

UNRAVELING HOLTZMANN'S LAW

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1. Holtzmann's Law

In the history of Germanic, one of the most problematic sound laws has been Holtzmann's Law (Holtzmann 1870). For over a century (at least since Kluge 1879), linguists have attempted to justify the law in a number of ways, appealing to such concepts as *Verhärtung*, *Verschärfung*, lengthening, and the influence of laryngeals. These arguments have been succinctly summarized first by Lehmann (1952) and more recently by Collinge (1985).

The law itself involves a great many rather complex issues. However, at the crux of the problem lie such data as the following (from Collinge 1985: 93):

- (1) PIE **dwey-* 'two' > Got. *twaddjē* 'of two'
- (2) PIE **dwey-* 'two' > ON *tweggja* 'of two'
- (3) PIE **drew-* 'tree' > Got. *triggws*, *triggwa* 'true'

In Table 1 (on the following page), these examples can be seen to typify three categories of data. Each category involves a change intervocalically and at the end of a short syllable from the glide *j* to a sequence *ddj* or *ggj*, and a parallel change from the *w* under the same conditions to a sequence *ggw*. While category 1 and category 2 could be collapsed into one (as in Collinge 1985: 93), there has been considerable debate as to whether both forms were actually pronounced, with some claiming that one or the other was simply a spelling variant. Both for the sake of clarity and precision and for arguments that will be made later, the two are represented here distinctly.

Such a pattern of change is indeed counterintuitive. It appears as though a glide somehow creates not only an obstruent before it, but perhaps even a prothetic or geminate obstruent. If the preceding syllable were long, then we might possibly justify some sort of closure for it; but the preceding syllable is short, and herein lies the central knot of the problem.

To unravel this knot, some linguists have held that the motivating factor was not length, but accent. However, every attempt to connect the law to the placement of the Indo-European accent either before the short vowel of the syllable (e.g. Kluge 1879) or after it (e.g. Bechtel 1885) failed

Table 1: Holtzmann's Law data

Proto-Indo-European	Non-Germanic reflex	Germanic
Category 1		
<i>dwey-</i> 'two'	Sanskrit <i>dváyāṣ</i> 'of two'	Gothic <i>twaddjē</i> 'of two'
<i>dhē(i)</i> 'to nurse'	Sanskrit <i>dháyati</i> 'sucks'	Gothic <i>daddjan</i> 'to nurse'
<i>ei-</i> 'to go'	Avestan <i>aēiti</i> 'to go'	Gothic <i>iddja</i> 'I went'
<i>ō(y)i-om</i> 'avian'	Greek <i>ώτόν</i> 'avian'	Gothic <i>*addja</i> 'egg'
<i>prijā-</i> 'wife'	Sanskrit <i>priyā</i> 'wife'	Gothic <i>Friiddja/ Friiddjōs</i> (deity)
<i>uei-</i> 'to twist'	Sanskrit <i>váyati</i> 'weaves'	Gothic <i>waddjus</i> 'wall'
Category 2		
<i>dwey-</i> 'two'	Sanskrit <i>dváyāṣ</i> 'of two'	Old Norse <i>tweggja</i> 'of two'
<i>ō(y)i-om</i> 'avian'	Greek <i>ώτόν</i> 'avian'	Old Icelandic <i>egg</i> 'egg'
<i>prijā-</i> 'wife'	Sanskrit <i>priyā</i> 'wife'	Old Norse <i>Frigg/Friggiar</i> (deity)
<i>uei-</i> 'to twist'	Sanskrit <i>váyati</i> 'weaves'	Old Icelandic <i>véggr</i> 'wall'
Category 3		
<i>dreu-</i> 'tree' <i>dreyθ-</i>	proto-Slavic <i>druqa-</i> 'wood'	Gothic <i>triggws</i> 'faithful' Old Icelandic <i>tryggr</i> 'faithful' Gothic <i>triggwa</i> 'alliance' Old Norse <i>tryggvar</i> (pl.) 'trust'
<i>bhlewō-</i> 'to beat, weak'	Old Cornish <i>balow-</i> 'sicknesses'	Gothic <i>bliggwan</i> 'to beat'
<i>g(i)eu-</i> 'to chew'	North Persian <i>jāvīdan</i> 'to chew'	Old Icelandic <i>tyggva</i> 'to chew' (<i>< *kyggva</i>)
<i>ghlœu-</i> 'fresh' (?)	Greek <i>χλό(ρ)ος</i> 'yellow/bright green in color'	Gothic <i>glaggwō</i> 'accurately' Old Icelandic <i>glqgggr</i> 'accurate'
<i>kenu-, kneu-</i> 'to rub'	Greek <i>χνό(ρ)ος</i> 'squeaking'	Old Icelandic <i>hqggva</i> 'to knock'
<i>(s)keu-</i> 'to cover'	Sanskrit <i>skunāti</i> 'covered'	Gothic <i>skuggwa</i> 'mirror' Old Icelandic <i>skugg-sjá</i> 'mirror'

