Tonal oral reading errors in
# the orthography of Eastern Dan
(Côte d'Ivoire)

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Disciplinary field of study: Tone orthography

ABSTRACT

This article assesses tonal oral reading errors in the 1982 orthography of Eastern Dan, a South Mande language of Côte d'Ivoire. Fifty-seven adult participants orally read four narrative texts presented with and without tone marks. Subsequent linguistic analysis of tonal errors identified six possible causes: dialect diversity, homophony, tonal minimal pairs, alternating visually similar words, under-representation of longer words, and misspelled words. Extending the analysis to errors on individual tones reveals that the orthographic strategies for marking mid, low, extra-low and contour tones do not attract more tonal errors than any other tone. The paper concludes by acknowledging that many tonal errors are apparently not linguistically motivated at all and are probably due to lack of regular reading practice given the current stagnation in the literacy program.

Keywords: tone orthography, oral reading errors, experimental linguistics, Mande languages
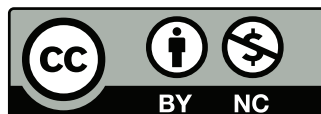
ABOUT THE AUTHORS

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1. INTRODUCTION

This article investigates the possible sources of tonal errors when orally reading Eastern Dan, a South Mande Niger-Congo language of Côte d'Ivoire.[1] Eastern Dan's unusually rich tonal inventory – it has five level tones and six contours (Flik 1977, Vydrine and Késségbeu 2008, 10-11) – and word structures largely restricted to one metric foot (Vydrine 2010b) combine to tone having an exceptionally heavy functional load. The first orthography developers opted for a novel solution that is quite distinct from the classic African strategy of superscript diacritics: using word initial and word final punctuation marks that could easily be reproduced on the manual typewriters of the time. This tone orthography was first developed in 1974, and survived a State imposed reform in 1982. It was also adopted by several Mande, Kru and Kwa languages in Côte d'Ivoire, not to mention being validated by the Ivoirian government (ILA 1979, 18-21).

Three studies have recently assessed the 1982 Eastern Dan orthography and have contributed to discussions among orthography stakeholders about possible reform.[2] In the first, Roberts (submitted) recorded fifty-seven mostly non-fluent adults reading four previously unseen narrative texts with and without tone marks. They measured speed, accuracy, and comprehension, and controlled for various linguistic and demographic variables. Statistical analysis revealed that punctuation marks indicating tone do not contribute to gains in reading speed; neither do they greatly facilitate comprehension. Granted, they do slightly reduce the number of tonal errors, but their average number is much higher in Eastern Dan than in the nine other Niger-Congo languages tested,[3] irrespective of whether tone is marked. As for writing, the average success rate in adding accents to zero tone texts was just over 60%, and only two participants scored over 90%.

In the second study Roberts et al. (forthcoming) propose a standardized methodology for quantifying the level of written ambiguity if tone is not marked in an orthography. The results show that the functional load of tone is far heavier in Eastern Dan than it is with the two other languages with which it is compared: Mbelime, a Gur language of Benin, and Elip, a Bantu A language of Cameroon.

In a third study, Roberts, Vydrin, and Basnight-Brown (forthcoming) tested a radical proposal for orthography reform that advocates, among other things, superscript diacritics instead of punctuation for marking tone. Sixty-eight participants with no previous exposure to written Eastern Dan were taught various combinations of tones and segments in parallel groups and their acquired skills were tested in dictation and oral reading tasks. The results of writing, reading speed (list and text), and reading errors (list) suggest that, in spite of the results of the first experiment, marking tone with punctuation is slightly more effective than marking superscript diacritics, and that the lack of biunique segmental correspondence is more of a challenge to

[3] The languages in question were Elip, Mmala, Yangben (Bantu A62), Yoruba, Idaasha, Ife (Ede), Nateni, Mbelime and Tem (Gur). None of these languages has a tone inventory as elaborate as Eastern Dan.

readers than marking tone.[4] Nevertheless, orthography stakeholders have recently taken the decision to adopt the entire reform (Vydrin, Zeh, and Gué 2019, Zeh 2018).

The present article complements these three studies with a fourth, more intensively linguistic analysis of the words and phrases that attracted a concentration of tonal errors in the oral reading task of the first study on the 1982 orthography, in an attempt to establish the possible causes. The methodology is exploratory, and as such can only make hypothetical predictions about the causes of tonal dysfluencies, but is nevertheless profitable as it seeks to establish potential links between literacy behaviour and linguistic structure.

The article is structured as follows. Section 2 surveys the existing literature on Eastern Dan linguistics and assessment of oral reading errors. Section 3 describes the Eastern Dan ethno-literacy context and the profile of the orthography. Section 4 introduces the methodology, Section 5 lists possible sources of tonal error peaks, and Section 6 investigates errors on individual tones. Section 7 discusses the results and makes some concluding remarks.

Orthographic data appears between <chevrons>, phonemic data between /forward slashes/, and phonetic data between [square brackets]. In phonemic and phonetic transcriptions, the palatal approximant [j] is transcribed [y] following the Africanist tradition and nasal vowels are marked with a subscript tilde [◌]. Tone marking conventions are presented in Section 3.2.3.

2. PREVIOUS RESEARCH

Early linguistic research on Eastern Dan includes a phonology sketch (Bearth and Zemp 1967), and studies of dialect mutual intelligibility (Bolli, Flik, and Bendor-Samuel 1972), prosody (Bolli 1976), tone (Flik 1977), tense-aspect and discourse (Flik 1978). More recently, Valentin Vydrin has published analyses of adjectives (2007), nominal declination (2011), tonal inflection (2016), quantifiers (2017), an overview of the language (Vydrine 2017) and a bilingual dictionary that includes an extensive grammatical sketch (Vydrine and Kességbeu 2008). References to Eastern Dan are also found throughout the same author's wider work on the Mande family (2006, 2009a, b, c, 2010a, b, 2002).

As for the history of oral reading error assessment, according to Johnston (1985) it can be traced back to the 19th century, but it was Kenneth Goodman (1969, 1965) who was the first to vigorously promote detailed analysis of oral reading errors[5] as a diagnostic tool to assess children's learning difficulties. It has since become a widely accepted educational technique in the English-speaking world (Brown, Goodman, and Marek 1996, Wilde 2000). More recently, research on oral reading errors has diversified to non-Western languages such as Chinese (Wu and Anderson 2007), Thai (Winskel and Iemwanthong 2010), Setswana (Lekgoko and Winskel 2008), Kiswahili, Dholuo and Gikuyu (Piper, Schroeder, and Trudell 2016).

Narrowing the focus to research that specifically investigates tone languages, all the early African experiments included some measure of accuracy, notably in Efik (Essien 1977), Bafut, Limbum (Mfonyam 1989), Kom (Bernard, Mbeh, and Handwerker 2002) and Dschang (Bird 1999b). However, none of these studies follow Bird's (1999a, 28) recommendation that

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[4] It should be noted that the time constraints of the training intervention led us to work with test materials containing only short words, whereas one of the advantages of the proposed orthography is that it permits biunique representation of tone on long words. See (Roberts, Vydrin, and Basnight-Brown (submitted) for more details.

[5] Goodman coined the term "miscue analysis" for this purpose, but since this term is so closely associated with the "whole language" theory of reading, we avoid it in favour of the more neutral "error analysis".

"[…w]e should undertake meticulous error analysis to see which words and constructions cause problems in practice" as a way of assessing whether, how and how much tone to mark in the orthography. This approach is exemplified in an analysis of the conditional clause in Kabiye, a Gur language of Togo (Roberts 2010) and it is this latter approach that we adopt in the analysis of Eastern Dan tonal reading errors presented in this paper.

3. EASTERN DAN

3.1 ETHNO-LITERACY CONTEXT

A word is in order concerning the Eastern Dan ethno-literacy context. In the 1970s, those involved in the process of orthography development remarked that the Dan people manifested "an intense, sustained, desire […] for reading their language" (Bolli 1980, 7) and that early literacy initiatives enjoyed "spectacular" results (Thomas 1978, 1), with teachers trained in their hundreds (Bolli 1983, 5), and students, many of them in their twenties, in their thousands (Lauber 1983). However, this is far from the case now. Literacy activities went into spiral decline during and following the two civil wars in 2002-2011 and the few literacy initiatives currently on offer tend to attract older people. Table 1 shows that, in the broader ten language study, the Eastern Dan participants, although they had been literate in their L1 for four years longer than average, actually self-assessed as reading and writing considerably less frequently than did those in other languages.[6]

Table 1: *Mean L1 Experience, Reading Frequency and Writing Frequency in Eastern Dan and in ten languages*

	L1 EXPERIENCE (years)	READING FREQUENCY (Days p/year)	WRITING FREQUENCY (Days p/year)
E Dan	19	245	141
Ten languages	15	339	270

3.2 ORTHOGRAPHY

The following sections describe the linguistic profile of the 1982 orthography that was in use until the 2018 orthography reform, and on which this study is based.

3.2.1 Consonants

Table 2 presents the consonant phoneme inventory. Where the corresponding graphemes differ from their IPA equivalents, they are indicated in chevrons.

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[6] We also observe that experiment participants in all the languages tended to be over-generous in their self-assessment of how often they use their literacy skills.

