Vowel quantity and the fortis-lenis distinction in North Low Saxon

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7. **Vocalic overlength in the languages of the world**

The LG data presented in the previous chapters demonstrate rather explicitly the presence of a third level of vowel duration in production and perception. Phonologically, there is reason to assume a binary representation of vowel length at the surface level. In order to put LG into a broader typological perspective, I provide here an overview of languages exhibiting three durational degrees of vowel length. We will see that the LG analysis is in fact one of many analytical possibilities to phonologically account for the phonetic facts.

The terminology used here is such that ‘duration’ denotes a purely phonetic property, i.e. measurable *absolute* time units of segments. ‘Overlong’ as compared to ‘short’ and ‘long’ is then used as a mere description of the phonetic realization available in the given language. ‘Quantity’ and ‘length’ by comparison denote equivalently *relative* time units as manifestation of an independent variable (i.e. duration) within the phonology (Laver 1994:436). *Phonology* here basically refers to the phonological surface representation as defined in chapters 2 and 4 with reference to Boersma (2007a:2). I assume that this level of representation contains (besides other properties) quantitative or syllable weight information. This content is not necessarily present in the underlying form, i.e. that level of representation that is part of the lexicon. The surface form is by comparison the output of the grammar and is generated by the interaction of markedness constraints, faithfulness constraints and metrical constraints.

The main question the typological excursion is now circling around is whether or not the phonology may contain a representation of ternary quantity in terms or three morae. Although ternary length systems are not exactly common and have been assumed to be particularly unstable (Schmidt 2002), there are several languages that have been found to display an according contrast. The respective languages cited in the literature (besides North Low Saxon) are Pai, Seri, Mayo, Wichita, Seneca, Sarcee, Central Siberian Yupik, Hopi, Mixe, (Luanyjang and Agar) Dinka, Scottish Gaelic, Estonian, Standard High German, and the Low and Central Franconian dialects.271 This particularly low frequency of languages with three overt degrees of length, and the recurring evasion of such a system by establishing subsidiary prosodic categories (e.g. tone, vowel quality) is the main focus of a 2007 article by McRobbie-Utasi. She essentially finds that systems retaining three degrees of vowel duration employ additional prosodic features (F0, intensity, duration ratios, etc.) to corroborate the contrast (McRobbie-Utasi 2007:195f.).272 “The implications of these

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271 Interestingly, a ternary length contrast has been claimed also for Proto-Indo-European (Antonsen 2002:254ff., and references therein). Another language with an alleged ternary vowel length contrast is the Austronesian language Rotuman (e.g. Churchward 1940, Blevins 1994, Hale 2011), though no conclusive phonological analysis is available as to this point.

272 Rather peculiarly, McRobbie-Utasi (2007) employs the term *quantity* only in cases “when the relevance of other prosodic factors (in addition to duration) need to be considered in the manifestation of contrast” (McRobbie-Utasi 2007:169). This basically means that quantity is seen as the collective of several prosodic features; namely duration, F0, intensity, duration ratio, etc.
tendencies clearly point to instability as being characteristic of a system with three-way length distinction” (McRobbie-Utasi 2007:196). She further notes that “it has been observed that languages with this type of contrastive system [i.e. a ternary length system] [...] undergo significant changes in their prosody in the direction of re-establishing binary distinctions” (McRobbie-Utasi 2007:167).

We will have a closer look at these claims in the course of this typological excursion. What we will see is that the phonological toolbox that is employed to analyze ternary contrasts is rather expansive – in fact so expansive that it might predict the occurrence of languages featuring even more than three length degrees.

I start out with a flying visit to the indigenous languages of the Americas. What we will see is that most of the supposedly ternary duration systems might need to be analyzed by means of a ternary quantity system. The phonetic data are, however, not entirely conclusive.

The subsequently discussed Nilo-Saharan language Luanyjang Dinka is by comparison rather well documented and, thus, well analyzable by means of elaborate phonetic data. The three durational levels within the vowel system may represent indeed a ternary moraic contrast as described by Remijsen & Gilley (2008).

The Eurasian languages broached in the final section of this chapter are indeed not covered by a ternary quantity interpretation. Each one of the four cases in point (i.e. Scottish Gaelic, Estonian, Standard High German, and Central Franconian) once again contain overlength – if at all – just as an overt phonetic realization. The underlying contrast in the language systems is inevitably binary.

7.1. Languages in the Americas: Pai, Seri, Mayo, Wichita, Seneca, Sarcee, Hopi, Mixe

The subsequently discussed languages fall rather short on phonetic as well as phonological investigations. However, they are assumed to employ a threefold length distinction of some kind within their vowel systems.

The languages, Seri, Mayo, Mixe, Wichita, Seneca, Sarcee, Central Siberian Yupik, and Hopi, do all comprise an overt ternary duration opposition. Pai is here the odd one out, not showing such a clear-cut threefold contrast in the overt form.

7.1.1. Pai

Pai is a branch of the Yuman language family in Arizona. There have been a number of publications stating that various Pai languages have three degrees of vowel duration that are likely to be phonological (Redden 1966 on Hualpai; Joël 1966 on Paipai; Kendall 1976 on Yavapai; Shaterian 1976, 1983 on Yavapai).

I pick out Yavapai for a brief illustration. Besides auditive studies, it has been subject to experimental phonetic surveys (Munro 1990; Thomas 1992), making it an

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273 The transcriptions provided in this section and the following sections are adopted from the respective references.

274 Thanks to Wolfgang Kehrein for pointing this language out to me.
opportune candidate for a closer inspection. Thomas (1992) investigates recordings of isolated items and connected speech with minimal triples and near minimal triples for short vowels, long vowels, and extra-long vowels put into neutral carrier sentences. An example of such a three-way contrast (based on Shaterian 1976, and Munro 1990) is given in Table 35. Thomas (1992) elicits basically data of two informants. A drawback of her sample set is that the words under investigation are rather heterogenous syllable-wise: they contain one to four syllables. To exclude the possibility of word length effects on the vowel duration it would have been better to focus on words of identical syllable number. Especially since it has been assumed that the number of syllables is inversely proportional to the absolute vowel durations of the syllables (i.e. the more syllables, the less vowel duration per syllable).276

Table 35. Ternary vowel duration in Yavapai

<table>
<thead>
<tr>
<th>V duration</th>
<th>item</th>
</tr>
</thead>
<tbody>
<tr>
<td>short</td>
<td>[ʔaha]</td>
</tr>
<tr>
<td></td>
<td>‘water’</td>
</tr>
<tr>
<td>long</td>
<td>[ʔaha]</td>
</tr>
<tr>
<td></td>
<td>‘be bitter’</td>
</tr>
<tr>
<td>overlong</td>
<td>[ʔaha]</td>
</tr>
<tr>
<td></td>
<td>‘cottonwood’</td>
</tr>
</tbody>
</table>

Thomas (1992:90) states that the Yavapai vowel inventory contains five qualities /a, e, i, o, u/, which occur in three contrastive length degrees. This difference emerges only in stressed syllables, which basically means in word-final position since Yavapai has a system of word-final stress. The C succeeding the nucleus in a CVC syllable seems to have no influence on the durational contrast. Unfortunately, the contrast is not as well established as Thomas puts it. Thomas’ third degree of vowel length is not consistently produced longer for every vowel quality than vowels of the second, i.e. long, degree (Thomas 1992:96). The phonetic data shows that only for /i/ a statistically highly significant difference between the duration of the long vowels and the overlong vowels can be found in both isolated items and connected speech. The vowels /a, e, u/ do generally differ – if at all – at a marginally significant level with respect to the duration of long vowels and overlong vowels (Thomas 1992:97ff.). The absolute durational difference is rather low. The first subject produces a significant difference for /o/ in connected speech if the data is adjusted for word length effects (mono-syllables and bi-syllables investigated separately). The second subject shows a marginally significant difference for /a/ in connected speech.

All in all, only /i/ does have a clear difference between the supposed short, long, and extra-long vowel length throughout the elicited Yavapai data, and independent of any word length effects.

Neutralization effects between the long vowels and the overlong vowels occur more often and more prominently in isolated items, i.e. as a result of utterance-final lengthening in prepausal position (Thomas 1992:104). Thomas (1992:104) notes that

275 The language is virtually on the verge of extinction (Thomas 1992).
276 See especially Pike (1945). Also Bertrán (1999) and the references cited therein.
“Prepausal lengthening has applied to all three length categories in isolation because any one length category is longer in isolation than it is in context. However, the extra-long length category seems to have reached its maximum duration and cannot stretch in duration as much as the long length category.”

The overall result of the statistical analysis is such that for the complete set of data (as pooled across all vowel qualities and both speakers) the difference between long vowels and extra-long vowels amounts up to a mere 2% in isolated utterances, and 8% in connected speech (Thomas 1992:109). Other factors like pitch, vowel quality, or lexical category do not add to the durational contrast. Thomas (1992:116) even notes that it is reasonable to ask whether the durational difference is sufficient to assume it to be the distinguishing factor between words with long and extra-long vowels. Nevertheless, she concludes on the basis of the marginally significant difference between long vowels and extra-long vowels with \( p < .02 \) (Thomas 1992:115) that “a strong case for positing three distinctive vowel lengths can be made.”

This is a conclusion I cannot share. Especially since the upper durational margin of \(+8\%\) for extra-long vowels in connected speech lies much below the conservative JND (just noticeable difference) threshold of 20 to 25% noted by Rosner & Pickering (1994:194) for natural speech. It is indeed rather questionable whether the durational difference between Yavapai long and supposedly extra-long vowels is reliably perceptible. A perception test would here be in order to clear the picture.

As for the Yavapai production data, it appears to be the case that phonologically only two distinct vowel quantity categories short vs. long are justifiable – at least for the mid and open vowels. The items [ʔaha] ‘be bitter’ and [ʔaha] ‘cottonwood’ of Table 35 would then belong to the same quantitative category (homophony), a position that is also held by other researchers (e.g. Langdon 1976; Munro 1990). An actual threefold duration difference is found for /i/, unconditioned by either morphology or syllable structure. This alludes to a possible ternary representation of the closed vowels in the phonology. A restriction of the threefold-length constraint to one vowel quality only must remain, however, rather suspicious. Nevertheless, the ternary length account is not invalidated for Yavapai.

7.1.2. Seri

Seri is a language isolate spoken at the northwestern coast of Sonora in Mexico. Its vowel system contains the four qualities /i, e, o, a/, with e representing the more open allophones [ɛ] and [æ].

