greek dialects is best represented by Bubenik (1983) in which stop-stop sequences or nasal-nasal sequences are noted and itemized, but no systematic attempt is made to explain why some sequences appear but not others. Without the historical data, though, there may be no reason to suspect an explanation is needed.

In both the synchronic and diachronic case, the dialects of Ancient Greek permit only three types of place sequences in stop-stop or nasal-nasal clusters: dorsal-labial, dorsal-coronal, labial-coronal. Only these three are permitted, even though others also occur in our reconstructions of Proto-Indo-European. What unites these sequences? In some synchronic phonological accounts such as those involving feature trees (Kenstowicz 1994), the dorsal feature is considered the most-marked, with the most tree structure required to express it in the grammar. Coronal is the least-marked as the default, structureless tree. Labial come between these. In these accounts, the consonant clusters that are permitted have the more marked (or most structure) of the two consonants first, the lesser marked (or less structure) second. The clusters that are not permitted in Greek are inverses of the marked-unmarked occurring clusters, with an unmarked consonant preceding a more marked one: coronal-labial, coronal-dorsal, or labial-dorsal. A structural

[*] My thanks go to Samuel Obeng, Ken De Jong and other members of the Indiana University Linguistics Department for their helpful comments on this paper. I would also like to thank the attendees at the 11th Annual UCLA Indo-European Conference for their comments on my presentation of this paper. Finally, particular thanks go to John McCarthy of U. Mass. and Beth Hume of Ohio State University for their encouragement and their advice on the theoretical aspects of this paper.

account of markedness makes some phonological sense in that a feature tree with less structure should not replace a tree with greater structure. This is a mere phonological stipulation since the hierarchy used in Indo-European assimilation is not universal. Some independent feature is needed to make the behaviour more universal. While this cannot yet explain the grouping of these consonants, it will give us a way to discuss the clusters until §5.

Diachronically, these unmarked-marked sequences that did occur in Proto-Indo-European are systematically eliminated. Synchronically, here too, all non-marked-unmarked sequences are avoided even with morpheme concatenation and neologisms. The phonological outcome of such inputs are determined by their place inside or outside a morphological stem, and whether any affix involved is prefixal or suffixal. These processes, morphological and phonological, when taken together, are capable of explaining a large portion of the data which before seemed only random.

2 The Changes

Sihler (1995) begins his discussion of groups of consonants with changes in sequences of two stops. In many of these cases, as shown in Table 2.1, the sequences of stops undergo laryngeal assimilation only, leaving the place features and more fundamental manner features unchanged. Laryngeal assimilation, as described in Steriade (1982), occurs in all contexts where two stops come together, but in all those cases where *only* laryngeal assimilation occurs, the place sequences within the stop-stop clusters conform to a dorsal-labial, dorsal-coronal, or labial-coronal (or marked-unmarked) sequence.

In the data given in Table 2.2, place assimilation occurs in these stop-stop sequences. In these cases, the labial or dorsal stop is preceded by a coronal stop. Without place assimilation in these cases, a sequence of place features would be generated in a stop cluster that involves a coronal-dorsal or coronal-labial sequence. While a seemingly trivial observation, place assimilation does not always occur in other morphological contexts. These place sequences are exact inverses of permitted place feature sequences that remain unchanged in the data in Table 2.1, reflecting an unmarked-marked order. This observation will be crucial to the analysis discussed below.

Even a series of three stops in sequence is permissible, as long as any sequence of two stops agrees with the dorsal-labial, dorsal-coronal, labial-coronal patterns that are allowable elsewhere in the data, reflecting the marked-unmarked pattern. In short, the only pattern of three place features that can occur in sequences of stops is the dorsal-labial-coronal sequence seen in 2.1.k.

None of the changes exemplified by the data in Tables 2.1 and 2.2 are particularly unusual, and are quite common to the assimilatory changes seen in a fellow Indo-European language like Latin. These examples are given in Table 2.3. Like the Greek cases, a dorsal stop that precedes a labial or a coronal stop remains unchanged but for laryngeal assimilation. Likewise for a labial stop that precedes a coronal stop. However, the inverses of these place sequences (coronal-labial, coronal-dorsal, or labial-dorsal) trigger not only voicing assimilation, but also place assimilation. Examples reflecting a labial-dorsal sequence are not common in Greek, and represent a potential gap in the data Latin does not have.

