

# Paradigm leveling and the role of universal preferences in morphophonological change

David Fertig  
Dept. of Linguistics  
University at Buffalo  
[fertig@buffalo.edu](mailto:fertig@buffalo.edu)

# Overview of talk

Part I: Introducing the phenomenon and the issues

What is paradigm leveling?

Garrett's question(s)

Part II: Mechanism(s?) of paradigm leveling

Part III: Optimization?

Part IV: Paradigm uniformity vs.

"harmony" / "symmetry" / "congruity" / "stability" /  
frequency

Part V: Where does this leave us?

Part I:  
Introducing the  
phenomenon and the  
issues

# Leveling

An early definition:

= "existing alternations are either curtailed or eliminated altogether, with the result that allomorphs of some morphemes become more similar to each other or merge completely" (Kiparsky 1968:200).

# Paradigm leveling

A recent, widely cited definition:

“the complete or partial elimination of paradigmatic alternations that do not seem to signal important differences in meaning or function” (Hock and Joseph 2009:152).

# Complete leveling, example 1

' to love '	Latin	Old French	Modern French
infin.	amāre	amer	aimer
1s	amō	aim	aime
2s	amās	aimes	aimes
3s	amat	aimet	aime
1p	amāmus	amons	aimons
2p	amātis	amez	aimez
3p	amant	aiment	aiment

# Complete leveling, example 2: *Rückumlaut* in German verbs:

(1s, pres-past)	Middle High German	Mod. Standard German
`to warm'	wermen-warmte	wärmen-wärmte
`to kiss'	küssen-kuste	küssen-küsste
`to hear'	hæren-hôrte	hören-hörte
`to lead'	vüeren-vuorte	führen-führte
to miss'	vælen-vâlte	fehlen-fehlte

# Complete leveling: Example 3

English *day*:

early Middle English *dai-dawes* → *day-days*

# Complete leveling: Example 4

English  $\eta$ - $\eta g$ :

early Modern English *sing-singer* = /sɪŋ/-/sɪŋgɪ/

-> present-day English /sɪŋ/-/sɪŋɪ/

compare retention of  $\eta g$  prevocally in:

(1) *finger* = /fɪŋgɪ/, etc. (monomorphemic)

(2) *long-longer* = /lɔŋ/-/lɔŋgɪ/, etc. (alternation retained with the comparative suffixes)

# Conceptual/definitional issues 1: leveling vs. regularization

“some English ‘strong’ verbs have been levelled to the ‘weak’ pattern, as for instance in dialects where *throw/threw/thrown* has become *throw/throwed/throwed*” (Campbell 2004:106)

“Leveling” is more commonly restricted to developments that consist only of elimination of stem alternations

(BUT: Many favorite examples of leveling are nevertheless **also** regularization, e.g. *old-elder* -> *old-older*)

# Conceptual/definitional issues 2: “leveling” by regular sound change

Examples:

Old English *æ*–*a* → Middle English *a*–*a*

OE *fæt*–*fatu* ‘vat(s)’ → early ME *fat*–*fate*

Gmc. *sōkjana*–*sōhtē* → German *suchen*–*suchte*  
(cf. English *seek*–*sought*)

# Revised definition

Paradigm leveling =

innovation/change that

(1) consists only of the partial or complete elimination of stem alternations/allomorphy;

(2) is motivated by morphological or morphophonological patterns.

# The question(s)

*“Optimization. Does paradigm leveling occur because of some optimizing impulse (a preference for simplicity in general or uniform paradigms in particular) or, alternatively, is it a consequence of independent mechanisms of morphological change?”* (Garrett 2008:125)

# (At least) two questions

Garrett's basic question -

"Does paradigm leveling occur because of some optimizing impulse [...] or, alternatively, is it a consequence of independent mechanisms of morphological change?"

- conflates (at least) two orthogonal issues: one concerns the mechanisms behind leveling innovations, the other the full range of factors that influence the course of morphophonological change.

# The mechanisms question

Do the mechanisms behind leveling innovations specifically involve the reduction/elimination of allomorphy in some way, or do they just happen to lead to this outcome in many cases?

This question is largely orthogonal to the "optimizing impulse" question...

# The optimizing-impulse question

Does some kind of "preference" for patterns or systems with certain properties play a role in shaping the course of morphophonological change?

and if so:

Does the preference specifically favor stem uniformity (non-alternation)?

