The Phonological Basis of Linguistic Rhythm

Cross-linguistic Data and Diachronic Interpretation

Introduction

Linguistic Rhythm as Isochrony
(Pike 1945, Abercrombie 1967, Bloch 1950)

(1) *Which is the train to Crewe, please?* (English)

(2) *C'est absolument ridicule*. (French)

(3) *o-mu-u* 'thinks' (Japanese)

- Stress-timing = interstress intervals are equal in duration (irrespective of the number of syllable)
- Syllable-timing = syllables are equal in duration (irrespective of stress placement)
- Mora-timing = morae are equal in duration (irrespective of 'syllable' structure and accent placement)

Introduction

Deconstructing Isochrony
(Roach 1982)

- With respect to syllable duration, so-called ‘syllable-timed’ languages are considerably heterogeneous.
- With respect to inter-stress durations, so-called ‘stress-timed’ languages do not form a class (cf. Dauer 1983).
- For ‘mora-timed’ languages, morae show considerable variation with respect to duration (Beckman 1982).
- On the other hand, experimental evidence underpins the psycholinguistic reality of rhythm classes (Lehiste 1977; Cutler & Mehler 1993)

Introduction

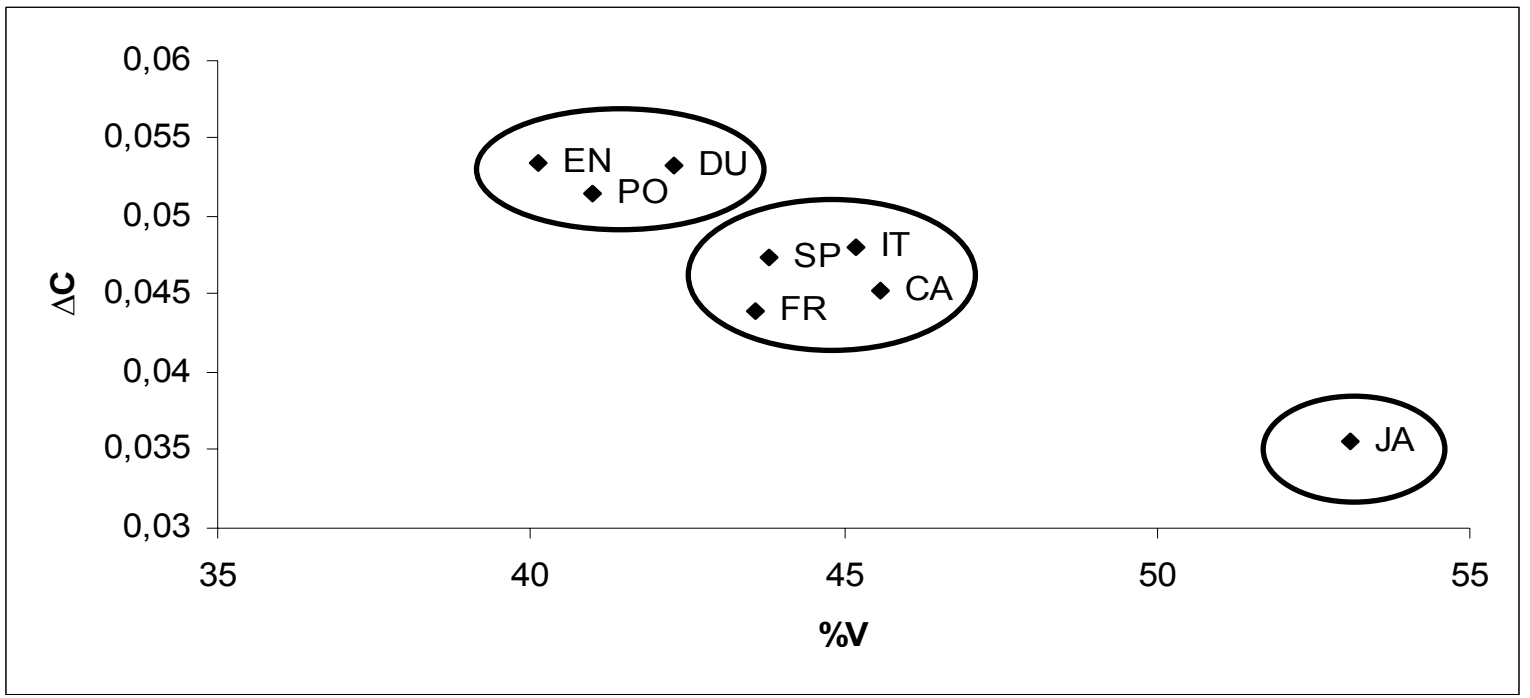
Recent Approaches to Linguistic Rhythm
(Ramus, Nespor & Mehler 1999)

- Languages of different rhythm types show different proportions of vocalic and consonantal intervals:
  - %V: the proportion of vocalic intervals within a sentence
  - ΔV: the standard deviation of the duration of vocalic intervals within a sentence
  - ΔC: the standard deviation of the duration of consonantal intervals within a sentence

Introduction

Recent Approaches to Linguistic Rhythm

(Ramus, Nespor & Mehler 1999)



Introduction

The Phonological Basis of Linguistic Rhythm

(Bertinetto 1977, Roach 1982, Dauer 1983, Auer 1993, 2001, Dufter 2003)

	Mora-based	Syllable-based	Stress-based
Stress correlates	pitch		pitch, duration, intensity
Stress effect	none		vowel reduction, vowel lengthening, consonant changes
Stress placement	predictable, fixed		unpredictable, free
Length	yes	possible in all syllables	not in unstressed syllables
Tone	possible		no
Syllable structure	simple		complex
Syllable division	unambiguous		ambiguous
Assimilation	few		frequent
Cluster resolution	yes		no
Vowel harmony	possible		no

Cross-linguistic Data

Language Sample

Amele (aey) (Trans-New Guinea, Papua New Guinea)

Basque (eus) (Isolate, Spain, France)

Cahuilla (nai) (Uto-Aztecan, Southern California)

Catalan (cat) (Indo-European, Spain, France, Sardinia)

Chukchi (ckt) (Chukotko-Kamchatkan, Northeastern Siberia)

Finnish (fin) (Uralic, Finland)

Georgian (kat) (Kartvelian, Georgia, Iran, Turkey)

Kayardild (gyd) (Australian, Australia)

Koyra Chiini (ssa) (Nilo-Saharan, Mali, Timbuktu)

Maltese (mlt) (Afro-Asiatic, Malta)

Cross-linguistic Data

Language Sample

Mandarin Chinese (chi) (Sino-Tibetan, China)

