

Writing grammar rather than tone: an orthography experiment in Togo

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ABSTRACT

Some orthographies represent tone phonemically by means of diacritics; others favor zero marking. Neither solution is entirely satisfactory. The former leads to graphic overload; the latter to a profusion of homographs; both may reduce fluency. But there is a 'third way': to highlight the grammar rather than the tone system itself. To test this approach, we developed two experimental strategies for Kabiye: a grammar orthography and a tone orthography. Both are modifications of the standard orthography that does not mark tone. We tested these in a quantitative experiment involving literate L1 speakers that included dictation and spontaneous writing. Writers of the grammar orthography perform faster and more accurately than writers of the tone orthography, suggesting that they have an awareness of the morphological and syntactic structure of their language that may exceed their awareness of its phonology. We conclude that languages with grammatical tone might benefit from grammatical markers in the orthography.

Keywords: Tone, Grammar, Orthography, African languages, Quantitative experiment

1. INTRODUCTION

1.1. Tone orthography research

For several decades, researchers have vigorously debated how tone should be represented in the emerging orthographies of the world's tone languages. The African continent has generated some of the most significant published research. Some researchers have developed analytical techniques (Snider 1999: 211-215); others have enumerated principles (IIALC 1930; Mfonyam 1990). Some have evaluated existing strategies (Bird 1999a; Kutsch Lojenga 1993; Mfonyam 1990); others have developed manuals for field workers (Schroeder 2008; Wiesemann et al. 1988). Some studies cover a particular geographical area, such as the Eastern Bantu languages of Tanzania (Stegen 2005), the Tano languages of Ivory Coast (Burmeister 1998) and the Grassfields languages of Cameroon (Mfonyam 1989); others focus on individual languages such as Kasem (Awedoba 1990), Gengbé (Mensah 1991) and Kroumen Tépo (Thalman 1987).

At the same time, voices in the wider world of reading research are increasingly stressing the need for empirical evidence based on quantitative experiments (eg. McCardle & Chhabra 2004). The body of such evidence in the domain of tone orthography is still pitifully small, in spite of several pleas for more (Bird 1999b: 86, 107-8; Gudschinsky 1970: 24; Mfonyam 1989: 535). To the authors' knowledge, only eight languages worldwide have ever been subject to formal, published tone orthography experimentation and, as it happens, they are all African. For a

comparative overview of these experiments, see Roberts (2008b). This article expands the repertoire by contributing one more experiment, focusing on Kabiye, a Gur language of Togo. It will be helpful to provide a brief sketch of the language before going any further.

1.1. The kabiye language

The earliest known vernacular publication in Kabiye appeared eighty years ago (Brungard 1932), but it was in the early 1980s that the Kabiye National Language Committee (CLNK), an organ of the Togolese Ministry of Education, standardized the orthography (Roberts 2011b). This process culminated in the publication of a bilingual dictionary (CLNK & SIL-Togo 1999) not to mention dozens of other publications (for an inventory see Pouwili 1999). This said, the motivation for reading and writing in the mother-tongue remains extremely low in the Kabiye community.

Tables 1 and 2 present the consonant and vowel grapheme inventories.

Table 1: Inventory of consonant graphemes in the Standard Orthography

		labial	labio-dental	dental	alveolar	retroflex	alveolo-palatal	palatal	velar	labio-velar	glottal
+ Obstruant	voiceless	P p	F f	T t			S s	C c	K k	Kp kp	
	voiced	B b	V v	D d	R r ¹	Ḑ ḑ	Z z	J j	G g	Gb gb	
- Obstruant				L l				Y y		W w	H h
Nasal		M m		N n				Ŋ ŋ			

Table 2: Inventory of vowel graphemes in the Standard Orthography

	Front		Back	
	[+ATR]	[-ATR]	[+ATR]	[-ATR]
Closed	I i	ɪ ɪ	U u	ʊ ʊ
Half-open	E e	ɛ ɛ	O o	ɔ ɔ
Open	A a			

Vowels may be short, long or extra-long. Long vowels are spelled by doubling and extra-long vowels by tripling the letters. In addition, there is a series of five long back unrounded vowels, shown in table 3.

¹ The letter <r> is reserved for borrowed words and foreign proper nouns. See CLNK minutes, 11-22 juillet 1983.

Table 3: Inventory of long back unrounded digraphs in the Standard Orthography

	Back	
	[+ATR]	[-ATR]
Closed	<iɣ> [ɰɰ]	<ɪɣ> [ɰɰ]
Half-open	<eɣ> [ʌʌ]	<ɛɣ> [ʌʌ]
Open	<aɣ> [ɑɑ]	

Capital letters are employed as they are in English: in sentence initial position, on the first letters of proper nouns and in titles.

Kabiye has two phonemic tones, high (H) and low (L), automatic and non-automatic downstep and numerous morphotonological processes that have been described in detail elsewhere (Delord 1976; Kassan 2000; Lébikaza 1994; Lébikaza 1999; Roberts 2002, 2003a, 2003b). Although tone plays a lexical and a grammatical role, all our previous research indicates that the real functional load of tone is in the grammar (Roberts 2008a, 2010a, 2010b). Indeed numerous grammatical constructions are signaled only by tone.

However, the Standard Orthography does not mark tone. This often leaves readers bereft of the clues they need to make correct interpretations. The CLNK is aware of this and the question has been the subject of a long debate (CLNK 1995a: 11-12; 1995b: 4-5, 16-17; 1998: 8-10) that one of the authors has participated in over a ten-year period. Some orthography stakeholders (politicians, literacy supervisors, writers, journalists, TV presenters, church leaders...) would like to mark phonemic tone;

others would prefer to maintain the status quo and put up with the ambiguities (CLNK 1995b: 4-5, 16-17).

1.2. Two experimental orthographies

Faced with these polarized positions in the Kabiye community, this experiment was conceived as an original contribution to the CLNK debate. We wanted to test a ‘third way’ that does not align itself with either extreme: highlighting the grammar rather than the tone system itself. This approach is not new in itself: other researchers have recommended it (Kutsch Lojenga 1993; Snider 1992: 29-30) and there is a growing list of languages that have applied it for the purpose of distinguishing one grammatical contrast or another. Specific examples are cited in Roberts (2013: 85-86). However, to our knowledge, this strategy has never been rigorously tested against the more common strategy of marking tones by means of diacritics. And since, at the local level, the CLNK had already recommended formal orthography testing (CLNK 1995b: 4-5, 16-17), the time seemed ripe to undertake a quantitative experiment, evaluating two experimental orthographies against each other — a tone orthography and a grammar orthography — both of which are modifications of the standard orthography.

The experimental tone orthography marks phonemic H tone by means of an acute accent and is a phonographic (i.e. sound-based) approach. It is based on prior autosegmental analysis (Roberts 2002, 2003a, 2003b). Visually, diacritics are superposed on the existing standard orthography. This is the classic solution,

advocated by most researchers (eg. Mfonyam 1989; Pike 1948; Wiesemann & Tadadjeu 1979).

