AUTOSEGMENTAL AND PEDAGOGICAL CONSIDERATIONS IN PREPARATION FOR A TONE ORTHOGRAPHY EXPERIMENT

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Abstract: This article describes the preparatory phase leading up to a tone orthography experiment in Kabiye (Gur, Togo). It aims to show the importance of integrating theory and practice when undertaking a classroom experiment. The first section applies certain principals from the theories of autosegmental and lexical phonology to the development of an experimental tone orthography and the pedagogical materials that were used to teach it. The second section describes four rounds of pilot tests that tested these principals in the classroom. These two tracks developed simultaneously until they coincided in test materials that were both theoretically and pedagogically sound. The article advocates the reporting of such preparatory work in order to optimise future experiment design.

Résumé : Dans cet article nous décrivons la phase préparatoire qui a précédé une expérience formelle sur la graphie tonale du kabiyè (gur, Togo). Notre objectif sera de démontrer l'importance d'une approche unifiée reliant théorie et pratique lorsqu'il s'agit de mener une expérience sur le terrain. La première partie applique certains principes de la théorie de la phonologie autosegmentale ainsi que celle de la phonologie lexicale à l'élaboration d'une graphie tonale expérimentale et les matériaux pédagogiques destinés à l'enseigner. La deuxième partie décrit quatre séries de tests pilotes dont le but était de mettre ces principes à l'épreuve dans les salles de classe. Ces deux pistes ont évolué simultanément, jusqu'à ce qu'elles coïncident dans des matériaux expérimentaux aussi solides sur le plan pédagogique que théorique. L'article plaide pour la publication de tels travaux préparatoires dans le but d'optimaliser la méthodologie des futures expériences.

Keywords: autosegmental phonology, lexical phonology, tone, orthography, pilot testing, pedagogy, experimentation, Gur languages.

0. INTRODUCTION

Various experiments evaluating tone orthographies have emerged over the last thirty years that have enriched our understanding of what an optimal tone orthography might look like (for an overview, see Roberts 2008b). Yet few of these contributions contain a detailed account of any preparatory research that took place in the run-up to the reported experiment. This might include, for example, a description of how an experimental orthography was developed, the process by which the pedagogical materials were compiled, or a discussion of any pilot testing that took place prior to the full-scale, formal experiment.

Mfonyam's (1989) experiments in Bafut and Limbum are a notable exception. They contain detailed descriptions of the process by which the experimenter developed several orthographies for testing purposes and he discusses pedagogical issues too, reproducing the lessons in the appendix. Beyond this, Bernard's first experiment in Kom (1995) might be viewed as a pilot test for the second (2002) and Bird makes a fleeting reference to pilot testing in his Dschang experiment (1999: 96). But in most of the published experiments, we can only guess whether any preparatory work took place, and if it did what it might have consisted of.

This paper focuses on the preparatory phase of a formal experiment undertaken in Kabiye, a Gur language spoken mainly in Togo. The results of the final experiment itself have been reported elsewhere (Roberts and Walter 2012). Here, the focus will solely be on the process of developing one of two experimental orthographies developed for testing purposes and the pedagogical materials used to teach it. It will be helpful to provide a brief sketch of both of these before going any further.

The experimental tone orthography was a modification of the existing standard orthography, which does not mark tone. The modified orthography adds multiple diacritics across the upper part of the script in order to represent the tone system exhaustively. It seemed wise to opt for a transparent representation corresponding to the output of the lexical phonology. This choice has been justified in a separate article (Roberts 2013).

The experimental grammatical orthography, on the other hand, targets a limited set of grammatical tone constructions that are ambiguous in the standard orthography. The experimental grammar orthography is not the focus of this article. I refer the interested reader to Roberts (2010a, 2010b, 2011) and also note that the results of the final experiment indicate that the experimental grammatical orthography has certain advantages over the experimental tone orthography.

The pedagogical materials for the experimental tone orthography consisted fifteen, thirty-minute lessons intended to be taught over three consecutive mornings. Each lesson ended with dictation and oral reading exercises. Each group of four lessons (i.e. each morning) ended with a revision lesson. The aim of the course was to help adult L1 speakers already literate in the standard orthography to transition to the experimental tone orthography. The pedagogical materials are reproduced in Roberts (2008a: appendix 7, p. A255).

This article is split into two major sections, describing two halves of a single methodological approach. The first section applies certain principals from the theories of

autosegmental phonology (Goldsmith 1990; Leben 1971, 1973) and lexical phonology (Kiparsky 1982; Mohanan 1986) to the development of the experimental tone orthography and the pedagogical materials. (Throughout this article, references to 'autosegmental theory' are understood to include the wider framework of lexical phonology.) The challenge was to explain the facts of the tone system to untrained lay people in a way that they could easily relate to. This meant examining, through an autosegmental lens, which parts of the tone system needed teaching and which parts would be assimilated naturally.

The second section of the article describes four rounds of classroom pilot tests that were performed in preparation for the final experiment. It examines the contribution that these had on the fine-tuning of the experimental tone orthography and the pedagogical materials.

The two sides of the methodology will, of necessity, be presented sequentially, and this does not do justice to the synergy they generated. Actually, they evolved in parallel as we oscillated back and forth between theory and practice. When autosegmental theory suggested a certain way of writing tone, it had to be thoroughly tested in the classroom pilot tests before being adopted as a spelling convention. Conversely, when the teachers hit a problem explaining an aspect of the tone orthography in the classroom pilot tests, we searched for the cause of the blockage in autosegmental theory. These two tracks continued until they coincided in an experimental tone orthography that was both theoretically and pedagogically sound.

The final experiment was quantitative, taking into account the contribution of all relevant variables in a statistical analysis. This article is complementary to this approach, being a qualitative analysis based on classroom observation and discussion. The research methodology demanded constant dialogue and negotiation between the researcher (myself) and two full-time mother-tongue research assistants.[1] The researcher's role was to find imaginative ways of applying autosegmental theory to a creative end. The assistants' role was to feedback their reactions to the experimental tone orthography as it took shape, to help write and critique the pedagogical materials, and to teach the lessons in the pilot tests and the final experiment.

All orthographic data is written in the experimental tone orthography unless otherwise indicated. In all cases except one,[2] the standard orthography is the same form as the experimental tone orthography with the accents stripped out. Orthographic data is cited between <chevrons>, phonemic data between /slashes/ and phonetic data between [brackets]. H tone is indicated by an acute accent **[á]**, low tone by absence of an accent **[a]**, and non-automatic downstep by a superscript arrow [$^{\downarrow}$**á**]. The tone bearing unit being the mora (Roberts 2005a), tone may be written on all vowels. This includes the both graphic segments in the series of five long back unrounded vowels that are written as digraphs <**aɣ, eɣ, ɛɣ, ɪɣ, iɣ**>. Tone may also be written on preconsonantal nasals <**m, n, ŋ**> and on the word final nasals <**m, ŋ**> The rationale for these decisions will

[1] Pidassa Emmanuel (previously French teacher at a local secondary school; thirteen years of formal education) and Bakoupète Noël (volunteer Kabiye teacher at a local secondary school; nine years of formal education). Throughout the article, the first person plural pronoun refers to the research team, consisting of the author and his two mother-tongue assistants.

