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Iconicity as the motivation for the signification and locality of deictic grammatical tones in Tal

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We present novel evidence for iconicity in core morphophonological grammar by documenting, describing, and analysing two patterns of tonal alternation in Tal (West Chadic, Nigeria). When a non-proximal deixis modifies a noun in Tal, every tone of the modified noun is lowered. When the nominal modifier is a proximal deixis, the final tone of the modified noun is raised. The tone lowering and raising are considered the effects of non-proximal and proximal linkers, which have the tone features [–Upper, –Raised] and [+Raised] as their respective exponents. The realisation and maximal extension of the non-proximal tone features are considered effects of morpheme-specific featural correspondence constraints. Similarly, the exponent of the proximal linker docking on the final TBU is due to the relative ranking of the proximal-specific correspondence constraints. The association of the tone features [–Upper, –Raised] and [+Raised] with non-proximal and proximal linkers, respectively, is in line with crosslinguistic patterns of magnitude iconicity. Given that the local and long-distance realisations of the proximal and non-proximal featural affixes respectively are perceptually similar to deictic gestures, the locality of the featural affixation is considered a novel pattern of iconicity. To motivate this pattern of iconicity, we extend the notion of perceptual motivation in linguistic theory to include the crossmodal depiction of sensory imagery. Consequently, Tal presents evidence for iconicity as a motivation for morphophonological grammar.

1 Introduction

We investigate how Tal (West Chadic, Nigeria) grammaticalises a crosslinguistic pattern of iconicity and explore the implications of the grammaticalisation for phonological theory. Iconicity, which is the resemblance between form and meaning, is an attribute of both vocal and sign languages (Perniss et al. 2010; Dingemanse et al. 2015). In studies focusing on vocal language, iconicity is often referred to as sound symbolism (Hinton et al. 1994). To contextualise this work in a vast and growing literature on form-meaning mapping in both vocal and sign languages, we use the term iconicity throughout this work. The relevant pattern of iconic form-meaning mapping for our purpose involves associating high acoustic frequency (i.e., fundamental frequency and second formant) with proximal deixis and low acoustic frequency with distal deixis (Nichols 1971; Nuckolls 1999; Ultan 1978; Johansson & Zlatev 2013; Haynie et al. 2014). Evidence for this pattern of iconicity is stochastic. If we consider that vocal imitation and crossmodal depiction, as the basis of iconicity, is an aspect of the general cognitive system (Kuhl & Meltzoff 1996; Doupe & Kuhl 1999; Hauser et al. 2002; Lockwood & Tuomainen 2015), we should expect grammaticalised iconicity in morphophonological operations. Given that iconicity is traditionally viewed as a peripheral aspect of human language (Hockett 1960; de Saussure 1974), there is reason to believe that its grammaticalisation is underdocumented.

To present evidence for grammaticalised deictic iconicity, we document, describe, and analyse the tonal alternations of modified nouns in Tal. For example, the modified nouns bear a low tone on all their tone-bearing units (TBUs) when the modifier is a medial or distal demonstrative pronoun, third-person possessive pronoun or a noun. When the modifier is a proximal demonstrative pronoun, a first-person possessive pronoun or a second-person possessive pronoun, the final low tone of the modified noun surfaces as a mid tone. In (1), the tonal alternations are illustrated through nouns modified by the demonstrative pronouns, namely distal (far from the speaker and the addressee), medial (near the addressee) and proximal (near the speaker).

(1) Demonstrative pronouns as modifiers in Tal

	N	N DISTAL	N MEDIAL	N PROXIMAL	
a.	dídí	dìdì ɲɛ̋	dìdì ɲɛ̀ː	dídí sɛ̄	‘sweat fly’
b.	ɓɔ̄lɔ̄ŋ	ɓɔ̀lɔ̀ŋ ɲɛ̋	ɓɔ̀lɔ̀ŋ ɲɛ̀ː	ɓɔ̄lɔ̄ŋ sɛ̄	‘internal organ’
c.	kàsɛ̀ŋ	kàsɛ̀ŋ ɲɛ̋	kàsɛ̀ŋ ɲɛ̀ː	kàsɛ̄ŋ sɛ̄	‘beer filter’
d.	àlmákàʃī	àlmàkàʃì ɲɛ̋	àlmàkàʃì ɲɛ̀ː	àlmákàʃī sɛ̄	‘scissor sp.’

Based on the structure of nominal modification in Chadic languages and the deictic properties of nouns and pronominals crosslinguistically, we will consider the overwriting low and mid tones by-products of non-proximal and proximal linkers which have the tone features [–Upper, –Raised] and [+Raised] as their respective exponents. In this case, the non-proximal and

proximal linkers are non-segmental morphemes, also known as featural affixes (Akinlabi 1996). The phonological asymmetry in the realisation of the [–Upper, –Raised] and [+Raised] featural affixes is a by-product of distinct and interacting constraints. A featural correspondence account of the featural affixation is presented within the framework of Optimality Theory (McCarthy & Prince 1993; 1995; Prince & Smolensky 2004).

We will argue that the form-meaning mapping of the proximal and non-proximal linkers is consistent with crosslinguistic patterns of distance-related iconicity (Nichols 1971; Ultan 1978; Johansson & Zlatev 2013; Haynie et al. 2014). We will also argue that iconicity motivates the long-distance and local realisations of the non-proximal and proximal featural affixes respectively, considering that the phonological locality of the featural affixes is perceptually similar to deictic gestures. As a result of this, we propose that the motivation for phonological grammar is not limited to language-internal conditions but also includes crossmodal perception of sensory imagery. We show that the grammaticalised deictic iconicity in Tal shares properties, such as phonetic grounding, naturalness and phonological asymmetry, in common with arbitrary phonological patterns. Most importantly, we contribute to the growing typology of grammaticalised iconicity (e.g., Hurch 2005 on reduplication, Alderete & Kochetov 2017 on expressive palatalisation, Akinbo 2021a on root-vowel fronting and backing). Consequently, Tal challenges the completely arbitrary view of form-meaning mapping (Hockett 1960; de Saussure 1974) and presents grammaticalised evidence in support of the view that recognises the role of both arbitrariness and iconicity in grammar (Lockwood & Dingemanse 2015; Dingemanse 2018).

As a background to the discussion in this work, we present the relevant background on the sound inventory and pronominal system of the language in §2. In §3, we present the dataset that forms the basis of this work. We present our analysis and discussion in §4. The summary and conclusion are presented in §5. For transparent and open research, the link to the database, which contains all the sound files, the accompanying textgrids of their phonetic transcription and R codes forming the basis of this work, can be found in the appendix.

2 Background

Tal is an A3 West Chadic language with about 30,000 speakers (Bulkaam 2022). The language is predominantly spoken in Pankshin local government area (LGA), Plateau State, Nigeria. Tal speakers are also found in Yashi (Shendam LGA) and along the border of Mikang and Pankshin LGAs. See **Figure 1** for the main settlements. The word Tal is the name of the people, their language, and homeland (Baklit 2014). Most Tal adults are bilingual in Hausa and Tal, while most children and elders are monolingual in Tal. There are six varieties of Tal, namely Muɗak, Mbaal, Mungɠoot, Muɗong, Bongmut, and Takong. According to Bulkaam (2022), the only

difference between the dialects are segmental and tonal variations in some words, such as the examples in (2). The variety of Tal that forms the basis of our investigation is Muɗak.

(2) Lexical differences among varieties of Tal (Bulkaam 2022: p. 33)

	Mbaal	Takong	Muɗak	Muɗong	Bongmut	Mungƙoot
eight	dɛ̄ːfɛ́j	pàːfɛ́j	pàːfɛ́j	ndɛ̀fɛ́j	fɛ́rɱfə̀j	dɛ̄ːfɛ́j
sweet potato	dàƙúŋ	nàƙúŋ	nàƙúŋ	nàƙúŋ	dàƙúŋ	dàƙúŋ
teeth	hā̌s	hā̌s	hā̌s	hɔ̄ːs	hɔ̄ːs	hɔ̄ːs
mouth	ƙàpʰɪ́	ƙàpʰɪ́	ƙàpʰɪ́	ƙàpʰɪ́	gɪ̀pɪ́	gɪ̀pɪ́
beans	ɪ̀jɪ̄m	ɪ̀jɪ̄m	ɪ̀jɪ̄m	ɪ̀jɪ̄m	ɪ̀rɪ̄m	ɪ̀rɪ̄m

The language is sparsely studied, considering that the only published work on the language is a 200 word list cited in Jungraithmayr & Holubova (2016). The only descriptive works on the language are the BA and MA theses of Bulkaam (2017; 2022).

As a background to the discussion in this work, this section focuses on aspects of Tal morphophonology that are directly relevant. The data source of our investigation is Bulkaam (2017; 2022) and the introspective knowledge of the second author who is a native speaker of the Muɗak variety. All the Tal data presented in this work are phonetically transcribed.

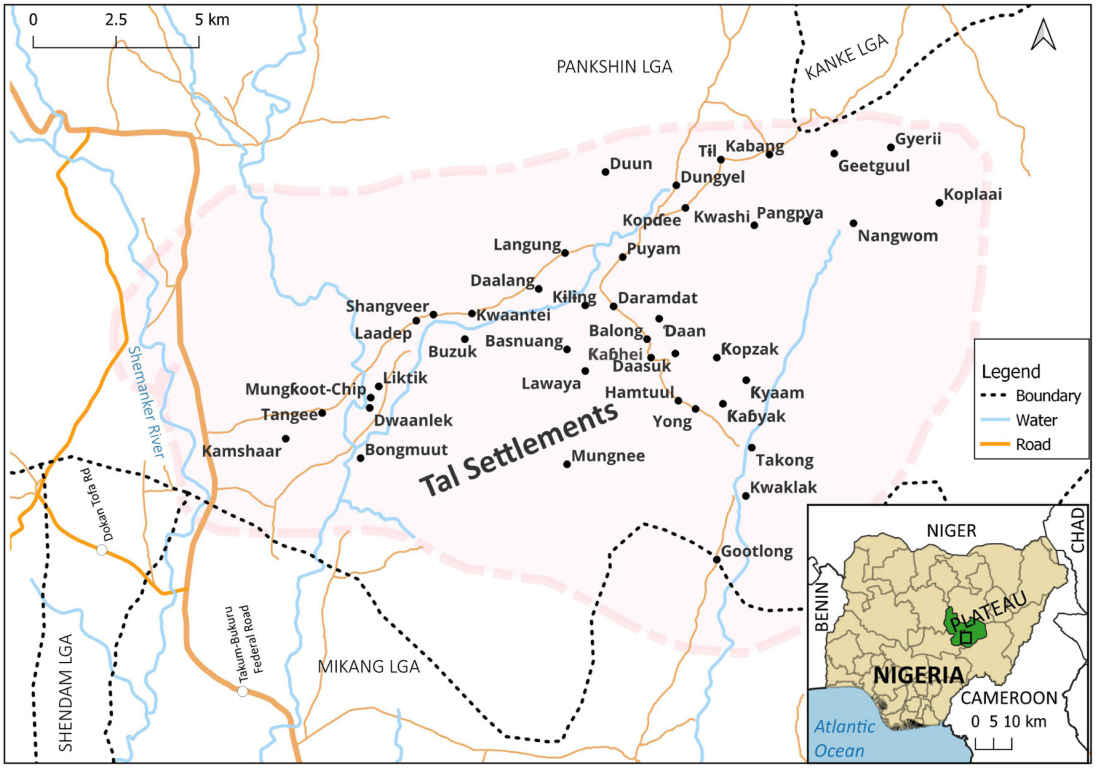


Figure 1: Tal settlements in Panskin LGA and along the border of Mikang LGA.

