A dependency account of the fortis-lenis contrast in Cama

Botma, E.D.; Smith, N.S.H.

Published in:
Linguistics in the Netherlands 2006

A dependency account of the fortis–lenis contrast in Cama*

Bert Botma and Norval Smith
University of Leiden/LUCL / University of Amsterdam/ACLC

1. Introduction

In this paper we offer a dependency-based analysis of the fortis–lenis contrast in Cama (also known as Ebrié), a Kwa language of the Potou subfamily spoken in the environs of Abidjan, the capital of the Ivory Coast. The challenge posed by Cama is that the language contrasts no fewer than four stop types, which have been categorized by Stewart (1973) as voiceless and voiced fortis, and voiceless and voiced lenis. In this respect, Cama is a modern instantiation of Stewart's (1973) reconstructed stop system for Proto-Volta-Bantu.

It is tempting to assume that all that is needed to account for the Cama facts are two binary features, say [lenis] and [voice]; though note that a feature [lenis] is not usually considered to be necessary. However, closer inspection reveals that things do not work as neatly as such an approach would forecast. The voiced fortis stops, roughly equivalent to the voiced stops of Dutch, condition a low tone on a following vowel, something that is not infrequent in tone languages. The voiced lenis stops, however, do not trigger tone lowering, which suggests that lenis voicing is of a different nature than fortis voicing. The voiced fortes and lenes also display different behaviour before nasalized vowels, where voiced lenes surface as nasals while voiced fortes remain unaffected.

In view of these observations, an alternative account is needed. Following Clements (2000), we claim that the lenis stops of Cama are most appropriately treated as sonorants. Clements analyzes stops in Cama-type languages in terms of the binary features [sonorant] and [voice]. However, like a [lenis, voice] account, this is observationally, but not explanatorily, adequate. We will argue that an account of the Cama stops in terms of the Element-based Dependency model of Botma (2004) is more adequate, both in terms of their phonological behaviour and their relative markedness.

Linguistics in the Netherlands 2006, **15–27**.
ISSN 0929–7332 / E-ISSN 1569–9919

This paper is organized as follows. In §2 we outline the main tenets of Element-based Dependency, paying particular attention to the representation of manner and phonation. In §3 we argue that the fortis and lenis stops of Cama differ in their manner of articulation. Specifically, our claim is that the manner structure of lenis stops contains the element |L|, which implies that they have the status of sonorants. §4 concludes.

2. Element-based Dependency

Element-based Dependency combines insights from Element Theory (cf. Harris & Lindsey 1995) and Dependency Phonology (cf. especially Anderson & Ewen 1987 and Smith 2000). The general segmental structure that is assumed is given in (1), where "O", "N" and "C" are short for onset, nucleus and coda. (Below, all consonants are dominated by onsets and all vowels by nuclei.)

(1) {O, N, C}

manner phonation

place

In (1), the manner and place components together form what may be termed the segmental "core". The phonation component forms a dependent of this core. This is in line with the observation that it is unmarked for a segment to be specified for manner and place, but marked for a segment to be specified for phonation.

As regards segmental content, Element-based Dependency uses a subset of the elements that are used in Element Theory: the "amplitude drop" element |ʔ|, the "high-tone" element |H| and the "low-tone" element |L|. These three elements represent both the manner and laryngeal aspects of segments, depending on their position in the segmental structure. Place is represented by the elements |A,I,U| and combinations of these; for a similar treatment of place, see e.g. van de Weijer (1996) and references there.

In their capacity as manner elements, |ʔ,H,L| have the following articulatory and acoustic interpretations:

(2)

		Articulatory interpretation	*Acoustic interpretation*
ʔ	:	complete closure	energy reduction
H	:	close approximation	aperiodicity
L	:	open approximation	periodicity

The articulatory interpretation of |ʔ,H,L| corresponds to the traditional three-way manner distinction in terms of degree of oral stricture. In the absence of place, |ʔ,H,L| have an autonomous interpretation: |ʔ| denotes [ʔ], |H| denotes [h], and |L| denotes a neutral or "placeless" vowel, typically [ə].