The experimental grammar orthography, on the other hand, assigns new functions to certain existing graphemes in order to highlight specific grammatical constructions and is a semiographic (i.e. meaning-based) approach. Visually, occasional characters are woven into the tissue of the standard orthography. Altogether, the experimental grammar orthography contains ten types of modification. These were chosen from a much larger pool of potential candidates on the basis of previous research (Roberts 2008a) that had identified them as being the most significant contributors to readers' difficulties. They not only disambiguate tonal minimal pairs, but also add clarity for the reader in many contexts that are not absolutely ambiguous (Roberts 2010a). It will be helpful to summarize the ten modifications before proceeding with an account of the experiment. Each of the examples that follow compares four things: the standard orthography, the tone orthography, the grammar orthography and the pronunciation.

1. A capital letter is written in *verb root* initial position, to distinguish cases where there is a morphemic mismatch (example 1). This article does not report on this particular modification because the results proved interesting enough to warrant separate treatment (Roberts 2010b). Nevertheless, we present it first in this overview of the grammar orthography, because it is ubiquitous in natural contexts.

1	Standard	<ετασι-m>	<ετασι-m>
	Grammar	<εΤασι-m>	<εταSi-m>
	Tone	<ετασί-m> [ε-ta-sí-m]	<ετασι-μί> [ε-ta-si-mí]
		SP3/1-add_AOR-OP1s <i>he added to me</i>	SP3/1-NEG-add_AOR-OP1s <i>he did not accompany me</i>

2. The *interrogative clause* is marked with an inverted question mark in sentence initial position to distinguish it from the declarative (example 2).

2	Standard	<αγockυ...?>	<αγockυ...>
	Grammar	<ι αγockυ...?>	<aYockυ...>
	Tone	<áyockú...?> [á-yók-úú]	<ayockú...> [a-yók-úú]
		INT-break-IPF <i>who breaks...?</i>	SP3/8-break-IPF <i>they break...</i>

3. The *imperative clause* is marked with an inverted exclamation mark in sentence initial position to distinguish it from the declarative (example 3).

3	Standard	<εηεδι e-wondu...>	<εηεδι e-wondu...>
	Grammar	<ι εΗεδι e-wondu...>	<εΗεδι e-wondu...>
	Tone	<έηέδι e-wóndu...> [έηέδι e-wóndu]	<εηέδι e-wóndu...> [εηέδι e-wóndu]
		SP3s-unpack_IMP PP3s-suitcases.9 <i>may he unpack his suitcases!</i>	SP3s-unpack_AOR PP3s-suitcases.9 <i>he unpacked his suitcases</i>

4. The *conditional clause* is marked with the symbol <±> in sentence initial position to distinguish it from the declarative (example 4).

4	Standard	<ηνιγ...>	<ηνιγ...>
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orthography:

Grammar	<±ηNιγ...>	<ηNιγ...>
orthography:		
Tone orthography:	<ήνίγ...>	<ηνίγ...>
	[ń-nú-ι]	[n-nú-ι]
	SP2s_CND-listen-IPF	SP2s-listen-IPF
	<i>if you listen</i>	<i>you listen</i>

5. The aorist and imperative forms of 36 *monosyllabic verb roots* are marked with silent superscript letters <^{b m w}> to distinguish them from each other (example 5).

5	Standard	<ετᵔᵔᵔ κpenzυυ>	<ετᵔᵔᵔ κpenzυυ>	<ετᵔᵔᵔ κpenzυυ>
	Grammar	<ετᵔᵔᵔ ^b κpenzυυ>	<ετᵔᵔᵔ ^m κpenzυυ>	<ετᵔᵔᵔ ^w κpenzυυ>
	Tone	<ετᵔᵔᵔ κpenzυύ>	<ετᵔᵔᵔ κpenzυύ>	<ετᵔᵔᵔ κpenzυύ>
		[ετᵔᵔᵔ κpenzυó]	[ετᵔᵔᵔ κpenzυó]	[ετᵔᵔᵔ κpenzυó]
		SP3/1-NEG- pound-AOR chilli- pepper-3	SP3/1-NEG- deprive.self-AOR chilli-pepper-3	SP3/1-NEG-plant-AOR chilli-pepper-3
		<i>She did not pound chilli pepper</i>	<i>She did not deprive herself of chilli pepper</i>	<i>She did not plant chilli pepper</i>

The three letters <^{b m w}> are chosen because they are present in the underlying forms which are pronounced in the perfective.

6	Standard	<εσᵔᵔᵔ ^b a>	<εσᵔᵔᵔ ^m a>	<εσᵔᵔᵔ ^w a>
		[εσᵔᵔᵔ ^b á]	[εσᵔᵔᵔ ^m á]	[εσᵔᵔᵔ ^w á]
		SP3/1-pound- PER	SP3/1-deprive.oneself- PER	SP3/1-plant-PER
		<i>She pounded</i>	<i>She deprived herself of</i>	<i>She planted</i>

6. The underlying form of the *negative perfective modal prefix* <ta>² is written in any context where writing transparent vowel harmony could be confused with the immediative (example 7).

7	Standard orthography:	<Tɛtv tiñamsɪ>	<Tɛtv tiñamsɪ>
	Grammar orthography:	<Tɛtv taÑamsɪ>	<Tɛtv tiÑamsɪ>
	Tone orthography:	<Té̌tv tiñámí> [té̌-tv ti-ɲámí]	<té̌tv tíñámí> [té̌- [↓] tó tí-ɲámí]
		earth-9 NEG-s-shake_AOR	earth-9 IMM-shake_AOR
		<i>The earth did not shake</i>	<i>Suddenly the earth shook</i>

The *distant modal prefix*, which in a subordinate clause has a future meaning, is written with an apostrophe to signal elision of the consonant <k> and to distinguish it from the negative perfective (example 8).

8	Standard:	<Paawoki pɪlɔŋ yɔɔ>	<Paawoki pɪlɔŋ yɔɔ>
	Grammar:	<Pa'aWoki pɪlɔŋ yɔɔ>	<PaaWoki pɪlɔŋ yɔɔ>
	Tone:	<paáwoki pɪlɔŋ yɔɔ> [pa-á-wo-ki pɪlá-ŋ yɔɔ]	<paawoki pɪlɔŋ yɔɔ> [pa-a-wo-ki pɪlá-ŋ yɔɔ]
		SP3/2/-FUT-go-PRF cemetery-3 LOC	SP3/2-NEG-go-PRF cemetery-3 LOC
		<i>When we go to the cemetery</i>	<i>We do not go to the cemetery</i>

² The negative perfective forms in Example 5 are formed by adding a negative prefix to the aorist.

The *coordinating conjunction* ‘but’ is written with an apostrophe to mark elision of the consonant <k> and to distinguish it from the absolute pronouns of classes 1 and 4 (example 9).

9	Standard:	<elε>	<elε>
	Grammar:	<'elε>	<elε>
	Tone:	<elé>	<élé>
		[elé]	[élé]
		/kelé/	/élé/
		CNJ	ABS3/1 ~ ABS3/4
		<i>but</i>	<i>him ~ her ~ them</i>

9. *Demonstrative pronouns* are written with voiceless obstruents to distinguish them from their relative pronoun counterparts (example 10). This modification applies to seven pairs.