Seri has a rather complex morphological system that is closely interrelated with the structure and length of the nuclei. Vowel length also interacts in a balancing manner with consonant length (Moser & Moser 1965). Phonetically, we clearly find a third – if not a fourth – degree of vocalic duration within a single syllable (Marlett 1988:251ff.). Moser & Moser (1965:65) note that
“Vowels occur in sequences of two identical or diverse vowels [i.e. $V_1V_1$ or $V_1V_2$], in sequences of three identical or diverse vowels or combinations of these [i.e. $V_1V_1V_1$, $V_1V_1V_2$, $V_1V_2V_2$, $V_1V_2V_1$, or $V_1V_2V_3$], and in sequences of four, which are combinations of identical and diverse vowels.

Sequences of two and three identical vowels are phonemically in contrast with single vowels and with each other and are structurally analogous to sequences of diverse vowels.”

Marlett (2008:5) notes that the extra-long nuclei may also consist of a combination of short vowel and long vowel. These combinations are usually characterized by comprising a more closed jaw opening for the shorter constituent, as compared to a more open realization of the longer constituent (Marlett 2005:71). In qualitatively identical sequences obviously only the durational factor is present.

The occurrence of four adjacent vowels in Seri is more restricted than the occurrence of the other vowel sequences; they are only allowed in syllable-medial and syllable-final positions. Short, long and extra-long vocalic configurations may by comparison also occur syllable-initially (Moser & Moser 1965:66). This basically means that we obtain an overt contrast of short vs. long vs. extra-long vocalic nuclei within a syllable. Examples with sequences of identical vowels are given in Table 36 (Moser & Moser 1965:65; Marlett 2003).

Table 36. Ternary vowel duration in Seri\(^{277}\)

<table>
<thead>
<tr>
<th>[short V]</th>
<th>[long V]</th>
<th>[extra-long V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘íttoox ‘my eyes’</td>
<td>‘ítton ‘my speech’</td>
<td>‘ítitt ‘my efforts’</td>
</tr>
<tr>
<td>‘éppen ‘white tail deer’</td>
<td>‘kéeti ‘to build up side of basket for extra load’</td>
<td>‘kéett ‘to lie (rep.)’</td>
</tr>
<tr>
<td>hapéxem ‘one who is feared’</td>
<td>hapéxem ‘one who is respected’</td>
<td>k’éeexam ‘those who groan’</td>
</tr>
<tr>
<td>kó?’a ‘to have’</td>
<td>kóoto ‘to hiss (tpl.)’</td>
<td>kóooWk’a ‘to bark (rep.)’</td>
</tr>
<tr>
<td>káttool ‘to be wild’</td>
<td>káaati ‘to use’</td>
<td>káaati ‘to talk excessively’</td>
</tr>
</tbody>
</table>

The length opposition between short vs. long vs. extra-long is only possible in stressed position (Marlett 1988:253).\(^{278}\) The extra-long vowels may be assumed to be trimoraic (Marlett 2003). Marlett et al. (2005:119) point out that the extra-long vowels result from the juxtaposition of (allo)morphemes containing identical vowel qualities. This third durational degree is therefore morphologically determined and not independently possible. The extra-long degree is not underlying but emerges in the surface form. Examples of verb stems containing such extra-long sequences as

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\(^{277}\) The acute accent on vowels marks the primary word stress. $W$ denotes a voiceless spirantized [w].

\(^{278}\) The stress assignment of Seri results from the construction of moraic trochees at the right edge of a root, but is at the same time quantity sensitive, i.e. influenced by syllable weight. Heavy or super-heavy final syllables attract stress. A final consonant counts as extrametrical for it does not add to the weight of a syllable (Marlett 2008:9).
provided in Marlett (1981:220ff.) are subject to a number of morpho-phonological processes.

Table 37. Seri verb stems (Sg. subject / Sg. action) with extra-long vocalic nucleus

<table>
<thead>
<tr>
<th>Verb Stem</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>/-aə/</td>
<td>‘call’</td>
</tr>
<tr>
<td>/-aɪɡ/</td>
<td>‘leave’</td>
</tr>
<tr>
<td>/-aɪx/</td>
<td>‘sway’</td>
</tr>
<tr>
<td>/-iɪn/</td>
<td>‘go’</td>
</tr>
<tr>
<td>/-keɪ-ɡ/</td>
<td>‘cut hair of’</td>
</tr>
<tr>
<td>/-sai-ɡ/</td>
<td>‘gather together with stick’</td>
</tr>
<tr>
<td>/-siɪx/</td>
<td>‘move’</td>
</tr>
</tbody>
</table>

Marlett (1981:95) therefore concludes that the respective vowel sequences are analyzable as structurally bi-vocalic clusters of short V and long V. All in all, the overt phonetic representation of short vs. long vs. extra-long vowels is always traced back to an phonological opposition of monomoraic vs. bimoraic; i.e. there appears to be no phonological ternarity of the vowel segments in Seri.

7.1.3. Mayo

Three types of overt vowel length are also documented within the Southern Uto-Aztecan family in Mayo and Yaqui, two closely related languages spoken in the Mexican provinces of Sonora and Sinaloa (Burnham 1988; Hagberg 2006). I focus here on Mayo. Besides a category of ‘no-length’ (i.e. short vowels), the two categories ‘underived length’ (i.e. long vowels) and ‘derived length’ (i.e. half-long vowels) occur in the language. Vowel length is basically predictable from the context, being interrelated with stress and pitch phenomena. The pitch peak (H) – the most salient phonetic correspondent of Mayo stress (Burnham 1988:39) – is assigned differently to phonologically long vowels and derived (i.e. overt) long vowels. Examples are given in Table 38 below (Burnham 1988:45; Hagberg 1988, 2006:151, 153).

Table 38. Ternary vowel duration in Mayo

<table>
<thead>
<tr>
<th>no-length [short V]</th>
<th>derived length [half-long V]</th>
<th>underived length [long V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ka-</td>
<td>‘no’</td>
<td>ká+ ‘no’</td>
</tr>
<tr>
<td>ne-</td>
<td>‘me’</td>
<td>né+ ‘me’</td>
</tr>
<tr>
<td>wé-ye</td>
<td>‘go-Pres.’</td>
<td>wé+ ‘go’</td>
</tr>
<tr>
<td>ýá-wá</td>
<td>‘make-Pres.’</td>
<td>ýá+ ‘make’</td>
</tr>
<tr>
<td>ýóka</td>
<td>‘paint’</td>
<td>ýó-ko ‘tomorrow’</td>
</tr>
<tr>
<td>natema</td>
<td>‘ask’</td>
<td>wá-te ‘others’</td>
</tr>
<tr>
<td>tóku</td>
<td>‘squirrel’</td>
<td>tééka ‘sky’</td>
</tr>
<tr>
<td>nátemae</td>
<td></td>
<td>wááte ‘remember’</td>
</tr>
<tr>
<td>yóóko</td>
<td></td>
<td>yóóko ‘jaguar’</td>
</tr>
</tbody>
</table>
The short vowels and the underived long vowels occur only in non-final positions, and the derived long vowels only in final positions.

The short vowels of the ‘no-length’ category as well as the long vowels of the ‘underived length’ are interpreted as being underlying, while the derived (half-long) type of vowel length is the result of a lengthening process of a short vowel. Besides the lengthening, different pitch contours occur on the phonologically long vowels and derived (i.e. overtly) long vowels. The underlyingly long vowels show an early aligned H (denoted by a double accent mark), whereas the derived (half-)long vowels exhibit a late peak on the vowel (denoted by a single accent mark) (Hagberg 2006:161).

Hagberg (2006:153f.) claims that the lengthening relates to mora insertion. It can happen if a word has either only one underlying mora, or an underlyingly moraic coda C is rendered extrametrical (Hagberg 2006:156). The difference in pitch contours could then be expressed by means of H assignment to the morae of the nucleus. The association of the H to the first part (or mora) of the vowel in underived long forms does not apply to the items with derived length. As to Hagberg, the late pitch peak rather indicates an association to the second part (or mora) of the nucleus. To be more precise, the stress associates to the leftmost mora of the nucleus in underived forms, and to the rightmost mora in derived forms. These pitch differences might be interpreted as some sort of stress autosegments as Hagberg (2006) postulates.

Another possibility would be to assume in a stratal fashion two levels of stress assignment. The first would be the level of the lexicon where stress is assigned by default to the initial mora of an underlyingly bimoraic vowel. The derived long vowel, being underlyingly monomoraic but at the surface level bimoraic, then receives post-lexical stress on the second mora of the nucleus.

What is also thinkable is that both types of long vowels differ by means of moraic structure. While the derived forms would be monosegmental with two mora associations, the underived forms comprise two segmental slots associated with two morae. An illustration of this option is given in Figure 80.

Figure 80. Derived and underived long vowels in Mayo

We see that there are at least three options to analyze the ternary vowel duration phonologically. The overt three types of vowel duration of Mayo do, thus, not constitute a phonological ternary length contrast. The major distinguishing factor is the variation in pitch (and hence stress) alignment.

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279 Hagberg (2006:164) states indeed that “the acoustic pattern of the pitch of Mayo utterances indicates that Mayo’s autosegmental stress ends up linking to a mora rather than to a syllable.”
7.1.4. Mixe

In our search for a vowel system with three phonological degrees of length we move on to the Mexican province Oaxaca. Here we find the language Mixe that belongs to the Mixe-Zoque language family. It can be split up into three to four rather distinct main varieties (Jany 2006:1). One of them is Coatlán Mixe, which has been identified as a language with a ternary contrast in vowel length (Hoogshagen 1959). Other Mixe varieties with a similar three-fold length distribution are Camotlán Mixe and San José El Paraíso Mixe (Hoogshagen 1959:111, and van Haitsma 1976, respectively). Minimal triples are available that differ only by means of vowel duration short vs. long vs. extra-long. Some examples are given below (Hoogshagen 1959; van Haitsma 1976).

Table 39. Minimal triple of Mixe vowel length

<table>
<thead>
<tr>
<th></th>
<th>[short V]</th>
<th>[long V]</th>
<th>[extra-long V]</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>po</em> 'guava'</td>
<td><em>po</em> 'a spider'</td>
<td><em>po</em> 'a knot'</td>
<td></td>
</tr>
<tr>
<td><em>pe</em> 'climb'</td>
<td><em>pe</em> 'a broom'</td>
<td><em>pe</em> 'Peter'</td>
<td></td>
</tr>
<tr>
<td><em>löy</em> 'although'</td>
<td><em>löy</em> 'he went'</td>
<td><em>löy</em> 'very'</td>
<td></td>
</tr>
</tbody>
</table>

This opposition occurs independently of sentence position only in stressed syllables (Hoogshagen 1959:114). Pitch contours appear to play no role here for the long and extra-long vowels show the same overall pitch movement.