For four of these clusters (those containing coronals) and the most common of them, one might attribute this behaviour to the often observed “specialness” of the coronal, its lack of markedness or some other factor particular to the coronal feature that might generate this type of behaviour. However, an appeal of this type cannot explain a similar differential between the dorsal-labial and labial-dorsal sequences. There is a great deal of controversy regarding the

relative markedness of these two place features. Which reflects the marked-unmarked pattern, and which the unmarked-marked? In Greek, based on its behaviour, the answer to this question is that dorsal is more marked, but in Korean, there is little or no evidence of a difference as sequences of [pk] and [kp] both remain unchanged where coronals preceding either exhibit assimilation (Martin 1992). This is where the structural analysis breaks down because structure trees are designed to work cross-linguistically. I will present an alternative analysis to the relationship between these clusters in §5.

Not all sequences of stops from Proto-Indo-European are corrected in the same way in Proto-Greek. While the data in Table 2.2 show that coronal-dorsal sequences such as *tk may undergo place assimilation and result in [kk] in Ancient Greek, this is not the only possible corrective strategy employed in the phonological development of the Proto-Greek period. Another possible development is the metathesis of the two segments resulting in the preferred [kt] sequence as shown for the data in Table 2.4. Why this differential behaviour? Does this reflect different periods of change, or is there some other explanation? Table 2.4 does show that the coronal-dorsal sequence is corrected both with plain dorsals (velar or palatal) as well as the labial velars. In 2.4.e, it is crucial that metathesis occur before the development of the labial velars into labials, coronals or dorsals. Without this ordering of changes, the following vowel would predict a coronal should arise from this labial-velar and not the labial dictated by being pre-consonantal.

Another possible outcome in both Proto-Greek and Ancient Greek is deletion. This corrective strategy is used less frequently than either place assimilation or metathesis. However, since it does occur, it is a phenomenon that should be addressed. The data for the deletion is given in Table 2.5. I have given both forms that occur for the perfect of πειθω 'persuade'. The form that occurs with the o-grade ablaut is older, and arises historically from a perfect ending consisting of alpha only, where the initial kappa is a consonantal glide between vowels. However, the newer form with the kappa arises after the [-ka] perfect had been well-established and apparently reanalyzed. It is in this later form that the deletion analysis is especially relevant because we might expect place assimilation otherwise. I will show deletion is well-motivated in the newer form and allows us to make this form less irregular.

In the cases of deletion in Table 2.5, as in the cases of metathesis and assimilation, sequences of coronal-dorsal, or labial-dorsal are the place sequences that are being eliminated. Compare the acceptable sequence of three stops in 2.1.k. with the disallowed sequence of stops in 2.5.a that is eliminated in Proto-Greek. The examples in Table 2.5 reflect the disallowed unmarked-marked sequences, while 2.1.k reflects a stable marked-unmarked sequence.

As I mentioned above, it is not just sequences of stops that obey this restriction on the order of place features within the cluster. Sequences of nasals also obey the restrictions, united to stop-stop sequences by being oral stops that don't change manner of articulation midstream. These nasal-nasal clusters are abundant in Ancient Greek because of a process of spreading the nasal feature. Sihler (1995) describes this process as applying in environments that are somewhat random in nature, but that the outcome when it happens to apply is predictable. In Table 2.6, I have given examples where the process of nasal spreading has applied. As one can see, the kinds of place sequences allowed to arise in these cases where there is a difference in place feature, seem to follow the dorsal-labial, dorsal-coronal, labial-coronal pattern seen previously in stop-stop sequences.

