

An Optimality-Theoretic Analysis of Lachmann's Law.

Candidate No.: 569387

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Chapter 1

Introduction.

1.1 The data.

Lachmann's Law is a peculiarity of the grammar of Latin whereby the past participles (and some other morphologically complex forms) of certain verbal roots show an etymologically unexpected long vowel. So, for example, we find *uīsus* alongside *uideo*, *ēsus* alongside *edo*, *āctus* alongside *ago* and *tūsus* alongside *tūdo*

The most important fact from the point of view of any phonological analysis of Lachmann's Law is that, as a lengthening process, it is **not surface-true**, which is to say that there is no featural statement of a surface environment which will suffice to capture every instance where lengthening is attested, while including none in which it is not. If, for example, we take as our environment *—Cto* (or subsequent reflex thereof, as in e.g. *cāsus* from **kad-tos*), then we have successfully accounted for the fourteen forms that appear to show lengthening by Lachmann's Law, but we have also included a greater number of forms that show no such lengthening, viz:

(1.1) With lengthening	Without lengthening
<i>āctus</i> ~ <i>ǣgō</i>	<i>fǣctus</i> ~ <i>fǣciō</i>
<i>frāctus</i> ~ <i>frǣngō</i>	<i>iǣctus</i> ~ <i>iǣciō</i>
<i>tāctus</i> ~ <i>tǣngō</i>	<i>uīctus</i> ~ <i>uīncō</i>
<i>pāctus</i> ~ <i>pǣngō</i>	<i>dōctus</i> ~ <i>dōceō</i>
<i>rēctus</i> ~ <i>rēgō</i>	<i>strīctus</i> ~ <i>strīngō</i>
<i>tēctus</i> ~ <i>tēgō</i>	<i>fīssus</i> ~ <i>fīndō</i>
<i>lēctus</i> ~ <i>lēgō</i>	<i>scīssus</i> ~ <i>scīndō</i>
<i>ēemptus</i> ~ <i>ēmō</i>	<i>trāctus</i> ~ <i>trāhō</i>
<i>tūsus</i> ~ <i>tūndō</i>	<i>pīctus</i> ~ <i>pīngō</i>
<i>fūsus</i> ~ <i>fūndō</i>	<i>fōssus</i> ~ <i>fōdiō</i>
<i>cāsus</i> ~ <i>cādō</i>	<i>(sēssum)</i> ² ~ <i>sēdeō</i>
<i>ēsus</i> ~ <i>ēdō</i>	<i>pāssus</i> ~ <i>pāndō</i>
<i>ōsus</i> ~ <i>(ōdium)</i> ¹	<i>uēctus</i> ~ <i>uēhō</i>
<i>uīsus</i> ~ <i>uīdeō</i>	<i>iūssus</i> ~ <i>iūbeō</i>

The forms in the “with lengthening” column of the table above are those generally accepted as being affected by Lachmann’s Law (e.g. by Sommer, 1914; Kent, 1928; Collinge, 1985; Jasanoff, 2004, etc.). The list should also be taken to include all compounds of the verbs present, e.g. *compactus* ~ *pactus*, *redactus* ~ *actus neglectus* ~ *lectus* and so on. Indeed, as we shall see below (p. 5), the behaviour of the vowels in compound forms is an important source of the evidence which leads us to ascribe these forms to the list in the first place.

¹The verb *ōdi* has perfect forms but present function, the earliest texts attest no present tense alongside it, and the form *ōdio* is a back-formation of Imperial date (Ernout and Meillet, 1959, 458). The noun *ōdium* is cited here in order to show that the root of *ōsus* had a short vowel

²The verb *sedeō*, being intransitive, lacks a past participle. Compounds such as *obsideō*, *possideō* have participles in *-sēssus*, however, and the form of *sedeō* cited here, the supine *sēssum*, likewise has a short vowel.

1.2 The evidence.

1.2.1 Sources.

The syllables of which the vowels we are concerned with are the peaks are necessarily closed, since they precede a cluster comprised of the final consonant of the verbal root and the *t* of the suffix *-tos*. Therefore, what is normally the most useful metric of vowel length available to us from the attested material, scansion of the syllables when they appear in verse, offers no evidence in this case, since the syllables will always be long “by position”, regardless of the length of the vowel. There are, however, other indicators of vowel length which suffice to give us the data for our analyses.

The apex.

Quintilian tells us (*Inst* I, 7, 2–3):

ut longis syllabis omnibus adponere apicem ineptissimum est, quia plurimae natura ipsa verbi quod scribitur patent, sed interim necessarium, cum eadem littera alium atque alium intellectum, prout correpta vel producta est, facit: III. ut “malus” arborem significet an hominem non bonum apice distinguitur, “palus” aliud priore syllaba longa, aliud sequenti significat, et cum eadem littera nominativo casu brevis, ablativo longa est, utrum sequamur plerumque hac nota monendi sumus.

“To place an apex on every long syllable is most absurd. . . , because most are obvious by the very nature of the word which is written, but from time to time, when the same letter is understood in one way or another, accordingly as it is long or short, it makes it necessary: whether *malus* means a plant or a man who is not good can be discerned from the apex, *palus* means one thing when the first syllable is long, and another when the second is, and when the

same letter is short in the nominative case and long in the ablative,
in many cases we are advised which sense to follow by this notation.”

Quintilian speaks of long and short syllables, rather than vowels, and indeed some uses of the apex mark short vowels in long syllables (see, for example *pássa* at CIL VI 22251, *cautíssimus* at Dessau (1892, 56)), but the majority of the evidence indicates that the apex is primarily a marker specifically of vowel length, rather than syllable weight (Rolfe, 1922). Oliver (1966, 135) suggests that “The use of the apex in inscriptions makes it obvious that, from the very first, the function of the apex was to show the correct pronunciation of words that, presumably, were sometimes mispronounced in current speech.” This would include the sort of disambiguation for which the apex is prescribed by Quintilian, but Oliver is at pains to point out that the majority of the attested instances of the apex do not in fact conform to Quintilian’s rule, and therefore that some other principle must have originally governed its use. Since the Lachmann forms comprise a minority of past participles, it is not unreasonable to imagine that they would be prime targets for apex-marking according to Oliver’s principle, and indeed we do find apices on many of the attested inscriptional examples of the Lachmann verbs.

It bears mentioning, however, that some scribes evidently intended their uses of the apex to mark syllable weight, rather than vowel length, and furthermore that there are uses of the apex which must be regarded as sheer mistakes, since they mark what we know from scansion or morphology are neither long vowels nor long syllables (e.g. *Germaníco* at Dessau (1892, 538), *Caesarís* at Dessau (1892, 391), *tectorúm* at CIL XIV 2922). This being so, we should take it as a principle that an apex alone is not sufficient to confirm vowel length definitively.

Regular sound changes.

Some sound changes within the history of Latin affect long vowels differently from short ones. Vowel weakening, for example, does not affect long vowels at all. Being conditioned by the pre-historic initial stress accent, vowel weakening

only affects medial and final syllables, so to identify a participle as falling subject to Lachmann's Law, we look for a lack of qualitative alternation between the participles of a simplex verb and its compounds. For example, we know that the \bar{a} of $\bar{a}ctus$ is long because the participles of compounds like *redactus*, *adactus* retain their *a*: if it were short, it would have weakened to *e*, as in *perfectus* \sim *f \acute{a} ctus*. Vowel weakening in general only affects *a* and *o* (Meiser, 1998, 70), and so can only provide testimony as to Lachmann's Law for verbs which a) have compounds and b) show *a* or *o* in the participle of the base form.

A related phenomenon is the contraction of vowels when adjacent to one another. Sequences of short vowel + long vowel only regularly contract together when in final syllables: e.g. *laudēs* < **laudaēs* (Meiser, 1998, 88), whereas sequences of short vowel + short vowel or long vowel + short vowel always contract: e.g. *cōgō* < *cō-agō* (Meiser, 1998, 88), *lātrīna* < *la \grave{u} atrīna*, with regular loss of intervocalic \grave{u} (Meiser, 1998, 87). So, when a verb without a stem-initial consonant is compounded with a prefix that ends in a vowel, we know the verb is subject to Lachmann's Law if the vowels do not contract together. An example of this is the past participle of the aforementioned *cōgō*: *co \bar{a} ctus*.

Romance reflexes.

An extension of this principle, of querying the effect of sound changes on the vowels whose quantity is in question, is to examine the reflexes of the forms we are concerned with in the Romance languages. For example, the regular French reflex of Latin \bar{e} (outside particular environments conditioning other changes) is ⟨oi⟩, while the reflex of \check{e} is ⟨i⟩. So, since *tectum* yields French *toit*, we can surmise that the *e* of *tectum* is long.

It should be noted that in some cases the evidence from Romance is equivocal: Abbruzzese Italian, for example, has *pettá*, which points to the attested Latin **p \check{i} ct-*, but standard Italian has *pittura*, which appears to reflect *p \bar{i} ctūra*, with an otherwise unevinced long vowel.

Degemination of -ss.

Indo-European *-tt-* or *-dt-* regularly yields Latin *-ss-* (Meiser, 1998, 124). However, following a long vowel or diphthong, this sequence, which is generally believed to represent a long consonant, underwent a change which simplified it to *s* c. 100 BC., e.g. in *mīsit* < *mīssit* (attested at CIL 1216) (Meiser, 1998, 124). This change was formalised in the orthography somewhat later than it actually occurred (see the quote from Quintilian and discussion on page 38 below), but nonetheless in participles from roots ending in a dental, a single *s* (as in *osus* and *esus*) suffices to show that the vowel of the stem is long.

Transcription into Greek.

Where Latin is written in the Greek alphabet, it becomes possible to distinguish some vowel quantities, since there are separate letters in the Greek alphabet for marking long \bar{e} and \bar{o} . The useful examples for our purposes are Dio Cassius' rendering of *Aemilio Recto* as *Αἰμιλίω*. . . *Ῥήκτω*, and the rendering of *redempta* as *ρεδημπτα* at CIG 9811. There are, however, counterexamples, as discussed by Osthoff (1884, 113), including one of Dio writing *Ἐκλεκτος* (LXXII, 4, 6) and an example of *Ῥεκτός* from a fragment of Plutarch. Osthoff presents two hypotheses for why the choice of Greek letters may not represent the correct Latin vowel quantity: firstly, if the author is a native speaker of Latin, he may be unused to making a written distinction between long and short vowels, and so use epsilon where he would naturally use *e* and omicron where he would use *o*. Conversely, if the author is a Greek, he may be influenced by the presence of similar-sounding words in his native language (e.g. *λεκτός* 'speakable') which, even if they are cognate, would of course not undergo Lachmann's Law, which is Latin-specific.

In any case, as with the apex, prudence dictates that we should not regard transcription into Greek alone as definitive evidence of vowel quality.

Testimony of contemporary authors.

The most straightforward evidence for Lachmann's Law, as we shall see, is that occasionally a grammarian or scholiast will comment directly on the length of a particular form.

We will now examine in detail the evidence which prompts us to claim that Lachmann's Law affects each individual form.

1.2.2 Forms.

āctus

Probably our best evidence for the length of the *ā* of *āctus* comes from the testimony of Aulus Gellius, who writes (IX, 6, 3):

(1.2) *quoniam frequentatiua ferme omnia eodem modo in prima syllaba dicuntur, quo participia praeteriti temporis ex his uerbis, unde ea profecta sunt, in eadem syllaba pronuntiantur, sicuti 'lego, lectus' facit 'lectito'; 'ungo, unctus' 'unctito'; 'scribo, scriptus' 'scriptito'; 'moueo, motus' 'motito'; 'pendeo, pensus' 'pensito'; 'edo, esus' 'esito'; 'dico' autem 'dictus' 'dictito' facit; 'gero, gestus' 'gestito'; 'ueho, uectus' 'uectito'; 'rapio, raptus' 'raptito'; 'capiro, captus' 'captito'; 'facio, factus' 'factito'. sic igitur 'actito' producte in prima syllaba pronuntiandum, quoniam ex eo fit, quod est 'ago' et 'actus'.*

“For nearly all frequentatives are pronounced in the same way in the first syllable, as the past participles of those verbs, from which they are derived, are pronounced in the same syllable, thus ‘lego, lēctus’ makes ‘lēctito’; ‘ungo, ūctus’, ‘ūctito’; ‘scribo, scriptus’ ‘scriptito’; ‘moueo, mōtus’ ‘mōtito’; ‘pendeo, pēnsus’ ‘pēnsito’; ‘edo, ēsus’ ‘ēsito’; but ‘dico, dictus’ makes ‘dīctito’; ‘gero, gestus’ ‘gestito’; ‘ueho, uectus’ ‘uectito’; ‘rapio, raptus’ ‘raptito’; ‘capiro, captus’ ‘captito’; ‘facio, factus’

‘*factito*’. So therefore ‘*āctito*’ is to be pronounced long in the first syllable, because it comes from *ago* and *āctus*.”

Note that in this passage Gellius is arguing for a four-part analogy, on the proportion *dīctus* : *dīctito* :: *āctus* : *X*, in an attempt to persuade the reader to adopt the frequentative *āctito*, instead of the *āctito* he has heard from ‘*non sane indoctos viros*’. This implies that the length of the *ā* of *āctus* is a well-established part of the contemporary grammar, or else Gellius could not expect it to be persuasive in an analogy.

Further corroborating evidence becomes visible when the *ā* of *āctus* occurs in environments where, if short, it would be subject to vowel weakening or contraction. Thus we find *adāctus*, with a word-medial *a* in a closed syllable, which we would expect, if short, to weaken to *e*, cf. *perfectus* < **per-fāctus* (Meiser, 1998, 70). Similarly, if the *a* of *coāctus* were short, we would expect it to contract with the preceding *o*, cf. *cōgō* < **co-āgō* (Meiser, 1998, 88).

There are three attestations of *āctus* with apex: *āctum* CIL XI, 3805; *exāctus* CIL XIII, 1668; *redācta* CIL VI, 701.

frāctus

The only evidence for the length of the *ā* of *frāctus* is the lack of vowel weakening in the prefixed form *effrāctus*.

tāctus

Likewise for *tāctus*, the only evidence is the lack of weakening in *contāctus*.

pāctus

Again in *pāctus*, we are reliant on the lack of vowel weakening in *compāctus* to evince the length of the vowel.

rēctus

Strong evidence for the \bar{e} of *rēctus* is provided by French *droit* < *dirēctum*, with ⟨oi⟩ as the regular reflex of Lat. \bar{e} (cf. *loi* < *lēgem*, *roi* < *rēgem*).

There is a corroborating apex on *réctorem* at CIL XII 4333. Cf. also Dio Cassius LVII, 10, 5 *Αἰμιλίω... Πήκτω*.

tēctus

The nature of the evidence for *tēctus* is almost identical with that of the evidence for *rēctus*: we have a French ⟨oi⟩ in *toit* < *tēctum* and an apex on *téctor* at CIL VI 5205.

lēctus

The length of the vowel in *lēctus* is directly attested to by Gellius in the passage quoted at (1.2), and the apex of *léctus* at CIL XI, 1826 agrees.

There is also evidence for a long \bar{e} in *lēctor*, viz. the apex of *léctor* at CIL VI, 9447 and the following passage Aulus Gellius XII, 3, 4

(1.3) *si quis autem est, qui propterea putat probabilius esse, quod Tiro dixit, quoniam prima syllaba in 'lictore', sicuti in 'licio', producta est in eo verbo, quod est 'ligo', correpta est, nihil ad rem istuc pertinet. nam sicut a 'ligando' 'lictor', et a 'legendo' 'lector' et a 'uiendo' 'uitor' et 'tuendo' 'tutor' et 'struendo' 'structor' productis, quae corripiebantur, vocalibus dicta sunt.*

“But if there is anyone who thinks that what Tiro says is more likely because the first syllable in ‘*līctor*’ is long just as that in ‘*licio*’, but in the word ‘*ligō*’ is short, that is not relevant to the discussion. For likewise in ‘*līctor*’ from ‘*ligando*’, ‘*lēctor*’ from ‘*legendo*’, ‘*uītor*’ from ‘*uiendo*’, ‘*tūtor*’ from ‘*tuendo*’, and ‘*strūctor*’ from ‘*struendo*’, the vowels, which were short, are pronounced long.”

Furthermore, in his commentary on Horace, *Serm.* I, 6, 122, Porphyrio tells us that *lecto producta priore syllaba enuntiare debemus, quia frequentatiuum est ab eo, quod est: lego* “we should pronounce the first syllable of *lecto* as long, because it is the the frequentative of *legō*.”

ēemptus

The evidence for the length of the vowel in *ēemptus* is probably the weakest in the Lachmannian dataset. We have an apex on *redēempta* at CIL VI 22251, and the same form is spelt *ρεδημπα* at CIG 9811.

For the participles of verbs with roots ending in dentals: *tūsus*, *fūsus*, *cāsus*, *ēsus*, *ōsus*, *uīsus*, we are mainly reliant on the simplification of *-ss-* to *-s-* to show us that the vowels in question are long.

1.3 Previous analyses.

The major division between accounts of how Lachmann’s Law came to be is between the two traditional mechanisms by which philologists have characterised changes between the proto-language and its attested children, viz. regular sound change and analogy.

1.3.1 Lachmann’s Law as regular sound change.

Lachmann (1850) himself, in first noting the rule, envisaged it as a sound change affecting past participles of roots ‘*ubi in praesenti media est*’ (which is taken to mean ‘roots ending in a voiced stop’). As it stands, Lachmann’s 23-word statement of the rule is more problematic than explanatory, since it offers no attempt to explain why such a phonological change should be restricted to the morphological domain of the past participle. Furthermore, it does not attempt to address the apparent exceptions to the rule, as enumerated above, and it ignores the fact that the required environment is not surface-true and likely was not so at any stage of the history of Latin.

Two developments towards the end of the nineteenth century created the basic ‘engine’ of Lachmann’s Law as sound change. First, and most important, was the contribution of de Saussure (1889). In investigating the development of consonant clusters from Proto-Indo-European into the various attested daughter languages, de Saussure (1889, 256) almost tangentially advances the hypothesis that the Lachmann participles were analogically re-made on the model of their respective paradigms at some point in the early history of Latin.

We have good comparative evidence for voicing assimilation of stop clusters across Indo-European: for example we have Greek $\lambda\epsilon\kappa\tau\acute{o}s$ from the root *leg*, cognate with Lachmannian *lēctus*, and likewise in Sanskrit we have *vēt-tha* from the root *vid-*, the same root found in Lachmannian *uīsus* (King, 1969, 43). This suggests that the assimilated forms are inherited from the proto-language. However, if this is so, then Latin must have inherited **ak-tos* as past participle for *ago*, and **fak-tos* as past participle for *facio*. If Lachmann’s Law is a regular sound change, then something must have occurred within the history of Latin to make the environment in the inherited **ak-tos* different from that in **fak-tos*. That something, Saussure suggested, was the analogical reintroduction of a voiced stop into the past participles of verbs which had them elsewhere in the paradigm. So **ak-tos*, **lek-tos*, **et-tos* (> *ēsus*) etc. were re-made to **ag-tos*, **leg-tos*, **ed-tos* and so on. Then the sound change hinted at by Lachmann occurred:

(1.4) $V > \bar{V} / \text{---DT}$, where D represents a voiced stop, and T a voiceless one.

Subsequent to this, a second voicing assimilation took place, and assibilation of the dental stop clusters¹, giving the attested *āctus*, *lēctus*, *ēsus* etc.