The syllables of Coatlán Mixe obligatorily have onsets, either a single C or a cluster. This is why the third degree of vowel duration cannot be reanalyzed as heterosyllabic V:V (see Scottish Gaelic below in section 7.3.1) (Hoogshagen 1959:115). There is, however, a possibility to analyze the phonetic facts in a binary manner. Hoogshagen (1959:115) assumes that

“phonetic [V:] = phonemic (V·h). This interpretation is based on complementary distribution and phonetic similarity: V may be accompanied by [h], V: may not be accompanied by [h] but by a third mora of length; [h] and a third mora of length are phonetically similar in that they are vocoids in quality (voiceless and voiced respectively). This interpretation of [V:] as (V·h) makes it possible to analyze the third mora of length as an allophone of a phoneme present elsewhere in the pattern”.

Hoogshagen’s preliminary comparison with Totontepec Mixe indicates indeed that the extra long vowels of Coatlán result from CL after the loss of a final glottal segment. This segment is assumed to be still present in Totontepec overt [V?] sequences. The glottal segment in Coatlán by contrast would then be present in the phonological surface representation, but would not be realized in the phonetic overt form. This means that we end up with a phonological system of binary vowel quantity short vs. long.

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280 The transcription used in Hoogshagen (1959) and accordingly Fox (2000:43) is rather ‘: ‘ for the extra long duration, and ‘ · ‘ for the long duration.
As a synchronic analysis this diachronically inspired approach is rather abstract and not entirely satisfactory – especially, since the phonetics appear to tell us that there are three degrees in vowel duration present in the language. The glottal segment remains a phantom. The synchronic data therefore rather allude to a ternary surface representation. For now, it remains unclear how a learner should be able to reanalyze the glottal segment (or any segment at all) without direct or indirect evidence for its existence. Further research is needed to clarify the phonetic picture and determine the status of the assumed glottal segment.

What we have seen so far from the indigenous languages of the Americas are several instances of overt ternary duration contrasts (though its occurrence is rather restricted for Yavapai).\(^{281}\) Almost all of the according languages might need to be analyzed in a ternary fashion. So far, one of the phonological analyses provides compelling and sound argumentations for a binary surface representation – the pitch alignment analysis of Mayo. Only one of the remaining languages of this chapter (i.e. Hopi) appears to definitely call for a binary analysis as well as we will see in due course.

7.1.5. Wichita

Wichita is a moribund North Caddoan language that is fluently spoken by only one remaining speaker. Nine additional persons are believed to be able to speak the language, though less proficiently. None of the speakers is monolingual. Naturally, no dialectal variation is discernible any more (Rood 2001). Wichita used to be spoken in central and south-central Oklahoma, southern Kansas, and northern Texas.

The language has a vowel system consisting of only three phonological vowel qualities /i, e, a/. Phonological /i/ basically covers the phonetic range between front closed and front close-mid unrounded vowels, /e/ represents the phonetic open-mid unrounded vowels, and /a/ incorporates the open back unrounded vowels. A sequence of any short V plus the labial approximant /w/ yields long [ɔ:]

In his 1975 article, Rood postulates a ternary durational contrast of short vs. long vs. overlong for the Wichita vowel system. Examples are given in Table 40 (Rood 2001).

Long vowels are assumed to be twice as long as short vowels, while the overlong vowels are 2.5 to 3 times as long as the short vowels (Rood 2001:581).

Besides the overt duration contrast there exists an independently distributed binary tonal contrast of H and L. The occurrence of the respective tones is completely unpredictable as Rood (2001:581) notes. Thus, no connection between quantity and tonal contour can be established.

\(^{281}\) The Algonquian languages Malecite and Passamaquoddy are left out of the discussion since it appears that only Hayes (1995:216) assumes here an overt ternary duration contrast depending on certain phonological rules. LeSourd (1989) in his comprehensive description of the languages makes no reference as to this point.
Table 40. Ternary vowel duration in Wichita

<table>
<thead>
<tr>
<th></th>
<th>[short V]</th>
<th>[long V]</th>
<th>[overlong V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>tiwäh</td>
<td>‘this’</td>
<td>tiwäs</td>
<td>‘medicine’</td>
</tr>
<tr>
<td>wickhēwes</td>
<td>‘funny’</td>
<td>hevääh</td>
<td>‘be fat’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>hehah</td>
<td>‘be a creek’</td>
</tr>
<tr>
<td>nahehārīh</td>
<td>‘creek’</td>
<td>nāwhh</td>
<td>‘his’</td>
</tr>
<tr>
<td>hárah</td>
<td>‘there’</td>
<td>harīh</td>
<td>‘that one’</td>
</tr>
<tr>
<td>kammac</td>
<td>‘grind corn’</td>
<td>cammarix</td>
<td>‘hoe, cultivate’</td>
</tr>
</tbody>
</table>

Rood (1975:318) finds that the overlong Vs may occur without any apparent restriction in any syllable. There might, however, be some interaction with stress and vowel quality, and stress and tone, respectively. The pattern of primary word stress decides that stress falls on long vowels (and thus also overlong vowels) if no H syllable is available (Rood 2001:582). No reference is made as to the possible duration degrees of secondary stressed syllables and unstressed syllables.

Considering vowel quality again, one can observe that not every of the three vowel phonemes occur equally frequently in each of the three durational degrees. While short /e/ is rather rare, this quality is very common in the long and especially in the overlong degree. For /a/ we basically find the opposite distribution. It is very common in the short and the long degree, whereas cases of overlength occur but in a few words. /i/ occurs equally frequently in either of the three durational degrees. All in all, certain vowel qualities appear to have clear preferences for certain durational categories.

Rood (2001) takes only the two degrees short and long to be definitely phonological, i.e. present in the phonological surface level of the language. He assumes that overlong vowels are most likely to be derived from V:CV sequences that syncopated the intervocalic C synchronically. The long vowel and the succeeding short vowel then merge into a phonetically overlong configuration. This is indicated by related languages that retain e.g. intervocalic /h/ and /j/ where Wichita shows deletion thereof (Rood 2001:584).

Rood’s approach essentially merges synchrony and diachrony for there appears to be no independent evidence for the actual presence of the assumed underlying /h/ and /j/ in Wichita. This diachronically inspired analysis that refers to consonantal positions not present in the synchronic language appears rather stipulative. As far as the auditory analyses can tell, there are three degrees of vowel duration that might as well be synchronically interpreted as a phonological ternary vowel length contrast. Indeed, Rood (2001:584f.) also notes that “it is necessary to preserve the contrast between long and overlong” until further research has been conducted. Otherwise, length differences occurring in certain root pairs may not be accounted for. The

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282 Note that Rood’s transcription of long vowels involves the IPA symbol for half-length ‘·’, and overlength is noted accordingly with ‘¨’.

283 See the analysis of Mixe above.
possibility of a ternary representation in the phonology is, thus, not at all obliterated. Given Rood’s (2001) diachronic analysis, a phonological representation of bisegmental \( V_{\mu\mu} V_{\mu} \) rather than \( V_{\mu\mu\mu} \) might be expected.

Rood (1975:318) mentions two further Amerindian languages assumed to show phonetic overlength: Seneca and Sarcee. Let us consider them briefly for a moment.

7.1.6. Seneca

Seneca is the westernmost language of the (northern) Iroquoian language family and was originally domiciled in New York State. The total number of fluent speakers is approximately 100, which places Seneca together with Wichita and Sarcee in the league of severely endangered languages.

In the synchronic vowel system of Seneca, we come across a matrix of five phonemic qualities /i, e, æ, a, o/. They may occur in a durational opposition of short vs. long vs. overlong. The latter case is a merger of a sequence of \( V_1 \)” and \( V_1 \), with both long vowel and short vowel being qualitatively identical (Chafe 1959:493; Rood 1975:318). Some examples of the three vowel durations as noted by Chafe (1959) follow in Table 41.

<table>
<thead>
<tr>
<th>[short V]</th>
<th>[long V]</th>
<th>[overlong V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>?otekha?</td>
<td>ëòkàat</td>
<td>kakaz?</td>
</tr>
<tr>
<td>&quot;it burns&quot;</td>
<td>&quot;it passed by&quot;</td>
<td>&quot;story&quot;</td>
</tr>
<tr>
<td>-no?se-</td>
<td>ëòkë:ti?</td>
<td>ëòkë:x?</td>
</tr>
<tr>
<td>&quot;to be uncle to&quot;</td>
<td>&quot;it’s gray&quot;</td>
<td>&quot;ashes&quot;</td>
</tr>
<tr>
<td>òiwa?</td>
<td>wa?</td>
<td>wa?</td>
</tr>
<tr>
<td>&quot;thing, cause&quot;</td>
<td>&quot;he said it&quot;</td>
<td>&quot;he put it in&quot;</td>
</tr>
</tbody>
</table>

The vowel merger is assumed to have occurred in connection to the (diachronic) loss of an intervocalic Proto-Northern-Iroquoian *h or *r. This is rather reminiscent of what we just saw for Wichita. Overlong vowel configurations are possible only in the penultimate or ultimate syllable of a PrWd. Chafe (1959) specifically transcribes a sequence of two vowels \( V_1 V \) rather than a single overlong \( V_2 \). This is justified by the fact that in sequences of qualitatively non-identical vowels no assimilation occurs. They end up with \( V_1 V_2 \) as for example in *wenökah?ga? > wenöka?ga? ‘they make holes’,285 or *hokay?ga > hokayt ‘he is telling stoRiese.’

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284 Not only single and multiple stresses are possible in a Seneca PrWd, but also no stress at all. An acute accent above the according vowel denotes the H.


286 Tonal interaction does not occur since high pitch is solely used to mark word stress rather than being employed as a paradigmatic property (Melinger 2002:288). No other phonetic feature is used to distinguish between stressed and unstressed syllables, which is why Seneca is termed a ‘nonstress accent language’. In a nutshell, stress is banned from occurring in word-final position as well as on penultimate syllables that have been lengthened via a process of Even Penultimate Lengthening (Melinger 2002:293). Main stress is allowed, then, under the following conditions. It exclusively falls on (underlyingly) even-numbered closed syllables, or on even-numbered open syllables immediately being succeeded by a non-peripheral closed syllable. This also entails the possibility of having more than one stress assigned to a PrWd. In the event of having no non-final closed syllable at hand, no stress at all is assigned (Melinger 2002:290).
Only one overlong vocalic sequence is generally tolerated in a PrWd. Chafe (1959:493) notes, however, that there might be dialectal divergence to this point. He gives the example of *wahariwáste* ‘he noticed it’, which underwent first r-loss to *wahairiwa*ste, and then h-loss that yielded *wažwáste*. This outcome was adjusted to waiwáste (with only one V₁V₂ sequences).

