

# *Evidence against voicing spread in Kera\**

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## **Abstract**

This paper presents the evidence that the phonological rule of long-distance voicing assimilation claimed to exist in Kera (Odden 1994, Rose and Walker 2004 and Uffmann 2003) can now be viewed as long-distance tone spreading instead. This eliminates one of the rare cases of long-distance consonant to consonant effects found in the literature. This supports the claims of Gafos (1998) that there are no real consonant to consonant effects, and that intervening segments always show signs of the spreading feature.

## **1 Introduction**

Kera has been used as key evidence of the existence of non-adjacent C to C voicing spread (Odden 1994, Rose and Walker 2004, Uffmann 2003, p.c.) based on Ebert's (1976, 1979) Kera grammar and lexicon. However, only a few languages show possible long-distance C to C spreading. Some linguists question whether it takes place in any language (Gafos 1998). In this paper, I give evidence that the Kera spreading is tonal, and that Kera does not provide a case of voice spreading. This raises questions as to whether long-distance C to C effects exist.

Kera is an Eastern Chadic language, spoken in Western Chad and parts of Cameroon, with 50,000 speakers, It has three tones: L, M, and H. In the literature, Kera is usually shown as having a voicing contrast in obstruents. There are apparent alternations in voicing in certain affixes.<sup>1</sup>

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<sup>1</sup> All of the data cited in this paper has been recorded during a field trip to Chad in February-March 2006. The recordings were made of Kera male speakers born in a village, but living in town. They are recognized as speaking good Kera. The VOT measurements when given refer to the town dialect of Kera. The author has since discovered that Kera village women make much less use of VOT, so clearly for them it cannot be voice spreading, but the voice spreading claims which are discussed in this paper are based on data from Ebert (1979) which was presumably

- (1) /k- b̄irwá-ŋ/    ḡib̄irwán    ‘white (pl.)’  
       /k- m̄arwā-ŋ/    k̄m̄arwāŋ    ‘new (pl.)’

Gafos (1998) claims that no long-distance C-C effects exist, and apparent examples can be explained by their place of articulation, where a secondary articulation can spread through adjacent sounds without affecting the primary articulation. So for example if the tongue tip is used for the sound, the body of the tongue can still spread some other feature at the same time, and this may appear to be long distance spreading, while it is in fact local spreading. But this explanation does not extend to the long-distance voicing spread examples that some linguists have found. Rose and Walker (2004) give examples of supposed long-distance voicing spread from Chaha, Ngizim, Ngbaka and Proto-Indo-European where only agreement within the root is involved. One could argue that these are simply historical and non-productive, so their strongest argument is the case of Kera where affixes are also involved. Hansson (2004) has also entered the discussion on long distance voicing spread. He suggests in passing that Kera tones might be influencing voicing and that this may account for the spreading effects, but he does not elaborate on the subject further.

My claim is that all of the apparent voicing spread in Kera can be accounted for by tone spreading and the resultant changes in VOT. My argument is that Kera does not have a distinctive feature [voice]. So it cannot have long-distance voicing spread. In fact, phonetic studies in Pearce (2005) have demonstrated extensively that VOT co-varies with F<sub>0</sub> and that tones are contrastive while the VOT is not. For this discussion, the key arguments will come from cases where only tonal spread can explain the apparent voice changes. I claim that the effect of voicing spread comes from L tone spreading. When this happens, obstruents get a shorter VOT due to the relationship between F<sub>0</sub> and VOT, and this is perceived as voicing.

In the rest of this paper, we will look at the counter-evidence to voicing spread from the affixes: K-, -Ki/Ka and -T, the counter-evidence from loans and finally the counter-evidence from a statistical analysis of lexicon, but firstly we will consider what claims have been made.

## 2 Voice-spreading claims

The voice-spreading claims (Rose and Walker (2004), Uffmann (2003) and Odden (1994) are based on two observations:

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taken from village or town male speakers because the VOT changes are reflected in the use of voiced and voiceless graphemes. So as much as possible, the same dialect is being discussed.

(i) The K- prefix ‘plural’ apparently has two alternants: [k] and [g]. It is claimed that the voicing spreads left onto the prefix. For the following examples, the voicing of obstruents matches the symbol used in the orthography. In (2a), the plural prefix is voiceless, matching the other obstruents in the word. In (2b), the prefix is voiced, again matching the voicing of other obstruents in the word. Before sonorants, all forms of the prefix are technically possible, but most examples are k- so this is generally assumed to be the UR.

(2)	sg.	pl.	
a.	kúmná	kíkámní	‘chief’
	tāatá	kītāatáw	‘big pot’
	táasā	kōtáasāw	‘cup’
b.	bìrwá	gìbìrwáj	‘white’
	dàarà	gədàarà	‘friend’
	àzrà	gàzráw <sup>2</sup>	‘gazelle’

(ii) Within a word, the obstruents usually agree in voicing. In (3a) this means that all obstruents are voiceless, in (3b), they are all voiced.