Table 2: *Consonantal grapheme-phoneme correspondences in the 1982 Eastern Dan orthography (Vydrine and Kességbeu 2008, 9-10, SIL 1982, 4)*

	Labial	Dental	Palatal	Velar	Labio-velar
Voiceless stops	p	t		k	kp, kw
Voiced stops	b	d		g	gb, gw
Voiceless fricatives	f	s			
Voiced fricatives	v	z			
Implosives	ɓ <bh, m>	ɗ <dh, n>			
Continuants		l <l, r>	y		w

The existing orthography contains three cases of consonant over-representation: the phoneme /l/ is pronounced [ɾ] and spelled <r> following a coronal consonant; the phoneme /ɓ/ is pronounced [m] and spelled <m> preceding a nasal vowel; and the phoneme /ɗ/ is pronounced [n] and spelled <n> preceding a nasal vowel.

3.2.2 Vowels

Table 3 presents the vowel phoneme inventory. Where the corresponding graphemes differ from their IPA equivalents, they are indicated in chevrons.

Table 3: *Vocalic grapheme-phoneme correspondences in the 1982 Eastern Dan orthography (Vydrine and Kességbeu 2008, 7-9, SIL 1982, 8)*

Oral				Nasal		
Front	Back			Front	Back	
Unrounded	Unrounded	Rounded		Unrounded	Unrounded	Rounded
			ŋ <ng>			
i	ɯ <ü>	u		ĩ <in>	ɯ̃ <ün>	ũ <un>
e <e, ι>	ɤ <ö, ü>	o <o, ʋ>				
ɛ	ʌ <ë>	ɔ		ɛ̃ <ɛn>	ʌ̃ <ën>	õ <ɔn>
æ <ɛa>	a	ɒ <aɔ>		æ̃ <ɛan>	ã <an>	ɒ̃ <aɔn>

The existing orthography contains three cases of vowel over-representation, at least in the standard Gweetaa dialect:[7] in a xH tone foot, the phoneme /e/ is pronounced [ɪ], the phoneme /o/ is pronounced [ʊ], and the phoneme /ɤ/ is pronounced [ʏ].[8] The velar nasal /ŋ/ is best interpreted as a vowel with a restricted distribution.[9]

3.2.3 Tones

Table 4 presents the tone phonemes with their grapheme correspondences. Level tones are marked with punctuation preceding the word. Contour tones are marked with the first tone mark word initially and the second tone mark word finally (Bolli ms 1989, 1978, SIL 1982, 12-13). Tone is under-represented in words longer than one foot. No automatic downstep is attested, and scarcely any tonal processes occur.

***Table 4**: Inventory of tones and their graphic equivalents in the 1982 Eastern Dan orthography*

		IPA	1982 orthography
Level tones	xH	/ő/	<″○>
	H	/ó/	<′○>
	M	/ō/	<○>
	L	/ò/	<_○>
	xL	/ȍ/	<-○>
Falling tones	xH-xL	/őȍ/	<″○○->
	H-xL[10]	/óȍ/	<′○○->
	M-xL[11]	/ōȍ/	<○○->
	L-xL	/òȍ/	<_○○->
Rising tones	M-H	/ōó/	<○○′>
	M-xH	/ōő/	<○○″>

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[7] We consider these vocalic alternations to be postlexical because (i) they can be described without any reference to the morphology, (ii) they occur systematically wherever the condition of a xH tone foot is met, and (iii) L1 speakers are largely unaware of them. This being the case, according to Snider's (2018, 2014) *Lexical Orthography Hypothesis*, they should not be represented in writing. However, recent fieldwork has revealed that, in some other dialects, including that of Man (the principle population centre), these vowels are contrastive, occurring in feet that do not bear an xH tone. Substantiating this claim with data would make an interesting topic for future research.

[8] Following Vydrine and Kességbeu (2008, 7), we use this symbol to indicate a near-close near-back unrounded vowel.

[9] Alternatively, it can be interpreted as a syllabic nasal, occupying an intermediate position between a vowel and a consonant. It cannot be interpreted as a consonant because ŋV is unattested, no consonants bear tone, and no other nasal consonants are attested with which it might form a series. In Table 3, the phoneme /ŋ/ is positioned between the oral and the nasal series because, although it is nasal, it does not participate in nasal harmony. Oral and nasal vowels never co-occur within a foot but both are compatible with /ŋ/, e.g. /ɗāŋ̀/ <dhaŋ-> 'heaven', /ɗṹŋ́/ <″nung> 'hammock'.

[10] H-xL contours are also attested on monosyllabic words, e.g. /dûı̀/ <′dü-> 'spear'. (Since HL contours are not attested on monosyllabic words, the circumflex is employed to transcribe H-xL in phonemic transcriptions).

[11] A M-xL contour is also attested on at least one monosyllabic word: /dī̀/ <din-> 'hunger'.

The somewhat counter-intuitive symbolization of L with a double stroke $<\_\circ>$ and xL with a single stroke $<\text{-}\circ>$ is due to the fact that the Eastern Dan orthography is an adaptation of the four-tone Western Dan orthography. The extra symbol was introduced with no consideration for its iconic value or the lack of visual symmetry with the H and xH tones, and is contrary to the Ivoirian government's guidelines (ILA 1979, 20).

Figure 1 shows a text written in the 1982 Eastern Dan orthography to show the visual effect of full tone marking.[12]

Figure 1: *Eastern Dan written with full tone marking (1982 orthography)*

-Yö -kë yi do ′ka -gbeng waa- ′gbɛn- -wo -kë ″taɔngdëdhɛ ′gü, ′wo ꞊niëë wo ′ko ″piʊ. ′Yö- -nu -wo -yö -kë do kö -wo ″kpaɔ ′sü kö -wo ′dho see″ ꞊kwaan-. ′Dhɛ ′wo -wo, ′yö -gbeng ꞊ya- pö ′gbɛn- -dhɛ : « Ma ꞊në ′a ′dɛdɛ, ꞊ya ′go mü ma ꞊në ′ö ″yan ′gü ′ö -kan, ꞊dhɛ ′ö ″dhʊ ma ꞊në ′a dho -da ″dhü -bha. Bhi zë -bhö ′to ″siaa kö ′ü see″ -wlö kö ′ü -a -da ″kpaɔ ′gü. »

4. METHODOLOGY

Before the experiment, we translated the four narrative texts that Bird used in his Dschang experiment (1999b, 111-114) from English into Eastern Dan via French. The texts are of similar style and difficulty, and do not significantly overlap in lexical content. We verified that they were in harmony with Eastern Dan culture and considered naturalness to be a higher translation criterion than accuracy.

Once the written translation was completed, spelling – especially of tones – was checked and rechecked with an experienced literacy worker (though see Section 5.6 for a discussion of spelling mistakes). The texts were prepared in two versions: zero tone and full tone,[13] plus an interlinearized word-by-word gloss version. Table 5 lists the size of each of the four texts and the total corpus size.

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[12] The text sample is borrowed from Bird (1999b, 112) and was translated into Eastern Dan for use in the oral reading task. The English translation is: 'Once upon a time, a squirrel and a dog were friends and always went about together. One day, they decided to get a sack and take themselves off to a grove to steal oranges. They left the house, and on arrival at the grove the squirrel said to the dog: "Since I am small and supple, I will climb the tree. You stay down below to collect the fruit and put it in the sack"'.

[13] We employ the term 'full tone marking' (Mfonyam 1990, 24, Kutsch Lojenga 2008, 7, Bird 1999b, 94, 96) to describe the African tradition, which Eastern Dan adheres to, of marking one fewer tones than the number of phonemic tones in the language. This is in contrast to 'exhaustive tone marking' which we define as marking each and every tone, a strategy that is seldom employed in Africa but is not uncommon elsewhere.

Table 5: Corpus size

Text Label	Number of words
SQUIRREL	235
EXILE	212
SORCERY	231
PANTHER	291
TOTAL	**969**

Fifty-seven adult participants, representing seven Eastern Dan dialects,[14] all orally read the same four narrative texts presented with and without tone marks. We prepared two 'booklets', each containing the four texts, half with Zero Tone marking (Z), and half with Full Tone marking (F). Both booklets contained the same texts, but differed in terms of which texts were marked for tone. They were presented to half the sample in the order Z1, Z2, F3, F4 and to the other half in the order Z3, Z4, F1, F2. Following the experiment, we prepared one Excel spreadsheet for each text. Each column contained one orthographic tone bearing unit[15] of the text and each row contained the tonal error scores for one participant. We then calculated, for each orthographic tone bearing unit, average oral reading errors per participant, that is, the total raw score divided by the number of participants. Figure 2 illustrates this procedure with the first few words of the full tone version of the Panther text and the scores of five representative participants:

Figure 2: Example of a scoresheet for the phrase 'Once upon a time there was a squirrel…'

1982 Orthography	<′Yö	-kë	yi	do	′ka	gbe	ng>
Phonemic form	/yɤ́	kɤ̀	yī	dō	ká	gbē	ŋ̄/
Gloss	CONS.3SG.CNJ	do\CNJ	day	one	with		squirrel
Participant 1	1	1				1	1
Participant 2						1	1
Participant 3						1	1
Participant 4	1					1	1
Participant 5	1					1	
TOTAL	3	1	0	0	0	5	4
Mean tonal errors p/ participant	0.6	0.2	0.0	0.0	0.0	1.0	0.8

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[14] The dialects represented in the sample were: Blouno (9 participants), Gama (3), Gouané (1), Gweetaa (23), Man (10), Tee (4), Yi (7).