Kuryłowicz (1968*b*) and Kiparsky (1965), in presenting their own individual alternative explanations of Lachmann’s Law, both dismissed Saussure’s hypothesis in no uncertain terms. Kuryłowicz (1968*b*, 295) flatly states that “Nowhere and at no period has *gt* been a possible combination in I.E. languages oppos-

¹The change of *o* to *u* in word final closed syllables is much later, within the attested history of Latin.

ing voiced *g d* to voiceless *k t*.” He also points out the existence of exceptions like the adjective *lāssus* < **lad-tos* and the noun *tūssis* < **tud-tis*, in order to advance his argument that Lachmann’s Law is not a sound change at all, but an analogy. Kiparsky (1965, 21), for his part, presents an objection based on the evidence of the process of assibilation which gives us (inter alia) *ēsus* from **ed-tos* and *cāsus* from **kad-tos*. Clusters of dental + dental which are formed within the history of Latin, Kiparsky points out, assimilate in voicing but do not undergo assibilation (see, for example, *attero* from **ad-tero*). So, if the inherited **kat-tos*, for example, had been analogically remade to **kad-tos* within the history of Latin, and then had its vowel lengthened by (1.4), we would expect **cāttus* or **cātus*, rather than the attested *cāsus*.

Jasanoff (2004, 411ff.) defends against these objections on behalf of the Neogrammarians. He neatly rebuts Kuryłowicz’s statement about the impossibility of *gt* or other voiced-voiceless combinations by pointing out examples from English like *ragtime*, *magpie*, *tadpole* etc., and meets Kiparsky’s objection by suggesting that the Lachmann participles from roots ending in dental stops were remade in *-sos* rather than *-tos*, so **kadsos*, **edsos*, **tudsos*, **odsos* for *cāsus*, *ēsus*, *tūsus*, *ōsus* etc. As for *tussis* and *lassus*, Jasanoff borrows Kiparsky (1965, 21)’s explanation for their exemption from Lachmann’s Law: their derivation from PIE roots was synchronically opaque at the time Lachmann’s Law operated (the root **lad* is otherwise unattested in Latin, and the verb *tundo* had already come to mean ‘bruise’, so that its link to *tussis* ‘cough’ was not apparent), so there was no model on which to remake them to **lad-sos* and **tud-sis*, as one might otherwise have expected. Jasanoff (2004, 412–413) is also able to offer an attested example of an analogy exactly like Saussure’s, from Ukrainian, in which the inherited infinitive *vesti* ‘to convey’ (attested in other East Slavic languages) is remade to *vezty* under the influence of forms in the paradigm like 1sg. *vezu*. Jasanoff (2004, 412) freely acknowledges, however, that none of this constitutes proof that Saussure’s analogical reformation of the participles really took place, it only rebuts the contentions of Kuryłowicz and Kiparsky that such

a reformation would have been impossible. Furthermore, his evidence that (1.4) really took place is not as ironclad as he makes it sound. He cites the irregular superlative *maximus*, and states that “we know that the -a- of this form is long” (Jasanoff, 2004, 411). He proposes, following Cowgill (1970), a development of original **mag-is-mmo-s* by syncope to **magsm̄mos* or **magsamos*, which, by (1.4), voicing assimilation and vowel weakening, gave *māximus*. This is quite plausible, but Jasanoff overstates the quality of the evidence for the length of the *a*: the length is attested to only by an apex in a single inscription (CIL vi. 2080, 17), and, as we saw above (p. 5), the use of the apex is not, on its own, a reliable indicator of vowel length. We will discuss the evidence of *maximus* and other possible examples of Lachmann’s Law outside participles below (p. 72)

The second contribution, which obviated a central difficulty of Lachmann’s formulation, was that of Pedersen (1896), who first made explicit the restriction of the operation of Lachmann’s Law to roots whose final voiced stop is original, i.e. not the reflex of a voiced aspirate. This dates the period of productivity of Lachmann’s Law to before the word-medial merger of the prehistoric Latin reflexes of the voiced aspirates with the voiced stops. Thereafter, up until the publication of Kuryłowicz (1968*b*), the textbooks generally took de Saussure (1889) and Pedersen (1896)’s observations as the core of their accounts of Lachmann’s Law, differing only in their characterisations of the scope of the lengthening process, and therefore which subset of the Lachmann forms they viewed as directly subject to the change, and which, for the sake of accounting for the exceptions, they viewed as secondary.

The first such attempt was that of Sommer (1914, 122–123), who suggests that the main participles for which lengthening is predicted on the Saussure-Pedersen model, but which do not show it, namely *fīssus*, *scīssus* and *strīctus* escaped Lachmann’s Law because the presence of a nasal infix in their present stems made the voiced quality of the relevant consonant less clear. However, Sommer offers no account of why the nasal infix had no such effect on e.g. *pāctus* ~ *pangō*, *tāctus* ~ *tangō* and *frāctus* ~ *frangō*.

Elsewhere, however, (Sommer, 1914, 38), he repeats a different account, due to Meillet (1908): that high vowels were regularly exempt from lengthening processes. On this account, *fissus*, *scissus* and *strictus* are regular, whereas *ūsus* and *fūsus* (and, presumably, also *tūsus*) were formed by a less thoroughgoing version of the Osthoff-Kent analogy we will discuss below (p. 31), taking over the long vowel of their respective perfect stems. This notion of high vowels being exempt from lengthening processes is a recurring theme in accounts of Lachmann’s Law and in phonetics generally, and indeed we shall be making mention of it in the next chapter (p. 77).

The phonetic story — Niedermann (1953)

Niedermann (1953, 69–71), unlike Meillet (1908), is happy to argue that this exemption from lengthening processes can apply solely to [i], rather than universally to the high vowels. This exception is built into his detailed phonetic account of the mechanism of Lachmann’s Law: he begins with the Saussure-remodelled form [ag.tos], and argues that lengthening of the vowel was a concomitant of the second devoicing of the restored voiced stop. His position may be put in terms of the misparsing model of sound change proposed by Ohala (1989): the speakers of the generation that restored the voiced stops to the Lachmann participles signalled the voicing of the stop in the usual way, by continuing vocal fold vibration longer into the closure phase of the stop than for a voiceless one; listeners of the succeeding generation, having acquired the generalisation that consonant clusters assimilate in voicing, interpreted this extended period of voicing as a cue to the length of the preceding vowel, rather than the voice feature of the stop. The length of [i] was left unchanged because of [i]’s special phonetic status: it is measurably the shortest of all the vowels, and the closest in articulatory position to the consonants. Therefore, the transition phase from [i] to a following consonant is shorter, and the available time within which to make the distinction between [i] and [i:] is less. Vocal fold vibration would be transferred from the stop to the vowel in the same way as for the forms

featuring other vowels, but the difference made by this added duration was not enough to cause the listener to perceive the phoneme /i:/ rather than /i/.

This reasoning closely foreshadows the “compensatory listening” argumentation retailed, *inter alia* by Gussenhoven (2004), and which I intend to use as the phonetic basis on which I exempt [i] from lengthening in my own account of Lachmann’s Law later on (p. 77). Where Niedermann’s argumentation becomes markedly weaker is in his account of the exceptions. The least controversial account of such is his answer to the evidence of *uīsus*. He echoes what would later come to be known as the Osthoff-Kent hypothesis (for which see p 31ff.), that the etymologically unexpected long vowel of the participle was taken over on the analogy of the long vowel of the perfect stem. *uīsus*, because of its exceptional nature, vexes even those who wish to claim that the Osthoff-Kent analogy is the basis for the entirety of Lachmann’s Law, so for detailed argumentation on the special nature of *uīsus* some of the best sources are analogists (see Watkins, 1970*b*, 62, Strunk, 1976, 49 and references therein). We will discuss *uīsus* further below.

Rather less convincing is Niedermann (1953, 71)’s account of the -*sĕssus* exception. He argues that “peut-être” the compound *obsĕssus* acquired its characteristic vowel length on the analogy of its synonym *prĕssus*. No doubt because of the tentative nature of the hypothesis, Niedermann leaves us to infer many of its details. One must suppose that once *obsessus* had undergone the analogy Niederman suggests, the other compounds in -*sessus*: *possessus*, *praesessus* etc., followed suit.

One may have to assume further that Niedermann means to claim that the supine *sessum* from the base verb *sedere* followed the vocalism of *obsessus*. It would seem that if this series of analogies did take place, they all had full and thoroughgoing effect before the attested period, since examples of the expected *-*sĕsum* are wanting. It is difficult to see how this can be so, since Niedermann’s theory is based on the synonymy of *pressus* and *obsessus* in very specific subsenses of each verb, viz. that of “besiege, blockade”. This being so, we might

expect to find evidence that the analogy Niedermann posits began specifically in the military sociolect, and eventually spread to the Latin speech community as a whole, then spread to the other forms of *-sessus*. If evidence for this exists, it has escaped the notice of both modern and ancient scholars.

Finally, it should be pointed out that Niedermann (1953) entirely omits the question of *ēemptus*. With some knowledge of phonetics, we might conclude that the arguments with respect to vocal fold vibration being reinterpreted as a continuation of a preceding vowel apply equally well to nasal stops as to (voiced) oral ones, but that would leave us with the task of explaining the lack of lengthening in forms with other-than-labial nasals: in *cāntus*, for example. Conversely, since nasals in Latin are not contrastively voiced, we might suppose that the deliberate cue to voicing which, on Niedermann's theory, was misparsed as vowel length, was absent from participles formed on roots ending in nasals, and so account for *cāntus*, but require an explanation for *ēemptus*. As we shall see, other scholars have essayed accounts that address these difficulties to variously convincing extents, but Niedermann offers none.

Maniet's account - only *g*?

A different approach, which also takes the Saussure-Pedersen hypothesis as its starting point, is that of Maniet (1956, 1957). Maniet (1957, 113) states the basic rubric of his hypothesis as follows: "Une voyelle, sauf *i*, s'est allongée par suite de l'assourdissement d'un *g* suivant dans les mots offrant un rapport clair avec les formes connexes en *g*" "A vowel, excepting *i*, is lengthened as a result of the devoicing of a following *g* in words which show a clear connection with related forms showing *g*." For the exception of [i], Maniet (1957, 114) uses the same phonetically-based reasoning as Niedermann (1953): [i] was lengthened, but not to the extent of being parsed as the phoneme /i:/. The rider stipulating the requirement of a clear connection with forms retaining *g* is essentially a restatement of the condition of the Saussure hypothesis that the etymological voiced stop must be recoverable from the synchronic facts of the rest of the

paradigm. Maniet (1957, 115) regards this as necessary to explain the lack of lengthening in *āxis* “axle” < **ag-sis*, which is a kindred example to *tussis* and *lāssus* (see p. 13).

Restricting the domain of Lachmann’s Law, as he envisions it, to verbs from roots ending in *g* explains the following forms without further ado:

(1.5) **participle 1sg. perf.**

<i>rēctus</i>	<i>rēxī</i>
<i>tēctus</i>	<i>tēxī</i>
<i>lēctus</i>	<i>lēgī</i>
<i>āctus</i>	<i>ēgī</i>
<i>frāctus</i>	<i>frēgī</i>
<i>tāctus</i>	<i>tetigī</i>
<i>pāctus</i>	<i>pepigī</i>

However, it requires Maniet to find alternate explanations for the following forms:

(1.6) **participle 1sg. perf.**

<i>fūsus</i>	<i>fūdī</i>
<i>ēsus</i>	<i>ēdī</i>
<i>ōsus</i>	<i>ōdī</i>
<i>ēemptus</i>	<i>ēmī</i>
<i>uūsus</i>	<i>uūdī</i>
<i>tūsus</i>	<i>tutudī</i>
<i>cāsus</i>	<i>cecidī</i>

Like Niedermann before him, Maniet makes no mention of *ēemptus*. For the other forms, all of which come from roots ending in **d*, he proposes that the length was taken over analogically from a putative full-grade supine, after the merger of *o* with *u* in closed word-final syllables made the majority of supines and (ACC.SG) past participles identical. Maniet (1956, 232) points to the participle *genitus* ‘begotten’, which shows full-grade treatment of the PIE

root *gen. The expected participle, according to the rubric zero-grade + *to*, is *g_hh₁tos > gnātus > natus ‘born’. Given that it is possible for a full-grade supine to be used as an analogical model for a participle, Maniet argues, why not posit a pre-historical supine *kād-tum, on which the attested participle cāsus could be built, and likewise *ēd-tum for ēsus, * μ eid-tum for uīsus and so on Maniet (1956, 232–233)?

Maniet conveniently ignores the fact that there is a specific motivation for the full-grade supine *genh₁tum > genitum to influence the shape of the participle: the IE root *gen yields *two* verbs in Latin: (g)nāscor ‘I am born’ and gignō ‘I beget’. It is the need to disambiguate between these two verbs that caused gignō to take over its participle from the full-grade supine (if indeed, that is the source of genitus, since it should be stressed that Maniet’s supines are entirely hypothetical creatures, at least as far as the Latin evidence goes). Maniet’s argumentation smacks of *ad hoc* reasoning: he offers no independent reason why it should be specifically the participles listed in (1.6) which take over their ablaut grades from the supine. This, combined with the fact that there is no direct evidence for the necessary supines, prompts Schrijver (1991, 137–138) to argue that the full grades — if it is an analogical importation of ablaut grades we are dealing with, rather than a sound change — are taken from elsewhere in the paradigm.

Maniet (1956, 236)’s stated reason for restricting his sound change to verbs from roots ending in *g*, and seeking full-grade supines to explain the forms in *d*, is the lack of lengthening in *passus*, past participle of *pandō*. Maniet notes the similarity in meaning between *pateō* ‘I am open’ and *pandō* ‘I open’ (transitive), but opines that the etymological link between the two is too unclear to judge definitively that *pandō* reflects *pantō and so that *passus* reflects *pat-tos, as opposed to *pad-tos. The prevailing opinion has moved on since the publication of Maniet (1956), and textbooks (Meiser, 1998, 122, Sihler, 1995, 209) now present it as uncontroversial that *pandō* reflects *patane/o-, with syncope and a metathesis of the resulting sequence *tn (this hypothesis is originally due to

Thurneysen, 1883). On this basis, we can assume that at the time Lachmann’s Law operated, the neutralisation of voicing contrasts after the nasal meant that the connection of *passus* to a form showing *d* was insufficiently strong, to co-opt Maniet’s terminology, for a *d* to be reintroduced by the Saussure process. We may suppose that the semantic connection with *pateō*, coupled with the irregular nature of *pandō* (it forms a so-called “simple” perfect stem *pand-* (e.g. in *pandī*), which is a formation preferred by a relatively small minority of third conjugation verbs) was enough to make it clear to the synchronic grammar that the participle was (or reflected) **pat-tos*. If this is found plausible, then, in conjunction with the objections to the full-grade supine hypothesis presented by Schrijver (1991), Maniet’s entire justification for restricting Lachmann’s Law to forms in *g* is called into question.

Glottalic Theory

Kortlandt (1989) claims that adopting the glottalic theory allows one to posit a phonetic account of Lachmann’s Law analogous to that of Niedermann (1953) and Maniet (1956), but without the need for any Saussurean analogical reintroduction of voiced (or glottalic) stops into the forms in question. Kortlandt’s contention is that the stops that conditioned Lachmann’s Law were inherited by Latin as being contrastively glottalic, so that e.g. *lēctus* began its post-PIE life as /lek’.tos/. For Kortlandt (1978, 1989), as for many other glottalicists (cf. the other papers in Vennemann, 1989), the attested phonation series in the IE languages result from reanalysis of contrastive features of the original PIE phonemes as contingent or phonetic, and of their contingent features as essential or contrastive. In this particular case, Kortlandt argues (obliquely; for criticism of the vagueness of Kortlandt’s argumentation see Garrett, 1991, 800–801) that voicing was reanalysed as the contrastive feature of the glottalic stops: where the stop is not adjacent to a voiceless one, we surmise, it was phonetically voiced before the change, and contrastively voiced after it, and the glottalic feature disappeared without trace. Where it was followed by a plain voiceless stop (as in

a *-to-* participle), it was phonetically voiceless by assimilation, and so became contrastively voiceless after the change. The glottalic feature, however, left a trace in this environment in that as it disappeared it lengthened the preceding vowel, presumably by a similar phonetic mis-parsing as that described by Niedermann (1953, 69–71) (see above p. 15).

The brief and condensed nature of Kortlandt’s essays into accounting for Lachmann’s Law (Kortlandt, 1978, 117, Kortlandt, 1989, Kortlandt, 1999) has caused them to attract a certain degree of opprobrium (see *inter alia* Collinge, 1985, 265 Garrett, 1991, 800–801, Jasanoff, 2004, p. 410 n. 10), but the shrift its detractors have given it may perhaps be too short. This is certainly the view of Schrijver (1991, 134–138) and Baldi (1991), whose views of Lachmann’s Law are based in glottalic theory and partly echo those of Kortlandt. Jasanoff (2004)’s objection, for example, is valid but overstates the case: he says “Kortlandt[’s]. . . interpretation, which effectively denies the merger of **-gt-* and **-kt-* in the parent language, is unacceptable”. Jasanoff is right to point out that there is an implicit challenge to our assumptions in Kortlandt’s arguments: we have taken it as read that assimilation of stop clusters took place in PIE because of the good comparative evidence that suggests as much (for which see p. 12), but claiming that the contrast between clusters survived into Latin in spite of it is not necessarily an untenable position. Wherever we observe a correspondence, there is always the possibility that equivalent forms have developed independently in related languages, by virtue of an inherited typological propensity towards the development or sheer chance. A good example of this principle is Grassmann’s Law: despite the fact that Greek and Sanskrit share it, as novice Indo-Europeanists are regularly warned, we cannot reconstruct Grassmann’s Law for PIE, and claim that every language but Greek and Sanskrit lost it, since Greek has to have inherited **b^he_gud^h-*, for example, to give *πευθ-* by Grassmann’s Law. If Greek had inherited a “pre-Grassmanized” **be_gud^h-*, the reflex would be **βευθ-*. Therefore the standard Neogrammarian theory leaves us no alternative but to claim that Sanskrit and Greek developed their respective in-

stantiations of Grassmann’s Law independently². Kortlandt (1978, 117) (which, to be scrupulously fair, it must be pointed out that Jasanoff does not cite) explicitly argues along the same lines, claiming that the evidence of Winter’s Law, Bartholomae’s Law and Lachmann’s Law argues for the retention of the glottalic feature into Balto-Slavic, Indo-Iranian and Latin respectively, even in environments subject to assimilation, and therefore that regressive voicing assimilation should be considered an independent development in each of the IE languages. This would not be unsurprising on typological grounds, since assimilation is one of the most widely found phonological processes (Cho, 1990). On the other hand, Jasanoff is right to point out that Kortlandt’s analysis implies this account of IE assimilation, and a more explicit mention of this entailment is an unfortunate casualty of the notorious (Garrett, 1991, 801) brevity of Kortlandt (1989, 1999)’s presentation.