10	Standard orthography:	<piɣa ŋga>	<piɣa ŋga>
	Grammar orthography:	<piɣa ŋka>	<piɣa ŋga>
	Tone orthography:	<pi'ɣá ŋgá>	<pi'ɣá ŋgá>
		[pɛ́ɛ́á ŋgá]	[pɛ́ɛ́á ʰŋgá]
		child.5 DEM.5	child.5 REL.5
		<i>this child</i>	<i>the child who</i>

10. The *adversative modal prefix* is written with a voiced obstruent, and the *expectative* with the letter <r>³ to distinguish them from each other and from the habitual (example 11).

11	Standard	<εjam tupay>	<εjam tupay>	<εjam tupay>
	Grammar	<εjam duPay>	<εjam ruPay>	<εjam tuPay>
	Tone	<εjam típay>	<εjam típáy>	<εjam típáy>
		[εɖʒam tíbaa]	[εɖʒam tíbáá]	[εɖʒam tíbáá]
		poor-man_1 ADV-dance-IPF	poor-man_1 EXP- dance-IPF	poor-man_1 HAB- dance-IPF
		<i>the poor man dances in spite of it</i>	<i>the poor man dances in the meantime</i>	<i>the poor man usually dances</i>

So the experimental grammar orthography has ten types of modification, eight of which can be assessed in a unitary fashion. In addition, there are three kinds of monosyllabic verb roots and seven demonstratives. This makes a total of 18 individual constructions.

This brief sketch of the experimental grammar orthography offers only a glimpse into how it tackles homograph disambiguation. We refer the interested reader to Roberts

³ The letter <r> in <εjam ruPay>, to represent [εɖʒam tíbáá] *the poor man dances in the meantime*, may raise some eyebrows. Of all the modifications in the experimental grammar orthography it is the least easy to justify linguistically and met with the most resistance during classroom pilots tests and regional orthography consultations.

(2008a: 372-410) for a more detailed description and analysis. For the purposes of this experiment, the essential point is that the experimental grammar orthography targets specific grammatical constructions rather than the tone system itself.

2. METHODOLOGY

2.1. Design

To test the two newly developed orthographies against each other, we undertook a practical but controlled experiment composed of the following elements:

1. Selection of 55 participants all of whom had experience in writing Kabiye as literacy instructors.
2. Matched assignment to two experimental groups.
3. Application of a pre-intervention test to all participants to establish their baseline skills in writing the language.
4. Application of a training regimen in which each group was instructed in one of the two experimental orthographies.
5. Application of a post-intervention test designed to assess a range of consequences for each of the experimental orthographies.

2.2. Experiment

The experiment took place in March 2007 at the Social Affairs Centre in Kara, Togo. Five associations involved in literacy sent a total of 55 delegates⁴. Most of the participants had worked as volunteer literacy instructors in adult literacy programs. They received a modest per diem. The experiment took place over five consecutive days. The structure was based on Mfonyam (1989).⁵

2.2.1. Pre-intervention test (day 1)

In a plenary session, we tested participants' competence in the Standard Orthography in three areas.⁶

- *Dictation*: a mother-tongue test administrator read the whole text first, then repeated each sentence three times, then read the whole text again. The variable of measurement was number of spelling mistakes per 100 words.

⁴ Action Aid, AFASA (Association des Femmes pour l'Alphabétisation, la Santé et les Activités génératrices de revenus), SIL, Affaires Sociales and SOTOCO (Société Togolaise du Coton).

⁵ We would like to thank M. GOMINA Sizing, representing the CLNK and Mme KASSAN Balaïbaou, representing the linguistics department of Kara University, for their participation in the opening and closing ceremonies.

⁶ The experiment data appear in Roberts (2008a: A187-191).

- *Spontaneous writing*: participants were asked to write as much as possible in 45 minutes on a given theme. The variables of measurement were productivity (number of words written) and writing accuracy.
- *Questionnaire*: Participants completed a sociolinguistics questionnaire, the results of which provided the information for the independent variables.

At the end of this first session, on the basis of the results obtained,⁷ we divided the sample into two balanced groups for the three following mornings, *the grammar group* (i.e. those who were taught the experimental grammar orthography) and *the tone group* (i.e. those who were taught the experimental tone orthography).

We confirmed the group balance retrospectively during statistical analysis. This analysis revealed a small bias in favor of the tone group. It had a slightly higher level of formal and informal education and the pre-intervention test performance of this group was slightly better than that of the grammar group. But none of these differences was statistically significant and they did not invalidate the results.

⁷ We would like to thank Mme ADAM Essowè and M. AGBA Payekinam for helping the research team during the marking session. They are both volunteer literacy instructors who had performed exceptionally well during pilot tests.

Furthermore, we used the results of the pre-intervention test as a covariate to statistically neutralize the slight difference observed between the two groups.

2.2.2. Intervention (days 2 - 4)

Prior to the experiment, we had developed two training courses designed to give participants a thorough grounding in the use of one of the two experimental orthographies. One introduced the learner to the experimental grammar orthography (Roberts 2008a: A192-253); the other to the experimental tone orthography (Roberts 2008a: A254-308). Each course contained fifteen lessons lasting 30 to 45 minutes, interspersed with practical exercises.

Two trained mother-tongue speakers taught these lessons. One of the authors was discretely present in the classroom, but only to ensure the smooth running of the experiment. Both transition courses were taught over a period of three consecutive mornings. The half-day rhythm allowed the teachers to spend the afternoons debriefing on the results of the morning sessions and preparing the following day's lessons.

2.2.3. Post-intervention test (day 5)

On the last day, in a plenary session, we tested skills acquired in dictation and spontaneous writing. These tasks were administered in the same way as they had

been for the pre-intervention test. The test materials were identical in content and structure for the two groups, apart from the experimental orthography in question (Roberts 2008a: A182-185). The whole experiment took place in Kabiye, with the exception of the sociolinguistic questionnaire, which was in French, the official language (cf. Bird 1999b: 96).⁸

2.3. Testing Corpus

For the dictation task, we chose two corpora: 8 sentences containing 76 words for the pre-intervention test and 9 sentences containing 67 words for the post-intervention test. These corpora was significantly smaller than those of previous researchers (Bernard et al. 1995, 2002; Bird 1999b). We shortened ours because the longer texts used during pilot tests had resulted in boredom and fatigue (Roberts 2011a: 100-104).

As for content, it would clearly have been preferable to use natural texts rather than lists of sentences (Bird 1999b). And this approach would have posed no problem for the experimental tone orthography, as any text contains the same modification multiple times: an acute accent to mark H tone. However, the content had to be identical for both experimental orthographies, and it would have been impossible to

⁸ We also prepared two preference questionnaires, one for each transition course. For a discussion of the results of these, we refer the interested reader to Roberts (2008a: 529-531).

find a short natural text containing all ten types of modification inherent in the experimental grammar orthography. And since invented texts would have sounded contrived, we decided upon lists of sentences instead (cf. Bernard et al. 1995, 2002). Nevertheless, we selected all the sentences from a large corpus of natural texts and we never sought to artificially juxtapose minimal sentence pairs.

2.4. Independent variables

We recorded and tracked thirteen independent variables elicited by means of the sociolinguistics questionnaire that participants completed on the first day. These are summarized in table 4.