[15] Following Bird (1999a, 4, footnote 5), we define the term "orthographic tone bearing unit" as any letter which can potentially be marked with a tone diacritic.

We generated graphs from the final line of the numerical data, enabling us to superimpose – and therefore visually compare – the results of oral reading performance on zero tone and full tone versions of the texts. Small sections of these graphs will be reproduced in the analysis that follows. Tonal errors were defined as any individual dysfluencies that included an incorrect pronunciation of the tone on a given orthographic tone bearing unit. So if the reader inserted an incorrect segment, omitted a correct segment, substituted a correct segment with an incorrect one, or repeated an orthographic TBU, as long as the tone was pronounced correctly, such errors were not scored as tonal errors. In cases of self-correction, one mark was awarded for the error, but the second attempt was not counted as an error even though it was a repetition. Hesitations were not counted at all.[16] The term "tonal error peak" will be used to refer to those sections of the texts that attracted high concentrations of tonal errors at the sample level, and which appear as summits on the following graphs.

Although the data itself is quantitative, the research methodology is essentially qualitative. Calculations are used, but only to draw the researcher towards the most fruitful lines of enquiry. The method crucially involves the researcher grappling with the language itself, and discussing nuanced shades of interpretation with a trained, literate L1 speaker. This process identifies six possible sources of tonal error peaks in oral reading: dialect diversity (Section 5.1), homophony (Section 5.2), tonal minimal pairs (Section 5.3), alternating visually similar words (Section 5.4), under-representation of longer words (Section 5.5), and misspelled words (Section 5.6), although many tonal error peaks are apparently not linguistically motivated at all (Section 5.7).

5. POSSIBLE SOURCES OF TONAL ERROR PEAKS

5.1 DIALECT DIVERSITY

Arguably the most obvious source of error peaks when reading Eastern Dan is dialectal diversity. The orthography is based on the Gweetaa dialect, which is one of about twenty in the eastern zone.[17] So it is unsurprising to find that tonal error peaks frequently align with words that have a limited dialectal distribution. We identify two scenarios. Firstly, five Gweetaa words in the texts have different equivalents in Man, which is the major population centre for Eastern Dan (Table 6). Note that what is considered to be "dialect variation" here is not merely a question of pronunciation; the pairs are not even lexical cognates.[18]

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[16] In the main experiment (Roberts, submitted), we judged that timing reading speed would be more accurate than tracking hesitations. The latter are inherently difficult to assess without an instrumental study.

[17] A separate orthography, based on the Blowo dialect but also representing about twenty others, has been developed for Western Dan. This orthography is beyond the scope of the present study.

[18] See Section 5.6 for another case of dialect diversity.

Table 6*: Gweetaa words that attracted tonal error peaks and their Man equivalents*

Text Label	Gweetaa[19] (in texts)		Man[20]		Frequency	
SQUIRREL	/kpɔ́ɓ́/	<˝kpaɔ>	/glɛ̄ɛ́/	<glɛɛn˝>	3	'bag'
EXILE	/dɪ̋ʌ̋ŋ̋/	<˝dhiëng>	/tòsǽæ̀/	<-tosɛa>	2	'life'
PANTHER	/gwēē/	<gwee>	/lāā/	<laa>	10	'panther'
PANTHER	/ɓɔ̄ɔ̀/ [mɔ̄ɔ̀]	<mɔɔ->	/ɓlɛ̄ɛ́/ [mlɛ̄ɛ́]	<mlɛɛ˝>	1	'to look for'

Figure 3 shows the tonal error peak on the first appearance of the word /kpɔ́ɓ́/ <˝kpaɔ> *bag* in the SQUIRREL text. Tone marks do reduce the error rate, but only slightly. If a reader from Man is simply unfamiliar with the Gweetaa lexicon, the presence of tone marks on this word may facilitate accurate decoding, but the reader will have to consult the context to ascertain the meaning. In this graph and all those that follow, the X-axis contains the text extract split into syllables, while the Y-axis shows the average number of tonal errors per participant.

Figure 3*: Tonal error rates on part of the extract '…they decided to take a bag and go and steal…' in the zero tone and full tone versions of the* SQUIRREL *text*

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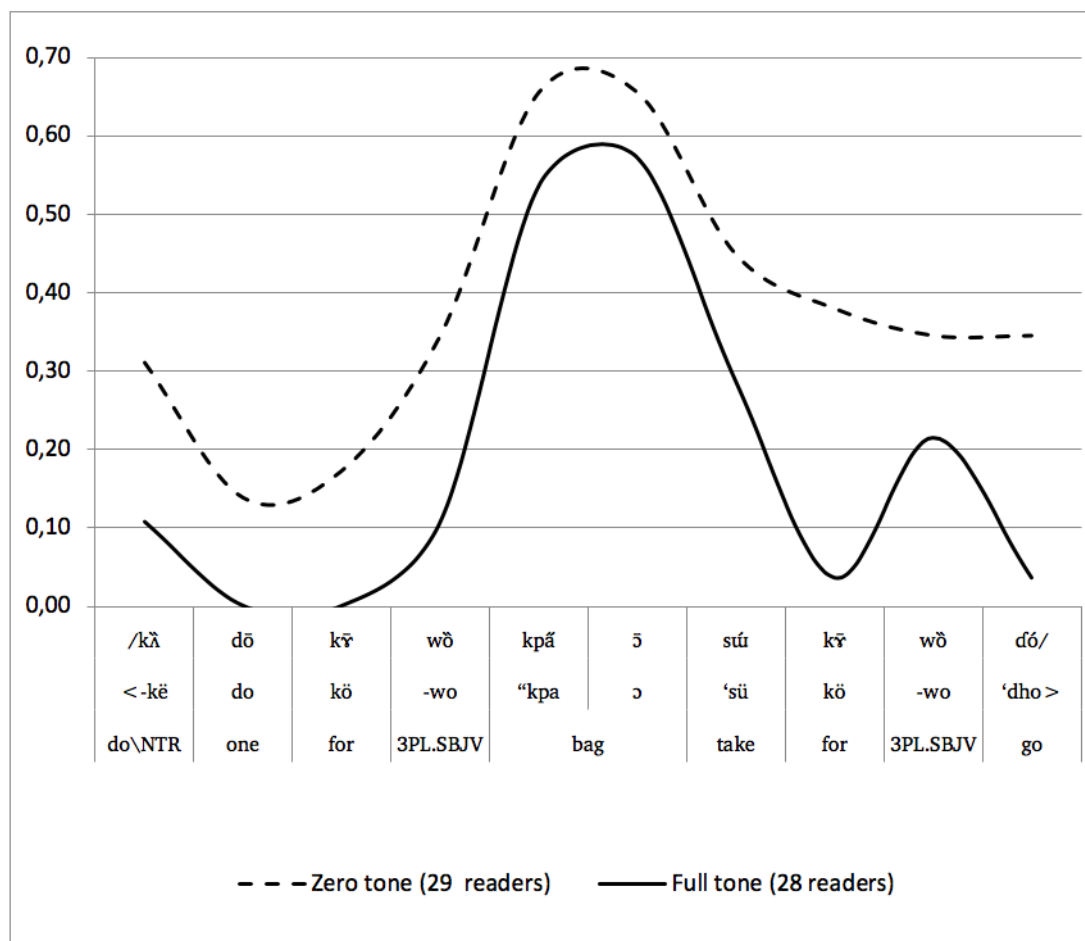
[19] And some other northern dialects.
[20] And some other southern dialects.

Secondly, although it was a Gweetaa speaker who edited the translations of the texts from French, he has lived in Man for many years, so words that are distinctive to that dialect slipped in. These also attracted high tonal error rates, presumably as readers from one dialect had difficulty identifying words from another. Again, the pairs are not lexical cognates (Table 7).

Table 7: Man words that attracted tonal error peaks and their Gweetaa equivalents

Text label	Man (in texts)		Gweetaa		Frequency	
SQUIRREL	/sēé/	\<see″\>	/dɤ̏ŋ̏/	\<dhöng-\>	4	'citrus fruit'
PANTHER	/dì̤à̤à̤/ [nì̤à̤à̤]	\<=niëë\>[21]	/zīɤ̏/	\<ziö\>	1	'to walk'

Figure 4 shows the tonal error peak on the first appearance of the word /sēé/ \<see″\> 'citrus fruit' in the SQUIRREL text. Tonal errors are relatively high irrespective of whether tone is marked although they do diminish on subsequent occurrences of the same word as readers benefit from the effect of repetition.