2.1 Consonants and vowels

There are thirty-four consonants in Tal, comprising oral stops (plosives and implosives), fricatives, nasals, trill and approximants (Bulkaam 2022), as shown in **Table 1**. The oral stops have four-way contrast, namely voicelessness, voicing, aspiration and implosive. The fricatives also contrast aspiration, voicing, and voicelessness.

	Bilabial	**Labio-dental**	**Alveolar**	**Post-alveolar**	**Palatal**	**Labial-palatal**	**Velar**	**Labial-velar**	**Glottal**
Plosive *Asp.*	p b pʰ		t d tʰ				k g kʰ	kp gb	ʔ
Implosive	ɓ		ɗ				ƙ		
Fricative *Asp.*		f v fʰ	s z sʰ	ʃ ʒ ʃʰ					h
Nasal	m		n		ɲ		ŋ		
Trill			r						
Appr. *Lateral*			l		j	ɥ	ɯ	w	

Table 1: Phonemic consonants in Tal (Bulkaam 2022:29).

Tal has twelve contrastive vowels, comprising six short vowels and the corresponding long counterparts. In **Table 2**, we present the vowel inventory.

	Front	**Central**	**Back**
High	i iː	ɨ ɨː	u uː
Mid	ɛ ɛː		ɔ ɔː
Low		a aː	

Table 2: Phonemic vowels in Tal (Bulkaam 2022:36).

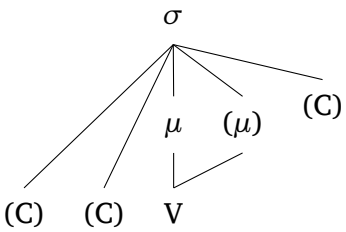
To show the contrastive status of all the vowels in Tal, we present the (near) minimal pairs in (3).

(3) Contrast between short and long vowels in Tal

a.	[i]	lít	‘lion’	[iː]	lìːt	‘shrine’
	[ɛ]	lɛ̀	‘to put’	[ɛː]	lɛ̀ː	‘to harvest with sickle’
b.	[u]	ƙún	‘three’	[uː]	ƙūːn	‘snake specie’
	[ɔ]	nɔ̋k	‘to leave’	[ɔː]	nɔ̀ːk	‘life’
c.	[ɨ]	ƙɨ̀n	‘uncle’	[ɨː]	ƙɨ̀ːn	‘buffalo’
	[a]	ƙáp	‘to dig up crop’	[aː]	ƙàːp	‘baboon’

In Tal, a syllable can contain a vowel with or without an onset or coda.. A syllabic nasal can also form a syllable on its own in the language. The language permits an onset geminate or cluster, only if the first consonant is a nasal. The syllable template in Tal is represented using the moraic structure in (4).

(4) Syllable structure in Tal



Under the standard moraic theory, a vowel or a syllabic nasal projects a mora (Hyman 1985; Hayes 1989). A long vowel in this case projects two morae. When a syllabic nasal forms a syllable in Tal, it bears no onset or coda.

2.2 Tone

Tal is a tone language, like all Nigerian languages, with the exception of Fulani (Williamson 1984). The language contrasts three level tones, namely H(igh), M(id) and L(ow). In addition to the level tones, the language also contrasts the contour tone HR, which is a raised H tone. As shown in (5), the tones mark both lexical and grammatical distinctions.

(5) Tone contrast

a.	H	tʰál	‘only’	lú	‘house’	ɓáŋ	‘to be red’
b.	M	tʰāl	‘to greet’	lūk	‘to gossip’	tɔ̄ŋ	‘sitting’
c.	L	tʰàl	‘greeting’	lùk	‘to swell’	tɔ̀ŋ	‘to sit’
d.	HR	tʰǎl	‘a Tal person’	lǘk	‘to burn’	ɗɛ̌ːt	‘to be bitter’

Based on the tone features in Pulleyblank (1986), we propose the feature specification in **Table 3** for the tones in Tal. The tone features are modified version of the features proposed in Yip (1980). As shown in **Table 3**, H and HR form the natural class [+Upper] and the tones L and M form the natural class [–Upper]. The feature specification also indicates that the tones HR and M are [+Raised].

	H	**M**	**L**	**HR**
Upper	+	–	–	+
Raised	–	+	–	+

Table 3: Tone features in Tal.

The use of tone features, instead of primitives such as H, L and M (Hyman 2010; Clements et al. 2011), is based on the tonal alternation in nominal modification (§4.1) and the acoustics of the tones. The division of the pitch range into two registers is acoustically supported with the F0(Hz) height plot in **Figure 2**. The plot is based on monomoraic words, which were spoken in isolation by the second author. To control for the effect of vowels and consonants on the F0(Hz) values of the tones (see Hombert 1977; Maddieson 1984; Whalen & Levitt 1995: for further discussion), the spoken words were also hummed in isolation.

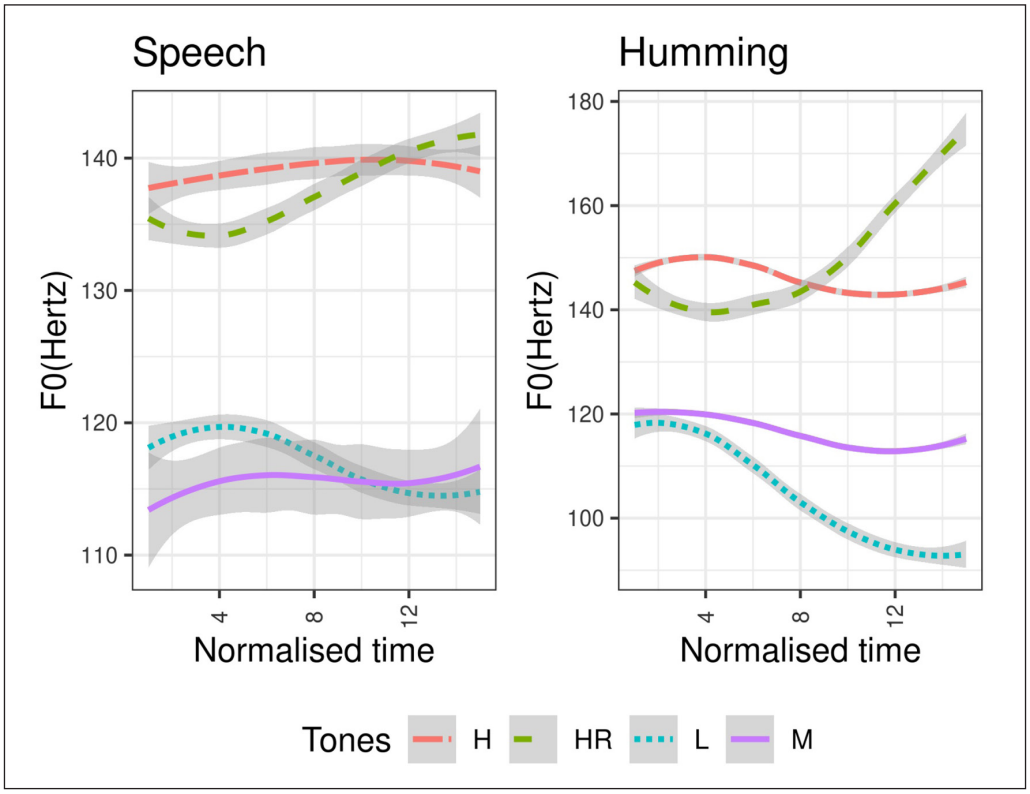


Figure 2: F0 plots of Tal tone contrasts in speech and humming modes.

In speech mode, the pitch trajectories of the H and HR tones are as expected. However, the pitch trajectories of L and M tones in speech mode are not as expected. Specifically, the M tone has a lower F0(Hz) than the L tone at the onset but vice versa at the end. The plot of the tones in humming mode suggests that the F0(Hz) trajectories of L and M, as well as H and HR, in speech mode might be an effect of the consonants and vowels. Regardless of the segmental effect on the pitch height of the tones, the F0(Hz) plot simply shows that the four tones are divided into two pitch registers.

(6) Cooccurrence of tones

			Second tone			
			H	M	L	HR
First tone	H	ɓél 'flute'	dídí 'sweat fly'	kádāːl 'head'	ŋǩínì 'today'	
	M	ɓēl 'to punch'	wīwɛ́l 'cry-FOCUS'	ɓālāŋ 'to groan'	vɛ̄ːkùː clarinet	
	L	ɓɛ̀l 'wisdom'	ǩàǩíː 'sacrifice'	ǩàkɔ̄ŋ 'river area'	kàsɛ̀ŋ 'beer filter'	
	HR	hăr 'rebuke'	kʰăpsáŋ 'hut'	bătɛ̄j 'divorcée'	ɓămlàŋ 'bird sp'	

The data in (6) shows that all the combinatorial possibilities are attested for the cooccurrence of level tones, but we find no instances where the HR tone occurs as the final tone of a monomorphemic word with two or more syllables. Given that all logically possible cooccurrences are attested for the level tones, we assume that tones must be associated with the tone-bearing unit (TBU) in the input. Considering that a bimoraic syllable in Tal can have two tones and in line with the proposal in Yip (2002), we assume that the TBU in Tal is a mora. Throughout this work, tones of all Tal examples are fully marked.