In combination with place, |ʔ,H,L| denote stop, sibilant and vocalic manner. This is motivated by the observation that plosives, sibilants and vowels are the unmarked segmental instantiations of the properties associated with |ʔ,H,L|.[1]

(3)	ʔ	:	plosive	(unmarked stop type)
	H	:	sibilant	(unmarked fricative type)
	L	:	vowel	(unmarked sonorant type)

Consider as an illustration the structures in (4). (Here and below, |A,I,U| denote velar, coronal and labial place, respectively.)

	a.	b.	c.	d.
(4)	O	O	O	N
	|	|	|	|
	ʔ	H	L	L
	|	|	|	|
	A	I	U	U
	/k/	/s/	/w/	/u/

In (4c,d), the difference between a vocalic and a consonantal realization depends on whether the manner component is dominated by an onset or by a nucleus.

|ʔ,H,L| may also enter into dominance relations, which results in "complex" manner types. An example is given in (5), where |L| dominates |ʔ|. This structure involves a combination of sonorancy and stopness; we call this segment type a "sonorant stop".

(5)

O
|
L
|
ʔ
|
U

[m~b~^{m}b]

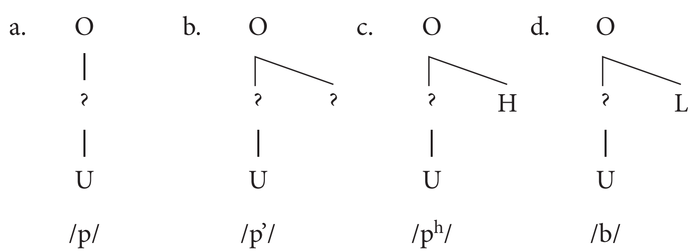
The dominance relation in (5) is motivated by the interaction between manner and prosodic interpretation on the one hand, and manner and place on the other. Sonorant stops function as sonorants for the purposes of prosodic interpretation. As such we expect this segment type to be able to occur in relatively "vocalic" positions, such as the coda.[2] The presence of |ʔ| in the manner component implies that sonorant stops have the same range of place contrasts as plosives; as regards place, sonorant stops typically pattern as obstruent stops.

In Botma (2004), it is argued that the phonetic realization of sonorant stops is variable, and ranges between a voiced oral consonant, a nasal consonant and a nasal contour. This variability is in part a matter of free variation, and is in part dependent on the phonological system of the language concerned (see Botma 2004 for further details). In most languages, sonorant stops are realized as nasals, presumably because the acoustic signature of nasals offers the perceptually most salient compromise between sonorancy and stopness.[3] However, there are some languages in which sonorant stops surface as oral. Indeed, we will see in §3 that the voiced lenis stops of Cama are most appropriately viewed as sonorant stops.

The interpretation of |ʔ,H,L| as phonation elements is given in (6):

(6) ʔ : glottal constriction
H : glottal widening
L : voice or nasalization

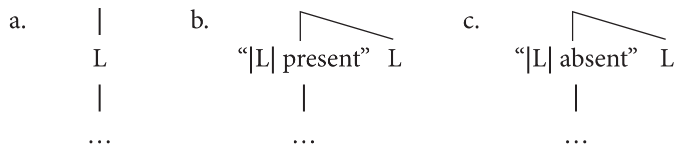
Consider the examples in (7). (7a) represents an unmarked labial stop, containing a manner component |ʔ| dominating |U|. (7b-d) represent more marked options. (7b) has a dependent |ʔ|, which denotes glottal constriction; a frequent realization of this structure is that of ejective [p']. (7c) has a dependent |H|, and is typically realized as aspirated [pʰ]. A labial stop structure with dependent |L|, as in (7d), denotes voiced [b].

(7)


The phonation component cannot contain more than one element. This is in line with the assumption that heads permit greater complexity than dependents (see e.g. Dresher & van der Hulst 1995).

