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Vowel elision and reduction in Bambara

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The goal of this study is to test instrumentally the hypothesis that Bambara disyllabic feet are distributed into three types. The results of the study can be summarised as follows:

– reduction and elision of a short V1 in disyllabic feet is phonetic, rather than phonological, and can be explained by phonotactics. Therefore, disyllabic feet with a short first vowel form just one type;
– V1 length, although phonologically relevant, displays some instability between speakers;
– in a disyllabic foot (at least when its boundaries coincide with word boundaries), length characteristics are in complementary distribution: if the first vowel is short, the second is long, and if the first vowel is long, the second is short. This phenomenon can be defined as 'foot isochrony';
– if the first vowel of a disyllabic foot is short, the duration of the second vowel depends on the position of the foot within the word: word-finally it is long, otherwise it is short;
– the difference between disyllabic feet types in Bambara can be exhaustively described by means of the length of the first vowel; there seems to be no need to postulate the existence of stress.

KEYWORDS: vowel elision, featural foot, syllable weight, Bambara.

1. General information about Bambara

Bambara (also Bamana, Bamanankan < Manding < Western Mande < Mande < Niger-Congo) is spoken mainly in Mali by some 4 million L1 speakers and by a further 10 to 12 million L2 speakers.

2. Basics of Bambara phonology

2.1. Phonemic inventory

The Bambara vowel system is triangular with three degrees of aperture. It consists of three series of vowels: short oral /i, e, ɛ, a, ɔ, o, u/, long oral /iː, eː, ɛː, aː, ɔː, oː, uː/, short nasal (*ĩ*, *ẽ*, *ɛ̃*, *ã*, *ɔ̃*, *õ*, *ũ*).[1]

The Bambara consonants are represented in Table 1.

Place / Manner	Labials	Alveolars	Palatals	Velars	Labialised velar
Prenasalised voiceless stops	mp	nt	ɲʧ	ŋk	
Prenasalised voiced stops	mb	nd	ɲʤ	ŋg	
Prenasalised fricatives	mf	ns / **ns**			
Voiceless stops	p	t	ʧ	k	
Voiced stops	b / **b**	d / **(d)**	ʤ	g / **g**	(gw)
Voiceless fricatives	f / **f**	s / **s**	(ʃ)	h	
Voiced fricatives	(v)	z			
Oral sonorants	w / **(w)**	l / **l**	j / **j**		
Trill		**r**			
Nasal sonorants	m / **m**	n / **n**	ɲ / **ɲ**	ŋ / **ŋ**	

Table 1. Bambara consonants.[2]

The consonants appearing in foot-initial position are given in regular characters, and those occurring in foot-internal position are in bold (after a slash, if a consonant can occur both in foot-initial and foot-internal positions). Marginal phonemes (contact-induced ones or those with variable status across dialects) are given in brackets.

Realisations of foot-internal /g/ vary between [k], [g], [ɣ] and [Ø], depending on the vocalic environment and the dialectal background of the speaker. There is also, to some extent, free variation. Foot-internal /ŋ/ can be realised as [ŋ] or [ŋg ~ ŋk], depending on the dialect background of the speaker. Realisations of /ns/, in both positions, vary [ns ~ nz ~ z]. The phoneme /r/ occurs only in foot-internal position.

2.2. Syllable structure

The canonical syllable type in Bambara is CV. Nasal vowels are realised as such before a pause, but when followed by a consonant, the realisation is [-VN], where -N is a nasal sonorant homorganic with the subsequent consonant, and the vowel is denasalised (at least partly), e.g. *dén* [dɛ̃] 'child' → *dénkɛ* [dɛ́ŋkɛ́] 'son' (*kɛ̀* 'male'), *dénso* [dénsó] 'womb' (*só* 'house'). Onsetless syllables are rare, appearing in personal pronouns (*à* '3SG', *í* '2SG', etc.), in interjections and at the beginning of some French and Arabic loans. True closed syllables are very rare and can be

found only in expressive adverbs (of ideophonic origin) and in semi-adapted loans.

2.3. Tonal system

There is an abundant literature on the Bambara tonal system (for surveys covering different interpretations, see i.a. Green 2015: e6-e8). In the present article, tone is not in focus; but, when necessary, the tonal facts will be interpreted according to the approach presented in Vydrin (2016; 2019). This approach is summarised in the following paragraphs.

Bambara has two level tones, low (marked by the grave accent) and high (marked by the acute accent; a circumflex is used in the phonetic transcription for the falling tone, i.e. a combination of H + L). A tonal domain most often (but not always) coincides with the word and consists of a tonally dominant syllable (the initial syllable of a domain whose tone is lexically determined) and, optionally, one or more recessive syllables (whose tones are assigned according to rules). It should be underlined that the tonally dominant character of the syllable is not equivalent with the headedness of the foot: these two phenomena are not isomorphic.

There is downdrift and downstep. Bambara has a tonal morpheme, an article represented by a floating low tone, which manifests itself in a tonal modulation on the preceding syllable and in a downstep on the subsequent high-tone syllable.