# 4 possible positions

1. There is no mechanism of paradigm leveling that specifically involves reduction/elimination of stem allomorphy and no preference for non-alternation. (Garrett, Paul)
2. mechanism yes, preference no (Croft, Kiparsky [?])
3. mechanism no, preference yes (Hale and Reiss [?])
4. mechanism yes, preference yes (Curtius, Vennemann)

# “optimizing impulse” (1):

“The motivation for leveling has been plausibly expressed in the slogan ONE MEANING – ONE FORM.” (Hock and Joseph 2009:152)

# “optimizing impulse” (2):

“...manifestations. of phonetic adaptation and inertia [...] may continuously cause us to stumble into allowing two meanings for a single form or two forms for a single meaning, but we do not live happily with either accident and only tolerate the one while moving immediately to repair the other.” (Bolinger 1977:19–20)

# “optimizing impulse” (3)

Kiparsky (1971:600–601) – reversing his own earlier position – argues for “minimization of allomorphy as an independent functional principle which is not reducible to formal properties of the generative system of a language.”

(...then later reversing this reversal: “Paradigmatic leveling is a direct reflex of language learners’ tendency to simplify grammar, ...” (1978:90))

# “optimizing impulse” (4)

“Language has a feeling for the affiliation of related forms; every one of these affects the others, and they show an unmistakable striving to make each other similar, even identical, to level out small differences resulting from individual conditions.” (Curtius 1860:331, quoted in Wheeler 1887:40, my translation)

# “independent mechanisms” (1)

“I have shown that pure leveling does not exist and that the emergence of paradigm uniformity is always the imposition of an existing (uniform) pattern on a non-uniform paradigm.” (Garrett 2008:142)

# “independent mechanisms” (2)

“It is now apparent that a simple account of analogy, both (a) interparadigm (four-part) analogy and (b) paradigm leveling, within the context of the development of a generative theory of grammar, is provided by the restructuring of the lexicon in the process of lexical acquisition.” (Hale and Reiss 2008:242)

# "independent mechanisms" (3)

"...paradigm uniformity is really just the extension of an existing pattern of non-alternation..." (Albright 2005)

# “independent mechanisms” (4)

“Where an unnecessary and useless difference has arisen through phonetic change, it can be eliminated with the help of analogy, specifically through the gradual replacement of the form that became differentiated in this way by a new formation that does not contain the difference in question. We can call this process leveling (*Ausgleichung*), but we must be clear in our own minds that the true essence of the process is not captured by this expression, that it consists rather of a complicated series of individual processes, which were analyzed in chapter 5.” (1886:161, my translation)

# Compromise views...

...are exemplified by Bybee's discussion of "Morphophonemic Change from Inside and Outside the Paradigm" (1980; cf. Fertig 1999).

Part II:  
Mechanism(s?) of  
paradigm leveling

# Garrett's mechanism:

"I assume that morphological production involves competition between the retrieval of memorized forms and the creation of new ones by rule, and that a mechanism of change is the creation of new forms if existing ones are not learned, remembered, or accessed fast enough ..." (2008:128)

"leveling is a special case of extension in which a non-alternating pattern is extended to a previously alternating paradigm. This requires that a suitable non-alternating model paradigm can be identified for every case of leveling." (127)

# Compare Paul:

"at the moment when a particular function is to be expressed, it is a question of relative dominance (*Machtfrage*) whether a form is brought into consciousness through simple reproduction or with the help of a proportion. [...] A proportional formation encounters no inhibition [...] if [the traditional form] has never been transmitted to the individual in question, [...] The strength of the representation in memory can, [...] also be so slight that it stands no chance against the proportional formation [...]." (Paul 1886:92-3)

# Can this mechanism account for all cases of partial leveling?

“the imposition of an existing [...] pattern on a non-uniform paradigm” (Garrett) is always a possible explanation for those leveling innovations that can also be characterized as regularization. Most cases of complete leveling seem to fall into this category.

With partial leveling, identifying a “suitable [...] model paradigm” is sometimes much less trivial.

Some examples of  
partial leveling, ordered  
from least to most  
problematic for the  
Paul/Garrett mechanism

# Partial leveling, example 1

Leveling of Verner's Law alternations in stem-final consonants of English strong verbs:

OE *cēosan–coren* -> *choose–chosen*

OE *frēosan–froren* -> *freeze–frozen*

Verbs of the same class that never had the stem-final consonant alternation provide a suitable model paradigm:

OE *bēodan–boden* 'command'; *clēofan–clofen* 'cleave';  
*scēotan–scotan* 'shoot'; *flēogan–flogen* 'fly', etc.