Figure 4: Tonal error rates on the phrase 'in order to go and steal citrus fruits' in the zero tone and full tone versions of the SQUIRREL text

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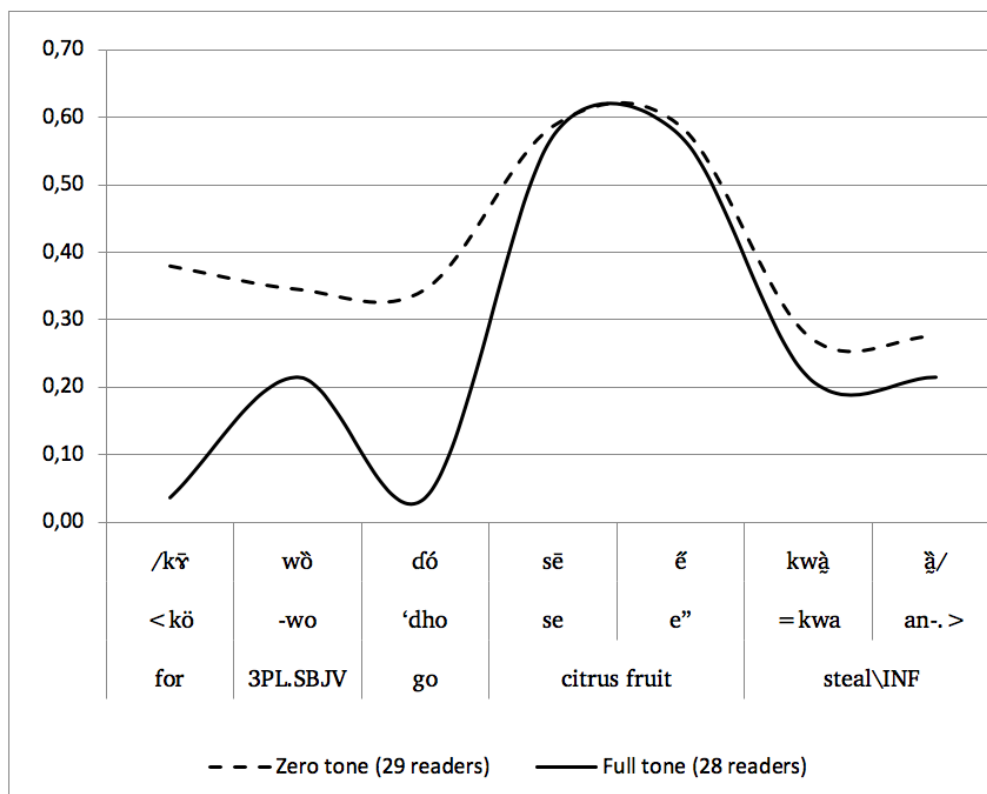
[21] This word also occurs in the SQUIRREL text, but without attracting a tonal error peak irrespective of whether tone is marked.

5.2 HOMOPHONY

Eastern Dan has mostly one-foot words, which may be monosyllabic (V, CV), disyllabic (CVV, CVŋ), or trisyllabic (CVVV, CVVŋ) (Vydrin 2017). This generates a remarkably high degree of homophony, as illustrated by this typical example from the Sǫᴜɪʀʀᴇʟ text (1).

1	/yɤ̋̀	dṵ̀	wò	yɤ̏	kʌ̏/
	[yɤ̋̀	nṵ̀	wò	yɤ̏	kʌ̏]
	<ʹYö-	-nu	-wo	-yö	-kë>
	ᴄᴏɴs-3ꜱɢ	ᴘʟ	voice	3ꜱɢ.ᴇxɪ	do\ɴᴛʀ
	'And they decided…'				

The only orthographic word in this phrase with a unique meaning is <-kë> /kʌ̏/: it is the verb 'do' in its neutral aspect form. All the others are homographic homophones, each with at least two meanings. The meaning that occurs in the text is highlighted in bold (2).

2	/yɤ́/[22]	<ʹyö>	**consecutive conjunction**
			3sg pronominal predicative marker (conjunctive)
	/dṵ̀/ [nṵ̀]	<-nu>	**plural marker**
			presumptive marker
			'give' (neutral aspect)
			'come' (neutral aspect)
	/wò/	<-wo>	'**voice**'
			'appear' (lexical tone, neutral aspect, conjoint form)
			3pl pronominal predicative marker (existential)
			3pl pronominal predicative marker (subjunctive)
			dummy verb 'to do' (neutral aspect)
	/yɤ̏/	<-yö>	**3sg pronominal predicative marker (existential)**
			3sg pronominal predicative marker (subjunctive)
			'see' (neutral aspect)

In principle, the single occurrence of a homophone in a text should not attract tonal error peaks, because the two pronunciations are identical and tone marking does not contribute to keeping the meanings apart. Furthermore, the syntactic context will often provide the necessary clue for establishing the meaning (e.g. the plural marker will never occupy the same syntactic slot as the verb 'give' in the neutral aspect). But when so many homophones converge in one short phrase, this may well have a destabilizing effect for non-fluent readers, and one way in which this may manifest itself is an increase in tonal errors. Whatever the case, it is most unlikely that homophony is uniquely responsible for tonal dysfluencies in cases such as example 1, because it only represents half the story: all of the words in the phrase are also tonal minimal pairs, so the two types of written ambiguity are best treated together.

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[22] The extra-low tone symbolised in the text by a word final hyphen is a trace of the elided 3rd person singular non-subjective pronoun <-a> [ä].

5.3 TONAL MINIMAL PAIRS

Example 3 lists the tonal minimal pairs and triplets found in the same short phrase (example 1). Again, the meaning that occurs in the text is highlighted in bold.

3	/yɤ́/	<′yö>	**consecutive conjunction**
	/yɤ̄/	<yö>	'this, here'[23]
			3sg pronoun (autonomous)
			'see' (lexical and conjoint forms)
	/yɤ̋/	<″yö>	'but how?!' (interjection expressing astonishment and discontent)
	/dɨ̀/ [nɨ̀]	<-nu>	**plural marker**
	/dɨ̄/ [nɨ̄]	<nu>	'give' (lexical and conjoint forms)
			'come' (lexical and conjoint forms)
	/dɨ́/ [nɨ́]	<′nu>	'already'
	/wò/	<-wo>	'**voice**'
	/wō/	<wo>	3pl pronoun (autonomous)
			3pl logophoric pronominal predicative marker (existential)
			3pl reflexive pronoun
			'to do' (lexical and conjoint forms of the dummy verb)
	/wó/	<′wo>	3pl pronominal predicative marker (conjoint)
			3pl logophoric pronominal predicative marker (conjoint)
			3pl logophoric pronominal predicative marker (subjunctive)
	/kʌ̀/	<-kë>	**'do' (neutral aspect)**
	/kʌ̄/	<kë>	'do' (lexical and conjoint forms)
			retrospective marker

Again, not all of these meanings will be possible, because each meaning can only occupy a certain syntactic slot. Nevertheless, the high concentration of lexical and grammatical tonal minimal pairs in one short phrase may be destabilizing for readers, most of whom are non-fluent and are still sounding out words one by one. A comparison of error scores on zero tone and full tone texts shows that tone marking clearly helps them navigate the pronunciation of this phrase (Figure 5).

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[23] It is debatable whether this is a case of polysemy or homophony.

Figure 5*: Tonal error rates on part of the extract '… and they decided' in the zero tone and full tone versions of the* Squirrel *text*
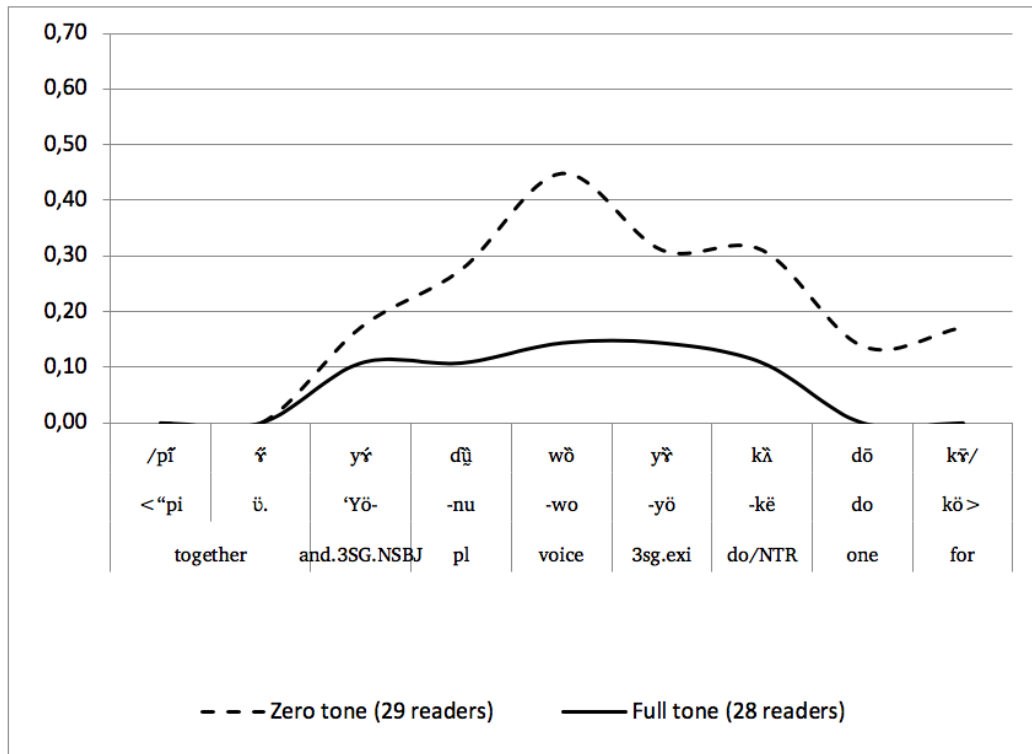

5.4 ALTERNATING VISUALLY SIMILAR WORDS

The Squirrel text contains two characters, <-gbeng> /gbèŋ/ 'squirrel' and <'gbɛn-> /gbɛ̂/ 'dog'. These two keywords alternate throughout the text, with six references to the former and eight to the latter. They are both animals, so they are interchangeable in many contexts. Visually, they are also similar, since they both contain the letters <g, b, n>, and a hyphen signalling xL tone. The two vowels share the same shape – neither having ascenders or descenders and both having an open right edge (cf. Bouma 1971) – and are close to each other in pronunciation. Furthermore, <-gbeng> /gbèŋ/ 'squirrel' is a homophone with <-gbeng> /gbèŋ/ 'ramification' and a tonal minimal pair with <gbeng> /gbēŋ/ 'night'. It is likely, then, that this constant alternation of semantically and visually similar forms throughout the story is what attracts tonal error peaks on these words, as readers try to separate the visual forms and their associated meanings in their minds.[24] The ordinal numbers in the horizontal axis of Figure 6 (and in the following graphs) refer to the consecutive occurrences of the word in the text.

