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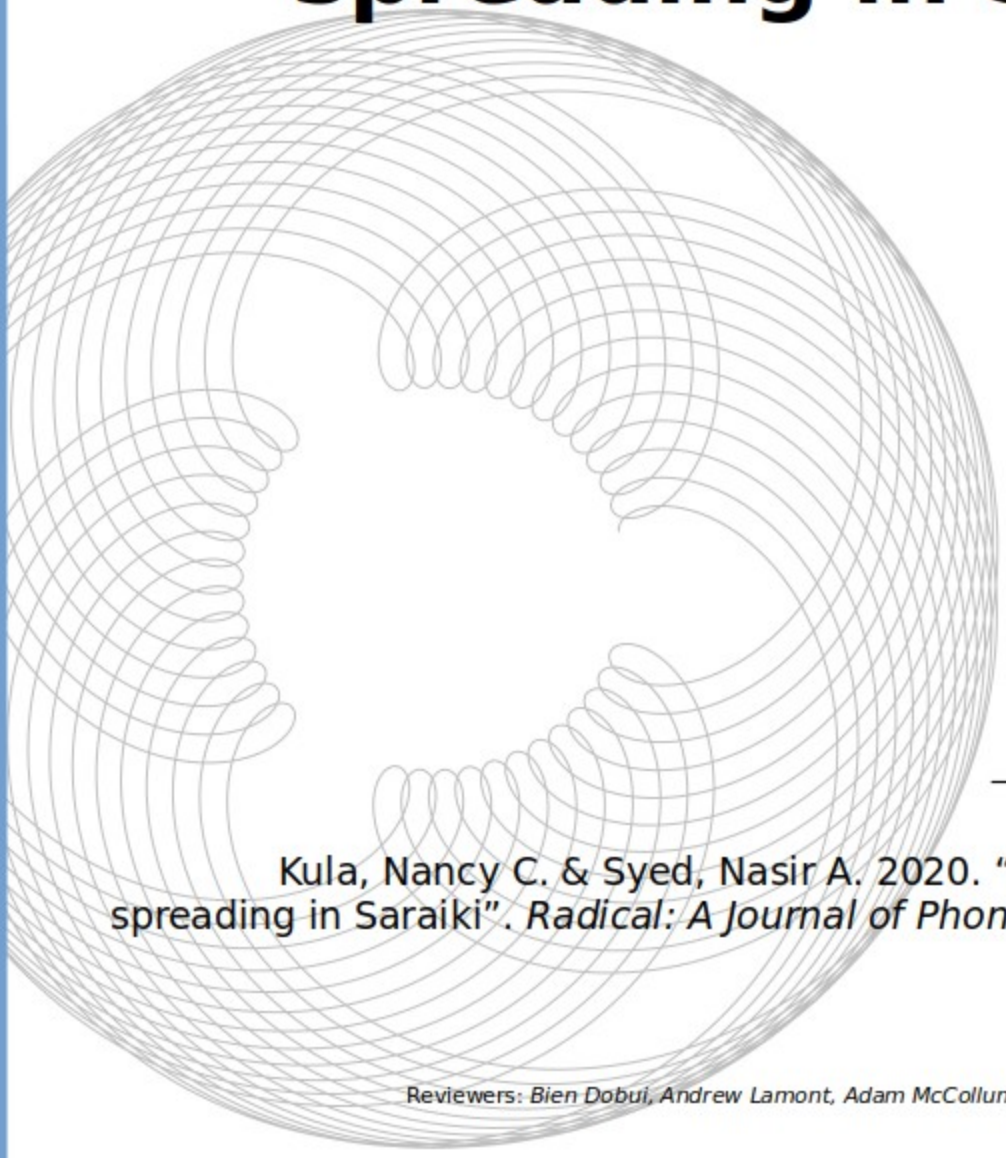

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PAPER

NON-MYOPIC NASAL SPREADING IN SARAIKI*

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Saraiki manifests asymmetric bidirectional nasal spreading. Regressive nasal spreading is sequential and myopic. It is triggered by a nasal and applies iteratively leftwards, unless it encounters a blocker. Vowels and approximants are targets, while liquids and obstruents are blockers. Progressive nasal spreading, by contrast, is non-myopic and categorical – it must apply to *all* segments in its domain. It only activates if there are suitable targets to the right edge of the domain. It does not activate at all, if there is a blocker ahead, even if that blocker is non-contiguous to the trigger, counter-intuitively showing a *sour grapes effect*. An element-based representational account is offered, warranting a rethinking of the typology of harmony systems.

Non-myopic spreading, nasal spreading, target-oriented spreading, Element Theory, bidirectional nasal spreading

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INTRODUCTION

Saraiki is a Sanskritic language (O'Brien 1881) of the Indo-Aryan family spoken in the central areas of Pakistan. It has a rich system of nasal segments with five plain nasal consonants, of which four have breathy variants. And of its nine vowels, five have an oral-nasal contrast (Shackle 1976, Syed 2013). Nasal spreading is bidirectional, triggered by inherently nasal phonemes, which target vowels, approximants and the laryngeal fricative /ɦ/. All other sounds are opaque to nasal spreading. What is unique about Saraiki is the contrastive pattern of progressive versus regressive nasal spreading. Regressive nasal spreading follows cross-linguistic trends in being myopic, affecting targets until it reaches a blocker. Progressive nasal spreading, by contrast, is non-myopic and will not begin to spread if there is a blocker anywhere in the domain. In addition, both processes may apply within the same domain, with regressive nasal spreading effectively removing the barrier for progressive nasal spreading to apply. A final unique characteristic of the Saraiki nasal harmony process is that stress blocks the propagation of nasal spreading, with nasality not able to skip over the onset of a stressed syllable.

The goal of this paper is to give a full exposition of the nasal spreading process in Saraiki, and demonstrate that the typology of nasal spreading patterns cross-linguistically must be revisited. An analysis that argues for more significant input from whole language phonology will be given, showing that although non-myopic patterns are cross-linguistically rare, the rich nasal and laryngeal system of Saraiki is what licenses the possibility of the non-myopic process in this particular context.

Previous discussion in the literature such as McCarthy (2009, 2010) and Wilson (2006) argue that nasal spreading is myopic, with no anticipatory power. Thus, non-myopic spreading is typologically predicted not to exist, i.e. phonology is argued to not have a look ahead ability. See also Kimper (2012), Mascaró (2019), for similar arguments and alternative analyses.[1] This position is held by a number of phonological ap-

1 The (non-) myopic spreading process focused on in this case is metaphony, based on Walker (2010), rather than nasal spreading. We take it Kimper's (2012) proposed analysis would broadly be assumed

proaches, demonstrating that processes in phonology generally tend to adhere to locality, with spreading and harmony processes standardly applying iteratively. McCarthy (2010) terms a non-myopic phonological process application a *sour grapes effect*, which is cross-linguistically rare. From this perspective it is desirable, McCarthy argues, that the commonly used constraints AGREE, ALIGN and SPREAD, in Classical OT, are not able to generate the unacceptable non-myopic spreading patterns.

This paper therefore allows us to extend our understanding of harmony processes, by investigating two cross-linguistically exceptional patterns; non-myopic nasal spreading, on the one hand, and, on the other hand, an asymmetric bidirectional nasal spreading pattern. A proposal using representations will be made, drawing on a contrast between domain defined target-oriented spreading, and the more standard iterative spreading, as the main ingredients differentiating the two types of nasal spreading in Saraiki.

The paper is organised as follows: §1 recaps nasal spreading generalisations as we understand them from previous work, and provides some context based on discussions of non-myopic patterns; §2 gives some brief background information on Saraiki phonology; §3 presents the data for regressive nasal spreading in Saraiki; §4 presents the main data of interest, demonstrating non-myopic progressive nasal spreading, as well as cases of inherent nasal suffixes and their blocking effects; §5 proposes a target-oriented analysis within Element Theory, to account for both the regressive and the progressive nasal spreading patterns, using element geometric representations; §6 is a short discussion on the diachronic evolution of nasals, to provide an understanding of the wider context; and finally, the conclusion offers some concluding remarks.