All in all, the overlong configurations in Seneca are represented in the phonology by binary vowel clusters V₁V₂ rather than just one single vocalic segment V. They emerge where diachronically a syllable was lost. Occurring in a single syllable, however, the adjacent vocalic segments establish a ternary duration contrast in the overt form – similar to the analyses we obtained for Seri and Wichita. In terms of morae and surface representations, we might indeed end up with a trimoraic syllable, though not a trimoraic segment.

### 7.1.7. Sarcee

The Athapaskan language Sarcee is an endangered language (approximately 50 speakers) that is spoken in the region of Calgary. The language system contains four vowel phonemes /i, a, u, o/, which can occur in three degrees of vowel duration. Additionally, we find a tonal contrast of three level tones H(igh), M(id), and L(ow), and the so-called ‘inflected tones’ or contour tones that are combinations of the former (Cook 1971:165). The short and overlong length degrees coincide only with the level tones, while the long vowels may bear either a level tone or a contour tone. This basically means that the level tones occur across all three durationalduring s.287

Concrete phonetic descriptions are, unfortunately, not provided in the material, obviating a comparison with other languages employing additional prosodic features such as tones to support a durational contrast (e.g. Estonian). Examples are given in Table 42 (Cook 1971, 1975).

**Table 42. Ternary vowel duration in the Sarcee level tone items**

<table>
<thead>
<tr>
<th>[short V]</th>
<th>[long V]</th>
<th>[overlong V]</th>
</tr>
</thead>
</table>
| tsá | * | tázá | *
| dícúh | ‘I will go’ | -tsí | ‘to put pickets around’ | di’káž | ‘it is red’ |

Summarizing findings by Cook (1971), Rood notes that the overlong vowels in Sarcee emanate from morphophonemic processes and widespread interaction with tones (Rood 1975:318). The same is valid for the long vowels with contour tones.

287 As to Cook (1971:166), the “phonetic difference between the long and the overlong is conditioned by tone: if the two vowels have different level tones, the result will be a long vowel with an inflected tone; if the two vowels have the same level tone, the result will be an overlong vowel with that level tone.” However, this assumption of a purely tonal contrast is not fitting for the cases with long level toned vowel vs. overlong level toned vowel.

288 The acute accent ‘´’ marks here a high tone, the macron ‘¨’ denotes a mid tone, and the grave accent ‘`’ marks a low tone. The diacritic ‘’’ denotes a long vowel, and an additional superscript vowel marks overlength. Note that only the items in the first row comprise identical tones.
Both incidents, long contour vowel and overlong level vowel, result effectively from the co-occurrence and subsequent contraction of a sequence of two qualitatively identical vowels with level tones; they are vowel sequences (termed ‘geminate vowels’ by Cook 1971:167). The long contour vowel is constituted by two adjacent short vowels with different level tones (e.g. áà > â), while the overlong level vowel relates to a sequence of two completely identical vowels (e.g. áá > áá). This sequencing behavior is illustrated by them being spread across (allo)morpheme boundaries (Cook 1971:166). They never occur morpheme-internally.

While the tonal contrast holds for the vowel sequences, we may not conclude right away that the tones can be assumed the primary feature of the Sarcee vowel system (McRobbie-Utasi 2007:188). The synchronic duration degrees are, still, the only contrastive properties in level-tone items of the same register (i.e. H, M, or L). Yet, as Cook (1971) describes the overt contrast, an underlying ternary contrast of mono-segmental V vs. V; vs. V; is rather unlikely. The vowel quantities may be reducible to just two underlying phonological degrees: short vowels, and long vowels, each enriched with one level tone. The overlong vowels would then result from V;V; or V;V in the phonology (see Seri). This means that we, again, find a ternary length contrast in the surface representation. Similar to the findings above, the three morae occur, however, not within a single segment but in bisegmental sequences.

7.1.8. Central Siberian Yupik

Another Amerindian language that has been argued to exhibit three distinctive degrees of vowel length is Central Siberian Yupik. It belongs to the Eskimo-Aleut language family and is spoken along the coast of the Chukchi Peninsula, on St. Lawrence Island, and in two Alaskan villages (Savoonga and Gambell). The language can be subdivided into several daughter languages and dialects.

The stress system is generally iambic, i.e. in the case of a bisyllabic foot, the foot-final syllable is stressed. All feet in non-final position within a PrWd receive stress. Now, this stress system relates to a synchronous change in the vowel system: a process of Iambic Lengthening (Leer 1985:136). It entails that non-final short stressed vowels of open LL syllables are lengthened to become heavy and be able to create an L.H iamb. Additionally, underlyingly long vowels of open syllables are lengthened to overlong vowels (Hayes 1995:241). Hayes (1995:269) interprets this process as a general strategy for avoiding contrast neutralization. The result is an overt three-way split of the vowel length into short vs. long vs. overlong. According examples are given in Table 43 (Krauss 1985a):

289 The only exception to this pattern is the synchronically mono-morphemic personal pronoun ád ‘we’ with a mid tone + contour tone that probably developed from two juxtaposed morphemes (Cook 1971:166).
A distinct falling pitch movement accompanies the overlong vowels. A relation to vowel quality is not mentioned. The change is basically the phonetic manifestation of the phonological entity ‘foot’ (Leer 1985:136). The opposition between the three duration degrees is not present in the underlying representation, though. It arises only in the surface form and is conditioned by the syllable structure (i.e. lengthened long V and overlong V are only possible in open syllables). The result is then the phonological representation of $V_{\mu}$ vs. $V_{\mu\mu}$ vs. $V_{\mu\mu\mu}$.

Krauss (1985b:47) states for the Alaskan varieties as well as for the east Russian variety of Central Siberian Yupik that nowadays “there is widespread loss of that distinction, between lengthened short vowels and lengthened underlyingly long (overlong) vowels in open syllables.” The avoidance of contrast neutralization between lengthened underlyingly short Vs and lengthened underlyingly long Vs appears to be, thus, on the verge of disappearance.

7.1.9. Hopi

The last language in our overview of the languages of the Americas is the Uto-Aztecan language Hopi (Whorf 1937, 1946). Whorf (1937:267) notes with reference to Uto-Aztecan vowel length that

“Perhaps it would be better to use the symbolism *a, *a, *a, and the terminology “reduced mora or ultra-short,” “full mora or short (or medium),” “two-mora or long.” In Hopi we have precisely this odd three-length system.”

The three lengths may occur only in stressed position. An illustration of the contrast by means of a minimal triple is given below.

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290 Word stress is marked with an acute accent above the vowel.

291 See the Muskogean pitch accent languages Choctaw and Chickasaw. They undergo basically the same process of iambic lengthening that converts feet of the type LL into LH (e.g. Choctaw salitihatok > salitihatok ‘I was dirty’, okčališ > okčališ ‘I woke him up’). This yields via avoidance of contrast neutralization a possible overt contrast of vowels in stressed open syllables of two vs. three morae (Hayes 1995:211), i.e. long vs. overlong. Unerleyingly, the contrast is short vs. long.

292 I diverge from the notations by Whorf (1937, 1947) by employing IPA for the transcription.
Table 44. Ternary vowel duration in Hopi

<table>
<thead>
<tr>
<th>underlyingly short</th>
<th>underlyingly long</th>
</tr>
</thead>
<tbody>
<tr>
<td>[short V]</td>
<td>[half-long V]</td>
</tr>
<tr>
<td>pas 'very'</td>
<td>pas's 'field'</td>
</tr>
<tr>
<td>[long V]</td>
<td>pas 'calm'</td>
</tr>
</tbody>
</table>

This observation is essentially repeated in his 1946 article (Whorf 1946:159). The shortest length degree is here defined as being ‘clipped’, i.e. abruptly cut-off by a following consonant. The medial length is described as half-long without clipping, and the character of the long degree is not further specified. This syllable structure-related view is essentially what Trubetzkoy stated (1938:196) in his Silbenschnitt-korrelation (syllable cut) with regards to the overt ternary contrast of Hopi.

Figure 81. Syllable cut in Hopi

- (a) short V
- (b) half-long V

The production of the short V in (a) is abruptly cut off by the succeeding C, while the half-long V in (b) occupies the syllable nucleus alone and is therefore produced longer. The long vowels are then represented with a bimoraic V and an equally extrametrical C. We arrive at a two-fold binary opposition of ‘strongly cut’ (short Vs) vs. ‘weakly cut’ (half-long Vs and long Vs), and monomoraic vs. bimoraic.

The claim of a ternary vowel duration contrast is based on very scarce material and has never actually been validated, though. The vowel system contains the six qualities /i, e, ø, a, o, u/, of which the /ø/ is produced as a less rounded [ø] and the /u/ is phonetically rather [u]. The suggested Hopi contrast of short vs. half-long vs. long vowels only occurs in so called pausal forms, i.e. in items like the object noun phrases (occurring usually in utterance-medial position) that are dislocated and realized in utterance-final position (Jeanne 1978:63). A final vowel is deleted in these forms. This process yields lengthening of a preceding short vowel in a compensatory fashion, and is accompanied by a change to a falling pitch contour (Jeanne 1978:63f.). This finding essentially results in an alternative approach of the Hopi quantity system. It appears to be the case that originally long vowels and short vowels differ from the lengthened short vowels by means of their pitch contour. The transcriptions in Table 45 illustrate this point.

293 See the syllable-cut approaches (abrupt ≈ short V vs. smooth ≈ long V) for vowels in Germanic languages.
294 Anderson (1985:103). Note that Trubetzkoy (1938) does not explicitly provide structures.
295 Another possibility to (a) would of course be an ambisyllabic final C that occupies both the coda position of the first syllable and the onset position of a (possibly empty) second syllable.
Jeanne (1978:64) notes “tentatively that the [deleted final] vowel is present in underlying representation”, i.e. in Boersma’s (2007a) phonological surface representation. A possibility is here to assume – somewhat similar to Mayo – that the lengthened (half-long) vowel consists of two morae just like the original long vowel does. A clear difference would be, however, that the second mora stems from the deleted final vowel and is associated to a low tone L. The first mora is inherited from the original short status of the vowel and is associated to a high tone H. This creates then the described falling pitch contour HL on the lengthened vowels. Unfortunately, Jeanne makes no actual reference to the tonal contour of the originally long vowels. What is clear is that the pitch does not change in these cases and by this differs from the one of the lengthened vowels. It seems reasonable to assume that it is a single H, i.e. a level high tone.

The result is a binary surface representation of Hopi vowel length, i.e. short vs. long, the short category containing the short and the lengthened vowels; it is then combined with a binary tonal contrast of (supposed) HL vs. H.

We, thus, end up with two possible twofold binary approaches for Hopi vowel length; the first one being related to the syllable structure and the phenomenon of syllable cut, the second one depending on tonal contours. We do not obtain a phonologically ternary quantity system.