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[24] A reviewer has commented that if our prediction is correct, we would expect the tonal errors to consist of systematic confusion between these two words. However, another reviewer has noted that *any* added processing load may cause tonal errors, even if they do not specifically confuse the source words of that extra load. Here, as elsewhere, we did not undertake such detailed investigation of tonal error types.

***Figure 6**: Tonal error rates on the visually similar keywords <-gbeng> /gbɛ̀ŋ/ 'squirrel' and <ꞌgbɛn-> /gbɛ̂/ 'dog' in the zero tone and full tone versions of the* Squirrel *text*
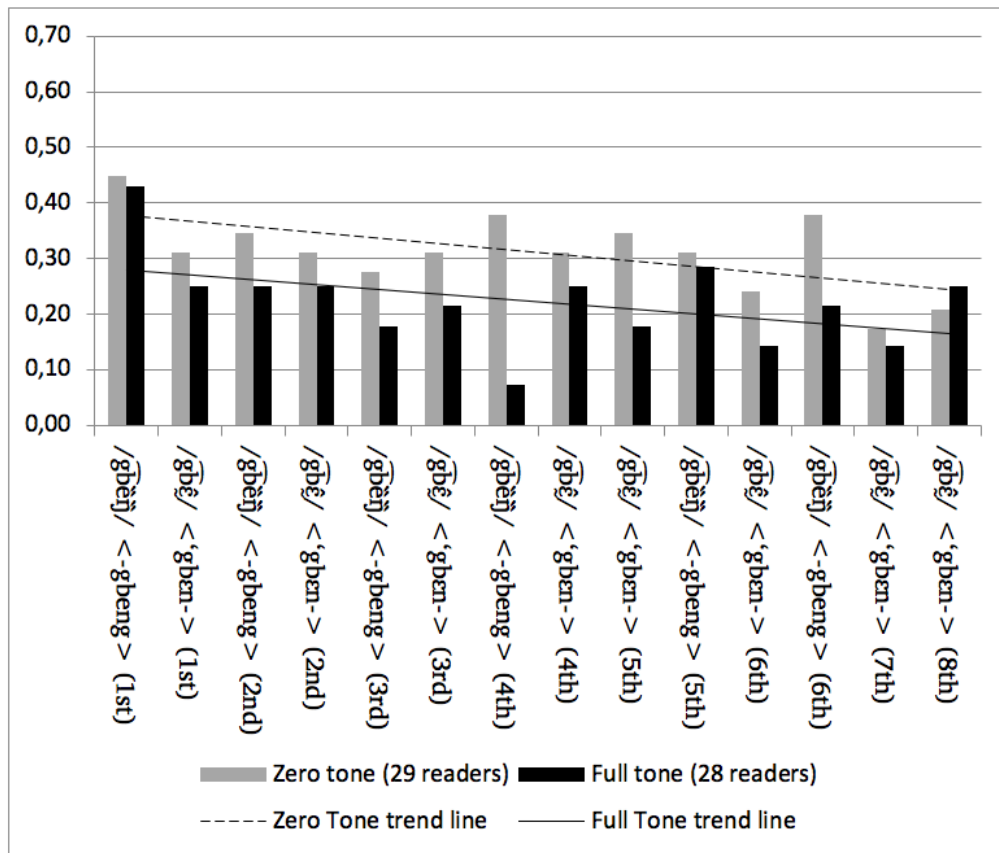
Tonal error rates on both words are consistently higher on the zero tone texts, with the exception of the final reference to 'dog'. Trend lines show that error rates on both versions of the texts show a modest decline as readers become more familiar with the two words, irrespective of whether tone is marked.
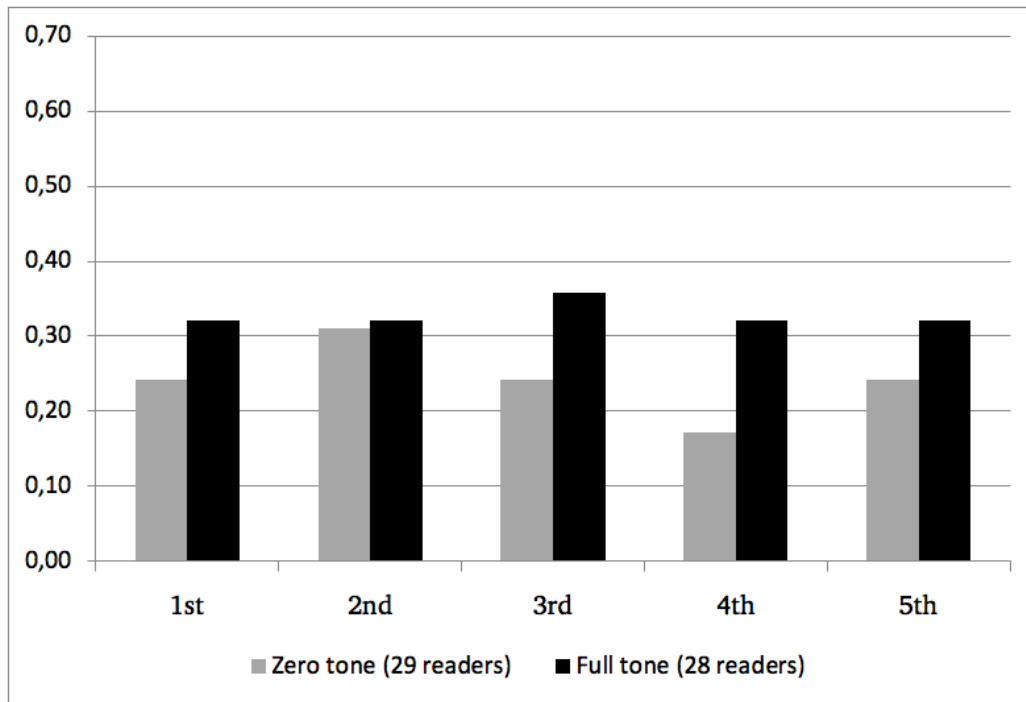
5.5 UNDER-REPRESENTATION OF LONGER WORDS

The orthographic strategy of word-initial and -final punctuation lends itself to one-foot words, which, as we have noted, are by far the most frequent word type in Eastern Dan. But it under-represents tone on longer words because it has no means of marking punctuation on non-initial syllables in two-feet words and on any non-initial syllable in a word which contains more than one metric foot, such as the first xL tone in /ɗɛ̄ɛ̀bà/ <ꞌnɛɛbë> 'children' and the H tone in /dē̄gbíȉ/ <dhegbiöö> 'pregnant woman'. This means that "absence of a tone mark" has two meanings: either "M tone" or "non-initial syllable".

The word /dēbà/ <dhebë> 'woman', which appears five times in the Sorcery text, is a case in point. In fact, it is unclear why Eastern Dan orthography decision makers chose not to mark the second foot of a two-foot word with word final punctuation, since it is certainly possible to

do so (<dhebë->); for whatever reason, this is not the case. One might expect this common word to be easily recognizable, and admittedly none of the tonal error peaks is excessively high. Yet, curiously, the full tone texts attract consistently more errors than the zero tone texts (Figure 7).

Figure 7: *Tonal error rates on the five occurrences of the word /dēbɞ̀/ <dhebë> 'woman' in the zero tone and full tone versions of the* Sorcery *text*

It is certainly possible that the two-foot structure of this word, and consequent under-representation of tone, contributes to tonal error peaks in the full tone version of the text on these examples.

5.6 MISSPELLED WORDS

The Panther text contains seven occurrences of the word /wɔ̀ɔ̀/ <=wɔɔ> 'monkey'. In the full tone version of the text, this word was misspelled as *<-wɔɔ> six times, demonstrating how easy it is, in even the most thoroughly prepared Eastern Dan texts, to inadvertently confuse the symbolization for L and xL because of its asymmetry with the symbolization for H and xH (see Section 3.2.3). The same word was also misspelled once as *<wɔɔ>. As for the zero tone version of the text, of course, the spelling mistake was absent because it concerned a tone diacritic.