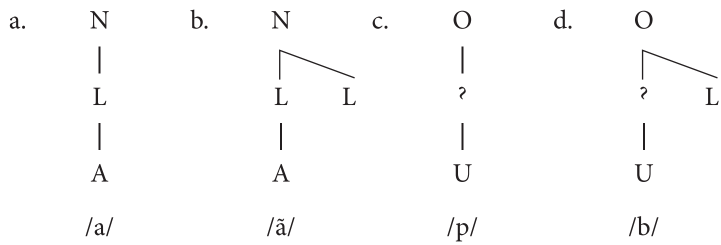
A key assumption of Element-based Dependency is that the interpretation of elements depends on their position in the segmental structure. A case in point is the element |L|. |L| has the articulatory correlate of open approximation and the acoustic correlate of periodicity, but the specific interpretation of |L| depends on its structural position. If |L| occurs as a manner element, i.e. as (part of the) head, as in (8a), the segment is identified as a sonorant. If |L| occurs as a phonation element, i.e. as dependent, its interpretation is variable: |L| denotes nasalization if there is also an |L| present in the head, as in (8b), and it denotes voice if there is no |L| present in the head, as in (8c):

(8)



Consider the examples in (9):

(9)



(9a) represents the low vowel /a/, which has a manner component consisting of |L| only; this |L| is dominated by the nucleus, and itself dominates |A|. Nasalized /ã/ in (9b) is like /a/, but has an additional dependent |L|; since there is another |L| in the manner structure, the dependent |L| denotes nasalization. (9c) represents a voiceless labial plosive /p/. (9d), which represents /b/, differs from (9c) in that it has an additional dependent |L|. This |L| denotes voice, given that there is no |L| present in the manner head. The context-sensitive interpretation of dependent |L| therefore embodies the claim that voice and nasalization are in complementary distribution at the phonological level (see Botma 2004 for support).

After this necessarily lengthy introduction, we are now ready to examine the representation of the Cama stops. Our main claim will be that the fortis and lenis stops are differentiated from each other by the presence of |L| in the manner structure of the latter. This therefore identifies the lenis stops as sonorants, which is supported by their phonetic properties and their phonological behaviour.

3. The Cama stop system

The Cama stop system is described by Stewart (1973) as involving an opposition between voiceless fortis and voiced fortis stops, and voiceless lenis and voiced lenis stops. Stewart's classification is given in (10), illustrated for labial place:

(10)

stops			
fortis		lenis	
voiceless	voiced	voiceless	voiced
/p/	/b/	/'p/	/'b/

We will follow Stewart's convention of representing lenis stops with a preceding apostrophe.

Traditionally, the labels fortis (i.e. "strong") and lenis (i.e. "weak") are used to describe the two contrasting series of obstruents as are found in the Germanic languages. The terms are descriptive, lacking any predictive power. For instance, it is generally accepted that in Dutch the lenis series is marked: the fortis–lenis opposition in Dutch is realized as a voicing contrast, with the lenis voiced series being neutralized to fortis voiceless syllable-finally. In Icelandic, on the other hand, there are good grounds to take the fortis series as being marked: here the fortis–lenis opposition is implemented as an aspiration contrast, with the fortis aspirates surfacing as aspirated in foot-initial position only (cf. the description in Árnason 1980). These facts indicate that there is more than one way in which a language can implement a fortis–lenis contrast. Matters are further complicated by a language such as Cama, which contrasts more than two types of stops. The two fortis stop series of Cama display an opposition which, according Stewart's (1973) description, is rather similar to the voicing opposition in Dutch — but the terminological confusion is that the voiced stops of Dutch are traditionally called lenis.

Despite this confusion, it does appear to be the case that fortis and lenis are each associated with certain phonetic properties. Regarding the fortis stops of English, for instance, Stahlke (2004) notes the following correlates:

(11) Phonetic correlates of fortis
 a. more energy
 b. greater duration
 c. more rapid closure

d. greater air pressure
e. greater contact area in articulation
f. greater muscular effort

Not all these correlates are independent. For instance, if the greater duration of fortis stops is equated with a prolonged stop phase, then the greater air pressure follows automatically from this.