to account for the phenomenon, tying the problem into more knots through a host of exceptions. The same problems arose in appealing to the placement of the Germanic accent (compare Hirt 1931: 114). Finally, in the face of all of the exceptions to any solution based upon accent, Lehmann noted: "One inescapable conclusion seems clear from the many discussions of [consonantal] lengthening: it has no relation whatsoever to either the IE or the Gmc. accent" (1952: 39).

If we cannot explain the change through accent, perhaps we could turn to the old stand-by – the laryngeals. By the strategic placement of a conjectured *H*, some proponents of the laryngeal theory hoped to capture the generalization that would justify the law. However, Lehmann concluded in this area as well "that the solutions proposed for lengthening and development of *w > k* by adducing the laryngeal theory are as unsatisfactory as those proposed by relating the accent" (1952: 41). This same conclusion was reached even more strongly two decades later by Beekes (1972), whose position was all-the-more convincing because of his otherwise strong support for the laryngeal theory.

From time to time, linguists resurrect these arguments in the hope that some aspect of the motivating environment might serve to explain the phenomenon (see especially Collinge 1985: 97-98). The only one point that all theorists can agree upon, though, is the fact that, with or without accent and with or without laryngeal articulations, the syllabic vowel was short. Of course, it is the very shortness of the vowel that ties the entire process into a knot in the first place.

2. Transition tempo in Swabian

The fact is, that phonetically such a lengthening after a short vowel should not happen, and especially not in intervocalic position. This is precisely the environment in which we would expect to find the reduction of some consonantal phonetic quality, not the lengthening of it (or the 'hardening' of it, or the 'sharpening' of it, or whatever). Either we should not see a change from glide to obstruent here or we have been looking at the wrong phonetic features.

Six years ago (Griffen 1992), a feature that can account for the phenomenon was discovered to be of phonological pertinence in Swabian, an Alemannic (Upper German) dialect widely spoken in the southwestern region of the Federal Republic of Germany. In the development of Swabian, some extremely problematic and historically attested changes have been noted from glides to obstruents. For example, Middle High German *houwen* 'to cut' (corresponding in New High German to *hauen*) has changed to Swabian [haubə], while MHG *blâve* 'blue' (corresponding in NHG to *blau*) has changed to Swabian [blɔ:b]. The environment in which this has occurred includes intervocalic and final positions – exactly where we would expect a weakening of the obstrusive constraint of the consonant on the vowel, not the apparent strengthening of consonantality.

The problem for Swabian, however, arises only when we consider the [w] to be definable as necessarily inherently 'weaker' than the obstruent in the series [w] - [b] - [p]. When we admit in the face of the data that the [b] must in this regard be 'weaker' than the [w] along some other scale, we find ourselves inexorably drawn to the feature of 'transition tempo.'

In synthetic acoustic phonetic experiments conducted in the 1950's by Liberman et al. (1956),

it was found that the lengthening of the transition from vowel to acoustic locus would produce a glide from a consonant, and a further lengthening would produce a vowel from a glide. Thus, “in the syllable consisting of the stop consonant *b* plus the vowel *ɛ*, the stop *b* was transformed into the semivowel *w* when the duration of the first- and second-formant transitions exceeded 40 msec; the corresponding change from *ge* to *je* occurred at 40 or 60 msec. Further increases in the duration of the transitions caused *wɛ* and *je* to become the vowels-of-changing-color *ue* and *ie*, respectively” (Lieberman et al. 1956: 137).

Since the vowel is marked by a steady-state approximation of the formant frequencies, and the consonant by an abrupt change to or from the locus, a shortening of the transition – or more precisely in the dynamics of speech, a ‘hastening’ of the transition tempo – constitutes both a weakening in duration and an increase in obstruence. In its functioning within the phonological system, “the change from Middle High German [w] to Swabian [b] provides unambiguous evidence of the use of transition tempo not just as a criterion for the differentiation of consonant, glide, and vowel, but as a phonologically pertinent opposition – a distinctive feature” (Griffen 1992: 158).