# Vowel alternation in present of some German strong verbs:

early MHG: *lësen* /lɛsən/ - *liſet* /lɪsət/ 'read' ->

(open-syllable lengthening + syncope)

late MHG: *lësen* /le:sən/ - *liſt* /lɪst/ 'read' ->

(leveling of vowel-length alternation)

Mod. Standard Ger.: *lesen* /le:zn/ - *liest* /li:st/ 'read'

No direct model for e:-i: alternation before this change.  
BUT: corresponding short vowel alternation in verbs with no open-syllable lengthening, e.g. *helfen-hilft*, could serve as a proportional model ( $\varepsilon : \text{ɪ} :: e: : X, X = i:$ ).

MHG *sitzen* - *gesëzzen* ->

Nürnberg dialect: *sitsn* - *gsetsn*

A "suitable model paradigm" possibly represented by two existing verbs:

MHG *bit(t)en* - *gebëten*; *ligen* - *gelëgen*

Why would innovators follow this rare pattern?

# Alternation in root vowel + root-final consonant of some Old English weak verbs:

	infinitive	early OE 1/3s past	late OE 1/3s past
'narrate'	reċċan	reahte	rehte
'shake'	cweċċan	cweahte	cwehte
'afflict'	dreċċan	dreahte	drehte
'moisten'	leċċan	leahte	lehte
'stretch'	streċċan	streahte	strehte
'cover'	þeċċan	þeahte	þehte
'awaken'	weċċan	weahte	wehte

## Proto-Germanic demonstrative

Sing.	M	N	F
N	sa	þat	sō, sjō
G	þes(a)	þes(a)	þezōz
D	þemmo	þemmo	þezāi
A	þan	þat	þō(m)

## Proto-Germanic 3rd sg. personal

Sing.	M	N	F
N	iz	it	si
G	is(a)	is(a)	izōz
D	immo	immo	izāi
A	in	it	ijō(m)

## Old High Ger. demonstrative

Sing.	M	N	F
N	dër	da <sub>3</sub>	diu
G	dës	dës	dëra
D	dëmu,	dëmu,	dëru
A	dën	da <sub>3</sub>	dea, dia,

## OHG 3rd sg. personal pronoun

Sing.	M	N	F
N	ër	i <sub>3</sub>	siu
G	ës (is)	ës (is)	ira
D	imu, imo	imu, imo	iru
A	inan, in	i <sub>3</sub>	sia, (sie)

# “Non-proportional” mechanisms of paradigm leveling (1)

Croft’s “intraference”:

“ Morphological leveling [...] is evidence of intraference. [...] Intraference is the consequence of identification of the meaning of one form with an overlapping meaning of another form, leading to the introduction of the other form with the first meaning.” (2000:150)

# “Non-proportional” mechanisms of paradigm leveling (2)

Oertel’s “associative interference”:

“...phonetic alterations will in most cases be found to involve a partial likeness of form as well as semantic similarity. [...] the stronger innervation of the first word is transferred to the second [...] This is the reason why analogy exercises so strong an influence over slightly differing forms of the same stem in the inflectional system” (1901:167–8)

# “Non-proportional” mechanisms of paradigm leveling (3)

Paul on contamination:

“the process whereby two synonymous expressions impose themselves simultaneously on the consciousness, so that neither is able to assert itself cleanly, but rather a new form arises in which elements of the one form are combined with elements of the other.” (1886:132)

# “Non-proportional” mechanisms of paradigm leveling (5)

Paul on (“the more complicated type of”) folk etymology (1):

“a transformation in sound, whereby a word that is reminiscent of another word due to coincidental similarity in sound is further assimilated to it.” (1886:182)

# “Non-proportional” mechanisms of paradigm leveling (4)

Paul on the mechanism of unintentional folk etymology:

“...it is entirely normal that people do not perceive the words that they hear exactly, in accordance with their sound components, but rather partially guess at them, usually supported by the meaning expected from the context. Naturally, people’s guesses favor sound complexes that are already familiar to them, and in this way a meaningless part of a larger word can [...] be replaced by a similar sounding common word.” (1886:183)

# Part III: Optimization?

# A surprising passage from Paul

“Every language is constantly busy eliminating all useless deviations from uniformity (*Ungleichmäßigkeiten*), creating the same phonetic expression for that which is functionally the same.” (Paul 1886:188)

# Nobody disputes... (1)

the mechanisms behind innovation are not the whole story of morpho(phono)logical change.

Of at least equal importance/interest: characterizing and explaining the (soft and perhaps also hard) constraints on this type of change.