In addition from criticising the slimness of Kortlandt (1989) as a product of excessive “chutzpah”, Garrett (1991, 801) raises a more trenchant exception to Kortlandt’s arguments. Since Kortlandt (1989, 103) claims that Saussure’s analogical reintroduction of voiced stops is unnecessary, he does not gain the benefit of being able to restrict the operation of Lachmann’s Law to participles which alternate with inflected forms in which the voiced (or glottalic) forms is still visible. Kortlandt claims that the glottalic stops which conditioned the Law as he formulates it were present by simple inheritance, having yet to be assimilated away by the foundational shift in the stop system from PIE to Latin. Therefore, he is obligated to explain the lack of lengthening in forms which Kiparsky (1965) and Maniet (1956) considered synchronically opaque and thus immune to Saussure’s analogy (see p. 13). These forms include *lāssus* ‘tired’, *tūssis* ‘cough’ and *āxis* ‘axle’, and are presumed to come from **lad-tos* (cf. Gk. *ληδειν*), **tud-tis* and **ag-sis* respectively. Kortlandt (1989, 104) rather unsatisfactorily dismisses the etymologies of *axis* and *tussis* as “too uncertain to

²I leave aside the not unconvincing generative account which claims that Grassmann’s Law was active for PIE but did not alter underlying representations until the dialectal period (for which see Kiparsky, 1973), since constraints of space prohibit a full discussion, and in any case Jasanoff’s arguments are Neogrammarian, so I meet them on Neogrammarian terms.

serve as an argument”. He engages more closely with *lassus*, and accounts for it by arguing for a sound change HT' > HT, so that **lh₁t'-tos* > **lat-tos* > *lassus*, without going through the intermediate stages **lat'-tos* > **lad-tos* which would subject it to Lachmann's Law. If this sound change is not intended to be subject to any environmental restriction, and Kortlandt does not mention one in either of the places where he invokes it (Kortlandt, 1989, 104, Kortlandt, 1999, 247), then, as Garrett (1991, 801) rightly points out, it predicts more widespread effects which fail to be attested: we might expect **tēns* < **h₁d_{nt}t* for *dēns* “tooth” or **suātuis* < **s_uah₂d-u-ih₂-s* for *suāuis* “sweet”. This last example is particularly damning, since the **d* (or **t'*, as the glottalic theory demands we reconstruct it) is tautosyllabic with the preceding laryngeal, exactly as in **lh₁t'-tos* > *lassus*, and so serves as a counterexample to what might otherwise be a sensible reformulation of Kortlandt's sound change.

Kortlandt (1989, 104)'s account of the exceptions in [i] is likewise problematic. He claims that the glottalic **t* we might expect in the antecedents of *fissus*, *scissus*, *strictus* etc. is absent because the contrast between obstruent series in the present stem is neutralised after the nasal infix: as the **pand-* of *pandō* comes from **patane-*, Kortlandt argues, the present stems **find-*, **scind-* and **string-* of *findō* *scindō* and *stringō*, with their glottalisation feature neutralised in the post-nasal environment, caused the analogical creation of new participles **fit-tos*, **scit-tos* and **strik-tos*, giving the attested *fīssus*, *scīssus* and *strīctus*. In an omission that must be regarded as fatal to the credibility of this argument, Kortlandt (1989, 1999) offers no account of why the same analogy was not extended to the other Lachmann verbs with nasal infixes in the present, giving e.g. **tūssus* from *tundō* or **pāctus* from *pangō*.

Kortlandt (1989, 104) argues that *-sessus* is to be accounted for by virtue of the fact that it shows an e-grade. In general terms, participles in PIE are formed on the rubric ⟨∅-grade of root⟩+ *-tos*. For the IE root **sed*, this would predict participle **sdtos*, which would not square with Latin phonotactics. Kortlandt argues that in order to avoid the infelicitous zero-grade, the grammar

innovated an *e*-grade participle for the compounds of *sedeō* after the operation of Lachmann's Law, so that the environment of Lachmannian lengthening was not present in the participle at the time the Law took effect. In view of the fact that *sedeō* itself has no past participle, it is intuitive to suppose that its compounds might have developed an *e*-grade in their participles later than verbs built on other CeC roots (and indeed Watkins (1970*b*) advances a hypothesis that shares this notion, that the participles in *-sessus* were formed too late to be affected by Lachmann's Law, as we shall see in the next section). It must be pointed out that the adoption of *e*-grades for the participles of verbs from CeC roots in general must have been earlier than for *-sessus*, if Kortlandt's theories are correct, since there are Lachmann participles from CeC roots, like *ēsus* (root **h₁ed*) and *lēctus* (root **leĝ*). Kortlandt might have benefited from stipulating that his principle of zero-grade for CeRC roots and *e*-grade for CeC-roots was generally instantiated before Lachmann's Law, and the compounds of *-sessus* followed it analogically after Lachmann's Law, but such reasoning is more or less implicit in his argumentation.

Because Kortlandt follows Strunk (1976) (whose arguments are discussed in the section on analogists) in claiming that *cāsus* was not subject to Lachmann's Law proper, and follows Maniet (1956) in linking Plautine *cassō* 'I waver' with *cadō* 'I fall', Kortlandt is obliged to claim that for CeHC roots, both zero- and *e*-grade participles are possible, and that *cāsus* reflects a full grade, and the presumed **cassos* (on which Maniet (1956, 233) claims *cassō*, *cassāre* is built) reflects a zero-grade. However, Schrijver (1991, 136) argues that the evidence for **cassos* is much slimmer than it appears. Since *cassō* is found in the meaning 'I waver' only in Plautus, who predates the degemination of *ss* after long vowel, his writing *cass-* cannot be proven not to represent **cāss-*. Schrijver also points out that the semantic connection between *cassō* and *cadō* is not conclusive, and that *casso* may be related instead to *quassō* 'I shake'. Kortlandt's analysis would be considerably tidier if we simply consider *cāsus* to be a Lachmann form and so argue that CeHC roots produce zero-grade participles in Latin, just like

(other) CeRC roots.

Kortlandt (1989, 104) and Schrijver (1991, 136) both use the same evidence to dismiss *maximus* and *pessimus* as irrelevant that Jasanoff (2004, 412) uses to adduce them, namely Cowgill (1970, 125)'s reconstruction of them as coming from **magismmos* and **pedismmos* respectively. Schrijver and Kortlandt fail to explore the implication of this reconstruction, that syncope must have created the forms **mags-* and **peds-* at some point within the history of Latin, since the devoicing (or deglottalisation) of the **g* and **d* cannot have occurred before they were brought into assimilatory contact with the following *s*, and we are left to infer that they believe that this point came after the operation of Lachmann's Law. It is certainly more convenient to dismiss the single apex that supports the reading of length in *māximus* as unreliable than to assume that Lachmann's Law must have affected both forms, since Jasanoff (2004, 412) has to claim that the synchronically regular superlative form *-ssimus* was re-imported into his putative **pēsimus*, whereupon the *e* was shortened by the *littera*-rule³.

Given the above empirical and implementational difficulties with the ideas laid out in Kortlandt (1978, 1989, 1999), we may pass lightly over the theoretical objections; it is enough to note that Kortlandt's equation of Bartholomae's Law, Lachmann's Law and Winter's Law under the rubric of epiphenomena of the preservation of glottalics has been called into question (difficulties summarised neatly in Collinge, 1985, 226) and to mention that the glottalic account of Winter's Law, with which Kortlandt most strongly equates Lachmann's Law, competes with, among others, accounts that ascribe its characteristic lengthening to the presence of laryngeals (Collinge, 1985, 225–227). To do full justice to these theoretical debates would require a more lengthy investigation of the relevant data from Indo-Aryan and Balto-Slavic than the soundness of Kortlandt's argumentation on the subject of Lachmann's Law and the space available to us warrant.

³Kortlandt (1989, 104) deals with the other Lachmann-embarrassing reflex of the root **ped*, namely the supine *pessum* 'to the ground', by citing Collinge (1975, 475)'s suggestion that the vowel was shortened to avoid homophony with forms of the verb *pēdō* 'break wind'. This hypothesis is essentially unprovable.

A different analogy.

Drinka (1991) discards the Saussure-Pedersen engine of Lachmann's Law and offers an entirely novel account. Like Saussure, she obviates the difficulty that Lachmann's Law is not surface-true by arguing that the environment which conditioned it was introduced analogically and lost again after the change took place, but unlike the followers of Saussure and Pedersen, she relies on a sound change which has already been posited for Latin on independent grounds, namely the following:

$$(1.7) V > \bar{V} / \text{---}n\{s,f,c\}$$

So *cōnsul*, *īnferī*, *sānctus*, *quīntus* (< *quinctus*)

The analogy that Drinka claims created the environment for this change to take place in the Lachmann verbs was the importation of the *n*-infix of the present into the past participle, as well as a present-forming suffix *-de/o-* in some cases. Drinka (1991, 60ff.) envisages this as a staged process, with the jumping-off point being forms such as *spondeō*: *spopondī*: *spōnsus* 'pledge oneself', *tondeō*: *totondī*: *tōnsus* 'shear' etc. Drinka points out that alongside Lachmannian *tūsus*, we also have attested *tunsus*. She argues that all the Lachmann forms with nasal infixes in the present, so *frāctus*, *pāctus*, *tāctus*, *tūsus* *fūsus* imported the nasal infix of their present stems into their participles on the model of verbs with nasals in the root like *spondeō*: *spōnsus*, then lost the nasal with compensatory lengthening and nasalisation of the vowel. Drinka (1991, 62) adduces parallels from Oscan and Umbrian, viz. O. *saahútum* and U. *sahatam* to *sānctum* and U. *šihitu* to *cīnctus* in an attempt to show that the loss of the nasal with compensatory lengthening was the regular Italic treatment, and that the presence of the nasal in some Latin forms like *sānctus* and *cīnctus* was secondary and analogical.

One difficulty that Drinka (1991, 65–66) forthrightly acknowledges is the fact that Lachmann's Law does not seem to apply to participles in *i*, with the exception of *uīsus*. (1.7), by contrast, seems to have no difficulty in lengthening

i (cf. *quīntus*). For this she presents the essentially *ad hoc* explanation that the analogy spreading the nasal infix to the participle did not affect verbs in *i* until the secondary stage, whereupon it produced *uīnctus*, *cīnctus* and *extīnctus*.

Finally, Drinka (1991, 68–69) proposes another secondary innovation (which may be contemporaneous with the first one) which spread the lengthening to the Lachmann forms without nasal infixes in the present, so *lēctus*, *tēctus*, *ēsus*, *ōsus* etc. In particular, she claims that the model of *frēgi*, *frāctus* was the source of the *ē* of *ēgi* as well as of the *ā* of *āctus*, in contrast to accounts which claim that *ēgī* was the model for *frēgī* (e.g. Meiser, 1998, 211). In any case, Drinka offers no account of where the *ē* of *frēgī* comes from.

Although the title of Drinka (1991) bills it as “a phonological solution”, Drinka exploits the fact that analogy creates the environment for the sound change in a way reminiscent of the manoeuvrings of the analogists. She relies on the fact that analogy, unlike sound change, is not inherently regular to avoid explaining why the analogy that gives us *lingō*: *līnctus* and *cingō*: *cīnctus* does not also give us *stringō*: **strīctus* or *mingō*: **mīctus*, for example. Furthermore, she elides the issues of *uīsus* and *sessum*: if, as we might suppose, the final process, which gave us *lēctus* from *legō* on the model of *pactus* from *pangō* etc. was also enough to give us *uīsus* from *uideō*, why did it not also give **-sēsus* from *-sideo* (< *sedeo*)? Conversely, if the final analogy did not affect presents in *-eo*, whence *uīsus*?

Drinka (1991, 70) also attempts to claim it as an advantage of her theory that “it does not seek to account for every datum at one synchronic level”. However, absent evidence from the attested language that one change actually preceded another, the way that she envisages the analogies and subsequent sound changes occurring by stages must be viewed as an *ad hoc* hypothesis, and can hardly be claimed as an advantage.

Like the analogists (p. 31ff.), Drinka abandons the descriptive criterion that Lachmann’s Law affects verbs whose IE roots ended in voiced stops, and attempts to replace it with morphological conditioning. Even accepting the fact

that the descriptive criterion does not hold entirely (given the exceptions of *uīsus* and *sessum*), and is difficult to make accessible to the synchronic grammar (requiring an analogy like that of de Saussure (1889), or a generative account like that of Kiparsky (1965), which we will look at next), it is nonetheless my contention that Drinka’s alternative fails as satisfactorily to answer the question “Why these verbs and not any others?”

Generative sound change.

The zenith of accounts of Lachmann’s Law as a sound change is that of Kiparsky (1965, 19–24), which is so rarefied that most would not categorise it as belonging to that class at all. The key insight of Kiparsky’s analysis was that Neogrammarian sound changes are the observable artefacts of changes in the structure of the phonological component of the grammar. Therefore, rather than try to characterise Lachmann’s Law as a regular sound change directly, he posited a change in the phonology of Latin that cast Lachmann’s Law as a case of rule insertion.

The generative theory of the time (best exemplified in Chomsky and Halle, 1968) cast phonology as a series of language specific, extrinsically ordered rewrite rules: an “assembly line”, to use the colourful metaphor of Hayes (1999), which converted underlying phonological representations into surface utterances by applying atomic processes one after another. On this model, the standard way to model a Neogrammarian-style sound change was simply to turn the > into a →, as it were, and add the rule to the end of the derivation.

Kiparsky (1965, 19)’s suggestion was that it might be possible to add rules to the derivation in places other than the very end. He proposed the following rules for the grammar of Latin:

$$(1.8) \quad V \rightarrow [+long] \quad / \quad \text{---} \quad \left[\begin{array}{c} +obstruent \\ +voice \end{array} \right] \quad \left[\begin{array}{c} +obstruent \\ -voice \end{array} \right]$$

$$(1.9) \quad [+obstruent] \rightarrow [\alpha \text{ voice}] \quad / \quad \text{---} \quad \left[\begin{array}{l} + \text{ obstruent} \\ \alpha \text{ voice} \end{array} \right]$$

(Kiparsky, 1965, 19)

On this account, (1.9), which predicts voicing assimilation of adjacent stops would have been inherited from Proto-Indo-European, squaring with our observation that such assimilation can be found across the Indo-European languages (see page 12), but (1.8), which gives rise to the Lachmannian lengthening proper, would be a Latin innovation. This removes the need for Saussure’s analogical reintroduction of voiced stops into participles, since the necessary voiced stops, Kiparsky argued, were present in the underlying representations of the Lachmann participles already. All that was needed was to take the sound change (1.4) proposed by Saussure and his followers, and add it to the phonology where it could “see” the voiced stops that conditioned it, i.e. before (1.9) could assimilate them away. This is an example of counterbleeding, an opaque interaction between rules like that which was posited as giving rise to e.g. the misapplication of Canadian diphthong raising in Chomsky and Halle (1968, 342–343).

Kiparsky appears to have been unaware of the exceptions to Lachmann’s Law that we have discussed. In particular, in discussing certain non-participles which one might expect to undergo the Law, he shows that he expects words from IE roots ending in voiced aspirates to undergo Lachmannian lengthening as well. We have already mentioned (p. 13) the exceptions *tussis* and *lassus*, from **tud-tis* and **lad-tos* respectively, which Kiparsky (1965, 21) explains by arguing that the etymological voiced stops were no longer present in the underlying representations of the words in question, as their connection to verbal paradigms in which the stops were visible was no longer apparent. The revealing fact, however, is that Kiparsky includes *lectus* with *tussis* and *lassus* as another example of word whose vowel would have lengthened if its UR had reflected its etymology at the time Lachmann’s Law operated. *lectus*, of course, is reconstructed as being built on an IE root **leg^h* (cf. Gk. *λεχος*) (Kiparsky, 1965, 21).

No doubt Kiparsky was forced to this conclusion by his belief that Lachmann’s Law is “a relatively late Latin innovation”, which would entail that it occurred after the merger of the voiced aspirates with the voiced stops (in the positions we are concerned with). Nonetheless, however, this would require an explanation of why the Law did not affect participles from roots with voiced aspirates, like *fos-sus* from **b^hod^h*. I can only conclude that Kiparsky was unaware that this was the case. This omission need not be fatal to the proposal, however, since (1.8) can still be hypothesised to be a Latin-specific rule. We must simply argue that it was inserted into the grammar before the voiced aspirates were merged away, and remained there long enough to change the underlying representations of the Lachmann participles to include their characteristic long vowels. This step is necessary because (1.8) cannot have remained in the grammar after the merger of the voiced aspirates. If it had, it would have produced **fōsus* etc. If we were merely refurbishing Kiparsky’s rule-based account, we would have to leave that as a stipulation. As we shall see, however, transposing Kiparsky’s account into OT will allow us to explain the short half-life of (1.8) in independently-derived terms (see p. 80).

The above objection to Kiparsky’s account does not necessitate a change in the rules (1.8) and (1.9), only a stipulation as to chronology. The other main respect in which Kiparsky’s analysis is false to the facts, however, does. His general statement: “In Latin, vowels become lengthened before clusters of the form ‘voiced obstruent + voiceless obstruent’ by Lachmann’s Law” (Kiparsky, 1965, 19) is of course an overstatement of the case. Where the vowel in question is *i*, as we have seen, the lengthening generally does not occur (as in *scīssus*, *pīctus*, *fīctus*), with the apparent exception of *uīsus*. Furthermore, there is the exception of the compounds in *-sessus* to the rule as applied to *e*. There is also the lengthening before *m* in *ēemptus*.

The fact that Kiparsky offers no account of these empirical objections to his hypothesis made it all the more easy for others to abandon it when faced with a theoretical objection. The form of change which Kiparsky argued that

Lachmann's Law exemplified, non-chronological rule insertion, was new, and as Kiparsky (1965, 19) himself acknowledges, hard to concretely exemplify. The validity of Kiparsky's approach, and of rule addition in general, was hotly debated on the squib pages of *LI* (Watkins, 1970*a*; Perini, 1978; Joseph, 1979; Klausenburger, 1979; Stephens, 1979), but the hypothesis never truly recovered from the dramatic recantation of King (1973). King had repeated Kiparsky's account of Lachmann's Law in his textbook King (1969, 43–44) as an example of rule insertion, but by 1973 he had searched in vain for parallels, and decided on the basis of their absence that rule insertion did not exist. The field moved on, and Kiparsky's account of Lachmann's Law fell out of fashion. I believe that this was unfortunate, since the basic engine of Kiparsky's analysis seems to me to be the most sound of those that have been offered so far. In the next chapter I hope to show, by setting them in the empirical framework of Optimality Theory, how Kiparsky's arguments can be refurbished and updated to take full account of the facts of Lachmann's Law as we understand them.