As an intermediate result, we can say at the moment that all but two of the indigenous American languages presented in this chapter are most likely to employ three distinct degrees of vowel duration (Pai, Seri, Seneca, Sarcee, Central Siberian Yupik, and Mixe). Mayo and Hopi were identified to show sound arguments for a binary representation of a (possible) ternary duration contrast.

The quantity systems of three of the languages, i.e. Wichita, Seneca, and Mixe, have been analyzed in the past as being binary by means of employing an invisible, inaudible, but phonologically present consonantal segment (Rood 1975; Chafe 1959; Hoogshagen 1959). While this might be justified diachronically and from a purely structuralist perspective, it seems not to be vindicated by the synchronic language data. The analyses are therefore not entirely convincing and do not exclude a three-way length distinction right away. What might be a viable option is to assume vowel sequencing as in Seri or Sarcee. So far, however, none of the investigated languages gives water-proof evidence against a surface phonological representation of ternary vowel length /VV/.

However, the overall available perception data with respect to the three durational degrees for each of the presented languages is rather scanty – if at all present. Further research is here definitely necessary in order to test the functional load of the vowel durations, and to smooth out all remaining analytical problems.
We will now see what (and if) other languages from across the world can add to the findings attained from the languages in the Americas.

7.2. African languages: Dinka

Our typological excursion leads us now from the Americas to Africa and the Western Nilotic language Dinka. This is a tone language spoken mainly in Southern Sudan, and more specifically along the tributaries of the White Nile. Several rather distinct dialects exist that differ by means of tones, vowel articulation, and possibly vowel quantity. What all of them have in common is that inflected stems are mainly monosyllabic. They differ from their uninflected, equally monosyllabic, counterparts by marking grammatical information in terms of segmental and/or prosodic alternations (Remijsen & Manyang 2009:113).

I focus here primarily on the dialect Luanyjang Dinka discussed in the studies by Remijsen & Gilley (2008) and Remijsen & Manyang (2009). This variety comprises a set of four tones (low, high, rising, falling), two voice qualities (breathy vs. modal/creaky), seven vowel qualities /i, e, a, ɔ, o, u/, and again a ternary vowel duration contrast short vs. long vs. overlong. An example of the contrast is given in Table 46.

Table 46. Ternary vowel duration in Dinka

<table>
<thead>
<tr>
<th>[short V]</th>
<th>[long V]</th>
<th>[overlong V]</th>
</tr>
</thead>
</table>

This length opposition developed due to CVCV CL of originally short vowels and originally long vowels after the loss of an inflectional suffix. In the course of events, short vowels of phonologically short stems became long, and long vowels of phonologically long stems became overlong (Kavitskaya 2002; Remijsen & Gilley 2008:322, based on Andersen 1987). The distribution of the so-called long grade of a long stem (resulting from CL) is restricted to morphologically complex or marked forms, e.g. plural forms. They differ from their morphologically simplex or unmarked counterparts, e.g. singular forms, by means of one to two length degrees. Overall, the alternations in vowel length given in Table 46 can be summarized in the following schema.

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296 The Bantu language Kikamba (Roberts-Kohno 1995, 2005) with its supposed quadruple vowel length contrast of short : half-long : long : very long is left out of the overview. The four durational degrees are (convincingly) analyzable as a phonological binary contrast of short : long.

297 Arbitrarily termed short : half-long : long by Remijsen & Gilley (2008). This notation appears to be phonetically more appropriate since the mean maximum vowel duration of the longest degree as taken from their complete data set only barely reaches 170 ms (Remijsen & Gilley 2008:332). By comparison, the mean vowel duration of Q3 in Estonian as reported by Lehiste (2003:30) amounts to 435 ms, and the vowel duration of ELD 3 in the investigated LG data (complete samples) as seen in chapter 3 averages out at 254.85 ms (Kw.), 298.22 ms (Aw. group 1), 395.57 ms (informant III.6.Aw), and 265.77 ms (Alfs.).
The grade alternation is in the majority of cases accompanied by a change in the tonal contour, as can be seen in the examples above. There is a limited number of words available that differ within a paradigm only by means of quantity. These cases indicate in particular that vowel quantity can act independently of other prosodic properties. In most cases, however, various combinations of the factors quantity, tone, vowel height, voice quality, differing coda Cs, and occurrence of a semivowel in onset position are employed (Remijsen & Gilley 2008:324).

Remijsen & Gilley (2008:335) point out that in terms of vowel quality the long grade of the short stem patterns together with both grades of the long stems. The two long vowel lengths, i.e. the long grade of the short stem and the short grade of the long stems, are close to being completely identical with respect to vowel duration and vowel quality. They cannot clearly be teased apart (Remijsen & Gilley 2008:338). The short grade of the short stems, i.e. short V, shows by comparison considerably centralized vowel qualities (except for /ɔ/). This is attributed to the short duration and the resulting “articulatory undershoot” (Remijsen & Gilley 2008:335). The lax quality is therefore not interpreted as phonological.

The mean durational differences within the Luanyjang vowel system as identified by Remijsen & Gilley (2008:339) are 31.89% for short vs. long, and 57.39% for long vs. overlong, if the long degree is taken as the basic value, i.e. the short degree reaches 68.11% of the duration of the long degree, and the overlong degree reaches 157.39% of the duration of the long degree. The authors note that “the differences in vowel duration that are involved in the Luanyjang Dinka phonemic length distinction should be distinguishable by the human auditory system—they are well above the JND range of 7-20 percent” (Remijsen & Gilley 2008:339). Note that the JND mentioned here refers not to natural speech sounds (see the conservative JND of 20 to 25% noted by Rosner & Pickering 1994:194) but rather to sounds in general, i.e. synthetic speech and non-speech stimuli as e.g. described in Lehiste (1970a:11ff.). A desiderate of Remijsen & Gilley’s analysis is that they do not provide a perception study to verify their assumption of perceptual relevance.

As an alternative to the three durational degrees, an approach of two durational degrees plus stress / no-stress was brought forward by Gilley (2003). However, her proposal is based on a phonetic absurdity: a stressed syllable receives only half the duration and a more centralized vowel than an unstressed syllable. This is contrary to current findings on the realization of stress (Gussenhoven 2004).
The conclusion drawn on the basis of their data is such that the three durational degrees of the Dinka vowel system represent an according ternary quantity contrast. The authors express this by means of morae. Short vowels have one mora, both versions of long vowels have two morae, and overlong vowels ultimately have three morae in the phonological surface representation. The vowel quality lax or tense does not (yet) play a part in the distinction. The ratio between stressed short and long vowels is on average 2:1 as noted by Lehiste (1970a:34) for languages with a binary vowel quantity system. Now, looking at the rather close-packed quantity space of Dinka, ratios of only 3:2 can be found (Remijsen & Gilley 2008:340). The durational range between the average of the lowest quantity degree and the highest quantity degree of a binary vs. a ternary system is, however, basically the same. The authors infer from this “that the phonetic space for vowel length distinctions is constant. As a result, any increase in categories on the continuum will lead to crowding of the phonetic space” (Remijsen & Gilley 2008:340). They conclude that the ternary quantity contrast is, as a matter of fact, the upper limit, defined and constrained by the phonetic space available for duration distinctions.299

We now have indeed one language with a three-way duration opposition that appears to require an analysis with a phonological ternary contrast of vowel quantity. What has not yet been sufficiently investigated for Dinka, though, is the influence of the coda C on the duration of the preceding vowel. It is generally assumed that Luanyjang Dinka comprises a voicing opposition in onset stops but not in codas.300 Remijsen & Gilley (2008:334) found that the duration of a coda stop is longer if succeeding a short V, shorter if succeeding a long V, and correspondingly shortest after an overlong V. This effect “cannot be explained in terms of the three-level vowel length hypothesis” as they note (Remijsen & Gilley 2008:341). A possible interpretation would here be that the language comprises some sort of isochrony with respect to syllable length. After all, the progressive decrease in duration might hint on a relevant contrast for the coda stops. Though of course highly speculative, one wonders whether there could be a fortis vs. lenis distinction that has its finger in the vowel quantity pie.301

7.3. Eurasian languages: Scottish Gaelic, Estonian, Franconia and German(?)

The languages discussed so far are on the rather poorly investigated end of the research scale. This is definitely not true for the now following Eurasian languages.

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299 What Remijsen & Gilley (2008) omit from their discussion is that the ‘phonetic space’ in e.g. Estonian is comparably broader. While Luanyjan Dinka shows a range of the mean vowel duration from about 72 ms (short V) to about 170 ms (overlong V), Estonian comprises a durational range from approximately 106 ms (Q1) to 435 ms (Q3) (Lehiste 2003:50). Crucial seems to be here that Luanyjang does not employ additional prosodic features to underpin the length distinction.

300 The phoneme inventory of Luanyjang Dinka lacks fricatives (Remijsen & Manyang 2009:114).

301 Kehrein (p.c.) notes that a possibility to check the influence of the coda stops on the vowel length differences would be to have a look at the vowel length differences in open syllables. If the contrast fails to apply in this context, the coda stops are likely to trigger the difference. Otherwise, the fortisness cannot be the source of the length contrast.
All of the given languages facilitate some sort of quantitative processes in connection to the loss of a final segment or syllable. We start this section with Scottish Gaelic, moving then to the most famous language when it comes to ternary length contrasts: Estonian. Standard German and the German and Dutch varieties of the Central Franconian dialect continuum finally conclude the overview.

7.3.1. Scottish Gaelic

Ternes (1989:102ff.) analyzes the Scottish Gaelic dialect of Applecross as having phonetically three distinct vowel quantities short, half-long, and long in monosyllables. He assumes that each of these three durations is phonological, assigning one, two and three morae, respectively. The synchronic contrast is illustrated by two (near) minimal triples in Table 47 (Ternes 1989:102).

Table 47. Ternary vowel duration in Scottish Gaelic, dialect of Applecross

<table>
<thead>
<tr>
<th>[short V]</th>
<th>[half-long V]</th>
<th>[long V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ṭín ‘we-stressed Pron.’</td>
<td>ṭín ‘venison’</td>
<td>ṭín ‘to sing’</td>
</tr>
<tr>
<td>tut ‘to go’</td>
<td>ṭúl ‘apple’</td>
<td>suţ ‘eye’</td>
</tr>
</tbody>
</table>

The short vowels originate diachronically from short vowels, and the long vowels stem from long vowels. Ternes (1989) notes, based on his auditory impression, that the duration of the long vowels corresponds to a half-long vowel plus a short vowel. Crucial is the half-long series. It is a merger of a hiatus of two short vowels $V_1$-$V_2$. Such mergers also occurred with a preceding long vowel and a short $V_2$ of the same quality, resulting in a long $V$. If the vowel quality differed, however, hiatus was maintained.