Maori (mao) (Austronesian, New Zealand)

Nigerian Pidgin (pcm) (English-based Creole, Nigeria)

Slave (den) (Na-Dene, Canada)

Tamil (tak) (Dravidian, India)

Tariana (tae) (Arawakan, Brazil, Colombia)

Udihe (ude) (Altaic, Eastern Siberia)

West Greenlandic (kal) (Eskimo-Aleut, Greenland)

!Xóõ (nmn) (Khoisan, Botswana, Namibia)

Yoruba (you) (Niger-Kongo, Nigeria)

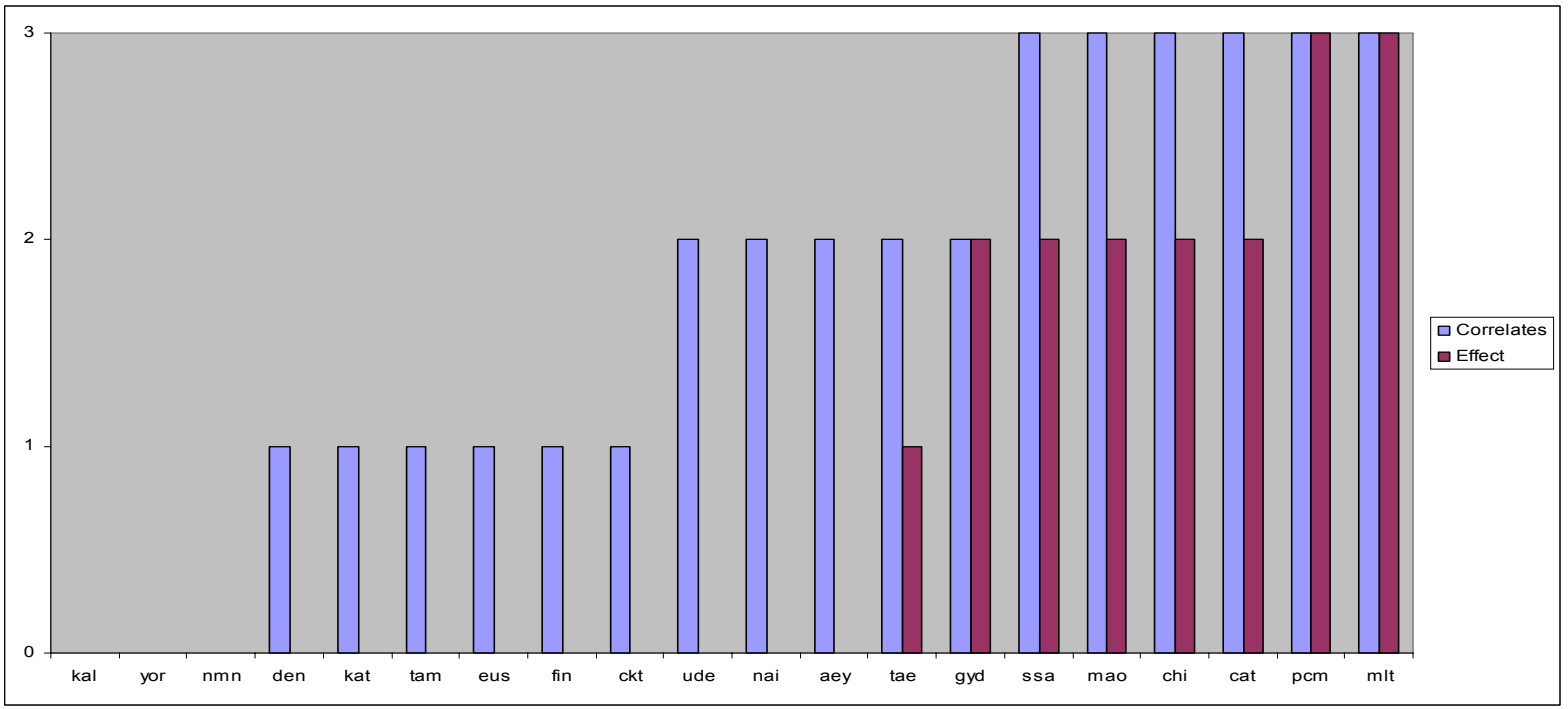
Cross-linguistic Data

Stress-related Parameters: Stress cline

- "[S]egmental effects of stress are the result of the development of duration and magnitude of gesture as correlates of stress" (Bybee et al. 1998)
- "Accent has to be realized very distinctively in stress-timing languages, i.e. there must be a phonetically strong emphasis" (Auer 1993: 9)
- Phonetic correlates of stress: pitch, intensity, duration
  (0 = no stress, 1 = one of the above, 2 = two of the above, 3 = all three)
- Segmental effects of stress: vowel reduction, vowel lengthening, consonant changes
  (0 = none, 1 = one of the above, 2 = two of the above, 3 = all three)

Cross-linguistic Data

Stress-related Parameters: Stress cline



Cross-linguistic Data

Stress-related Parameters: Stress cline

- The prediction of a correlation between the phonetic strength of stress and segmental effects of stress is borne out:
  - The stronger stress is realized phonetically, the more segmental effects of stress are to be expected
- However, the differences across the languages of the sample seem to be gradual rather than discrete. The data thus do not suggest two or three distinct types.
- The generalization is best formulated in terms of a *stress cline* ranging from weak to strong stress, with a concomitant increase of segmental effect