While we see no place assimilation in these cases where there were historical stops, what about other nasal-nasal contacts? This data is given in Tables 2.7 and 2.8. In some instances, nasals are assimilated to the place of a following nasal as shown in Table 2.7. In these cases, as

with the stop-stop clusters, coronal nasals preceding nasals of any other place are eliminated in the output. Nasal-stop clusters always show regressive place assimilation in Greek, but this is an issue aside from the topics discussed here.

In Table 2.8 neither the place assimilation takes place nor the nasal feature spreading. In these examples, the sequence of a coronal nasal followed by a labial nasal are also eliminated, but instead of spreading the place feature to the coronal nasal, creating two labial nasals as in 2.7.b, the nasal is replaced with a coronal fricative, thereby persevering the place of the coronal segment, and still avoiding the coronal-labial sequence in the nasal series.

The puzzling part of this is the difference between 2.7.c and 2.8.a . While dialect variation can explain having two different outcomes, the reason why the nasal becomes a fricative in this case remains an open question.

Sihler (1995) asserts that this change of the coronal nasal to a coronal fricative in Table 2.8, when it occurs before a labial nasal, is the result of analogy with the behaviour of coronal stops that occur before other coronal stops (which also become fricatives, but which I will not discuss here). This change, however, need not be due to analogical processes. In Table 2.9, I have given the results of historical coronal stops followed by labial nasals. These, like the coronal nasal examples in Tables 2.7 and 2.8, show dialect variation. Compare these results to the results of non-coronals in the same environments as shown in Table 2.6. While the nasal feature may spread to non-coronal stops, the nasal feature never spreads to coronal stops, though the assibilation may occur as with the historical coronal nasal. Are these behaviours related, and if so, how?

Nasal features cannot spread here because it generates a nasal-nasal cluster of the unmarked-marked type. One method of preventing such a cluster from arising is to prevent the nasal feature from spreading. However, if the nasal feature did spread in a linear phonological analysis, the cluster would need corrected. In this second case, the outcome might predictably look like the results in Table 2.8.

Despite the seemingly contradictory behaviours, these changes that developed in Proto-Greek can be reduced to some common factors. The first of these is that all of these situations involve historical stop-stop or nasal-nasal sequences, or involve the potential generation of such sequences. The second of these is the place feature consideration I have been discussing. When dorsals precede labials or coronals, or when labials precede coronals, the consonants are more stable; i.e. the preservation of historical or underlying place features are more likely when a marked place feature precedes an unmarked one. This agrees with a structural approach. When the place features are the inverse of any of these, that is coronals precede either labials or dorsals, or labials precede dorsals, then the consonants are more unstable when an unmarked place precedes a marked one. The corrective strategies employed vary, but these two factors are constant throughout the data. However, there is a third factor that affects the choice of corrective strategy, and that is the morphology. I will discuss this in §3.

3 Morphological Effects on Changes in Stop-Stop and Nasal-Nasal Clusters

Let us review the data in §2 and look at where these changes occur. In this section I will summarize the changes that occur in the morphological units of stem, prefix, and suffix. As one will see, the changes that occur depend in large part on the morphological relationship of the segments that are interacting. Not all types of corrective strategies are employed in all environments.

When both of the interacting stops occur within the stem, and not across morpheme boundaries, only two types of strategies are employed. Metathesis is the usual outcome within stems, and it may never occur at morpheme boundaries. Metathesis may be preferred because place assimilation would serve to eliminate phonological contrast in roots, and thus semantic contrast as well. Deletion, however, is employed in the case of an initial three-stop sequence, so avoiding initial gemination might lead to deletion anyway. An initial three-stop sequence is otherwise unknown in Greek, so metathesis would not affect an effective repair. Thus, deletion here might be responding to other pressures, but appears to be a choice of last resort. Because these two outcomes are responding to the same pressures, these different outcomes need not reflect different periods of change.

When prefixes and stems meet, two possible changes may occur. Place assimilation occurs when the final consonant of the prefix is a coronal, and the first consonant of the stem is a stop or a nasal of some other place feature. Voicing assimilation occurs when the final consonant of the prefix is a stop, and the initial consonant of the stem is also a stop. Such stop-stop clusters generated at morpheme boundaries undergo voicing assimilation everywhere. Nasal features do not spread from stem to prefix, so these situations result in no new nasal-nasal cluster and no change. There is also no deletion in a sequence of three stops in 3.5.a. This is the only series of three stops with independent place features that meets the Greek pattern of marked-unmarked places in a stop cluster.