Table 4: independent variables

AGE	Participant's age.
GENDER	Participant's gender.
ASSOCIATION	Name of literacy association that delegated the participant to attend
L1	Whether or not participant was a mother-tongue Kabiye speaker.
DIALECT	Participant's dialect.
DIASPORA	Whether or not the participant had had any contact with the Kabiye diaspora.
INSTRUCTOR	Whether or not the participant was a literacy instructor.

EXPERIENCE	Amount of experience with standard orthography measured in years.
TRAINING	Amount of training as a literacy instructor measured in days.
EDUCATION	Level of formal education measured in years.
WRITEFREQ	Frequency of writing Kabiye measured in days per year.
TRANSITION	The grouping variable associated with the intervention.

3. ANALYSIS

3.1. Pre-intervention test (Day 1)

The aim of the pre-intervention task on the first day was to assess proficiency in writing the standard orthography. Participants completed two tasks: dictation and spontaneous writing. They were recorded for accuracy in both and speed in the second. We then performed regression analysis on the data, with four independent variables demonstrating statistically significant correlational effects (table 5).

Table 5: Results of regression analysis showing independent variables that significantly impacted pre-intervention test performance

Task	Dependent variable	Independent variable	Constant	Co-efficient	P-value	R ²
Dictation	Accuracy	EXPERIENCE	58.61	-1.111	0.048	7.2%
		TRAINING	70.31	-0.727	0.002	17.0%
Spontaneous writing	Speed	EDUCATION	135.8	-6.671	0.002	16.3%
	Accuracy	TRAINING	38.687	-0.336	0.012	11.4%

The first line of table 5 shows that, from a base of 58.61 spelling mistakes per 100 words if the variable is not taken into account (constant), each successive year of literacy experience reduces the number of spelling mistakes per 100 words by a little more than one (coefficient). However, this result does not account for a particularly high proportion of the variance in the data (R^2) and it is only just statistically significant (p).

Participants made many more spelling mistakes in dictation (a task which included all the grammatical constructions that would later be included in the experimental grammar orthography test) than they did when writing spontaneously. EDUCATION was a strong predictor of writing speed but not of accuracy. Both EXPERIENCE and TRAINING both made a modest contribution to the highly controlled dictation task, but only TRAINING improves accuracy when writing spontaneously.

We should underline that an average of 78 minutes to write 100 words is extremely slow. Normally, writing speed for writers who know what they want to say and write legibly is 3 to 5 minutes per 100 words. American first and second grade children are expected to take 15 to 20 minutes to write 100 words. Clearly, the writing performance of the participants in the study is low by any recognized standards, and this should be borne in mind throughout the analysis that follows.

3.2. Post-intervention test (Day 5)

The post-intervention test contained the same tasks as the pre-intervention test - dictation and spontaneous writing. As before, the metrics of comparison were accuracy and speed.

3.2.1. Writing accuracy

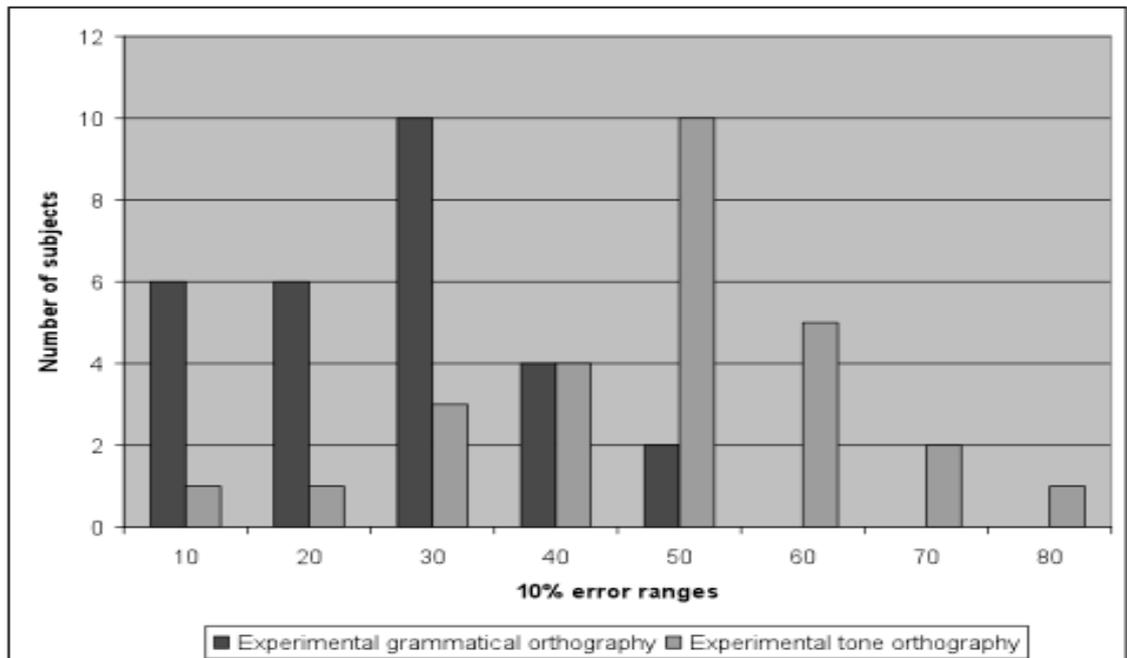
A measurement issue had to be resolved before making comparisons between the two experimental orthographies. The experimental tone orthography presents a binary choice in each of the 172 tone bearing units in the text: to write or not to write an acute accent. The experimental grammar orthography, on the other hand, presents another kind of choice: how to write each of the 39 required modifications in the text.⁹ To resolve this difficulty and to make the scores comparable, we created a single variable (ED-ACCURACY), which represents the error rate as a percentage of the total

⁹ In the introduction, we described the experimental grammar orthography as having ten types of modification and 18 individual constructions. But some of these (in particular the capitalized verb roots) appear more than once in the test materials.

number of choices to be made in each orthography. We will return to this question in section 3.2.3.

Figure 1 presents a histogram of the dictation accuracy metric. For the grammar group, the largest mode falls in the 30% error band while it falls in the 50% error band in the tone group. Over 40% of the grammar group registered less than 30% errors, compared to only 7% of the tone group. Nobody in the grammar group lies in the 60-80% error band, but nearly 30% of the tone group is located there. The mean error rate was 25.3% for the grammar group and 48.5% for the tone group. The difference is statistically significant ($p < 0.000$).

Figure 1: Distribution of subjects by percentage error rate (ED-ACCURACY) in the two experimental orthographies: dictation task



3.2.2. Spontaneous writing speed (productivity)

The spontaneous writing task was assessed by means of two metrics — accuracy (ES-ACCURACY) and speed (ES-SPEED). The results of the accuracy metric paralleled those of the dictation task so will not be further investigated here. The writing speed metric is a composite of ability to write plus ability to generate content. We did not attempt to tease apart these components of the metric. However, the use of the pre-intervention test as a covariate served as a means of controlling for this unknown influence in spontaneous writing. Table 6 shows the mean scores for each group in terms of number of words written in the time allowed.