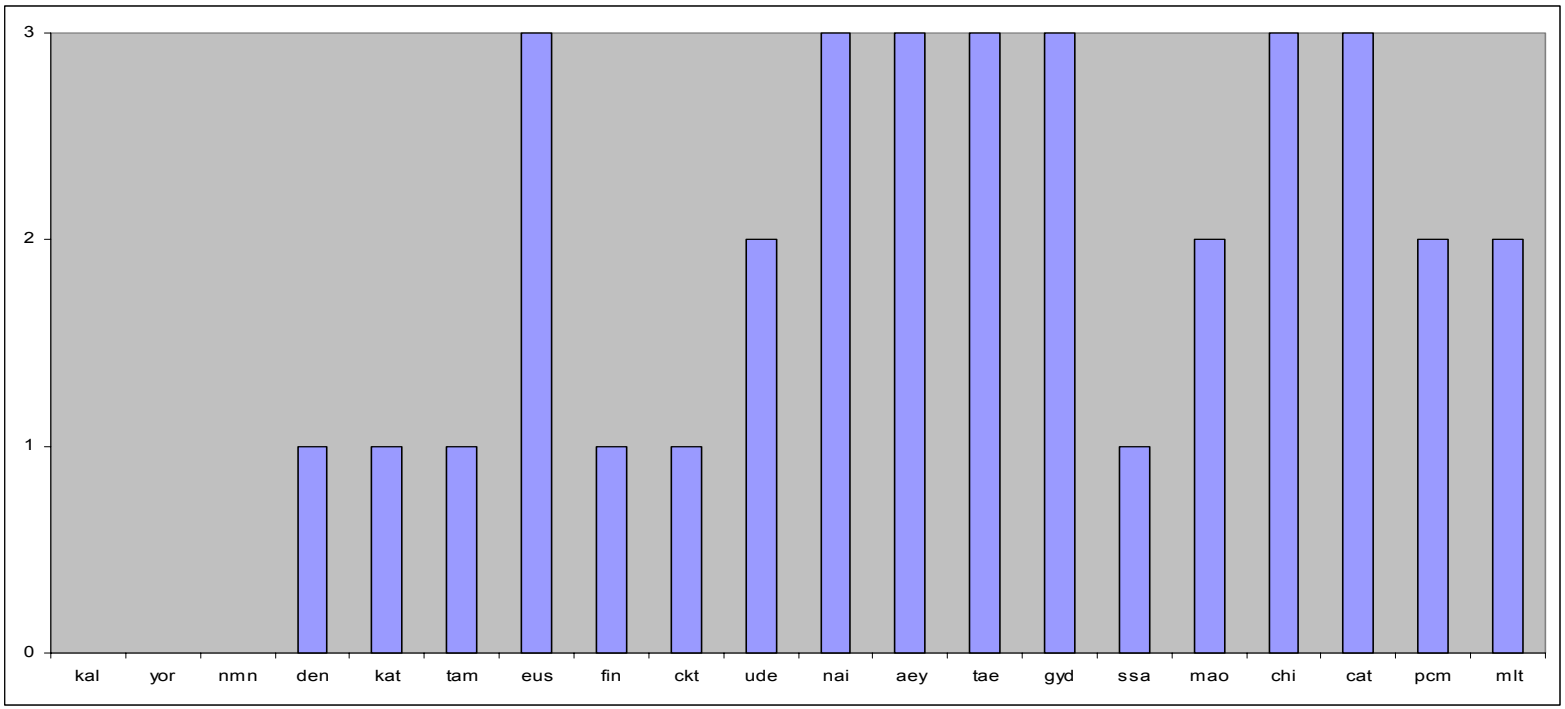
Cross-linguistic Data

Stress-related Parameters: Stress Placement

- Segmental effects of stress render stress placement less predictable (loss of syllables) and enhance the development of morphological conditioning (Bybee et al. 1998)
- Accordingly, rules of stress placement are typically very complex in stress-timed languages (Auer 1993)
- Stress placement: fixed, weight-sensitive, morphologically or lexically conditioned
  (0 = no stress, 1 = fixed, 2 = weight sensitive, 3 = morphologically/lexically conditioned, see also Goedemans & van der Hulst 2005)

Cross-linguistic Data

Stress-related Parameters: Stress Placement



Cross-linguistic Data

Stress-related Parameters: Stress Placement

- The predictions are not borne out cross-linguistically: unpredictable stress placement is found all over the stress cline
- Stress placement is neither a reliable parameter for typologizing rhythm nor do rules of stress placement follow from other rhythmic properties
- [As will be discussed later, the proposed correlation of segmental effects of stress and morphologically conditioned stress placement has a weak motivation]