3. Featural foot in Bambara

The Bambara foot has been discussed in a number of works (Vydrin 2001; Leben 2002; Leben 2003; Weidman & Rose 2006; Green 2010; Vydrin 2014; Green 2015; Vydrin 2019: 45-47). My current view is that the Bambara foot is determined by segmental, rather than prosodic factors (although the segmentation into feet impacts also prosody). It can be therefore characterised as a featural foot.[3]

This approach can be summarised as follows.[4] In Bambara, the foot is a rhythmic unit consisting of one or two syllables. A foot may be equal to or smaller than a morpheme and synchronically,[5] it cannot include more than one morpheme (i.e., in Bambara, the morpheme boundary is stronger than the foot boundary). The foot is characterised by an inner integrity which manifests itself in:

– a discrepancy between the inventories of the foot-initial and the foot-internal consonants (see Table 1) with foot-initial consonants tending to be ‘stronger’ and internal consonants ‘weaker’;

– restrictions on vocalic combinations within a foot, with combinations of two identical vowels being most preferred and combinations of mid-open and mid-closed vowels among the combinatory possibilities least preferred;
– tonal realisations: in trisyllabic monomorphemic words, a high tone is inserted at the end of a low-toned domain followed by another low-toned domain, and the span of this high tone coincides with the foot.[6]

In Vydrin (2014), I postulated three classes of disyllabic feet in Bambara:
– trochaic: the first vowel is long;
– iambic: the vowel of the initial syllable is susceptible to elision (or strong reduction), although it can be restored in slow careful speech;
– neutral: the first vowel is short but it is not susceptible to reduction.

This classification, however, is not without questions.

First, the distinction between the 'iambic' and 'neutral' types in Vydrin (2014) was based on my auditory perception and on the data from big Bambara dictionaries (Bailleul 2007, Dumestre 2011), and has never been verified experimentally. However, these dictionaries sometimes contradict each other (see below), which makes it difficult to draw a clear boundary between the two types.

Second, there are questions also about the trochaic feet. On the one hand, they may seem to be clearly distinct from the two other types if we proceed from the fact that vowel length in the foot-initial syllable is phonologically relevant. On the other hand, the duration of long vowels is not very stable and varies between speakers. Some words lose their vowel length more readily (i.e. many speakers pronounce them with short vowels), while others retain it better.

The current study is an attempt to verify experimentally and, if necessary, to update the hypothesis formulated in Vydrin (2014).

4. The experiment

Originally, my experiment was designed to study the distinction between 'potentially neutral' and 'potentially iambic' feet: words with vocalic elisions and reductions were specifically targeted. A limited number of 'potentially trochaic'[7] feet were included, as well as some trisyllabic words, for the sake of comparison. At the analysis stage, the goals of the

experiment were reformulated, but unfortunately it was too late to collect further data. Therefore, there are no instances of vowel combinations such as CeCi or CoCu or of foot-internal *-g-* in my sample, and the rare trisyllabic type (CV)(CV:CV), as in *kàsaara* 'accident, catastrophe', is also absent. These lacunae should be filled in subsequent experiments, but the results of the current study still shed some light on the problems discussed.

My phonetic questionnaire consisted of 132 words of different types, both disyllabic (potentially 'trochaic', 'iambic', and 'neutral') and trisyllabic. Words were almost exclusively nouns and verbs and were recorded in June 2016 from two inhabitants (and natives) of the village of Dugukunna (15 km west from Segu), MT and KK. Both speakers were males in their 40s at the time of the recording.

In each of the two samples, 45 presumably 'iambic', 10 presumably 'trochaic', and 45 presumably 'neutral' forms (the same words for both speakers) were selected for the 'disyllabic sample'. Each word was pronounced by each speaker three times in isolation, then three times in phrase-internal position.

Trisyllabic monomorphemic words were represented in the questionnaire by 27 items of the structure (CVCV)(CV), all of them with short V1, and 5 items of the type (CV)(CVCV) (this type is much less frequent in Bambara in general).

The words were segmented in Praat, and the duration of the vowels was calculated. The words were taken only in the context of a carrier phrase (3 pronunciations for each word). For the nouns, it was typically the phrase *Mùsá bɛ X yé* 'Musa sees X' (in some cases, where this particular context was semantically inappropriate, other contexts were taken, as *Án tɛ́ bàlawu fɛ̀* 'We don't want a catastrophe'). For the verbs, these were phrases with an adverbial expression (most often, the adverb *bì* 'today'), in order to avoid a phrase-final position, e.g. *Mùsa ká fisa bì* 'Musa feels better today'.

It was also decided to consider a vowel absent if its duration was equal to or below 20 ms,[8] because such vowels are practically imperceptible to the human ear. Tokens with zero V1 (i.e. with a duration below 20 ms) were calculated separately from a non-zero V1 (more than 20 ms).[9]

POTENTIALLY 'TROCHAIC' FEET can be divided into three groups, with respect to the representation of their vowel length in the two major Bambara dictionaries:

1) those with a long V1 in both Bailleul's (B) and Dumestre's (D) dictionaries: *bòolo* 'fish Clarotes laticeps';
2) those with a short V1 in both dictionaries: *bòoso* ~ *bòso* 'Bozo',[10] *dóolen* ~ *dólen* 'fishing hook', *jɛ̀ɛrɛ* ~ *jɛ̀rɛ* 'to gather together', *jɔ̀ɔrɔ*

~ *jɔ̀rɔ* ‘to worry’;

3) those with variable vowel length: *dòolo* (B. *dòlo* ~ *dòolo*, D. *dòlo*) ‘star’, *fòolo* (B., D. *fòlo* ~ *fòolo*) ‘goitre’, *wéele* (B., D. *wéle* ~ *wéele*) ‘to call’, *bɛ̀ɛsɛ* (B. *bɛ̀sɛ*, D. *bɛ̀sɛ* ~ *bɛ̀ɛsɛ*) ‘coquettish’.