1.3.2 Lachmann's Law as analogy.

As early as 1884, the difficulties inherent in treating Lachmann's Law as a regular sound change were sufficiently well recognised for Osthoff (1884, 113) to abandon the idea entirely, and to propose in its stead the hypothesis that the vowels of Lachmann's past participles were lengthened by analogy with the long vowels of their respective verbs' perfect stems. This hypothesis is enthusiastically taken up by Kent (1928), but it is acknowledged by both Osthoff and Kent that it only goes so far, i.e. it only accounts for those verbs which have a long vowel perfect, as follows:

(1.10) **participle 1sg. perf.**

Accounted for by Osthoff-Kent	
<i>rēctus</i>	<i>rēxī</i>
<i>tēctus</i>	<i>tēxī</i>
<i>lēctus</i>	<i>lēgī</i> ⁴
<i>fūsus</i>	<i>fūdī</i>
<i>ēsus</i>	<i>ēdī</i>
<i>ōsus</i>	<i>ōdī</i>
<i>ēemptus</i>	<i>ēmī</i>
<i>uīsus</i>	<i>uīdī</i>

Arguably accounted for by Osthoff-Kent	
<i>āctus</i>	<i>ēgī</i>
<i>frāctus</i>	<i>frēgī</i>

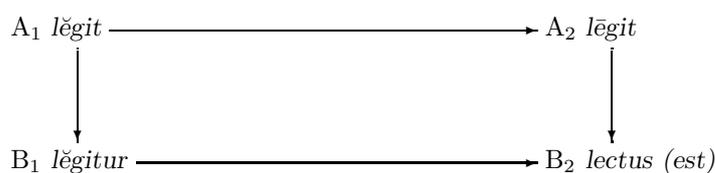
Unaccounted for by Osthoff-Kent	
<i>tāctus</i>	<i>tetigī</i>
<i>pāctus</i>	<i>pepigī</i>
<i>tūsus</i>	<i>tutudī</i>
<i>cāsus</i>	<i>cecidī</i>

As we can see, the difficulties with the Osthoff-Kent hypothesis fall into two broad categories: there are those words in which the analogy seems to be incomplete, insofar as the length of the vowel has been extended from the perfect active to the participle, but not the vowel quality (*āctus* ~ *ēgī* and *frāctus* ~ *frēgī*), and, more seriously and numerously, there are those Lachmann verbs which have no long vowel in the perfect active to be imported into the perfect passive, e.g. *tutudī* ~ *tūsus*, *pepigī* ~ *pāctus*. These problems have been subject to multiple attempts at solution: Kuryłowicz (1968*a,b*) offered a comprehensive account which Jasanoff (2004) described as a “counterattack” to Kiparsky (1965)’s phonological account. Watkins (1970*b*) supplemented and amended it to the extent that Collinge (1985) refers to the analogical account of Lachmann’s Law in general as the “Osthoff-Kent-Kuryłowicz-Watkins formulation”, and the latest complete account is offered by Strunk (1976). We shall treat these accounts in chronological order.

⁴A perfect in *-lēxī* is attested for certain compounds of *legō*, viz. *intellēxī*, *dīlēxī* and *neglēxī*.

The fact that there seems to be a gradient scale of difficulties with the Osthoff-Kent hypothesis, from the forms where the perfect stem has a long vowel, but does not otherwise perfectly match the shape of the present stem: e.g. $r\bar{e}x\bar{i} \sim reg\bar{o}$, to those where the perfect stem has no long vowel for the participle to appropriate, such as $tetig\bar{i} \sim teg\bar{o}$, might suggest to the well-trained analogist that the attested facts are the result of a successive series of analogical processes. This is exactly the way Kuryłowicz (1968*a,b*) formulates his account. He begins by casting the original observation of Osthoff and Kent in the form of the following diagram (Kuryłowicz 1968*a*, 326, Kuryłowicz 1968*b*, 296):

(1.11)



On this account, the *fons et origo* of Lachmann’s Law is a paradigm levelling: informally “if the active and passive present stems match, then the active and passive perfect stems should too!” According to Kuryłowicz, however, it affected only those forms where the A_1 and A_2 stems were identical in shape save only for the length of the vowel (“subgroup (a)”). Thus he accounts for $l\bar{e}ctus$, $\bar{e}sus$, $u\bar{i}sus$, $\bar{e}mptus$ and $\bar{o}sus$. Kuryłowicz (1968*b*, 298) stipulates that this process took place at a stage when the medial reflexes of the PIE voiced aspirates were still voiced fricatives, and stipulates that the analogy covers only forms whose paradigms match the prescription of (1.11), and whose perfect stems end in $-d$, $-g$ or $-m$, hence the lack of lengthening in $f\check{o}ssus$: $f\bar{o}d\bar{i}$ and $tr\check{a}ctus$: $tr\bar{a}h\bar{i}$ (or, at the time: $*/fo\theta.tos/$: $*/fo:\delta i:/$ and $*/tra\chi.tos/$: $*/tra:\gamma.ti:/$ or similar.)

The first extension of this process is subject to certain phonological restrictions: as with the initial analogy, the root must end in $-d$, $-g$ or $-m$ (hence the lack of lengthening in $factus$, $missus$), and, though the A_2 (perfect) stem does not have to have the same shape as the B_2 (participial) stem, the shape of the B_2 stem must match that of the A_1 (present) stem (i.e. the present must not

have a nasal infix, hence the short vowel of *fissus* from *findō*, *strictus* from *strin-*
go). Thus Kuryłowicz accounts for *rēctus: regere*, *tēctus: tegere*, *āctus: agere*
and *cāsus: cadere* (“subgroup (b)”).

Kuryłowicz divides the remaining four Lachmann participles, which do not fulfil any of the conditions of (1.11) (neither the present nor the perfect stem has the same shape as the participial stem): *fūsus*, *tūsus*, *tāctus* and *frāctus* into two groups, based on the vowel that is lengthened, but each is accounted for more or less individually. The opposition *fundere: fūsus* is described as arising analogically on the model of *ēsus*, and *tūsus* in turn on the model of *fūsus*, under further pressure from the also-attested *tūnsus*, which shows the regular lengthening of vowel before *-ns* (cf. *cōnsul*).

Kuryłowicz (1968*a*, 328) adduces the parallel of Gk. *ἐπάγγελν: πηκτός* to demonstrate that the long vowel of *pāctus* is inherited. He posits (Kuryłowicz, 1968*b*, 299) that the length of the vowel in *frāctus* may be analogical on the inherited *pāctus*, and states that although we have a Greek parallel in *τεταγών* for *tetigī*, it is impossible to state which of the two possible ætiologies for *tāctus*, inheritance from PIE *à la pāctus*, or analogy on *pāctus à la frāctus*, is more likely.

Chief among the perceived weaknesses of the account expounded in Kuryłowicz (1968*a,b*) is that it delimits the environment of Lachmann’s Law by both phonological and morphological criteria — all of Kuryłowicz’s processes are restricted to roots ending in an original voiced stop (or *m*), and the process is explicitly limited to past participles. To obviate this difficulty, Watkins (1970*b*) discards all but Kuryłowicz’s initial process (1.11), and sets himself the task of either explaining how the forms that do not appear to meet the conditions of (1.11) (i.e. a present stem that has the same shape as the perfect stem save for the length of the vowel, which is short in the present and long in the perfect), in fact do meet the conditions, or why their lengthening is not to be considered a part of Lachmann’s law at all.

With the parameters of the question so defined, Watkins can and does accept Kuryłowicz’s account of the lengthening in *lēctus*, *ēemptus*, *ēsus* and, assuming the existence of an appropriate present stem at the time the process operated, though none such is attested, *ōsus*. He might also accept the first process as applying to *uīsus*, but instead rightly points out that the IE perfect for this root had an *i*-diphthong (cf. Gk. *οἶδα*, Skt. *veda*), which had probably not yet changed to *ī* at that point in the history of Latin. He nonetheless argues that *uīsus* took over the vocalism of the perfect *uīdī*, but argues that the process must be seen as distinct from the rest of Lachmann’s Law, since its effect was diphthongisation rather than lengthening of a monophthong. For a parallel, he cites the development in Germanic which gives Gothic *un-weis* and English *wise* (Watkins, 1970*b*, 62).

Watkins’ most uncontroversial contribution to the development of the Harvard account is to refer the reader to Watkins (1962, 32–35), where, in order to support his contention that the IE sigmatic aorist did not ordinarily show a lengthened grade of ablaut, he dismisses *rēxī* as a Latin innovation by citing Festus (422–423) to the effect that Livius Andronicus regularly employed a perfect *surēgit*. This places *rēctus* within the domain of (1.11), since the perfect stem *rēg* matches the present stem *rĕg*, save only for the length of the vowel, as with *lĕgō* ~ *lĕgī*, *ĕdō* ~ *ĕdī* etc.

Watkins (1962, 33) wishes to extend the same argumentation to include *tēctus* in the domain of (1.11). The requisite perfect stem **tĕg-* is not attested, but Watkins points out that neither the sigmatic *tĕxīt* nor any other perfect of *tegō* is attested until Lucretius, and that the attested paradigms of the three verbs with rhyming stems in *-ĕg-*: *regō*, *tegō*, *legō*, otherwise match in every detail (once we have accepted Festus’ evidence for *rĕgī* as the original perfect of *regō*), even to the point that *rĕgula* and *tĕgula*, forms ostensibly derived from the perfect stems of *regō* and *tegō*, are alike. If we accept the arguments of Watkins (1962) to the effect that the lengthened grade was not characteristic of the IE sigmatic aorist, then *tĕxī* cannot be inherited, and since the paradigms

of *tegō*, *regō* and *legō* are otherwise so alike, it is difficult to imagine that *tēxī* would have been innovated significantly earlier than *rēxī* or (*intel*)*lēxī*. Thus it seems plausible to include *tēctus* with the other Lachmann participles accounted for by (1.11).

Watkins (1970*b*, 62) accounts similarly for *ēgī* ~ *āctus*, by taking a stand on the issue of exactly what the source of *ēgī* is. The alternation between *ǎ* in the present stem and *ē* in the perfect stem arises originally as the regular behaviour of Latin verbs which meet the following conditions:

- (1.12)
1. The IE root from which the verb is derived ends in a laryngeal.
 2. The present stem of the verb in Latin is formed by one of the IE derivational processes which indicates a zero-grade of the root: e.g. *-ie/o*-suffixation.
 3. The perfect stem of the verb is formed on a full-grade IE aorist, e.g. the root aorist.

An example of a Latin verb that meets these conditions is *faciō* ~ *fēcī*: the IE root in question is **d^heh₁* (cf. Gk. *τι-θη-μι*) (Mayrhofer, 1986, 95); the present is formed by *-ie/o*-suffixation of the root aorist: *faciō* < **d^hh¹-k-jō* (Meiser, 1998, 196); and the perfect stem is formed on the IE root aorist: *fēcī* < **d^heh₁-k-* (cf. *ἔ-θη-κᾶ*) (Meiser, 1998, 212).

agō, by contrast, does not meet the conditions set out in (1.12). It derives from an IE root **h₂eg*. This has led certain scholars, most notably Benveniste (1949), to assume that *ēgī* cannot be original, and must therefore be analogical on the verbs which acquire the *ǎ/ē* alternation by regular sound change, e.g. *faciō* ~ *fēcī*, *iaciō* ~ *iēcī* etc. Benveniste (1949, 17) accounts for the long vowels of the Latin perfects that are attested from similar IE laryngeal-initial roots by reduplication, as follows:

$$\begin{aligned}
 (1.13) \quad & *h_1e-h_1p-ai > \text{Lat. } \bar{e}p\bar{i} \\
 & h_1e-h_1d-ai > \text{Lat. } \bar{e}d\bar{i} \\
 & h_3e-h_3d-ai > \text{Lat. } \bar{o}d\bar{i}
 \end{aligned}$$

On this account, we would expect $*h_2e-h_2g-ai > **\bar{a}g\bar{i}$ for $\bar{a}g\bar{o}$, and Benveniste (1949, 17) cites Old Norse $\bar{o}k < * \bar{a}ga$ as comparative support for his hypothesis that Latin showed exactly such a form, before it was replaced by the $\bar{e}g\bar{i}$ which he views as analogical.

Kent (1928, 186) anticipated Benveniste in citing $\bar{o}k$ as a parallel for a hypothetical Latin $*\bar{a}g\bar{i}$ in his attempt to explain the inclusion of $\bar{a}ctus$ in Lachmann's Law, and Watkins (1970*b*, 62) cites Benveniste as vindicating Kent's views on this point, but it should be noted that Benveniste's is not the only account of the genesis of $\bar{e}g\bar{i}$. Sihler (1995, 581), for example, accounts for $\bar{e}g\bar{i}$ as the product of a reduplication taking place after the loss of the laryngeals in pre-Latin. On this account $*h_1e-h_1g-ai > *e-ag-ai > \bar{e}g\bar{i}$ by contraction without ever passing through the intermediate stage $*\bar{a}g\bar{i}$ necessary to bring $\bar{a}ctus$ within the purview of (1.11). Chronology, at least, is on Sihler's side here, since reduplication appears to have remained a productive part of the Latin grammar well after the laryngeals were lost from it⁵, but the majority of scholars accept the account of Benveniste (1949).

Having thus folded $\bar{r}\bar{e}ctus$, $\bar{t}\bar{e}ctus$ and $\bar{a}ctus$ into Kuryłowicz's original analogy (1.11), Watkins (1970*b*, 62ff.) is left with the following Lachmann participles to account for:

(1.14)	<i>cadō</i>	<i>cecidī</i>	<i>cāsus</i>
	<i>frangō</i>	<i>frēgī</i>	<i>frāctus</i>
	<i>fundō</i>	<i>fūdī</i>	<i>fūsus</i>
	<i>pangō</i>	<i>pepigī</i>	<i>pāctus</i>
	<i>tangō</i>	<i>tetigī</i>	<i>tāctus</i>
	<i>tundō</i>	<i>tutudī</i>	<i>tūsus</i>

Watkins (1970*b*, 63) adds further support to Kuryłowicz (1968*b*, 297)'s assertion that the lengthening in $\bar{t}\bar{u}sus$ is late, and analogical on the regular lengthening of its competitor form $\bar{t}\bar{u}nsus$ by citing a possible example of Kuryłowicz's

⁵As we shall see, Watkins (1970*b*) himself relies on reduplication being an active part of the morphological component of the grammar.

hypothesised older *tūssus* from Plautus: *Pseud.* 369 has *pertussum*. On its own, however, the double ⟨ss⟩ of Plautus' *pertussum* does not guarantee that the *u* in question was short, even if we accept that it is not the result of an error in the transmission of the text. The point is made aptly in the following passage of Quintilian (*Institutio Oratoria* I, 7, 20–21)

(1.15) *quid quod Ciceronis temporibus paulumque infra, fere
quotiens s littera media vocalium longarum vel subiecta longis
esset, geminabatur, ut caussae, cassus, divissiones? quomodo
et ipsum et Vergilium quoque scripsisse manus eorum docent.
atqui paulum superiores etiam illud, quod nos gemina
dicimus iussi, una dixerunt*

For was it not in the time of Cicero and a little later, that in nearly all cases an *s* between long vowels or after a long vowel, was doubled, as in *caussae*, *cassus*, *diuissiones*? That he himself, and also Vergil wrote in this way is shown by [manuscripts in] their own hands.

Yet a little before that, that *iussi* which we write with a double *s*, they spelled with one.

Quintilian speaks only of the time of Cicero and later, not of that of Plautus, but nonetheless the implication is clear: it was not until after Cicero that the convention of writing ⟨-ss-⟩ after a short vowel and ⟨-s-⟩ after a long was entrenched, and even then the vagaries of spelling convention are such that we should not rely solely on it as an indicator of the length of the preceding vowel.

Watkins also notes that *fundō* may not originally have had a participle in root + *-tos*. He cites the gloss in Paulus ex Festo 59 of *exfuti* as *effusi*. This, when taken with Gk. *χυτός* seems to make it relatively certain that we have to reckon with an IE past participle **g^hutós* or similar. However, this seems only to defer, not to answer the question of why Latin, when it chose to innovate a participle for *fundō*, innovated *fūsus* as opposed to anything else. In fact, as we

shall see, Watkins tacitly re-formulates (1.11) to ignore nasal infixes in the A_1 form, so it seems to be an unnecessary multiplication of difficulties to call *fūsus* a “late creation” — one could simply argue that *fundō* had its inherited past participle (*futus*, according to Festus’ gloss) replaced on the principle of (1.11) at the same time as *regō*, *legō* etc.

To account for *cāsus*, *frāctus*, *pāctus* and *tāctus*, Watkins (1970*b*, 62) appeals to a pattern in the distribution of methods of Latin perfect marking which is noted by Ernout and Meillet (1959, 94) viz. that with the functional merger into Latin of the IE stative and aorist, the domain of reduplication as a perfect marker shrank to cover only those roots where apophonic marking of the perfect would be impossible (i.e. roots with *a*-vocalism). On this account, reduplicated and long-vowel perfects are to be seen as equivalent for the purposes of (1.11), hence *cāsus* from *cadō*: *cecidī*. Watkins (1970*b*, 63) also abandons Kuryłowicz (1968*a*)’s strictures regarding the lack of nasal infix, hence successfully deriving *pāctus* from *pango*: **pepagai* (> *pepigī*), *tāctus* from *tango*: **tetagai* (> *tetigī*) and *frāctus* from *frango*: **fefragai* (which form is reconstructed on the basis of the Old Irish parallel *bebraig* ‘broke wind’).

This proposal is difficult entirely to square with our understanding of Latin grammar: certainly the long-vowel and reduplicated forms are functionally equivalent, in that they are allomorphs of the same notional PERFECT morpheme, but Watkins seems to suggest that they have a closer equivalence with each other which they do not share with the simple, sigmatic and *u*-perfects, or else we should expect e.g. **pāsus* from *pandō*: *pandī*.

Without direct experimental access to the intuitions of native speakers, there is little to be gained by further debating the theoretical merits of this hypothesis. Its empirical implications, however, do admit of further test. Having eliminated phonological conditions entirely from the domain of (1.11), Watkins is forced to concede that Lachmannian lengthening ought to extend to any verb that has a short vowel in the present stem (with or without nasal infix) and a long-vowel or reduplicated perfect, which leaves him the task of explaining the lack

of lengthening in participles from roots ending in other than an original voiced stop.

Watkins (1970*b*, 63) proposes to account for the lack of lengthening in *canō*: *cecini*: *cāntus* and other roots ending in a sonorant by appealing to Osthoff's Law, which states that long vowels are not permitted before a sequence of sonorant plus stop (Meiser, 1998, 75). The difficulty with this suggestion is obvious — if Osthoff's Law applied after (or simultaneously with) Lachmann's Law, why did it not reverse the lengthening of *ēemptus* as well? Watkins (1970*b*, 60) redefines Osthoff's Law to apply only to *n*, *l*, *r*. This squares with the attested evidence, since certain examples of Osthoff's Law applying before *m* in Latin are wanting. A non-Lachmannian example of Latin *-V̄mT-* would be valuable for the purposes of evaluating Watkins' views, but in its absence there is no evidence on which to discount the hypothesis.

A more serious objection can be raised to the reasoning in Watkins (1970*b*, 63–64)'s account of why there should be no lengthening in *fössus*. His statement “If *fōdī* had existed . . . it would have produced **fōsus*. The implication is clear: *fōdī* did not exist at the time of the operation of the rule” is shockingly circular in its reasoning. The implication would in fact be “*either fōdī* did not exist at the time of the operation of the rule *or Watkins has fundamentally mischaracterised the rule itself.*”

Watkins is on firmer ground when he points out that there is no comparative evidence to suggest that *fōdī* is inherited, Meiser (1998, 212), for example, agrees with him in accounting for *fōdī* as analogical, though they disagree in the proportion. Watkins (1970*b*, 64) adduces *ōdī* as the analogical model for *fōdī*, though it is difficult to see on what proportion such an analogy could be founded, given that *ōdī* lacks present-tense forms: a proportion *ōsus*: *ōdī* :: *fossus* : ??? would be unfortunate for obvious reasons. Meiser (1998, 212), however, derives *fōdī* on the proportion *ueniō* : *uēnī* :: *fodiō* : *fōdī*, which is generally satisfactory. He likewise derives *scābī* (\sim *scabō*) from *lēgī*. Positioning these analogies chronologically after the operation of (1.11) would be sufficient

to explain their lack of susceptibility to Lachmann's Law as Watkins formulates it.