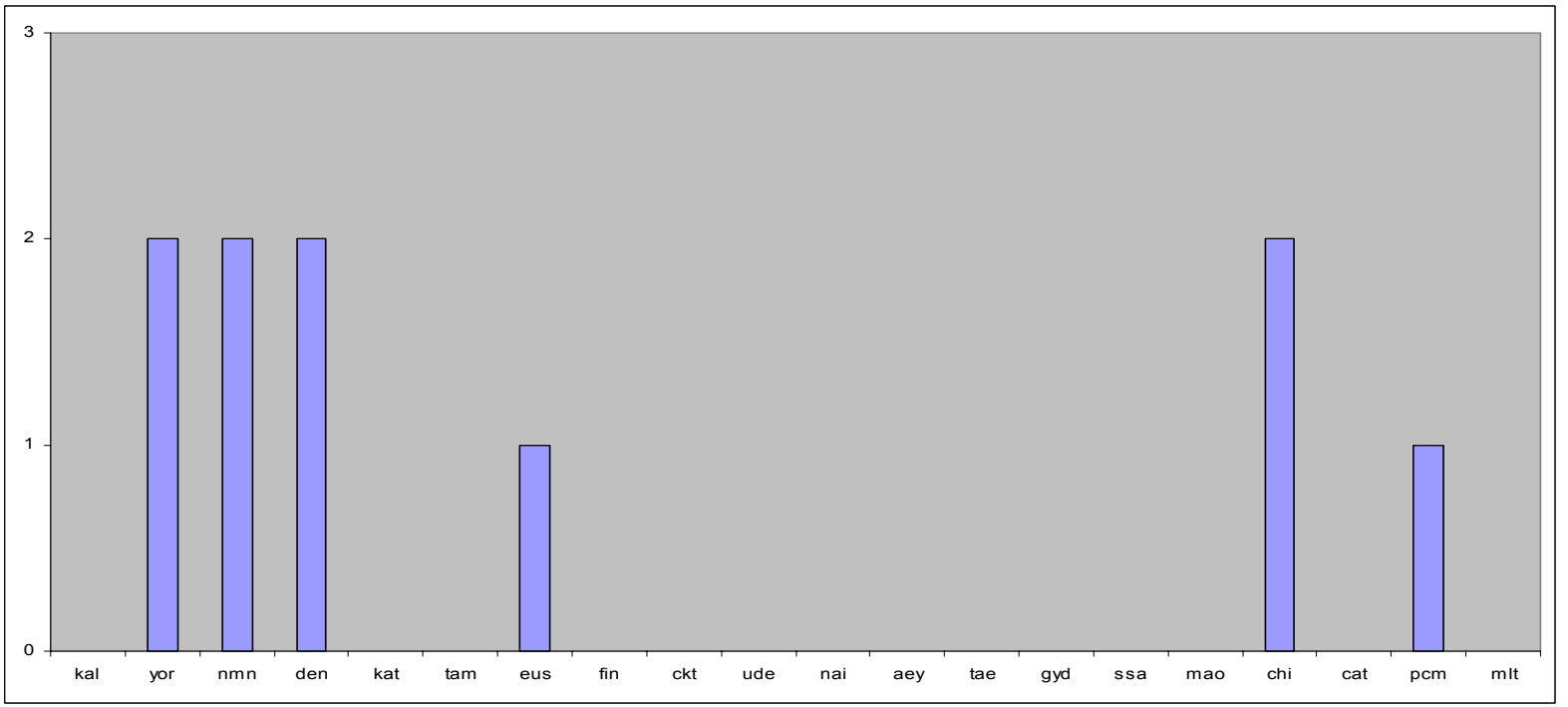
Cross-linguistic Data

Stress-related Parameters: Tone

- "If syllables are to carry *tone*, they are best suited for this purpose if their sonority is high, i.e. if they have no reduced […] vowels" (Auer 1993: 7)
- "[S]tress-timing languages tend to realize accent phonetically by pitch movement; were the same languages to exploit pitch movement for lexically distinctive purposes, the saliency of this cue would be diminished by functional overload" (Auer 1993: 7)
- Tone: restricted, unrestricted
  (0 = no tone, 1 = restricted, 2 = unrestricted; see Maddieson 2005b for a different classification)

Cross-linguistic Data

Stress-related Parameters: Tone



Cross-linguistic Data

Stress-related Parameters: Tone

- Although unrestricted tone systems are more frequent in languages which have no stress, there is no principled incompatibility of vowel reduction, stress and tone
- Complex interactions of stress and tone:
  - stress may impose restrictions w.r.t. the distribution of tone
  - stress may trigger special rules of tonal sandhi (e.g. neutral tone)
  - stress may enlarge the pitch range in the realization of tone
- Tone is not a primary indicator of linguistic rhythm. The actual manifestation of tone, however, is dependent on the nature of the rhythmic parameter of stress

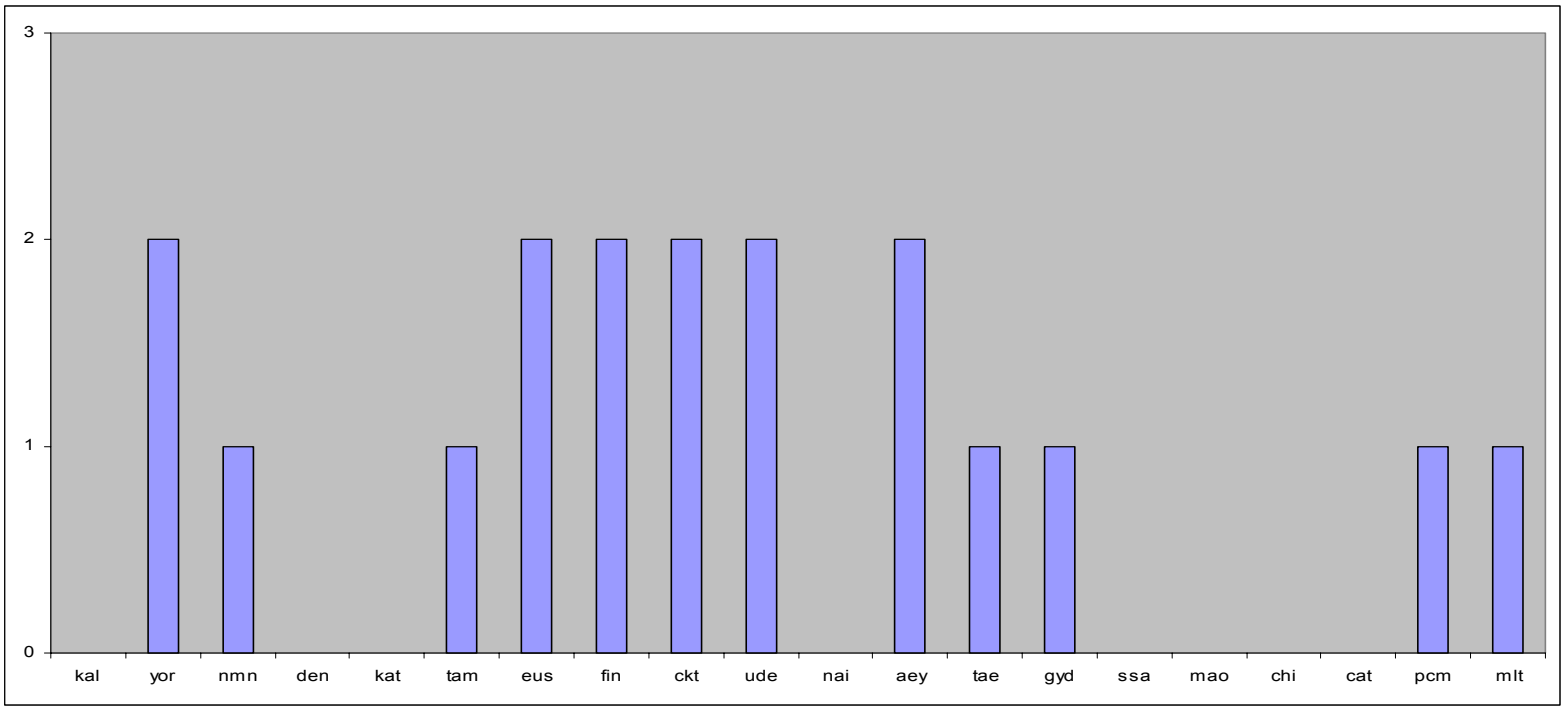
Cross-linguistic Data

Stress-related Parameters: Vowel Harmony

- "[T]he spreading of vowel features across syllables is at odds with vowel reduction and centralization in non-accented syllables" (Auer 1993: 9)
- "[O]nly prototypical syllable-timed languages have *vowel harmony* in order to mark word boundaries" (Auer 1993: 9)
- Vowel Harmony: only in adjacent syllables (*Umlaut*), word-spanning
  (0 = no vowel harmony, 1 = only in disyllabic domains, 2 = word-spanning)

Cross-linguistic Data

Stress-related Parameters: Vowel Harmony



Cross-linguistic Data

Stress-related Parameters: Vowel Harmony

- The predictions about the nature and domains of vowel harmony are borne out:
  - Word-spanning vowel harmony is only attested in languages with weak or no stress which lack segmental effects of stress (in particular vowel reduction)
  - In languages with strong stress and segmental effects of stress vowel harmony processes only apply in smaller domains
- Vowel harmony is not a primary indicator of linguistic rhythm. Its cross-linguistic distribution can, however, be predicted with reference to rhythmic parameters relating to stress