Table 6: Results of the writing productivity metric (mean scores)

Group	Pre-intervention test			Post-intervention test		
	Words	SD	P	Words	SD	P
Grammar	71.2	28.7	0.570	50.4	21.1	0.027
Tone	66.9	26.8		38.4	17.6	

The difference in productivity between the two groups was slight in the pre-intervention test ($p=0.570$). In the post-intervention test, however, there is a much more marked decline in productivity in the tone group ($66.9 - 38.4 = 28.5$) than in the grammar group ($71.2 - 50.4 = 20.8$) and this result is statistically significant ($p=0.027$). We had predicted that both groups would write more slowly in the post-intervention test than in the pre-intervention test, since both were now grappling with spellings to which they had only had three days exposure. But there is a much more marked decline in productivity in the tone group than there is in the grammar group. This is not surprising, given that the tone orthography requires an orthographic decision on every single tone-bearing unit.

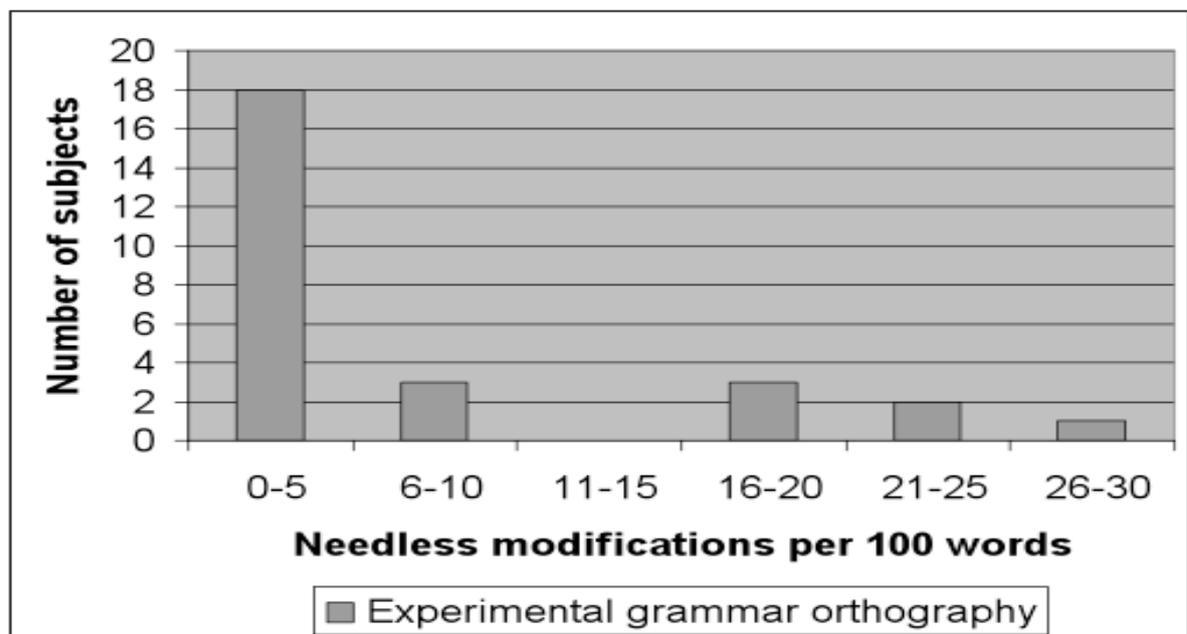
3.2.3. *The nature of grammatical representation*

The experimental tone orthography presents the writer with a binary choice on each syllable – to write or not to write an acute accent depending on the tone in question. The experimental grammar orthography, on the other hand, presents a much more complex set of choices – being able to identify where to apply a varied set of ten spelling rules. Moreover, the grammatical constructions in question vary in their salience and frequency of occurrence in natural contexts. In this section, we take a

closer look at the issues involved in representing grammatical constructions orthographically.

First, we consider the case of spurious modifications. Those who write in the experimental grammar orthography, in addition to misspelled or missed modifications to the Standard Orthography, may also add modifications needlessly. It did not seem appropriate to include these in the accuracy variable because they do not refer to a specific choice in the text and their frequency is potentially unlimited. So we counted them separately, and then calculated error rates (figure 2).

Figure 2: *Needless modifications in the Experimental Grammar Orthography dictation task*



The average is seven errors per 100 words in the experimental orthography dictation task.¹⁰ The majority (64%) of the group added five or less needless modifications per 100 words. However, we should note that even if needless modifications are included in the variable of accuracy, the grammar group (37.4 errors per 100 words) still outperforms the tone group (48.5 errors per 100 words) by a wide margin and this result is still statistically significant ($P = 0.034$). By way of comparison, participants wrote an average of 7 needless modifications in the dictation task and 10 in the spontaneous writing task.

Secondly, we will explore the correlation between frequency and success. Given that the experimental grammar orthography contains such a diverse set of grammatical constructions it seems reasonable to assume that some would be easier to represent than others. Figure 3 identifies the 18 constructions and compares rates of successful representation between the two experimental orthographies.

¹⁰ By way of comparison, the results for the spontaneous writing task were ten needless modifications per 100 words.

Figure 3: Success rates on grammatical constructions targeted for modification in the experimental orthographies dictation task

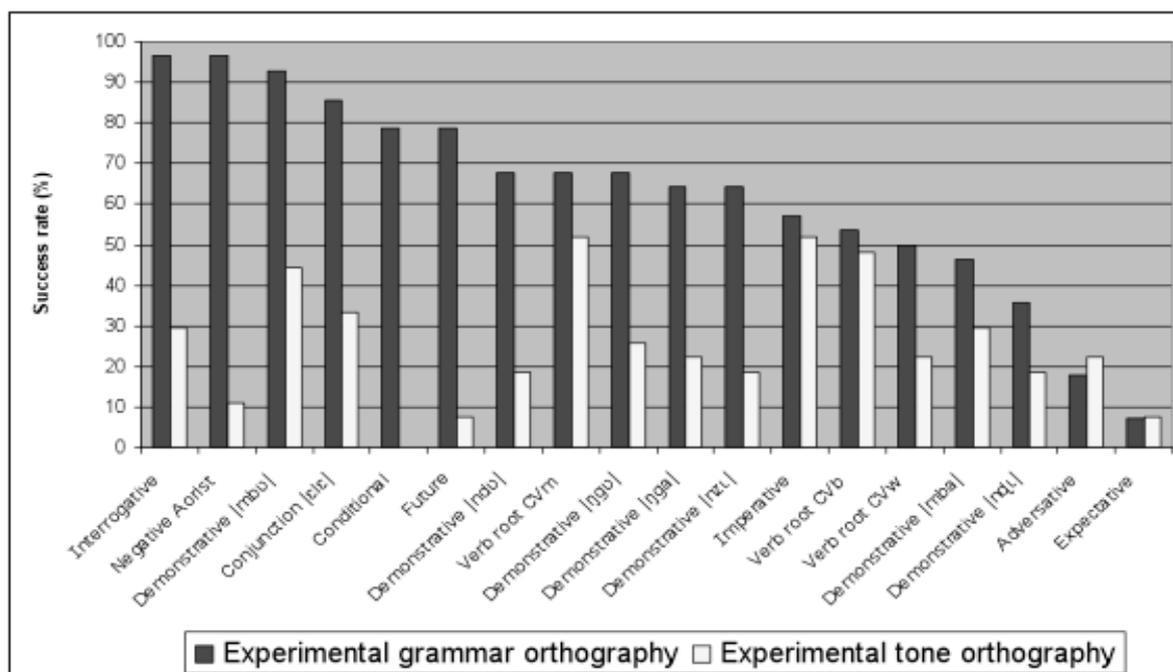


Figure 3 shows that the grammar group's performance surpasses that of the tone group on all grammatical constructions but two. The difference is often quite wide, especially in the first seven constructions to the left of the graph. Interestingly, when a construction was well mastered by the grammar group, performance by the tone group was often correspondingly poor. The most striking example is the conditional clause, where almost 80% of the grammar group succeeded in writing the modification, but everyone in the tone group failed. The margin between the two

groups becomes closer to the right of the graph, indicating that when a modification was not well mastered by one group, the other group did no better.