By way of explaining the lack of lengthening in *-sessus* (*obsēssus*, *possēssus*), Watkins (1970*b*, 64–65) makes the important point that Lachmann's Law, however it is formulated, applied in the first instance only to past participles, and *not* to supines. He does so by invoking the supine *pessum* 'to perdition', which comes from a well-paralleled IE verbal root **ped-* (cf. Skt. *padati*, OCS *pado*, OE *fetan*) (Watkins, 1970*b*, 64). Watkins chooses to infer from this datum that Lachmann's Law cannot be a purely phonological change of the order posited by Saussure, Maniet, Kiparsky etc., since *pessum* must derive from **ped-tu*, which displays the consonant cluster characteristic of phonological accounts of the Law, and therefore that the identity of vowel length between the Lachmannian participles and the supines of the same verbs must be the result of a separate analogy conditioned by the widespread identity of supine and perfect participle in most other Latin verbs.

Watkins uses this evidence as the starting point for his account of the lack of lengthening in participles in *-sessus*, which runs as follows: at the time of the operation of (1.11), *sedere* had neither a perfect participle (for semantic reasons: there was no function for the perfect participle passive of an intransitive verb of this kind to serve) *nor yet any compounds*. It had a supine *sessum*, attestations of which Watkins (1970*b*, 64) cites from both Plautus and Cicero, but as *pessum* demonstrates, supines lacking a corresponding past participle went unaffected by Lachmann's Law. Subsequently, and after (1.11) ceased to be a productive analogy, new verbs were derived from *sedeō* by compounding, verbs for which the semantic function served by the past participle was not empty as it is for the base verb. To innovate the necessary participles, the grammar turned to the form which most closely resembles the past participle, namely the supine, as an analogical model, hence **-sessus*.

The most recent account that accepts the OKKW engine of Lachmann's Law undiluted — which is to say without translating it into generative mor-

phophonemic rule-notation or otherwise re-characterising it as anything but a pure analogy — is that of Strunk (1976). Strunk accepts and further develops Watkins (1970*b*)’s proposal of a synchronic equivalence between reduplicated and long-vowel perfects, and between thematic root presents with and without nasal infix, that is stronger than the simple allomorphic equivalence they share with other forms serving the same grammatical function.

Like Watkins (1970*b*), Strunk (1976) begins by taking (1.11) as the basic analogy driving Lachmann’s Law, and rejecting the phonological conditions Kuryłowicz (1968*b*) originally imposed on it. This leaves him with a starting point as follows:

- (1.16) *lĕgitur: lēgī: lēctus*
ĕmitur: ēmī: ēmptus
uĭditur: uīdī: uīsus
ĕditur: ēdī: ēsus
(ōdium): ōdī: ōsus

Strunk endeavours to get the right result by delimiting the scope of (1.11) in new ways. He sets out the following three conditions:

- (1.17) Reduplicated perfects are equivalent to long-vowel perfects for the purposes of the analogy. Sigmatic, simple and *u*-perfects are not.

- (1.18) Presents with nasal infix are equivalent to root presents for the purposes of the analogy. Derived presents (e.g. in *-ĭe/o-*) are not.

- (1.19) There must be two differences between the active perfect and the passive perfect before the analogy will take effect.

Each of these claims is essentially *ad hoc*: it is hard to see any reason independent of the Lachmann data to make them. Indeed, from the point of view of Latin grammar generally, there are positive difficulties with them, many of which are pointed out by Morpurgo Davies (1979). Firstly, though Strunk (1976, 36ff.) relies heavily on the notion of an equivalence of reduplicated and

long-vowel perfect stems, he does not present an account of how this equivalence operates. The question in Morpurgo Davies (1979, 260) deserves restating: “is it something which can be stated by a morphophonemic rule?” In other words, if Watkins (1970*b*) and Ernout and Meillet (1959) are right, and the domain of reduplication can be described as “verbs with (Latin) root vowel /a/ which would otherwise form long-vowel perfects”, then we need a synchronic account of how the grammar selects which method of forming the perfect to use. We might say that for the third conjugation (into which all the Lachmann-susceptible verbs fall), long-vowel/reduplicated perfects are the default, and simple or sigmatic perfects are lexically-specified exceptions. This would raise questions such as “why do we have reduplicated *tutudi* for *tundo*, but long-vowel *fūdi* for *fundo*?” Before we can accept grand statements about the workings of Latin morphology such as Strunk’s, answers to these and other questions, answers which make empirical predictions that we can test, need to be provided. What Strunk does offer, namely the idea that the two short vowels of the reduplicated forms are metrically equivalent to the single long vowel of perfects like *lēgi*, on principles familiar from the scansion of Latin verse, is problematic. Morpurgo Davies (1979, 260) points out that in verse, quantitative equivalence holds not between vowels, but between *syllables*, and the syllables of the Lachmann participles are already long “by position”, that is, because they are closed and therefore bimoraic.

Similar objections can be made to Strunk’s other claims: the assertion that nasal infixes are invisible to the analogy, but suffixes deriving present stems are not, is even less well-motivated than the claims about reduplicated vs. long-vowel perfects. In the case of the perfects, there are the distributional regularities noted by Ernout and Meillet (1959), but for the presents there are none such. Without an independently motivated theory of how one process can be invisible to the analogy, but another can be visible enough to prevent it from occurring, the generalisation in (1.18) must be considered unacceptably *ad hoc*.

Strunk (1976, 60)’s third assertion, that the analogy only operated when there was more than one difference between the perfect stem and the stem of the participle, may be intuitively pleasing, since it squares with the cross-linguistic tendency of analogies to obviate some, but not all of the irregularity in language, but like Strunk’s other contentions, its lack of corroborating evidence raises questions. Morpurgo Davies (1979, 260) cuts to the chase once again: “if we want to think in terms of a two-feature contrast, why does Latin preserve *pēs*⁶, *pedis*?” In other words, why is it only in the alternation between perfect verb stem and past participle that Strunk’s dictum seems to hold? As an analogy, it would be fallacious to expect his process to be as exceptionless as a Neogrammarian sound change, but nonetheless Strunk does implicitly claim a degree of regularity for his analogy, and Morpurgo Davies (1979) is right to point out that that claim is ill-supported by evidence that is not part of the Lachmann dataset.

Furthermore, the analogy is false to the attested facts even under these constraints. *scāptus* meets all the necessary conditions to fall subject to Strunk’s analogy: its present stem is not derived, being simply *scabō*, *scabit* etc., it forms a long-vowel perfect (*scābī*, *scābit* etc.), and it has exactly the same differences between active and passive perfect as any of the Lachmann forms: if we do not take the inheritance of voiced aspirates to be significant, then *lēgit*: *lēctus* is an exact parallel for *scābit*: *scāptus*, yet Strunk’s generalisations predict ***scāptus*.

Strunk (1976) does make general statements about the nature of the analogy that, in his view, produced Lachmann’s Law, but since they are not independently motivated, and fall down when confronted with evidence that Strunk’s work is silent on, the allegation of Jasanoff (2004, 410) that “Strunk’s theory is little more than a *post hoc*, case-by-case justification of why each form turned out the way it did” would not seem unmerited.

⁶As we shall see later on (p. 72), *pēs* is an interesting datum for Lachmann’s Law considered as a sound change.

1.4 Why Optimality Theory?

The great disadvantage of Kiparsky (1965)'s account of Lachmann's Law, one which was a systemic property of the phonological theory of its time, was that it was essentially *stipulative* in character. It made the observations a) that Lachmann's Law could be effectively captured (give or take a few exceptions) by assuming a counterbleeding interaction between a pre-voiced-stop vowel-lengthening rule and a regressive voicing assimilation rule and b) that for such an interaction to come about, the lengthening rule would have to be inserted into the derivation at a point such that it preceded the older rule. Given that the ordering of rules within the generative phonology of the time was a stipulative matter, designed to describe rather than to explain the sound pattern of a given language, little wonder should attach to the fact that no conclusion was drawn as to whether such non-chronological rule addition was possible within phonology.

The structure of Stratal OT, by contrast, places very strict limits on the extent to which opaque interactions of the type we are here attempting to model are possible. Opacity is possible within Stratal OT only as the result of interaction between co-phonologies at different levels of the *cycle* (Kiparsky, 2000).

The search for a phonological account of Lachmann's Law might well lead us to consider the cycle, even if we had not yet settled on Stratal OT as the paradigm within which to base our analysis, given that incidences of Lachmann's Law appear to be restricted to a particular morphological domain (the past participle).

Stratal OT, however, is by no means the only theory of phonology to include the cycle in its architecture. We could, for example, provide a motivation for the addition of the vowel-lengthening rule at a stage earlier than that of voicing assimilation by framing our analysis in terms of rule-based Lexical Phonology and Morphology (henceforth LPM) as defined in e.g. Kiparsky (1982); Mohanan (1986). We might content ourselves by stating that the change that gave rise to Lachmann's Law was the addition of Kiparsky's lengthening rule

to the stem-level co-phonology, and point out that the assignment of the rule to the stem-level is motivated by its observable restriction to a particular morphological domain, and likewise the fact that voice assimilation shows no such domain restriction requires us to assign it to the word-level, hence the ordering relationship between the two rules.

Casting our analysis in Optimality-Theoretic terms, however, gives us the means to evaluate our work, insofar as the structure of OT necessitates that any account couched in its terms will have empirical consequences, either for the grammar of the particular language in question or for language typology. In contrast to LPM and the generative tradition (as in Chomsky and Halle, 1968), OT analyses can lay claim to explanatory, rather than simply descriptive adequacy. This is achieved by characterising phonological generalisations of the sort exemplified in (1.20) not as denizens of linguistic competence in and of themselves, but as epiphenomena of a mapping function from underlying to surface representations which operates by evaluating output candidates against a ranked hierarchy of violable constraints.

(1.20) Examples of phonological generalisations:

1. [-continuant] \rightarrow \emptyset / ___#
2. Underlying /s/ is realised as [r] between vowels

Constraints in OT fall into two categories: markedness constraints and faithfulness constraints. These are defined and exemplified in (1.21) and (1.22):

(1.21) Markedness constraints penalise dispreferred structures in the output.

Examples:

1. *[ɣ]... : No word-initial velar nasals (McCarthy and Prince, 1999, 50)
2. STRESS-TO-WEIGHT : Stressed syllables are heavy (Kager, 1999, 268)

(1.22) Faithfulness constraints penalise differences between the input and the output. Examples:

1. IDENT-[nasal]: for a segment in the input α that has a correspondent in the output α' , α' must match α in respect of the feature $[\pm \text{nasal}]$. So, a candidate output [iba] for an input /ima/ would incur a violation of this constraint. (Kager, 1999, 29)
2. MAX-seg: every segment in the input must have a correspondent in the output. An output [ma] for an input /ima/ would incur a violation of this constraint. (Kager, 1999, 67)

An OT grammar, as defined by Prince and Smolensky (1993, 4ff.), consists of two functions: GEN and EVAL⁷. GEN generates an exhaustive set of possible candidates for any given input, and EVAL evaluates those candidates and selects as the winner the candidate which best satisfies the language's particular ranking of the universal set of constraints.

The standard method of illustrating the workings of EVAL with respect to a particular input and constraint (sub-)ranking is by the use of an OT tableau, which illustrates the number of violations of constraints of each candidate of a judiciously chosen subset of the output of GEN. An example tableau is as follows:

(1.23)

	/bɛd/	*VOICED-CODA	IDENT	VOP
a. ↵	bɛt		*	*
b.	pɛt		**!	
c.	bɛd	*!		**
d.	pɛd	*!	*	*

Kager (1999, 41)

The asterisks represent violations of the relevant constraint, and the exclamation marks represent crucial violations, that is, violations which suffice to

⁷This is notated “H-eval” throughout Prince and Smolensky (1993), however, later works (Kager, 1999; McCarthy, 2002, etc.) have established the convention which I follow here

eliminate the candidate from consideration. So for candidates c. and d., the fact that they violate the top-ranked constraint *VOICED-CODA is enough to eliminate them from consideration, so the violations are notated “*!”. In the case of candidate b., the crucial fact is that it violates IDENT twice, whereas the winner, candidate a. violates it only once, therefore the violations are notated “**!”. If one violation of IDENT would have been enough to disqualify candidate b., the violations would have been notated “*!”.

The phonologist’s task, therefore (and indeed the task of the child acquiring phonological knowledge of a particular language), is to select a ranking of constraints that predicts every observable generalisation in the surface forms of the language in question, and does not predict any patterns that are ungrammatical. The linguist has the added difficulty that the nature of the individual constraints is not independently discoverable, and must be determined by the same scientific process of hypothesis, prediction and test.

The set of all constraints (notated CON), is hypothesised to be universal across all languages, either as a part of UG or as a mental epiphenomenon of the nature of the vocal apparatus (Bermúdez-Otero and McMahon, 2006). Therefore, it is an essential feature of OT that the interaction between constraints and the generalisations they capture must predict all and only the phonologies found in the languages of the world. This built-in typology, so to speak, and strict insistence on empirical justification, are the main underlying reasons for my choice to formulate my analysis of Lachmann’s Law in Optimality-Theoretic terms.

1.4.1 Why not OO-correspondence?

Optimality Theory as it was originally formulated by Prince and Smolensky (1993) had as its principle distinguishing feature from previous, SPE-style generative phonology the property that it was radically parallel in its derivation from input to output. Where SPE-style phonology applied rules serially, creating, in effect, an intermediate representation after the application of every

pre-terminal rule, an OT grammar derives output from input in a single atomic step. This has the consequence that OT as originally formulated, with CON admitting only output-based markedness constraints and input-output faithfulness constraints (I shall refer to this from now on as “Classic OT”), is incapable of predicting generalisations which are not surface-true.

Consider, for example, the simplification of nasal clusters in English. Tautosyllabic clusters of heterorganic nasals are simplified: e.g. for *damn*, underlying /dæmn/ gives surface [dam]. Where the cluster is heterosyllabic, simplification ordinarily does not occur, as in [æm.ni:.v.tik] or [dæm.nei.ʃŋ]. However, in *damning*, cluster simplification overapplies, so that we have [dæ.mŋ], despite the fact that in the UR, presumably /dæm.nŋ/, the cluster is heterosyllabic Bermúdez-Otero and McMahon (2006, 17).

In SPE-style or Lexical Phonology, the analysis of [dæ.mŋ] presents little difficulty: one simply argues that the UR /dæm.nŋ/ consists of a stem-level domain /dæmn/ plus the suffix -ŋ on the word level. The stem-level phonology simplifies the cluster, and sends the input /dæ.mŋ/ to the word-level.

OT, however, cannot do this. Classic OT holds that the derivation from input to output is one-stage: there can be no intermediate UR /dæ.mŋ/. Positing a markedness constraint of the form “no heterorganic clusters within the same syllable or across a syllable boundary that immediately precedes a morpheme boundary” is also not feasible, since the rubric for markedness constraints is “the simpler the better”. Every constraint, as we have shown, makes typological claims, and must be verified by factorial typology before it can be relied upon as part of our model of CON. Therefore, we are best advised to keep the constraint set as simple and minimal as possible (McCarthy, 2002, §1.4.4).

Instead, two modifications to Classic OT have been proposed to handle paradigm effects like *damn* ~ *damning* ~ *damnation*. One is Stratal OT, the other, and the older of the two, is transderivational identity or output-output correspondence Benua (1997). OO-correspondence accounts for paradigmatic opacity by proposing a new kind of faithfulness constraint, that penalises differ-

ences between morphologically derived forms and their bases. If we believed in the Osthoff-Kent hypothesis, that the vowel length of the participle was taken over from the perfect stem, then Lachmann’s Law would be exactly the sort of phenomenon which is susceptible to an OO-correspondence-based analysis.

Leaving aside the question of Osthoff-Kent, there are good reasons to doubt the validity of OO-correspondence as a model of grammar. An essential empirical prediction of OO-correspondence is Priority of the Base: this holds that non-surface-true generalisations will never change morphologically simplex forms to match forms derived from them, only ever *vice versa* (Benua, 1997, 240). This prediction has been falsified: in Catalan, a process which delaryngealizes coda consonants overapplies, producing e.g. [go.zə.lat] for *gos alat* ‘winged dog’; cf. [gos] ‘dog’ and derived [go.sə] ‘bitch’ (Bermúdez-Otero, 2001). The *gos* of *gos alat* is a base form, therefore it ought not to be affected by misapplication of phonological processes according to Priority of the Base⁸.

OO-correspondence has the further weakness that it cannot account for those cases of opacity which are not paradigm effects: for these, a different formalism and a new species of faithfulness constraint have been proposed, creating what is known as Sympathy Theory (McCarthy, 2002). Sympathy has its own inherent empirical prediction: it is structurally incapable of modelling opaque generalisations for which the rule-based account would require more than one intermediate stage. This prediction is likewise falsified by evidence from Catalan (see Bermúdez-Otero, 2003, 3).

By contrast, Stratal OT accounts for both paradigmatic and non-paradigmatic opacity at once, and its central empirical prediction, that opacity is only possible as a result of interaction between phonological processes that have different domains, has yet to be falsified (Kiparsky, 2000).

⁸For more general criticism of the ill-defined nature of the notion of “base”, see Bermúdez-Otero (1999, §3.4.1.3).

Chapter 2

The analysis.

The debate around Lachmann's Law has historically been concerned primarily with settling the question of which of its properties is essential and which contingent: the analogists argued that the essential property was its restriction to a morphologically-defined domain - the past participle, and the phonologists argued that the essential property was its primarily phonological effect (vowel lengthening) and the phonological criterion by which the verbs to which it applies are selected (presence of a final voiced stop in the verbal root, whether underlyingly or by Saussure's analogical reintroduction). This frame has largely been forced onto the question by the necessity of choosing between one of two classically understood mechanisms of linguistic change: Neogrammarian-style sound change or analogy. The nature of the problem means that deciding one way or the other will cause the resultant analysis to be a poor fit to the data, as the morphological and phonological properties of Lachmann's Law seem about equally essential to it. This fact is the ultimate rationale behind my choice to frame the present account in terms of Stratal Optimality Theory: Stratal OT is a model not only of phonology, but of the interface between morphology and phonology.

2.1 Assumptions.

It is as well to list all the assumptions and stipulations that the analysis entails in one place and at the outset. They fall broadly into two categories: the chronological, where I set out exactly at what period in the history of Latin I am claiming the changes in the grammar I describe in this chapter take place, and the morphological, where I describe the synchronic state of affairs that I assume to obtain as concerns the formation of Latin stems and words.

2.1.1 Chronology.

Voiced aspirates.

Accepting that Pedersen (1896)'s observation, that Lachmann's Law does not affect verbs from roots ending in an IE voiced aspirate, is accurate and reflects an essential component of the restriction of the operation of the Law requires that we model our phonological changes as taking place while the voiced aspirates (or their Latin reflexes) were still distinct from the voiced stops in word-medial position. This same assumption is more or less explicitly made by, and in any case required of any phonological account of the Law (Sommer, 1914; Niedermann, 1953; Maniet, 1956), but its implications deserve to be explored.