The threefold vowel length opposition is only present in monosyllables. As soon as monosyllabic words with a trimoraic long vowel are suffixed for example with the plural marker /-on/, the long vowel of the stem is ‘shortened’ to half-long, i.e. bimoraic (Ternes 1989:109f.).

Smith (2004) finds the ternary vowel length contrast rather dubious and seeks to reanalyze the syllable structure of Applecross Gaelic along the lines of Leurbost and Islay Gaelic. He comes to the conclusion that instead of the three distinctive vowel quantities rather a binary contrast combined with binary differences in syllable structure can be assumed. The insertion of a syllable boundary is what is needed. Smith arrives at the following (four-way) system of vowel quantity.

Figure 83. (a) $V$ short vowel
(b) $V$.V short vowel plus hiatus
(c) $V$: long vowel
(d) $V$:V long vowel plus hiatus

The ‘.’ indicates in (b) and (d) the syllable boundary. The splitting into $V$.V and $V$:V might indeed appear justifiable if we consider that these are the diachronic
hiatus cases. This is also vindicated by the (synchronic) intuitions of the speakers. The original hiatus words are basically perceived as bisyllabic. Along the lines of Smith (2004) it is therefore unnecessary to postulate phonologically trimoraic vowels for synchronic Applecross by relying on the historical syllable status.\footnote{See the syllable-based re-analysis of Roberts-Kohno (1995, 2005) for the supposed phonological quadruple vowel length contrast of short : half-long : long : very long to a phonologically binary contrast of short : long in the Bantu language Kikamba.}

7.3.2. Estonian

The probably most prominent and notorious representative of languages with an assumed ternary quantity distinction in the vowel system is the Uralic language Estonian.\footnote{Saami as a representative of a language with an overt ternary length contrast in the consonant system is here left out of the picture.} It has been the subject of a rather huge amount of linguistic studies over the years. The common ground established by now is that it has three overt degrees of vowel duration as well as consonant duration short : long : overlong.\footnote{The studies by Lehiste (1960, 1965, 1966, 1968, 1970a, 1970b, 1977, 1980, 1985, 1997, 1998, 2003) have contributed a major part to arriving at this point.} Examples for this contrast in the vowel system follow in Table 48.

Table 48. Ternary vowel length in Estonian

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>koti ‘to roam around-Imp!Sg.’</td>
<td>kooti ‘code-Gen.Sg.’</td>
<td>koozi ‘code-Part.Sg.’</td>
</tr>
<tr>
<td>sada ‘hundred-Nom.Sg.’</td>
<td>saada ‘send-2.Sg.Imp!’</td>
<td>saada ‘get-Inf.’</td>
</tr>
</tbody>
</table>

Lehiste (2003:49) notes accordingly that the “existence of three contrastive quantities is, however, a phonetic fact, regardless of how the phonetic data are interpreted.” The three duration degrees are commonly termed ‘Q1’ for short duration, ‘Q2’ for long duration, and ‘Q3’ for the extra-long or ‘overlong’ duration. These terms may refer to segments and syllables alike.\footnote{If a syllable contains only Q1 segment, it ‘is in Q1’; if a syllable contains only Q2 segments, or Q2 and Q1 segments, it ‘is in Q2’; finally, if a syllable contains a Q3 segments, it automatically ‘is in Q3’ (Lehiste 2003:49f.).}

It has been shown that the vowel duration itself is not the primarily distinguishing factor between Q<3 (i.e. Q1 and Q2) and Q3 vowels, but rather the duration ratio within a sequence of two syllables and the according F0 contours (Eek 1980; Lehiste 1997, 2003; Lippus et al. 2007). Lehiste (2003:62) finds that the “phonetic correlates of overlength are not completely stable”. The length contrast is aided by additional auditory properties. Besides the durational ratio between two syllables, there exists a meaningful correlation between syllable quantity and the respective pitch contour. Where Q1 and Q2 of Estonian bisyllables have a fall in the F0 contour between the end of the first and the beginning of the second syllable, Q3 shows a rather early fall already within the first syllable and a low level-falling pitch in a succeeding syllable. The F0 differences between Q<3 and Q3 in single syllables are insufficient to distinguish between the respective length degrees, though.
Perceptual studies demonstrate that the pitch movement — just like the durational ratio — is significant only in sequences containing more than one syllable. Then it becomes an important cue for the discrimination between Q1 and Q2 on the one hand, and Q3 on the other hand (Lehiste 2003:53, 61; Lippus et al. 2007:1051f.). Lehiste suggests that the presence of a pitch contour is “a necessary condition for the perception of the [three way length] difference, and that durational patterns alone do not provide a sufficient amount of information” (Lehiste 2003:62). The two degrees of short and long are distinguishable by means of duration alone.

Diachronically, the intricate vowel duration system came about due to the loss of an unstressed short vowel of an open syllable. Q3 is the result of this process that is usually assumed to be a form of CL (Lehiste 2003:48). Synchronic Q3 still behaves bisyllabic in the sense that it exhausts the foot and displays a condensed version of the bisyllabic pitch contour of Q<3 syllables (Lehiste 2003:64). Kehrein (p.c.) notes that the difference in pitch contours between Q3 and Q<3 could be seen as a direct result of foot structure. We could therefore say that it is duration and pitch that provide cues to perceive a contrast in foot structure.

It is especially the bisyllabic behavior of Q3 that has inspired the various phonological analyses. There are mainly two possible approaches for a phonological analysis of the phonetic facts that have been proposed over the years.

(a) The ternary durational opposition of the system is explained by means of the metrical stress system. The defining characteristic of (phonetic) Q3 is its ability to occupy a whole foot, while Q<3 cannot do so (Prince 1980; Elenbaas / Kager 1999).

(b) Alternatively, a binary quantity contrast with additional prosodic features on the syllable level or the foot level is supposed, avoiding a trimoraic and quadrimoraic syllable by assuming special structural configurations such as a degenerate syllable, a free mora or mora-sharing (e.g. Bye 1997; Eck & Meister 1997).

XXXV) A third approach was brought forward by Ehala (2003) on the basis of his Q3-shortening hypothesis. It is basically a combination of the two approaches: instead of the binary quantity contrast, a binary syllable weight contrast of light vs. heavy is proposed, where all Q<3 syllables invariably count as light while Q3 are heavy. In a fourth approach, Pöchtrager (2006) argues within the framework of Government Phonology that Q3 cannot be a property of the syllable, simply because there are no syllables and feet at all. He reinterprets the sequence of alleged Q3-vowel and Q3-consonant in e.g. [koottii] ‘flail-Part.Sg.’ as Q2-Q2, referring to the duration measurements that corroborate his theory (see also Ojamaa 1976) and to the fact that [koottii]-forms are always morphologically complex. He concludes that
Let us have a brief look at the approach in (a). Prince (1980) states that a Q3 syllable alone exhausts the metrical foot by having at the same time a strong (s) and a weak (w) constituent. This is not true for either Q1 or Q2 syllables. They need a Q1 or Q2 syllable to follow within the same foot. The result is a contrast between monosyllabic feet and bisyllabic feet. This distribution is depicted in Figure 84.

Figure 84. Estonian metrical feet

Monosyllables comprise at least one Q3 segment in order to satisfy the foot requirements. The effect is that a ternary quantity opposition in monosyllabic words is impossible. Only Q1 and Q3 segments may occur in this domain-final position. Perception studies confirm this restriction. The Estonian subjects tested were not able to distinguish between Q2 and Q3 segments on the basis of a monosyllable. Q1 was, however, easily identified (Ehala 2003:52, drawing on data from Eek & Meister 1997). Phonologically, a trimoraic representation is not necessary by means of the metrical approach because the length distinction is realized at the foot level and not the syllable level. A binary representation is sufficient to express the difference.

7.3.3. Low and Central Franconian

Let us now turn to the local German and Dutch varieties of the Rhineland region. Here, we do find some peculiar durational and F0 patterns that where up until the early 1980s interpreted as quantity phenomena by some researchers (e.g. Hardt 1843, Laven 1858, Baldes 1895, Menzerath 1928/1929, Dittmaier 1934, Ternes 1981).

This dialect area extends roughly from the northern Saarland in the south to just north of Krefeld and Venlo in the north, and from the Westerwald in the east to the Romance language border in the west, including also the eastern border region of Belgium and the provinces of Limburg in the Netherlands and Belgium. The map in Figure 85 outlines the respective area.

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309 Bye (1997:78) rather assumes that the third mora of a Q3-syllable may be either freestanding [σ₀₁µ] or parsed into another syllable [σ₀₂µ₁σ₂].

310 Note that clitics such as ma ‘I-Pers.Pron’ and sa ‘you-Pers.Pron.’ are exceptions to this (otherwise obligatory) foot pattern. According to Pöchtrager (2006:155) they do “not qualify as domains of their own”, though.

311 Note that the dialects of Luxembourg lost the tonal accents in the past (Gilles 1999, 2002; Wiesinger 1970). They are therefore excluded from the map.
Franconian is certainly one of the most extensively studied German varieties, the earliest linguistic approaches dating back to Neogrammarian time. The area can be generally divided into four subareas:

i) Rule A, constituting the main part of the continuum,

ii) Rule A2, an area running along the northern border of the tone accent territory, including most of Limburgs and ending slightly south of Remscheid,

iii) Rule AB, being located in the Hunsrück region, and

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312 Adapted from Schmidt & Künzel (2006:139).
313 For an extensive overview on the German research history from the beginning until 1986 see Schmidt (1986:50ff.).
iv) Rule B, extending over the Westerwald region at the eastern border of the tone accent area.

All of the dialects are characterized by the presence of an apparent three-way vowel duration contrast of short vs. long vs. overlong.

Table 49. Ternary length in Central Franconian

<table>
<thead>
<tr>
<th>[short V]</th>
<th>[long V]</th>
<th>[overlong V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>klat ‘smooth’</td>
<td>klat ‘to endue-3.Sg.Pres.’</td>
<td>klaat ‘dress-Sg.’</td>
</tr>
</tbody>
</table>

This contrast goes along with tonal differences between short vowels and long vowels or VR sequences on the one hand, and overlong vowels or VR sequences on the other hand. While short vowels can bear only tone accent 1 (TA1), long vowels and VR sequences are able to carry either TA1 or tone accent 2 (TA2). The overlong vowels receive invariably tone accent 2 (TA2). The respective prototypical pitch contours occurring in phrase-final position are as follows.

Table 50. Prototypical declarative contours of TA1 and TA2 in monosyllables

The contours may vary in dependence on intonational boundary tones present in the declarative, continuant, or interrogative sentence context. Extended duration, i.e. the phonetic overlength (Schmidt 2002:204; Gussenhoven & Aarts 1999), is attributed to a more complex F0 movement in TA2. Overall, the prototypical declarative contours of the two tonal accents as produced in monosyllables in phrase final position are a rather steep fall for TA1 as compared to a falling-rising-falling pitch in TA2.