[2] The exception is the interrogative particle <**na**> introduced in section 1.12.

be explained in due course. As for the pedagogical materials, all examples were written in unchevroned orthographic script, and they contained none of the autosegmental representations that appear in the following presentation.

1. AUTOSEGMENTS AND PEDAGOGY

1.1 UNDERLYING MELODIES

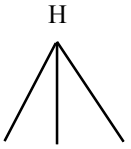
Kabiye has two underlying level tones, H and L, and six underlying melodies on noun roots of up to three TBUs. These melodies associate to the whole (singular) word, which is composed of a root and a class suffix, so it is relatively easy to identify animal keywords to represent them (cf. Burmeister 1980: 10) (examples (1 - 6).

(1)	/H/	<**fétîyé**>	/**fétî-yé**/	**[fétîyé]**	toad-7
(2)	/L/	<**kozoŋa**>	/**kozoŋ-a**/	**[kozoŋa]**	hare-5
(3)	/HL/	<**kpáŋaɣ**>	/**kpáŋɑ-ɑ**/	**[kpáŋɑɑ]**	donkey-5
(4)	/LH/	<**kpeluú**>	/**kpelu-ú**/	**[kpeluú]**	sparrow hawk-3
(5)	/HLH/	<**nákaǘ**>	/**náka-ǘ**/	**[na↓ká-ǘ]**	grasshopper-3
(6)	/LHL/	<**kɪláku**>	/**kɪlák-u**/	**[kɪlák-u]**	monitor lizard-3

So for example, instead of saying the 'LHL tone melody', the teacher always referred to <**kɪláku wîtu**> 'the monitor lizard's cry'. He took care to explain that is was not a reference to the sound that the monitor lizard makes, but to the sound of its name. Pictures of the animals accompanied the keywords, so the learner benefitted from both visual and auditory aids. The keywords were introduced in contrastive pairs, H ~ L, HL ~ LH, and HLH ~ LHL because pilot tests showed that binary choices facilitated auditory discrimination tasks.

1.2 ADJACENT TONES

From an autosegmental perspective, the three sequences [HHH], [HH] and [H], are all manifestations of a single /H/ melody. The pedagogical implication of this is that one keyword, <**fétîyé**> 'toad' is sufficient to represent all the lexemes that carry the H melody, whether they associate to three TBUs (example 7, two TBUs (example 8) or one TBUs (example 9). We used keywords of three-TBUs in all six cases to facilitate comparison between them since the /LHL/ and /HLH/ melodies can only associate to words with three TBUs.



(7) **[fé tí yé]**
/fétí-yé/
<fétíyé>
toad-7 [keyword]

(8) **[sá nú]**
/sán-ú/
<sánú>
army ant-1

(9) **[sú]**
/sú-/
<sú>
guinea fowl-1

1.3 DISSIMILAR CV STRUCTURES

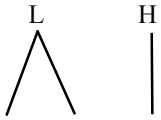
According to autosegmental theory, the same underlying melodies exist whatever the skeletal structure to which they associate. The pedagogical implications of this are that each keyword serves as a template for all the words that share that melody, even those of a dissimilar skeletal structure (examples 10 - 12). During multiple pilot tests, no participant ever questioned why words with such dissimilar segmental structures were taught together. They quickly understood the essential thing: they all share the same HL melody.

(10)	**<kpáŋaɣ>**	**/kpáŋɑ-ɑ/**	**[kpá**	**ŋɑ-**	**ɑ]**	donkey-5 [keyword]
(11)	**<ɖíziyu>**	**/ʈ͡ɕísi-yu/**	**[ʈ͡ɕí**	**zi-**	**yu]**	breeder-1
(12)	**<máaʊ>**	**/máa-ʊ/**	**[má**	**a-**	**ʊ]**	forge-3

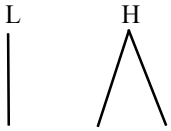
1.4 DISSIMILAR TONAL ASSOCIATIONS

When a two-tone melody associates to a three-TBU noun, it can surface in either of two ways. /HL/ can surface as either [HHL] or [HLL], and /LH/ as either [LLH] or [LHH]. From an autosegmental point of view, the surface melodies [HLL] and [LHH] are unusual in that they are the only nouns that do no associate in a one-to-one, right to left fashion, so this must be prespecified in the underlying forms of these items. Nevertheless we chose two rather than four animal keywords to cater for these melodies. This decision was partly based on a frequency count of words with these melodies in the Kabiye-French dictionary (CLNK and SIL-Togo 1999).

When the /LH/ melody associates to three TBU nouns, it surfaces as [LLH] in 95% of cases (examples 13 - 15) and as [LHH] in only 5% of cases (examples 16 - 18). Since there are no animals in the latter, the choice was straightforward: we chose a word from the majority list (example 13), as the keyword.

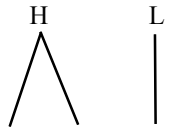


(13)	<**kpeluú**>	**/kpel-uú/**	**[kpe**	**lu-**	**ú]**	sparrowhawk-3 (keyword)
(14)	<**kujuká**>	**/kut͡ʃuká-/**	**[ku**	**d͡ʒu**	**ká-]**	Sunday-5
(15)	<**ŋgbɔ́**>	**/ŋkpɔ-ú/**	**[ŋ**	**gbɔ-**	**ú]**	large pot-3



(16)	<**aɖálá**>	**/aʈá-lá/**	**[a**	**ɾá-**	**lá]**	flat millet beer-8
(17)	<**kelúú**>	**/kel-úú/**	**[ke**	**lú-**	**ú]**	fang-3
(18)	<**ŋgíné**>	**/ŋkí-né/**	**[ŋ**	**gí-**	**né]**	soaked millet flour-7

As for the /HL/ melody, when it associates to a word containing three TBUs, it surfaces as [HHL] in 82% of cases, most of which are plural or uncountable nouns (examples 19 - 21). The surface melody [HLL] occurs in only 18% of cases (examples 22 - 24). Since there is no singular animal in the majority list, we were constrained to choose a keyword from the minority list (example 22).



(19)	<**kóláa**>	**/kóláa/**	**[kó**	**l-á**	**a]**	blacksmiths-2
(20)	<**kpáɖíŋ**>	**/kpáʈíŋ/**	**[kpá**	**ɾ-í**	**ŋ]**	pincers-4
(21)	<**páátʊ**>	**/páátʊ/**	**[pá**	**á-**	**tʊ]**	palm branches-9

(22)	<**kpáŋaɣ**>	**/kpáŋɑ-ɑ/**	**[kpá**	**ŋɑ-**	**ɑ]**	donkey-5 [keyword]
(23)	<**ɖíziye**>	**/ʧísi-ye/**	**[ʧí**	**zi-**	**ye]**	breeding-7
(24)	<**sálaŋ**>	**/sálaŋ-/**	**[sá**	**la**	**ŋ-]**	September-3

In the classroom pilot tests, we closely observed students responses to these two choices. Sometimes no reaction is the best possible confirmation. No student ever questioned why a [LLH] keyword should represent a [LHH] noun, nor why a [HLL] keyword should represent a [HHL] noun. They were apparently at ease with the concept that the keywords represent the underlying melodies /HL/ and /LH/.

1.5 TONE BEARING NASALS

The vast majority of pre-consonantal nasals take the same tone as that of the preceding vowel (examples 25 - 30).