The one (hard) constraint inherent in the Paul/Garrett mechanism – the requirement that there be a "suitable [...] model paradigm" for every innovation – has always been recognized as insufficient.

# Nobody disputes... (2)

that morpho(phono)logically motivated change very often results in stem uniformity.

The question here is:

What, if anything, does this frequent outcome of analogical change have to do with the forces that shape the course of change?

Arguing that it has nothing to do with the mechanism of innovation does not answer this question!

# Where do constraints on change operate?

Aside from being inherent in the mechanism of innovation, factors influencing the course of change could come into play in two places:

1. They could influence the relative likelihood of occurrence of different kinds of innovations (see Hare and Elman 1995; Albright 2009).
2. They could influence the relative likelihood of different occurring innovations catching on and becoming established as the new normal.

# Two hypotheses

(both independent of the question of whether the mechanisms of innovation have anything to do with stem uniformity)

1. Innovations that reduce/eliminate stem allomorphy are more likely to occur than otherwise comparable innovations that do not have this effect.
2. Actual innovations that reduce/eliminate stem allomorphy are more likely to catch on and become changes in the language than otherwise comparable actual innovations that do not have this effect.

# Another question

How do these two hypotheses relate to the notion of an "optimizing impulse" shaping the course of morpho(phono)logical change?

# “Darwinian” historical linguistics (1)

“a theory of language change must distinguish the two processes of change [...] INNOVATION or actuation – the creation of novel forms in the language – and PROPAGATION or diffusion (or, conversely, loss) of those forms in the language. [...] The framework for understanding language change to be presented here is based on a generalized theory of selection for all types of evolutionary phenomena, originally developed in biology [...]” (Croft 2000:4–6)

# “Darwinian” historical linguistics (2)

“‘imperfect learning’ (along with language contact and other sources of linguistic innovation) constantly replenishes the language with a fresh supply of coexisting variants. [...] Some of the variants arising this way will tend to be avoided in speech because they are dysfunctional or because they become stigmatized. Others will be favored [...] because they can be used to make things easier to say or to understand.” (Kiparsky 1978:86)

# “Darwinian” historical linguistics (3)

“We have in effect ended up dividing the explanation of analogical change between two different theories, one dealing with the source of the innovations (imperfect learning) and the other with their selection in speech and eventually in grammar. (A vague parallel might be the theory of evolution as a function of genetic variation and natural selection.)” (Kiparsky 1978:87; cf. Samuels 1972)

# “Darwinian” historical linguistics (4)

“The real cause of change in language usage is found in everyday speech. Here, there can be no question of any intentional effect. The only intention that is at work is the intention aimed at the momentary need to make one’s own wishes and thoughts understandable to others. Otherwise, purposefulness (*Zweck*) plays no role in the development of general language usage other than what Darwin assigned to it in the development of organic nature: How well suited the resulting formation is for some function or purpose determines its survival or death.” (Paul 1886:29–30, translated by Peter Auer)

## Part IV:

Paradigm uniformity  
vs. "harmony" / "symmetry" /  
"congruity" / "stability" /  
frequency

# What could a uniformity preference amount to? (1)

Candidate 1: a constraint of the synchronic grammar

“The Optimal Paradigms (OP) model [...] The stem (output form of the shared lexeme) in each paradigm member is in a correspondence relation  $\mathcal{R}_{OP}$  with the stem in every other paradigm member. [...] There is a set of Output–Output faithfulness constraints on the  $\mathcal{R}_{OP}$  correspondence relation.” (McCarthy 2005:173–4)

# What could a uniformity preference amount to? (2)

Candidate 2: a property of the “evaluation measure”:

Kiparsky’s “paradigm conditions” (1971:596):

“...the evaluation measure is to somehow check the outputs of grammars [...] and assign a ‘cost’ to allomorphic variation in paradigms.”

# What could a uniformity preference amount to? (3)

Candidate 3: a general cognitive distaste for allomorphy:

“the mind shuns purposeless variety” (Anttila 1972:181)

# What could a uniformity preference amount to? (4)

Candidate 4: a processing bias

"When the derivative maintains intact the phonology of the base, listeners can easily access the lexical entry to interpret the nonce form. If the derivative's stem is modified, this makes it harder to access the lexical entry." (Steriade 2000:317)

"...forms which were subject to phonological change during derivation were always recognized significantly slower than those without phonological alternations" (Tsapkini et al. 1999:318; cf. Ussishkin and Wedel 2009).