A prerequisite for the occurrence of a tonal accent contrast is in any case a long nucleus consisting either of a bimoraic vowel (V1), a diphthong (V1V2), or a short vowel succeeded by a sonorant consonant (VR). Two examples of the contrast are given below.

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314 City dialect of Trier (Ternes 1980:382; Werth 2011:124).
316 The tonal accents are transcribed with superscript 1 and 2 respectively. I employ here the conventions of the IPA, marking the tone accent at the beginning of the syllable that is actually carrying it.
Table 51. Rule A minimal pairs

<table>
<thead>
<tr>
<th>TA1</th>
<th>TA2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) [dœuf] ‘pigeon-Nom.Sg.’</td>
<td>[dœuf] ‘baptism-Nom.Sg.’</td>
</tr>
<tr>
<td>(b) [ˈhaʊs] ‘house-Dat.Sg.’</td>
<td>[ˈhaʊs] ‘house-Nom.Sg.’</td>
</tr>
</tbody>
</table>

Despite the experimental phonetic studies carried out by Heike (1962, 1964) and Jongen (1967, 1969ab, 1972ab) it was until the early 1980s believed by some researchers that the primary characteristic of these dialects is the ternary split in vowel duration of short vs. long vs. overlong. The occurring pitch movements, prominence and intensity phenomena were accordingly assumed to be accompanying phonetic properties. This quantitative view was convincingly invalidated with the release of Hermans’ M.A. thesis (1982) and Schmidt’s (1986) seminal dissertation on the Central Franconian tone accents. The primarily distinguishing features have been established to be the two tonal accents since then, i.e. TA1 and TA2. Current phonological approaches treat these tone accents in a privative fashion. The lexical tone is TA2, which contrasts with ‘nothing’, i.e. TA1. No ternary length contrast is needed.

There are basically two diachronic sources of TA1 in Rule A. Firstly, the Middle High German (MHG) long open and mid Vs and diphthongs and their umlaut products receive TA1 automatically. This assignment is usually referred to as spontaneous. Secondly, the MHG long closed Vs and diphthongs, their umlaut products, long Vs of Open Syllable Lengthening (OSL), and VR also receive TA1 in Rule A – if a sequence of voiced C and retained or apocopated schwa succeeds them. This assignment is referred to as combinatorial. All remaining cases with long nucleus obtain TA2 in Rule A. While spontaneous TA1 is identically distributed in Rule A2 as compared to Rule A, the distribution of the combinatorial TA1 shows a significant difference between the two areas. In Rule A2, the long closed Vs, closing diphthongs and OSL lengthened Vs receive combinatorial TA1 only if a voiced C and apocopated schwa follows. If the schwa is maintained, we find TA2 (de Vaan 1999:26; Köhnlein 2011:220ff.).

That an account incorporating the tonal characteristics (see Kehrein’s (2008; 2009) mora accents, Köhnleins’s (2011) tone accents, Werth’s (2010) tones) is likely

317 Dialect of Mayen (Schmidt 1986).
318 For phonetic approaches see among others e.g. Hardt (1843), Diedrichs (1886), Frings (1913), Graß (1920), Menzerath (1928/1929), Palgen (1931), Bruch (1954); a three-way contrast as a phonological notion is introduced by Ternes (1981).
319 An exception is Chapman (1993:137) who still assumes a ternary quantity contrast, referring back to Ternes (1981). She is quite obviously not familiar with Schmidt’s (1986) work.
320 Various terms have been employed in the literature to denote both prosodemes, occasionally confusing the two. They are basically as follows: TA1 = acute, circumflex(!), correetion, Kürzungsauskent ‘shortening accent’, Doppelton ‘double tone’, eingipflig ‘single peaked’, Staaton or Stoottoon ‘pushing tone’, stark or scharf geschnitten ‘strongly or sharply cut’, Schärfung ‘sharpening’; TA2 = circumflex, grave, extension, overlong, zweigipflig ‘double peaked’, Schweifbaut ‘leviating sound’, Schleifton or sleeptoone ‘dragging tone’, Dehinton ‘drawing tone’, Trägheitsakzent ‘sluggish accent’, schwach or sanft geschnitten ‘weakly or smoothly cut’ (de Vaan 1999:25 FN4; Schmidt 2002:202).
to be preferable above the quantitative one becomes evident if we constrain our view to the development of vowel length only. Instead of a diachronic lengthening process in connection to schwa deletion and a succeeding voiced obstruent like in LG, we find shortening in deleted cases and no change in items without schwa deletion in the dialects of the Rule A2 area. This Low Franconian process appears as particularly counterintuitive, especially since the shortening would be conditioned by the presence of a voiced word-final obstruent (and the loss of schwa). Usually, it is exactly these sounds and these contexts that yield lengthening processes in preceding vowels (Kohler 2001:397). The tonal account does not suffer from this problem and may indeed be able to explain the shortening. I provide here one possible diachronic explanation. Its basis is that the Middle Limburgian (MLb) final schwa of a bi-syllable holds a low tone L, while the bi-moraic head-syllable $\sigma_1$ has a high tone H. Deleting the schwa does not do away with the mora and the L of $\sigma_2$. It seeks to remain incorporated in the PrWd and associates to a preceding voiced C, which links as a coda to $\sigma_1$. We attain a TA1 contour of H*L in the monosyllable. The weak mora of $\sigma_1$ is deleted in favor of the strong mora of the second syllable. A binary configuration in adherence to MaxBin is preferred above a ternary one. This tonal based change is illustrated below by means of MLb ouge ‘eye-Sg.’ in the city dialect of Sittard.

Figure 86. Diachronic tone of Sittard (Rule A2)

\[
\begin{array}{c}
\text{MLb} \\
\begin{array}{c}
\sigma_1 \\
\mu
\end{array} \\
\begin{array}{c}
\sigma_2 \\
\mu
\end{array} \\
\begin{array}{c}
CV V, C \\
ouge
\end{array} \\
\begin{array}{c}
\mu \\
\mu
\end{array} \\
L \% \\
\end{array} > \\
\begin{array}{c}
\sigma \\
\mu
\end{array} \\
\begin{array}{c}
CV V, C \\
ouge
\end{array} \\
\begin{array}{c}
\mu \\
\mu
\end{array} \\
H \% L \%
\]

\[
\begin{array}{c}
\text{Sittard} \\
\begin{array}{c}
\sigma \\
\mu
\end{array} \\
\begin{array}{c}
CV C \\
ouge
\end{array} \\
\begin{array}{c}
\mu \\
\mu
\end{array} \\
H \% L \%
\end{array} > \\
\begin{array}{c}
\sigma \\
\mu
\end{array} \\
\begin{array}{c}
CV C \\
'eye-Sg.' (TA1)
\end{array} \\
\begin{array}{c}
\mu \\
\mu
\end{array} \\
H \% L
\]

The resulting mono-syllable contains one mora on the V and one mora on the coda C. The tonal development of TA1 therefore effectively results in the shortening of the originally long vowel of the nucleus. Looking at the TA2 items, voiceless Cs as compared to voiced Cs are inherently unable to bear the L of the schwa-syllable. The prosodic content of the $\sigma_2$ cannot associate and is therefore deleted along with the final schwa. The vowel of the $\sigma_1$ remains long with a tonal contour of H*H for TA2. We find an almost completely opposite system to LG with shortened Vs in connection to apocope and a preceding voiced C.

Interestingly, Rule B also seems to turn the lexical distribution we find in Rule A upside down. The cases in Table 51 (a) receive TA2 and overlength for ‘pigeon-Nom.Sg.’ and TA1 and normal length for ‘baptism-Nom.Sg.’, the cases in (b) accordingly receive TA2 and overlength for ‘house-Dat.Sg.’ and TA1 and normal


\[322\] Hanssen (2005).

\[323\] See Boersma (2007b).
length for 'house-Nom.Sg.'  

Another intriguing detail is that a part of the TA2-items of Rule B with their elongated pitch contours occur basically in the same environment where we find phonetic overlength in LG – i.e. after schwa-loss in post-lenis position. Besides other factors, schwa loss was also accompanied by the lengthening of a preceding nucleus in Rule B. Schmidt (2002:219, 229f.) relates these similarities between LG and Rule B to a diachronic pre-tonemic language stage that was valid for both areas, and in fact even for the whole of the North and West Germanic languages including also parts of the Balto-Slavic region. He states that allophonic durational differences that were accompanied by some minor tonal features were characteristic of this period. The synchronic prosodic phenomena ultimately developed from these due to macroprosodic changes in syllable structure, i.e. apocope (West Germanic languages) or morphophonological integration of the final syllable, i.e. clitics, into the PrWd (North Germanic languages).  

The former process yields the two differing patterns of tone accents in Low and Central Franconian (Rule A(2) vs. Rule B), and a quantity contrast in LG.

7.3.4. Standard High German

A language that is also being cited in connection with overlength is Standard High German (McRobbie-Utasi 2007). The assumption of overlong vowels for this supraregional language system is rather far-fetched and cannot be upheld, as has been shown already several years ago in experimental phonetic studies (Hanhardt et al. 1965; Wodarz 1979).  

The phenomenon of overlong vowels is attributed to compensatory lengthening processes. Long main stressed vowels of open syllables are assumed to lengthen to overlong after apocope or syncope of a succeeding vowel (Wodarz 1979:29). The resulting contrast in the vowel system might be interpreted as three length degrees if leaving aside the qualitative differences (tense vs. lax). Examples are given below von Essen 1957:241; Hanhardt et al. 1965:214; Pilch 1966:258).

Table 52. Ternary vowel duration in Standard German?

<table>
<thead>
<tr>
<th></th>
<th>[short lax V]</th>
<th>[long tense V]</th>
<th>[overlong tense V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>List</td>
<td>'cunning-Sg.'</td>
<td>ließt</td>
<td>'to read-3.Sg.Pres.'</td>
</tr>
<tr>
<td>Büte</td>
<td>'vat-Sg.'</td>
<td>Blüte</td>
<td>'to bloom-3.Sg.Pret.'</td>
</tr>
<tr>
<td>satt</td>
<td>'full'</td>
<td>Saa't</td>
<td>'to see-2.Pl.Pret.'</td>
</tr>
</tbody>
</table>

Wodarz (1979:28) summarizes earlier research findings that state an according vowel length contrast of [i] ≠ [ii], [y] ≠ [ii], [r] ≠ [rr], [u] ≠ [uu], [e] ≠ [ee], [ae] ≠ [aæ], and [a] ≠ [aa] for Standard German. The vowels [e]  

324 The perception and production of the ‘reversed’ tonal accents of Rule B, and possible phonological analyses thereof in synchronic and diachronic perspective, are currently investigated in the two rather different dissertations by Werth (2010) and Köhnlein (2011).