3. Holtzmann’s Law and transition tempo

Since we already know that phonologically pertinent transition tempo has been at work in the history of Germanic, let us return to Holtzmann’s Law to see how it could explain that particularly perplexing phenomenon.

3.1. *The basic change.* First of all, we must review the basic environment. In sequential segments, this can be represented as in (4); and since we are dealing with consonantal phenomena at the syllable transitions, we need not be more precise in the dynamics of the description (that is, with regard to dynamic coarticulatory constraint).

(4) VjV / VwV

At this point, it is suggested that the glide becomes both the final constraint of the first syllable and the initial constraint of the second. This is similar to the phenomenon that we can hear in emphatic *Oh yes* [oj jes] or *Oh wow* [ow waw], in which, as in Holtzmann’s Law, the first syllable (minus the glide) is short. This can be represented as in (5), with the syllable transition marked as \$.

(5) VjV > Vj\$jV / VwV > Vw\$wV

Here is where the final glide of the initial short syllable weakens to the obstruent, in a manner rather similar to the attested changes in Swabian. Because this syllable is indeed short, the overall syllabic tempo requires a relative shortening of the transition tempo of the glide, resulting naturally

in the obstruent, as represented in (6).

(6) Vj\$jV > Vd\$jV or Vg\$jV / Vw\$wV > Vg\$wV

Moreover, since the pertinent feature is not obstruence *per se*, but transition tempo, there is no motivation for the change to affect the following syllable-initial consonant. One would, after all, not expect an initial consonant to ‘weaken’ – to become less consonantal within the pertinent feature in the environment.

3.2. *The orthography.* At this point, we should note an apparent discrepancy between the proposed change and the data. According to the data, the consonant is doubled, ostensibly representing gemination or provection. Indeed, this is where much of the problem in the traditional approaches has arisen.

The doubling of the consonant that makes it appear as though there were some sort of lengthening at work need have nothing to do with the length or duration of obstruence. If a single consonant [g] or [d] were realized in syllable-final position and before a semi-vowel, there would be a tendency to pronounce it as [ɣ] or [ð], respectively. However, deriving from a shortened glide articulation, the obstruent would have been realized as obstruence, not as frication.

One widespread manner of showing in the orthography that it is the obstruent pronunciation indicated by the letter that is to be pronounced, and not some derivative form, is by doubling the consonant. Indeed, we see a similar orthographic practice in modern Swabian, in which historical [k] is now realized intervocally and finally as [g] but without any compensatory lengthening or other developments (such as frication in some dialects). Thus, we find such conventional spellings as *Daggl* (NHG *Dackel*) ‘badger’, *drugga* (NHG *drücken und trocken*) ‘to draw out and dry’, and *Begg* (NHG *Bäcker*) ‘baker’ (compare Vogt 1979: 86).

Given the facts that there would have been no motivation for the lengthening of the consonant and that a geminate spelling need not have indicated a geminate or provector pronunciation, it is far more likely that the syllables were uttered with short, single obstruents. In the face of orthographic practice and phonetic probability then, the latter is by far the more motivated choice.

3.3. *Variant forms.* When we compare the data with the expected changes due to adjustments of transition tempo, however, we find what may appear to be a problem in the phonetics. While a shortening of transition tempo should bring about a change from [w] to [b] and from [j] to [g], the actual changes in Holtzmann’s Law are from [w] to [g] and from [j] to either [g] or [d] (or both). Given the phonetic features involved in transition tempo and in Holtzmann’s Law though, the variants can be accounted for in a rather straightforward manner.

3.3.a. *The labiovelar.* With regard to the labial glide [w], we should bear in mind that labials (including [b] and [w]) and velars (including [g]) are grouped together as grave articulations, “with aperiodic energy in the lower part of the spectrum” (Ladefoged 1997: 613). Although the labial and

velar are articulated at opposite ends of the oral cavity, they are acoustically quite close. Thus, while we might prefer from purely physiological considerations a change from [w] to [b] over a change from [w] to [g]; from acoustic considerations, the difference is not so great, especially if some patterning between [g] and [w] is already found in the language.

Indeed, such patterning is a mark of Germanic phonology. The labial protrusion of [w] was coarticulated with the velar obstruction resulting in the 'labiovelars.' This coarticulation was so prominent in Germanic that a labiovelar order is generally assigned along with the labial, dental, and velar (compare, for example, Prokosch 1939: 71-74). (To be sure, the palatal was inherited from Indo-European. Nonetheless, it fell together with the velar in Germanic, as seen in outline, for example, in Krahe and Meid 1969: 82-93.)