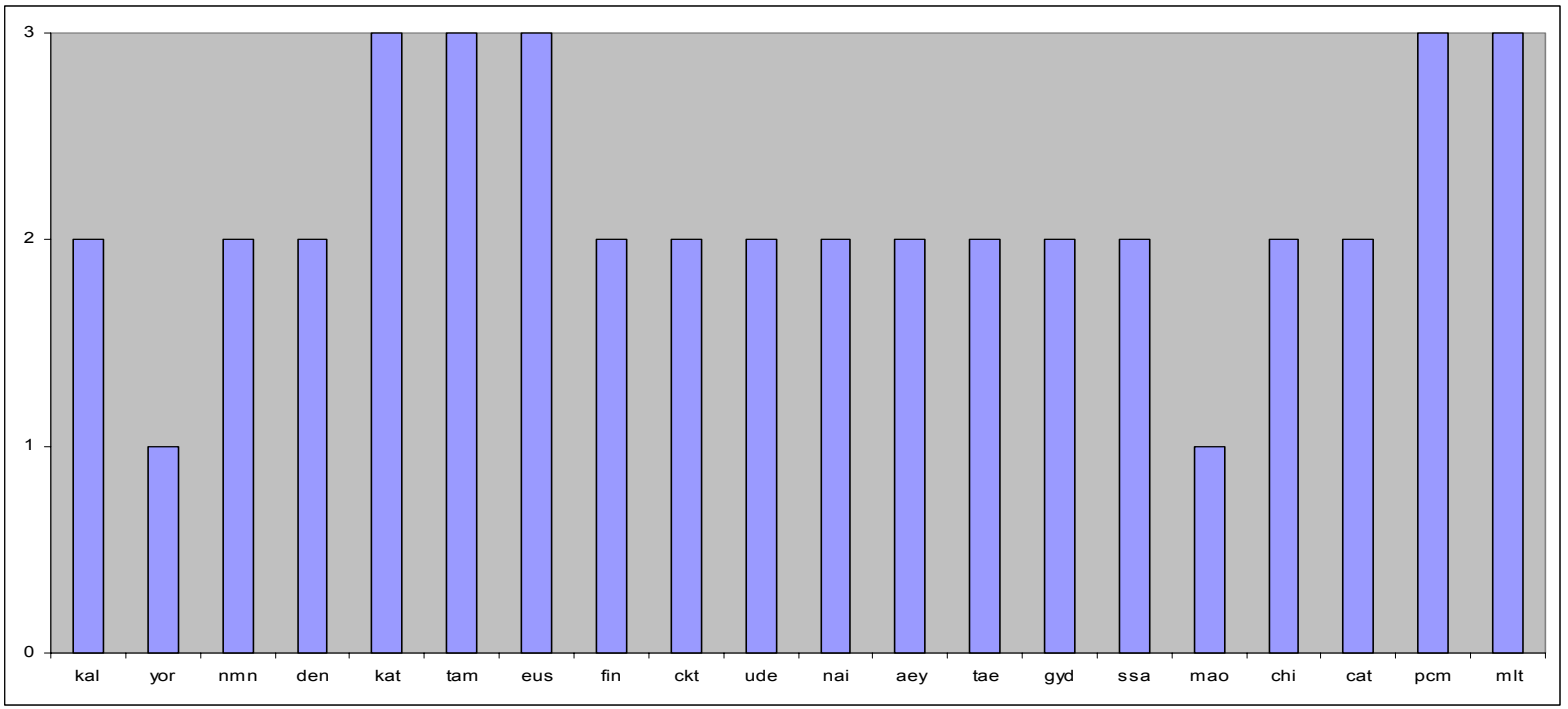
Cross-linguistic Data

Syllable-related Parameters: Syllable structure

- "In a language which strives to keep syllable duration constant, phonemic and phonetic syllables should be of a very restricted type" (Auer 1993: 7)
- "In a stress-timed language, […] [t]he total reduction of non-accented syllables as well as morphological processes will give rise to consonant clusters" (Auer 1993: 8)
- Syllable structure: simple (CV), moderate (CCVC), complex (anything extending CCVC)
  (1 = simple, 2 = moderate, 3 = complex, cf. Maddieson 2005a)

Cross-linguistic Data

Syllable-related Parameters: Syllable structure



Cross-linguistic Data

Syllable-related Parameters: Syllable structure

- Simple and complex syllable structures show a rather erratic distribution across the stress cline:
  - Simple syllable structure is found in Yoruba (no stress) and Maori (strong stress with segmental effect)
  - Complex syllable structure is found in Nigerian Pidgin and Maltese (strong stress with all segmental effects), but also in Georgian, Tamil, Basque (weak stress without segmental effect)
- The correlation between strong stress and complex syllable structure is not supported. Prototypical stress-based rhythm may be defined by the combination of these logically independent features