(25)	<**kómna**>	**/kómna-/**	**[kómna-]**	government-3
(26)	<**timɖe**>	**/tim-ʈe/**	**[tim-ɖe]**	large flute-7
(27)	<**abíńda**>	**/apíńt-a/**	**[abíńd-á]**	weeding-8
(28)	<**canzí**>	**/t͡ʃansí-/**	**[t͡ʃanzí-]**	chameleon-1
(29)	<**káŋwá**>	**/káŋwá/**	**[káŋwá]**	potassium-3
(30)	<**kpaŋnó**>	**/kpaŋn-ó/**	**[kpaŋn-ó]**	horse-1

This level of predictability and a desire for graphic economy led us to want to exclude the nasals from the list of accent-bearing letters. However, in a minority of case, labial and alveolar nasals associate to a H tone when the preceding vowel is L (Roberts 2005b) (examples 31 - 33).

(31)	<**saḿtʊ**>	**/saḿ-tʊ/**	**[saḿ-tʊ]**	praise-9
(32)	<**hɛńzɪ**>	**/hɛń-sɪ/**	**[hɛń-zɪ]**	cracks-6
(33)	<**pɪŋ́gʊ**>	**/pɪŋ́gʊ/**	**[pɪŋ́gʊ]**	what sort of?-3

Also, among the concordant markers in the noun class system there are contrastive tones on labial, alveolar and velar pre-consonantal nasals (examples 34 - 39).

(34)	<**mbʊ́**>	<**mpʊ́**>	**[mbʊ́]**	REL-10
(35)	<**mbʊ́**>	<**mpʊ́**>	**[mbʊ́]**	DEM-10 ~ INT-10
(36)	<**nzí**>	<**nsí**>	**[nzí]**	REL-6
(37)	<**ńzí**>	<**ńsí**>	**[ńzí]**	DEM-6 ~ INT-6
(38)	<**ŋgʊ́**>	<**ŋkʊ́**>	**[ŋgʊ́]**	REL-3
(39)	<**ŋ́gʊ́**>	<**ŋ́kʊ́**>	**[ŋ́gʊ́]**	DEM-3 ~ INT-3

So which H tone nasals should be marked with an acute accent in the experimental tone orthography? This question is typical of a kind that could only be resolved by means of pilot testing. Classroom experience led us to mark all H tone pre-consonantal nasals. This proved easier than trying to teach the difference between eligible and ineligible nasals.

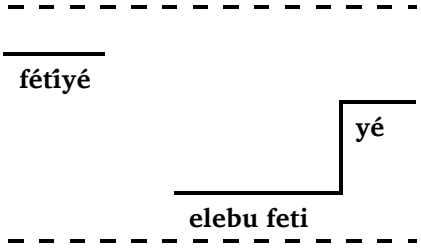
1.6 L TONE SPREADING

In the associative noun phrase, a lexical process stipulates that the L tone of the first noun spreads rightwards onto the second noun until it is blocked by a singly linked H tone (Roberts 2003b). A similar lexical process applies in the verb phrase (Roberts 2004). Since the experimental tone orthography represents the output of the lexical phonology, this spreading process is written. The pedagogical materials illustrated this spelling rule with a cultural allusion. Habɪyɛ, the dance of the sorcerers, takes place once every five years in Kabiyeland. Dancers show off their magic powers, which includes eating toads. The noun phrase <elebu fetiyé> ‘habiye dancer’s toad’ is a good example to use for the L tone spreading process, because it builds on an already known animal keyword (example 40).

	/e	**le**	**bu**	**fé**	**tí**	**yé/**	
(40)	**[e**	**le**	**bu**	**fe**	**ti**	**yé]**	habiyè dancer's toad
	habiye dancer-1			toad-7			

We called the L tone spreading process **<fétíyé paɣtʊ>** *'the toad rule'*. During the pilot tests, we experimented with drawing pitch contour diagrams on the blackboard to demonstrate this spelling rule (figure 1). Learners found this helpful, so we included them in the pedagogical materials.

Figure 1: Pitch contour representation of the L tone spreading process (the toad rule)



1.7 POST-LEXICAL HLH PLATEAUING

The post-lexical plateauing process[3] stipulates that a singly linked L tone between two H tones delinks and the neighbouring H tone spreads across to take its place. The floating L tone triggers non-automatic downstep (Lébikaza 1999: 191-195; Roberts 2003a: 57-58). The direction of the spreading depends on the supporting segmental structure. The lowering of the tonal register aligns with the postvocalic or postnasal consonant. So the melody /HLH/ is pronounced either as [H↓HH] (examples 41 - 43) or as [HH↓H] (examples 44 - 46).

(41)	**<nákaʊ>**	**/ná**	**ka-**	**ú/**	→	**[ná**	**↓ka**	**ú]**	grasshopper-3 [keyword]
(42)	**<kpízimɨ́>**	**/kpí**	**zi**	**mɨ́/**	→	**[kpí**	**↓zí**	**mɨ́]**	measles-3
(43)	**<káɖaɣ>**	**/ká**	**ʈɑ**	**á/**	→	**[ká**	**↓ɾá**	**á]**	garden-5

[3] Lébikaza (1999: 190-194) calls this process 'assimilation verticale'.

(44)	<**ñúʋdú**>	**/ɲú**	**ʊ**	**t-ú/**	→	**[ɲú**	**ú**	**ꜜdú]**	president-1
(45)	<**ñándú**>	**/ɲá**	**n-**	**tú/**	→	**[ɲá**	**ń**	**ꜜdú]**	bitter leaf-9
(46)	<**ɖéndɖé**>	**/ʈé**	**n**	**ʈé/**	→	**[ʈé**	**ń**	**ꜜɖé]**	where

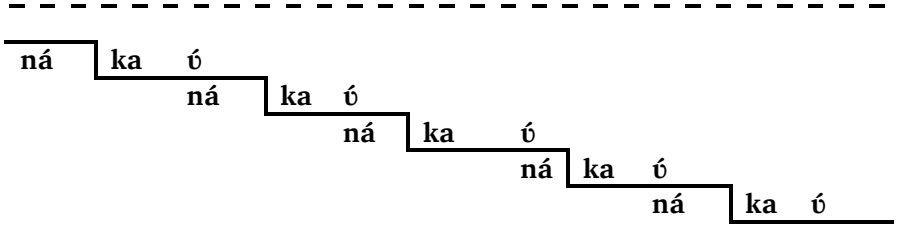
The melody /HLH/ occurs in only nineteen words and only these three surface as [HHꜜH]. Autosegmental theory and classroom observation concurred that one melody was sufficient to represent both surface forms. In practice, learners are not even aware of the surface difference between [HHꜜH] and [HꜜHH].

However, this does not mean that the pedagogical materials could skate over the /HLH/ melody quickly. On the contrary: the surface forms [HꜜHH] and [HHꜜH] are ubiquitous once words are placed in context, because the process is triggered every time a singly linked L tone occurs between two H tones, whether it be within three-TBU words (examples 41 - 46), in longer words (examples 47 - 49) or across word boundaries (examples 50 - 52).