1 NASAL SPREADING GENERALISATIONS AND PREVIOUS ACCOUNTS

Walker (1998) developed a universal scale of markedness for the nasalisation of segments. According to this scale, a more sonorous segment is more liable to nasalisation.

to extend to nasal spreading.

This is reproduced below in terms of an OT constraint ranking.[2]

(1) *NASOBSTSTOP≫*NASFRIC≫*NASLIQ≫*NASGLIDE≫*NASV

This is a relative scale of markedness showing that nasalisation of one class of phonemes, implies that all other more sonorous phonemes will also undergo nasalisation (see also Piggott, 2003). The relative ranking of a constraint that favours nasal harmony within (1) (e.g. NASHARM), distinguishes subsets of languages with respect to what segments undergo nasal harmony. This creates a hierarchy, or markedness scale, from languages like Spanish, with no nasal harmony, to those like Tuyuca, where all segments can be nasalised (see Walker, 2003). One observation to make with respect to targets of nasal spreading is that in a number of languages, including Saraiki, the laryngeal fricative /ɦ/, behaves like an approximant in nasal spreading and is therefore categorized as such in a number of studies, including Walker (2000).[3]

An important condition in nasal spreading, as in other harmony processes, is the locality condition. According to Piggott & Humbert (1997), the locality condition demands that nasalisation does not skip any phoneme in the process of nasal spreading, and is argued to never be violated in any optimal output (Piggott 2003: 382). The locality condition is widely accepted in the literature, and is implemented as a no crossing constraint in autosegmental phonology (Goldsmith 1990) and as a requirement for string adjacency in Nasukawa (2005), for example.

Piggott (2003) divides nasal harmony into types A and B, depending on the behaviour of neutral segments that themselves do not undergo nasalisation. In Piggott's (2003:

2 Nasal consonants are not part of this scale because they are triggers of nasality.

3 Another possible explanation offered for the cross-linguistic nasalisability of [ɦ] in Walker (2000: 49) is that [ɦ] is affiliated to a supra-laryngeal node and therefore cannot resist nasalisation, which starts with velum lowering above the laryngeal cavity. Boersma (2003:18ff) also predicts that if glides can be nasalised, then vowels and laryngeals can also be nasalised, ranking [ɦ] with vowels in a nasalisability hierarchy. Similarly, Piggott (2003: 382) treats [h ʔ] as laryngeal glides, while De Lacy (2007) considers [ɦ] an approximant. These all offer possible explanations why [ɦ] undergoes nasalisation.

378) categorization, neutral segments are opaque in type A nasal harmony, but are transparent in type B nasal harmony, i.e. they do not undergo the process, but allow nasalisation to propagate through them in type B. In this sense, Saraiki is a type A language that allows no possibility of nasality skipping over blockers. There are thus no words like *[tãkʌ̃ŋ] in Saraiki, with regressive nasal spreading skipping over the opaque segment /k/, in order to reach the target /a/ in the next syllable. The output would in this case involve minimal spreading to only the preceding vowel to produce the hypothetical form [takʌ̃ŋ].

Another parameter in nasal harmony types is in terms of symmetry in systems with bidirectional spreading. In Walker's (2003) cross-linguistic survey of nasal harmonies, she finds few examples of asymmetric nasal spreading, with only one or possibly two languages that show an asymmetric pattern. Saraiki is an example of a system with asymmetric nasal spreading, with regressive nasal spreading being myopic, but progressive nasal spreading being non-myopic.[4]

1.1 NON-MYOPIC SPREADING IN CLASSICAL OT

McCarthy (2011) points out some significant issues with accounting for nasal spreading using classical OT in preference of Harmonic Serialism. The argument is that constraints like AGREE, SPREAD or ALIGN suffer from a sour grapes effect if they are considered as requiring absolute application, satisfied by the alignment of nasality with word edges. The following tableau adapted from McCarthy (2011) reflects this. In this tableau, the alignment constraint demands alignment of nasality with the right edge of words in Johore Malay, wrongly yielding as the optimal candidate (2a), where no nasal spreading applies at all, hence the term *sour grapes*.

4 Asymmetric application of processes other than nasal spreading can be found for vowel harmony or tone processes, see e.g. for Arabic in Davis (1995); Kinande in Archangeli and Pulleyblank (2002); and Chimila (Chibchan, Columbia) in Malone (2010).

(2) Tableau 1: Sour grapes effect of ALIGN-R[nasal]

/mawasa/	*NASFRIC	ALIGN-R ([nasal])$^{\text{Categorical}}$	IDENT-IO-[nasal]
☹ a. /mawasa/		*	
b. /mãwasa/		*	*!
c. /mãw̃asa/		*	*!*
L d. /mãw̃ãsa/		*	*!**
e. /mãw̃ãša/	*!	*	****
f. /mãw̃ãšã/	*!		*****

As the above tableau shows, a high ranked ALIGN-R([nasal]) constraint does not distinguish between a candidate like (2a), that does not spread any nasality at all, from one which spreads nasality as far to the right as is possible until it meets a blocker, as in candidate (2d). This then implies that IDENT-IO[nasal] will prefer (2a) as the winner. This categorical interpretation of ALIGN-R([nasal]) facilitates a look-ahead ability to avoid any spreading, if there is a blocker before the right edge of the word. All candidates that do not spread to the right edge (2a-e), get one violation of ALIGN-R([nasal]). However, at least in Johore Malay, and the majority of languages cross-linguistically, this is not the preferred outcome, with the correct winner being (2d), where iterative spreading is what is predominantly attested. This means that this interpretation of the ALIGN-R([nasal]) constraint fails to generate the correct winning candidate, motivating an alternative analysis in Harmonic Serialism. Note however, that a gradient (i.e. step by step application) interpretation of the ALIGN constraint would in fact give us the correct winner as the following tableau shows.

(3) Tableau 2: ALIGN- as a gradient constraint

/mawasa/	*NASFRIC	ALIGN-R ([nasal])$^{\text{Gradient}}$	IDENT-IO-[nasal]
a. /mawasa/		***!**	
b. /mãwasa/		***!*	*
c. /mãw̃asa/		***!	**
☞ d. /mãw̃ãsa/		**	***
e. /mãw̃ãs̃a/	*!	*	****
f. /mãw̃ãs̃ã/	*!		*****

McCarthy (2011) further notes that this innocent looking analysis in tableau (3) also suffers some serious undesirable pathologies. One concern with such a gradient interpretation of ALIGN, and other such constraints, is that these constraints may encourage metathesis in order to better satisfy nasal harmony, if LINEARITY (a constraint which militates against metathesis) is low ranked in a language.[5] Similarly, if a language does not allow codas and would thus undergo epenthesis to satisfy the constraint *CODA, vowel epenthesis will be blocked in such a language, if the constraint demanding nasal harmony is higher ranked than *CODA to ensure that nasal spreading was closer to the right edge of the word. Another issue raised is that the constraints demanding nasal harmony may encourage deletion or change the position of an affix, if this would better satisfy how well nasality aligns with the right edge.

One example of a possible case of non-myopic harmony is discussed by Walker (2010), for the vowel harmony processes found in Romance dialects spoken in the Veneto region on the island of Grado. Walker analyses non-myopic harmony within classic OT, utilizing the relative positioning of a locality constraint. Kimper (2012), reacting to this, offers an alternative analysis (using **SKIP* constraints, Kimper (2012: §3)) that allows the harmony process to be treated as myopic to satisfy typological predictions. However, Mascaró (2019) questions the validity of the Veneto data, which the non-my-

5 Note that LINEARITY would be low ranked in Saraiki because metathesis is a very frequent and productive process (Shackle 1976).

opic analysis is based on.