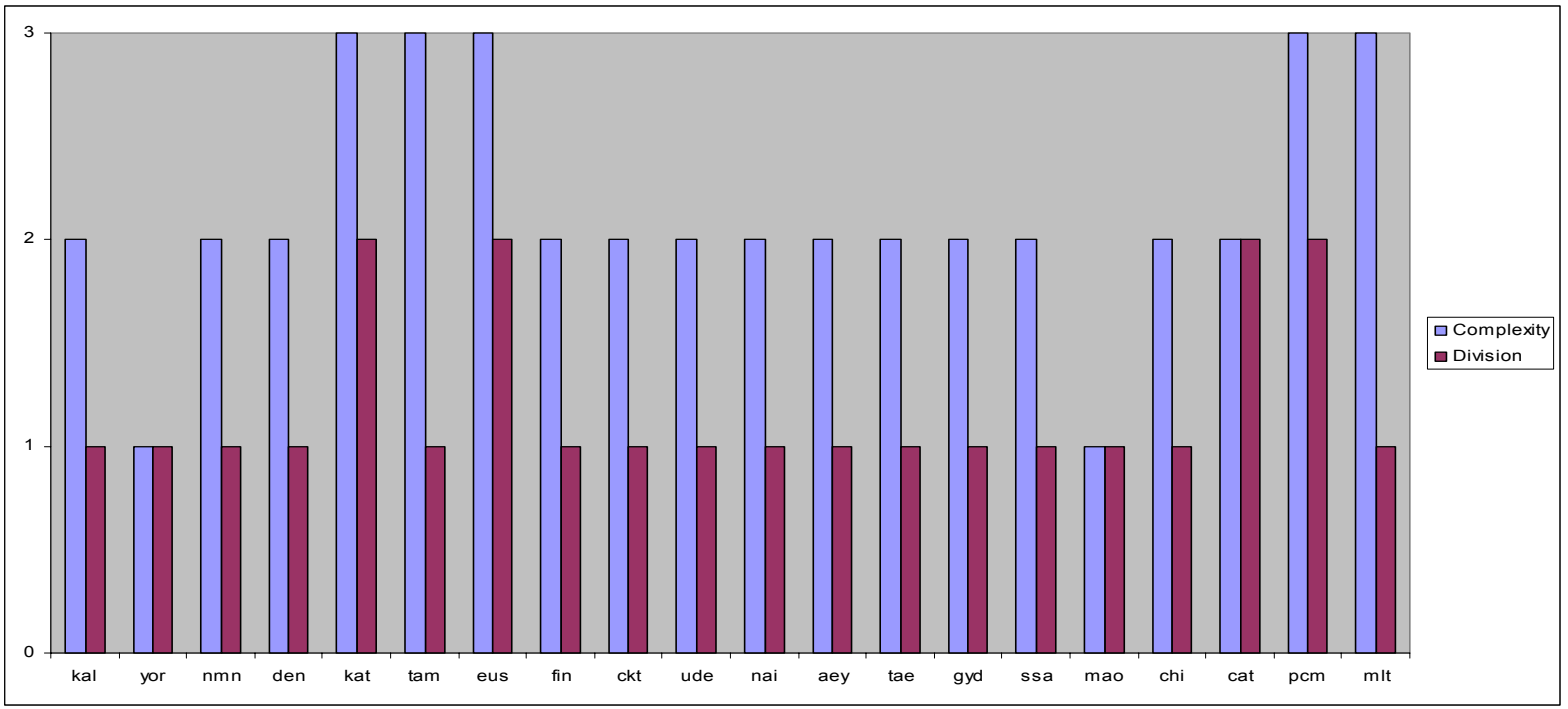
Cross-linguistic Data

Syllable-related Parameters: Others

- "Given the potential complexity of the accent syllable in stress-timed languages, syllable division in the phonological word is notoriously difficult" (Auer 1993: 8)
  (1 = unambiguous, 2 = ambiguous)
- "[D]ifficulties in articulating these clusters lead to assimilations" (Auer 1993: 8)
  (0 = none, 1 = one process, 2 = more than one process)
- Consonant clusters are resolved in syllable-timed languages to adhere to the overall CV syllable structure, e.g. by cluster simplification or epenthesis (Auer 2001)
  (0 = none, 1 = one of the above, 2 = two of the above)