The two historically dominant accounts of the development of the voiced aspirates in Italic, that of Ascoli (1868) and that of Rix (1957), as well as the "early split" account in Stuart-Smith (2004), all share the same assumptions for our purposes: firstly, they assume that Latin and the Sabellian languages share a common ancestor in Proto-Italic that they do not share with the other Indo-European languages, and secondly, they agree that the immediate Proto-Italic forerunner of the attested reflexes of the voiced aspirates in Latin and Sabellian was a series of fricatives (Stuart-Smith, 2004, 196–198). Because Latin and Sabellian treat these fricatives differently (at least in the word-medial positions we are concerned with, where Sabellian generally merges them with one another, giving a phoneme written *f* and believed by all authorities to be pronounced

[β], whereas Latin merges them with the voiced stops), we must assume that Latin inherited this series of fricatives as distinct phonemes. The assumption, then, is that pre-historic Latin retained the distinction between medial reflexes of voiced aspirates and medial reflexes of voiced stops long enough for a generation to acquire the phonological change giving rise to Lachmann’s Law, and for a subsequent generation to acquire a grammar in which that change was no longer productive.

Laryngeals.

Throughout this work, except when specifically referring to the PIE forms, I have referred to e.g. **ag-tos* > *āctus* and **od-tos* > **ōsus*, rather than **h₂eg-tos* and **h₃ed-tos*. This convention is not haphazard: I am assuming that we have to do with a Latin that postdates the loss of the laryngeals, because of the implications that that assumption has for the synchronic working of Latin morphology. Fortunately, the chronological ordering that this entails: loss of laryngeals, then word-medial merger of voiced aspirates with voiced stops, is implied if we assume that Latin and Sabellian share a common ancestor in Proto-Italic, by the way that Latin and Sabellian treat the IE laryngeals. Latin and Sabellian share the following general rules with regard to laryngeals:

- (2.1) If the laryngeal is between consonants of lower sonority than itself (i.e. if it is syllabic), its Italic reflex is *a*, e.g. in *factus*, *status*, *datu*s, cf. Gk. *θετός, στατός, δοτός*.
- (2.2) Otherwise, if the laryngeal is word-initial and precedes a vowel, the vowel is coloured as appropriate and the laryngeal itself is lost, e.g. *est* < **h₁esti*, *ago* from a root **h₂eg*, *onus* < **h₃enos* (Schrijver, 1991, 50) etc.
- (2.3) All other consonantal laryngeals are lost entirely, with compensatory lengthening in certain post-vocalic environments (Schrijver, 1991; Ringe, 1988, see).

This suggests that the sound changes which eliminated the laryngeals from the Italic segment inventory occurred in Proto-Italic, which necessarily entails that it preceded the Latin-specific changes affecting the voiced aspirates.

However, this analysis is only logically entailed if we believe that Proto-Italic genuinely existed, a question that is still open and subject to debate (Jones (1950); Beeler (1966); Rix (1994); Clackson (2008)). If we do not believe in Proto-Italic, and so claim that the sound changes of Latin are independent of those that give rise to Sabellian, this ordering that we have established: loss of laryngeals followed by medial merger of voiced aspirates with voiced stops, must be regarded as a stipulation. It is, nonetheless a necessary one, since the assumptions which I make about the workings of Latin morphology (see below) often require the laryngeals to have already been lost. Many features of the familiar Latin system of conjugations and declensions are the result of the analogical spread of a feature that has its genesis in the reflex of a form containing a laryngeal. For example, the characteristic \bar{a} of the first conjugation comes, in most cases, originally from a laryngeal, as in *nat* ‘swims’ < $*sneh_2-si$ (cf. Skt. $sn\acute{a}$ -ti ‘bathes’) or *tonāre* ‘thunder’ from $*tonh_2-ej\bar{e}$ - (cf. Skt. *stanāya*- ‘thunder’) (Meiser (1998, 186–188)). Crucially, I am assuming that the IE rubric for forming past participles, namely $\langle \text{ROOT} \rangle + \text{-tos}$, still applies, but that synchronically, the notion of “root” has been redefined in the first, second and fourth conjugations to include those conjugations’ characteristic vowels, so that the stem-level underlying representation of e.g. *amātus* was at the time already $/ama\text{:}to\text{-}/$, and the environment conditioning Lachmann’s Law was not present. Since in many cases the analogical models on which the general principles of Latin synchronic morphology were built arose due to loss of laryngeals, it is necessary to assume that that loss has already occurred.

2.1.2 Morphology.

The inflected forms of Latin verbs are built on one of two basic stems: the present stem and the perfect stem. My assumptions with regard to the formation

of these stems are as follows:

The present stem.

If we were dealing solely with the synchronic facts of Latin as it is attested, we might wish to argue that the present-tense endings of the third conjugation are *o*, *is*, *it* etc., and so that the present stem is simply the verbal root, i.e. that 3rd conjugation forms built on the present stem analyse as e.g. *reg-it*, *ag-ē-bātis*, etc. This assumption may well be adequate to the description of Classical Latin, but the examination of the comparative evidence for the source of the third declension verbs indicates a different analysis.

Meiser (1998, §126) gives a concise summary of the sources of the present stems of third conjugation verbs. The simplest source is PIE presents built with a thematic vowel: this is what we find in e.g. *agit* ‘drives’ < $*h_2eg-e-ti$ *coquit* < $*pek^w-e-ti$. However, the PIE thematic/athematic distinction is obscured in that athematic root presents built on roots ending in laryngeals also enter the third conjugation; see e.g. *uomit* ‘vomits’ < $*uema-ti$ < $*uemh_1-ti$, *sonit* ‘sounds’ < $*suena-ti$ < $*suenh_2-ti$. The third conjugation also includes verbs formed in vowel-final suffixes such as $*-s\hat{k}e/o-$ (e.g. *poscit* ‘demands’ < $*porske-ti$ < $*pr\hat{k}-s\hat{k}e-ti$, from the same root $*pre\hat{k}-$ found in the noun *preces* ‘prayer’ and the verb *precor* ‘I pray’.) and $*-je/o-$ (as in *fugit* ‘flees’ from $*b^hug-je-ti$). This being so, it seems uncontroversial to assume that the present stem of the third conjugation was characterised at the time by a short vowel. Given that we have already stipulated that the basic Latin system of conjugations was already in effect, the present stems of the other conjugations would of course have been characterised by \bar{a} , \bar{e} , or \bar{i} as appropriate.

The perfect stem.

The prototypical source for the long-vowel perfect stems of Latin is a PIE root aorist in the *e*-grade, from a root containing a glide or laryngeal (so $f\bar{u}d\bar{i}$ < $*\hat{g}^heud-$ (cf. Goth. *giutan*) \sim $f\ddot{u}nd\bar{o}$, $\bar{l}iqu\bar{i}$ < $*leik^w-$ (cf. Ved. *rik-thās*) \sim $\bar{l}inqu\bar{o}$,

$f\bar{e}c\bar{i} < *d^h e h_1 - k - ai$ (cf. Gk. $\xi - \theta \eta - \kappa \bar{a}$) (Sihler, 1995, 582)), or were modelled on forms of that kind by analogy. This being so, the synchronic assumption is that the grammar includes a morphological process for which some verbs are flagged in the lexicon that says, informally “to form the perfect stem, take the vowel of the root and lengthen it”. So the stem-level underlying representation for a long-vowel perfect stem like the $\bar{l}\bar{e}g$ of $\bar{l}\bar{e}g\bar{i}$ will be $/le:g/$.

Similar diachronic reasoning tells us that the stem for a reduplicated perfect like $tutud\bar{i}$ must be $/tu.tud/$ *vel sim.* I am assuming in order to simplify the present analysis that the change from reduplicants in Ce- to reduplicants that mimic the vocalism of the root (for which see Sihler, 1995, 580) has already occurred. The salient points of the analysis below (p. 74) will apply equally well to a grammar that produces reduplicants with *e*. This suggests that reduplication is still a productive part of the Latin grammar, and so, instead of $/tu.tud/$, I am going to follow the standard Optimality-Theoretic approach to reduplication (see McCarthy and Prince, 1999, Kager, 1999, Chapter 5), and assume that the reduplicated element of the stem is generated by an underlying morpheme RED. So, the underlying representation of $tutud$ in $tutud\bar{i}$ is assumed to be $/RED-tud/$. This assumption will become particularly important later on (§2.3.2).

Roots.

I am assuming that, outside obvious cases of suppletion (as in $ferr\bar{o}$, $ferre$, $tul\bar{i}$, $\bar{l}\bar{a}tum$), the stems of any given verb are all built by modifying the same root, so that the stem-level underlying representation of e.g. $\bar{l}\bar{e}git$ was $/le.ge/$, built from the root leg + stem-vowel *e*, the perfect stem $/le:g/$ was built by a non-concatenative morphological operation lengthening the vowel of the root, and the participle stem (underlying) $/leg.to/$ is built by the morphological operation of root leg + *to*.

In making this proposal, I am assuming that, for the purposes of morphophonology, the stem of the Latin of the period was maximal; that is, that

it encompassed everything except the inflectional ending. So the input to the ranking in 2.7 was, to take *āctus* as an example, /ag.to/. This stipulation is supported by the observation which has been imported into Stratal OT from the LPM tradition, namely that roots are phonologically inert (Kiparsky, 1982, 32–33, Inkelas, 1990, 48–55, Bermúdez-Otero, in preparation, ex. (2,119)). This principle, which is supported by observations from a number of languages, has useful implications for our present analysis, as we shall see below (p 59).

This assumption entails that where a vowel is long throughout the paradigm, eg. in *scrībō*, *scrīpsī*, *scrīptus*, the synchronic root will likewise contain the long vowel, and so such forms do not need to be explained by our account of Lachmann’s Law.

2.2 The general case.

2.2.1 Objectives.

I said above, at the end of §1.3.1, that my intention in this chapter is to update and extend Kiparsky (1965)’s generative account of Lachmann’s Law. The core of Kiparsky’s analysis was the rules I cited above as examples (1.8) and (1.9).

I shall repeat them here for ease of reference:

$$\begin{array}{l}
 (1.8) \quad V \rightarrow [+long] \quad / \quad \text{————} \quad \begin{bmatrix} +obstruent \\ +voice \end{bmatrix} \quad \begin{bmatrix} +obstruent \\ -voice \end{bmatrix} \\
 (1.9) \quad [+obstruent] \rightarrow [\alpha \text{ voice}] \quad / \quad \text{————} \quad \begin{bmatrix} + \text{ obstruent} \\ \alpha \text{ voice} \end{bmatrix} \\
 \hspace{20em} \text{(Kiparsky, 1965, 19)}
 \end{array}$$

We have already seen that there is one minimal modification that could make this model more persuasive. Adopting the cycle, and arguing that the rule in (1.8) is stem-level, explains the restriction of its effects to particular morphological domains, and the fact that it appears to have been inserted into the grammar above (1.9) (which we have independent reason to believe is word-

level, see p 61 below). We will now go further, and attempt to “translate” these rules into the OT formalism. We do this because the architecture of OT demands that our analyses have empirical predictions about the nature of grammar and language typology built into them. We will list these predictions, and in so doing, give our account the status of scientific hypothesis.

2.2.2 A new constraint.

To model (1.8), we will need to propose the addition of a new constraint to CON. Adding a new constraint in OT is permissible insofar as CON as it stands does not account for all human grammars, but the addition of a constraint to CON has empirical consequences in terms of the grammars we predict to be possible. The way the new constraint interacts with the other constraints in the set will predict the existence of certain grammars; we will examine the typological implications of our new constraint below.

The constraint I propose to add is as follows:

$$(2.4) \text{ *V}_\mu\text{D} \dots \sigma]$$

Assess a violation for every sequence in the output of a vowel followed by a tautosyllabic voiced stop where the vowel is dominated by only one mora.

A proposed new constraint like $\text{*V}_\mu\text{D} \dots \sigma]$ must pass a factorial typology before it can be accepted as a member of CON as we model it, and indeed I put $\text{*V}_\mu\text{D} \dots \sigma]$ through this process below (§2.2.4), but there is also a rule-of-thumb which may be considered the first hurdle a constraint has to leap: it must capture an observable cross-linguistic tendency (McCarthy, 2002, §3.1.5). In the case of $\text{*V}_\mu\text{D} \dots \sigma]$, the tendency is the frequently-observed one that the relative duration of a preceding vowel is one of the cues to the specification of the [voice] feature for consonants (Delattre, 1962; Klatt, 1976; Jongman et al., 1992). This phenomenon, termed Pre-Fortis Clipping by Wells (1990) and others, is not generally considered to be a part of the phonology, but it should be

noted that a closely related phenomenon must be. Moreton (2004) found that the off-glides of diphthongs were higher before voiceless consonants than before voiced ones: this may well have been the genesis of the well-known phonological process of Canadian Diphthong Raising, whereby diphthongs are raised before voiceless stops. So, *ride* is pronounced as [ɹaɪd], but *write* is pronounced [ɹaɪt]. Crucially, however, Canadian raising must be a part of the phonology, not simply a phonetic observation, since it occurs before underlying voiceless stops that are turned into flaps by a process occurring later in the derivation: *rider* is pronounced [ɹaɪrɾɹ], but *writer* is pronounced [ɹaɪrɾɹ] (Chomsky and Halle, 1968, 342). This would seem to be good *prima facie* evidence for the plausibility of $*V_{\mu}D \dots \sigma$

Modelling (1.8) will also require us to admit the following previously-defined constraints:

(2.5) $*\sigma_{\mu\mu\mu}$ Syllables should dominate no more than two morae.

(2.6) DEP- μ Morae in the output should have correspondents in the input.

My hypothesis is that, at the period we have defined above (§2.1.1), a generation of learners of pre-Latin acquired the following constraint ranking at the stem level:

(2.7) $*V_{\mu}D \dots \sigma$], FAITH-IO \gg DEP- μ , $*\sigma_{\mu\mu\mu}$

where FAITH-IO is a cover term for all constraints that militate against other potential repair strategies for $*V_{\mu}D \dots \sigma$]. I further propose that, at the time in question, the stem of the participle was the only one that regularly contained the structure penalised by $*V_{\mu}D \dots \sigma$] in its underlying representation. It is at this point that the assumption mentioned above (p. 56) about the phonological inertness of roots becomes important: if it were untrue, and roots formed active phonological domains, the first iteration of the stem-level co-phonology over a Lachmann form like *āctus* would operate on an input /ag/ for all forms in the paradigm. This would, of course, violate $*V_{\mu}D \dots \sigma$], and so we should expect

lengthening in all forms of the verb, so a 1SG.PRES **āgō*, a 3PL.IMPF **āgebant* etc. However, it is a well-settled principle that roots do not form stem-level domains until a stem is derived from them (see Inkelas, 1990, §3.5 and references therein for empirical support for this claim). Since we have already established it as a reasonable assumption that the present and perfect stems, on which the other forms of the Latin verb are built, regularly ended in vowels (§2.1.2), the structure targeted by $*V_{\mu}D \dots \sigma$] will not occur in those stems even if the root ends in a voiced stop.

So, my claim is that for a Lachmann participle like *lēctus*, the underlying representation is $/[\text{leg.to}]s/$, the bracketed section being the stem-level domain. The input to the first stage in the derivation is therefore $/\text{leg.to}/$, and the calculus looks like this:

(2.8)

	$/\text{leg.to}/$	$*V_{\mu}D \dots \sigma$]	FAITH-IO	$*\sigma_{\mu\mu\mu}$	DEP- μ
a.	leg.to	*!			
b.	lek.to		*		
c.	☞ le:g.to			*	*

2.2.3 Assimilation.

To model the rule in (1.9), the OT literature offers multiple approaches that we could take. For present purposes, I will follow the account given in Lombardi (1999), and assume the following constraints and ranking:

(2.9) AGREE-[voice]

Obstruent clusters should agree in voicing

(2.10) ONSIDENT-[voice]

Segments in output onsets should have the same specification with respect to the feature [voice] as their input counterparts.

(2.11) IDENT-[voice]:

Output segments should have the same specification with respect to [voice] as their input counterparts.

(2.12) ONSIDENT-[voice], AGREE-[voice] \gg IDENT-[voice]

If voicing assimilation of stops in Latin applies across word boundaries, the evidence for this is masked by the writing system. However, there is evidence that assimilation applies across morpheme boundaries, such as that between a prefix and a verb stem: we have *appareo* attested alongside *adpareo* ‘I appear’¹. This implies that the level on which assimilation operates cannot be higher than the word level. Since we are going to place the constraint ranking that models (1.8) on the stem level, we can in principle place the ranking in (2.12) on either the word or the phrase level and still attain the required counterbleeding effect. We will assume for present purposes that (2.12) is in effect on the word level.

To continue our example derivation of *lēctus*, then, recall that the stem-level ranking has already given us /le:g.to/; on the word level, we add the ending to form the input /le:g.tos/, and present it to the word-level constraint ranking:

(2.13)

	/le:gtos/	ONSIDENT-[voice]	AGREE-[voice]	IDENT-[voice]
a.	le:g.tos		*!	
b.	le:g.dos	*!		*
c.	↵ le:k.tos			*
d.	le:k.dos	*!	*	*

This produces the attested output: [le:k.tos] > *lēctus*.

2.2.4 Typological implications of $*V_{\mu}D \dots \sigma$.

One of the axioms of Optimality Theory is that constraints specify targets, not repair strategies: NOCODA, for example, does not say “If a syllable has a coda, delete it”, merely “Syllables should not have codas.” How a crucially undominated constraint is satisfied depends on the ranking of other constraints. A

¹Allen (1978, 22) argues that even an analogically reintroduced form such as *adpareo* would have been pronounced, if it is not just a written form, with voicing assimilation (i.e. as a[t]pareo).

further desideratum for a proposed markedness constraint is that it show robust rerankability: a constraint which is envisaged as being top-ranked in some languages, and bottom-ranked in others, so that it behaves like a parameter in more traditional generative phonology (Booij, 1983; Kenstowicz, 2006) is presumed to be ill-thought-out until proven otherwise (McCarthy, 2002, §3.1.5). Therefore, we will now examine the interaction of $*V_{\mu}D \dots \sigma]$ with other constraints that have been proposed for CON, and list the typological generalisations that are entailed by it. The method by which this is accomplished is known as factorial typology.

Repair strategies.

On a purely *a priori* basis, using only our knowledge of how $*V_{\mu}D \dots \sigma]$ is formulated, we can surmise in advance what we expect the repair strategies to be. Violation of $*V_{\mu}D \dots \sigma]$ depends on the conjunction of three requirements, viz.:

(2.14) The vowel in question must be short.

(2.15) The consonant in question must be voiced.

(2.16) Vowel and consonant must be adjacent to one another within the same syllable.

Therefore, $*V_{\mu}D \dots \sigma]$ can in principle be satisfied by any repair strategy that causes any of the conditions above not to be true. Lachmann's Law satisfies $*V_{\mu}D \dots \sigma]$ by making the vowel long, and so falsifying (2.14), but we might instead devoice the consonant, and so falsify (2.15). If we wish to deny (2.16), we might delete either the vowel or the consonant, or we might insert a segment, either between vowel and consonant, so they are no longer adjacent, or such that resyllabification is triggered, so that vowel and consonant are adjacent but heterosyllabic.

Another, more subtle means of falsifying (2.16) may be at our disposal. If our grammar ordinarily does not tolerate branching onsets, so that e.g. /pakri/

is syllabified as [pak.ri], we may breach that restriction in order to satisfy $*V_{\mu}D \dots \sigma$, so that the input /adri/, for example, produces the output [a.dri]. In cases like these, there will always be inputs for which resyllabification is not a possible repair strategy, e.g. when the offending syllable is input-final, as in /fad/. So it follows that in any case where resyllabification is the grammar's preferred strategy, it will select one of the others to handle violations for inputs where resyllabification is not possible.