The discussion around Walker's (2010) paper highlights the view in the literature that non-myopic spreading does not exist – should not exist – and possible cases are to be treated with caution and regarded as likely mis-analyses of data, with phonological theory modelled to ensure that such patterns cannot be generated. This is, however, challenged by some recent work showing non-mypoic phonological patterning. Stanton (2018) discusses a case of nasal cluster dissimilation in Gurindji (Pama-Nyungan) where some blockers, present within a spreading domain, cause triggers to be deleted. The process is non-myopic in the sense that it requires, as Stanton proposes, surface candidates to be globally evaluated. McCollum and Essegbey (2018, 2019) also provide examples of non-myopic [ATR] spreading in Tutrugbu involving conditional blockers, where a non-local non ATR vowel in the initial syllable, blocks regressive spreading from a stem to an intermediate suffix. Similarly, Jardine (2016) discusses the non-locality of tonal processes as demonstrating the long known distance effects prevalent in tone languages, which he computationally accounts for as involving input melody-local functions, to, for example, account for patterns like unbounded High tone plateauing, where a spreading High tone must see a High tone in a non-local position to activate plateauing. We are therefore building on a growing body of data demonstrating the existence of non-myopic processes, and will show that the Saraiki data also call for phonology to have a way of accounting for these occurrences, while at the same time also explaining why non-myopia remains less robustly attested.

2 BASICS OF SARAIKI PHONOLOGY

Saraiki is an Indo-Aryan language spoken in central Pakistan. In the area where it is spoken, it is surrounded by Hindko (Northern Lahndi/Lahnda) to the north, Punjabi to the north east, Pashto (Iranian) to the west, Balochi (Iranian) to the south-west and Sindhi to the South. The dialect of Saraiki we present here is spoken in the central part

of the Saraiki speaking area in Multan. Hindko (Northern Lahndi/Lahnda), Punjabi and Sindhi are the most closely related languages to Saraiki, according to Shackle (1976). This said, there are also other dialects within the Saraiki speaking area, mainly based on geographical location. The central dialect that we describe here, and the southern dialect within the Saraiki area, make up the largest areas where Saraiki is spoken. There are about 11 million first-language speakers of Saraiki, according to the 1998 national census. Speakers of Saraiki are generally multilingual, with Punjabi and Urdu and/or other languages also spoken in the area.[6]

There are a number of striking characteristics of Saraiki phonology, most of which are shared with other Indo-Aryan languages. One is the presence of breathy voiced sounds, with plosives at 5 places of articulation having a four-way laryngeal contrast. There are also breathy sounds for nasals, flaps, laterals and the approximant [ʋ] as shown in the consonantal inventory in Table 1. In addition, Saraiki also has implosives at four places of articulation. The other feature is the prevalence of nasal contrasts. At the consonantal level, there are five simplex nasals and four breathy ones, with the velar nasal not having a breathy counterpart. Compared to this, the vowel inventory of Saraiki is fairly simple, with nine vowels of which six are peripheral and three are central, as Table 2 shows.[7] All peripheral vowels are long and all central vowels are short. For this reason, vowel length is not usually indicated orthographically, since the symbols always indicate which vowels are long and which are short. All peripheral vowels, apart from the mid back vowel [o], have an oral~nasal contrast. [ʌ] alternates with [ə], with the latter appearing in unstressed syllables, so we do not treat [ə] as an independent phoneme.

6 The second named author is a native speaker of the central dialect and was the original and main source of the data discussed in this paper. Almost all data were checked with other speakers in Multan and Muzaffargarh districts. Descriptions of Saraiki can be found in Shackle (1976) and in a recent grammar by Bashir & Conners (2019). What is most certainly needed to accompany this phonological analysis is a phonetic study of nasalisation which we hope to investigate in the near future.

7 There is a slight controversy as to whether there are nine or ten vowels depending on whether one treats schwa and the central vowel [ʌ] as two distinct vowels, or as allophones of one sound. Varma (1936) argues for the former position, and Shackle (1976) for the latter. We follow Shackle (1976) because [ʌ] alternates with [ə] with the latter appearing in unstressed syllables, although nothing crucially hinges on this distinction for the purpose of this paper.

Table 1: Consonant inventory of Saraiki (Syed 2013)

	Voice	Aspirate	Labial	Dental	Alveolar	Retroflex	Palatal	Velar	Glottal
Plosives	- - + +	- + - +	p pʰ b bʱ	t̪ t̪ʰ d̪ d̪ʱ		ʈ ʈʰ ɖ ɖʱ	c cʰ ɟ ɟʱ	k kʰ g gʱ	
Implosives			ɓ		ɗ		ʄ	ɠ	
Fricatives	- +		f		s z		ʃ	x ɣ	
Nasals	+ +	- +	m mʱ		n nʱ	ɳ ɳʱ	ɲ ɲʱ	ŋ	
Flaps					ɾ ɾʱ	ɽ ɽʱ			
Laterals					l lʱ				
Approximants			ʋ ʋʱ				j		ɦ

Table 2: Vowel inventory of Saraiki (Bashir & Conners 2019)

	Front unrounded	Peripheral	Centralized		Back rounded
High	i		ɪ	ʊ	u
Mid	e		[ĕ] ʌ	[ŏ]	o
Low	æ	a			

Contrastive nasal vowels are exemplified in the minimal pairs in (4) below. These are monomorphemic words, but as will be shown later, there are also cases where inherent nasal vowels are part of suffixes.[8]

(4) Oral-nasal vowel minimal pairs (stress is leftmost)

a.	cʰa:	'butter milk'	cʰã:	'shade'
b.	ci:ci:	'small finger'	cĩ:cĩ:	'squeaking'
c.	pæ:	'husband'	pæ̃:	'lying (2nd person)'
d.	a:kʰu:	'teller'	a:kʰũ:	'let us say'
e.	ba:le:	'burn'	ba:lẽ:	'children'

Stress in Saraiki is fairly simple. There are words consisting of light, heavy or super-heavy syllables. The language is quantity sensitive (the Weight-to-Stress Principle is active), with a heavy syllable in penultimate position always attracting stress. There are no words of only light syllables. A final heavy/superheavy syllable can be stressed, but otherwise stress avoids the final syllable. Some illustrative examples are given in (5).

(5)	a.	ˈci:r.ɓi:l	(ˈHH)	'owl'
	b.	mɪ.ˈla:	(LˈH)	'meet (causative)'
	c.	mu:l.ˈta:n	(HˈH)	'Multan' (city name)
	d.	mʊ.ˈkla:.ʊʌɳ	(LˈHH)	'farewell'
	e.	ku:r.ˈla:.ʊʌɳ	(HˈHH)	'bemoaning'
	f.	ɦə.rɪ.ˈjar	(LLˈH)	'agile animal'
	g.	kʊ.tɪ.ˈja:.ɳa:	(LLˈHH)	'a sub-caste name'

One prevalent feature of Saraiki phonology is word internal epenthesis, where onsetless

8 The following abbreviations are used in the remainder of the paper: ADJ = adjective; N = noun; MASC = masculine; FEM = feminine; V = verb; IMP = imperative; INF = infinitive; VOC = vocative; SG = singular; PL = plural.

syllables created during affixation processes get an epenthetic consonant, usually /ʊ/, which we will mark with hyphens as /-ʊ-/ in the rest of the paper. This epenthetic segment can be seen in examples (5d-e) above where the morphological breakdown is a stem that ends in /a:/, followed by epenthetic /ʊ/ and then the nominalizing suffix /-ʌɳ/. We will show all morphological breakdown in the remainder of the paper. The other approximants /j, ɦ/ can also act as epenthetic consonants in different contexts. There are also processes of gemination and vowel elision to avoid word-internal onsetless syllables, although onsetless syllables do occur word-initially, as will be seen in the data.