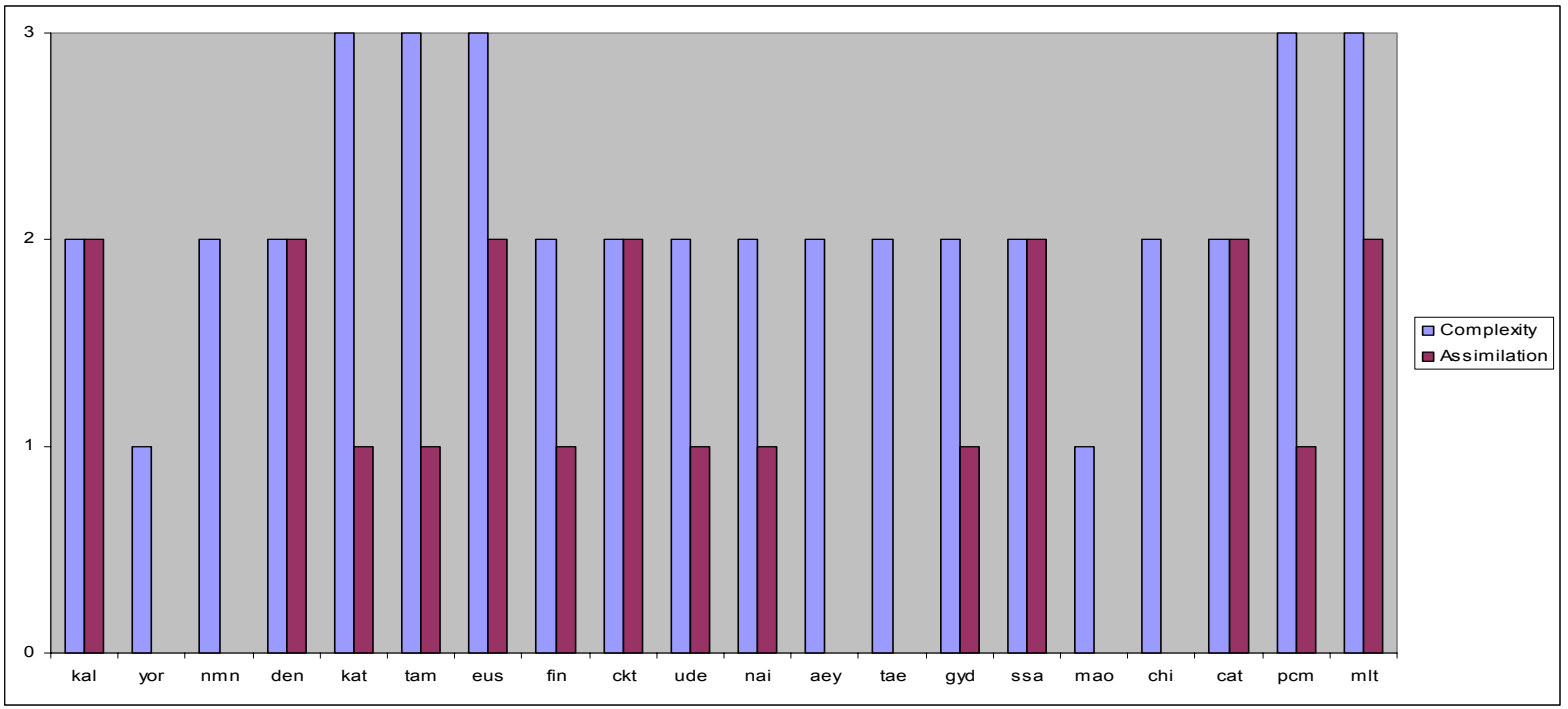
Cross-linguistic Data

Syllable-related Parameters: Syllable Division



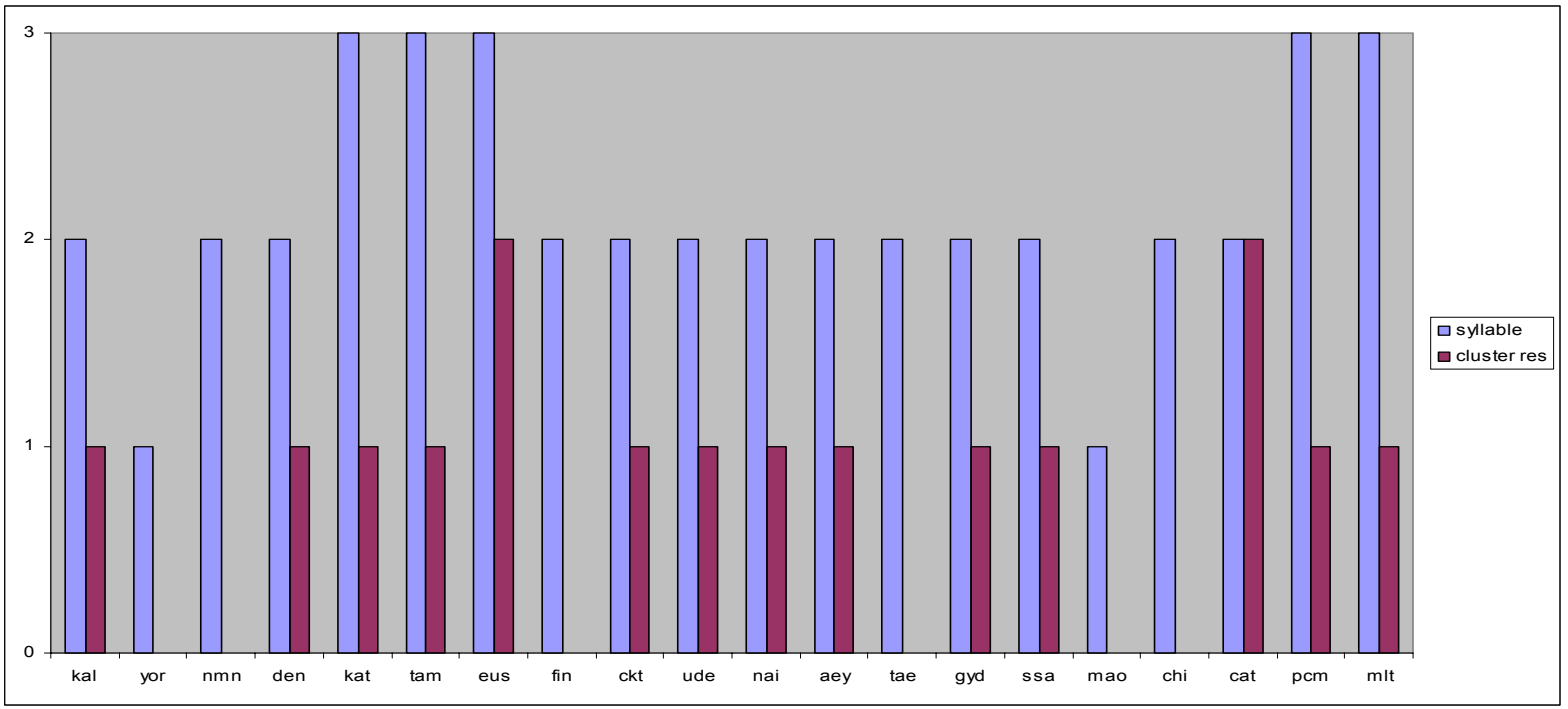
Cross-linguistic Data

Syllable-related Parameters: Assimilation



Cross-linguistic Data

Syllable-related Parameters: Cluster Resolution



Cross-linguistic Data

Syllable-related Parameters: Others

- Ambiguous syllable divisions seem to be more likely in languages with complex syllable structure
- Assimilations across consonant clusters and rules of cluster resolutions occur in languages with syllable structures exceeding the CV shell
- None of the secondary syllable-related parameters turns out to be reliable in typologizing rhythm. The factors determining the nature and frequency of such processes are dependent on other components of phonology