Potentially ‘neutral’ feet.

básа ‘agama lizard’, *bére* ‘stick’, *bɔ̀lɔ* ‘peg, pole’, *bɔ́lɔn* ‘lane’, *dísi* ‘chest’, *fála* ‘orphan’, *fɛ̀rɛ* ‘public square’, *fúru* ‘marriage’, *gére* ‘horn’, *jàla* ‘string’, *jéle* ‘axe’, *jíri* ‘tree’, *jùru* ‘rope’, *kìsɛ* ‘grain’, *kólo* ‘bone’, *kòlon* ‘mortar’, *kóro* ‘calabash’, *kɔ́lɔ* ‘shea kernel’, *kɔ̀lɔn* ‘well (with water)’, *kùlu* ‘mountain’, *mìnan* ‘bushbock’, *ɲímі* ‘head louse’, *ɲínɛ* ‘mouse’, *sìna* ‘co-wife’, *síra* ‘road’, *tɛ́nɛ* ‘paternal aunt’, *wòlo* ‘skin’, *wɔ̀lɔ* ‘francolin’, *wúla* ‘wilderness’, *bísi* ‘to press’, *dɔ́nɔ* ‘to lend’, *fàra* ‘to add’, *fúran* ‘to sweep’, *gáran* ‘to hobble’, *gèrɛn* ‘to evaporate’, *kísi* ‘to save’, *ɲìna* ‘to forget’, *síran* ‘to fear’, *sìri* ‘to tie’, *túnu* ‘to err; to disappear’, *wólo* ‘to give birth’, *wúlan*, *wúran* ‘to skin’, *fɔ́lɔ* ‘first’, *kólo* ‘to educate’, *kólon* ‘used, old’.

Potentially ‘iambic’ feet. In the words of this list, V1 is easily perceptible as elided or strongly reduced in the pronunciation of at least one of my speakers. The words are divided in four groups, depending on their representation in Bailleul’s and Dumestre’s dictionaries:

1) elision is indicated in both dictionaries: *bíŋɛ* ‘liver’, *bùlon* ‘ante-chamber’, *dàla* ‘lake, pond’, *dálan* ‘bed’, *díŋɛ* ‘world’, *dɔ̀lɔ* ‘beer’, *dúnan* ‘foreigner, guest’, *fílan* ‘age-mate’, *fìle* ‘flute’, *fíyen* ‘blind’, *fúla* ‘Fulbe’, *tìle* ‘sun’, *bìla* ‘to put’, *dúla* ‘to make’, *dúlon* ‘to hang’, *fílɛ* ‘to look at’, *fìsa* ‘be better’, *tíla* ‘to divide’, *tílen* ‘to straighten’, *bìlen* ‘red’, *fìla* ‘two’;
2) no elision is indicated in either dictionary, but is attested (at least occasionally) in my data: *búran* ‘in-law’, *fólon* ‘ravine’, *kíli* ‘egg’, *kúma* ‘speech’, *kùru* ‘ball, bowl’, *kúrun* ‘boat’, *mùso* ‘woman’, *ntúra* ‘bull’, *túlo* ‘ear’, *túlon* ‘play’, *tùma* ‘time’, *bísan* ‘to whip’, *fíri* ‘to overturn’, *fìri* ‘to cook couscous’, *gírin* ‘to rush’, *mìnɛ* ‘to catch’, *tára* ‘to stick’, *dɔ́rɔn* ‘only’;
3) elision is indicated in Dumestre (2011), but not in Bailleul (2007): *fíŋɛ* ‘water jar’, *fíŋɛ* ‘wind’, *túlu* ‘oil’;
4) elision is indicated in Bailleul (2007), but not in Dumestre (2011): *díli* ‘root’, *fìli* ‘to throw’, *fìli* ‘to mistake’.

As already stated, the limit between ‘iambic’ and ‘neutral’ feet in Bambara is vague, and it would be difficult (if not impossible) to formulate a clear criterion for classifying each particular word as belonging to the iambic or neutral type. In this situation, we can say that the

classification of any particular foot to the 'iambic' or 'neutral' type (if such classes are proved to be valid) should be as a result of experimental study, rather than as a precondition of such a study. In order to avoid a vicious circle, in the following data analysis all 'potentially iambic' and 'potentially neutral' feet were grouped together.

TRISYLLABIC (CVCV)(CV) WORDS: *bàlawu* 'catastrophe', *béreke* 'stick', *bìlisi* 'demon', *bóloma* 'intermediary', *bɔ̀rɔkɔ* 'mud', *dórɔmɛ* '5 francs', *dálasi* '5 francs', *dáraja* 'celebrity', *dàraka* 'breakfast', *dùlɔki* 'shirt', *fɔ̀lɔkɔ* 'dust', *fúlumɛ* 'blacksmith's hammer', *gèrɛntɛ* 'pression', *jàlaki* 'guilt', *jɔ̀lɔkɔ* 'chain', *kílisi* 'magic formula', *kùlusi* 'pants', *ntíleku* 'lead (metal)', *ntúloma* 'forked post', *séleke* 'angle', *sìlamɛ* 'Muslim', *sìrimɛ* 'melted butter', *sìrife* 'rasor', *bèleke (mɔ̀gɔ lá)* 'to surprise', *bùluku* 'to dig over', *búruja* 'to dénigrate', *fàrati* 'to take a risk', *féreke* 'to tangle', *fòroki* 'to chafe', *fùruku* 'to grow angry', *gírinti* 'to belch', *kɔ̀lɔsi* 'to observe', *mùluku* 'to paralyse', *ɲàraki* 'to waste', *pùruti* 'to snatch', *wùlusi* 'to shell'.

TRISYLLABIC (CV)(CVCV) WORDS:[11] *bìsigi* 'image', *fitinɛ* 'oil lamp', *fitinɛ* 'conflict', *mísɛli* 'needle', *mìsiri* 'mosque'.