Saraiki has rich suffixation morphology, with pronominal suffixes being of particular aerial interest within Indo-Aryan studies. There are also prefixes, but these are fewer. Owing to the position of stress at the beginning of the stem in bi-syllabic words, which are dominant, nasalisation processes cannot be exemplified in prefixed forms since stress is a blocker. The focus will therefore be on suffixes, with the nasalisation processes to be discussed and illustrated being between a stem and its suffixes. The role of stress in the nasalisation processes will be discussed in more detail presently.

3 REGRESSIVE NASAL SPREADING IN SARAIKI

The nasal spreading processes to be discussed for Saraiki are triggered by inherently nasal segments, which may be consonants or vowels, although in the majority of cases the trigger will be a nasal consonant. Regressive nasal spreading is mandatory in Saraiki, i.e. must apply to any undergoer until it meets a blocker. A final nasal consonant, or nasal vowel, triggers regressive nasal spreading in morphological contexts, i.e. from a suffix to a stem or a preceding suffix.[9] Regressive nasal spreading is myopic and affects all vowels and approximants [j ʊ ɦ]. It is not uncommon for approximants to be targets of nasal harmony, as shown in Lin (2018) and Walker (2000). As noted earlier,

9 The process also actually applies in lexical forms as well, since any vowel that precedes a nasal consonant is nasalised. In these cases, where there are no alternations, it is difficult to convincingly argue that nasalisation is an active process. We sometimes refer to this as phonetic nasalisation.

[ɦ] will be treated as an approximant, following arguments in Walker (2003). All other segments are opaque. A nasal consonant within the domain of nasalisation does not block the nasal spreading process. The most productive suffix showing regressive nasal spreading is the verbal nominalizing suffix /-ʌɳ-/, which we will use in the majority of cases discussed.[10] But other suffixes, either composed of nasal vowels (e.g. the first person singular marker /-ã:-/), or consisting of nasals at other places of articulation, do also occur. Some examples with the 1st person singular pronominal suffix /-ɪm-/ and the 3rd person singular pronominal suffix /-ɪn-/ are given in (6) below. Both illustrate regressive nasal spreading. Stress is leftmost in the inflected forms, and /-ʊ-/, as pointed out, is an epenthetic consonant providing an onset for the final syllable.

(6)	Verb stem		inflected forms	gloss
a.	a:	‘come’	ã:-ʊ̃-ĩn	‘if they come’
b.	kʰa:	‘eat’	kʰã:-ʊ̃-ĩn	‘if they eat’
c.	pi:	‘drink’	pĩ:-ʊ̃-ĩn	‘if they drink’
d.	a:	‘come’	ã:-ʊ̃-ĩm	‘someone comes tome’
e.	ɗe:	‘give’	ɗẽ:-ʊ̃-ĩm	‘someone gives me’

Two factors play a role in how far nasalisation may spread from right to left – the presence of blockers, and the presence of stress. Stress, like opaque segments, acts as a blocker, with nasal spreading unable to cross a stressed syllable. The regressive nasal spreading pattern is further exemplified in (7), where the leftmost column shows the process spreading up to the initial syllable, in these words with initial stress. By contrast, the third column shows cases where stress is on the penult, and nasal spreading fails to affect the vowel in the initial syllable. These data contrast causative and non-causative verb forms. The non-causative form contains the verbal nominalizer/infinitive

10 We regard this suffix as having a lexically oral vowel i.e. as /-ʌɳ/ since short vowels do not have a lexical oral-nasal contrast. We will, in any case, see a number of examples where regressive spreading goes into the preceding syllable.

marker /-ʌɳ-/. The causative is marked by /-a:-/, resulting in epenthesis of the approximant [ʊ], to create an onset for the final syllable containing the suffix -ʌɳ. In examples (7c-f) the non-causative already has an epenthetic /-ʊ-/ making the corresponding causative forms have two epenthetic consonants.

(7)

	Non-causative		Causative	
a.	ˈsʌ̃ɦ̃-ʌ̃ɳ	‘tolerate’	səˈɦ̃-ã:-ʊ̃-ʌ̃ɳ	‘cause to tolerate’
b.	ˈrʌ̃ɦ̃-ʌ̃ɳ	‘be alive’	rəˈɦ̃-ã:-ʊ̃-ʌ̃ɳ	‘give life/plant’
c.	ˈpĩ:-ʊ̃-ʌ̃ɳ	‘drink’	pɪˈ-ʊ̃-ã:-ʊ̃-ʌ̃ɳ	‘give to drink’
d.	ˈsĩ:-ʊ̃-ʌ̃ɳ	‘sew’	sɪˈ-ʊ̃-ã:-ʊ̃-ʌ̃ɳ	‘get sewn’
e.	ˈdẽ:-ʊ̃-ʌ̃ɳ	‘give’	dɪˈ-ʊ̃-ã:-ʊ̃-ʌ̃ɳ	‘cause someone to give’
f.	ˈpõ:-ʊ̃-ʌ̃ɳ	‘knit’	pʊˈ-ʊ̃-ã:-ʊ̃-ʌ̃ɳ	‘cause to knit’

As was pointed out earlier, the vowel [ʌ] alternates with [ə], with the latter appearing in contexts where [ʌ] is unstressed, as demonstrated in the first two forms of the causative (7a-b). The causative forms in (7c-e), which have [ɪ] as the initial vowel, show that it is indeed stress that blocks further nasal spreading, rather than the inability of [ə] to bear stress. The opacity of stress to nasal spreading is also attested elsewhere in the literature (see e.g., Beckman 1997; McCarthy 2009). The examples below in (8a-e) demonstrate the blocking effect of obstruents and liquids. This contrasts with (8f-h) where regressive nasal spreading goes further when these blockers are absent.

(8) Blocking effect of obstruents and liquids in the infinitive

	stem	stem + infinitive marker	
a.	rʌkk^{h}	rʌkk^{h}-ɑ̃ɳ	‘put’
b.	sʌʈʈ	sʌʈʈ-ɑ̃ɳ	‘throw’
c.	k^{h}ʌss	k^{h}ʌss-ɑ̃ɳ	‘snatch’
d.	ʈʊrr	ʈʊrr-ɑ̃ɳ	‘departure’
e.	sʌɗɗ	sʌɗɗ-ɑ̃ɳ	‘call’
f.	ɗəra:	ɗərɑ̃:-ʊ̃-ɑ̃ɳ	‘frighten’
g.	t^{h}ʌɦ	t^{h}ʌ̃ɦ̃ɦ̃-ɑ̃ɳ	‘adjustment’
h.	ʊʌɦ	ʊ̃ʌ̃ɦ̃ɦ̃-ɑ̃ɳ	‘flow’

As also shown in (8), we see that for three different suffixes, stress blocks nasal spreading in (9) below, even if there is no segmental blocker ahead. The initial syllable, which would otherwise be a target of nasal spreading, fails to be nasalised in this case.

(9) Stress blocking nasal spreading

a.	ʊɪˈjɑ̃:-ʊ̃-ɑ̃ɲ	‘to give birth’
b.	ʊɪˈjɑ̃:-ʊ̃-ɑ̃:	‘I give birth’
c.	ʊɪˈjɑ̃:-ʊ̃-ĩn	‘They give birth’

We can thus generalize regressive nasal spreading in Saraiki as phonologically triggered in morphologically complex forms by a nasality-bearer, which then spreads nasality iteratively until it is blocked by an opaque segment or by a stressed syllable.

Within Optimality Theory, we can account for this spreading pattern with either a gradient alignment constraint, as discussed earlier, or in order to avoid all the issues raised with that analysis, within Harmonic Serialism, as proposed in McCarthy (2011). In more representation-based approaches, this is also straightforward, with the harmonic feature spreading through a domain until it meets a blocker, as done in a standard au-

tosegmental analysis. Features may be organised on tiers, with blocking implemented as avoidance of crossing an association line of a feature of the offending opaque segment.