In suffixes, there are more changes underway as there are more suffixes and thus possible types of sequences arising from morpheme contact. Compare Tables 3.6 and 3.7. Nasal feature spreading from a suffix-initial nasal is nearly mandatory in Ancient Greek, particularly for suffixes beginning with a labial nasal. This is subject only to specific exceptions, such as a preceding coronal. This is true for verbal suffixes like {-μαι} and {-μενος} as well as nominal suffixes like {-ματ-}. Nasal spreading may also occur within a stem, but here it is not very consistent in its application. Voiced stops are more likely to undergo the nasal spreading, or as with the example in 3.7.a, may be possible when a word may be morphologically reanalyzed or suffer analogical change.

Another possible change that takes place at stem-suffix boundaries is the widespread laryngeal assimilation. This data is given in Table 3.8. As mentioned previously, laryngeal assimilation occurs in all such clusters regardless of morpheme affiliation.

The data in Tables 3.9 and 3.10 illustrate the process of assibilation. The outcome of these historical inputs differs by dialect, by era, and by author. The unassibilated forms are typical of older and non-Attic dialects. In these cases, the place feature of a suffix-initial labial nasal assimilates a stem-final coronal nasal, but leaves stem-final coronal stops unchanged. The coronal-labial sequence in a nasal-nasal cluster is thus eliminated or prevented from arising by not spreading the nasal feature onto the coronal stop. In the latter case, this allows the historical place feature to remain in the stem.

The assibilated forms are typical of Attic and later texts. In these cases, those stems with coronal-nasals finally preserve the coronal feature, while still eliminating the coronal-labial place sequence in a series of nasals. Those stems that end in coronal stops undergo the assibilation either by analogy, or else, in a linear, rule-based approach, undergo the nasal-spreading before undergoing the assibilation process. The latter analysis would allow the coronal stops to behave more in line with the non-coronal stops by then also being subject to the nasal spreading process, even if the nasalization is then later removed.

The common feature in these two cases is the need to preserve underlying place in the stem. The difference between the early Ionicized dialects and the later Attic dialects is the assibilation. Despite the similarities of Attic and Ionic dialects, and though Attic is later in time, Attic should not be considered a direct descendant of the dialect of the older Homeric texts. Because of the gap in our texts, and the well-known Ionicization common to early Attic authors, we need not assume that the assibilation of coronal stops before labial nasals directly arose from coronal stops. Rather, a spoken dialect with assibilation the result of a more general nasal spreading, akin to that seen in non-coronals is also possible, but whose outcome only appeared in writing after the change had been completed, masking its likely source.

The last behaviour seen at stem-suffix boundaries is shown in Table 3.11. Deletion occurs at the stem-suffix boundary only in the perfect active, and the cases can de difficult to make. The deletion of the stem-final consonant is typically seen with stems ending in coronal-stops, and which do not undergo ablaut in the perfect, as if the dorsal stop of the suffix is needed to mark the perfect clearly. In these perfect cases, when the dorsal stop is preserved from the suffix, the stem-final stop never remains, and never undergoes place assimilation. This resistance to place assimilation is consistent with other stem-final coronal observations.

Based on these observations, in a historical or linear phonology, we can say that nasal spreading must occur before assibilation in the Attic-type dialects where assibilation occurs both in coronal stops and in coronal nasals. However, the assibilation rule is absent in Ionic-type dialects that undergo place assimilation where a coronal nasal and a labial nasal meet at the stem-suffix boundary. In these Ionic-type dialects, the nasal spreading rule is limited to non-coronals.