4.1. 'Iambic' and 'neutral' feet

The following tables present correlations between different segmental factors and the susceptibility of disyllabic feet to the reduction of their first vowel.

For each evaluation criterion, the data are represented in a pair of tables: first, the percentage of the tokens with compete V1 elision (the 'elision tables'); second, the number and mean V1 duration in the remaining tokens (i.e. those which do not undergo V1 elision, the 'duration tables').

In both types of tables, when the numbers of pronunciations by KK and MT are different, the first number is for KK, and the second one (after the slash) is for MT. For example, '27/30' in the second column, line two of Table 2 means that KK pronounced 27 tokens and MT pronounced 30 (i.e., for some reason, 3 tokens were not pronounced by KK).

In the 'elision tables', in lines 3 and 4, the number of V1 drops is given in absolute figures, and in lines 5 and 6, the percentage of drops in each respective sample. In line 7 (Combined %), the rate of drops in the whole sample across both speakers is given. The data are arranged in decreasing order according to the rate of V1 drops.

In the 'duration tables', the data are arranged in the order of increasing mean vowel duration.

INITIAL CONSONANTS.[12]

Initial consonant	t	d	f	b	m	g	k	s	ɲ	j	w
Nr. of tokens, KK/MT	27/30	33	57/60	33	8/9	12	39	12	9	12	15
KK n of drops	11	12	25	12	1	1	5	0	0	0	0
MT n of drops	24	24	30	11	3	3	6	0	0	0	0
KK % of drops	41%	36%	44%	36%	12,5%	8%	13%	0%	0%	0%	0%
MT % of drops	80%	73%	50%	33%	33%	25%	15%	0%	0%	0%	0%
Combined % of drops	60,5%	54,5%	47%	34,5%	22,5%	16,5%	14%	0%	0%	0%	0%

Table 2. V1 drops for 'neutral' and 'iambic' feet, by foot-initial consonants.

As we can see, in MT's pronunciation V1 elision is much more frequent. Otherwise, both speakers display the same trends: feet with initial dental /t d/ and labial /f b/ obstruents are most liable to V1 elision (and for MT, dental-initial feet are considerably more liable to exhibit elision than labial-initial ones). Feet with initial velar or /m/ are less susceptible to V1 elision, while those with initial palatal and labial sonorants /ɲ, w/, as well as the dental fricative /s/ and palatal glide /j/ do not exhibit it at all.

Initial consonant	s	f	m	ɲ	t	k	g	b	d	j	w
Nr. of tokens KK/MT	12	25/28	8/9	9	16/6	33/32	11/9	21/22	21/9	12	15
KK, ms	33	37	34	42	48	42	47	45	53	59	47
MT, ms	36	38	51	44	38	45	41	46	44	47	65
Combined, ms	34,5	37,5	42,5	43	43	43,5	44	45,5	48,5	53	61

Table 3. Mean V1 duration for 'neutral' and 'iambic' feet in ms, by foot-initial consonants.

If the tokens with full elision of V1 are not taken into account, the fricative initial consonants /s f/ have the shortest realisations of V1, and the oral sonorants (/j/ and especially /w/), the longest ones. The stops and nasal sonorants occupy an intermediate position. More precisely, the situation of /m/ is rather ambiguous: as a sonorant, it tends to be resistant to V1 reduction, and as a labial, it tends to favour it.

Unlike the 'elision table', the 'duration table' reveals no clear tendencies (with the exception of the feet with initial /j/ and /w/ in which V1 is not susceptible to elision and which are realised longer than elsewhere). Data for non-elided V1 recorded from both informants are often contradictory and in most cases, the variability in the duration of such vowels seems to be rather irrelevant. Therefore, the rate of V1 drops appears as a more relevant factor than the duration of V1 in the remaining tokens, i.e. after the cases of V1 elision are discarded, remaining feet behave relatively homogeneously.

FOOT-INTERNAL CONSONANTS.[13]

Internal consonant	ɲ	l	m	j	n	r	s
Nr. of tokens KK/MT	12	117/123	9	3	27	68/69	20/21
KK n	11	51	2	2	1	6	0
MT n	5	71	6	0	7	9	3
KK %	92%	44%	22%	67%	4%	9%	0%
MT %	42%	58%	67%	0%	26%	11%	14%
Combined %	67%	51%	44,5%	33,5%	15%	10%	7%

Table 4. V1 drops for 'neutral' and 'iambic' feet, by foot-internal consonants.

The results are indicative primarily for the most frequent internal consonants, /l/ and /r/. The presence of /l/ in foot-internal position certainly favours V1 elision, while a foot-internal /r/ does so to a much lesser degree. However, as for other internal consonants, the samples are not representative enough and words with vocalic combinations of V1 close vowel and V2 open or semi-open vowel predominate in this sample. It will be shown below that this combination favours V1 elision and it can only be stated that any foot-internal consonant represented in Table 5 allows V1 elision if other favourable conditions (type of initial consonant; vocalic combination) are satisfied.

Internal consonant	j	ɲ	n	r	s	m	l
Nr. of tokens KK/MT	1/3	1/7	26/20	62/60	20/18	7/3	66/52
KK, ms	22	21	38	43	43	40	49
MT, ms	27	41	41	41	45	51	47
Combined, ms	24,5	31	39,5	42	44	45,5	48

Table 5. Mean V1 duration for 'neutral' and 'iambic' feet in ms, by foot-internal consonants.

If we discard the rare feet with palatal consonants /j, ɲ/, average V1 durations in feet with all other internal consonants do not vary much. Interestingly, the average V1 duration in the feet with internal /l/ exceeds that in the feet with /r/, which does not correlate with the fact that /l/ facilitates V1 elision, while /r/ does not. It can be said that after omitting words with V1 elision (and if rare palatal consonants are not taken into account) the foot-internal consonants do not really influence the susceptibility of feet to V1 reduction.