(47)	<**kelîmiyé**>	**/kelîmi-yé/**	**[kelîꜜmî-yé]**	hen
		hen-7		
(48)	<**maacétɪ-ŋ́**>	**/ma-a-t͡ʃétɪ-ŋ́/**	**[ma-a-d͡ʒéꜜtí-ŋ́]**	I had lied to you
		SP1s-DIS-lie-OP2s		
(49)	<**kîmaɣ́naʊ**>	**/kî-mɑána-ʊ/**	**[kî-ꜜmáána-ʊ]**	average
		ADJ-average-I		
(50)	<**má nɛ ŋ́**>	**/má nɛ ŋ́/**	**[má ꜜné ŋ́]**	me and you
		SP1s CNJ SP2s		
(51)	<**kpelaɣ́ yɔ́**>	**/kpelɑ-á yɔ́/**	**[kpelɑ-á ꜜyɔ́ɔ́]**	on the chair
		chair-5 LOC		
(52)	<**sétʊ fɛ́yí !**>	**/sé-tʊ fɛ́yí/**	**[sé-ꜜtú vɛ́yí]**	don't mention it!
		thanks-9 there is not		

We called this <**nákaú paɣ́tʊ**> *'the grasshopper rule'*. It often applies recursively, that is to say the second H of a HLH sequence is also the first H of the next HLH sequence. In the pilot tests, we found that the best way to teach this was to write the sentence on the blackboard, cascade the keyword across the top and superimpose the pitch contours (figure 2).

Figure 2: Pitch contour representation of the recursive HLH process (the grasshopper rule)



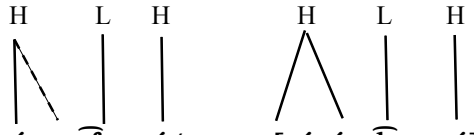
<Ńɛ́	**wɛ**	**ná**	**e**	**gbé**	**le**	**kó**	**ɖʊ**	**mí**	**ɖe**	**ké.>**
/ɲɛ́	**wɛ**	**ná**	**e**	**kpé**	**le**	**kó**	**ʈʊ**	**mí**	**ʈe**	**ké/**
[ɲɛ́	**ˈwɛ́**	**ná**	**ˈé**	**gbé**	**ˈlé**	**kó**	**ˈɾó**	**mí**	**ˈʈé**	**ké]**
FOC	have-PER		maternal uncle-1			one-1			only	

As for you, you have only one maternal uncle.

Unsurprisingly, the HLH melody presented learners with a real challenge. It was not particularly difficult for them to identify it on isolated words, nor to match other lexical items of the same melody, because it is musically distinctive. The difficulties began when we introduced the grasshopper rule i.e. spelling the HLH melody across word boundaries. And unsurprisingly, applying the grasshopper rule recursively proved to be an even more formidable challenge. Consequently the teacher had to spend a long time on this point, with plenty of whistling, dictation and oral reading exercises to reinforce the point.

1.8 H TONE SPREADING

When two TBUs with no intervening consonant (i.e. VV, NN, VN, Vɣ), associate to the melody /HL/ before another L tone, the H tone of the first TBU spreads to the second (Roberts 2003a: 59). Again, this is a post-lexical phenomenon that is below the awareness threshold of the mother tongue speaker. The experimental tone orthography represents the underlying form (examples 53 - 55).



(53)	**<ñé-ɛjaɖɛ́>**	**/ɲé**	**ɛ**	**t͡ʃa-**	**ʈé/**	→	**[ɲé**	**ɛ́**	**d͡ʒa-**	**ɾɛ́]**	your country-7
(54)	**<táabalʊ́>**	**/tá**	**a**	**pa**	**l-ʊ́/**	→	**[tá**	**á**	**ba**	**l-ʊ́]**	friend-1
(55)	**<líidiyé>**	**/lí**	**i**	**ti**	**-yé/**	→	**[lí**	**î**	**di**	**-yé]**	money-7

If the second H tone (i.e. on the first vowel [**ɛ́**] of the noun) were to be represented in writing it would be misleading, because the vertical assimilation process (the grasshopper rule) already stipulates that HLH is pronounced [HˈHH] (example 56).

(56) ***<ñé-ɛ́jaɖɛ́>** ***/ɲɛ́ɛ́t͡ʃaʈɛ́/** ***[ɲɛ́ɛ́ˈd͡ʒáɾɛ́]** your country

Clearly, from a pedagogical point of view, it is best to avoid as many abstract explanations as possible, especially those that refer to surface processes. During the first pilot tests, we tried avoiding referring to the H tone spreading process altogether but this proved unsuccessful. So in the next round of pilot tests, we included it, calling it <**táabalɔ́ paɣtʊ**> 'the friend rule'. Of all the spelling rules in the course, this one was the most difficult to teach, learn and write. Apart from any other consideration, it was the only teaching point for which we were unable to find an animal keyword, so it stood out as being different. In pilot tests, participants spelled this convention incorrectly time and time again, and the teachers themselves never entirely mastered it. Nonetheless, the spelling rule is based on sound autosegmental principles, and is unavoidable in a transparent tone orthography that represents the output of the lexical phonology.

Having described the spelling of the three major morphotonological processes, it only remains to describe four grammatical particles which need special attention.

1.9 THE PARTICLE <yɔ>

In the majority of cases, the particle <**yɔ́**> carries a H tone and marks the end of a subordinate clause. The experimental tone orthography marks this with an acute accent (example 57). But sometimes this particle is preceded by non-automatic downstep, marking the end of a condtional clause. The experimental tone orthography marks this with an apostrophe <**'yɔ́**> (example 58). However, this does not mean though that every time there is orally a lowering of tonal register immediately before this particle that it is necessary to add an apostrophe. Non-automatic downstep can occur in a subordinate clause simply because a singly linked L tone is found between two H tones, triggering the usual vertical assimilation process (example 59).

(57) <**Ajɛyɛ́ wená ayɔ́ɔ́dʊʊ fransíɪ kʊnʊŋ yɔ́ asîítuu fransíɪ mátʊ sukúli wɪlʊ́ʊ yɔɔ́.**>
/atʃ͡ɛyɛ́ wená ayɔ́ɔ́tʊʊ fɪ̨ansíɪ kʊnʊŋ yɔ́ asîítuu fɪ̨ansíɪ mátʊ sukúli wɪlʊ́ʊ yɔɔ́/
[adʒ͡ɛ-yɛ́ ↓wéná ↓á-yɔ́ɔ́d-ʊʊ fɪɾansíɪ kʊnʊ-ŋ yɔ́ a-sîít-uu fɪɾansíí ↓má-tʊ sukúli- wɪl-ʊ́ʊ yɔɔ́]
country-8 REL-8 SP3/8-speak-IMP French language-3 SUB SP3/8-insist-IMP French letter-9 school-3 teaching-10 LOC
Francophone countries emphasise orthography in their education system.

(58) <**ŋmaɣzí sóná 'yɔ́, ŋnáɣ se atalí tánzɪñáńzɪ nîídozo.**>
/ŋ́-mɑɑsí sóná ↓yɔ́ ŋ-náɑ se a-talí táńsɪñáń-sɪ nîítoso/
[ŋ́-mɑɑzí sóná ↓yɔ́ ŋ-náɑ se a-talí táń↓zíñáń-zɪ nîídozo]
SP2s/CND-measure_BP beans-8 CND SP2s-see-IMP CNJ SP3/8-arrive_AOR large_basins-6 thirty
If you measure the beans, you will see that they fill thirty large basins.