In order to investigate performance on this word, it will be helpful to clarify the relationship between spelling mistakes and oral reading fluency. The meaningful interpretation of a misspelled word is an important fluency sub-skill, so assessment should not reward a reader who faithfully reproduces the spelling mistake in speech even though it is void of meaning. This principle was

underlined when training the scorers. A participant who pronounced the tone correctly as L (i.e. meaningfully, in spite of the spelling mistake) scored 0 errors; a participant who pronounced the tone incorrectly (i.e. either faithfully decoding the spelling mistake as xL, or with another tone, but in either case without phrase-level meaning) scored 1 error. Figure 8 shows tonal error rates on each of the seven occurrences.

Figure 8: *Tonal error rates on the misspelled word* /wɔ̀ɔ̀/ **<-wɔɔ ~ wɔɔ> 'monkey' in the zero tone and full tone versions of the* Pᴀɴᴛʜᴇʀ *text*
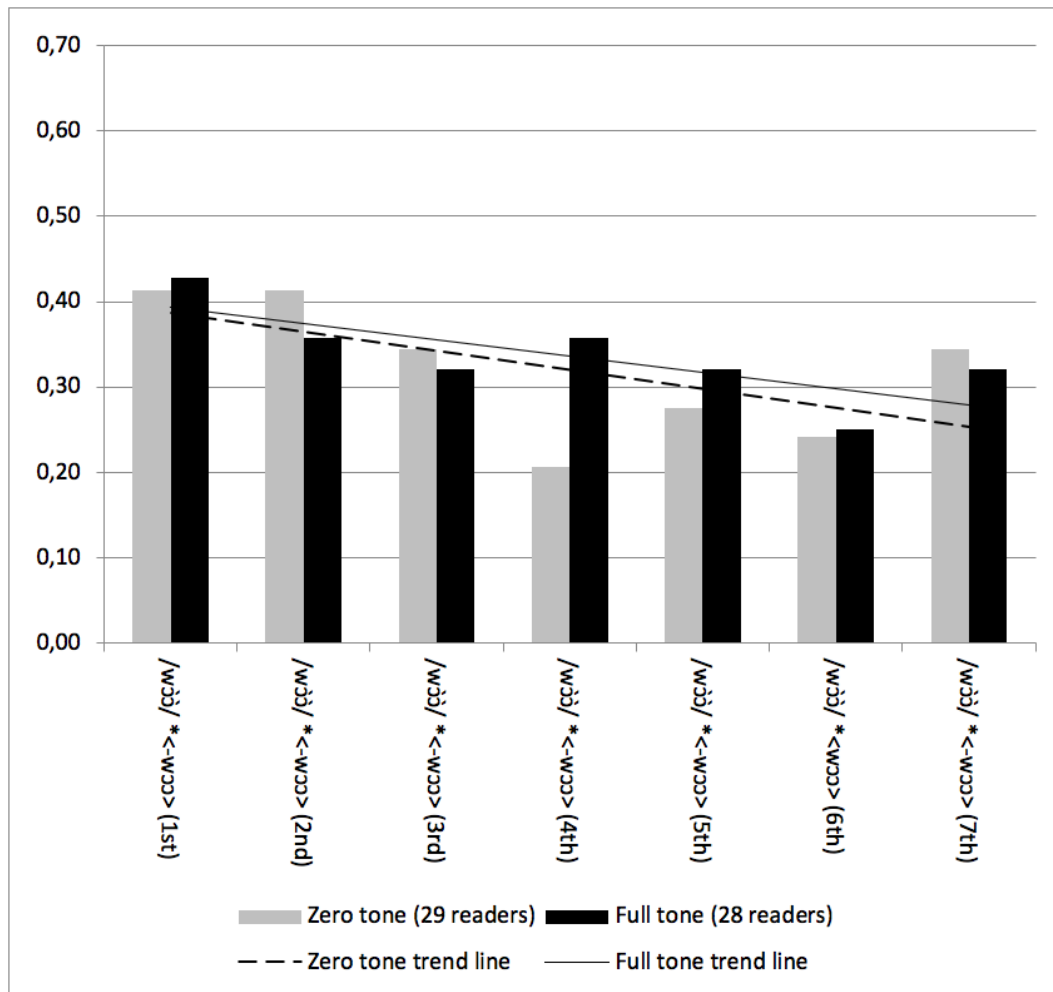

The numerous tonal errors on the first occurrence of the word in the full tone version of the text are unlikely to be due to the misspelled tone, because the zero tone version of the text attracted almost as many errors. Thereafter there is an overall decline in both conditions, as shown by the almost parallel trend lines, presumably as readers become familiar with the monkey as the story's protagonist. Tellingly, in four of the seven cases, the zero tone version of the text attracted fewer tonal errors than the full tone version, suggesting that the spelling mistake was not a major contributor to tonal oral reading errors. What is perhaps more likely is that dialect diversity (see Section 5.1) negatively impacted performance, as the corresponding word in the Man dialect is /klȉ̀ȉ̀/ <-klöö> 'monkey'.

5.7 APPARENTLY NON-MOTIVATED ERRORS

Finally, in numerous locations the reason for the tonal error peak is not easy to detect, and may not be motivated by linguistic factors at all. Two representative word-level examples will suffice to illustrate this, while bearing in mind that such apparently non-motivated tonal reading errors often extend across entire phrases or sentences.

In the KIDNAP text, the polysemic postposition <ꞌka> /ká/ occurs three times, first expressing an equative meaning, then a transformational meaning, then, in the last sentence of the text, the sociative meaning 'with' (Figure 9). In other contexts, the same postposition can have instrumental, locative and temporal functions. The third occurrence of the postposition attracted comparatively few tonal errors, but noticeably more on the full tone text than on the zero tone text. This postposition should be easily recognizable in this context, in spite of its polysemic nature, and we are at a loss to find any credible linguistic motivation for the disturbance.

Figure 9: *Tonal error rates on part of the extract* 'you should know the one you're going to confront' *in the zero tone and full tone versions of the* KIDNAP *text*
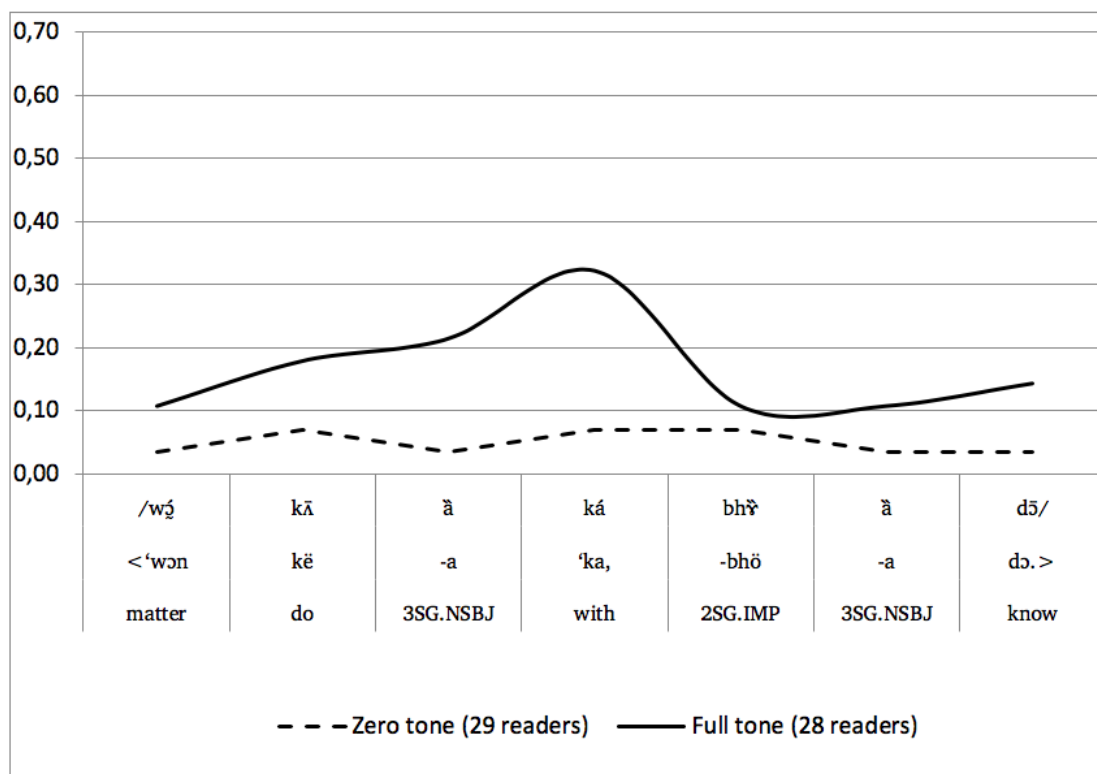
Similarly, the word <-da> /dà/ 'to come up' makes a relatively late appearance in the PANTHER text, but then occurs three times. Each time, it attracted a higher rate of average tonal error peaks per participant on the full tone texts than on the zero tone texts (Figure 10).