VOCALIC COMBINATIONS

In Bambara disyllabic feet, some vowel combinations are impossible, and among the allowed combinations, some are very frequent, while others are rare (see in particular Konaté 1989; Konaté & Vydrine 1989).[14]

In my sample, all more or less frequent combinations appear. However, because of the considerable number of combinations, most of them are represented by a small number of tokens: the highest score is for the combination *i-i*, i.e. the type CiCi, which is represented by 12 words (36 tokens). The low frequency makes it difficult to discover tendencies concerning vocalic elision or reduction. For this reason, these combinations are grouped into clusters, to make tendencies more visible.[15]

The following clusters were formed:

1. Combinations with vowels of different aperture but not contrasting for the feature 'front/back' (heterotimbral):

(a) close V1 (*i*, *u*), mid V2 (*ɛ*, *e*, *ɔ*, *o*, *ɛ̃*, *ẽ*, *ɔ̃*, *õ*), V1 and V2, without front-back differences (e.g. CiCɛ or CuCo, but not CiCo or CuCɛ); in Table 6 these are labelled i-E and u-O;[16]

(b) close V1 (*i*, *u*), open V2 (*a*, *ã*), labelled i/u-A in Table 6.

2. Combinations with vowels for the same aperture and same front-back value (i.e. homotimbral: identical or differing only in the nasality feature):

(c) close vowels: V1 *i*, *u*, V2 *i*, *u*, *ĩ*, *ũ*, labelled i-I, u-U in Table 6.

(d) open vowels: V1 *a*, V2 *a*, *ã*, labelled a-A in Table 6.
(e) mid vowels: V1 *ɛ*, *e*, *ɔ*, *o*, V2 *ɛ*, *e*, *ɔ*, *o*, *ɛ̃*, *ẽ*, *ɔ̃*, *õ*, labelled E-E, O-O in Table 6.

Vocalic combinations clusters	i-E, u-O	i/u-A	i-I, u-U	a-A	E-E, O-O
Nr. of tokens KK/MT	50/54	63	56/60	24	66
KK n	35	21	11	3	3
MT n	35	30	22	8	6
KK %	70%	33%	20%	12,5%	4,5%
MT %	65%	48%	37%	33%	9%
Combined %	67,5%	40,5%	28,5%	23%	7%

Table 6. V1 drops for 'neutral' and 'iambic' feet, by V1-V2 combination.

Table 6 reveals quite clear tendencies:
– heterotimbral combinations (especially, the type with close V1 and mid V2, both anterior or both posterior) are more favourable to V1 elision/reduction;
– for homotimbral combinations, those with close vowels are the most favourable to elision and reduction while those with mid vowels are most unfavourable.

Vocalic combinations clusters	i-E, u-O	i/u-A	i-I, u-U	E-E, O-O	a-A
Nr. of tokens KK/MT	15/19	42/33	45/38	63/60	21/16
KK, ms	35	36	43	47	57
MT, ms	41	42	41	45	45
Combined, ms	38	39	42	46	51

Table 7. Average V1 duration for 'neutral' and 'iambic' feet in ms, by V1 and V2 combination.

Here too, after removing the feet with V1 elision, tendencies are unclear. For MT, differences among the types are insignificant. In KK's pronunciation, V1 is shorter in heterotimbral combinations, while in the homotimbral ones the shortest V1s are the close ones and the longest V1 are the most open ones, possibly a manifestation of a general cross-linguistic tendency (de Lacy 2007: 27).

Let us also test the hypothesis of correlation between V1 duration and the orality/nasality of the final vowel, see Tables 8 and 9.

Vocalic combinations clusters	V-V	V-Ṽ
Nr. of tokens KK/MT	184/192	75
KK n	51	22
MT n	71	30
KK %	28%	29%
MT %	37%	40%
Combined %	32,5%	34,5%

Table 8. V1 drops for 'neutral' and 'iambic' feet, V-V *vs* V-Ṽ.

Vocalic combinations clusters	V-V		V-Ṽ	
	V1	V2	V1	V2
Nr. of tokens KK/MT	133/121	183/192	53/45	75
KK, ms	44	80	44	102
MT, ms	43	81	44	101
Combined, ms	43,5	80,5	44	101,5

Table 9. Average V1 and V2 duration for 'neutral' and 'iambic' feet in ms, V-V *vs* V-Ṽ.

The rate of V1 drops in the types V-V and V-Ṽ is almost the same, and it can be assumed that the nasality of the final vowel does not influence the susceptibility of V1 to elision. The V1 lengths in both groups of vocalic combinations are also practically identical. Therefore, the nasality/orality of V2 does not influence the V1 duration. On the other hand, the nasalised V2 turn out to be by 20% longer than non-nasalised ones.

4.2. 'Trochaic' feet

As mentioned in 3.1, the contrast of vowel length in Bambara is pertinent only in the non-final syllable of a disyllabic foot. Even in this position, long vowels are relatively infrequent and often unstable among speakers. In my questionnaire, only nine single-foot words are 'potentially trochaic', i.e. appear with a long V1 in one or both dictionaries of reference (or previously attested so in my field data).

The analysis of the recordings has shown that the speaker KK preserves vowel length much better than MT. Out of the 9 words, only one

(*wéle* 'to call') is pronounced by KK with a short V1, and in the remaining 8 words, V1 is longer than V2. As for MT, he pronounced a relatively long vowel only in one word (*bòoso* 'Bozo'), in 3 other words (*dòolo* 'star', *dóolen* 'fishing hook', *bèɛsɛ* 'coquettish') V1 was of the same length as V2. Elsewhere, V1 was short (although it did not elide).