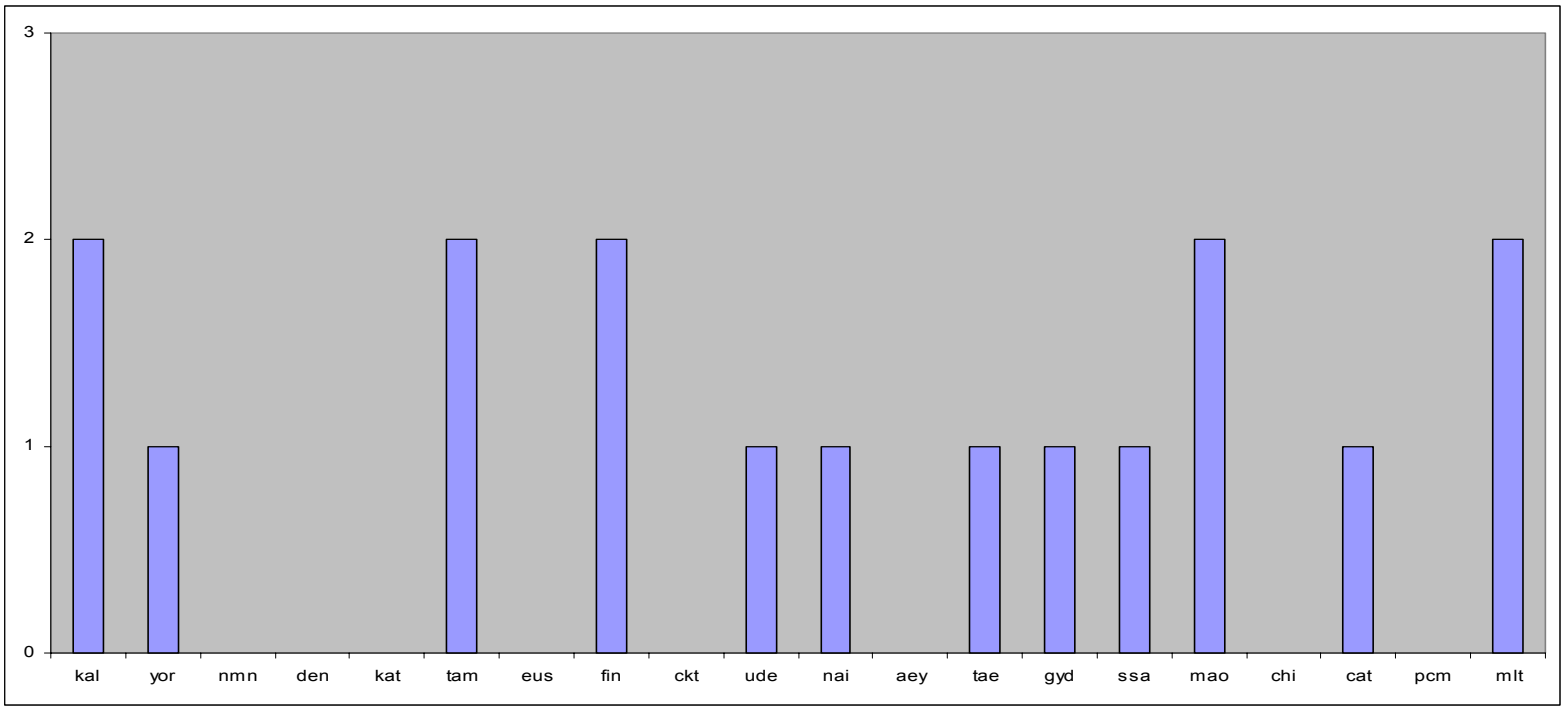
Cross-linguistic Data

Mora-related Parameter: Length Contrasts

- In stress-timed languages, long phonemic segments (long vowels or geminate consonants) will not be allowed in non-accented syllables (Auer 1993: 6)
- The ‘staccato rhythm’ of mora-timed languages like Japanese, on the other hand, has its basis in phonemic length distinctions in vowels and consonants
- Length contrasts: vowel length, geminates
  (0 = no length contrasts, 1 = in vowels or consonants, 2 = in vowels and consonants, 3 = only in stressed syllables)

Cross-linguistic Data

Mora-related Parameter: Length Contrasts



Cross-linguistic Data

Mora-related Parameter: Length Contrasts

- No language in the present samples shows a restriction for length contrasts to appear in stressed syllables only
- Length contrasts in vowels and geminates are found in West Greenlandic, Tamil and Finnish (weak stress)
- However, the length contrasts are also possible in languages with strong stress (Maori and Maltese)
- The correlation between stress and length contrasts is not supported. Prototypical mora-based rhythm may be defined by the presence of length contrasts and the lack of stress-related properties

Cross-linguistic Data

Summary

- Only six of the proposed parameters are reliable in typologizing linguistic rhythm:
  - Phonetic correlates of stress
  - Segmental effects of stress
  - Syllable structure
  - Length contrasts
  - Tone
  - Vowel harmony
- However, there are no clusters which allow the postulation of two or three distinct rhythm classes

Cross-linguistic Data

Summary

- Phonetic correlates and segmental effects of stress constitute a cross-linguistic *stress cline,* i.e. stress-based phonology is a matter of degree
- The non-contained effect of stress constrains tonal phonology and vowel harmony (Hyman 2001)
- In the absence of other rhythmic cues, the salience of length contrasts characterizes mora-based phonology
- Syllable-based rhythm is negatively defined by the absence of stress- or mora-based phonology (cf. Dufter 2003)

Diachronic Interpretation

The Problem

- The gradual differences across the languages of the sample may be modeled as a cline ranging from mora-based > syllable-based > stress-based phonology
- Within diachronic typology, such synchronic clines are often interpreted as mirroring diachronic change (cf. Lehmann 1985)
- Concomitant changes in stress-related parameters can thus be modeled as constituting a gradual shift from syllable-timing to stress-timing (Bybee et al. 1998)

Diachronic Interpretation

A Diachronic Scenario (Bybee et al. 1998)

- The evolution of word stress
  - Reinterpretation of phrasal intonation as word stress
  - Duration/magnitude of gesture as phonetic correlates
  - Segmental effects of stress
  - Unpredictable stress through the loss of unstressed vowels
- The evolution of syllable complexity (Vennemann 1988)
  - Consonant clusters through the loss of unstressed syllables
    **harbista-* > *herbisto* > *herbest* > *herbst*
    (Old High German > Middle High German > German)

Diachronic Interpretation

Alternative Scenarios

- Another source of word stress
  - From purely tonal to accentual through tone dissimilation (cf. Meeussen's Rule in Bantu)
  - H Pitch gets attracted to the penultimate lengthened syllable (cf. Philippson 1998 on Eastern Bantu)
  - This leads to an accent system where pitch and duration are the phonetic correlates of stress
  - However, this does not necessarily lead to segmental effects of stress
- Accordingly, diachrony may lead to different phonetics-phonology constellations in stress (cf. Hyman 1977)

Diachronic Interpretation

Alternative Scenarios

- Unpredictable stress placement in Turkish
  - Predictable final stress (Lewis 2000):
    çocúk ‘child’, *çocuklár* ‘children’, *çocuklarımíz* ‘our children’,
    çocuklarımızín ‘of our children’ (Lewis 2000: 19f.)
  - Borrowing (Lewis 2000):
    lokánta ‘restaurant’, *rádyo* ‘radio’, *kókteyl* ‘cocktail(-party)’
  - Phonology in Grammaticalization (Schiering 2006):
    Old Turkish $[(gelí)_{\omega}\ (yürür)_{\omega}]_{\Phi}$ > Modern Turkish $(gelíyor)_{\omega}$
    ‘s/he is coming’
- There are multiple sources of unpredictable stress placement in languages lacking segmental effects of stress

Diachronic Interpretation

Alternative Scenarios

- Another source of consonant clusters
  - Although the loss of vowels increases syllable complexity, such vowel deletions are not always triggered by stress-related rules
  - For instance, in Austronesian vowel syncope has its basis in Structural Analogy (Blevins 2004):
    $VC^{V}CV$ > VC.CV if there are pre-existing word-final VC syllables
- Accordingly, increase of syllable complexity may also be found in languages without segmental effects of stress

Diachronic Interpretation

The evolution of geminates

- Multiple paths (Blevins 2004)
  - Assimilation in consonant clusters
  - Assimilation between consonants and adjacent vowels/glides
  - Vowel syncope
  - Lengthening under stress (including expressive lengthening)
  - Boundary lengthening
  - Reinterpretation of a voicing contrast
  - Reanalysis of identical C+C sequences
- The evolution of length contrasts is not necessarily incompatible with stress-based phonology

Diachronic Interpretation

Conclusions

- Since several types of diachronic change are encountered on each parameter, the cross-linguistic cline should not be interpreted as a mirror of diachrony
- In fact, the independence of change on the various parameters may account for the weak cross-linguistic evidence for the clustering of rhythm-related properties
- Prospects for future research:
  - reconsider the ‘European bias’ in the cross-linguistic study of linguistic rhythm (quantitative methods / cluster analysis)
  - evaluate which scenarios of change are common enough to result in cross-linguistically frequent clusters of phonological properties