The correlates in (11) create the impression that fortis involve "more". This leads us to expect that lenis, being the opposite of fortis, involves "less". This expectation is confirmed by the properties of the lenis stops in Kwa as described by Stewart (1973, 1989), Clements (2000) and Clements & Osu (2002). The lenis stops of Cama are produced with less energy than their fortis counterparts, they have a shorter duration, they involve spontaneous voicing and they are realized as non-exploded, often with an implosive quality. Much the same properties have been observed by Elugbe (1980) for the lenis stops of Edoid, which we briefly consider below, and by Kaye (1981) for the implosives of Kru. The absence of air pressure build-up which characterizes the lenis stops of Cama and related languages suggests that these stops qualify as sonorants. Consider the definition of sonorancy given by Halle & Clements (1983:6), cited by Stewart (1973:232):

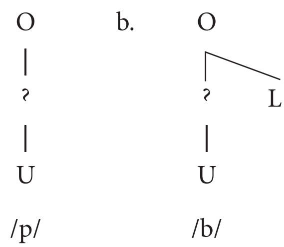
> Sonorant sounds are produced with a vocal tract configuration sufficiently open that the air pressure inside and outside the mouth is approximately equal. Obstruent sounds are produced with a vocal tract constriction sufficient to increase the air pressure inside the mouth significantly over that of the ambient air.

An analysis of lenis stops as sonorants, in both Cama and related languages, is also supported by their phonological behaviour. A general argument for this concerns the status of voicing, which is marked in fortis stops but unmarked in lenis stops. Most Kwa languages, e.g. Ewe, Fon and Gen, have a voiced series of lenis stops only. This mirrors the more familiar and cross-linguistically rather more frequent situation that is exemplified by Dutch, where obstruents display a voicing contrast while sonorants are redundantly voiced. Note that this argument can be extended to include implosive stops. In his discussion of the fortis–lenis contrast in Kwa, Clements (2000:132) notes that the natural state for implosives is to be voiced. From this he concludes that implosives function as sonorants, a claim that is corroborated by the observation that the distribution of implosives generally parallels that of nasals and liquids (cf. Clements 2000:132).

Additional support for the sonorant status of lenis stops comes from the observation that lenis stops, parallel to sonorants, generally fail to trigger tone lowering in adjacent vowels (see e.g. Bradshaw 1999, Clements 2000). In Cama, only the voiced fortis stops, i.e. obstruent stops with marked voicing, trigger tone lowering, as we will see below.

We interpret the properties of fortis and lenis stops as described above to mean that in Cama the former are obstruents and the latter are sonorants. Turning first to the representation of the two fortis stop series, we propose that these have structures such as in (12a,b). (Cama fortis stops are found in onset position only.)

(12) a. b.



The voiceless fortis stop in (12a) is maximally unmarked: it has a simple manner structure and lacks dependent structure. This reflects its (lack of) phonological activity: voiceless fortis stops do not trigger any segmental or tonal changes.

The voiced fortis stop in (12b) also has a simple manner structure, but it is marked on account of the presence of dependent |L|, which, since it is linked to obstruent manner, denotes voicing. The presence of |L| correctly identifies voiced obstruents as marked. In addition, voiced fortis stops in Cama trigger allophonic tone lowering, as is illustrated by the examples in (13) (here and below, all Cama data are taken from Stewart 1973):[4]

(13)	/ã́dú/	→	[ńdù]	'water'
	/ágbá/	→	[ágbà]	'cold'
	/ã́jʒɛ́/	→	[ã́jʒɛ̀]	'ear'

Allophonic tone lowering does not result in tone neutralization, since underlying final tones have a falling realization; compare the forms in (17) below.

In our model there is a natural relation between fortis voicing and low tone, in that both are expressed by the dependent low-tone element |L|. We leave the specific nature of the interaction between fortis voicing and low tone for further research, however.