(3) a.	tīrīnká	‘old (f)’
	kūpūrki	‘billy goat’
	tépé	‘to gather’
b.	agònògì	‘grudge’
	gùjùglùgì	‘granary cover’
	bèzèrnègì	‘fox’
	đìbìrgì	‘chicken’

The above examples suggest that these claims might be viable for Kera. We now examine some counter-examples.

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<sup>2</sup> The claim by Rose and Walker (2004) that fricatives do not agree in voicing in Kera is false. They agree as much as stops.

### 3 Counter-evidence for voice spreading claim from affixes

The words in (4) have voiced obstruents, so a C to C voice spreading account predicts voiced prefixes. In contrast, a tone account predicts that since the first syllable has high tone, the onset of that syllable, which is the prefix, will have a long VOT and will therefore be perceived as voiceless. This is exactly what we find. So (4) supports the tone account.

#### 3.1 K- prefix

(4)	sg	pl		
	ágày	k-ágày	‘hoe’	(pronounced [kógày])
	ágàmlà	k-ágàmlà	‘bull’	(pronounced [kógàmlà])

Further examples to support the tone account come from Proto-Chadic (Jungrauthmayr and Shimizu 1981, Stolbova 1996, 2005). It would seem that the voiceless prefix has changed voicing because of the L tone that is associated with the first syllable. It cannot be because of a voiced obstruent because there are no other obstruents in the examples given.

(5)	<i>With f. prefix:</i>	*t-làarɪ	[(dàa)(rɪ:)]	‘friend’
	<i>With pl. prefix:</i>	*k-làarɪ	[(gəlàa)(rɪ:)]	‘children’

Compare with \*rVmV ‘child’

<i>With m. prefix:</i>	/k-r̄mɪ/	[(kōr)(m̄:)]	‘son of...’
<i>With f. prefix:</i>	/t-r̄ɪnɪ/	[(f̄ɪr)(n̄:)]	‘daughter of...’
<i>With pl. affix:</i>	/k (a)-r̄m/	[(kōmār)]	‘children’

#### 3.2 -Ki/Ka suffix and the predictions of the two accounts

Rose and Walker also claim voicing spread in the –ki/ka (m./f.) suffix. For this suffix, masculine words have the –ki/gi ending, while feminine words have the –ka/ga ending. In (6), both the voicing account and the tone account can adequately cover the facts.

(6)	/kísír <u>kí</u> /	‘black (m.)’	/sár <u>ká</u> /	‘black (f.)’
	/ágèzè <u>gì</u> /	‘frog (m.)’	/dày <u>gà</u> /	‘jug (f.)’

But (6), and indeed all the examples quoted by Rose and Walker are simply based on the orthography. If we consider more carefully what the voice spreading and the tone spreading accounts should give us, we will note that a voicing account predicts a 2-way contrast in voice, which is realised in VOT alternations, while a tone account predicts a 3-way contrast in tone, with the F0 and VOT values co-varying in line with the tones. This means that we can examine examples like those in (6) more closely to see which set of predictions holds. In (7), measurements of VOT and F0 are given. We see that the three way contrast supports the tone account.

- (7) Tén ásáŋ pírkí ‘I saw a mountain’ k VOT=30 ms, final syllable F0=137 Hz  
 Tén ásáŋ hàrkā ‘I saw a goat’ k VOT=21 ms, final syllable F0=119 Hz  
 Tén ásáŋ dàygà ‘I saw a jug’ g VOT=8 ms, final syllable F0=104 Hz

This is just one example, but in (8), 50 words containing these suffixes were measured for VOT. Again, there appears to be a 3-way split.

- (8) Mean VOT of –K suffixes, tested on 50 words

32 ms	Preceding H tone.
22 ms	Preceding M tone.
9 ms	Preceding L tone.

(All significantly different,  $p < 0.01$ .)

It would seem from this that the orthography symbol for <k> is misleading as it covers a range of VOTs with an approximate measurement of 22 ms preceding M tone and an approximate measurement of 32 ms preceding H tone. The linguists who made the voice spreading claims did not have access to these measurements and therefore assumes that all <k> symbols in the orthography were indistinguishable from each other. In fact, we should be saying that the K- prefix and the –K suffix both have three alternants which differ in VOT. These three alternants are not phonologically contrastive, but they differ phonetically in VOT measurements which are different enough to be perceived.

There is a further alternating suffix which is not discussed by Rose et al. This is the –T verb suffix to mark habitual action.