2.3 Possessive pronouns

The possessive pronouns in Tal are presented in **Table 4**. The possessive pronouns can be divided into dependent and independent.

	DEPENDENT		**INDEPENDENT**	
	SG	**PL**	**SG**	**PL**
1.POSS	nā/ná	nū/nú	mmāːn	mmūːn
2.POSS.M	gā/gá	gū/gú	mmāk	mmūk
2.POSS.F	gī/gí		mmīk	
3.POSS	mīːp	mʸá	mù mīːp	mù mʸá

Table 4: Possessive pronouns in Tal.

Both dependent and independent possessive pronouns are marked for person and number. In addition to these two grammatical features, the 2.SG possessive pronouns distinguish masculine

and feminine gender. The possessive pronouns are labelled *dependent* and *independent* because only the independent pronouns can occur in isolation or be conjoined, as illustrated in (7).

(7) Answer fragments: Independent possessive pronouns

a.	mmā:n	'(it is) mine'
	mmū:n	'(it is) ours'
	mmāk	'it is yours(m)'
	mmīk	'(it is) yours(f)'
b.	mmā:n ƙín mmīk	'(it is) mine and yours(f)'

Both independent and dependent pronouns can function as modifiers but we only focus on the dependent pronouns in this work. See §3 for the usage of the dependent possessive pronouns as modifiers.

2.4 Demonstrative pronouns

Tal has a three-way distinction between demonstrative pronouns, namely proximal (near the speaker), medial (near the addressee) and distal (far from the speaker and addressee), as shown in **Table 5**. The demonstratives are pluralised with the third-person possessive pronoun [mʸá].

	SG		PL		
a.	sɛ̄	'this'	sɛ̄ mʸá	'these'	(near the speaker)
b.	ɲɛ̀ː	'this'	ɲɛ̀ː mʸá	'these'	(near the addressee)
b.	ɲɛ̋ː	'that'	ɲɛ̋ː mʸá	'those'	(far from the speaker and the addressee)

Table 5: Demonstratives in Tal.

The medial and distal demonstratives in the language can occur independently as the subject or object of a verb, but the proximal demonstrative cannot, as shown in (8). Consequently, the medial can also be used to refer to entities between the speaker and the addressee in certain contexts.

(8) Demonstratives in Tal

a. ***sɛ̄*** tʰùːɪ̄ː nī
PROX.DEM kill goat DEF.DET
"this (near the speaker) killed the goat" (*intended meaning*)

b. ***ɲɛ̀ː*** tʰù**ː** **ɪ̄ː** nī
MED.DEM kill goat DEF.DET
"this (near the addressee) killed the goat"

c. ***ɲɛ̋ː*** tʰù**ː** **ɪ̄ː** nī
DIST.DEM kill goat DEF.DET
"that (far from the speaker and addressee) killed the goat"

To understand the distinction between the proximal and medial demonstrative pronouns, we must look at their cooccurrence in a contrastive context.

(9) Comparative use of proximal and medial demonstratives

a. pʰɛ̀tɛ̄j sɛ̄ wàk pʰɛ̀tɛ̀j ɲɛ̋
bed PROX.DEM better bed MED.DEM
'this bed (near the speaker) is better than this bed (near the addressee)'

b. pʰɛ̀tɛ̄j sɛ̄ mʳá wàk pʰɛ̀tɛ̀j ɲɛ̋ mʳá
bed PROX.DEM PL better bed MED.DEM PL
'these beds (near the speaker) are better than these beds (near the addressee)'

As shown in (9), when juxtaposing two entities between the addressee and speaker, the form [sɛ̄] refers to the entity near the speaker and the form [ɲɛ̋] refers to the entity near the addressee. In the next section, we focus on the use of the pronominal forms and nouns as modifiers.

3 Nominal modification

This section describes the modification of nouns with pronouns and nouns in Tal. The discussion will only focus on the demonstrative pronouns, possessive pronouns, and nouns as modifiers. As a point of departure, we start with demonstrative pronouns.

3.1 Demonstrative pronouns as modifiers

The demonstrative pronouns in Tal can modify a noun. In this case, the demonstrative pronouns immediately follow the nouns being modified, and the modified nouns undergo a tonal alternation, depending on the type of demonstrative modifier and the tone of the nouns in isolation.

(10) H-tone nouns

N	N distal	N medial	N proximal	
lú	lù ɲɛ̋	lù ɲɛ̀ː	lú sɛ̄	'house'
bí	bì ɲɛ̋	bì ɲɛ̀ː	bí sɛ̄	'something'
áj	àj ɲɛ̋	àj ɲɛ̀ː	áj sɛ̄	'fatness'
páŋ	pàŋ ɲɛ̋	pàŋ ɲɛ̀ː	páŋ sɛ̄	'stone'
zɔ́k	zɔ̀k ɲɛ̋	zɔ̀k ɲɛ̀ː	zɔ́k sɛ̄	'hill'
fɔ́ːk	fɔ̀ːk ɲɛ̋	fɔ̀ːk ɲɛ̀ː	fɔ́ːk sɛ̄	'bushy area'
ʔʲáːn	ʔʲàːn ɲɛ̋	ʔʲàːn ɲɛ̀ː	ʔʲáːn sɛ̄	'sclera'
tíː	tìː ɲɛ̋	tìː ɲɛ̀ː	tíː sɛ̄	'sand type'
lɛ́ː	lɛ̀ː ɲɛ̋	lɛ̀ː ɲɛ̀ː	lɛ́ː sɛ̄	'load'
dídí	dìdì ɲɛ̋	dìdì ɲɛ̀ː	dídí sɛ̄	'sweat fly'
ƙʷáják	ƙʷàjàk ɲɛ̋	ƙʷàjàk ɲɛ̀ː	ƙʷáják sɛ̄	'twisting'

(11) M-tone nouns

N	N distal	N medial	N proximal	
ɗā	ɗà ɲɛ́ː	ɗà ɲèː	ɗā sɛ̄	‘calabash’
ūs	ùs ɲɛ́ː	ùs ɲèː	ūs sɛ̄	‘fire’
ās	às ɲɛ́ː	às ɲèː	ās sɛ̄	‘dog’
bāŋ	bàŋ ɲɛ́ː	bàŋ ɲèː	bāŋ sɛ̄	‘drum’
fʰīn	fʰìn ɲɛ́ː	fʰìn ɲèː	fʰīn sɛ̄	‘flour’
zʷāːl	zʷàːl ɲɛ́ː	zʷàːl ɲèː	zʷāèːl sɛ̄	‘needle’
fiːt	fiːt ɲɛ́ː	fiːt ɲèː	fiːt sɛ̄	‘whistling’
pʰɛ̄ː	pʰɛ̀ː ɲɛ́ː	pʰɛ̀ː ɲèː	pʰɛ̄ː sɛ̄	‘place’
māː	màː ɲɛ́ː	màː ɲèː	mā sɛ̄	‘mother’
kālāp	ƙàlàp ɲɛ́ː	ƙàlàp ɲèː	ƙālāp sɛ̄	‘something used for sharing’
bɔ̄lɔ̄ŋ	bɔ̀lɔ̀ŋ ɲɛ́ː	bɔ̀lɔ̀ŋ ɲèː	bɔ̄lɔ̄ŋ sɛ̄	‘internal organ’

(12) L-tone nouns

N	N distal	N medial	N proximal	
èn	èn ɲɛ́ː	èn ɲèː	ēn sɛ̄	‘heart’
ès	ès ɲɛ́ː	ès ɲèː	ēs sɛ̄	‘faeces’
pʰàŋ	pʰàŋ ɲɛ́ː	pʰàŋ ɲèː	pʰāŋ sɛ̄	‘fence stone’
pʰɛ̀l	pʰɛ̀l ɲɛ́ː	pʰɛ̀l ɲèː	pʰɛ̄l sɛ̄	‘flower’
vèːl	vèːl ɲɛ́ː	vèːl ɲèː	vɛ̄ːl sɛ̄	‘bone marrow’
sʷɛ̀ːp	sʷɛ̀ːp ɲɛ́ː	sʷɛ̀ːp ɲèː	sʷɛ̄ːp sɛ̄	‘hair’
ɯà:	ɯà: ɲɛ́ː	ɯà: ɲèː	ɯā: sɛ̄	‘grains’
gù:	gù: ɲɛ́ː	gù: ɲèː	gū: sɛ̄	‘cactus’
pʰɛ̀tɛ̀j	pʰɛ̀tɛ̀j ɲɛ́ː	pʰɛ̀tɛ̀j ɲèː	pʰɛ̀tɛ̄j sɛ̄	‘bed’
kàsɛ̀ŋ	kàsɛ̀ŋ ɲɛ́ː	kàsɛ̀ŋ ɲèː	kàsɛ̄ŋ sɛ̄	‘beer filter’

As shown in (10–12), nouns that are modified with the distal [ɲɛ́ː] or medial [ɲèː] demonstratives consistently bear an L tone on every TBU regardless of their tones in isolation. The modification of a noun with the proximal demonstrative pronoun [sɛ̄] only results in a tonal alternation when the final tone of the noun is L. As shown in (12), the final L tone of a noun surfaces as M when the noun is modified with the proximal demonstrative pronoun [sɛ̄]. This is the case regardless of the syllable, tonal combinations or tone-type, as exemplified in (13–15).

(13) Bisyllabic nouns with dissimilar tones

	N	N distal	N medial	N proximal	
H-M	ʒáŋlīp	ʒàŋlìp ɲɛ́ː	ʒàŋlìp ɲèː	ʒáŋlīp sɛ̄	‘spirogyra’
	ƙádāːl	ƙàdàːl ɲɛ́ː	ƙàdàːl ɲèː	ƙádāːl sɛ̄	‘head’
M-H	ƙāmɓél	ƙàmɓèl ɲɛ́ː	ƙàmɓèl ɲèː	ƙāmɓːél sɛ̄	‘tool used for digging’
	gāːlí	gàːlì ɲɛ́ː	gàːlì ɲèː	gāːlí sɛ̄	‘millet sp.’