4 PROGRESSIVE NASAL SPREADING IN SARAIKI

Progressive nasal spreading in Saraiki is unexpectedly non-myopic, manifesting a look-ahead ability, that is uncharacteristic of phonological processes. As with regressive nasal spreading, progressive nasal spreading applies in morphologically complex forms, with nasality spreading from the stem to following suffixes. The unique characteristic of this spreading pattern is that, if the progressive nasal spreading process anticipates a blocker within its domain of spreading, then it does not activate at all. Thus, spreading only applies if there is no blocker between the trigger and the right edge of the word. It is in this sense, an all or nothing type of harmony process, unexpectedly endorsing the otherwise eschewed sour grapes effect. Thus, the phonological context for non-myopic nasal spreading is provided by the morphological context, regulated by the phonological shape of the suffix, in terms of containing nasalisable segments.[11]

The following paradigm of Saraiki with the adjectival suffix /-a:/, and the nominalizing suffix /-p/ illustrates the general pattern of progressive nasal spreading. Progressive nasal spreading applies in (10b), where only a nasalisable suffix follows, but fails to do so in (10c), where the suffix contains a blocking obstruent. (Stress is initial in (10b) and final in (10c)).

(10)	a.	[sõ:ɳʱ]	‘beauty’ (N)	(informal form)
	b.	[sõ:ɳʱ-ã:]	‘beautiful’	< [sõ:ɳʱ+a:]
	c.	[sõɳʱ-ʌp]	‘beauty’	< [sõ:ɳʱã:]+[p][12]

11 There are examples in the literature where other, less common factors, determine whether spreading processes apply or not. These include; sonority (Lamont & Washington 2019); stress (Hendon 1966); prosodic structure (feet) (Beddor 1983); rhymes (Coelho da Silva & Nevins 2015, White, et. al. 2018); or are morpheme-based (Barnes 1996, Noske 1995).

12 The underlying vowel [a:] emerges as [ʌ] in this word, perhaps to avoid a super-heavy syllable, although these do occur. There is also a change in the stem vowel from /o:/ to /ʊ/ due to stress shifting

The monomorphemic words in (11), where no nasal spreading takes place, despite the presence of an initial nasality-bearing trigger, and no following blocker, demonstrate that progressive nasal spreading only applies in morphologically complex words.

(11) a. ma: ‘mother’
b. ne: ‘take lead’
c. nɪʊ ‘bow’
d. ma: ‘stuff’
e. nəɪ ‘barber’

Some adjectival suffixes, whose nasal status we elaborate on below, can be used with verbal bases in some instances and in this case they are interpreted as agentive. It may be that these are separate homophonous suffixes but this is not immediately crucial here. What these agentive interpretations allow us to show is that an initial onset can spread nasalisation so that it is indeed the morphological context, rather than syllabic position, that is crucial for nasal spreading. This is illustrated in (12a-b) with the verbal form in (11c).[13] In these cases we see progressive nasal spreading to the end of the word. As would be predicted by non-myopic progressive nasal spreading (12c) with a passive suffix shows no nasal spreading.

(12)

	base form		agentive/nominal form	
a.	nɪʊ	→	nĩʊ̃-ã:	‘one who bows (masc.)’
b.	nɪʊ	→	nĩʊ̃-ĩ:	‘one who bows (fem.)’
c.	nɪʊ	→	nɪʊ-iːɟ	‘to be/one who is prostrated (N from V)’

The following examples in (13) illustrate that the adjectival suffix /-a:/ in (10) and (12)

to the final syllable.

13 (11b) does not create an agentive as (11c) does. We could not at the moment find any other examples that allow further exemplification of spreading from an onset but (12) sufficiently illustrates that this is not blocked per se. We thank an astute reviewer for allowing us to further exemplify this.

is lexically oral, as seen from its use in (13a-e), which do not contain a nasality trigger. (13f) has a nasality trigger word-initially, but no spreading applies because there is a liquid blocker. (Stress is on the leftmost heavy syllable in the adjectival forms).

(13)		base form		adjectival form with -a	
	a.	bʱe:ɗ	'sheep'	bʱe:ɗ-a:	'of sheep'
	b.	ʊa:t̪	'mouth'	ʊa:t̪-a:	'mouthed'
	c.	sa:l	'year	sa:l-a:	'annual'
	d.	po:l	'hole	po:l-a:	'hollow'
	e.	ʊɓa:ɦəl	'haste	ʊɓa:ɦil-a:	'hasty (m.)'
	f.	ni:l	'bluishness'	ni:l-a:	'blue'

There are three other long oral vowels that function as adjectival suffixes: /-i:/, /-e:/, and /-u:/. For illustration, /-i:/ is given in (14), surfacing as oral when there is no nasality trigger.[14] (14d-e) also show no nasal spreading because of the stem-final consonant blocker. We will see a case where /-:i/ with an adjectival reading is nasalised, presently, in (16) below.

(14)		base form		adjectival form with -i:	
	a.	la:l	'red'	la:l-i:	'red (fem.)'
	b.	pa:l	'queue'	pa:l-i:	'queue (fem.)'
	c.	ʊɓa:ɦəl	'haste'	ʊɓa:ɦil-i:	'hasty (fem)'
	d.	ni:l	'blueness'	ni:l-i:	'blue (fem.)'
	e.	na:l	'pipe'	na:l-i:	'pipe (miniature)'

Examples (15-17) below provide further cases of non-myopic nasal spreading in different morphological contexts, to show that the process is robust.

14 Vowel syncope occurs in words of three syllables as in (13c) when stress falls on the antepenult.

The examples in (15) present morphological paradigms of three morphologically related words, with the forms in the second and third columns based on the stem in the initial column. This nicely contrasts cases where the same stem triggers progressive nasal spreading, when the suffix contains only undergoers/targets (second column), but fails to do so, when a suffix that contains a blocker is introduced (third column).

(15)	Stem		Spreading		No spreading	
a.	lũːɳ̣	'salt'	lũːɳ̣-ãː	'salty'	lũːɳ̣-ʌk	'a saltish vegetable'
b.	bʱɐ̃n	'break (verb)'	bʱɐ̃nn-ãː	'broken (past)'	bʱɐ̃n-iːɟ	'broken (passive)'
c.	sõɲ	'barren land'	sõɲɲ-ãː	'barren (adj)'	sõɲɲ-ʌp	'barrenness'

In the above examples, when the vocalic adjectival suffix /-aː/ is added in the second column, the preceding nasal spreads its nasality to the newly added vowel. As has been shown in (13), this adjectival suffix is lexically oral, therefore its surfacing as nasal in this case can only be from nasal spreading, triggered by the stem-final nasal. By contrast, in the third column, the same nasal trigger in the stem fails to initiate nasal spreading when the suffix contains a blocker, thereby further demonstrating the non-myopic nature of progressive nasal spreading.

The same is illustrated in the examples in (16), with the adjectival suffix /-iː/. Recall that the other adjectival suffixes all contain long vowels: /-uː/ and /-eː/ This prompted Shackle (1976) to argue that progressive nasal spreading only targets long vowels, with other instances of nasality bearing suffixes being explained as involving lexical nasal vowels. Let us first consider the relevant data in (16), before we offer counter evidence to this long vowel target analysis. As in (15), the data in (16) show nasal spreading in the second column with the suffix /-iː/, while the third column further illustrates the anticipatory power of progressive nasal spreading, with no spreading occurring when the suffix contains a blocker. As the language does not tolerate onsetless syllables word-medially, any following V-initial suffix triggers gemination of the stem

final consonant if the stem vowel is short (16c, f). That this does not apply when the vowel is long (16a-b, d-e) shows that it is maintaining the heavy syllable of the stem (final) syllable that is important.