It is of interest that in some words V1 is always long, and in others it varies among speakers. According to my field data (exceeding the limits of the current experiment), stability or instability of the long vowel in V1 position seems to be relatively independent of the dialect.[17]

4.3. Durational ratio between V1 and V2

Table 10 represents mean durations of V1 and V2 in feet of different types ('iambic' and 'neutral' types are lumped together, as in the preceding counts; the difference between the number of tokens for V1 and V2 equals the number of V1 drops). For trochaic feet, only words pronounced with a long vowel (and 'semi-long' in MT's pronunciation) were included.

Type of foot	'Trochees'		'Neutral' + 'Iambs'	
Nr., KK/MT	24/12		186/167	258/267
	V1	V2	V1	V2
KK, ms	88	58	44	86
MT, ms	79	82	43	86

Table 10. Average V1 and V2 duration in ms, by foot type.

As we can see, in the 'neutral/iambic' feet, even if V1 is not elided, the second vowel is, on average, twice as long as the first. In the 'trochaic' feet, in KK's pronunciation, V2 is shorter than V1 by approximately 1/3 (and also 1/3 shorter than V2 in 'neutral/iambic' feet), while in MT's pronunciation, it is roughly equal to the V1. In MT's idiolect, degradation of the vowel length contrast proceeds in two directions. First, the vowel length disappears in less stable words; second, in the words maintaining vowel length, this feature grows less distinctive, and the contrast between long and short vowels weakens. However, even in MT's pronunciation, in these words, V1 reduction (let alone elision) is never observed.

One may ask: may V2 length be explained by the presence of the tonal article which manifests itself as tonal modulation at the end of a noun (cf. 2.3)? To answer this question, let us compare the average vowel lengths for nouns and verbs, cf. Table 11.

	Nouns		Verbs	
	V1	V2	V1	V2
Nr., KK/MT	119/109	160/165	54/46	80/84
KK, ms	46	87	41	86
MT, ms	45	91	39	77

Table 11. Average V1 and V2 duration in ms, 'iambic' + 'neutral' feet, in nouns and verbs.

It turns out that in KK's pronunciation the average duration of both V1 and V2 in verbs is practically identical to that of V2 in nouns. MT pronounces both V1 and V2 in verbs a bit shorter than in nouns, but the ratio between V1 and V2 is roughly the same: V1 is twice as short as V2. It can be concluded that the difference in V2 and V1 duration in nouns cannot be explained by grammatical tone.

4.4. Vowel realisations in trisyllabic words

As mentioned at the beginning of section 4, trisyllabic words form two groups, depending on their segmentation into feet: the more numerous group of the (CVCV)(CV) type, and the rarer type (CV)(CVCV). Mean durations of vowels for both these groups are represented in Table 12.

	(CVCV)(CV)			(CV)(CVCV)		
	V1	V2	V3	V1	V2	V3
Nr., KK/MT	85/91	103/105	103/105	15	9	15
KK	37	51	80	42	50	81
MT	34	56	75	48	51	76

Table 12. Mean V1, V2 and V3 durations in ms in monomorphemic trisyllabic words.

The following tendencies can be observed (for both speakers):

– in some disyllabic feet, the first vowel elides, cf. *bìlisi* [blìsî ~ bìlìsî] 'demon' (segmentation into feet: (bìli)(si)), *fìtinɛ* [fìtnɛ̂] 'oil lamp' (segmentation into feet: (fì)(tinɛ));
– if words with vowel elision are not taken into account, in both types of words, the shortest vowel is V1. However, the duration difference between V1 and V2 in (CVCV)(CV) is larger than in (CV)(CVCV) and in some realisations, V1 in (CV)(CVCV) can be longer than V2;

– the word-final vowel (V3) is considerably longer than any other vowel of the word. The status of the final syllable (the only syllable of a monosyllabic foot or the final syllable of a disyllabic foot) seems to have no impact on the duration of its vowel.

4.5. Summary table

	KK			MT			Total/Average		
	V1	V2	V3	V1	V2	V3	V1	V2	V3
Iamb. + **Neut. CVCV** Nr.	186	258		167	267		352	525	
duration, ms	44	86		43	86		43,5	86	
standard dev., ms	14	27		11	27		12,5	27	
Trochees CVCV Nr.	24	24		12	12		36	36	
duration, ms	88	58		80	82		85	66	
standard dev., ms	12	15		9	17		12	19	
(CVCV)(CV) Nr.	85	103	103	91	105	105	176	208	208
duration, ms	37	51	80	34	56	75	36	53	78
standard dev., ms	11	14	24	11	15	18	11	15	21
(CV)(CVCV) Nr.	15	9	15	15	9	15	30	18	30
duration, ms	42	50	81	48	51	76	45	50	78
standard dev., ms	19	14	26	20	14	13	20	14	20

Table 13. Mean duration of vowels in all foot types (both disyllabic and trisyllabic words).

5. Discussion and conclusions

5.1. 'Iambic' vs *'neutral' feet*

My experiment confirmed that, on the one hand, the elision of a short V1 is optional. It varies between speakers (and even in the pronunciation of the same speaker), and an elided V1 can always be restored in careful speech. On the other hand, elision seems to be conditioned by the segmental composition of a foot, i.e. by phonotactics. The following factors are of importance:

1) Foot-initial consonants. Bilabial and alveolar stops and fricatives favour vowel elision; sonorants (both oral and nasal, probably with

the exception of the labial /m/) and palatal stops (or affricates) disfavour it, while velar stops (and, probably, the labial sonorant /m/) occupy an intermediate position.