Alternatively, in a constraint-based approach, such as Optimality Theory, one can say that there is a high-ranked constraint determining the sequence of stop clusters, followed by another constraint against spreading place features into a stem. In other words, this second constraint is a strong identity constraint for place features in a stem. In the Ionic-type dialect, an identity constraint for nasals is ranked higher than the morphological identity, and so the place feature is spread in order to preserve the nasal feature, but still obey the place-sequencing constraint for stops. In the Attic-type dialect, the nasal identity constraint is not so highly ranked, so the nasal is sacrificed in favor of preserving the place feature. A potential flaw in this analysis is that morphological identity constraints are somewhat controversial, but this Greek data may provide good evidence for such a constraint. The outcome of the coronal stops would be determined by other constraints, but the basic principle remains the same. I do not wish to use this paper to argue strongly for a constraint-based analysis over the linear approach, but I will discuss the constraint-based approach further below, as well as the implications of the place sequencing constraint for phonology in general.

4 Relevance to Modern Greek

Modern Greek developed from Koine, and inherited some of the traits discussed for Proto-Greek and Ancient Greek. One of these that played a role in specific developments of Greek is the tendency to order consonant clusters with no sonority slope (such as stop-stop or nasal-nasal clusters) in terms of their place features. In Ancient Greek, these included only sequences of two stops, or two nasals. However, as Greek developed, some of these clusters changed. The voiceless aspirated stops became voiceless fricatives. In some cases, a series of these stops became a fricative and a stop. Voiced stops became a series of voiced fricatives. Where no other changes occurred around them, the order of the place features in these clusters remained

constant, but when these clusters immediately followed the loss of an initial vowel, the cluster suffered metathesis.

Table 4.1 shows some Modern Greek data with a series of initial voiced fricatives and the Greek Koine forms from which they have developed. In part, because of the metathesis in these words, fricatives, even though they have developed from stops that did obey the place sequencing constraint, now no longer do. Other stops and nasals, which did not undergo any articulatory changes, continue to obey the sequencing constraint.

One question that arises in the phonetic consideration of this relationship between vowel loss, place ordering and historical metathesis, is certainly how are these made to act together? One possible answer to that comes from an argument from phonetics which says that consonant sequence timing is tied to the preceding vowel. Because of this, the place sequencing constraint operating over this leftward-timed consonant cluster, would likewise be timed to the leftward vowel. When this leftward vowel is lost, the timing has no choice but to be timed now to the rightward vowel. This shift may drag the sequencing of the consonant places along with it, and in time be reanalyzed as no longer being part of the place-ordering environment at all. It is a tempting connection, but one that will have to be tested with additional research.

5 Articulatory Basis of the Place-Ordering Principle

Much of the discussion up until now has been based on the reality of a principle that requires place features in certain consonant clusters to arrange themselves in a particular way. I have described this as a marked-unmarked order which is preferred because of the assimilation patterns. When unmarked precedes marked, assimilation follows. However, the definition of markedness is a precarious one, and the subject of much debate. As we have seen, cross-linguistically, a pure phonologic, structural analysis will not always work. Fortunately, there is a better phonetic account that can be made for the principle of ordering place features in consonant clusters.

Lindbolm (1983) describes a phonetic experiment regarding the articulatory facts of series of consonants with differing place features. His experiment shows that the height of the jaw is one way of describing the place feature in a consonantal gesture. Of the three most common place features which he tested, coronals have the highest jaw height. Velar consonants have the lowest, and labials fell in between these. Based on this data, it is possible to argue that there is a phonetic basis for the "markedness" behaviour seen in Ancient Greek and other Indo-European languages' place-sequencing process. Indo-European languages like Greek prefer to have consonant clusters with a rising jaw motion. This is especially true in consonant sequences that have no other articulatory changes, such as stop-stop or nasal-nasal clusters. Onsets in Greek like [dm] are allowed to remain because they conform to other properties of syllable well-formedness. Greek is an especially good test case for the principle of a place-ordering phenomenon because more behaviour can be ascribed to it than simply assimilation.

More phonetic work on other languages cross-linguistically will have to be done to flesh out the details of such an articulatory account. However, it offers certain advantages over previous accounts. As a phonetic explanation, it is independent of the theory of phonology used to explain other phenomena. For instance, in Optimality Theory, formalizing a place-ordering constraint has been problematical because it must operate at the level of a consonant cluster, but no formal architecture of Optimality Theory specifically allows reference to this level for purposes of ordering. However, phonetically-motivated constraints can be easily incorporated into the constraint inventory with considerably less controversy.