(16)	Stem		Derived adjectives		Derived nouns	
a.	mʊ̃:m	'wax'	mʊ̃:m-ĩ:	'wax-like'	mʊ̃:m-əl	'soft'
b.	zæ̃:n	'Zan'	zæ̃:n-ĩ:	'Zan (voc.)'	zæ̃:n-əb	(female name)
c.	mʌ̃n	'agree'	mʌ̃nn-ĩ:	'agreed'	mʌ̃nn-ə̪	'thing agreed upon'
d.	ɦərã:m	'illegitimate'	ɦərã:m-ĩ:	'bastard'	ɦərã:m-ɪl	'bastard fem'
e.	cĩ:n	'China'	cĩ:n-ĩ:	'Chinese'	cæ̃:n-ək	'China kettle'
f.	bʌ̃ɳ	'manufacture'	bʌ̃ŋɳ-ĩ:	'made'	bə̃ŋɳɪ-ʈr	'manufactured item'

The data in (14) show that the adjectival suffix /-i:/ is lexically oral, and therefore nasality is derived via nasal spreading in (16). To counteract the possible argument that progressive nasal spreading only targets long vowels, we provide the data in (17) below which have an immediately following long vowel after the trigger in the third column. As in (15-16), we still do not see any nasal spreading in these forms. (17c-e) have regressive nasal spreading which is halted by a blocker. We must thus conclude that no spreading applies in the third column, due to the presence of blockers, making progressive nasal spreading an all or nothing process. (N in (17) denotes nominal forms).

(17)	Stem		Derived adjectives		Derived nouns	
a.	ɖɦã:m	'hustle bustle'	ˈɖɦã:m-ã:	'noisy drum side'	ɖɦəˈm-i:ca:ɽ	'pandemonium'
b.	rʌ̃n	'lady/wife'	ˈrʌ̃nn-ũ:	'wife's slave'	rəˈn-u:ha:ɽ	'women groups'
c.	cɦã:ɳ	'sieve V.'	ˈcɦã:ɳ-ã:	'sieve mas. N'	cɦəˈɳ-i:ɟ-ʌ̃ɲ	'sieve N passive'
d.	põɳ	'abuse V'	ˈpũ:ɳ-ã:	'abuses N.'	pʊˈɳ-i:ɟ-ʌ̃ɲ	'being abused'
e.	ɖɦʌ̃ɳ	'get pregnant'	ɖɦʌ̃ŋɳ-ĩ:	'got pregnant'	ɖɦəˈɳ-i:ɟ-ʌ̃ɲ	'being pregnant'

In order to demonstrate iterative progressive nasal spreading, we would need to have multiple suffixes containing nasalisable segments, in particular, combinations of vowels and approximants. Although we can demonstrate this with a single CV suffix, combinations of multiple suffixes of the required structure do not exist. The situation is further compounded by the fact that of the three target approximants – [ʊ], [j], [ɦ] – the latter two undergo morphophonological changes, that then disqualify them from being candidates illustrating iterative nasal spreading. [j] undergoes palatalization, and becomes secondary articulation on a preceding consonant (Atta, 2019), while [ɦ] undergoes metathesis (Syed, 2016). Thus, only examples of suffixes with the labial approximant [ʊ] and a following vowel, allow us to show iterative nasal spreading beyond one segment.[15] These data are given in (18) with the oblique case suffix /-e:/ that triggers epenthetic /-ʊ-/. In these data, the stem ends in a nasal vowel or a nasal consonant, which in each case triggers rightward iterative nasal spreading to the following two segments of the suffix.[16]

15 We are grateful to Andrew Lamont for pointing out in a spontaneous review the need to show iterativity, which made us have a closer look at the data. In his words 'confirming whether progressive nasalization is unbounded would make the case for non-myopic nasalization' – The data in (17) demonstrate that progressive nasal spreading *can* affect more than one segment. There are no naturally occurring examples of combinations of a vowel-final stem with a VC suffix, like the passive /-i:ɻ-/, to give outputs like **pæ̃:-ʊ-i:ɻ*. We would predict non-myopic progressive nasal spreading in such forms, based on alternations in examples like (14-16).

16 Progressive nasal spreading also reaches enclitics attached to short, single syllable nouns and pronouns. This is an instance where nasal spreading also applies more than once in forms like /ĩ:#i:/ → [ĩ:# ɦĩ:] 'he too (NOM, proximal)', with the enclitic /i:/ meaning 'also'. This form also involves [ɦ]-epenthesis, which occurs/is motivated independently. Another scenario where progressive nasal spreading could potentially be iterative, and apply over more than one segment, involves examples with the feminine marker /-i/, followed by the plural marker /-a:/. However, these undergo palatalization, which neutralises the iterative context: /ka:ɳ-i:-a/ → /kã:ɳʲ ã/ 'defect (fem/pl)' *kã:ɳ-ĩ:-ã. Interestingly, Syed & Saleem (2020) show that children in first language acquisition produce forms like this as: /kã:-ɳ̃ĩ:-j̃ã:/ with full iterative spread, although of course this may be being applied indiscriminately.

(18)	Stem	Oblique case	gloss
a.	nã:	nã:-ṽ-ẽ:	proper name
b.	kã:ɳ	kəɳã:-ṽ-ẽ:	‘sunlight peeping through narrow opening’
c.	cʰã:	cʰã:-ṽ-ẽ:	‘shadow/cover’
d.	cʰã:	pɪcʰã:-ṽ-ẽ:	‘shade’
e.	ʈ̪ã:ɳã:	ʈ̪ã:ɳã:-ṽ-ẽ:	‘rope’

The examples in (19) below are given to show that this suffix is lexically oral, and remains so when there is no nasal to trigger rightward nasal spreading. In (19a) we see the blocking effect of the consonants following the initial nasal consonant.

(19)	Stem	Oblique case	gloss
a.	mo:kʌl	mʊkl-a:-ʊ-e:	‘permission’
b.	ɦʌl	ɦəl-a:-ʊ-e:	‘tremble’
c.	pe:r	p-a:-ʊ-e:	‘leg (of furniture)’
d.	bʱa:ɽ	bʱʌɽ-ʊ-e:	‘pimp’

In terms of stress blocking progressive nasal spreading, this can be seen in a few examples, where the trigger is initial and the penult is stressed, as in the examples in (20).

(20) Stress blocking progressive spreading

a.	nɪˈ-ʊ-a:-ʊ-e:	‘may he bow’	*nĩˈ-ʊ-a:-ʊ-e:/ *nĩˈ-ṽ-ã:-ṽ-ẽ:
b.	məˈ-ʊ-a:-ʊ-e:	‘may he stuff’	*mə̃ˈ-ʊ-a:-ʊe:/ *mə̃ˈ-ṽ-ã:-ṽ-ẽ:

In these examples, all the segments to the right of the nasal are possible targets of progressive nasal spreading, as they consist solely of vowels and approximants, but we see no nasal spreading at all because stress acts as a blocker in the penultimate syllable. The forms in the rightmost column, where nasality either spreads only once, and is then ar-

rested by stress as a blocker, or where stress spreads through the whole word domain are ungrammatical.

4.1 BI-DIRECTIONAL NASAL SPREADING

Regressive and progressive nasal spreading can also apply within the same form. In such cases their respective contrasting myopic and non-myopic spreading patterns are maintained. Thus, in the examples in (21) below, regressive nasal spreading applies until it meets a blocker, spreading to three segments in (21a-d) and to one in (21e). By contrast, progressive spreading (from the word initial nasal) fails to initiate at all. In each case in (21), the stem-final consonant acts as a blocker of progressive nasal spreading between the word-initial nasal trigger and the right edge of the word. (21e) is a bisyllabic stem with only the infinitive.