We should not rush to the conclusion that the less well-assimilated modifications in the experimental grammar orthography were necessarily bad design choices on the part of the research team. They may also be poorly assimilated because the construction itself rarely appears in natural contexts. To test this, we examined the correlation between success rates and frequency in natural contexts (CORPUSFREQ) using a corpus of natural texts containing 142,483 words (Table 7).

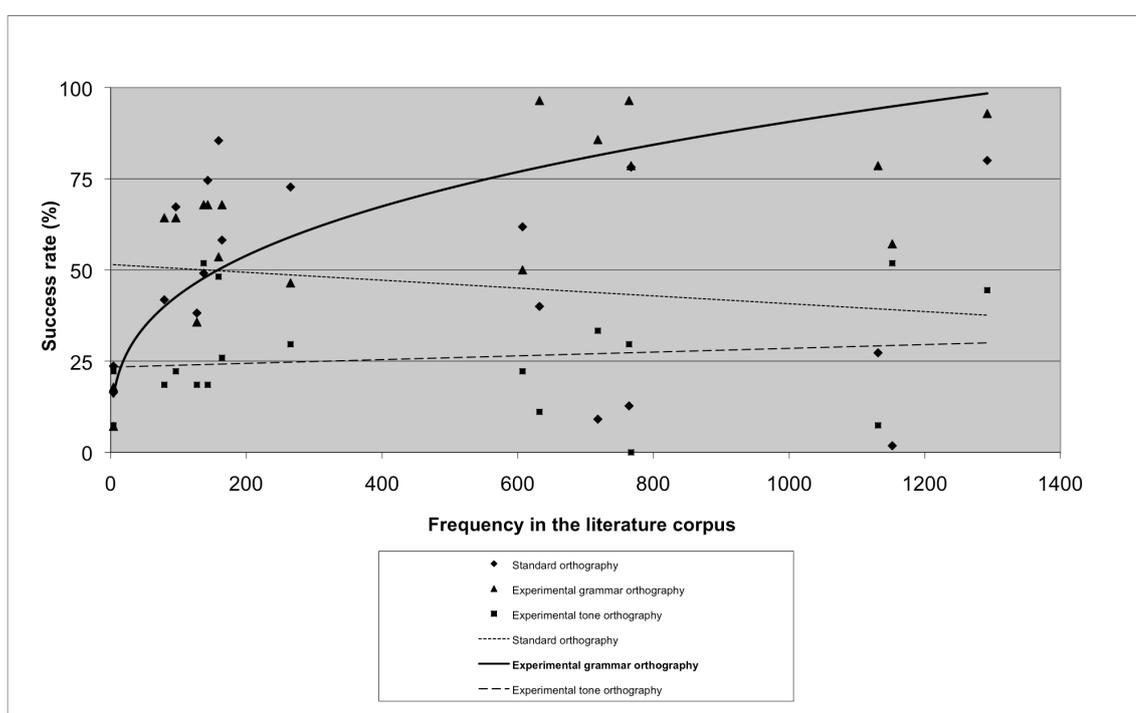
Table 7: Correlation between frequency of occurrence and rate of success

	Group	Constant	Co-efficient	P	R ²
PRE-INTERVENTION TEST	STANDARD	51.49	-0,011	0.497	2.9%
POST-INTERVENTION TEST	GRAMMAR	46.48	+0,035	0.007	37.0%
POST-INTERVENTION TEST	TONE	23.36	+0,005	0.569	2.1%

The results for the grammar group stand out from the others as being highly significant. From a constant of 46.48 if the variable CORPUSFREQ is not taken into account, each additional one hundred occurrences in natural contexts of a particular grammatical construction in natural texts improves the success rate in writing the experimental grammar orthography by about 3.5%. Frequency of occurrence of a given construction in natural texts correlates with the likelihood of correctly representing this construction in the experimental grammar orthography (p = 0.007;

$R^2 = 37.0\%$). However, frequency in natural contexts confers no such advantage in the tone group or in the standard orthography (figure 4).

Figure 4: Relationship between success and frequency in natural contexts of the targeted grammatical constructions in dictation tasks (standard and experimental orthographies),



Each point on the graph represents a grammatical construction in one of the three orthographies. When writing the experimental grammar orthography, only three of the grammatical constructions targeted for modification had a success rate of less than 40%. These are all low frequency constructions. None of the high frequency constructions has a success rate of less than 50%.

Summarizing the results of the dictation task, the grammar group surpasses the tone group by a wide margin. The difference between the two would be even stronger were it not for the presence of a small group of modifications in the experimental grammar orthography that were not well mastered.

3.2.4. *Impact of other independent variables*

Are there factors other than those being directly manipulated in the research which might explain the findings? With relation to writing speed, the only independent variable that accounted for a significant amount of the variation in performance on the experimental orthographies was EDUCATION ($p=0.010$). Surprisingly, it proved to be a stronger predictor of writing speed by those in the tone group than by those in the grammar group (Table 8).

Table 8: Correlation between EDUCATION and the metric of writing speed

Group	Constant	Coefficient	R ²	P
Grammar	182.3	-8.6	12.7%	0.063
Tone	279.1	-15.2	22.6%	0.014

EDUCATION improves performance by reducing the amount of time to write 100 words in both groups but accounts for a much larger percentage of the variance in the data for those in the tone group ($R^2 = 22.6$) than those in the grammar group ($R^2 = 12.7\%$)

4. DISCUSSION

4.1. Writing tone, writing grammar

Why should an experiment pitch a tone orthography against a grammar orthography in the first place? Is there any particular reason to choose between them? First impressions of the title of this paper might suggest that we believe tone and grammar to be two mutually exclusive domains. Of course this is not the case. In a language where tone has a grammatical function, we usually refer to ‘grammatical tone’; but it would be equally valid to refer to ‘tonal grammar’. The two terms describe a single phenomenon from two perspectives. Likewise the spelling system: the experimental tone orthography makes the tone system explicit, leaving the L1 reader to deduce the grammar from it; the experimental grammar orthography makes certain elements of the grammar explicit, leaving the L1 reader to deduce the tone pronunciation from it.