As a phonetic explanation, it may also potentially be used to account for other phenomena not specifically related to ordering, such as, order of acquisition of place contrasts. It is also a testable phenomenon that goes beyond simply sloppy articulation.

6 Conclusion

This paper has shown that a number of seemingly independent changes in Greek are not independent, but rather integrated by the interaction of a morphological identity constraint with a principle of ordering stop-stop clusters by place. Not just a phonological construction, this place-ordering principle is motivated by a phonetic principle of rising jaw height through a consonant sequence. In addition to explaining historical data from Ancient Greek, it is also capable of explaining metathesis in voiced fricatives in later Greek. The power of this phonetic account for the Greek data is heightened by its independence and applicability to many approaches to phonological theory. While further research needs done on the details of this approach to assimilatory behaviour, its ability to also account for non-assimilatory changes is a clear strength.

References:

Browning, Robert.
1969 *Medieval and Modern Greek*. 2nd edition. New York: Cambridge University Press.

Bubenik, Vit.
1983 *The Phonological Interpretation of Ancient Greek: A Pandialect Analysis*. Toronto: U. Toronto Press.

Kenstowicz, Michael
1994 *Phonology in Generative Grammar*. Cambridge, MA: Blackwell Publishers.

Ladefoged, Peter and Ian Maddieson
1996 *The Sounds of the Worlds Languages*. Cambridge, MA: Blackwell Publishers.

Liddell, Henry George and Robert Scott.
1996 *A Greek-English Lexicon*, rev. Sir Henry Stuart Jones and Roderick MacKenzie. Oxford: Clarendon Press.

Lindbolm, B.
1983 Economy of speech gestures. *Speech Production*, MacNeilage, P.F., ed. NY: Springer Verlag, 217-245.

Magazis, George A.
1989 *Langensheidt's Standard Greek Dictionary: Greek-English English-Greek*. Berchtesgaden: Graphische Betriebe Langenscheidt.

Marinone, N.
1985 *All the Greek Verbs (Tutti i Verbi Greci).* London: Duckworth.

Martin, Samuel E.
1992 *A Reference Grammar of Korean: A Complete Guide to the Grammar and History of the Korean Language*. Rutland, Vermont: Tuttle Language Library.

McCall, Betsy
1998 Restrictions on Stop-Stop Clusters in Ancient Greek: Implications for Alignment. Presented at 4th Mid-Continental Workshop on Phonology, October 1998.

Sihler, Andrew L.
1995 *New Comparative Grammar of Greek and Latin.* New York: Oxford University Press.

Steriade, Donca.
1982 *Greek Prosodies and the Nature of Syllabification*. MIT dissertation.

Sturtevant, Edgar H.
1940 *The Pronunciation of Greek and Latin*. Chicago: Ares Publishers Inc.

Table 2.1 Laryngeal Assimilation, No Place Assimilation

a.	(λε)λεγ + ται	[(le)leg + tai] >	λελεκται	[lelektai] ‘talk’
b.	ε + λεγ + θην	[e + leg + t^he:n] >	ελεχθην	[elek^{h}t^{h}e:n]
c.	ε + πλεκ + θην	[e + plek + t^he:n] >	επλεχθην	[eplek^{h}t^{h}e:n] ‘plait’
d.	πλεκ + δην	[plek + de:n] >	πλεγδην	[plegde:n]
e.	(τε)τριβ + ται	[(te)tri:b + tai] >	τετριπται	[tetri:ptai] ‘rub’
f.	ε + τριβ + θην	[e + tri:b + t^he:n] >	ετριφθην	[etri:p^{h}t^{h}e:n]
g.	(γε)γραφ + ται	[(ge)grap^h + tai] >	γεγραπται	[gegraptai] ‘write’
h.	γραφ + δην	[grap^h + de:n] >	γραβδην	[grabde:n]
i.	εκ + παλεια	[ek + paleia] >	εκπαλεια	[ekpaleia] ‘dislocation’
j.	εκ + τασις	[ek + tasis] >	εκτασις	[ektasis] ‘extension’
k.	εκ + πτυξις	[ek + ptyksis] >	εκπτυξις	[ekptyksis] ‘spreading’
l.	εκ + βαινω	[ek + baino:] >	εκβαινω	[egbaino:]* lit. ‘go out’