325 For alternative diachronic approaches see Gussenhoven (2000), Boersma (2006), or Kortlandt (2007).

326 Also, the Upper Saxon dialect of the city of Leipzig is referred to as showing overlong vowels (Zimmermann 1998).
and [ø] do not exhibit the postulated ternary length-distinction. Wodarz (1979:283ff.) finds that in fact neither the measurements of vowel duration, nor the structure of the formant frequencies, nor the structure of the F0 points to a phenomenon of overlength in Standard German. Similarly, Hanhardt et al. (1965:216f.) state that

“there is no systematic pattern of any kind in the hypothesized contrast between long and overlong in German vowels. One is as likely to find greater length in the vowel of the allegedly long member of the pair as in that of the overlong”.

Crucially, earlier auditory and experimental phonetic observations of overlong vowels in Standard German (e.g. Martens & Martens 1965; Mueller 1956; von Essen 1957; Pilch 1966; etc.) are falsified for every possible direct phonetic correlate.

Even stronger, Wodarz (1979:284f.) states that also speakers of the northern German dialect continuum show no general tendencies that point towards a ternary length distinction. He had, however, only one single informant coming from the relevant region (i.e. Ahrensburg near the city of Hamburg). A different study carried out by Kohler and Tödter (1984) verified by comparison a transfer of durational contrasts of LG to the standard language for speakers of LG varieties of Schleswig-Holstein. What we can conclude is basically that there is no such thing as overlength in nation wide Standard German. Different languages (Low German) or local dialects (Rhineland area) might influence the regional varieties, though. This is not only reflected in the production but also in the perception of Standard German vowels.

Weiss (1976:159f.) found in his perception study on Standard German vowel quality and duration that out of his group of seven originally northern German informants five speakers relied mainly on qualitative differences between lax and tense vowels, and not on vowel duration (be it short, long or overlong). Interestingly, all of these informants where raised in the region of Hamburg and therefore in an allegedly LG context. The other two informants of the group stemmed from southern Niedersachsen, i.e. an Eastphalian speaking area. They relied in their judgments primarily on vowel duration short vs. long. The additional 13 subjects that participated in Weiss’ test exhibited a split pattern. The two informants coming from the city of Berlin basically resembled the test results of the Hamburg speakers. Their choices where clearly determined by the vowel quality. The subjects that where raised in southern and/or eastern German areas patterned together with the southern Niedersachsen informants. Their choices unequivocally relied on duration as the crucial phonetic cue in vowel discrimination (Weiss 1976:160).

The most straightforward conclusion to be drawn is that perceptual cues needed in LG are transferred to the standard language in northern Germany. Those cues are likely not to be as important in the rest of the German language area (except for maybe Berlin). The question now is, what kind of linguistic characteristic could it be that induces a qualitative distinction lax vs. tense rather than a quantitative one short vs. long in northern Germany? I will come back to that in only a moment in the discussion of the LG vowel system.
The overall result for the Standard German vowel system is that we have a binary opposition in either qualitative terms (lax vs. tense), or quantitative terms (short vs. long).³²⁷ A ternary length contrast is not detectable. Weiss (1976:218) concludes that “one cannot generally say duration is a more important perceptual criterion than vowel quality and vice versa.” Furthermore,

“clear-cut parameters cannot be stated with any degree of validity, since the significance of duration and quality varies not only from person to person, depending on production and dialect, but also varies according to the vowels themselves.” (Weiss 1976:223)

The matter is still far from being settled, both positions, quantity vs. quality, having their advocates.³²⁸ Be that as it may, the contrast present in the Standard German vowel system can be assumed to be binary; either qualitatively, or quantitatively. The postulate of a ternary contrast of vowel length is out of the picture.

### 7.4. A typological conclusion

The discussion showed that one language that had been assumed in the literature to comprise a ternary length contrast yields no convincing evidence for a third degree of vowel duration at all (i.e. Standard High German). The phonetic studies of this language do not deliver conclusive evidence for a phonologically ternary length contrast. Ternarity – overt as well as phonological – may therefore be assumed to be out of the picture in this case. A second language for which such a contrast is rather questionable is Yavapai, the opposition being restricted to the closed vowel /i/ only. Although the confined occurrence of the distinction is a rather unusual asymmetry in the vowel system, there is up to now no way of generally excluding a ternary contrast for Yavapai.

For the remaining twelve languages (plus LG), a number of phonological tools have been employed in order to account for the three-fold durational contrasts in the overt forms, some of them being based upon additional prosodic features corroborating the duration contrast. I give a summary in form of a small catalogue in Table 53.

We see that a ternary length contrast is assumed at the phonological surface level for several languages in addition to Yavapai. Except for Dinka, where a true ternary quantity contrast is found, length has been reanalyzed by means of a variety of phonological tools: morphological structure, pitch peak alignment, phonological Cs standing in between the overt V:V sequences, a phonological V:V sequence (bi-segmental rather than mono-segmental), metrical processes applying to the phonological surface (Iambic Lengthening), syllable cut, tonal or tone accent

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³²⁷ Weiss (1976:13, FN11) acknowledges the possibility of phonetically overlong vowels in Standard German in cases of compensatory lengthening. However, he specifically notes that only two degrees of length, i.e. short vs. long, are in fact distinctive.

³²⁸ The so-called syllable-cut theory is noteworthy in this context. It relates the vowel qualities lax and tense prosodically to the presence or absence of a coda C. Only long, i.e. tense, vowels may occur in the nucleus of open syllables while lax vowels are confined to closed syllables (Trubetzkoy 1938; Auer et al. 2002).
differences, compensatory processes due to C deletion, a combination of quality and quantity, syllable structure, and foot structure.

Table 53. The phonological toolbox for overt ternarity

<table>
<thead>
<tr>
<th>Language</th>
<th>Phonological tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seri</td>
<td>Juxtaposition of morphemes containing identical vowel qualities yields extra-long vowels: $V_1V_1 &gt; VV$;</td>
</tr>
<tr>
<td>Mayo</td>
<td>Lengthening of CV in final position in a PrWd results in an intermediate, half-long V duration. A phonological contrast derived long vs. underived long (i.e. underlyingly mono- vs. bimoraic) is maintained by means of differences in pitch peak alignment. Three possible tools are employed: 1. Stress autosegments, 2. Lexical and post-lexical stress assignment, 3. Monosegmental vs. bisegmental surface representation.</td>
</tr>
<tr>
<td>Mixe</td>
<td>The phonetically overlong $[VV:]$ derives from a phonological surface form /Vh/.</td>
</tr>
<tr>
<td>Wichita</td>
<td>1. Overlong vowels are mergers of long V and short V of bisyllabic V:CV sequences that deleted the intervocalic C synchronically. The contrast occurs in the overt form. 2. Ternary length contrast of V vs. V: vs. V:V in the phonology.</td>
</tr>
<tr>
<td>Seneca</td>
<td>Diachronic deletion of intervocalic *h and *r result in the merger of the two remaining vowels to V:V that contrast at the phonological surface level with V and V:.</td>
</tr>
<tr>
<td>Sarcee</td>
<td>The overlong vowels stretch across morpheme boundaries and may be represented as $V_1V_1 &lt; V_1V_1$ or $V_1V_1 &lt; V_1V_1$V_1 in the phonological surface form.</td>
</tr>
<tr>
<td>Central Siberian Yupik (+Choctaw, Chickasaw)</td>
<td>The metrical process of Iambic Lengthening of LL &gt; L.H in conjunction with the avoidance of contrast neutralization produces the overt opposition of short vs. long vs. overlong vowels.</td>
</tr>
<tr>
<td>Hopi</td>
<td>1. The syllable structure and the phenomenon of syllable cut determines a binary contrast and a distinction between short Vs and half-long Vs. 2. Tonal contours distinguish between the half-long (HL) and the long (H) length degree.</td>
</tr>
<tr>
<td>Dinka</td>
<td>A ternary vowel length contrast in the phonological surface form: V vs. V: vs. VV:;</td>
</tr>
<tr>
<td>Scottish Gaelic</td>
<td>The (perceptually verified) reanalysis of the syllable structure yields a phonological four-way contrast with monosyllabic short V, monosyllabic long V, a heterosyllabic sequence of two short V (hiatus), and a heterosyllabic sequence of long V: and short V (hiatus).</td>
</tr>
<tr>
<td>Language</td>
<td>Phonological tools</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Estonian</td>
<td>Vowel length depends on foot structure. An overlong Q3 vowel behaves bisyllabic in exhausting the foot. Phonologically, no ternary contrast exists since the Q3 can be analyzed as binary by means of e.g. a degenerate syllable, a free mora or mora-sharing.</td>
</tr>
<tr>
<td>Low and Central Franconian</td>
<td>The threefold length contrast in the overt form is dependent on two distinctive tonal accents, one being phonetically longer than the other.</td>
</tr>
<tr>
<td>North Low Saxon</td>
<td>The overt three-way duration contrast is traced back to a binary length contrast at the surface level combined with a binary quality contrast.</td>
</tr>
</tbody>
</table>

Although the main goal of phonology is to be restrictive in order to give a meaningful explanation of facts, we see here that we can indeed be restrictive in about eleven different ways. Yet, only five out of the thirteen approaches presented in this study (i.e. the phonetically grounded accounts for Mayo, Hopi, Scottish Gaelic, Low and Central Franconian, and North Low Saxon) provide so far a solid analytical alternative to the ternary length contrast at the phonological surface level in the respective languages.

For the remaining languages we can say with Sherlock Holmes: when you have eliminated the impossible, whatever remains, however improbable, must be the truth. Surface ternarity, though rather rare cross-linguistically, is for now in some languages a necessary means to account for the overt ternary duration contrasts. This is true for those languages that show up to now no verifyable evidence for a phonological tool other than length. Further research is here clearly required and may reveal quite different phonetic data and phonological analyses. One thing that the typology indicates already at this point is that there are certain limitations to phonological contrasts, constraining the length oppositions to a maximum of three degrees.

The phonetically based approach of Remijsen & Gilley (2008) provides another answer as to why phonological ternary systems are rare. They assume an upper boundary for the available duration of segments. Within this limited scale and with reference to auditorily recognizable contrasts, a language may establish its length oppositions. In order to make a contrast most salient, fewer length categories (preferably two) have to be arranged on the scale. Accommodating three length categories then results in a rather crowded durational space. The individual categories are perceptually not as distinct as in the case of a binary length contrast. This can be taken as the main reason to either phonetically enhance the contrast (e.g. by means of differing pitch contours in Estonian), or introduce a distinctive opposition of another prosodic feature (e.g. in Mayo, Sarcee, Central Franconian, North Low Saxon).