L-H	ǹdʷáŋ	ǹdʷàŋ ɲɛ̋	ǹdʷàŋ ɲɛ̀ː	ǹdʷáŋ sɛ̄	‘meningitis’
	ɠàǩíː	ɠàǩìː ɲɛ̋	ɠàǩìː ɲɛ̀ː	ɠàǩíː sɛ̄	‘sacrifice’
L-M	tìzɛ̄ːl	tìzɛ̀ːl ɲɛ̋	tìzɛ̀ːl ɲɛ̀ː	tìzɛ̄ːl sɛ̄	‘sperm’
	ɠàkɔ̄ŋ	ɠàkɔ̀ŋ ɲɛ̋	ɠàkɔ̀ŋ ɲɛ̀ː	ɠàkɔ̄ŋ sɛ̄	‘river area’
M-L	ɓāgàj	ɓàgàj ɲɛ̋	ɓàgàj ɲɛ̀ː	ɓāgāj sɛ̄	‘stone cave’
	vɛ̄ːkùː	vɛ̀ːkùː ɲɛ̋	vɛ̀ːkùː ɲɛ̀ː	vɛ̄ːkūː sɛ̄	‘clarinet’

(14) Trisyllabic nouns with dissimilar tones

	N	N distal	N medial	N proximal	
L-H-L	àsǩúwɛ̀t	àsǩùwɛ̀t ɲɛ̋	àsǩùwɛ̀t ɲɛ̀ː	àsǩúwɛ̄t sɛ̄	‘type of dance’
M-H-H	tʰāŋdáján	tʰàŋdàjàŋ ɲɛ̋	tʰàŋdàjàŋ ɲɛ̀ː	tʰāŋdáján sɛ̄	‘type of raft’
H-L-M	pélɛ̀mpʰɛ̄	pɛ̀lɛ̀mpʰɛ̀ ɲɛ̋	pɛ̀lɛ̀mpʰɛ̀ ɲɛ̀ː	pélɛ̀mpʰɛ̄ sɛ̄	‘dragonfly’
	ǩálàʔās	ǩàlàʔàs ɲɛ̋	ǩàlàʔàs ɲɛ̀ː	ǩálàʔās sɛ̄	‘herb sp.’
L-H-H	ǩɨ̀nkʷálák	ǩɨ̀nkʷàlàk ɲɛ̋	ǩɨ̀nkʷàlàk ɲɛ̀ː	ǩɨ̀nkʷálák sɛ̄	‘pot cover’
	nàŋʒílíŋ	nàŋʒìlìŋ ɲɛ̋	nàŋʒìlìŋ ɲɛ̀ː	nàŋʒílíŋ sɛ̄	‘sunbird’
L-M-M	ǩàskɛ̄lɛ̄m	ǩàskɛ̀lɛ̀m ɲɛ̋	ǩàskɛ̀lɛ̀m ɲɛ̀ː	ǩàskɛ̄lɛ̄m sɛ̄	‘herb sp.’
L-H-L-M	àlmákàʃī	àlmàkàʃì ɲɛ̋	àlmàkàʃì ɲɛ̀ː	àlmákàʃī sɛ̄	‘scissors’

The only contrastive contour tone in the language is HR. The contour tone, like all the level tones, is consistently lowered when a noun is modified with the medial or distal demonstrative but invariant in the environment of the proximal demonstrative, as shown in (15).

(15) Nouns with contour tones

	N	N distal	N medial	N proximal	
HR	tʰa̋l	tʰàl ɲɛ̋	tʰàl ɲɛ̀ː	tʰa̋l sɛ̄	‘Tal person’
	kʰṵ́m	kʰùm ɲɛ̋	kʰùm ɲɛ̀ː	kʰṵ́m sɛ̄	‘spirit’
HR	ʒɛ́lɓáŋ	ʒɛ̀lɓàŋ ɲɛ̋	ʒɛ̀lɓ àŋ ɲɛ̀ː	ʒɛ́lɓáŋ sɛ̄	‘red bean’
HR-H	kʰa̋psáŋ	kʰàpsàŋ ɲɛ̋	kʰàpsàŋ ɲɛ̀ː	kʰa̋psáŋ sɛ̄	‘hut’
L-HR	ɠàdắm	ɠàdàm ɲɛ̋	ɠàdàm ɲɛ̀ː	ɠàdắm sɛ̄	‘place for drying millet’

As mentioned earlier, the tonal alternations are not limited to nominal modification with the demonstrative pronouns. In the next section, we turn to nominal modification with possessive pronouns.

3.2 Possessive pronouns as modifiers

The nouns in Tal can also be modified with the possessive pronouns. Like the demonstrative modifiers, the nouns that are modified with the possessive pronouns also undergo tonal alternation.

(16) First person possessive pronouns

	N	N my	N our	Gloss
L-L	pʰɛ̀tɛ̀j	pʰɛ̀tɛ̄j nā	pʰɛ̀tɛ̄j nū	‘bed’
	kàsɛ̀ŋ	kàsɛ̄ŋ nā	kàsɛ̄ŋ nū	‘beer filter’
H-H	dídí	dídí ná	dídí nú	‘sweat fly’
	méréŋ	méréŋ ná	méréŋ nú	‘being sour’
M-M	ƙālāp	ƙālāp nā	ƙālāp nū	‘som. used for sharing’
	ɓɔ̄lɔ̄ŋ	ɓɔ̄lɔ̄ŋ nā	ɓɔ̄lɔ̄ŋ nū	‘internal organ’
L-H	dàgú	dàgú ná	dàgú nú	‘he-goat’
	tʰàƙɔ́:p	tʰàƙɔ́:p ná	tʰàƙɔ́:p nú	‘dry okra’
M-H	tɔ̄nín	tɔ̄nín ná	tɔ̄nín nú	‘baobab’
	jāŋlɛ́:t	jāŋlɛ́:t ná	jāŋlɛ́:t nú	‘terrace’
M-L	bāgàj	bāgāj nā	bāgāj nū	‘cave between stones’
	vɛ̄:kù:	vɛ̄:kū: nā	vɛ̄:kū nū	‘clarinet’
L-H-L	àsƙúwɛ̀t	àsƙúwɛ̄t nā	àsƙúwɛ̄t nū	‘type of dance’
HR	kʰű́m	kʰű́m ná	kʰű́m nú	‘spirit’
	jɔ̋ŋ	jɔ̋ŋ ná	jɔ̋ŋ nú	‘invitation’

(17) Second person possessive pronouns

	N	N your(m)	N your(f)	N your(pl)	Gloss
L-L	pʰɛ̀tɛ̀j	pʰɛ̀tɛ̄j gā	pʰɛ̀tɛ̄j gī	pʰɛ̀tɛ̄j gū	‘bed’
	kàsɛ̀ŋ	kàsɛ̄ŋ gā	kàsɛ̄ŋ gī	kàsɛ̄ŋ gū	‘beer filter’
H-H	dídí	dídí gá	dídí gí	dídí gú	‘sweat fly’
	súmá:	súmá: gá	súmá: gí	súmá: gú	‘fainting’
M-M	ƙālāp	ƙālāp gā	ƙālāp gī	ƙālāp gū	‘som. used for sharing’
	ɓɔ̄lɔ̄ŋ	ɓɔ̄lɔ̄ŋ gā	ɓɔ̄lɔ̄ŋ gī	ɓɔ̄lɔ̄ŋ gū	‘internal organ’
M-H	gā:lí:	gā:lí: gá	gā:lí: gí	gā:lí: gú	‘millet specie’
	ƒāŋƙúm	ƒāŋƙúm gá	ƒāŋƙúm gí	ƒāŋƙúm gú	‘navel’
L-H	tʰì̀sí̀j	tʰì̀sí̀j gá	tʰì̀sí̀j gí	tʰì̀sí̀j gú	‘bed bug’
	tʰì̀vúk	tʰì̀vúk gá	tʰì̀vúk gí	tʰì̀vúk gú	‘foam’
M-L	bāgàj	bāgāj gā	bāgāj gī	bāgāj gū	‘cave between stones’
	vɛ̄:kù	vɛ̄:kū gā	vɛ̄:kū gī	vɛ̄:kū gū	‘clarinet’
L-H-L	àsƙúwɛ̀t	àsƙúwɛ̄t gā	àsƙúwɛ̄t gī	àsƙúwɛ̄t gū	‘type of dance’
HR	kʰű́m	kʰű́m gá	kʰű́m gí	kʰű́m gú	‘spirit’

As shown in (16), the final L tone of the nouns surfaces as M when they are modified by a first- or second-person possessive pronoun. However, non-final L tones or any other tones are invariant under the same condition. In this sense, the first- and second person possessive pronouns are

similar to the proximal demonstrative. The examples also show that the first- and second-person possessive pronouns bear the same tone as the preceding modified noun.

The modified nouns bear an L tone on all their TBUs when the modifier is a third-person possessive pronoun, as illustrated in (18). The tone lowering of nouns modified with third-person possessive pronouns is similar to that of the distal demonstrative (see §3.1).

(18) Third-person possessive pronouns

	N	N his/her	N their	Gloss
L-L	pʰɛ̀tɛ̀j	pʰɛ̀tɛ̀j mīːp	pʰɛ̀tɛ̀j mʸá	‘bed’
	kàsɛ̀ŋ	kàsɛ̀ŋ mīːp	kàsɛ̀ŋ mʸá	‘beer filter’
H-H	dídí	dìdì mīːp	dìdì mʸá	‘sweat fly’
	wúrúŋ	wùrùŋ mīːp	wùrùŋ mʸá	‘speeding up’
M-M	kālāp	kàlàp mīːp	kàlàp mʸá	‘som. used for sharing’
	ɓōlōŋ	ɓɔ̀lɔ̀ŋ mīːp	ɓɔ̀lɔ̀ŋ mʸá	‘internal organ’
L-H	tʰìvúk	tʰìvùk mīːp	tʰìvùk mʸá	‘foam’
	tʰʰɨ̀sɨ̀j	tʰɨ̀sɨ̀j mīːp	tʰɨ̀sɨ̀j mʸá	‘bed bug’
M-H	ƙōmtíŋ	ƙɔ̀mtɨ̀ŋ mīːp	ƙɔ̀mbɨ̀l mʸá	‘masquerade type’
	gāːlíː	gàːlìː mīːp	gàːlìː mʸá	‘millet specie’
M-L	bāgàj	bàgàj mīːp	bàgàj mʸá	‘cave between stones’
	vēːkù	vɛ̀ːkù mīːp	vɛ̀ːkù mʸá	‘clarinet’
L-H-L	àsƙúwɛ̀t	àsƙùwɛ̀t mīːp	àsƙùwɛ̀t mʸá	‘type of dance’
HR	ɓǎmlàŋ	ɓàmlàŋ mīːp	ɓàmlàŋ mʸá	‘bird sp.’
	jɔ̃ŋ	jɔ̀ŋ mīːp	jɔ̀ŋ mʸá	‘invitation’

The tonal alternation in nominal modification is not limited to the usage of possessive and demonstrative pronouns as modifiers but also includes associative construction. In the next section, we focus on the associative constructions.