We believe that a comparison between these two strategies is pertinent because it examines the phenomenon of tone from two different angles: its form and its function. Most previous research has tended to focus on the phonological *form*, advocating a sound-based, phonographic representation of the tone system itself. This experiment, on the other hand, brings the *function* of tone into focus, and this seems particularly appropriate for languages like Kabiye in which the functional load of tone

is largely grammatical.¹¹ Again, this is not to say that the two strategies are mutually exclusive. All the world's writing systems are essentially mixed, containing both phonographic and semiographic elements (Catach 1988: 249). This principle can already be identified as far back as Champollion's (1824) research on Egyptian hieroglyphics, but Gelb (1952, 1973 [1952]) was one of the first to identify it as a universal principle. Even orthographies at the extreme phonographic end of the continuum, such as Spanish or Finnish, make concessions to semiography, because they include punctuation, numbers, mathematical symbols, abbreviations, the distinction between upper and lower case, and other codes that maintain no direct link between the written and the oral (Jaffré, 2006a: 27). Catach insists that the result is not chaotic, it is simply plurisystematic (1989: 264). A hybrid writing system does not choose between phonography or semiography: both principles are valid and they complement one another (Jaffré & David 1993). So for Kabiye, a mixed approach combining tone marking with a selection of grammatical markers may be the optimal solution. It would also be possible to mark grammar by means of diacritics, though testing this option was beyond the scope of our experiment.

¹¹ Granted, no quantitative measure of functional load exists. Our qualitative assessment is based on one of the author's extensive frequency and distribution analysis of tonal ambiguities in the language (Roberts 2008a, 2010a).

The experimental grammar orthography should not be seen as a “middle ground” or compromise between the classic strategies of zero and exhaustive marking. As semiographic representation it does not even lie on that continuum. In this respect, it is a more radical solution than has hitherto been advocated. Indeed, the visual appearance of the experimental grammar orthography may seem farfetched if we do not take the time to understand the linguistic considerations that undergird and validate it. With its inverted punctuation symbols, its word medial capital letters, and its superscript silent letters, first impressions are of an outlandish orthography that no language committee would ever authorize. In contrast, the experimental tone orthography, with its single accent employed multiple times, seems a model of logic and simplicity.

Such subjective first impressions raise an important question. Given the very different profiles of the two experimental orthographies, was the test really fair? Didn't those in the grammar group face the most daunting challenge simply because of the variety and complexity of the modifications they were expected to master? Apparently not; the results show the contrary. Participants in the grammar group wrote faster (table 6, page 24) and more accurately (figure 1, page 23) than those in the tone group.

These results suggest two things that have so far been given scant recognition in the debate about emerging African orthographies. First, writers are apparently more comfortable with the inclusion of complex occasional characters into the fabric of the

Standard Orthography than they are with a single accent sprinkled multiple times across the top (cf. Mann 1969: 100). Secondly, spelling conventions that highlight grammar may be easier for writers to master than spelling conventions that highlight the tone system itself. In this experiment, one group of Kabiye writers demonstrated an awareness of the morphological and syntactic structure of their language while another group did not demonstrate a clear awareness of its tone system.

A word is in order concerning needless modifications in the experimental grammar orthography (figure 2, page 26). On average participants wrote more in the spontaneous writing task than they did in the dictation task. This is surprising, given that a certain number of grammatical constructions are deliberately and artificially embedded in the dictation text, while the spontaneous writing task, by definition, can only contain the grammatical constructions with which the participant is familiar. We consider it likely that a spontaneous writing task immediately after an intensive transition course encourages a more spontaneous application of the modifications, the default thinking being "when in doubt, include the modification." It could be that this trend would fade away with longer training.

As for the strong correlation between the success rates of different grammatical constructions and their frequency in natural texts (figure 4, page 30), it suggests that the experimental grammar orthography does what its development was intended to do: facilitate the recovery and encoding of grammatical information by the writer

without the mediation of the phonology. The more writers in the grammar group are already familiar with a particular grammatical construction because of its frequency in natural texts, the more likely they are to employ the modification for that construction in the experimental grammar orthography. The same effect of familiarity does not confer any advantage for those writing the experimental tone orthography nor (which is perhaps more surprising) for those writing the standard orthography.

Now let us examine the contribution of the independent variables. In the standard orthography pre-intervention test, length of experience and length of training both contributed to writing accuracy, while education level contributed only to writing speed (table 5, page 20). In the two experimental orthographies test, however, education level takes over as the highest predictor of writing speed (table 8, page 31). It is the only variable that has any impact, eclipsing all the others.

This is not surprising, because the two transition courses are intellectual activities. Those with a higher level of education are better placed to learn new concepts in a short space of time, and they are accustomed to the demands of an examination. In addition, school prepares the mind to accept new ideas. For these reasons, we do not believe that the experimental orthographies are inherently easier for a student than for someone who has dropped out of school. It simply means that school is a good preparation for following an intensive three-morning transition course.

However, there is a surprise concerning the impact of education level. We correctly predicted that it would contribute to performance in the grammar group. School teaches students language awareness, especially in the Francophone setting, with its strong emphasis on orthography and grammar. But we also predicted that education level would have no impact on performance in the tone group. We reasoned that the ability to write tones requires good auditory perception rather than intellectual ability. One would have thought that someone who has not completed primary school but who has a musical ear would have a better chance of writing the experimental tone orthography than a lycée student who is tone deaf.¹² For whatever reason, this is not the case. Education level confers a stronger advantage in writing speed for the tone group than it does for the grammar group.

4.2. Methodological gaps and limitations

When considering the limitations of this research, our primary concern is the poor entry-level literacy skills of the participants. All the writing speeds reported are extremely slow (Table 6). We cannot dismiss the possibility that Kabiye literacy skills are so under-developed that they neutralize or obscure any experimental effects from the orthographic innovations that made up this investigation. We were not in a

¹² We did not control for this variable; to do so would make an interesting subject for future research.

position to resolve this during the intervention; we can only acknowledge it as a possible distorting variable (cf. Bird 1999b: 97).

The model we employed varied from true experimental design in three respects. First, participants were selected and sent by their sponsoring organizations so we cannot claim truly random selection. Second, participants were assigned to the two groups by a matching strategy which sought to ensure that the two groups were equivalent, based on performance in the pre-intervention test. Third, it is likely that performance in the post-intervention test was at least partially influenced by the unusual circumstance of a five-day immersion in literacy activities. To control for this, we could have included a third group who would have simply continued practicing the standard orthography on days 2 to 4, and test them on day 5 along with the others.

Similarly, evaluation of writing skills in the post-intervention test was based only on the novel orthographic elements. We did not continue to monitor performance in the unmodified aspects of the orthography. Such data might have shed light on the possible impact of the modifications on global writing performance.

This experiment, like most previous efforts, does not succeed in disentangling one parameter from another. On one hand, it tests a grammatical representation against a tonal representation. On the other hand, it tests the choice of symbol, because it evaluates the use of letters and punctuation marks against the use of accents. So if one

experimental orthography outperforms the other, it is not yet clear whether this is because of the choice of linguistic domain represented or the choice of orthographic symbol.

Similarly, one could criticize the intensive evaluation of individual grammatical constructions because it is difficult to disentangle the effect that they may have on one another. But when the comparison between the success rate and frequency in natural texts in the dictation task proved so striking, we considered it important to report this. However, it should be borne in mind that it was never our intention to evaluate individual modifications, nor even to evaluate an orthography. Rather, our goal was to test a *principle*: namely that in a language that uses tone to convey grammatical information, marking grammar can be an effective strategy.