(21) Causative /-a:-/ and infinitive marker /-ʌɳ/, with epenthetic /ʊ/ (Stress is on the heavy penult)

	SR	UR	
a.	mɪl-ã:-ʊ̃-ʌ̃ɳ	/mɪl-a:-ʊ-ʌɳ/	‘meeting’
b.	nəc-ã:-ʊ̃-ʌ̃ɳ	/nəc-a:-ʊ-ʌɳ/	‘dance’
c.	nəp-ã:-ʊ̃-ʌ̃ɳ	/nəp-a:-ʊ-ʌɳ/	‘get caught’
d.	mʊk-ã:-ʊ̃-ʌ̃ɳ	/mʊk-a:-ʊ-ʌɳ/	‘end’
e.	nɪʈa:r-ʌ̃ɳ	/nɪʈa:r-ʌɳ/	‘clarification’

The examples in (22) below present a case where the trigger of progressive nasal spreading is not stem-initial but stem-final. This does not affect the pattern of non-myopic spreading. The derived forms in the second column are a little complex. There are two instances of regressive nasal spreading triggered by the two nasals in each form: In each case there is spreading once from the nasal of the nominalizer /-ʌɳ/ and then also (phonetic) regressive spreading from the stem final nasals as shown in the phonetic

form of the first column. What is missing though is any progressive spreading from the stem-final nasal, in each case, to the following vowel of the passive marker /-iːɟ-/, due to the presence of a blocker. The ungrammatical forms where progressive nasal spreading applies in the third column illustrate this. (Stress is on the heavy penult).[17]

(22)	Stem	Derived Nouns (passive)		gloss
a.	[ʊ̃ãːɳ]	[ʊ̃ə̃ɳ-iːɟ-ʌ̃ɳ]	*[ʊ̃ə̃ɳ-ĩːɟ-ʌ̃ɳ]	‘being woven’
b.	[cʰãːɳ]	[cʰə̃ɳ-iːɟ-ʌ̃ɳ]	*[chə̃ɳ-ĩːɟ-ʌ̃ɳ]	‘being filtered’
c.	[mʌ̃n]	[mə̃n-iːɟ-ʌ̃ɳ]	*[mə̃n-ĩːɟ-ʌ̃ɳ]	‘being agreed’
d.	[ʊ̃ʌ̃ɲ]	[ʊ̃ə̃ɲ-iːɟ-ʌ̃ɳ]	*[ʊ̃ə̃ɲ-ĩːɟ-ʌ̃ɳ]	‘being lost’
e.	[bʱʌ̃n]	[bʱə̃n-iːɟ-ʌ̃ɳ]	*[bʱə̃n-ĩːɟ-ʌ̃ɳ]	‘being broken’

The net effect of progressive nasal spreading is that it only applies if it can create a domain of only nasalized segments from the trigger to the right edge of the word.[18] We can see this minimally applying in the data in (23), where a final vowel suffix is added to the verb forms. In this case, progressive nasal spreading applies, as does regressive nasal spreading, resulting in all nasalised forms in these examples, which do not have any blockers. There is vowel elision of /ɪ/ in (23c).

17 (22a-b) have vowel reduction in the initial syllable to avoid three heavy syllables, which never occurs in Saraiki. In (22c-d) there is a /ʌ ~ ə/ alternation, when stress shifts to the penult.

18 In general, one could describe this as a requirement to have words that are fully nasalized if the trigger is word-initial. This would probably be much easier to account for as a whole word phenomenon. However this is not quite accurate since there can be stems that are CVN- where the initial C is not nasalized (as in the examples in (22a-b, d-e)). In this case the trigger is the stem-final nasal, which in this case produces word forms that are not solely composed of nasalised/nasal segments.

(23) Bidirectional spreading (stress is leftmost)

	Stem	UR		SR	
a.	a: (imp.)	a:-ʌɳ-a:	→	ã:-ʊ̃-ʌ̃ɳ-ã:	‘arrival (inf.)’
b.	ʊ̃ã:ɳ (imp.)	ʊ̃ã:ɳ-i:	→	ʊ̃ã:ɳ-ĩ:	‘weave (2nd Sgl. imp)’
c.	ʊʌɦɪ (imp.)	ʊʌɦɪ-ʌɳ-a:	→	ʊ̃ʌ̃ɦ̃-(ʌ̃)ɳ-ã:	‘plough (inf.)’
d.	ɦa:	ha:-m-i:	→	ɦ̃ã̃:-m-ĩ:	‘me too’
e.	ɦa:	ha:-n-i:	→	ɦ̃ã̃:-n-ĩ:	‘yours too’

In (23c) there is double elision, first of the stem final /ɪ/, and then of the suffix vowel /ʌ/ as well, presented here in parenthesis in the surface form.

A data question that arises, in this case, is whether progressive nasal spreading would apply, if only stress is present as a blocker, and regressive nasal spreading has applied to all segments after the stressed syllable. This provides a context in which progressive nasal spreading can apply when all following segments are nasalised, but stress is present as a blocker. In this case, progressive nasal spreading applies, satisfying the requirement of having only nasalised segments from the trigger to the right edge. These are the cases we referred to earlier as instances where regressive nasal spreading appears to (inadvertently) create conditions that allow progressive nasal spreading to apply. Consider the examples in (24) containing a CVC- stem, the causative /-a:-/, and the epenthetic /-ʊ-/ before the nominalizing suffix /-ʌɳ/.

(24) Bidirectional spreading with penult stress

a. nĩˈʊ̃-ã:-ʊ̃-ʌ̃ɳ ‘bow (N, causative)’
b. nĩˈʊ̃-ã:-ʊ̃-ĩn ‘bow (3rd pl.)’
c. mə̃ˈʊ̃-ã:-ʊ̃-ĩn ‘stuff (N, causative)’
d. mə̃ˈʊ̃-ã:-ʊ̃-ʌ̃ɳ ‘stuff (3rd pl.)’

In the data in (24) the word-final nasal regressively spreads nasality up to the penult

where it is halted by stress as already discussed – regressive nasal spreading does not cross a stressed syllable (see earlier examples in (17)). In this context, progressive nasal spreading also applies, spreading once in word-initial syllables, as this produces a form where there is no blocker till the right edge of the word. There is, however, some variation in these data, with both forms where there is nasalisation in the initial syllable, and where there isn't being possible (e.g. /nĭˈʊ̃-ã:-ʊ̃-ʌ̃ɳ/ ~ /nɪˈʊ̃-ã:-ʊ̃-ʌ̃ɳ/ are both possible for (24a)).[19]

We have discussed a number of examples that sufficiently demonstrate that progressive nasal spreading in Saraiki is non-myopic. It rather manifests a look ahead ability to detect any blockers in the spreading domain. When such blockers are present anywhere between the trigger and the right edge of the word, then progressive nasal spreading is not activated. Progressive nasal spreading applies in morphologically complex words, spreading from the stem to suffixes. Particularly compelling are those cases where the same stem shows nasal spreading when suffixes do not contain any blockers, but fails to do so when suffixes with blockers are added. In bidirectional spreading, we again see the contrast between regressive and progressive spreading, with the former applying until it hits a blocker, while the latter does not initiate when a blocker is anticipated. We also presented cases where the requirement of progressive nasal spreading – to only have nasalised segments after the trigger – is achieved by a combination of both regressive and progressive nasal spreading.

4.2 SEGMENTAL HOMOPHONY AND NASAL CONTRASTS

In order to provide a complete picture of progressive nasal spreading, and more broadly,

19 In these particular examples, it is perhaps difficult to know whether this is active progressive nasal spreading or simply automatic contextual nasalisation, since it is difficult to switch to oral articulation for a vowel that is sandwiched between two nasals, and also in a context where all other segments in the word are nasalised. An additional syllable between the left edge and stress would clarify the matter, but such cases are unattested. Impressionistically, based on the second-named author's random sampling of speakers in Multan, forms with nasalisation seem to be more frequent but may still well be a phonetic effect. Systematic sampling would need to be conducted before anything conclusive can be said.

the context of nasal spreading processes in Saraiki, we consider in this sub-section, cases where suffixes show segmental homophony, but contrast with respect to nasality in being either oral or inherently nasal. By inherent nasality we consider those cases where we can assume that a nasal feature is lexically present in a suffix, and not derived from nasal spreading. We will discuss some consequences of this homophony, which initially appears to pose a challenge to the nasal spreading processes we have thus far assumed.