3.3 Nouns as modifiers in associative construction

The associative construction in Tal structurally contains two nouns. The first noun (N_1) is the possessum, and the second noun (N_2) is the possessor. Just like the nouns with pronominal modifiers, the possessum undergoes a tonal alternation. The examples in (19) illustrate the tonal alternation.

(19) Associative constructions

	N_1	N_2 →	N_1 N_2	‘N_1 of N_2’
L-L	pʰɛ̀tɛ̀j	tɨ̀sɨ́j	pʰɛ̀tɛ̀j tɨ̀sɨ́j	‘bed of bed bug’
	ɨ̀jɨ̀m	dídí	ɨ̀jɨ̀m dídí	‘beans of sweat fly’
H-H	dídí	ƙàkíː	dìdì ƙàkíː	‘sweat fly of sacrifice’
	ƙʷájàk	gʷīm	ƙʷàjàk gʷīm	“twisting of man’

M-M	ƙālāp	tìvúk	ƙàlàp tìvúk	‘something for sharing of foam’
	ɓɔ̄lɔ̄ŋ	gʷīm	ɓɔ̀lɔ̀ŋ gʷīm	‘internal organ of man’
L-H	tìvúk	gʷīm	tìvùk gʷīm	‘foam of man’
	tɨ̀sɨ́j	tɔ̄nín	tɨ̀sɨ̀j tɔ̄nín	‘bed bug of baobab’
M-L	ɓāgàj	ƙɔ̄mtɨ́ŋ	ɓàgàj ƙɔ̄mtɨ́ŋ	‘cave stones of masquerade type’
	vɛ̄:kù	gʷīm	vɛ̀:kù gʷīm	‘clarinet of man’
L-H-L	àsƙúwɛ̀t	gʷīm	àsƙùwɛ̀t gʷīm	‘dance-type of man’
M-H	dāŋɓáŋ	gʷīm	dàŋɓàŋ gʷīm	‘animal sp. of man’

The nouns surface with an L tone on all their TBUs when they occur as the possessum, regardless of their tones in isolation. In the next section, we present the descriptive generalisations of all the nominal modification.

3.4 Descriptive generalisations

Based on the description above, the following generalisations can be made about the modification of nouns with the (pro)nominals in Tal: (i) nouns bear an L tone on all their TBUs when they are the possessum in an associative construction or modified by a medial demonstrative pronoun, a distal demonstrative pronoun or a third-person possessive pronoun, and (ii) the final L tone of a noun surfaces as M when the noun is modified by a proximal demonstrative pronoun, a first-person possessive pronoun or a second-person possessive pronoun. In **Table 6**, we schematically present the generalisations.

	M tone on the final TBU	**L tone on all TBUs**
POSSESSIVE PRONOUNS	first and second person	third person
DEMONSTRATIVE PRONOUNS	proximal	distal and medial
ASSOCIATIVE CONSTRUCTIONS		possessum (N_1)

Table 6: Schematic representation of the generalisations.

In the next section, we account for the source of the tonal overwrite, the features of the overwriting tones and the realisation of the overwriting tones. Our account of the tonal overwrite will mostly draw insights from similar constructions in other Chadic languages.

4 Analysis and discussion

4.1 Tonal overwrite as effects of deictic linkers

This section focuses on the source of the tonal overwrites in the modification of nouns with possessive pronouns, demonstrative pronouns, and the possessor in an associative construction.

To account for the tonal overwrites, we must refer to similar constructions in other West Chadic languages, as schematically represented in (20). In many Chadic languages, when a noun is modified by a pronominal or nominal modifier, a linker occurs between the noun and its modifier (e.g., Hoskison 1983 on Gude, Viljoen 1983 on Buwal, Cosper & Gital 2004 on Zul, Zimmermann 2008 on Hausa, and Shay 2021 on Giziga). In some Chadic languages, the linker is a floating tone which overwrites the inherent tone of the modified noun (e.g., Hellwig 2011 on Goemai and Fwangwar 2018 on Mwaghavul).

(20) Noun and (pro)nominal modifiers in West Chadic languages
N_1 Linker N_2

Based on insight from other Chadic languages, we assume that the source of the tonal alternation on Tal nouns with (pro)nominal modifiers is a linker. To distinguish between M- and L-tone overwrites, we start with the usage of the demonstrative pronouns as modifiers. Given that the modified nouns bear different tones depending on whether the modifier is a proximal or non-proximal demonstrative pronoun, we assume that Tal has two classes of linkers, namely proximal and non-proximal linkers. In this case, the choice of linker is determined by the deictic property of the nominal modifier. Following the account of spatial deixis by Fillmore (1982), we assume that the proximal and non-proximal linkers have the semantic features [+Proximal] and [–Proximal] respectively. The account of the demonstrative pronouns can be extended to the possessive pronouns and nouns, given that they trigger the same tonal overwrites on their modified nouns. This means that the first- and second-person possessive pronouns have proximal deictic properties and that the third-person possessive pronouns and nouns have non-proximal deictic properties, as presented in **Table 7**. Deixis, as a property of pronouns and nouns, is not unique to Tal but found across languages (Fillmore 1971; Levinson 2008; Ekasriadi et al. 2021).

	[+Proximal]	**[–Proximal]**
POSSESSIVE PRONOUNS	first and second person	third person
DEMONSTRATIVE PRONOUNS	proximal	distal and medial
ASSOCIATIVE CONSTRUCTIONS		possessum (i.e., noun)

Table 7: Deictic properties of (pro)nominal modifiers.

The deictic classification of the demonstrative pronouns is fairly intuitive. To support our deictic categorisation of the possessive pronouns and nouns, we refer to the deictic classification of personal pronouns and nouns crosslinguistically. Studies suggest that the distinction between the deictic roles of English personal pronouns are drawn between “primary participants”, in this case the speaker and addressee, and “others” (Lyons 1977; Thrane 1980). Consequently, our classification of first- and second-person possessive pronouns in Tal as proximal, and the third-person possessive pronoun as non-proximal is similar to the classification of English personal

pronouns. If we take into account that nouns usually have third-persons as their anaphora in many languages (Mohanan 1981; Wiese 1983; Reinhart 2016), the morphophonemic grouping of nouns and third-person pronouns as non-proximal in Tal is a crosslinguistic feature. Another argument in support of our classification of the nominal modifiers in Tal as non-proximal comes from Pomo (Pomoan, Northern California USA). In Pomo, the nouns generally refer to entities outside "focal consciousness", just like third-person pronouns and distal demonstrative pronouns (Mithun 1990). Similar to Pomo, the impersonal pronouns in other Chadic languages, which mostly emerge from nouns, refer to entities outside the focal consciousness of the speaker (Buba 1997; Pawlak 2009). Considering that the deictic usage of pronouns and nouns is context-dependent in most languages, a unique property of proximal and non-proximal forms in Tal is that they are morphophonologically marked.

Based on the distributions of the deictic linkers in Tal, the speaker is considered the deictic centre of the demonstrative pronouns, but for the possessive pronouns and nouns, the speaker and addressee are the deictic centre. This deictic classification in Tal is comparable to languages like English (Lyons 1977) and Karbi (Konnerth 2014; 2015).

We now turn to the phonological exponents of the proximal and non-proximal linkers. As shown earlier, the tonal alternation on nouns with proximal modifiers only involves realising the final L tone of the modified nouns as M. In other words, the final TBUs of nouns with proximal modifiers bear an M, H or HR tone. To capture that the final TBUs of nouns with proximal modifiers bear either of these tones, the phonological exponent of the [+Proximal] linker is considered the tone feature [+Raised]. Thus, the final L tone of a noun with a proximal modifier surfacing as M is as a result of overwriting the [–Raised] feature of a lexical L tone with the [+Raised] exponent of the proximal linker. We assume that the [+Raised] exponent of the proximal linker also overwrites the [+Raised] feature of the root-final lexical M, H and HR tones, but the overwrite is not auditorily apparent. Given that nouns with non-proximal modifiers bear an L tone on all their TBUs, the phonological exponent of the [–Proximal] linker is considered the tone features [–Upper, –Raised]. The phonological exponent of the non-proximal linker could have been analysed as the primitive L tone, but we consider it to be tone features in order to unify it with the exponent of the proximal linker. In (21), we present the deictic linkers and their exponents. As we will see in §4.3, the sound-meaning association of the deictic linkers is also in line with crosslinguistic patterns of deictic iconicity.

(21) Linkers as featural affixes in Tal

a. –Proximal: $[\text{–Upper, –Raised}]_{[\text{–Prox}]}$

b. +Proximal: $[\text{+Raised}]_{[\text{+Prox}]}$

Figure 3 shows the pitch contours of monosyllabic words with their tones in isolation and with the tonal overwrite of the [–Proximal] and [+Proximal] linkers. The F0(Hz) height of the lexical tones, namely H, L, M, and HR, are distinct in isolation. In the [+Proximal] position, the lexical

L and M tones are raised such that they are close to the F0(Hz) height of the lexical H tone in both speech and humming modes. The F0(Hz) heights of the lexical H and HR are also raised in the [+Proximal] position for the speech mode but slightly for the humming mode. In the [–Proximal] position, the F0(Hz) heights of the lexical H and HR tones are as low as the F0(Hz) height of the lexical M tone. The lexical L and M tones have nearly identical F0(Hz) height in the [–Proximal] position. The results are in line with our account that the [+Raised] exponent of the [+Proximal] linker overwrites the lexical tones in all cases, contrary to the auditory impression that the lexical M, H and HR tones are invariant.