(59) **<Mayabá kɔ́pɪnáa nɛ mélɛ́ɛ́sínɪ́ cáɖási nzí ŋyɔɔkáa yɔ́.>**
/ma-yap-á kɔ́pɪ-náa nɛ mélɛ́ɛ́sí-ní t͡ʃáṭá-sɪ nsí ŋ-yɔɔk-áa yɔ́/
[ma-yab-á kɔ́↓pí-náa nɛ mé-lɛ́ɛ́sí-ní t͡ʃárá-sɪ nzí ɲ-yɔɔk-áá ↓yɔ́]
SP1s-buy-PER cup-2 CNJ SP1s-replace-with calabash-6 REL-6 SP2s-break-PER SUB
I have bought some plastic cups to replace the calabashes that you broke.

The final experiment constrained the teacher who taught the experimental tone orthography to explain everything in terms of the tone system itself, never in terms of grammar. Conversely, the teacher who taught the experimental grammatical orthography was told to explain everything in terms of the grammar, never in terms of the tones. We adopted these pedagogical strategies because we wanted to compare two radically different approaches to tone representation. But these examples demonstrate just how difficult it is to teach the contrast between **[yɔ́]** and **[↓yɔ́]** in purely phonological terms. The non-automatic downstep can be pertinent (example 58) or non-pertinent (example 59), and a simple reference to the grammar renders the spelling rule clear.

1.10 THE PARTICLE <lɛ>

The particle **<lɛ>** presents a similar scenario. Usually it carries a downstepped H tone, and marks the end of a temporal clause. The experimental tone orthography represents this by preceding it with an apostrophe **<'lɛ>** (example 60). However, in a minority of cases the downstep is absent, and the meaning is 'then'. The experimental tone orthography represents this without the apostrophe **<lɛ>** (example 61). Again, it is difficult to teach the contrast between these two forms by referring to the tones alone. A simple reference to the grammar would make everything clear.

(60) **<Pehizaɣ́ namɨ́ 'lé, pɔ́cɔ́ŋʊʊ pɨ́ɣ́á>**
/pe-hiz-ɑɑ́ namɨ́ ↓lé pɔ́-t͡ʃɔ́ŋ-ʊʊ pɯ́-ɯ́á/
[pe-hiz-ɑɑ́ ↓námɨ́ ↓lé pɔ́-t͡ʃɔ́ŋ-ʊʊ pɯ́-ɯ́á]
SP3/2-cut-up-PER deer_1 TMP SP3/2-look-IMP child-5

As they were cutting up the deer, they kept an eye on the child.

(61) **<Elosî tʊ́ýʊ́ʊ́ nɛ ékóu se : « Mansɪbá lé ! »>**
/e-losî tʊ́ý-ʊ́ʊ́ nɛ é-kó-u se ma-sɪp-á lé /
[e-losî tʊ́ý-ʊ́ʊ́ ↓né é-kó-u se man-sɪb-á lé]
SP3/1-perceive_BP lion-3 CNJ SP3/1-shout-IMP CNJ SP1s-die-PER then
She saw the lion and cried out "I'm dead then!"

1.11 THE PARTICLE <nɛ>

When the particle **<nɛ>** 'and' joins two nouns, it carries a L tone, so it is written without an accent (examples 62 - 63).

(62) **< tíńdíné nɛ penîm >**
/tíńtí-né nɛ penî-m/
[tíńdí-né nɛ penî-m]
beanflour-cake-7 CNJ palm-oil-10
beanflour doughnuts and palm oil

(63) **< méta nɛ hɔɔlʊ́ >**
/méta- nɛ hɔɔl-ʊ́ʊ́/
[méta- nɛ hɔɔl-ʊ́ʊ́]
metre-3 CNJ half-3
one and a half metres

In all other contexts, the particle **< nɛ >** carries a copy of the preceding tone and therefore, in writing, of the preceding accent (examples 64 - 65).

(64) **< Ɛlɪzí ɛsáñíníŋ nɛ éhá-mí. >**

/ɛ-lɪsí ɛsáɲín-íŋ nɛ́é-há-mí/

[ɛ-lɪzí ↓ésáɲín-íŋ nɛ é-há-mí]

SP3/1-take-out_BP glasses-4 CNJ SP3/1-give_AOR-OP1s

He took the glasses out and gave them to me.

(65) **< Yúlʊ́mí ɛɛtɔkí né épé ɛ-hɔnʊ́. >**

/yúlʊ́mí ɛ-ɛ-tɔ-kí né é-pé ɛ-hɔn-ʊ́/

[yúlʊ́mí ɛ-ɛ-tɔ-kí né é-bé ɛ-hɔn-ʊ́]

blindman-1 SP3/1-NEG-eat-IMP CNJ SP3/1-serve-AOR PP3/1 guide-1

The blind man never eats without giving some to his guide.

When the particle **< nɛ >** appears between two H tones, it is in free variation. It can be pronounced either H or L. This detail of the tone system only emerged as a result of listening to oral reading exercises during the pilot tests. As a result, we decided that the experimental tone orthography would tolerate both spellings in this context, and that participants would not be marked down for their choice (example 66).

(66) **< Man-caa kpá kpóú taá nɛ ~ né écósî kétʊ́. >**
/man-t͡ʃaa kpá kpó-ú taá nɛ é-t͡ʃózî két-ʊ́ʊ́/
[man-d͡ʒaa kpá kpó-ú ↓táá nɛ ~ né é-t͡ʃózî kɛ↓t-ʊ́ʊ́]
PP1s-father climb-BP granary-3 LOC CNJ SP3/1-draw-from_AOR peanut-3
My father climbed into the granary to get some peanuts.

1.12 THE PARTICLE < na >

The interrogative particle **< na >** carries a L tone. But the segments of this particle frequently elide, leaving the L tone to re-associate to an extension of the previous TBU. The experimental tone orthography represents this as a separate word (examples 67 - 69).

(67) **<Nó-kpóú taá sú mílá a ?>**
/ɲó-kpó-ú taá sú mɪ-lá na/
[ɲó-kpó-ú ↓táá sú ↓mí-lá a]
PP2s-granary-3 LOC be-full-BP millet-8-INT
Is your granary full of millet?

(68) **<Ðɪpísɪɣ ɖíná ɖama ɖánáɣ́ ɣ ?>**
/ʈɪ-pís-ɯɯ ʃí-ná ʈama ʈáná-á na/
[ʈɪ-bíz-ɯɯ ʃí-ná ʈama ʈáná-á ɑ]
SP1p-be-able-IMP SP1p-see-AOR ADV afternoon-5 INT
Can we meet this afternoon?

(69) **<ŋpísɪɣ ŋ́kátí ŋ́kú ɖʊḿ m ?>**
/ŋ-pís-ɯɯ ŋ́-kátí ŋ́-kó ʈʊḿ na/
[m-bíz-ɯɯ ŋ-gátí ŋ́-gó ↓ʈúḿ m]
SP2s-be-able-IMP SP2s-dare-AOR SP2s-kill-AOR snake-1 INT
Would you dare to kill a snake?

Neither teachers nor students greeted this spelling convention with great enthusiasm during the pilot tests, but it seemed to be the least troublesome way of accurately representing the facts of the tone system. Again, if the teacher had been allowed to refer to the grammar in this course, the convention would not be necessary at all. L1 readers, once they see the question mark and recognise the grammatical construction, instinctively know that the final segment needs lengthening.