Figure 10: *Tonal error rates on the three occurrences of the word* /dä/ <-da> 'to come up' *in the zero tone and full tone versions of the* PANTHER *text*
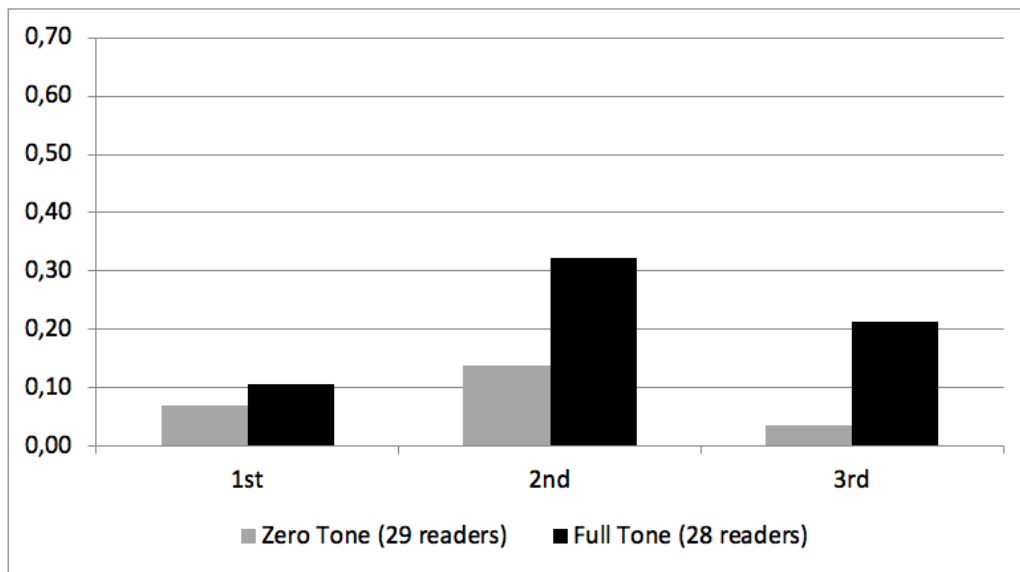

Again, we find no reasonable linguistic motivation for this anomaly. It is a relatively frequent word in natural contexts, and it is difficult to imagine how it could be confused with /dà/ <=da> 'mother-in-law', its only tonal minimal pair, since the semantic and syntactic contexts are so divergent.

6. ERRORS ON INDIVIDUAL TONES

Before concluding we should explore the data from one more angle, comparing error rates on the inventory of specific, individual tones when orally reading the full tone versions of the four texts. Figure 11 reports the results (the number of occurrences is shown in parentheses).[25]

Figure 11*: Average tonal error rates on individual tones in the full tone versions of the four texts*
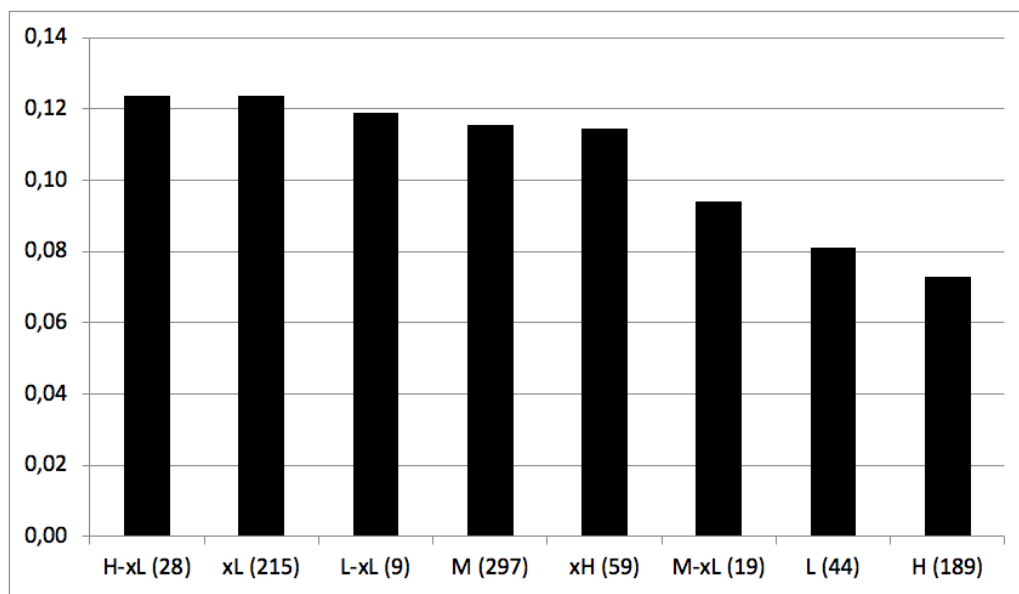
Three findings about individual tones in Eastern Dan are noteworthy:

> 1. the orthographic strategy of 'absence of an accent' to mark M tone does not attract more tonal error peaks than any other tone symbol;

> 2. L and xL tones do not attract more tonal error peaks than other tones, in spite their counter-intuitive symbolisation;

> 3. contour tones do not attract more tonal error peaks than level tones.

Although these findings are all negative, they are nonetheless worth reporting since they respond to points that have been raised by orthography stakeholders. This experimental evidence shows that such concerns have no empirical basis, though of course, stakeholders may still decide to reform these points of the orthography on grounds other than linguistic ones.

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[25] The texts contained no examples of xH-xL or M-H contours. They did, however, contain four examples of a M-xH contour, which were all occurrences of the same word: [sēέ] <see"> 'citrus fruit'. It would have been impractical to include this contour on the graph, because, as a dialect word (see Table 7, Section 5.1) it attracted many more average tonal errors per participant than any other level tone or contour (0.37).

7. DISCUSSION AND CONCLUSION

Since the methodology presented in this paper has not been employed very widely elsewhere, it will be useful to briefly assess its merits. First, as a reviewer has noted, we should perhaps have counted self-corrections separately from other kinds of repetition, as they can be considered a reading skill rather than a dysfluency. Second, this study has scored tonal errors on each orthographic TBU. However, given that the phoneme of tone is the tone pattern on the morpheme rather than the individual tone on the TBU (Snider 2018), it might be wiser, especially for languages less monosyllabic than Eastern Dan, to consider scoring morpheme level tone patterns.

We have identified six possible linguistic reasons why Eastern Dan speakers may stumble when orally reading zero tone or full tone texts. It is a language with an unusually high degree of dialect diversity, an exceptionally high number of homophones and tonal minimal pairs, many visually similar words (because of the pervasive monosyllabicity) and systemic under-representation of tone on any words of two or more metric feet. Furthermore, the text, although carefully prepared, contained one frequent spelling mistake involving a tone diacritic.

However, we must conclude with some words of caution. Firstly, this analysis has only been able to predict what the linguistic source of oral reading errors *might* be; it can make no categorical claims. Secondly, the fact that numerous tonal errors do not appear to be linguistically motivated casts something of a shadow over the entire analysis, because it is possible that at least some of the individual tonal errors classified as having a linguistic cause actually did not. Thirdly, it would be quite wrong if such an intensive focus on linguistic phenomena were to blind us to the possibility that social factors may also be a major, and perhaps even an overriding contributor to reading dysfluencies in Eastern Dan. The poor oral reading performance by most participants in this language must, at least partially, be explained by the disruption caused by the two civil wars. Test participants cannot be expected to read unless they are getting regular exposure to print, and this is not currently the case in the Eastern Dan context. This would go some way to accounting for the large number of tonal reading errors for which we have no linguistic explanation. Finally, it should be borne in mind that the results reported in this paper are valid only for the 1982 orthography which has now been superseded. A similar investigation of tonal errors when orally reading the 2018 orthography would be the obvious next step in Eastern Dan experimental linguistics.

ABBREVIATIONS

C	consonant
CONS	consecutive conjunction
EXI	existential series of pronominal predicative markers
H	high tone
IMP	imperative
INF	infinitive
L	low tone
M	mid tone
NSBJ	non-subject pronominal series
NTR	neutral aspect
PL	plural
SBJV	subjunctive
SG	singular
V	vowel
xH	extra-high tone
xL	extra-low tone
1, 2, 3	first, second, third person

REFERENCES

Bearth, Thomas, and Hugo Zemp. 1967.
"The phonology of Dan (Santa)." *Journal of African Languages* no. 6 (1):9-29.

Bernard, Russell H., George N. Mbeh, and W. Penn Handwerker. 2002.
"Does marking tone make tone languages easier to read?" *Human Organisation* no. 61 (4):339-349.

Bird, Steven. 1999a.
"Strategies for representing tone in African writing systems." *Written Language and Literacy* no. 2 (1):1-44.

Bird, Steven. 1999b.
"When marking tone reduces fluency: an orthography experiment in Cameroon." *Language and Speech* no. 42:83-115.

Bolli, Margrit. 1976.
Etude prosodique du dan (blossé). Edited by Thomas Bearth, *Publications conjointes ILA-SIL*. Abidjan: Institut de Linguistique Appliquée de l'Université d'Abidjan and SIL.

Bolli, Margrit. 1978.
"Writing tone with punctuation marks." *SIL Notes on Literacy* no. 23:16-18.

Bolli, Margrit. 1980.
"Yacouba literacy report 2 (March 1977 - February 1979)." *SIL Notes on Literacy* no. 31:1-14.

Bolli, Margrit. 1983.
"The Victor Hugoes in Dan country: Developing a mother-tongue body of literature in a neoliterate society." *SIL Notes on Scripture in Use* no. 5:3-14. Published version of a paper presented at the International Reading Association 9th world congress on reading, Dublin, 26-30 July 1982.