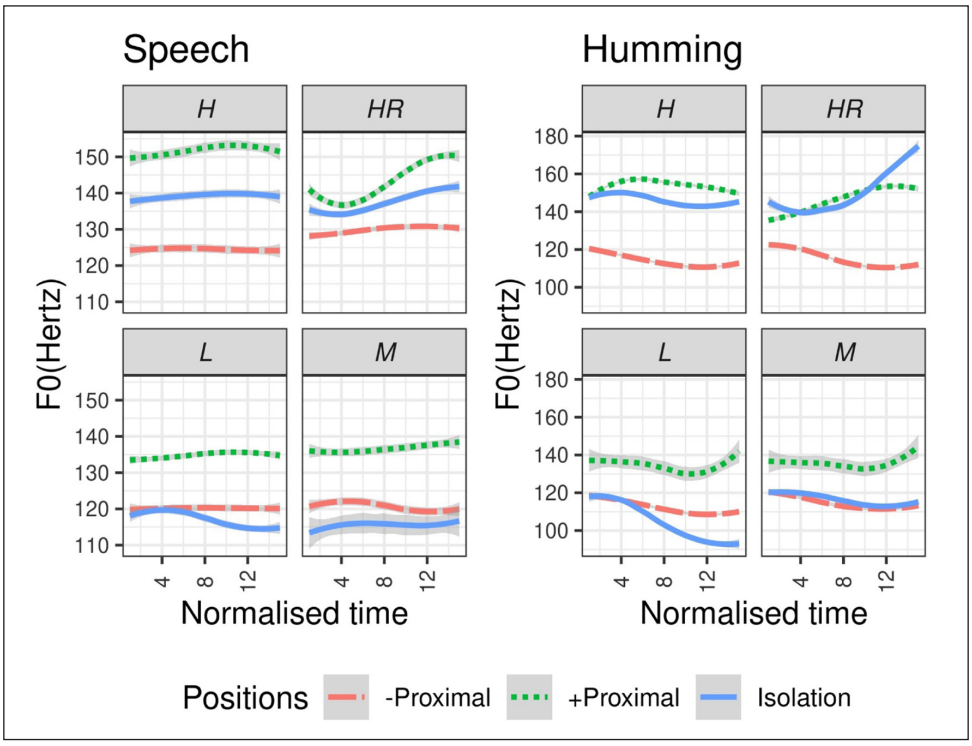


Figure 3: F0 plot of lexical tones and their realisation in nominal modification.

To investigate whether the differences are significant, we extracted F0(Hz) values at 25%, 50% and 75% intervals for each of the tones in isolation, and in both [+Proximal] and [–Proximal] positions. Using the lme4 package (Bates et al. 2015) in R (Team 2023), the F0(Hz) values at the three intervals were fitted to a linear mixed effect model as the dependent variable. The fixed effects were the positions (isolation, [+Proximal] and [–Proximal]) with the isolation as the intercept and the word-types as the random effect. The results show that the [+Proximal] and [–Proximal] positions have a statistically significant effect ($p < 0.05$) on the F0(Hz) height at a minimum of two intervals for the H, L, M and HR tones. See the appendix for the results and the supplementary material for the R code. In the next section, we formally account for the

phonological realisation of the deictic linkers which have the tone features [–Upper, –Raised] $_{[-\text{Prox}]}$ and [+ Raised]$_{[+\text{Prox}]}$ as their exponents respectively.

4.2 Realisation of the featural affixes

The discussion in the previous subsection indicates that the proximal and non-proximal linkers are featural affixes (Akinlabi 1996). As featural affixes, the phonological exponents of the proximal and non-proximal linkers could have been realised on the modifier or the modified noun. The underlying assumption in this work is that the linkers are affixes which take the modified nouns as their morphological stem. In this case, the domain of morphological and phonological realisation coincide. For the realisation of the featural affixes on the stem, there are four possible options: the featural affixes could have been realised on (i) the rightmost TBU of the nominal root, (ii) the leftmost TBU of the nominal root, (iii) the medial TBU of the nominal root or (iv) all the TBUs of the nominal root. The lowering of all TBUs in the context of the non-proximal modifiers indicates that the featural affix of the non-proximal linker prefers option (iv). On the other hand, the proximal feature prefers option (i), given that the tonal alternation in the context of proximal modifiers only targets the rightmost TBU of the modified nouns.

To account for the realisation of the proximal and non-proximal featural affixes, we adopt the morpheme-specific correspondence constraints, as proposed in Finley (2009). These constraints are morpheme-specific versions of Edge-Anchor and Contiguity in McCarthy & Prince (1993; 1995). The constraints require correspondence between features and edges of a relevant domain. The formulation of the constraints in (22) is specific to the [–Upper, –High] features of the non-proximal linker.

(22) Constraints on the [–Upper, –High] features of non-proximal linker

a. L-Anchor-[–Prox]
   The [–Upper, –Raised] features of the non-proximal must be in correspondence with the leftmost TBU of the root.

b. R-Anchor-[–Prox]
   The [–Upper, –High] features of the non-proximal must be in correspondence with the rightmost TBU of the root.

c. O-Contiguity-[–Prox]
   The tone feature of a TBU in correspondence with the featural affix [–Upper, –Raised] must form a contiguous string.

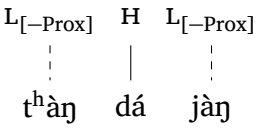
d. Integrity-[–Prox]
   No [–Upper, –High] of the non-proximal linker has multiple correspondents in the output.

The constraint L-Anchor-[–Prox] assigns no violation if the exponent of the non-proximal linker is realised on the leftmost TBU. Similarly, the constraint R-Anchor-[–Prox] also assigns

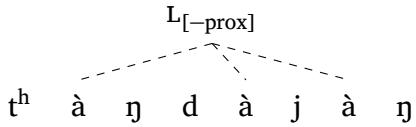
no violation if the exponent of the non-proximal linker is realised on the rightmost TBU. By realising the exponent of the non-proximal linker on both edges of the root, it will automatically be realised on the medial TBU(s) as a result of adjacency and precedence relations (see Archangeli & Pulleyblank 1994; Pulleyblank 1996; Ní Chiosáin & Padgett 2001). In a situation where the exponent of the non-proximal linker is realised but not on the rightmost TBU of the root, the constraint R-Anchor-[–Prox] assigns a violation for each root TBU to the right of the realised exponent. Similarly, if the exponent of the non-proximal linker is realised but not on the leftmost TBU, the constraint L-Anchor-[–Prox] assigns a violation for each root TBU to the left of the realised exponent. As illustrated in (23a), another possible way to satisfy the constraints is to realise one copy of the exponent on the leftmost TBU and another copy on the rightmost TBU. This solution can result in the violation of the constraint Integrity-[–Prox], which prohibits the exponent of the non-proximal linker from having multiple correspondents in the output. L-Anchor-[–Prox] and R-Anchor-[–Prox] assign violation for each TBU of the stem if the exponent of the non-proximal linker is not realised in the output.

(23) / tʰāŋdáján + [–Upper, –Raised]$_{[-Prox]}$ /... → [tʰàŋdàjàŋ] 'type of raft'

a.* [tʰāŋdáján]



b. [tʰàŋdàjàŋ]



Under the account of morphemic harmony in Finley (2009), the realisation of the featural affix on the medial TBU will be considered an effect of the constraint O-Contiguity-[–Prox], which prohibits a gapped representation. Considering that a gapped representation can create a phonetically inviable structure with contradictory precedence relations (see Pulleyblank 1996; Ní Chiosáin & Padgett 2001), Akinbo (2021a) suggests the replacement of Contiguity with Integrity for morphemic harmony. Following Akinbo (2021a), we replace the constraint O-Contiguity-[–Prox] with the morpheme-specific version of the constraint Integrity, as in (22d).

(24) *Float-T

No floating tone features

Realising the featural affix can result in deleting or floating the lexical-tone features of the nominal root. For analytical reasons, we assume that the features of the lexical tones float. The

floating tone features will violate the constraint *FLOAT-T, which prohibits floating tone features (Pulleyblank 1997; Zoll 2003). For the constraint *FLOAT-T, one violation is assigned to all the floating features in each tone.

We can account for the realisation of the non-proximal morphemic feature on all TBUs by ranking the constraints L-ANCHOR-[–PROX], R-ANCHOR-[–PROX] and INTEGRITY-[–PROX] above the constraint *FLOAT-T. The account is illustrated in (25). The lexical tone and the exponent of the non-proximal linker are indicated with numeral indexation. Featural affixation is indicated by parentheses, comparable to an autosegmental association line.

(25) Non-proximal linker

	$à_1sǩú_2wɛ̀_3t$ + $[-\text{UPPER}, -\text{RAISED}]_{[-\text{PROX}]4}$	L-ANCH-[–PR]	R-ANCH-[–PR]	INTEG-[–PR]	*FLOAT-T
a.	$(à)_1(sǩú)_2(wɛ̀)_3t$	*!**	*!**		*
b.	$(à)_1(sǩú)_2(wɛ̀)_4t$	*!*			*
c.	$(àsǩù)_4(wɛ̀)_3t$		*!		**
d.	$(à)_4(sǩú)_2(wɛ̀)_4t$			*!	**
e. ☞	$(àsǩùwɛ̀)_4t$				***
f.	$(à)_1(sǩù)_4(wɛ̀)_3t$	*!	*!		*

For not realising the exponent of the non-proximal linker on the rightmost or leftmost edge of the root, the candidates in (25a-c,f) are ruled out. For having multiple correspondents of the phonetic exponent, the candidate in (25d) is ruled out. The candidate in (25e) wins for spreading the exponent of the non-proximal linker to all root TBUs. The candidate in (25f) and the optimal candidate are similar in terms of their surface tones, but the featural correspondence constraints are able to distinguish lexical and grammatical tones.

We now turn to the phonological realisation of the proximal linker. We assume that the proximal instantiation of the anchor constraints in (22) exists in the system. That the exponent of the proximal linker is only realised on the rightmost TBU of the nominal root is a kind of asymmetry between the exponent of the proximal and non-proximal linkers. We can account for the asymmetry with the proximal-specific instantiation of the constraints. In this case, all the proximal-specific instantiation of the constraints, except the constraint L-ANCHOR-[+PROX], have to be ranked above *FLOAT-T. With the ranking, as shown in (26), we can account for the phonological realisation of the proximal feature.

(26) Proximal linker

	à$_1$sḱú$_2$wɛ̀$_3$t + [+Raised]$_{[+PROX]4}$	R-ANCH-[+PR]	INTEG-[+PR]	*FLOAT-T	L-ANCH-[+PR]
a.	(à)$_1$(sḱú)$_2$(wɛ̀)$_3$t	*!**		*	***
b. ☞	(à)$_1$(sḱú)$_2$(wɛ̄)$_4$t			*	**
c.	(ā)$_4$(sḱú)$_2$(wɛ̀)$_3$t	*!*		*	
d.	(ā)$_4$(sḱú)$_2$(wɛ̄)$_4$t		*!	**	
e.	(āsḱūwɛ̄)$_4$t			**!*	
f.	(à)$_1$(sḱū)$_4$(wɛ̀)$_3$t	*!		*	*

We have shown that the phonological realisation of the proximal and non-proximal feature involves morphemic-featural correspondence constraints. While the realisation of the non-proximal features involves maximal extension, the phonological feature of the proximal linker is only realised on the rightmost TBU.