Turning next to the lenis stops, we propose that these have structures such as those in (14). (Like fortis stops, lenis stops are restricted to onset positions.)

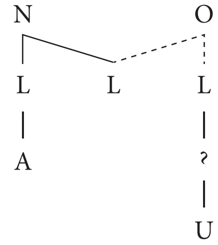
(14)	a.	O	b.	O	
		|		|	
		L		L	H
		|		|	
		ʔ		ʔ	
		|		|	
		U		U	
		/ʼb/		/ʼp/	

Observe first of all that the lenis stops are marked as compared to the fortis stops on account of their complex manner structure, which contains an additional |L|. This seems reasonable on the grounds that they are sonorant stops, i.e. stops with added sonorancy. Note in this respect that Elugbe (1980:41), in his discussion of the fortis–lenis contrast in Edoid, asserts that "the non-lenis consonants of the Edoid languages are more likely to be found in other non-Edoid languages than their lenis counterparts, which are more 'unusual' in phonetic terms". He goes on to note that in the northern Edoid language Ghotuo, lenis sounds are acquired later than non-lenis sounds.

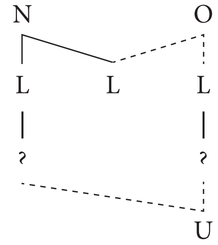
An important consequence of the analysis of voiced lenes as sonorant stops is that it makes such stops potential targets for nasalization. The point is that the presence of |L| in the manner head implies that an associated *dependent* |L| will be interpreted as nasalization. In Cama, nasalization of voiced lenis stops applies in the context of a preceding nasalized vowel, as in the forms in (15):

(15)	/ã́ʼbɛ́/	→	[ḿmɛ́]	'trap'
	/ã́ʼdɔ́/	→	[ńnɔ́]	'tooth'
	/ã́ʼdã́/	→	[ńnã́]	'animal'

Following Stewart (1973), who assumes that the noun class marker preceding the stop is an underlyingly nasalized vowel, this process can be represented as in (16a), using the form for 'trap' as an example. In Stewart's analysis an additional process is required to turn the nasalized vowel into a nasal. This process would not be necessary if the noun class marker is a nasal consonant instead, which seems feasible for at least some of the forms that Stewart provides (see also n.4). According to the latter assumption, the process can be represented as in (16b), where the nasal trigger consists of an underlyingly high-toned sonorant stop with dependent |L|, which is underspecified for place. Dependent |L| spreads to the lenis stop, nasalizing it, while the place element of the lenis stop, in this case |U|, spreads to the nasal trigger:

(16) a. 

/ã́’bɛ́/ → [ḿmɛ́]

b. 

/Ń’bɛ́/ → [ḿmɛ́]

It is the relation between sonorancy, voice and nasalization — formalized in terms of |L| — which makes the present approach superior to an analysis in terms of traditional binary features. In the latter type of approach, the relation between lenis stops and nasalization must be stipulated. In the present approach, it simply results from the context-sensitive interpretation of |L|. More generally, traditional feature-based accounts fail to account for the difference in markedness relations between fortis and lenis voicing. In our approach this difference follows from the difference in the structural position of |L|. Voicing is unmarked or "spontaneous" if |L| forms part of the manner component; voicing is marked, and distinctive, if |L| is a dependent of an obstruent manner component.

Our representation of the voiceless lenis series in terms of dependent |H|, as in (14b), is more tentative. A theory-internal argument for it is that the presence of dependent |H| rules out voiceless lenes as nasalization targets. The data in (17) indicate that voiceless lenis stops do not nasalize in the context of a preceding nasalized vowel. (The exclamation mark is Stewart's description of a falling tone or "downglide".)

(17)	/ã́’tɔ́/	→	[ń’tɔ́]	‘urine’
	/ã́’tʊ̀/	→	[ń’tʊ́!]	‘sand’
	/ã́’tà/	→	[ń’tá!]	‘leg’

Clearly, more evidence is needed to substantiate this representation.