The experiment included an oral reading task that we have not reported here, because the results were unclear. We conclude that a three-morning transition course is simply insufficient to influence participants' reading habits. Participants in both groups learned to write a series of modifications in this short time period. But they inevitably require more time to adjust psychologically to the new visual images presented in oral reading, especially since they are already under the influence of a pre-existing orthography in which they are not entirely proficient.

We predicted that WRITEFREQ, the variable that measures how often a participant writes outside of a structured literacy program, would have had some impact in the writing tasks. But it is remarkable by its absence. This suggests either that the participants (for whatever sociological reasons) evaluated themselves incorrectly, or that there is room for improvement in the measures used to calculate the responses.

5. CONCLUSION

In this experiment writers performed quicker and with greater accuracy in the grammar group than in the tone group. What are the implications of these results for linguists, decision makers, literacy specialists and other orthography stakeholders?

Quite apart from anything else, the results plead for more writing tasks in future experiment design. Adams asserts that writing skills are the motor that drives reading proficiency forward in the early stages of literacy acquisition, and that it is writing rather than reading which is the main vehicle for the development of analytical skills (1990: 375-6; 386-7, 420). In writing, the ability to plot a particular grammatical construction on paper not only requires recognition of its visual image, but also a personal reflection and self-criticism that the reading process does not. The participant, when writing either of the newly learned experimental orthographies, is forced to make decisions. In the reading process, on the other hand, the reader may be tempted not to face the challenges of the new orthography and simply revert to

searching for clues in the underlying and familiar Standard Orthography. For this reason, writing activities deserve to be given more attention in the quest for optimal tone orthographies.

Let us also consider the merits of the targeted approach that the experimental grammar orthography exemplifies. The ten types of modifications bring specific solutions to specific problems. This strategy is like microsurgery in the world of medicine — a precise and intricate operation that manipulates individual cells, treating only the malaise and leaving no collateral damage. With this analogy in mind, when we shared the strategy of marking grammar with orthography stakeholders,¹³ we were not suggesting that the CNLK should adopt the entire experimental grammar orthography, lock, stock and barrel. Such a scenario is inconceivable in a language community with a pedigree of eighty years orthography development behind it. However, we do believe that targeting individual grammatical constructions has a distinct sociolinguistic advantage over the classic phonological representation of the tone system: Each proposed modification can be evaluated individually on its own merits, and decision makers may adopt some whilst rejecting others. This in turn

¹³ With the CLNK at a five day seminar in Lomé (Roberts 2010c) and at three regional consultations in Kara and Lomé (Pidassa & Roberts 2005, 2006, 2008).

means that modifications may be adopted progressively, as and when the need is felt, a process that could conceivably span several decades.

As far as the choice of symbol is concerned, orthographers would do well to consider strategies other than the classic diacritic approach, at least for certain languages. This advice seems particularly appropriate for languages in which the functional load of tone is largely grammatical, though the experience of adding superscript final letters to monosyllabic verb roots demonstrates a possible application to lexical tone as well, particularly in contexts where monosyllabic tonal minimal pairs have emerged as a result of morphophonemic elision (Example 5).

The other side of the coin is the choice of what should be symbolized. Since writers apparently recognize the grammatical function of tone more readily than they do the tones themselves, it seems appropriate for the orthography to highlight the grammar rather than the tone. This strategy has pedagogical implications too: This paper helps build a case for teaching grammatical tone as grammar, without any reference to tones at all.

Frequency also plays its part. When writing the experimental grammar orthography, morphological awareness increases in proportion to the frequency of a given grammatical construction in natural texts. The number of times a writer is likely to encounter a given grammatical construction in natural texts has an impact on his or

her ability to write that construction. This frequency does not confer any advantage on those who learned the experimental tone orthography. The issue of frequency has rarely been introduced into the debate about the representation of tone in African languages. Our data indicates that researchers should pay greater attention to it.

Finally, let us return to the Phonemic Principle. For most of the 20th century, orthography development of previously unwritten languages has laboured under the tyranny of phonology, causing Bird (2001: 20) to remark that ‘phonological fundamentalism’ has often trumped other legitimate considerations. However, it is far from clear that a tight one-to-one mapping will necessarily result in an optimal orthography, because it is found wanting in at least three respects. First, it only represents the phonology, and ignores other important linguistic information such as morphology, syntax and the lexicon. Second, it can only represent one dialect, because a phonemic contrast in one speech variety may be absent in another (Koffi 2006). Third, even if an orthography is faithful to the phonology at the moment when it is adopted by the speech community, this advantage will be lost over time; as the spoken language evolves, the written language remains unchanged.

Moreover, the positions of some of the most prominent researchers are more nuanced than they have often been given credit for. Several have sought to distance themselves from a strictly phonographic approach. Nida was one of the first to flag a

warning: *"There seems always to be a tendency to ride a good horse too hard and too far. That is almost what has happened with regard to phonemic alphabets [...]"* (1963: 22).

In fact, the literature is full of advice to take sociolinguistic, psycholinguistic and pedagogical considerations in account (Bauernschmidt 1980: 12-21; Hollenbach 1978: 52; Priestly 1992: 314; Sjoberg 1966: 273; Venezky 1970: 256; Weaver 1980: 15-18). This is even the case among those whose names are most closely associated with the Phonemic Principle (Gudschinsky 1973: 116-125; Pike 1947: 211-215; Wiesemann 1981: 29). Any one of these considerations leads the orthographer away from a purely phonographic representation. And the most recent researchers are unequivocal on the need to view writing *"as embodying the entire linguistic system, [...] – morphology, syntax or semantics – and not just the phonology. Instead of devising an orthography simply by identifying the contrasting phonemes of a language and assigning symbols to each one, written language needs to be viewed as encoding much more than just the sounds"* (Grenoble & Whaley 2006: 141). The evidence brought to the table by this experiment concurs with this position. Far from being disturbing, it should release us in the direction of greater creativity (Gordon 1986: 74), promoting more imaginative solutions than have

been possible under strict constraints imposed by phonological analysis with its rigid insistence on the phonemic principle.¹⁴

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Table 9: Abbreviations

ABS	Absolute
ADV	Adversative
AFASA	Association des Femmes pour l'Alphabétisation, la Santé et les Activités génératrices de revenus (Women's Association for Literacy, Health and Income Generation).
AOR	Aorist
C	Consonant
CLNK	Comité de Langue Nationale Kabiyè (Kabiyè national language committee)
CND	Conditional
CNJ	conjunction
DEM	demonstrative pronoun
EXP	expectative
F	female
FUT	future
H	high tone
HAB	habitual
IMM	immediative
IMP	imperative
INT	interrogative pronoun
IPF	imperfective
L	low tone
L1	first language
LOC	locative
M	male

N1	noun of class 1 (and similarly for the other classes)
NEG	negative
OP	object pronoun
p	plural
P	probability
PP	possessive pronoun
PRF	perfective
REL	relative pronoun
s	singular
SD	standard deviation
SP1	first person subject pronoun (and similarly for the other persons)
V	vowel
wpm	words per minute
3/1	third person class 1 (and similarly for the other classes)
<>	orthographic data
[]	phonetic data
∅	zero

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