Finally, since we know that $*V_{\mu}D \dots \sigma$ is violable, we have to reckon with the possibility that it will be bottom-ranked, so that /fad/ surfaces as [fad], and /adri/ as [ad.ri]. This is the situation familiar from English and most European languages. In cases like these, there will always be inputs for which resyllabification is not a possible repair strategy, e.g. when the offending syllable is input-final, as in /fad/. So it follows that in any case where resyllabification is the grammar's preferred strategy, it will select one of the others to handle violations for inputs where resyllabification is not possible.

This reasoning predicts that when we perform the factorial typology of $*V_{\mu}D \dots \sigma$, we will find that the following behaviours of a grammar are possible:

(2.17) Resyllabification possible?

No	Yes		
no change	no change	/fad/ → [fad],	/adri/ → [ad.ri]
devoice C	devoice C	/fad/ → [fat],	/adri/ → [at.ri]
lengthen V	lengthen V	/fad/ → [fa:d],	/adri/ → [a:d.ri]
delete	delete	/fad/ → [fa],	/adri/ → [a.ri]
insert	insert	/fad/ → [fa.də],	/adri/ → [a.də.ri]
no change	resyllabify	/fad/ → [fad],	/adri/ → [a.dri]
devoice C	resyllabify	/fad/ → [fat],	/adri/ → [a.dri]
lengthen V	resyllabify	/fad/ → [fa:d],	/adri/ → [a.dri]
delete	resyllabify	/fad/ → [fa],	/adri/ → [a.dri]
insert	resyllabify	/fad/ → [fa.də],	/adri/ → [a.dri]

Constraints.

The constraints which penalise or otherwise control these repair strategies, and so are relevant to the factorial typology of $*V_{\mu}D \dots \sigma$, are as follows:

(2.18) $*\sigma_{\mu\mu\mu}$

Syllables should dominate no more than two morae.

(2.19) IDENT-[voice]

Corresponding segments in the input and output should be identically specified for the feature $[\pm\text{voice}]$.

(2.20) MAX-seg

Segments in the input should have correspondents in the output.

(2.21) DEP-seg

Segments in the output should have correspondents in the input.

(2.22) DEP- μ

Morae in the output should have correspondents in the input.

(2.23) $*\text{COMPLEXONSET}$

Onset nodes should dominate no more than one segment.

Factorial typology.

Factorial typology is so-named because, in Classic OT, the maximum number of possible grammars is predicted to be $x!$, where x is the cardinality of CON, the universal constraint set, as there will be $x!$ possible rankings of the constraints in CON. For Stratal OT, the theoretical maximum is higher. We expect it to be $(x!)^3$, as there are three co-phonologies. Two facts, however, minimise the potential difficulties that this theoretical observation poses with respect to the task of factorial typology.

Firstly, although there is nothing implicit in the architecture of the theory that constrains the extent to which rankings at different levels of a Stratal OT

phonology can differ, there is an independently observable diachronic tendency for the domains of phonological processes to shrink over time. This has been formalised in hypotheses of the acquisition of Stratal OT phonology, to the extent that one can state in general terms that the stem-level phonology originates on the word level, and the word-level phonology on the phrase level (Bermúdez-Otero, 2007). Therefore, we can expect that some of the $(x!)^3$ grammars that are theoretically possible are much more highly unlikely to be attested than others.

Secondly, and more importantly for our purposes, Stratal OT subsumes Classic OT in the same way that the Theory of Relativity subsumes Newton’s Laws of Motion. The predictions of a Classic-OT style factorial typology will be a proper subset of the predictions of what we might call a “factorial-cubed typology” in Stratal OT. For generalisations that apply globally, either over the entire phrase or over the entire word, we can temporarily forget about the existence of strata and perform our analyses in Classic-OT terms, just as one does not need to worry about relativity in order to calculate the trajectory of a ball on a pool table. It is in the exceptional situations, i.e. where we observe opacity, or a restriction in the domain of a phonological process, that we must remember the strata again, just as relativity becomes important when calculating trajectories of objects moving at exceptionally near-light speeds. Put more concretely, even though there may be $(|\text{CON}|!)^3$ possible SOT grammars, each of those grammars must instantiate one of only $|\text{CON}|!$ rankings at the phrase level.

Therefore, we must stipulate for present purposes that this factorial typology is a typology of phrase-level generalisations, and when we look for examples to vindicate it we keep in mind that there may be opaque interactions that complicate the assessment of any given phonology.

Since we have seven constraints to deal with, the six in (2.18) through (2.23) plus $*V_\mu D \dots \sigma$, that gives $7! = 5040$ possible rankings. I will now go through each of the repair strategies in (2.17), list the crucial rankings that give rise to them, and show that these crucial rankings account exhaustively for all 5040

possible rankings of the constraints in consideration.

To yield **lengthening in all environments**, the repair strategy we posit for the stem level to give Lachmann's Law requires the following ranking:

$$(2.24) \ *V_{\mu}D \dots \sigma], \text{IDENT-}[\text{voice}], \text{MAX-seg}, \text{DEP-seg}, \ *COMPLEXONSET \gg \ * \sigma_{\mu\mu\mu}, \text{DEP-}\mu$$

The following tableau shows this ranking in action:

(2.25)

	/fad/	*COMPLEX	*V _μ D...σ]	ID-[VOI]	MAX-seg	DEP-seg	*σ _{μμμ}	DEP-μ
a.	fad		*!					
b.	fa:d						*	*
c.	fat			*!				
d.	fa.də					*!		
e.	fa				*!			

There are $5! \times 2! = 120 \times 2 = 240$ possible rankings that conform to the specification of (2.24), leaving us with 4800 rankings still to account for.

To yield **no change in any environment**, the behaviour we posit for the word and phrase levels of Latin so that /is.tud/ surfaces as the attested *istūd*, requires either of the following rankings:

$$(2.26) \ \text{IDENT-}[\text{voice}], \ *COMPLEXONSET, \ * \sigma_{\mu\mu\mu}, \ \text{MAX-seg}, \ \text{DEP-seg} \gg \ *V_{\mu}D \dots \sigma]$$

$$(2.27) \ \text{IDENT-}[\text{voice}], \ *COMPLEXONSET, \ \text{DEP-}\mu, \ \text{MAX-seg}, \ \text{DEP-seg} \gg \ *V_{\mu}D \dots \sigma]$$

The reason why there are two crucial rankings here is that, as we saw above (2.24), both DEP-μ and *σ_{μμμ} have to be dominated in order for the ranking to satisfy *V_μD...σ] by lengthening. This means that for any other repair strategy, so long as one of DEP-μ and *σ_{μμμ} dominates the constraint that militates against the strategy (or *V_μD...σ], for no change), the ranking of the other is immaterial.

There are 888 rankings that meet one (or both) of these conditions, which leaves 3912 to go.

Epenthesis in all environments is predicted by the following rankings:

(2.28) $*V_{\mu}D\dots\sigma]$, IDENT-[voice], *COMPLEXONSET, $*\sigma_{\mu\mu\mu}$, MAX-seg \gg
 DEP-seg

(2.29) $*V_{\mu}D\dots\sigma]$, IDENT-[voice], *COMPLEXONSET, DEP- μ , MAX-seg \gg
 DEP-seg

As with the crucial rankings above, there are 888 rankings that meet these specifications, and so there are 3024 still to account for.

The following crucial rankings predict **Deletion in all environments**:

(2.30) $*V_{\mu}D\dots\sigma]$, IDENT-[voice], *COMPLEXONSET, $*\sigma_{\mu\mu\mu}$, DEP-seg \gg
 MAX-seg

(2.31) $*V_{\mu}D\dots\sigma]$, IDENT-[voice], *COMPLEXONSET, DEP- μ , DEP-seg \gg
 MAX-seg

This definition covers 888 rankings, leaving 2136 still to go.

The following crucial rankings predict **Devoicing in all environments**:

(2.32) $*V_{\mu}D\dots\sigma]$, *COMPLEXONSET, $*\sigma_{\mu\mu\mu}$, DEP-seg, MAX-seg \gg
 IDENT-[voice]

(2.33) $*V_{\mu}D\dots\sigma]$, *COMPLEXONSET, DEP- μ , DEP-seg, MAX-seg \gg
 IDENT-[voice]

This definition covers 888 rankings, and leaves 1248 still to go.

To predict **Resyllabification where possible, otherwise lengthening**, a ranking must meet at least one of the following specifications:

(2.34) $*V_{\mu}D\dots\sigma]$, DEP-seg, MAX-seg, IDENT-[voice] \gg $*\sigma_{\mu\mu\mu}$, $*\sigma_{\mu\mu\mu}$, DEP- μ
 \gg *COMPLEXONSET

(2.35) $*V_{\mu}D\dots\sigma]$, DEP-seg, MAX-seg, IDENT-[voice] \gg $*\sigma_{\mu\mu\mu}$ \gg
 $*\text{COMPLEXONSET} \gg$ DEP- μ

(2.36) $*V_{\mu}D \dots \sigma]$, DEP-seg, MAX-seg, IDENT-[voice] \gg $*\sigma_{\mu\mu\mu} \gg$ DEP- $\mu \gg$
 $*COMPLEXONSET$

Once again, the fact that either $*\sigma_{\mu\mu\mu}$ or DEP- μ can inhibit lengthening imposes complicated conditions on what constitutes a ranking that generates this repair strategy:

1. One of $*\sigma_{\mu\mu\mu}$ or DEP- μ must dominate $*COMPLEXONSET$
2. The other constraints must dominate both $*\sigma_{\mu\mu\mu}$ and DEP- μ .

The following tableaux illustrate these principles in action:

(2.37)

/fad/	MAX-seg	DEP-seg	$*V_{\mu}D \dots \sigma]$	ID-[voi]	$*\sigma_{\mu\mu\mu}$	$*COMPLEX$	DEP- μ
a. fad			*!				
b. $\text{\textcircled{e}}$ fa:d					*		*
c. fat				*!			
d. fa.də		*!					
e. fa	*!						

(2.38)

/adri/	MAX-seg	DEP-seg	$*V_{\mu}D \dots \sigma]$	ID-[voi]	$*\sigma_{\mu\mu\mu}$	$*COMPLEX$	DEP- μ
a. ad.ri			*!				
b. a:d.ri					*!		*
c. at.ri				*!			
d. a.də.ri		*!					
e. a.ri	*!						
f. $\text{\textcircled{e}}$ a.dri						*	

4 possible rankings of $*\sigma_{\mu\mu\mu}$, $*COMPLEXONSET$ and DEP- μ multiplied by 4! possible rankings of the other constraints equals $24 \times 4 = 96$ rankings down, 1152 to go.

The crucial rankings that give rise to **Resyllabification where possible, otherwise no change** are similarly convoluted:

(2.39) MAX-seg, DEP-seg, IDENT-[voi], $*\sigma_{\mu\mu\mu} \gg$ $*V_{\mu}D \dots \sigma]$ \gg
 $*COMPLEXONSET$

(2.40) MAX-seg, DEP-seg, IDENT-[voi], DEP- $\mu \gg$ $*V_{\mu}D \dots \sigma]$ \gg
 $*COMPLEXONSET$

They may be stated in words as:

- $*V_{\mu}D \dots \sigma]$ must dominate $*COMPLEXONSET$
- One of $*\sigma_{\mu\mu\mu}$ and $DEP-\mu$ must dominate $*V_{\mu}D \dots \sigma]$
- All other constraints must also dominate $*V_{\mu}D \dots \sigma]$

These principles are illustrated by the following tableaux:

(2.41)

/fad/	MAX-seg	DEP-seg	$*\sigma_{\mu\mu\mu}$	ID-[voi]	$*V_{\mu}D \dots \sigma]$	*COMPLEX	DEP- μ
a. $\not\Leftarrow$ fad					*		
b. fa:d			*!				*
c. fat				*!			
d. fa.də		*!					
e. fa	*!						

(2.42)

/adri/	MAX-seg	DEP-seg	$*\sigma_{\mu\mu\mu}$	ID-[voi]	$*V_{\mu}D \dots \sigma]$	*COMPLEX	DEP- μ
a. ad.ri					*!		
b. a:d.ri			*!				*
c. at.ri				*!			
d. a.də.ri		*!					
e. a.ri	*!						
f. \Leftarrow a.dri						*	

There are 288 rankings that meet these criteria, therefore we have 864 rankings left to cover.

Similar principles to those in (2.2.4) govern the remaining repair strategies. To predict **Resyllabification where possible, otherwise epenthesis** requires the following crucial rankings:

(2.43) $*V_{\mu}D \dots \sigma]$ MAX-seg, IDENT-[voi], $*\sigma_{\mu\mu\mu} \gg DEP-seg \gg *COMPLEXONSET$

(2.44) $*V_{\mu}D \dots \sigma]$ MAX-seg, IDENT-[voi], $DEP-\mu \gg DEP-seg \gg *COMPLEXONSET$

This accounts for 288 rankings, and leaves 576 still to go.

Likewise, to predict **Resyllabification where possible, otherwise deletion** takes the following crucial rankings:

(2.45) $*V_{\mu}D \dots \sigma]$ MAX-seg, IDENT-[voi], $*\sigma_{\mu\mu\mu} \gg$ DEP-seg \gg
 $*COMPLEXONSET$

(2.46) $*V_{\mu}D \dots \sigma]$ MAX-seg, IDENT-[voi], DEP- $\mu \gg$ DEP-seg \gg
 $*COMPLEXONSET$

288 rankings are consistent with this specification, and 288 are left over. It will come as no surprise to the reader to learn that the remaining 288 are those which meet the following specification, and predict **Resyllabification where possible, otherwise devoicing**:

(2.47) $*V_{\mu}D \dots \sigma]$, MAX-seg, DEP-seg, $*\sigma_{\mu\mu\mu} \gg$ IDENT-[voi] \gg
 $*COMPLEXONSET$

(2.48) $*V_{\mu}D \dots \sigma]$, MAX-seg, DEP-seg, DEP- $\mu \gg$ IDENT-[voi] \gg
 $*COMPLEXONSET$

It should be noted that this factorial typology only covers grammars in which the effects of $*V_{\mu}D \dots \sigma]$'s ranking are visible. For example, it does not predict phonologies which do not tolerate voiced obstruents at all. In such a language, VOP (Voiced Obstruent Prohibition) dominates IDENT-[voice], and so output candidates that contain the structure $*V_{\mu}D \dots \sigma]$ penalises can never be considered harmonic by EVAL. Our factorial typology assumes that, in searching for examples to vindicate it, we will ignore languages in which $*V_{\mu}D \dots \sigma]$'s ranking is never the crucial factor in selecting the winning candidate.

It should likewise be noted that other constraints not included in the typology will predict exactly how certain repair strategies are instantiated. For example, where MAX-seg is dominated, and so structures targeted by $*V_{\mu}D \dots \sigma]$ are repaired by deletion, other constraints will control which segment is deleted, according to the relative markedness of the candidates violating MAX-seg. Similarly, the constraints generally grouped under the cover term SONORITY, which collectively determine the grammar's particular instantiation of the Sonority Sequencing Generalisation, will control which inputs cause $*V_{\mu}D \dots \sigma]$ to be

satisfied by resyllabification, and which by another repair strategy, in those cases where *COMPLEXONSET is bottom-ranked.

Evidence.

To vindicate our hypothesis that $*V_\mu D \dots \sigma]$ is a member of CON requires that we find examples of all the grammars predicted to exist by our factorial typology. The magnitude of the necessary research means that such an undertaking is beyond the scope of the present work, however, there are certain indications of which we may make mention. A promising initial datum for any search for typological parallels is the fact that the structure $*V_\mu D \dots \sigma]$ penalises as marked is entirely absent from underlying representations in modern German²; an observation made by (Lahiri and Dresner, 1999, 688). Richness of the Base dictates that for this generalisation over underlying representations to remain stable, it must be the result of lexicon optimization based on the constraint ranking (Prince and Smolensky, 1993, 209). We might hypothesize that $*V_\mu D \dots \sigma]$ is crucially undominated at a level of the grammar of German higher than that on which the well-known process of final devoicing takes place, and so the neutralization of length contrasts counterbleeds final devoicing in the same way that Kiparsky (1965) suggested that Lachmannian vowel lengthening counterbleeds voicing assimilation in Latin.

2.3 Exceptions and refinements.

So far, we have hewn closely to Kiparsky (1965)'s account, merely translating it into Optimality-Theoretic terms and deriving the advantages associated with that framework. However, Kiparsky's account is demonstrably false to the facts of Lachmann's Law: it does not account for the lengthening of *ēemptus*, nor predict the lack of lengthening in *strictus*, *fictus* and *-sēssus*. We will now

²Hagège and Haudricourt (1978, 85) make a similar observation with respect to the phonology of the French spoken in the Alsace region. Very probably this is under the influence of the local Alemannic dialect.

attempt to modify our analyses to take in the exceptions to the general rule proposed by Kiparsky and adapted above.

2.3.1 Lexical under- and overgeneration.

Since we have argued that the characteristic lengthening of Lachmann's Law is a stem-level phonological process, not a strictly morphological one, it follows that the particular restriction to past participles must be an accidental one: that is, that any Latin form that has a stem-level domain in its underlying representation could potentially show Lachmannian lengthening. Particularly, we must consider nouns and other substantives that may contain the Lachmann environment. Two such examples have already been mentioned: Schrijver (1991, 135) adduces the example of *pēs* 'foot'. If the stem of this noun is underlyingly /ped/ (and the existence of alternating forms in the paradigm such as ACC.SG *pedem*, GEN.SG *pedis* would require us to suggest that it is, by the same reasoning that leads us to suppose a stem /ag/ for *āctus* on the basis of *agō*, *agis* etc), then our conception of Lachmann's Law would require us to assume that it was lengthened to /pe:d/ as the input to the word level. This explains the vocalism of the NOM.SG *pēs* (which is unexpected in IE terms: Latin should have inherited **pōd-s*, cf. Gk. *πούς*, English *foot*), but is embarrassing with respect to the rest of the paradigm, which has *pēdem*, *pēdis* etc. Schrijver (1991) mentions a possible analogy on the model of nouns with long vowels in the NOM and short vowels in the oblique cases, such as *sāl* ~ *sālis*, *mās* ~ *māris*, but the assumption of such a change would be unprovable.

Similar difficulties obtain for the other main example of a substantive which appears to be affected by Lachmann's Law: if indeed Jasanoff (2004) is right, and *maximus* was underlyingly /mag.sa.mos/ at the crucial period, then Lachmann's Law ought to apply, and that explains the apex which leads us to read it as *māximus*. However, the same reasoning leads us to expect that the antonym, *pessimus*, ought to have been underlyingly /ped.sa.mos/ and given us **pēsimus*. As we have been forced to in the matter of *pēs*, Jasanoff suggests an analogy,

which restored the *-ss-* on the model of the regular superlative, and shortened the vowel by the *littera*-rule.

This brings us to the question of the supines: are we to adopt Watkins (1970*b*)’s reasoning, and suppose on the basis of *sessum* and *pessum* that supines as a whole were exempt from the workings of Lachmann’s Law itself, and that where they are found to match a Lachmann participle, this is due to analogy? Since we have assumed a strict definition of the term “stem” for our present purposes — that is, anything to which inflectional endings are appended is a stem — we might be justified in arguing that supines, which do not inflect, do not form stem-level domains, so that the stem-level ranking which precipitated Lachmannian lengthening did not apply to them. If this is not palatable, we must assume that the supines underwent Lachmann’s Law along with the participles, and find reasons why *pessum* and *sessum* were excluded from the general development. Perhaps the analogical change from **pēsimum* to *pessimus* spread to *pessum* as well, or perhaps the link from *pessum* to a root in **ped-* was unclear, so that at the time *pessum* was underlyingly /pet.tum/. If necessary, we might revive Collinge (1975, 475)’s suggestion that the vowel was shortened to avoid homophony with forms of the verb *pēdō* ‘break wind’, but as I noted above, this hypothesis is essentially unprovable.