2) Foot-internal consonants. Sonorants /l/ and probably /j/ and /ɲ/ favour elision of the preceding vowel; the stops /b/ and /g/, the fricative /f/ and the labiovelar sonorant /w/ are strongly unfavourable to it.[18] The other foot-internal consonants allow V1 elision provided that other conditions (foot-initial consonants, vocalic combinations) are met.
3) Vocalic combinations. Heterotimbral combinations with a close V1 favour elision; homotimbral combinations of mid-open vowels disfavour it. The homotimbral combinations of closed and open vowels occupy an intermediate position.

Susceptibility to V1 elision is determined by the combination of these three factors. If favourable conditions on all the three parameters are simultaneously met, the probability of elision is extremely high. If all three parameters are unfavourable, V1 elision normally does not occur (in particular, the presence of foot-internal consonants /g, b, f, ns, ŋ, w/ seems to be sufficient to block V1 elision). If a foot combines favourable and unfavourable (or 'intermediary') factors, the elision varies across and within speakers.

This explanation does not cover cases where, in some feet, reduction often takes place, and in other feet under identical conditions, it does not. Here are some examples (among many others).

V1 CAN ELIDE	NO ELISION OF V1
dɔ̀lɔ 'beer'	*bɔ̀lɔ* 'stake, peg'
dàla 'lake, pond'	*fála* 'orphan'
fólon 'ravine'	*bólo* 'hand, arm'

The presence of elision in the words of the first column and its absence in the words of the second column can probably be explained by a different degree of lexicalisation. On the other hand, the experiment showed that the lack or the presence of V1 elision is not absolute. We have an entire set of words which are normally pronounced without elision, but still, elision may occur occasionally (*mùso* 'woman', *júfa* 'carrion', *bàra* 'calabash', etc.), and vice versa (*dúnan* 'foreigner', *tùma* 'time', *fìli* 'to mistake', etc.). The word *bólo* 'branch' is believed to have a non-eliding V1, however, MT pronounced the word *jíribolo* 'branch of a tree', contrary to the general tendency, as [jíríbʷlô].

The conclusions are the following:

– the reduction and elision of a short V1 in disyllabic feet is a phonetic, rather than phonological, process; it is (at least partially) conditioned by the phonotactics;
– contrary to Vydrin (2014), the distinction between 'iambic' and 'neutral' feet is phonologically irrelevant. All disyllabic feet with a short first vowel can be classified into one type;
– V2 in a 'iambic' foot which coincides with a disyllabic word is automatically realised as a long vowel. Being automatic and predictable, this vowel length cannot be regarded as phonological. This is confirmed by the fact that in trisyllabic words of the type (CVCV)(CV), V2 is realised short.

5.2. 'Iambic' and 'trochaic' feet or 'light' and 'heavy' feet?

In what concerns the duration of vowels in 'trochaic' feet, the results of my experiment are preliminary (a more thorough experiment is necessary and is planned). However, some preliminary conclusions can be drawn.

1) The contrast between 'iambic' and 'trochaic' feet remains pertinent in modern Bambara: at least in some words (such as *báara* 'work', *míiri* 'to think', and, in fact, in many others) the long vowel seems to be indisputable for speakers of this language. However, in numerous other words a long V1 turns out to be more or less unstable, and this durational volatility seems to be unrelated to dialectal variation. For example, both participants in my experiment, KK and MT, live on the same street of the same village, belong to the same age group and are close friends, but display considerable divergences in the duration of their realisations of long V1).

If we compare Bambara with other languages of the Manding group, its position can be viewed as intermediary between the extreme points of a cline. At one extreme, there is Mandinka, where vowel length is phonologically relevant in all positions, long vowels are very frequent and their functional load is very high, see (Creissels & Sambou 2013: 21). At the other extreme, there is Guinean Maninka, where the original vowel length contrast has been practically lost (Diané & Vydrin 2014).[19] It seems that the erosion of the vowel length contrast in Bambara (its irrelevance in foot-final position; its instability in the first syllable) may be indicative of a further loss of its functional load and a drift towards a situation such as that seen in Guinean Maninka.

2) An interesting phenomenon discovered through the experiment is the shortened realisation of V2 in 'trochaic' feet.[20] It turned out that in a disyllabic foot (at least when its boundaries coincide with the word

limits), the durational characteristics of V1 and V2 are in inverse relation. If the first vowel is short, the second is long (a 'iambic' foot), and if the first vowel is long, the second is short (a 'trochaic' foot). One can say that a disyllabic foot tends to maintain its overall duration. This phenomenon can be defined as foot isochrony; a similar phenomenon is observed, for example, in Finnic languages (Kuznetsova 2018: 119).

3) The calculation of vowel duration in trisyllabic monomorphemic words showed that when a disyllabic foot occupies a non-final position in a word (i.e. in a structure (CVCV)(CV)), its V2 is still longer than V1 (approximately by 50%). However, their quantitative difference is not as great as in a single-foot disyllabic word CVCV (where V2 is approximately twice as long as V1).[21] As for a monosyllabic foot in a non-word-final position, i.e. in structures (CV)(CVCV), its vowel is normally longer than V2 (i.e. the vowel of the initial syllable of a 'iambic foot'), but shorter than V3 (it should be however kept in mind that V2 in these words is susceptible to elision, while V1 cannot be dropped). This means that the durational characteristics of vowels are sensitive not only to foot boundaries but word boundaries are also of relevance. It can be reformulated as follows: a word-final vowel is, by default, phonetically long, but it is predictably shortened if it belongs to a disyllabic foot with an initial heavy syllable.