### 3.3 –T habitual suffix

The –T suffix has two apparent alternants [t] and [d]. In (9), two verb paradigms are given. These are tone minimal pairs, but a closer inspection shows that the VOT

of the suffix differs according to the following tone. The VOT values are given in parentheses. The box surrounds the L tone examples where the affix is perceived to be [d] and the VOT is low. As these two verbs are minimal pairs, the apparent change in voicing cannot be due to any voicing spread as the only obstruent is the infix. (Note that in Kera, implosives behave like sonorants).

(9)                      lɔ́bɛ́ ‘to convince’    lɔ̀bɛ́ ‘to fatten’<sup>3</sup>

1 sg	lɔ̀b-T-n	lɔ́bɛ́n	M (23)	lɔ̀bɛ́n	L (12)
2 sg m	lɔ̀b-T-m	lɔ́bɛ́m	M (25)	lɔ̀bɛ́m	L (16)
2 sg f	lɔ̀b-T-i	lɔ́bɛ́i	M (35)	lɔ̀bɛ́i	L (15)
2 pl	lɔ̀b-T-ŋ	lɔ́bɛ́ŋ	M (19)	lɔ̀bɛ́ŋ	L (17)
3 sg m	lɔ̀b-T-ú	lɔ́bɛ́ú	H (32)	lɔ̀bɛ́ú	H (30)
3 sg f	lɔ̀b-T-á	lɔ́bɛ́á	H (29)	lɔ̀bɛ́á	H (23)
3 pl	lɔ̀b-T-áy	lɔ́bɛ́áy	H (33)	lɔ̀bɛ́áy	H (38)

This is just one example, but in (10), the same measurements are repeated on 240 words with –T suffixes.

(10) Mean VOT of –T suffixes, tested on 240 words (3 speakers)

20 ms	Preceding H tone.
16 ms	Preceding M tone.
11 ms	Preceding L tone.

(All significantly different,  $p < 0.01$ .)

These examples suggest that the tone account fits the facts best. We have seen that the change in –T cannot be voice spreading. The minimal pairs example in (9) will not allow such an account. Clearly in all of these examples VOT is co-varying with tone. These affixes alternate in voicing as the tone changes and the alternation is not caused by the voicing of any obstruents in the root.

This section has shown that the voicing spread claims for Kera cannot be based on affixes because the tone account does a better job in covering the facts. There is

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<sup>3</sup> Like other Chadic languages including Ngizim (Hansson 2004), ɓ does not act as if it's voiced.

another area which could be looked at for evidence and that is the form taken by loan words which enter into Kera. Rose et al did not have access to data on loans, so they do not use any examples in their analysis, but if the tone account is correct, it should have implications for how voiced obstruents are perceived and pronounced in loan words. We look at this in the next section.

#### 4 Counter-evidence from French loans

Loans in Kera can come from several languages, but the main source is French. French is not a tone language, but when the Kera perceive a final prominence in French, this is often realized as a H tone in the Kera word. This H tone may spread onto the final epenthetic vowel. In this case, the preceding obstruent becomes voiceless as seen in (11a). Note that Kera does have voiced fricatives so the change to the voiceless form is not simply a default form.

(11)	French	Kera	
a.	ʃmiz	s̄imísí	‘shirt’
	vilaʒ	wélásí	‘village’
	ʃez	sésí	‘chair’
	grɛv	gàrèfi	‘strike’

When a L tone is perceived, the obstruents in that syllable are pronounced as voiced, as can be seen in (11b).

b.	kɔʃɔ̃	gòzð̃ɲ	‘pig’
	mɔ̃tr	mónd̃ðr	‘wrist watch’
	petrəl	b̀ðdrón	‘paraffin’
	kɔtɔ̃	gòdð̃ɲ	‘cotton’
	ʒyp	j̄ibĩ	‘skirt’
	bik	b̄igĩ	‘pen’

Space does not permit a complete analysis of French loans, but the examples above do support the tone account, since voicing seems to be changing according to the tone and not vice-versa. The voicing account, on the other hand, cannot explain all of the changes in voicing that occur, especially when the result is to have a mismatch of voicing throughout the word, such as in *gàrèfi*. The voicing account claims that Kera prefers voicing to agree throughout the word, so changes which cause less agreement cannot be accounted for.

We have already seen that the voicing agreement claims are based both on affixes and on agreement in monomorphemic words. In the next section, we will look at the number of words that do actually agree in voicing and we will see that as there is a small but significant group of words which do not agree, the voicing account again has problems in explaining the Kera data. In contrast, the tone account can explain these exceptions.