Realising the exponent of the proximal linker on the rightmost TBU of the word can be perceptually motivated, considering that contour tones across languages are often restricted to perceptually prominent positions, such as the initial and final TBU of a domain (Yip 1989; Zoll 1996; Gordon 2001). In the same way, the contour tone in Tal, as shown in **Table 6**, is restricted to word-initial position. Thus, realising the exponent of the proximal linker on the rightmost TBU of the nouns with at least two syllables can also be considered a strategy for preserving the lexical tone of the perceptually prominent position (i.e., the word-initial position). Under this account, the exponent of the proximal linker could have associated with all the TBUs, excluding the leftmost one. The realisation of the proximal feature suggests that there is an additional motivation in the language, beyond preserving the lexical tone of the perceptually prominent position. Our account is that the local and long-distance realisations of the proximal and non-proximal features, respectively, are also motivated by iconicity, which is form-meaning resemblance. To this end, we examine the form-meaning association of the deictic linkers in the next section.

4.3 Iconic status of the deictic linkers

The traditional view in modern linguistics is that form-meaning mapping in grammar is completely arbitrary (Hockett 1960; de Saussure 1974), but this view is giving way for the emerging view that both arbitrariness and iconicity play crucial roles in grammar (Lockwood & Dingemanse 2015; Dingemanse 2018). Iconic sound-meaning mapping covers various semantic categories and

there is compelling evidence from distance-related words (Nichols 1971; Ultan 1978; Johansson & Zlatev 2013; Haynie et al. 2014; Wikström et al. 2023). The crosslinguistic pattern of distance-related iconicity involves associating front vowels with proximal deixes and back vowels with non-proximal deixes (Tanz 1971; Ultan 1978; Woodworth 1991; Traunmüller 1994; Johansson & Zlatev 2013; Joo et al. 2022). This pattern of distance iconicity is not limited to vowels but also includes consonants. For instance, a survey of 120 Australian languages shows that palatal and velar consonants tend to be associated with near and far words respectively (Haynie et al. 2014). However, the iconic association of distance-related words with morphophonological alternations and tone patterns is underdocumented. To this end, it is important to ask whether the exponents of the proximal and non-proximal linkers in Tal are consistent with crosslinguistic patterns of distance iconicity.

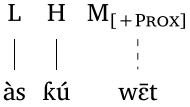
To establish whether the sound-meaning association of the deictic linkers in Tal is a kind of iconicity, we must refer to the phonetic basis of deixis-specific iconicity. Articulatory and acoustic explanations have been put forward for iconically associating front vowels (and analogously front consonants) with low magnitude and back vowels (and analogously back consonants) with high magnitude across languages. On the articulatory end, the prediction is that the magnitude of a referent directly correlates with the felt and seen degree of articulatory aperture in the segment's production (Sapir 1929; Johansson & Zlatev 2013; Kawahara 2021). To investigate the acoustic cues that underlie magnitude iconicity, Knoeferle et al. (2017) conducted acoustic and perceptual experiments. The results of their experiments indicate that the magnitude of a referent positively correlates with the values of first formant (F1) and intensity but negatively correlates with fundamental frequency (F0) and second formant (F2): (i) high F1 (Hz) and low intensity (dB) tend to be associated with low magnitude and vice versa; (ii) low F2 (Hz) and F0 (Hz) tend to be associated with high magnitude and vice versa.

The articulatory hypothesis cannot explain the form-meaning association of the deictic linkers in Tal, given that the exponents of the deictic linkers in the language are tonal not segmental. More so, there is no evidence to suggest that the everyday user of a language is aware of the biomechanics involved in tone production. However, the prediction of the acoustic explanation holds, considering that tone lowering is associated with the non-proximal linker and tone raising with the proximal linker. Consequently, the form-meaning association of the proximal and non-proximal linkers in Tal is consistent with crosslinguistic patterns of distance-related iconicity. By this, we mean that the inverse relationship between the size of a vibrating body and its natural acoustic frequency is depicted through the form-meaning association of the deictic linkers. This indicates that the intent to create perceptuomotor analogies drives the iconic form-meaning of the deictic linkers (Dingemanse et al. 2015; Thompson et al. 2021). Ohala (1994) refers to this pattern of perceptuomotor analogies as the frequency code. The form-meaning mapping of the deictic linkers in Tal indicates that distance-related iconicity is not limited to segmental features but includes tone features.

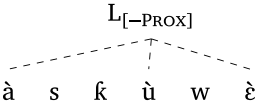
We now turn to the long-distance and local realisations of the non-proximal and proximal features respectively. Spreading the exponent of the non-proximal linker over a long phonological distance and docking the exponent of the proximal linkers on the final TBU seem to depict the deictic properties of the referents (i.e., farness and nearness respectively). As illustrated in (27), the phonological realisation of the proximal and non-proximal features can be considered an iconic grammaticalisation of the deictic gestures, 👇 and 👉 respectively. Similar to the gestures, the locality of the deictic featural affixes in Tal calls attention to the personal and spatial properties of the referents (Hoffmeister 1978; Bangerter & Louwerse 2005; Ciciliani & Wilbur 2006; Tkachman 2022). This indicates that iconicity is not limited to the exponents of morphosyntactic elements but also includes the phonological realisation of such exponents. Associating the exponent of the proximal linker with the leftmost TBU instead of the rightmost one could still have resulted in an iconic mapping. That the exponent of the proximal linker is not linked to the the left edge (the prominent position in Tal) suggests an interplay between iconicity and language-internal condition. The exponents of the deictic linkers and their phonological realisation contribute to the typology of iconicity, considering that these patterns of iconicity are undocumented in spoken language until now.

(27) Iconic realisation of the deictic linkers for [àsƙúwèt] ‘type of dance’

a. Proximal (gestural≡👇)



b. Non-proximal (gestural≡👉)



The deictic linkers in Tal are similar to crosslinguistic patterns of iconicity, which also involve featural affixation. For example, the vowel alternations of Korean (Lee 1992) and Japanese (Hamano 1986) ideophones have been shown to be cases of featural affixation. Just like the iconic tonal alternations in Tal, the featural affixations of Japanese and Korean ideophones have also received theoretical attention (Akinlabi 1996; Chung 2000; Finley 2009). The expression of diminutive and augmentative in Fungwa through root-vowel fronting and backing respectively is another pattern of featural affixation with iconic motivation (Akinbo 2021a; 2023a). Our account of Tal is crucially influenced by that of the root-vowel mutation in Fungwa. Compared to discussions about other levels of grammar, the implications of iconicity for phonological grammar are one of the least explored issues in linguistic theory. In the next section, we explore what the form-meaning mapping of the deictic linkers in Tal means for phonological theories.

4.4 Theoretical implications of deictic linkers in Tal

This section discusses the implications of form-meaning mapping of the deictic linkers in Tal for phonological theory. Ohala (1994) proposes the frequency code hypothesis as the biological motivation for the iconic association of high acoustic frequency with low magnitude referent and vice versa. The frequency code hypothesis is in line with the acoustic principle that there is an inverse relationship between the size of a vibrating body (e.g., vocal cords) and the natural frequency at which the body vibrates (Titze 1989; Lee et al. 1999; Titze 2008). In this case, the association of high pitch with proximal and low pitch with non-proximal relatively evokes the natural acoustic principles. According to Kawahara (2020), this kind of natural connection between form and meaning in iconicity is a naturalness argument for the inclusion of iconicity in phonological theory. This suggests that the form-meaning mapping of the deictic linkers in Tal is phonetically natural.

Evidence for iconicity are mostly from probabilistic tendencies in lexicon across diverse samples of world languages (Hinton et al. 1994; Haynie et al. 2014; Thompson et al. 2021; Winter et al. 2022) and experimental conditions (e.g. Sapir 1929; Ramachandran & Hubbard 2001; Dingemanse et al. 2016; Rabaglia et al. 2016; Laing et al. 2017; Perry et al. 2018; Vainio 2021; Van Hoey et al. 2023). Outside reduplication and repetition (Hurch 2005), iconicity in morphophonological processes is under-represented (Alderete & Kochetov 2017; Akinbo 2021a; b). Being that iconicity has long been considered a peripheral aspect of human language, there is a reason to believe that morphophonological processes motivated by iconicity, such as the crosslinguistic patterns of expressive palatisalisation (Alderete & Kochetov 2017) and the iconic root-vowel mutation in Fungwa (Akinbo 2021a; 2023a), are underdocumented. The form-meaning associations of the proximal and non-proximal linkers in Tal are crucial evidence for iconicity in core grammar, given that the morphophonemic properties of the deictic linkers in Tal are comparable to arbitrary featural affixes (Akinlabi 1996; Ettlinger 2004). For instance, the realisation of the non-proximal linker results in morphemic harmony (Finley 2009). Similar to various patterns of arbitrary and iconic phonological processes (Knoeferle et al. 2017; Hayes 1999; Hayes et al. 2004), the deictic iconicity in Tal is phonetically grounded. Most importantly, we are able to account for the realisation of the morphemic features of the proximal and non-proximal linkers with lexically indexed constraints that have been applied to arbitrary pattern of featural affixation.

We now turn to the issue of phonological asymmetry, which is widely attested in arbitrary phonological patterns. One of the widely attested patterns of phonological asymmetry is the restriction of contour tones to long vowels, word-initial position or word-final position (Gordon 2001; Zoll 2003; Zhang 2004). Similar to contour tones, level tones also show phonological asymmetry. For example, relative to L tone (and M tone, depending on the number of tones in a language), H tone is rarely targeted for deletion and epenthesis (Pulleyblank 1986; 2004;

Zoll 2003) and is often restricted to a specific position in their post-lexical distribution (Meyers 1997; Zoll 2003; Jenks & Rose 2011). Compared to arbitrary phonological patterns, phonological asymmetry is underdocumented in iconicity (Haynie et al. 2014; Akinbo 2021a). One of the few documented cases of phonological asymmetry in iconicity is the fronting and backing of non-high vowels that mark diminutive and augmentative respectively in Fungwa. The iconicity in Fungwa is consistent with crosslinguistic patterns of phonological asymmetry between high and non-high vowels, considering that the root-vowel mutations of the evaluative formation do not target high vowels in most cases (Akinbo 2021a; b; 2023a). The tonal alternation of modified nouns in Tal presents another example of phonological asymmetry in iconicity, given that the [+Raised] exponent of the proximal linker is only realised on the final TBU not all root TBUs like [–Upper, –Raised] exponent of the non-proximal linker.