A direct consequence is that the final vowel of what is hitherto referred to as the 'iambic foot' is not inherently long. It may be either short or long, depending on the position of the foot in a word.

4) Another conclusion of this study is the following. Contrary to what was postulated in Vydrin (2014), the difference between the disyllabic feet types in Bambara can be exhaustively described in the terms of the length of the first vowel, there is no need to postulate the existence of stress.

If we assume that the difference between the two foot types can be exhaustively described in terms of the quantitative opposition of the first syllable vowels (and the durational differences in second syllable vowels are stipulated by the length of V1 and therefore not phonological),[22] the next question is, do we really need to distinguish between iambic and trochaic feet? In fact, this distinction turns out to be redundant. It seems enough to distinguish between disyllabic feet with long and short vowels in the initial syllable. One could designate them 'heavy' and 'light' feet respectively.

Therefore, in a language with a featural foot and no stress (like Bambara), the question of the directionality of the foot turns out to be superfluous.

Abbreviations

B, D = Bailleul's (2007) and Dumestre's (2011) dictionaries; KK, MT = names of the informants; V1, V2 = first, second vowel of a (disyllabic) foot; V3 = third vowel of a word.

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Notes

[1] In Bambara orthography, vowel nasality is indicated by <n> after the vowel: *mén* /mɛ̃/ 'to hear', *sàn* /sã̀/ 'to buy'. Vowel length is rendered by a double letter: *míiri* /mí:rí/ 'to think'. In this paper, I follow these orthographic conventions.

[2] Following the established orthographic tradition for the great majority of West African languages, in this paper (everywhere, with the exception of Table 1) the voiceless affricate /ʧ/ is written *c*, the voiced affricate /ʤ/ as *j*, and the glide /j/ as *y*.

[3] This term was suggested by Green (2015), although that author's approach to the Bambara foot is different from mine.

[4] A detailed argumentation for this approach cannot be provided here due to lack of space.

[5] There are cases where ancient bimorphemic words have been re-interpreted as monomorphemic, and they may function now as consisting of a single foot.

[6] It can also be mentioned that a tonal domain can coincide with a foot (*mɔ̀gɔ́* 'human being') or include two or more feet (*kóló|gélé|yá* 'solidity'), and cannot be shorter than a foot. An exceptional case is represented by a floating low tone which has no segmental base (and is therefore shorter than a foot).

[7] By 'potentially trochaic' feet I mean those feet where a long V1 is attested in at least one of the aforementioned Bambara dictionaries, or those which were at least sometimes recorded with a long V1 during my previous field work. I use the labels 'potentially neutral feet' and 'potentially iambic feet' in the same way.

[8] I established the threshold of 20 ms when processing the audio files. To my ear, Bambara vowels slightly longer than 20 ms are still distinguishable. It seems that the threshold of perceptibility may vary across different languages; so, in English it is about 30 ms (Lehiste 1977: 256-258), while specialists in Finnic languages put it at 35 ms (Kuznetsova & Verkhodanova 2019: 4).

[9] If a speaker pronounced one token of a word with V1 elision and the other two without elision (or vice versa), these tokens were included in different groups.

[10] The name of an ethnic group in Mali.

[11] Four out of five words of the type (CV)(CVCV) are Arabic loans; in general, this type is not very frequent in the original Bambara vocabulary.

[12] Words with initial *n, y, c* (/n, j, ʧ/) have not been included in the questionnaire which targeted vocalic elision/reduction, as they were presumed to not be susceptible to V1 reduction.

[13] Unfortunately, words with foot-internal consonants /g/, /ŋ/, /ns/, /f/, /b/, /w/ were not included in the questionnaire (it had been presumed that, in such words, V1 is not susceptible to elision), as well as the single-foot words with the rare internal phoneme /d/.

[14] In Konaté & Vydrine (1989), data from the Beledugu dialect of Bambara are analysed in this respect; in Konaté (1989), both the Beledugu and the Bamako (in fact, the Standard Bambara) data are presented. There are some divergences between both dialects but the main tendencies are the same.

[15] An anonymous reviewer has objected against lumping together different features and insisted on a more fine-grained approach. I can answer to this objection that, of course, in my analysis, each vocalic combination was originally represented separately, and their conflation was a conscious decision, driven also by space constraints.

[16] I use here the convention of designating a group of phonetically similar phonemes by a capital letter. So, 'E' stands for *e*, *ɛ*, *ẽ*, *ɛ̃*; 'I' for *i*, *ĩ*, etc.

[17] This phenomenon is intended to be the subject of a separate experiment.

[18] Feet with internal /ns/ [ns ~ z] and /-ŋ-/ [ŋ] ~ [ŋg] ~ [ŋk] were absent from my sample. In the available dictionaries, their V1 is never marked as reducible, which is confirmed by my personal experience of work with the Bambara language.

[19] To be more precise, in Guinean Maninka a new length contrast emerged as a result of the elision of velar consonants in intervocalic position (**sìGi* > *sìi* 'sit down', **bùGu* > *bùu* 'hut', etc.).

[20] One of two informants whose recordings were analysed, KK, displayed this tendency, but not the other one, MT. However, the majority of my other informants (whose recordings were analysed only preliminarily) pronounce 'trochaic' feet in the same way as KK.

[21] We should also not forget that V1 is susceptible to elision; when speaking about the durational ratio of V1 and V2, only non-elided V1s are meant.

[22] In this relation, an interesting point is the length difference between realisations of oral and nasal vowels in word-final position (see Table 8) and its implications on the status of vowel nasality in Bambara. However, this question can hardly be solved without a thorough analysis of realisations of nasal vowels in different positions, and, in any case, lies outside the scope of the present paper.

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