1.13 SUMMARY

The preceding analysis has shown how a creative application of autosegmental principles helped to develop an experimental tone orthography for Kabiye. Table 1 shows how these principles were organised coherently into a transition course of fifteen lessons.

Table 1: The transition course

	Theme	Aim
PART 1: THE MENAGERIE		
1	Acute accent	the acute accent and the letters that can bear it
2	Toad and hare	distinguishing between H and L
3	Donkey and sparrowhawk	distinguishing between HL and LH
4	Monitor lizard and grasshopper	distinguishing between HLH and LHL
5	Revision lesson	revision of lessons 1-4
PART 2: WORDS IN CONTEXT		
6	Context rules!	tones often change in context
7	The toad rule	writing the L tone spreading process
8	The grasshopper rule	writing the HLH process
9	The friend rule	writing the H tone spreading process
10	Revision lesson	revision of lessons 1-9

PART 3: INDIVIDUAL PARTICLES

11	The particle **yɔ́**	distinguishing between [**yɔ́ ~ ↓yɔ́**]
12	The particle **lɛ́**	distinguishing between [**lɛ́ ~ ↓lɛ́**]
13	The particle **nɛ́**	distinguishing between [**ná ~ na**]
14	The particle **na**	writing the interrogative particle
15	Revision lesson	revision of lessons 1-14

The first lesson of part one introduced the acute accent and the inventory of letters that can carry it. The ensuing lessons introduced the six basic melodies in pairs by means of animal keywords. With minimal training, distinguishing between the melodies of isolated words did not pose many problems for most participants.

Part two was where the real difficulties began. As words were placed in context, certain morphotonological processes had to be mastered. But even here, it was noticeable that most participants did not struggle with learning the lexical process of L tone spreading (the toad rule). The real challenge was applying the two post-lexical processes of vertical assmilation (the grasshopper rule) and H tone spreading (the friend rule).

Part three of the course was devoted to the four small particles <**yɔ, lɛ, nɛ, na**> and when to write the apostrophe to indicate non-automatic downstep. The devil is in the detail, and the pilot tests showed clearly that these particles were going to require an inordinate proportion of the total teaching time. We reluctantly decided to allot these particles one lesson each.

We have viewed the research methodology from the theoretical point of view of autosegmental phonology. Along the way, we have discussed how this theory related to the practicalities of the classroom setting. Now we will focus on the four rounds of pilot tests themselves in greater detail.

2. PILOT TESTING

2.1 INTRODUCTION

Several rounds of pilot testing are indispensible preparation for any successful experiment for several reasons. They provide important insights that may contribute to honing the spelling rules if a new or modified orthography has been developed for the purpose of the experiment. They also help in the development of pedagogical materials. Over time, several versions of the lessons may be drafted, taught and revised as teachers and students are given the opportunity to feedback their comments on the lesson content. They are also the means by which the teachers become familiar with the materials themselves so that they can in turn teach the course to others in the final experiment.

Pilot tests also help to iron out potential logistical problems before running up against them unexpectedly in the final experiment. This might include anything from the availability of power for audio recordings to the synchronisation of parallel lessons by

ensuring the proximity of classrooms. Logistical concerns are crucial, because in most circumstances the researcher only has one bite at the apple. If the final experiment fails on a practical detail, it will be extremely difficult, if not impossible, to organise a rerun at a later date.

Last but not least, pilot tests can also be turned to sociolinguistic advantage. If orthography stakeholders are invited as participants in the pilot test, this is an ideal opportunity for relationship building. They will be better informed about the nature of the researcher's contribution to the orthography debate. They will have time to ponder over the issues related to the representation of tone in the orthography. They will have an opportunity to express their own opinions. All this smoothes the way for collaborative decision-making at a later date.

Table 2 gives an overview of the pilot test schedule that spanned four months. We will describe each round in detail in the following sections.

Table 2: Pilot testing schedule

	Teacher(s)	Learner(s)	Researcher's role
1st pilot test	researcher	2 assistants	taught
2nd pilot test	2 assistants	1 participant	intervened
3rd pilot test	2 assistants	3 participants	observed
4th pilot test	2 assistants	6 participants[4]	observed
Final experiment	2 assistants	27 participants[5]	coordinated

2.2 1ST PILOT TEST: THE TWO RESEARCH ASSISTANTS

The first pilot test took place in the research team's office, on 11 - 15 December 2006. The aims were twofold. We wanted to test the draft experimental tone orthography itself and to make any necessary changes in the light of the results. Also, this pilot test provided the opportunity for the two research assistants to master the spelling rules of the tone orthography so that they in turn would be able to teach it to others. They had both been employed full-time for eighteen months when they took the test. They are not typical Kabiye literates, because they are immersed in the written language at work, and are confronted with the question of the orthographic representation of tone on a daily basis.

First task: The aim of the first task was to teach melody discrimination on isolated words written in the standard orthography. In preparation, I compiled written lists of two- and three-TBU nouns. It was not necessary to include one-TBU nouns, because they are all H tone. Tonal minimal pairs, dialect variants, dubious spellings and unknown words were excluded from the list. Then I wrote each word on a card. The task itself required the two research assistants to catalogue the nouns according to their melodies. They managed to do this in a short space of time and with minimum training. This was the first indication

[4] The fourth pilot test divided the participants into two parallel groups, so altogether there were twelve participants. Six of them learned the experimental tone orthography and six learned the experimental grammar orthography.

[5] The final experiment divided the participants into two parallel groups, so altogether there were 54 participants. 27 of them learned the experimental tone orthography and 27 learned the experimental grammar orthography.

that the recognition of tone melodies on isolated words presents no great challenges in Kabiye. The real difficulties begin when words are placed in context.

Second task: I selected ten, hundred-word texts and printed them in standard orthography, one text to a page. I wanted to observe intuitive performance with no prior training, so I told the first assistant that he should simply add acute accents to the texts to represent H tone and left him to it. Then I marked his work, subtracting half a point for every mistake from a total of 20 to assess his progress. We discussed the results in French, and this time I taught him the spelling rules. He then proceeded to add accents to the other texts. After each round, I marked the text and we discussed the results together before moving on. In this way, the assistant gradually mastered all the spelling rules. Our discussions also threw up several points where the experimental orthography itself needed further refinement. Once the first assistant had annotated all ten texts, he was able to teach the orthography to the second assistant in Kabiye and to mark his annotations. I intervened only occasionally to arbitrate difficult points.

I encouraged the assistants to read aloud and whistle the texts as much as possible. They interspersed the text annotation task with other unrelated work so as to minimise boredom and fatigue. I imposed no time limits. However I noted that each hundred-word text took over an hour to annotate, which is obviously insufficient by any recognised standards of literacy practice.