*****Despite the most common spelling that does not show the voicing assimilation here, we have every reason to believe that voicing assimilation did occur based on spelling “errors”, as well as the outcome of this word in Modern Greek, for which see §4. (Sturtevant 1940)

(data from Sihler (1995) and Liddell & Scott (1996))

Table 2.2 Place Assimilation in Stop-Stop Clusters

a.	κατ(α) + κειοντες	[kat + keiontes] >	κακκειοντες	[kakkeiontes] ‘lie down’
b.	κατ(α) + πεσε	[kat + pese] >	καππεσε	[kappese] ‘fall down’

(Sihler (1995))

Table 2.3 Latin Examples of Assimilation

a.	*ad + kapio >	accipio
b.	*sub + geso >	suggero
c.	*k^{w}id + pe >	quippe

(Sihler (1995))

Table 2.4 Metathesis in Sequences of Stops

a.	*titko: >	τικτω	[tikto:] ‘beget’	
b.	*dhghom- >	χθων	[k^{h}t^{h}o:n] ‘earth’	
c.	*tkey- >	κτιζω	[ktizdo:] ‘found’	
d.	*H_2rtko- >	αρκτος	[arktos] ‘bear’	
e.	*dhg^{w}hey- > *g^{w}hdhey- >	φθινω	[p^{h}t^{h}ino:] ‘perish’	(Sihler (1995))

Table 2.5 Deletion in Sequences of Stops

a. *pktens > κτεις [kteis] ‘comb’
b. **(**πε**)**ποιθ + α [(pe)poit^{h} + a] > πεποιθα [pepoit^{h}a] /
(πε**)**πειθ + κα [(pe)peit^{h} + ka] > πεπεικα [pepeika] ‘persuade’
(Sihler (1995) and Marinone (1985))

Table 2.6 Nasal Feature Spreading to Stops

a.	*ok^{w}ma > *opma >	ομμα	[omma] ‘eye’	
b.	*prak + *mat- >	πραγμα	[praŋma] ‘deed’	
c.	*seb- + *-nos >	σεμνος	[semnos] ‘revere’	
d.	**(**γι**)**γνωσκω	[giŋno:sko:] ‘learn’ (later γινωσκω [gino:sko:])		
e.	**(**λε**)**λειπ + μαι	[(le)leip + mai] >	λελειμμαι	[leleimmai] ‘leave’
f.	**(**πε**)**πλεκ + μαι	[(pe)plek + mai] >	πεπλεγμαι	[pepleŋmai] ‘plait’
g.	δραχμη	[drak^{h}me:] ~	δραγμα	[draŋma] ‘drachma’

(Sihler (1995))

Table 2.7 Place Assimilation in Sequences of Nasals

a.	εν + γναμπτω	[en + ŋnampto:] >	εγγναμπτω	[eŋŋampto:] ‘bend in’
b.	εν + μανης	[en + mane:s] >	εμμανης	[emmane:s] ‘frantic’
c.	**(**ε**)**ξαν + μαι	[ksan + mai] >	εξαμμαι	[eksammai] ‘card wool’

(Sihler (1995) and Marinone (1985))

Table 2.8 Dissimilatory Processes with Coronal Nasals Preceding Labial Nasals

a.	**(**ε**)**ξαν + μαι	[ksan + mai] >	εξασμαι	[eksazmai] ‘card wool’
b.	**(**πε**)**φαν + μαι	[(pe)p^{h}an + mai] >	πεφασμαι	[pep^{h}azmai] ‘speak’

(Sihler (1995) and Marinone (1985))