Bolli, Margrit. ms 1989.
The teaching of tone in the Dan language. Abidjan: SIL.

Bolli, Margrit, Eva Flik, and John Bendor-Samuel. 1972.
Testing the mutual intelligibility of dialects: Yakouba dialect survey. In *10th West African Languages Congress*. Accra, 21st - 27th March 1972.

Bouma, Herman. 1971.
"Visual recognition of isolated lower case letters." *Vision Research* no. 11:459-474.

Brown, J., Kenneth S. Goodman, and A. Marek. 1996.
Studies in Miscue Analysis: An Annotated Bibliography. Newark, Delaware: International Reading Association.

Essien, Udo E. 1977.
"To end ambiguity in a tone language." In *Languages and linguistics problems in Africa. Proceedings of the 7th Conference on African linguistics*, edited by Paul F. A. Kotey and Haig Der-Houssikian, 155-167. Columbia, South Carolina: Hornbeam Press.

Flik, Eva. 1977.
"Tone glides and registers in five Dan dialects." *Linguistics* no. 201:5-59.

Flik, Eva. 1978.
"Dan tense-aspect and discourse." In *Papers on discourse*, edited by Joseph E. Grimes, 47-62. Dallas: SIL International.

Goodman, Kenneth S. 1965.
"A linguistic study of cues and miscues in reading." *Elementary English* no. 42 (6):639-643 and reprinted in *Theoretical Models and Processes of Reading*, 3rd edition, eds. Harry Singer and Robert B. Ruddell. Newark, Delaware, International Reading Association, pages 129-134.

Goodman, Kenneth S. 1969.
"Analysis of oral reading cues: Applied psycholinguistics." *Reading Research Quarterly* no. 5:9-30 and reprinted in *Language and Literacy: the Selected Writings of Kenneth Goodman*, ed. F. Gollasch. 1982, Boston, Routledge & Kegan Paul, pages 123-134. .

ILA. 1979.
Une orthographe pratique des langues ivoiriennes. Abidjan: Institut de linguistique.

Johnston, Peter H. 1985.
"Assessment in Reading." In *Handbook of reading research, volume 1*, edited by P. David Pearson, Rebecca Barr, Michael L. Kamil and Peter Mosenthal, 147-184. London: Longman.

Kutsch Lojenga, Constance. 2008.
The orthography of tone in African languages. In *5th symposium "The idea of writing: The unspoken parts of writing"*. University of Leiden, Netherlands.

Lauber, Edward. 1983.
"The indigenisation of literacy in Dan (Yacouba)." *SIL Notes on Literacy,* no. 37: 16-21.

Lekgoko, O., and H. Winskel. 2008.
"Learning to read Setswana and English: Cross-language transference of letter knowledge, phonological awareness and reading skills." *Perspectives in Education* no. 26 (4):1-18.

Mfonyam, Joseph Ngwa. 1989.
Tone in Orthography: the Case of Bafut and Related Languages. Thèse d'état, Université de Yaoundé, Cameroun.

Mfonyam, Joseph Ngwa. 1990.
"Tone analysis and tone orthography." *Journal of West African Languages* no. 20 (2):19-30.

Piper, Benjamin, Leila Schroeder, and Barbara Trudell. 2016.
"Oral reading fluency and comprehension in Kenya: Reading acquisition in a multilingual environment." *Journal of Research in Reading* no. 39 (2):133-152.

Roberts, David. 2010.
"Exploring written ambiguities can help assess where to mark tone." *Writing Systems Research* no. 2 (1):25-40.

Roberts, David. submitted.
Tone orthography and literacy: The voice of evidence in ten Niger-Congo languages. Amsterdam: John Benjamins.

Roberts, David, Ginger Boyd, Johannes Merz, and Valentin Vydrin. forthcoming.
"Quantifying written ambiguities in tone languages: A comparative study of Elip, Mbelime and Eastern Dan." *Language Documentation and Conservation*.

Roberts, David, Valentin Vydrin, and Dana Basnight-Brown. forthcoming.
"Marking tone with punctuation: an orthography experiment in Eastern Dan." In *Proceedings of the conference* "*Grafematik: Graphemics in the 21st century from graphemes to knowledge*", edited by Yannis Haralambous. Brest, France: Fluxus.

SIL. 1982.
Guide d'orthographe pour la langue dan (dialecte gwetaawo). Abidjan: SIL.

Snider, Keith. 2014.
"Orthography and phonological depth." In *Developing orthographies for unwritten languages*, edited by Michael Cahill and Keren Rice, 27-48. Dallas: SIL International.

Snider, Keith. 2018.
Tone analysis for field linguists. Dallas TX: SIL International.

Thomas, Paule. 1978.
Alphabétisation en yacouba. Abidjan: Institut de Linguistique Appliquée.

Vydrin, Valentin. 2009a.
"Areal features in South Mande and Kru languages." In *When languages meet: Language contact and change in West Africa*, edited by Norbert Cyffer and Georg Ziegelmeyer, 91-116. Köln: Rüdiger Köppe.

Vydrin, Valentin. 2009c.
"On the Problem of the Proto-Mande Homeland." *Journal of Language Relationship (*Вопросы языкового родства*)* no. 1:107-142.

Vydrin, Valentin. 2010a.
"Co-ordinative pronouns in Southern and South-Western Mande: A second compound pronouns area in Africa?" In *Personal pronouns in Niger-Congo languages: International workshop. St. Petersburg, September 13-15, 2010. Abstracts and papers: Working materials*, edited by Konstantin Pozdniakov, Valentin Vydrin and Alexander Zheltov, 164-172. St. Petersburg: St. Petersburg University Press.

Vydrin, Valentin. 2011.
"Déclinaison nominale en dan-gwèètaa (groupe mandé-sud, Côte-d'Ivoire)." In *Faits de langues*, 233-258. Paris: Ophrys.

Vydrin, Valentin. 2016.
"Tonal inflection in Mande languages: the cases of Bamana and Dan-Gwɛɛtaa.» In *Tone and Inflection: New facts and new perspectives. Trends in linguistics studies and monographs. Vol. 296*, edited by Enrique L. Palancar and Jean Léo Léonard, 83-105. Berlin: De Gruyter — Mouton.

Vydrin, Valentin. 2017.
"Quantifiers in Dan-Gweetaa (South Mande)" In *Handbook of quantifiers in natural language: Volume 2. Studies in linguistics and philosophy, vol. 97*, edited by Denis Paperno and Edward L. Keenan, 203-280. Cham: Springer.

Vydrin, Valentin. 2017.
"Dan jazyk (Дан язык) [Dan]." In *Jazyki mira: Jazyki mande (*Языки мира*:* Языки манде*)* *[Languages of the world: Mande languages]*, edited by Valentin Vydrin, Yulia Mazurova, Anderj Kibrik and Elena Markus, 469-583. St. Petersburg: Nestor-Historia.

Vydrin, Valentin, Emmanuel Zeh, and Nestor Gué. 2019.
Guide de nouvelle orthographe dan de l'est pour les apprenants familiers avec l'ancienne orthographe. Man: EDILIS.

Vydrine, Valentin. 2002.
"Some hasty notes on the ways of the evolution of Mande tonal systems." In *Lexical and structural diffusion*, edited by Robert Nicolai and Petr Zima, 243-264. Nice et Prague: Faculté des Lettres, Arts et Sciences Humaines, Université de Nice et Faculté des Etudes Humaines, Université Charles de Prague.

Vydrine, Valentin. 2006.
"Emergence of morphological cases in South Mande: From the amorphous type to inflectional?" In *Case, Valency and Transitivity*, edited by L. Kulikov, A. Malchukov and P. de Swart, 49-64. Leiden and Nijmegen: John Benjamins.

Vydrine, Valentin. 2007.
"Les adjectifs en dan-gwèètaa." *Mandenkan* no. 43:77-103.

Vydrine, Valentin. 2009b.
"Negation in South Mande." In *Negation Patterns in West African Languages and Beyond*, edited by Norbert Zyffer, Erwin Ebermann and Georg Ziegelmeyer, 223-260. Amsterdam: John Benjamins.

Vydrine, Valentin. 2010b.
"Le pied métrique dans les langues mandé." In *Essais de typologie et de linguistique générale. Mélanges offerts à Denis Creissels*, 53-62. Lyon: ENS Éditions.

Vydrine, Valentin, and Mongnan Alphonse Kességbeu. 2008.
Dictionnaire Dan – Français (dan de l'Est) avec une esquisse de grammaire du dan de l'Est et un index français-dan, 1ère édition. St Pétersbourg: Musée d'anthropologie et d'ethnographie, Académie des sciences de la Russie.

Wilde, Sandra. 2000.
Miscue analysis made easy. Portsmouth, New Hampshire: Irwin, Heinemann.

Winskel, Heather, and Kanyarat Iemwanthong. 2010.
"Reading and spelling acquisition in Thai children." *Reading and Writing* no. 23 (9):1021-1053.

Wu, Xiaoying Wu, and Richard C. Anderson. 2007.
"Reading strategies revealed in Chinese children's oral reading." *Literacy Teaching and Learning* no. 12 (1):7-72.

Zeh, Emmanuel. ms. 2018.
Rapport de l'assemblée générale d'adoption de la nouvelle orthographe en langue dan-est le samedi 8 décembre 2018 à Man-Libreville.