Further support for dependent |H| comes from the realization of voiceless lenis stops. While the available descriptions indicate that voiceless lenis stops are unaspirated, this does not rule out a representation in terms of dependent |H|. As was noted in (6), we take the general phonetic correlate of dependent |H| to be glottal widening. Given that vocal cord abduction inhibits voicing, we therefore expect sonorant stops with dependent |H| to have realizations which include slack voice, breathy voice or, as is apparently the case in Cama, voicelessness.

Another argument for dependent |H| is comparative. According to Stewart (1973), the four-way stop contrast of Cama dates back to Proto-Benue-Kwa, the ancestor language of Kwa (of which Cama is a member), West-Benue-Congo (which comprises, among others, the Edoid languages) and East-Benue-Congo (which comprises, among others, the Bantu languages). If the voiceless lenes of Proto-Benue-Kwa were sonorant stops with dependent |H|, we expect to find evidence for this |H| in at least some daughter languages. One type of evidence for |H| comes from the Edoid branch of West-Benue-Congo, where the voiceless lenis stops reconstructed for Proto-Edo have fricative and breathy voiced reflexes in at least some modern Edo languages (data from Elugbe 1980). Fricatives and breathy voiced sounds, like voiceless sonorant stops, have |H| as part of their segmental make-up.

(18)	a.	P-Edo	’kʊ (‘be heavy’)	b.	P-Edo	ʼcuene (‘hear’)
		Yekhee	’kua		Yekhee	so
		Avbiele	’kua~’xua		Ibilo	ʒʱo
		Edo	xua		Oloma	zʱo
		Egene	’kʊɛ		Edo	hõ

At present, we do not know whether there are any fricative or breathy voiced reflexes in Kwa, nor are we aware of any Kwa languages in which the original voiceless lenes have aspirated reflexes. Further research, particularly within the Kwa branch, is needed to substantiate our analysis.

A further argument for |H| being part of the specification of voiceless lenes comes from another branch of Benue-Kwa. The Atlantic language Seereer-Siin has a voiceless implosive series in contrast to the more normal voiced implosive series (McLaughlin 2005). McLaughlin notes that oral pressure measurements of both series support Clements & Osu’s (2002) position that implosives are non-explosive rather than strictly implosive. The voiceless implosives of Seereer-Siin typically display a period of silence followed by *prevoicing* before the release of the closure. This reminds us of the prevoicing that is found in “voiceless”, i.e. aspirated sonorants. Compare Scottish English <wh> as in *where*, *whistle*, which is realized with an aspirated portion followed by prevoicing before a following vowel, as is suggested by its frequent representation as [hw]. Much the same realization is reported by Okell (1969) for the “voiceless” sonorants of Burmese.

4. Conclusion

In this paper we have offered a dependency-based account of the stop system of Cama. Cama has a four-way opposition with fortis and lenis voiced and voiceless stops in all four combinations. The Cama stop system presents a challenge, since an adequate account of it must not only describe the contrasts, but also explain the phonological behaviour of each of the stops. Approaches which make use of binary features such as [voice], [lenis] and [sonorant] succeed in the former, but not the latter. Specifically, such approaches fail to make explicit the different status of voicing in fortis and lenis stops, and the fact that only the voiced lenis stops are potential targets for nasalization. In these respects, a dependency-based account in which nasalization, voice and sonorancy are all expressed in terms of one and the same phonological element, i.e. |L|, is both more restrictive and more adequate.

Notes

* It is with great sadness that the authors of this article have heard of the death of John Stewart on the 22nd of May. John Stewart made a notable contribution to African linguistics during his career. He was one of the minority of linguists who combined valuable descriptive and theoretical contributions to the field.

His last university appointment was as Professor of African Linguistics at the University of Leiden, a position he was unfortunately forced to retire from prematurely due to ill health. He continued to attend conferences, and contribute to scientific discussions on African language phonology and historical phonology until his stroke about a year ago.

Therefore the authors would like to dedicate this article to his memory.