Table 2.9 Coronal Stops Preceding Labial Nasals

a.	κεκαδμαι	[kekadmai] ~	κεκασμαι	[kekazmai] ‘surpass’
b.	οδμη	[odme:] ~	οσμη	[ozme:] ‘smell’
c.	τεθμος	[tet^{h}mos] ~	θεσμος	[t^{h}ezmos] ‘ordinance’
d.	αδματος	[adma:tos] ~	Ασμητος	[azme:tos] ‘untamed’
e.	⎸ιδμεν	[widmen] ~	ισμεν	[izmen] ‘know’
f.	*kharit- + *mat- >		χαρισμα	[k^{h}arizma] ‘grace’

(Sihler (1995) and Marinone (1985))

Table 3.1 Stems: Metathesis:

a. *titko: > τικτω [tikto:] ‘beget’
b. *dhg^{w}hey- > *g^{w}hdhey- > φθινω [p^{h}t^{h}ino:] ‘perish’

Table 3.2 Stems: Deletion:

a. *pktens > κτεις [kteis] ‘comb’

Table 3.3 Prefixes: Place Assimilation:

a.	κατ(α) + κειοντες	[kat + keiontes] >	κακκειοντες	[kakkeiontes]	‘lie down’
b.	εν + μανης	[en + mane:s] >	εμμανης	[emmane:s]	‘frantic’

Table 3.4 Prefixes: Voicing Assimilation:

a.	εκ + βαινω	[ek + baino:] >	εκβαινω	[egbaino:]	lit. ‘go out’

Table 3.5 Prefixes: No Change:

a.	εκ + πτυξις	[ek + ptyksis] >	εκπτυξις	[ekptyksis]	‘spreading’
b.	εκ + νιζω	[ek + nizdo:] >	εκνιζω	[eknizdo:]	‘wash out’

Table 3.6 Suffixes: Nasal Spreading:

a.	*prak + *mat- >	πραγμα	[praŋma]	‘deed’
b.	(λε)λειπ + μαι	[(le)leip + mai] >	λελειμμαι	[leleimmai] ‘leave’
c.	*seb- + *-nos >	σεμνος	[semnos]	‘revere’

Table 3.7 Suffixes: No Change or Nasal Feature Spreading:

a.	δραχμη	[drak^{h}me:] ~	δραγμα	[draŋma] ‘drachma’
b.	(γι)γνωσκω	[giŋno:sko:] ‘learn’ (later γινωσκω [gino:sko:])		
c.	αφνειος	[ap^{h}neios]		

Table 3.8 Suffixes: Voicing Assimilation:

a.	πλεκ + δην	[plek + de:n] >	πλεγδην	[plegde:n]
b.	ε + τριβ + θην	[e + tri:b + t^he:n] >	ετριφθην	[etri:p^ht^he:n]
c.	(λε)λεγ + ται	[(le)leg + tai] >	λελεκται	[lelektai] 'talk'

Table 3.9 Suffixes: Place Assimilation or Assibilation/Dissimilation:

a. (ε)ξαν + μαι [ksan + mai] > εξαμμαι [eksammai] 'card wool'
b. (ε)ξαν + μαι [ksan + mai] > εξασμαι [eksazmai] 'card wool'

Table 3.10 Suffixes: No Change or Assibilation:

a.	κεκαδμαι	[kekadmai] ~	κεκασμαι	[kekazmai] 'surpass'
b.	τεθμος	[tet^{h}mos] ~	θεσμος	[t^{h}ezmos] 'ordinance'

Table 3.11 Suffixes: Deletion:

a. (πε)ποιθ + α [(pe)poit^h + a] > πεποιθα [pepoit^{h}a] /
(πε)πειθ + κα [(pe)peit^h + ka] > πεπεικα [pepeika] 'persuade'

Table 4.1 Metathesis After Initial Vowel Loss

a.	βγαινω	[vɣeno] 'speak' <	εκβαινω	[egbaino:] 'go out'
b.	βγαζω	[vɣazo] 'lead' <	εκβαζω	[egbazdo:] 'speak out'

(Magazis (1989) & Browning (1969))