# What could a uniformity preference amount to? (5)

Candidate 5: an acquisition bias

"... a child can acquire a lexicon only if the initial state of the grammar is such that surface forms and underlying representations are [...] identical to each other" (Hale and Reiss 2008:241)

"Psycholinguistic and diachronic evidence [...] suggests that learners [...] require positive evidence to abandon the **identity map**, in which inputs are identical with the corresponding outputs" (Ricardo Bermúdez-Otero 2006).

# The Principle of Contrast

“to acquire words children must assume that word meanings are contrastive.” (Markman 1990:67; cf. Clark 1983; Bolinger 1977)

# The Principle of Contrast and Paradigm Leveling

Carstairs-McCarthy 2010: Coarticulation effects in fluent speech give rise to “synonymy dilemmas” (= violations of the Principle of Contrast)

“The first way to resolve a synonymy dilemma is to discard all but one of the synonyms. [...] This mode of resolution parallels many of those recorded or reconstructable morphological changes that are typically attributed by historical linguists to ‘levelling’ or ‘analogical extension’” (2010:74).

# “harmony” (1)

“one could rightly [...] portray the operation of false analogy as something highly beneficial for language and claim that only this force – as ‘the beneficent heavenly daughter who freely and easily and joyfully binds that which is alike’ – has brought out the true harmony in the structure of language.” Brugmann (1876: 317–18fn.33)

# “harmony” (2)

Against the great harmony [of a newly emerged morphological subsystem], phonetic transformation operated from the very beginning as an inconspicuous but relentless destructive force [...]. So-called false analogy is not only a necessary consequence of this disruption of the harmony but also, at the same time, a reaction against it, by means of which the memory is freed from the crushing burden of the mass of peculiarities that have imposed themselves on it. Due to the seemingly arbitrary randomness of this burden, the memory is no longer capable of dealing with it (Paul 1877:327–8).

# "symmetry"

"In phonetic change, the symmetry of the system of forms is confronted with a relentless enemy and ravager. It is hard to imagine the degree of disconnectedness, confusion, and incomprehensibility that language would gradually reach if it were obliged to patiently endure the devastations of phonetic change, if no *reaction* against this were possible. But a means for such a reaction is available in *analogical formation*. With its help, language gradually works its way back, again and again, to a more tolerable situation, to firmer connectedness and more functional groupings in inflection and word formation." (Paul 1886:161)

# System congruity and inflectional-class stability

"System congruity is the degree of correspondence of a paradigm (and thus also of an inflectional class), of a subparadigm, or an inflectional form, or of a morphological marker with the system-defining structural properties of a language." (Wurzel 1984:86-7)

"STABLE inflectional classes are [those] whose paradigms follow the implicative pattern of an exclusive or dominant paradigm-structure condition ..." (Wurzel 1989:125)

"System-defining" and "dominant" are defined in terms of type frequency.

# *Machtverhältnisse*

"As soon as a form can, based on its shape, belong to more than one class, [...] Which of the various applicable proportions wins out depends only on the dominance relationships (*Machtverhältnisse*) among them." (Paul 1886:92)

Paul relates his notion of dominance of morphological patterns to both token and type frequency: "both the frequency of the individual words and the number of possible analogous proportions." (1886:88)

# Explicit models

"The model of paradigm learning advocated in this paper always extends the strongest pattern, regardless of whether it is alternating or uniform." (Albright 2005; cf. Hare and Elman 1995)

Accounting for the "typological bias towards paradigm leveling" without positing a preference for stem uniformity.

"I conjecture that morphophonemic alternations typically affect only a smallish subset of the phonemic inventory [...]. The end result is that alternations tend to be the minority pattern, and there will be a tendency to generalize non-alternation, or level." (Albright 2005; cf. Wurzel 1984:169–72; Bybee and Newman 1995; Haspelmath 2006)

Part V:

Where does this leave us?

# One firm conclusion

There are no grounds for maintaining that paradigm leveling has anything to do with "preferences" or an "optimizing impulse", in a teleological sense.

2. But there are some plausible factors that might **bias** morphophonological change towards paradigm leveling

# A bias favoring paradigm leveling?

Some plausible factors that might bias morphophonological change towards paradigm leveling:

1. At the level of the mechanisms of innovation:  
"Intraference" among forms within a paradigm might play a role, alongside extension of existing (non-alternating) patterns in giving rise to leveling innovations.
2. At the level of constraints favoring the occurrence and/or the ultimate success of certain types of innovations over others:  
an acquisition bias grounded in the Principle of Contrast

What do we do with these plausible factors in light of Albright's argument that there are no grounds for positing a uniformity bias?