## 5 Counter-evidence from statistical analysis of lexicon

Uffmann (2003) cites several Kera words which agree in voicing, a few of which were given in (3). He acknowledges that there are exceptions, but he still claims that this shows voicing spread. Uffmann was not in a position to know how many exceptions there are, but a quick count based on the orthography in the present lexicon gives the following results:

(12)

Matching or irrelevant	53 % of words have less than two obstruents.	
	20 % of words have voicing throughout	
	18 % of words have just voiceless obstruents	
Mismatching	9 % of words have a voicing mismatch	8 % have voiced obstruent + voiceless obstruent
		1 % have the opposite mismatch.

From these results, we can say that Kera appears to have a bias towards voicing agreement. This could lead someone to conclude that this bias is produced by long-distance voicing spread. After all, 9% is significantly less than one would expect if words picked their consonants randomly from the inventory ( $p < 0.001$ ). But my argument is that there is no voicing-spread. Instead, I have argued that the effect is produced because VOT co-varies with tone. The tone patterns can account for the apparent agreement in voicing. Unlike the voice-spreading argument, tone patterns can also explain why the agreement is not 100 %.

### 5.1 Investigation

For L tone syllables, I claim that the onset obstruent will have a VOT of 0-20ms which may be perceived as ‘voiced’, certainly by linguists who speak languages such as English where 20 ms is the cut off point between two phonemic categories. This means that in the lexicon, these obstruents have probably been recorded as voiced. For M and H tone syllables, the VOT is longer, and these are generally perceived as voiceless.

The goal of this investigation is to find the percentage of words which contain at least two obstruents and have a tone pattern involving both L and H. According to my claims, these words should be perceived as having a change in voicing as well as tone. If the percentage of these words (with tone mismatch) is close to the 9% of words which have a voicing mismatch in the lexicon, then we can conclude that the tone is affecting the apparent voicing changes.

*5.1.1 Method* For this investigation, I examined 1132 nouns already classified for tone. I divided the 1132 nouns according to their tone patterns, the number of syllables and the foot structure<sup>4</sup>. I noted the onset of each syllable as an obstruent or a non-obstruent. Only obstruents show changes in VOT which are interpreted as voicing. In words with more than two syllables, I considered the onset of the first syllable in each foot. (Pearce (to appear)).

A simplified table of the results is produced below. In this table, rounded percentages replace the actual figures. The shaded cells indicate the categories where two obstruents occur with a change between H and L tone. These are the words where we would expect to see a voicing mismatch.

(13)

		Apparent voicing change			
		H, M, or L	MH or HM	LH	HL
1 syll		11			
2 syll	2 obst	15	5	4	2
	other	23	8	6	2
>2 syll	2 obst	4	4	2	1
	other	6	4	2	1

The sum of the shaded cells total 9 %. So 9 % of all words would be expected to have a voicing mismatch because of the combination of H and L. This fits in well with the results we have already obtained from the lexicon. We found that the voicing mismatch in the lexicon was also 9 %. The other figures in (14) do not match exactly, but they are close enough to suggest that we are comparing like with like and that the voicing mismatch is caused by a tone mismatch. From the above figures, it appears that there is an asymmetry between the LH pattern and the HL pattern. This in turn gives rise to an asymmetry in voice/voiceless combinations

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<sup>4</sup> The foot structure is relevant because for longer words the tone bearing unit is the foot, not the syllable.

versus voiceless/voiced combinations. At this point, there is no clear indication as to why such an asymmetry should exist.

(14)

	<b>voiced/ voiceless</b>	<b>voiceless/ voiced</b>
voicing in lexicon (Kera orthography)	8 %	1 %
prediction from tones	6 %	3 %

From this we can see that both the lexicon and the prediction from tones give a 9% mismatch in voicing. We have already said that the voicing spread claim has no account for the existence of the 9% of words where voicing does not agree, but the tone account can adequately explain the 9%.

## 6 Conclusion

We have seen that the voice spreading claim cannot explain all of the facts. It has difficulty explaining the affix alternates, it cannot explain the forms of French loans, and it cannot account for the 9% of words with a voicing mismatch. Added to this, the voicing claim is controversial because it involves non-local spreading.

In contrast to this, the VOT/tone claim does cope with the Kera voicing facts. This view says that as [voice] is not a feature in Kera, it cannot spread. When spreading takes place, it is the tone that spreads. This theory accounts for the VOT values in the K- prefix and the -T suffix. It gives a plausible explanation for the changes in French loans, and it also explains why 9% of words have a voicing mismatch. In addition, tone spreading is common in many languages and is not controversial.

Therefore Kera cannot be used as key evidence in favour of long-distance C to C voicing spread and this paper raises serious questions about whether long-distance C to C effects do exist. We cannot conclude on the basis of one language that long-distance C to C effects definitely do not exist, but the onus is on the linguists who claim these effects to find another language that demonstrates voicing alternations as a result of voicing spread. In this paper we have seen that Kera cannot be used as evidence of this.

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