Figure 3: The experimental tone orthography taught to the two research assistants

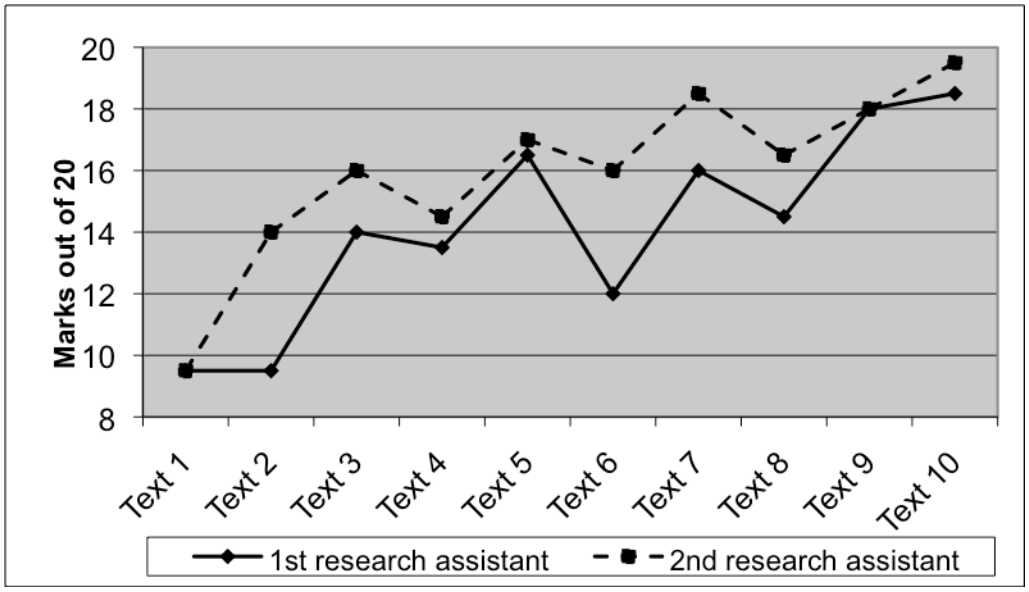


Figure 3 shows that, from very poor marks to begin with, both research assistants improved as the test progressed.[6] The final texts were annotated with very few mistakes. Most of remaining difficulties concerned recursive vertical assimilation (see section **Erreur ! Source du renvoi introuvable.**, page 2**Erreur ! Signet non défini.**), H tone spreading (see section 1.8, page 10) and non-automatic downstep (see sections 1.9 - 1.10, pages 11 - 12). The second assistant invariably scored higher marks than the first assistant. This may be because he had a higher level of education, but also because he was taught in Kabiye, whereas the first assistant was taught in French. All other considerations apart, learning is easier between two native speakers using their mother-tongue.

Following this first pilot test, we began to draft the pedagogical materials. This was done in parallel by the researcher in French and by one of the research assistants in Kabiye. Then we merged the two versions, taking the best ideas from each. From this point onwards, all the teaching in the pilots tests and the final experiment was in Kabiye.

2.3 2ND PILOT TEST: SINGLE PARTICIPANT

The second pilot test took place in the research team's office on 15 - 17 January 2007. The aim was to test the first draft of the pedagogical materials. The two research assistants taught the course to a single participant who was already literate in the standard orthography.[7] The assistants took turns teaching so as to give both of them the chance to practice and observe. The researcher intervened liberally with suggestions during the lessons. Each lesson was followed by a discussion in which the participant himself freely participated. No further modification of the orthography proved necessary, but numerous changes were made to the explanations in the pedagogical materials.

This round of pilot tests also enabled us to balance the duration and content of the lessons and to test the illustrations. We asked the participant to name each animal without being told what it was supposed to be. We showed him several versions of one illustration and asked him to pick the best. We also discussed establishing a common teaching style concerning, for example, how to write examples consistently on the blackboard, what physical gestures were appropriate for indicating tone melodies, and how to administer the dictation exercises.

2.4 3RD PILOT TEST: THREE PARTICIPANTS

The aim of the third test was to test a second draft of the pedagogical materials, this time including the dictations and oral reading exercises that followed each lesson. The two research assistants taught the course on three consecutive mornings on 6 - 8 March 2007 at the AFASA centre in Kara, five lessons on each morning. Three volunteer literacy

[6] I omitted to give the first assistant a mark for the first text. To complete the graph, I awarded him 9.5 retrospectively. This mark corresponds to his own performance in the second text, and the second assistant's performance in the first.

[7] I would like to express my thanks to PIDASSA Jonas, a sociology student at Kara University, for his participation.

instructors participated[8]. The two assistants took turns to teach the lessons and helped each other out. The researcher only observed without intervening. At the end of each morning we discussed difficulties encountered. This was a further opportunity to fine-tune the pedagogical materials, in particular making sure that appropriate examples had been chosen for the oral reading and dictation exercises, weeding out any ambiguities, borrowed words, proper nouns, dialect variants and unknown concepts.

At this juncture, we also spent time clarifying explanations in the pedagogical materials, usually in the direction of greater simplicity. For instance, we had put a lot of time into inventing neologisms for certain technical terms. But in the classroom, the two research assistants spontaneously abandoned most of these, preferring to use examples and analogies. I never sought to discourage this practice.

2.5 4TH PILOT TEST: TWELVE PARTICIPANTS

The fourth pilot test was a dress rehearsal for the final experiment. It took place over a period of five consecutive mornings at the regional community centre of the Ministry of Social Affairs on 12 - 16 March 2007.[9] The aim of this test was to test the between-groups design of the final experiment, in which we were going to pitch the experimental tone orthography against an experimental grammar orthography. Day 1 consisted of a pre-test to test participants' prior knowledge of the standard orthography. Days 2 to 4 were devoted to teaching the two experimental orthographies in two parallel classes. Day 5 tested the participants' acquired knowledge in dictation, spontaneous writing and oral reading tasks.

The fourth pilot test reproduced the conditions of the final test as closely as possible, but with an easily manageable number. Twelve people participated, six of whom learned the experimental tone orthography. On the basis of this experience, we ironed out certain logistical problems, but did no further work on the written materials at this late stage, with one significant exception: that of the sociolinguistic questionnaires.

We were planning to incorporate two sociolinguistic questionnaires in the final experiment. The first was to be filled in on day 1 to gather basic sociolinguistic information that would then be fed into the statistical analysis. The second was to be filled in on day 5 to gather information about reactions to the course and preferences as far as the orthography was concerned. Initially, we had hoped that the whole experiment would take place in the mother tongue to put participants at their ease. So, during this fourth round of pilot testing, the two questionnaires were written in Kabiye and the participants were expected to write their responses in Kabiye.

However, our insistence on monolingualism greatly impoverished the quality of the responses, because most participants were unable to apply their literacy skills to the language register required for filling in a sociolinguistic questionnaire. Also, the exclusive

[8] AFASA is the Association des Femmes pour l'Alphabétisation, la Santé et les Activités génératrices de revenues. I would like to thank DJATO Akouvi, ADAM Essowè and DJAKADA Abidè for their participation.

[9] I would like to express my thanks ABINA Essobiyou for his invitation and for his tireless help in administrative details.

use of Kabiye hindered the marking speed on the afternoon of day 1, when the teachers had a very narrow time margin to analyse the answers and divide the sample into two groups for the start of the transition course day 2. So in the final experiment we bowed to the realities of the bilingual context, abandoning Kabiye questionnaires in favour of French ones (cf. Bird 1999: 96).

It was also during this pilot test that one of the research assistants learned how to use the recording equipment to record oral reading of individual participants. The researcher was present in these sessions to ensure that they ran smoothly, but the aim for the final test was that the assistant would be proficient enough to be able to conduct them by himself without help.