Wurzel offers one answer: "System-independent" factors are real, but their influence on the course of morpho(phono)logical change pales in comparison to that of the type frequency of different patterns in the system.

## Selected references (1)

- Albright, Adam 2005 The morphological basis of paradigm leveling. In: Laura J. Downing, T. A. Hall, & Renate Raffelsiefen (eds.), *Paradigms in phonological theory*, 17–43. Oxford: Oxford University Press.
- Andersen, Henning. 1980. 'Morphological Change: Towards a Typology', *Historical Morphology*, ed. by Jacek Fisiak, (Trends in Linguistics, Studies and Monographs 17), 1–50. New York: Mouton.
- Bolinger, Dwight. 1977. *Meaning and Form*. New York: Longman.
- Brugmann, Karl 1876. Nasalis sonans in der indogermanischen Grundsprache. In: Georg Curtius & Karl Brugmann (eds.), *Studien zur griechischen und lateinischen Grammatik*, vol. 9, 285–338. Leipzig: Hirzel.
- Bybee, Joan 1980. Morphophonemic change from inside and outside the paradigm. *Lingua* 50: 45–89.
- Curtius, Georg 1860. Das dreisilbengesetz der griechischen und lateinischen betonung. *Zeitschrift für vergleichende Sprachforschung* 9: 321–338.
- Fertig, David 1999. Analogical "leveling" from outside the paradigm: Stem-vowel changes in the German modals. *Diachronica* 16: 233–260.
- Fertig, David 2013 *Analogy and morphological change*. Edinburgh: Edinburgh University Press.
- Garrett, Andrew. 2008. 'Paradigmatic uniformity and markedness', *Linguistic Universals and Language Change*, ed. by Jeff Good, 125–143. Oxford: Oxford University Press.
- Hill, Eugen (2007). 'Proportionale Analogie, paradigmatischer Ausgleich und Formerweiterung: ein Beitrag zur Typologie des morphologischen Wandels'. *Diachronica* 24.81–118.
- Hock, Hans Henrich. 1986. *Principles of Historical Linguistics*. Berlin: Mouton de Gruyter.
- Kiparsky, Paul. 1992. 'Analogy', *International Encyclopedia of Linguistics*, vol. 1, ed. by William Bright, 56–61. New York: Oxford Univ. Press.
- Mańczak, Witold. 1958. 'Tendences générales des changements analogiques'. *Lingua* 7.298–325 and 387–420.
- Markman, Ellen. 1980. Constraints Children Place on Word Meanings. *Cognitive Science* 14.57–77.
- Mayerthaler, Willi. 1981. *Morphologische Natürlichkeit*, (Linguistische Forschungen 28). Wiesbaden: Athenaion.
- McCarthy, John J. 2005. 'Optimal Paradigms', *Paradigms in Phonological Theory*, ed. by Laura J. Downing, T.A. Hall and Renate Raffelsiefen, 170–210. Oxford: Oxford University Press.

## Selected references (2)

Oertel, Hanns 1901 Lectures on the study of language. New York: Scribners.

Paul, Hermann 1877 Die Vocale der Flexions- und Ableitungs-Silben in den aeltesten germanischen Dialecten. Beiträge zur Geschichte der deutschen Sprache und Literatur 4: 315-475.

Paul, Hermann. 1886. Principien der Sprachgeschichte, 2nd ed. Halle: Niemeyer.

Paul, Hermann 1920[1880]. Prinzipien der Sprachgeschichte, 5th edn. [2nd edn. 1886, 3rd edn. 1898, 4th edn. 1909.] Halle: Max Niemeyer.

Samuels, Michael L. 1972. Linguistic Evolution, Cambridge: Cambridge University Press.

Steriade, Donca (2000). 'Paradigm uniformity and the phonetics-phonology boundary', Papers in Laboratory Phonology 5, ed. by Michael Broe and Janet Pierrehumbert, 313-334. Cambridge: Cambridge University Press.

Wheeler, Benjamin Ide 1887 Analogy and the scope of its application in language. Ithaca, NY: John Wilson and Son University Press.

Wundt, Wilhelm 1904 Völkerpsychologie, vol. 1: Die Sprache, part 1, 2nd edn. Leipzig: Engelmann.

Wurzel, Wolfgang Ullrich (1984). Flexionsmorphologie und Natürlichkeit, (studia grammatica 21). Berlin: Akademie-Verlag.