I can offer no better account of the exceptional nature of the compounds in *-sessus* or of *uīsus* than those given by Watkins (1970*b*). I shall merely note that our OT account is compatible with his arguments, and offer some extra indications in support of them.

For *-sessus*, Watkins (1970*b*, 64–65) argues that the basic verb *sedeō*, being intransitive, originally had no past participle, and so that when its (transitive) compounds came to form past participles, they relied on the nearest available model: the Lachmann-exempt supine *sessum*.

Our hypothesis also includes a provision for supines to be exempt from lengthening, though it is a stipulative one, so it is compatible on that score. As to the plausibility of the compounds’ using the supine as a model, I can only

echo Kortlandt (1989)’s observation that they may have been given extra incentive to do so by the fact that if *sedeō* had a past participle, we would expect it to reflect the rather unlikely **sdtos*.

For *uīsus*, Watkins (1970*b*, 62) argues for an independent analogy that built a new participle **uēid-to-* on the model of the perfect stem with original diphthong (cf. Gk. *οἶδα*, Skt. *veda*). Our stem-level ranking as defined in (2.7) would lengthen underlying /wid.to/ to [wi:d.to] as it stands, but I am about to argue (§2.3.4) for a separate constraint which exempts /i/ from the lengthening generated by (2.7), and so I must treat *uīsus* as an exception the same way Watkins does. I would add as a possible reason for the reformation the comparatively pronounced difference in meaning between the active forms of the IE root **uīd* and the stative forms, which are reflected by the Latin perfect. It seems reasonable to infer that in Proto-Indo-European the stative of **uīd* ‘see’ became specialised in the meaning ‘know’: cf. Irish *fios* ‘knowledge’, Gk. *οἶδα* ‘I know’, English *wit* etc. (Vanhove, 2008, 341) Therefore, the participle **wid-tos* may have acquired the meaning ‘known (having been seen)’, necessitating the formation of a new one to mean ‘seen’ without this sub-sense. This does however raise the question of how Latin managed to retain the stative **uoid-ai > uīdī* ‘I have seen’ without the ‘know’ sub-sense, but need to form a new participle. These questions cannot be definitively answered, but the facts are suggestive nonetheless.

2.3.2 Reduplicated perfects.

We have taken it as an assumption (§2.1.2) that the underlying representation of a reduplicated perfect stem like the *tutud* of *tutudī* is /RED.tud/. Since $*V_{\mu}D \dots \sigma$ targets vowels which are tautosyllabic with voiced stops, rather than vowels preceding stop clusters as in Kiparsky (1965), why, does lengthening not give us [tu.tu:d] as input to the word level, producing a perfect in **tutūdī*? The answer lies in the way reduplication is traditionally modelled in OT. The textbook account (e.g. Kager, 1999, Chapter 5) is to assume that the under-

lying representation of a reduplicated form contains the morpheme RED, giving us our /RED.tud/, and to go on to propose that CON includes faithfulness constraints that, instead of penalising differences between input and output, penalise differences between base and reduplicant (Kager, 1999, 201ff.). Within this framework, the account of the underapplication of our lengthening process in Latin is parallel with the account of the behaviour of Tonkawa analysed by Gouskova (2007). Latin is like Tonkawa in that it appears that the reduplicant adheres to a specific template: namely, the reduplicant must be a single $C\check{V}$ -syllable. Gouskova (2007, 375) captures this restriction by proposing the following constraint:

$$(2.49) \text{ RED}=\sigma_{\mu}$$

The reduplicative morpheme is a light syllable

As Gouskova goes on to explain, this constraint is in fact a cover term for three separate markedness constraints affecting the reduplicant specifically. These are:

$$(2.50) \text{ NOCODA}_{\text{RED}}$$

Syllables in the reduplicant do not have codas.

$$(2.51) \text{ NOLONGV}_{\text{RED}}$$

No long vowels in the reduplicant.

$$(2.52) \text{ AFFIX} \leq \sigma$$

The phonological exponent of an affix is no longer than a syllable.

Gouskova (2007, 378)

Like Gouskova, we will rank these constraints as one, and so will use the cover term for the sake of readability. The crucial ranking that predicts a Latin- and Tonkawa-style restriction of reduplicants to $C\check{V}$ -shape is as follows:

$$(2.53) \text{ RED}=\sigma_{\mu} \gg \text{ MAX-BR}$$

Where MAX-BR is defined as “Every element of the base has a correspondent in the reduplicant.” The behaviour of reduplicated perfects like *tutudī* can be predicted by placing (2.53) over (2.7), giving the following overall ranking:

$$(2.54) \text{ RED}=\sigma_\mu, \text{ MAX-seg-IO} \gg \text{ MAX-BR} \gg *V_\mu\text{D} \dots \sigma], \text{ FAITH-IO}$$

This form of the ranking is abbreviated for the sake of readability. Strictly speaking, MAX-BR is a cover constraint since it can be decomposed into MAX-seg-BR, MAX- μ -BR etc. Likewise, FAITH-IO stands for all the constraints that militate against repair strategies for $*V_\mu\text{D} \dots \sigma]$. Constraints militating against vowel lengthening should be assumed to be bottom-ranked.

The ranking generates the correct output for the perfect stem from /RED-tud/ as follows:

(2.55)

	/RED-tud/	RED= σ_μ	MAX-seg-IO	MAX-BR	$*V_\mu\text{D} \dots \sigma]$	FAITH-IO
a.	tu:tu:d	*!		*		*
b.	tud.tud	*!			*	
c.	tu.tu:d			**!		*
d.	tu:d.tu:d	*!		*		*
e.	tu.tu		*!			
f.	\emptyset tu.tud			*	*	

Since RED= σ_μ is top-ranked, it is impossible for a candidate to win where the reduplicant is anything other than /tu/. Therefore, MAX-BR is satisfied by selecting the candidate in which the base is minimally different from the reduplicant, without violating MAX-seg-IO (that is, we cannot delete from the base to give the output /tu.tu/. Our lengthening process underapplies in reduplicated environments in Latin in the same way that syncope underapplies in reduplicated environments in Tonkawa (Gouskova, 2007).

2.3.3 Lengthening before nasals?

In order to account for the lengthening in *emptus*, I suggest that it may be possible to borrow the reasoning of Watkins (1970b, 63) regarding the interaction between Lachmann’s Law and Osthoff’s Law. Watkins redefined Osthoff’s

Law in Latin to affect only the set of coronal sonorants $\{/r/, /l/, /n/\}$. He argued that we might expect lengthening in a form like *cantus*, since it meets the conditions to fall subject to the OKKW analogy, but that the lengthening was blocked by Osthoff’s Law. We might perhaps argue along similar lines, by proposing that Lachmann’s Law was counterbled not only by voicing assimilation, but by Osthoff’s Law. This would involve reformulating $*V_{\mu}D \dots \sigma]$ to penalise short vowels before tautosyllabic voiced plosives, whether oral or nasal. It would, of course, also require us to formulate an Optimality-Theoretic model of Osthoff’s Law.

On this hypothesis, the underlying stems $/kan.to/$ and $/em.to/$ would each lengthen, giving $/ka:n.tos/$ and $/e:m.tos/$ as word-level inputs, but Osthoff’s Law would, in turn, shorten the vowel of $/ka:n.tos/$ giving the attested output $[kan.tos]$, and leave the long vowel of $[e:m.tos]$ alone, giving *ēemptus*³. Formulating and justifying the OT model of Osthoff’s Law necessary to vindicate this hypothesis is beyond the scope of the present work, especially as the necessary constraints do not appear to have been proposed, so that the task would require a factorial typology like that proposed for $*V_{\mu}D \dots \sigma]$. If, however, in searching for data to support $*V_{\mu}D \dots \sigma]$, we find that vowels show the expected behaviours before nasals as well as before voiced stops, that would be consistent with this proposal.

2.3.4 No lengthening of /i/.

Assuming that we are justified in our reasoning for excluding *-sessus* and *uīsus* from our analyses, this will leave us needing to account for Lachmann’s Law as lengthening all vowels except /i/. Niedermann (1911) was already able to cite “neuere experimentalphonetische Untersuchungen” in support of his phonetic account of the Law, which held that the lengthening imposed on [i] was insufficient to cross the perceptual boundary between the phonemes /i/ and

³I am assuming that the ⟨p⟩ of *ēemptus* does not reflect a discrete segment in either the underlying or surface representation.

/i:/ . Phonetic analyses in the intervening years have only confirmed Niedermann's observations, and provided more complete theoretical accounts of why they should be so. For example, Gussenhoven (2004, 18) and Catford (1977) agree in the finding that high vowels are inherently shorter than low vowels. Tellingly, Gussenhoven (2004) also finds that listeners tend to compensate for this inherent difference in duration by subtracting from the perceived length of a vowel in inverse proportion to its height as part of their computation of perceived length. That is, a listener hearing [a] tacitly knows that, since it is a low vowel, the speaker will involuntarily take more time to say it. This means that perceived duration of vowels is positively correlated with vowel height. Since [i], on Gussenhoven (2004)'s theory, is compensatorily perceived as longer, it follows that it will be less likely to be analysed as phonologically long when phonetic circumstances lengthen it.

This finding is supported by the study by Hillenbrand et al. (2000), who tested the extent to which the distinction between pairs of English vowels was controlled by duration. They found that markedly fewer experimental subjects identified an artificially lengthened /ɪ/ as /i/ or a shortened /i/ as /ɪ/ than identified lengthened /ɛ/ as /æ/ or shortened /æ/ as /ɛ/. These results are English-specific, and it might be argued that, although the phonological difference between English /i/ and /ɪ/ is primarily one of quantity, the pattern in the results of Hillenbrand et al. (2000)'s tests has more to do with their phonetic qualitative difference. This may very well be so, and if it is it is small wonder that Latin should show evidence of a similar tendency, since a tense/lax distinction between short and long *i* very much like that of English is proposed for Latin on the basis of the eventual merger of Latin short *i* with long \bar{e} Allen (1978, 47). In view of these findings, it does not seem controversial to suppose that a lengthening process might exempt /i/.

This observation has yet to be formalised in Optimality Theory, and, as with Osthoff's Law, the existing constraint set would not appear to account for it. However, I believe it can be accommodated if the following assumptions are

allowed to pass:

(2.56) That the markedness constraint NO-[i] proposed by Kager (1999, 284), which penalises occurrences of [i] in light syllables has a context-free counterpart (call it NO-[i]-EVER).

(2.57) That the formal definition of NO-[i] and NO-[i]-EVER is along the lines of “assess a violation for every mora in the output that dominates the features [-cons], [-back], [+high] (and [for NO-[i]] is the only mora dominated by its parent syllable.)

If these stipulations are allowed (and they must remain tentative stipulations until NO-[i]-EVER is verified by factorial typology), then we can account for the lack of lengthening in *strictus fictus* etc. by means of the following stem-level ranking.

(2.58) MAX-seg, MAX- μ , IDENT \gg NO-[i]-EVER \gg * $V_{\mu}D \dots \sigma$ \gg DEP- μ

So, when the stem is e.g. /strig.to/, the calculation is as follows:

(2.59)

/strig.to/	MAX-seg	IDENT	NO-[i]-EVER	* $V_{\mu}D \dots \sigma$	DEP- μ
a. strig.to			**!		*
b. stre:g.to		*!			*
c. \wp strig.to			*	*	
d. strik.to		*!	*		
e. stri.to	*!		*		

Because MAX-seg, MAX- μ and IDENT outrank NO-[i]-EVER, underlying /i/ or /i:/ will always surface unchanged, but the ranking IDENT \gg NO-[i]-EVER \gg DEP- μ ensures that an underlying short /i/ will always surface as [i] (lest it violate IDENT), even when it would otherwise surface as [i:], since the feature complex that gives rise to [i] is more marked with respect to NO-[i]-EVER when it is linked to two morae than when it is linked to only one.

2.3.5 Acquisition.

Optimality Theory has included a model of acquisition from its inception (Tesar and Smolensky, 1998). This model takes as its starting point the observation that children acquiring language begin pronouncing unmarked structures before they learn marked ones. Therefore, it is surmised that the child learning language begins with an absolute ranking of MARKEDNESS \gg FAITHFULNESS, that is a ranking of all markedness constraints over all faithfulness constraints. As she hears marked structures in the speech of adults, the child demotes the constraints that penalise them until she arrives at an appropriately generative constraint ranking. This process is referred to as Error-Driven Constraint Demotion.

Learning of underlying representations for the surface forms the child is exposed to is accomplished similarly by means of Lexicon Optimization (Prince and Smolensky, 1993, Chapter 9). The child begins with the assumption that inputs differ minimally from outputs. Therefore she will only posit underlying representations that differ from observed forms *where there are paradigmatic alternations to consider*. The classic example of this concerns German Final Devoicing and is discussed in Tesar and Smolensky (1996, 41). On the basis of other forms in the paradigm like [ta.gə] ‘day NOM.PL’, [ta.gəs] ‘day GEN.SG’, the learner acquires /tag/ as the underlying representation for the NOM.SG *Tag*, despite the fact that it is [tak] on the surface. These two hypotheses account for empirical observations from language acquisition like the following oft-cited exchange:

(2.60) Father: Say ‘jump’

Son: [dʌp]

Father: No, ‘jump’

Son: [dʌp]

Father: No, ‘jummmmp’

Son: Only Daddy can say [dʌp]

Smith (1973, 10)

This and other examples (cf. Clark, 2003, 71ff.) demonstrate both principles of OT learning: the fact that A (the child in Smith 1973) recognises that his father's speech is different from his own shows lexicon optimization in action: A has accepted /dʒʌmp/ as an input from his father's speech without modification, but the fact that A can only produce [dʌp] is indicative of the stage he has reached in the constraint demotion process. A has demoted NOCODA, and so can produce a closed syllable, but he has yet to demote *AFFRICATE or *COMPLEXCODA, and so cannot pronounce the onset /dʒ/ or the coda /mp/ that he has acquired in the input.

It is clear, therefore, that the OT learning model of Tesar and Smolensky (1998) is explanatorily useful and should not be discarded out of hand, but if we introduce a diachronic aspect into our observations, and look at sound change as an epiphenomenon of the language acquisition process as instantiated by successive generations, then we meet empirical observations which Classic OT is unprepared to explain. Specifically, I refer to the life cycle of phonological generalisations.

As far as we know, Baudouin de Courtenay (1895) was the first to articulate the observation that there are definite observable trends in the development of sound patterns. Bermúdez-Otero (2007, §21.3.2) summarises this process: in brief, phonological generalisations begin with the familiar Neogrammarian sound change, applying exceptionlessly to utterances without respect for morphological boundaries. The next stage is for the change to restrict itself to particular morphosyntactic structures. Finally, the process ceases to be phonological at all, and is reanalysed as a morphological process or a peculiarity of particular lexemes (for example, the irregular plural *feet*, which preserves a once-regular vowel gradation process). This observable reality of historical phonological development is readily modelable in Lexical Phonology by arguing that phonological generalisations begin their lives on the phrase level, and climb in successive generations to the word and stem levels. Stratal OT inherits this facility.

This general statement about the life cycle of phonological regularities is, however, embarrassing from the point of view of Kiparsky (1965)'s hypothesis of rule insertion. A well-behaved rule begins its life at the end of the derivation, and climbs up level by level, we are told, whereas Kiparsky's vowel-lengthening rule is explicitly claimed to have been acquired such that occurs earlier in the derivation than the rule of consonant assimilation. For our Stratal OT model, this entails that the ranking (2.7) of $*V_{\mu}D \dots \sigma]$ which gives rise to Lachmann's Law must have been acquired directly on the stem level, in order to stand in an opaque relationship with the word-level ranking (2.12), which gives rise to voicing assimilation of stop clusters. Indeed it cannot have passed through the word level, since we assume that endings are added on the word-level, and if an ending like the *-d* of *istud* were visible to $*V_{\mu}D \dots \sigma]$, the ranking would predict **istūd*. Therefore, if we cannot account for how the ranking in (2.7) can have been acquired directly on the stem level, we must abandon our analysis as untenable.

Fortunately, a number of considerations mean that we are not at the untenable stage yet: firstly, since the life cycle spans multiple generations within the history of a language, there must be a mechanism for a given generation to acquire a ranking that has already reached the stem-level, and indeed exactly such a thing has been proposed (see Bermúdez-Otero, 2003, §5.4). Secondly, the life cycle is not formally entailed in the architecture of Stratal OT. It is only acquisition mechanisms which constrain the stem-level co-phonology to have originated in the word-level, and the phrase-level in the word-level. So, it becomes possible that a child acquiring language could misinterpret the evidence before her as indicating a stem-level generalisation, without such a thing having actually existed in the word- or stem-level co-phonology of the previous generation.

I propose that exactly such a thing happened in the case of Lachmann's Law. It has been suggested (Ranjan Sen, personal communication) that vowels in closed syllables in Latin were phonetically longer in duration than those in open

syllables, and that in the Lachmann forms this extra duration was reinterpreted as a mark of phonological length. To this we can add that the reason for this reinterpretation was the recognition on the basis of other forms in the paradigm that the vowels in question underlyingly stood before tautosyllabic voiced stops. So, the child acquiring Latin at the time perceives (contrary to the intention of the speaker) a long vowel before tautosyllabic voiced stops on the stem level, and thus posits the stem-level ranking of $*V_{\mu}D \dots \sigma] \gg \text{DEP-}\mu$.

The learner of the next or a subsequent generation hears the deliberately-produced long vowels of her forebears, and on the principle of lexicon optimization, makes the assumption that the characteristic long vowels of the Lachmann forms are simply present in the underlying representation, and so writes them into her lexicon as irregular forms in the paradigm. In effect, Lachmann’s Law starts its life on stage III of the life cycle as defined by Bermúdez-Otero (2007, §21.3.2), then moves to stage IV.

This accounts for why King (1973) had such a difficult time finding parallel examples of rule insertion — since it is abnormal with respect to the life cycle of phonological processes — and why Lachmann’s Law did not begin to affect verbs from roots in original voiced aspirates after they merged with the voiced stops. By that stage, the generalisation had already become a system of lexical exceptions (reached Stage IV, in the terminology of Bermúdez-Otero), and so was no longer a productive part of the phonology.

2.4 Summary.

Limitations of time and space available for the purposes of this project mean that we have only the beginnings of a hypothesis before us. However, what we have accomplished is enough to indicate a definite direction for future research: the suggested refinements and means to account for exceptions that are enumerated in §2.3 must be elaborated, and a search must be mounted to find examples to vindicate the factorial typology of $*V_{\mu}D \dots \sigma]$.

The fact that I have insisted on empirical rigour in the formation of my hypothesis means that it will stand or fall as its predictions are verified or falsified, and, insofar as it is found to be internally consistent, and the Stratal OT framework in which it is formulated continues to be considered a consistent model of language in the mind, it will contribute to providing a principled answer to the question “is Lachmann’s Law a phonological change acting on a morphologically delimited domain, or a morphological change with phonological consequences?”

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