1. For arguments that sibilants are the unmarked fricative type, see Smith (2000).

2. By "coda" we simply mean syllable-final position. Cross-linguistic evidence suggests that sonorant consonants are relatively unmarked in this position (see e.g. Goldsmith 1990 for an overview).

3. The interpretation of sonorant stops as nasals is supported by two observations: (1) many languages restrict the range of coda consonants to nasals, and (2) the range of place contrasts in nasals typically parallels that of plosives (see e.g. Maddieson 1984).

4. We follow Stewart's (1973) assumption that the underlying forms contain an initial nasalized vowel, which functions as a noun class marker. However, as far as the data under discussion are concerned, an underlying nasal consonant that is underspecified for place seems a feasible alternative; see also (16b) below.

References

Anderson, John & Colin Ewen. 1987. *Principles of Dependency Phonology.* Cambridge: Cambridge University Press.

Árnason, Kristján. 1980. *Quantity in historical phonology: Icelandic and related cases*. Cambridge: Cambridge University Press.

Botma, Bert. 2004. *Phonological aspects of nasality: An Element-based Dependency approach*. Ph.D. diss., University of Amsterdam (published by LOT, Utrecht).
Bradshaw, Mary. 1999. A Cross-linguistic study of consonant–tone interaction. Ph.D. diss., Ohio State University.
Clements, Nick. 2000. "Phonology". *African languages: An introduction* ed. by Bernd Heine & Derek Nurse, 123–160. Cambridge: Cambridge University Press.
Clements, Nick & Sylvester Osu. 2002. "Explosives, implosives and nonexplosives: The linguistic function of air pressure differences in stops. *Laboratory Phonology 7* ed. by Carlos Gussenhoven & Natasha Warner, 299–350. Berlin & New York: Mouton de Gruyter.
Dresher, Elan & Harry van der Hulst. 1995. "Head–dependent asymmetries in phonology". *Leiden in Last* (= *HIL Phonology Papers I*) ed. by Harry van der Hulst & Jeroen van de Weijer, 401–431. The Hague: Holland Academic Graphics.
Elugbe, Ben. 1980. "Reconstructing the lenis feature in Proto-Edoid". *Journal of African Languages and Linguistics* 2.39–67.
Goldsmith, John. 1990. *Autosegmental and metrical phonology*. Oxford: Basil Blackwell.
Halle, Morris & Nick Clements. 1983. *Problem book in phonology: A workbook for introductory courses in linguistics and modern phonology*. Cambridge, Mass.: MIT Press.
Harris, John & Geoff Lindsey. 1995. "The elements of phonological representation". *Frontiers of phonology* ed. by Jacques Durand & Francis Katamba, 34–79. London & New York: Longman.
Kaye, Jonathan. 1981. "Implosives as liquids". *Studies in African Linguistics, Supplement* 8.78–81.
Maddieson, Ian. 1984. *Patterns of sounds*. Cambridge: Cambridge University Press.
McLaughlin, Fiona. 2005. "Voiceless implosives in Seereer-Siin". *Journal of the International Phonetic Association* 35.201–214.
Okell, John. 1969. *A reference grammar of Burmese*. London: Oxford University Press.
Smith, Norval. 2000. "Dependency Phonology meets OT: A proposal for a new approach to segmental structure". *Optimality Theory: Phonology, syntax, and acquisition* ed. by Joost Dekkers, Frank van der Leeuw & Jeroen van de Weijer, 234–276. Oxford: Oxford University Press.
Stahlke, Herbert. 2004. "Fortis and lenis obstruents in English". *Word* 54.191–217.
Stewart, John. 1973. "The lenis stops of the Potou-Lagoon languages". *The Research Review, Supplement 4: Papers in Ghanaian Linguistics*.
Stewart, John. 1989. "Kwa". *The Niger-Congo languages* ed. by John Bendor-Samuel, 217–245. Landham: University Press of America.
Weijer, Jeroen van de. 1996. *Segmental structure and complex segments*. Tübingen: Niemeyer.