As shown earlier, the motivation for the phonological asymmetry of the deictic features in Tal is iconicity. However, in phonological theory, perceptual advantage or prominence is traditionally considered the functional source of various phonological asymmetries (Zoll 1996; Beckman 1998; Walker 2001; 2005). As argued in §4.2, the iconic realisation of the proximal feature at the right edge, rather than the left edge, is also a result of preserving the input-output mapping of tone at the perceptually prominent position, which happens to be the left edge in the language. Being limited to perceptual prominence and distinctive identification (Boersma 1998; Frisch 2004), the traditional notion of perceptual motivation in linguistic theory cannot account for phonological asymmetries that are motivated by iconicity. The basis of the iconic phonological asymmetry lies in depiction, which is the perceived or sensory resemblance between a form and its referent (Abell 2009; Hyman 2012; Dingemanse 2015). Crossmodal correspondence or similarity, as a characteristic of depictive representation, also suggests that an intention to create perceptuomotor analogies of language-external experience facilitates iconic form-meaning mapping (Dingemanse et al. 2015; Thompson et al. 2021). If we take into consideration that crossmodal depiction is the basis of iconic patterns, we see that the perceptual motivation for phonological patterns is not limited to phonetic prominence and distinctive identification but includes crossmodal perception of sensory imagery. Consequently, the asymmetry in the phonological realisation of the proximal and non-proximal features in Tal is both natural and perceptually motivated. The idea that visual sensory inputs can motivate phonological condition is not new; the visual representation of phonological features in an orthographic system has been shown to influence loanword adaptation (Vendelin & Peperkamp 2006; Detey & Nespoulous 2008; Daland et al. 2015).

Iconicity is crucial to feature theory, given that segments in both arbitrary and iconic sound-meaning mapping have distinctive features as the basis of their representation (Alderete & Kochetov 2017; Kawahara 2020; Akinbo 2021a). In addition to the featural basis of segments in arbitrary phonological patterns, tones can also have features as their basic unit (Yip 1980;

Pulleyblank 1986; Clements et al. 2011; McPherson 2017), but some researchers argue that tones are basic units of phonological representation like features (Hyman 2010; Clements et al. 2011). Evidence for both views about phonological representation of tones exists in arbitrary phonological processes, but such evidence is sparse for iconicity. The [+Raised] feature as the exponent of the proximal linker in Tal is an evidence for tone features in iconicity.

We argue that iconicity does not only operate at the level of features but can also have privative and binary features like arbitrary phonological contrasts (Chomsky & Halle 1968; Clements & Hume 1995). For the present purpose, we only discuss the binary aspect. By grouping some semantic categories found in crosslinguistic patterns of magnitude iconicity into low magnitude *vs.* high magnitude, as in SIZE small *vs*. big (Sapir 1929; Ultan 1978; Shinohara & Kawahara 2010), DISTANCE near *vs*. far (Johansson & Zlatev 2013; Haynie et al. 2014), GENDER female *vs*. male (Pitcher et al. 2013), WEIGHT light *vs*. heavy (Ibarretxe-Antuñano 2017), AGE young *vs*. old (Kawahara et al. 2018), HEIGHT short *vs*. tall (Awoyale 1989; Egbokhare 2001) and COLOR brightness *vs*. darkness (Moos et al. 2014), as in **Table 8**, we present phonological typologies of magnitude iconicity. We do not consider the form-meaning mapping in the table to be an exhaustive list.

	Magnitude Iconicity	
	Low Magnitude	**High Magnitude**
Segmental features	[–Back]	[+Back]
	[+High]	[–High]
	[–Voiced]	[+voiced]
	[–Son]	[+Son]
Tone features	H(/M)	L
	H	L(/M)
	[+Raised]	[–Raised]
	[+Upper]	[–Upper]
Phonological processes	local	long distance

Table 8: Phonological typology of magnitude iconicity.

The morphophonological properties of the deictic featural affixes in Tal do not only challenge the traditional view that form-meaning association in core grammar is completely arbitrary but also presents a grammaticalised evidence for the alternative view that form-meaning mapping involves both arbitrariness and iconicity (Dingemanse et al. 2015; Lockwood & Dingemanse 2015). While various patterns of iconicity are known for being phonologically marked (Nuckolls

1996; Dingemanse 2012; Andrason 2017; Thompson 2018), patterns of iconicity like the proximal and non-proximal linkers in Tal indicate that they are also subject to similar constraints as arbitrary phonological patterns. Phonetic and natural bases of iconicity suggest its communicative potential rests on (relative) vocal imitation (Ohala 1994; Lockwood & Dingemanse 2015). The deictic iconicity in the core grammar of Tal is in line with the hypothesis that imitation is an integral aspect of language faculty (Hauser et al. 2002).

The discussion in §4.3 indicates that the basis of various iconic patterns involves paying attention to the details of a language-external event and linguistically depicting (aspects of) the event in a perceptually similar manner (Dingemanse 2015; Hawkins et al. 2023). The perceptual similarity between the event and phonological element calls attention to the property of the event (Ohala 1994; Dingemanse 2011; Erben Johansson et al. 2020; Thompson & Do 2019). That said, iconic mapping between form and meaning might be conventional and governed by language-internal constraints (Dingemanse et al. 2015; Akinbo 2021a; Thompson et al. 2022). The depictive property of iconicity is in line with the proposal of Emergent Grammar (Hopper 1987; Bybee 2010; Mielke 2008; Archangeli & Pulleyblank 2022; 2017: etc), that grammar emerges from general cognitive properties, such as paying attention to details and similarities. That imitation also facilitates sound-meaning mapping in music is more evidence for language involving general cognitive properties (Patel & Iversen 2003; Mercado III et al. 2014; Akinbo 2023b). For example, Akinbo (2023b) finds that Yorùbá gamers map meaning to videogame music by imitating the pitch contour of music motifs with the tone melody of their verbal interpretations. This suggests that iconicity can provide insight into the longstanding debate about the cognitive basis and relation between language and music (Koelsch et al. 2004; Patel 2008; 2012; Peretz et al. 2015).

5 Summary and conclusion

We have described and analysed the tonal alternation in three patterns of nominal modifications in Tal. Nouns bear an L tone on every TBU when they are modified with non-proximal modifiers. The final tone of nouns with a proximal modifier is raised. The L-tone overwrite of nouns with a non-proximal modifier is considered an effect of a non-proximal linker which has the tone features [–Upper, –Raised] as its phonological exponent. The tone raising of the final TBU of a noun with a proximal modifier is considered an effect of a proximal linker which has the tone feature [+Raised] as its exponent. In this case, the deictic linkers in Tal are featural affixes. We account for the phonological realisation of the deictic linkers using morpheme-specific featural correspondence constraints.

The association of tone lowering with the non-proximal linker and tone raising with the proximal linker is consistent with the crosslinguistic pattern of distance-related iconicity. Notably, realising the exponents of the non-proximal linker over a long phonological distance

and the proximal linker over a short distance is a previously unreported pattern of iconicity. The form-meaning association of the deictic linkers and their realisations suggests that iconicity is an integral aspect of grammar and can motivate the locality of morphophonological features. Considering that previous studies on deictic iconicity are only based on segmental features, the grammaticalised deictic iconicity in Tal contributes to the typology of grammaticalised iconicity.

The pattern discussed in this work has only been reported in A3 West Chadic languages such as Goemai Hellwig 2011:100) and Mwaghavul (Fwangwar 2018). Even in those cases, the tonal alternation in nominal modification is only limited to the L-tone overwrite of the associative construction. It would be important to investigates whether the pattern of tone overwrite in Tal is an areal feature of the A3 West Chadic languages. As mentioned earlier, most A3 West Chadic languages are understudied; only a few of them have been formally analysed. This work is an initial attempt at describing and formally analysing these languages. For our future direction, we hope to extend our research on Tal beyond iconicity.

Appendix

The results of the linear mixed effect model are presented in this appendix. The significance codes for the model are {≤ 0.001} ***, {≤ 0.01} **, {≤ 0.05} * and {> 0.05} ns (not significant).

		Isolation	**[–Proximal]**	**[+Proximal]**
Humming	F025%	***	***	***
	F050%	***	***	***
	F075%	***	***	***
Speech	F025%	***	***	***
	F050%	***	***	***
	F075%	***	***	***

Table 9: The distinction between H tone in isolation, [–Proximal], and [+Proximal] positions.

		Isolation	**[–Proximal]**	**[+Proximal]**
Humming	F025%	***	ns	***
	F050%	***	*	***
	F075%	***	***	***
Speech	F025%	***	***	***
	F050%	***	***	***
	F075%	***	***	***

Table 10: The distinction between L tone in isolation, [–Proximal], and [+Proximal] positions.

		Isolation	**[–Proximal]**	**[+Proximal]**
Humming	F025%	***	**	***
	F050%	***	*	***
	F075%	***	*	***
Speech	F025%	***	*	***
	F050%	***	*	***
	F075%	***	ns	***

Table 11: The distinction between M tone in isolation, [–Proximal], and [+Proximal] positions.

		Isolation	[–Proximal]	[+Proximal]
Humming	F025%	***	***	ns
	F050%	***	***	**
	F075%	***	*	***
Speech	F025%	***	**	ns
	F050%	***	***	*
	F075%	***	***	***

Table 12: The distinction between HR tone in isolation, [–Proximal], and [+Proximal] positions.

Abbreviations

1 = first person, 2 = second person, 3 = third person, DEM = demonstrative, DIST = distal, MED = medial, PL = plural, PROX = proximal, SG = singular, TBU = tone-bearing unit.

Data availability

The data and other resources that form the basis of this study can be found at the following link: https://osf.io/m8apg/. The link contains the sound files of all the examples cited in this paper, the sound files for the acoustic measurements, an R script for the data visualisation and statistical model, and the source files for creating the map of Tal settlements.

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Competing interests

The authors have no competing interests to declare.

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