Thus, for Germanic the transition-tempo shortening of [w] would not proceed so much along the purely physiological lines of place of articulation (labial) as in the physiological and acoustic features relating to configuration (protrusion). This propensity to maintain protrusion regardless of place of articulation is also found in the development of German umlaut. Under these circumstances, such a shortening from glide to obstruent would naturally proceed toward the grave labiovelar rather than toward the grave bilabial.

3.3.b. *Palatalization.* As we have seen, for the transition-tempo shortening of [j] the expected target is [g] from the standpoint of acoustic phonetics. This is indeed attested in one variant of the change, as seen in category 2, above: For some Germanic dialects, [j] did shorten to [g], as, for example, PIE *dwey- > ON *tweggja*. In Gothic, on the other hand, we find the unexpected variant in which [j] apparently changed to [d], as in category 1, above: PIE *dwey- > Got. *twaddjē*.

As in the case of the labiovelar, we see that the expectations from synthetic acoustic phonetic experimentation must be tempered by the actual feature coarticulations found in the particular language. As demonstrated in Griffen 1997, for example, the patterns of coarticulation inherent to a language are maintained even when new features are added to the mix by borrowing or change. In traditional segmental terms, "phonemes of a pattern tend to be as fully integrated as conflicting patterns make it possible" (Martinet 1952: 20).

The feature that needs to be accounted for in the Gothic variant is the palatal place of articulation. While the labial, dental, velar, and labiovelar places of articulation clearly functioned in the system (that is, they were phonologically pertinent), "[f]or the purposes of Germanic grammar, the distinction between palatals and velars is immaterial" (Prokosch 1939: 43). Thus, it is not a matter of velar articulation, but rather one of dorsal articulation.

What this means for phonetics and phonology is that the labiovelar had to maintain an articulation at the velum *per se*, but the dorsal could be articulated anywhere from the alveolum to the velum, depending upon the vowel or semivowel with which it was coarticulated. In terms of modern phonetics, this is an important point: "Consonants are not defined directly in terms of variable values but by constraints on articulator position relative to the fixed structures. Articulators independent of the specific constraints are free to take on positions independent of the consonant under production subject to the requirement that they do not otherwise constrict the vocal tract!"

(Mermelstein 1973: 1082).

According to this principle of dynamic coarticulatory constraint, when the tongue-body is in the alveolar position for the articulation of [j] and when the consonantal constraint is defined as occurring anywhere between the alveolum and the velum, then we may justifiably expect the dorsal obstruence to occur at the alveolum. The range of the dental obstruence, however, is generally anywhere from the teeth proper to the alveolum. Thus, we have a significant overlap of [d] and [g] articulations in this environment

Given the phonetic overlap between [d] and [g] with their coarticulation with the palatal [j], it is no wonder that there have been arguments (as noted above) that one or the other was simply a variant form. Indeed, they were both interpretations of the nonlabiovelar dorsal articulation physiologically within the palatal range.

Once again, the important point here is that such variations are totally in accord with the findings of Liberman et al. (1956). While the basic change in transition tempo may be manifest in a particular tendency, the details within the scope of the tendency are subject to the phonetic and phonological facts of the language involved. Both the labiovelar and the palatal features and the relationships they participate in predictably influence the basic tendency of change.

4. Conclusion

The reason why Holtzmann's Law has been so problematic is that we have traditionally been basing the analyses upon a faulty assumption. The doubling of the consonant in the orthography need not represent a gemination or provection in pronunciation (as it in fact does not in modern Swabian – or in English, for that matter). The assumption that there was lengthening amounts to the suggestion that a strengthening of obstruence would occur in an environment naturally requiring a weakening of obstruence – or of some other phonologically pertinent feature.

By admitting that the environment calls for a weakening of consonantality and by examining recent phonetic and phonological research, we can indeed conclude that the weakening occurred most likely not in the duration of obstruence itself, but probably in the tempo of the transition. Of course, such information was not available to Adolf Holtzmann. Nor has it been available to researchers until recently – with the discovery by Liberman et al. (1956) of the role of transition tempo in differentiating vowel, glide, and consonant; with the development of dynamic phonology to account for the findings of dynamic phonetics (Griffen 1976, 1985); and with the combination of the two developments for the isolation of the feature of transition tempo in its phonological function (Griffen 1992).

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