3. CONCLUSION

The final experiment took place over a period of five consecutive mornings at the regional community centre of the Social Affairs Centre in Kara on 26 - 30 March 2007. Five associations involved in mother-tongue literacy sent a total of 54 delegates. For a full description of this experiment and an analysis of the results, we refer the interested reader to Roberts and Walter (2012). But to summarise, the experiment demonstrated that writers find it easier to master an orthography that represents a limited set of grammatical constructions than they do an exhaustive diacritic representation of the kind presented in this article. These results concur with a detailed study of written ambiguity in natural contexts which showed that the functional load of tone in kabiye is largely grammatical (Roberts 2010a). In Kabiye, when all tones are represented in the orthography, the majority of them are superfluous. This was the message we sought to convey when reporting the results of our research at an extraordinary meeting of the Comité de Langue Nationale Kabiyè (Roberts 2010c).

This article has described the preparatory phase of a tone orthography experiment. It has traced two sides of one single methodological approach from the conception of an experimental orthography on paper to its teaching in the classroom. It required a two-way exchange between the theory of autosegmental phonology and the practice of classroom pilot testing. This exchange proved particularly fruitful for ironing out certain problems associated with the profile of the experimental tone orthography, the teaching materials that were used to teach it, and the design of the final experiment. The preparatory phase of any orthography experiment is rich in qualitative data. If researchers report on it, this will help optimise future experiment design.[10]

[10] This research was conducted while I was living and working in Togo as a member of SIL International. I would like to express my sincere thanks to all my SIL colleagues for their help and support. I am deeply indebted to my two research assistants, Pidassa Emmanuel and Pakoubètè Noël without whose efforts this research would never have been completed. I am grateful to Steven Bird, Bernard Caron, Marcel Diki-Kidiri, Philip Davison, Constance Kutsch Lojenga, Jacques Nicole and JeDene Reeder for reading and commenting on different drafts of this article. I would also like to express my thanks to the Kabiye National Language Committee for the interest they have taken in this research, particularly Alou Kpatcha (President), Batchati Baoubadi (vice-president), Simtaro Dadja (secretary) and Aritiba Adji (member). This article is based on a chapter of the author's unpublished PhD thesis which is in French (Roberts 2008a: 487-545).

ABBREVIATIONS

ABS	absolute pronoun
ADJ	adjectival marker
ADV	adverb
AOR	aorist
BP	bound perfective
C	consonant
CND	conditional
CNJ	conjunction
DEM	demonstrative pronoun
DIS	distant
FOC	Focalising subject pronoun
H	high tone
IMP	imperfective
INT	interrogative pronoun
L	low tone
LOC	locative
N	nasal
NEG	negative
OP	object pronoun
p	plural
PER	perfective
PP	possessive pronoun
REL	relative pronoun
s	singular
SP	subject pronoun
SUB	subordinate clause
TMP	temporal clause marker
V	vowel
-1	noun of class 1 (and similarly for the other classes)
3/1	third person, class 1 (and similarly for the other persons and classes)
[a]	phonetic data
/a/	phonemic data
<a>	orthographic data
[á]	high tone
[ꜜa]	downstepped high tone
[a]	low tone

REFERENCES

Bernard, R. H., G. N. Mbeh and W. P. Handwerker. 1995. The tone problem. In A. Traill, R. Vossen & M. Biesele (eds), The complete linguist: papers in memory of Patrick J. Dickens, 27-44. Cologne: Rüdiger Köppe.

Bernard, R. H., G. N. Mbeh and W. P. Handwerker. 2002. Does marking tone make tone languages easier to read? Human organisation, a journal of the Society for Applied Anthropology. 61:4.339-349.

Bird, S. 1999. When marking tone reduces fluency: an orthography experiment in Cameroon. Language and Speech. 42.83-115.

Burmeister, J. 1980. Tone orthography for Ivory Coast languages. Paper presented at the 14th West African Linguistics Congress, Université du Bénin, Cotonou.

CLNK and SIL-Togo. 1999. Tɔm kpou kabıyɛ-fransıı (Dictionnaire kabiyè-français). Lomé: Ministère de l'Éducation Nationale et de la Recherche, Comité de Langue Nationale Kabiyè et SIL-Togo.

Goldsmith, J. 1990. Autosegmental and metrical phonology. Oxford: Blackwell.

Kiparsky, P. 1982. From cyclic to lexical phonology. In H. Van Der Hulst & N. Smith (eds), The structure of phonological representations, 131-175. Dordrecht: Foris.

Leben, W. 1971. Suprasegmental and segmental representation of tone. Studies in African Linguistics. Supplement 2.183-200.

Leben, W. 1973. Suprasegmental phonology. Cambridge, Massachusetts: MIT. PhD dissertation.

Lébikaza, K. z. K. 1999. Grammaire kabiyè: une analyse systématique - phonologie, tonologie et morphosyntaxe. Cologne: Rüdiger Köppe.

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

Mohanan, K. P. 1986. The theory of lexical phonology. Dordrecht: Reidel.

Roberts, D. 2003a. La tonologie des préfixes de modalité en kabiyè: Université de la Sorbonne nouvelle, Paris III. Mémoire de DEA.

Roberts, D. 2003b. Tone spreading in the Kabiye associative noun phrase. Cahiers voltaïques / Gur Papers. 6.95-100.

Roberts, D. 2004. Tonal processes in the Kabiye verb phrase. Paper presented at the 24th West African Linguistics Congress, University of Ibadan, Nigeria, 1 - 6 August 2004.

Roberts, D. 2005a. The tone bearing unit in Kabiye: syllable or mora? Paper presented at the 4th Gur colloquium, University of Bayreuth, Germany, 12 - 14 October 2005.

Roberts, D. 2005b. The variable status of nasals as tone bearing units in Kabiye. Frankfurter Afrikanistische Blätter. 17.155-178.

Roberts, D. 2008a. L'orthographe du ton en kabiyè au banc d'essai. Thèse de doctorat (INALCO, Paris). Villeneuve d'Ascq: Atelier national de reproduction des thèses.

Roberts, D. 2008b. Thirty years of tone orthography testing in West African languages (1977 - 2007). Journal of West African Languages. 35:1-2.199-242.

Roberts, D. 2010a. Exploring written ambiguities can help assess where to mark tone. Writing Systems Research. 2:1.25-40.

Roberts, D. 2010b. Hidden morpheme boundaries in Kabiye: a source of miscues in a toneless orthography. Writing Systems Research. 2:2.139–153.

Roberts, D. 2010c. Vers une graphie tonale appropriée pour le kabiyè : une troisième voie. Paper presented at the extraordinary meeting of the Comité de Langue Nationale Kabiyè, Lomé, Togo, 28 June - 1 July 2010.

Roberts, D. 2011. La graphie tonale du préfixe de modalité du lointain en kabiyè. Paper presented at the Opération de recherche 1.2 "Modélisations de la description grammaticale", LLACAN-CNRS, Villejuif, 10 June 2011.

Roberts, D. 2013. A tone orthography typology. In S. R. Borgwaldt & T. Joyce (eds), Typology of Writing Systems, 85-111. Amsterdam: John Benjamins.

Roberts, D. and S. L. Walter. 2012. Writing grammar rather than tone: an orthography experiment in Togo. Written Language & Literacy. 15:2.226-253.