The relevant data involve oral vocalic suffixes that, counter to expectation, do not undergo nasal spreading from a preceding nasal. These are given in (25-29) below. In each of these cases, the stem-final consonant is a nasal, but it fails to trigger progressive nasal spreading to the following suffixal vowel, which remains oral, in spite of the fact that there are no blockers. Indeed, there are no other following suffixes/segments to act as blockers. In each case in (25-29), the underlying form appears on the left and the surface form on the right. All the examples undergo gemination after the suffix is added as also noted earlier, with stress on the initial syllable.

(25) [o:] 2nd person plural for imperative, vocative

a.	sʌ̃ŋ-o:	→	sʌ̃ŋŋo:	‘be ready for being milked’
b.	bʱʌ̃n-o:	→	bʱʌ̃nno:	‘break’
c.	bʌ̃ɳ-o:	→	bʌ̃ɳɳo:	‘be prepared’
d.	ʊʌ̃ɲ-o:	→	ʊʌ̃ɲɲo:	‘go’
e.	sʌ̃m-o:	→	sʌmmo:	‘sleep’

(26) [u:] 3rd person singular pronominal suffix for subjects

a.	sʌ̃m-u: →	sə̃mmu:	‘one who sleeps’
b.	bʌ̃ɳ-u: →	bə̃ɳɳu:	‘one wants to become’
c.	bʱʌ̃n-u: →	bʱə̃nnu:	‘breaker’
d.	ʊʌ̃ɲ-u: →	ʊə̃ɲɲu:	‘goer’
e.	sʌ̃ŋ-u: →	sə̃ŋŋu:	‘ready to be milked’

(27) [e:] 3rd person singular pronominal suffix for conditional verbs

a.	sʌ̃m-e: →	sʌmme:	‘when/if s/he sleeps’
b.	ʊʌ̃ɲ-e: →	ʊʌ̃ɲɲe:	‘when/if s/he goes’
c.	bʱʌ̃n-e: →	bʱʌ̃nne:	‘when/if s/he breaks’
d.	sʌ̃ŋ-e: →	sʌŋŋe:	‘when/if s/he milks’
e.	bʌ̃ɳ-e: →	bʌ̃ɳɳe:	‘when/if s/he becomes’

(28) [i:] V Past

a.	sʌ̃ŋ-i: →	sʌ̃ŋŋi:	‘readied for milk’
b.	bʱʌ̃n-i: →	bʱʌ̃nni:	‘broken’
c.	bʌ̃ɳ-i: →	bʌ̃ɳɳi:	‘prepared’
d.	ʊʌ̃ɲ-i: →	ʊʌ̃ɲɲi:	‘wasted, gone’
e.	sʌ̃m-i: →	sʌ̃mmi:	‘slept (informal)’

(29) [a:] Imperative, request

a.	bʌ̃ɳ-a: →	bə̃ɳɳa:	‘make’
b.	kʰʌ̃n-a: →	kʰə̃nna:	‘delay’
c.	sʌ̃ŋ-a: →	sə̃ŋŋa:	‘prepare for milk’
d.	sʌ̃m-a: →	sə̃mma:	‘sleep’
e.	ʊʌ̃ɲ-a: →	ʊə̃ɲɲa:	‘lose, waste’

All of the examples in (25-29) have the required context for progressive nasal spreading, i.e. no blocker between the trigger in the stem and the right edge of the word, but nevertheless progressive nasal spreading does not apply.[20] Because there are complementary, segmentally homophonous, suffixes, which are inherently nasal, we would like to explain this as a paradigm effect following discussion in Downing, Hall & Raffelsiefen (2004), see also Łubowicz (2012) on homophony avoidance. Thus, in the presence of homophonous forms, nasalisation of the suffixes in (25-29) is blocked to preserve semantic distinction. Table 3 gives the homophonous suffixes, which contrast in nasality. The suffix /-o:/ in (25) does not have a nasal counterpart. We treat this as just a gap in the system. Given that a nasalized /o/ can be generated in the language, albeit rarely (see e.g. (7f)), it begs the question why this suffix in (25) does not undergo nasalisation.[21]

20 A couple of reviewers have suggested that these data are perhaps suggestive of ternary feature specification where [+nas], [-nas] and [∅nas] could be used to capture the distribution, so that in this case only [∅nas] segments would be the target of nasal spreading changing to [+nas], while suffixes specified as [-nas], those in (25-29), would never be targets of nasal spreading. We consider this solution as opening up the broader issue of undesirable overgeneration and redundancy as this approach would have to be adopted for all features in the language and there is no evidence that this 3-way opposition is used is the same way, as would be argued for [nas], for the other features.

21 As noted earlier in section 2, there is no lexical /õ:/ in Saraiki. In the cases where we see surface /õ:/, (10a) and (16a) are the only instances in our data, there is always an adjacent nasal, so we take this to be the source of nasality. Overall, the distribution of /o:/ is very limited in comparison to the other vowels. The broader paradigm reasoning we are pursuing with respect to the examples in (25-29), would not work (without some tweaking) in this specific instance. Therefore, in this case, the representational account to be sketched in section 5, would be the only explanation we would be forwarding at present. We can only speculate that perhaps some change is going on that is affecting the status of /o:/, given its rarity. Bashir & Conners (2019), as well as preceding descriptions of Saraiki in Shackle (1976) and Varma (1936) do not comment on any special status of /o:/.

Table 3: Homophonous suffixes with an oral-nasal contrast

Suffix	Morphological gloss
u:	3rd person singular pronominal suffix for subjects
ũ:	1st person plural pronominal suffix of subjects (added to present or future verbs)
e:	3rd person singular pronominal suffix for conditional verbs
ẽ:	2nd person singular pronominal suffix of subjects added to conditional verbs
i:	V Past
ĩ:	2nd person singular pronominal suffix of subjects added to imperative verbs
a:	Imperative, request
ã:	1st person singular pronominal suffix of subjects added to present/future verbs

To verify that the nasal suffixes in Table 3 are lexical, (30) gives examples where there is no nasal in the stem that could be regarded as the source of nasalisation for the suffix, showing that nasalisation in this case is indeed inherent.

(30) Inherent nasal suffixes

Base stem	Glosses	[ũ:] 1st Plural	[ã:] 1st Sing. Conditional	[ẽ:] 2nd Singular Conditional	[ĩ:] 2nd Sing Imperative
kʌr	'do'	ka:rrũ:	karrã:	karrẽ:	ka:rrĩ:
rʌkʰ	'place'	ra:kkʰũ:	rakkʰã	rakkʰẽ:	Rr:kkʰĩ:
kʰʌs	'snatch'	kʰʌssũ:	kʰʌssã:	kʰʌssẽ:	kʰʌssĩ:
ʊʌl	'return'	ʊʌllũ:	ʊʌllã:	ʊʌllẽ:	ʊʌllĩ:
bʌc	'avoid'	bʌccũ:	bʌccã:	bʌccẽ	bʌccĩ:

We therefore argue that, understood within the wider verbal paradigms, (25-29) are not counterexamples to progressive nasal spreading. Rather, in these particular instances, nasal spreading is blocked to preserve the morphological identity of the verbs in-

volved.[22]

The role of nasalisation in verbal paradigms in Saraiki is further exemplified in the following examples in (31) where the contrast between 3rd person singular, and 2nd person singular is indicated by a contrast in nasalisation.

(31) Nasality as person marker

	oral	3rd sg.	nasal	(2nd sg.)
a.	pæ:	'he is lying'	pæ̃:	'you are lying'
b.	ɖæ:	'he went'	ɖæ̃:	'you went'
c.	ʈʰæ:	'he became'	ʈʰæ̃:	'you became'
d.	æ:	'he came'	æ̃:	'you came'

Overall, nasalisation is a strong and pervasive feature in the tense-aspect system of Saraiki, and for which we are willing to accept and put forward the proposal that, apart from segmental blockers of nasal spreading, there are also paradigm effects at play, particularly in progressive nasal spreading. The following section presents an analysis of the myopic and non-myopic nasal spreading patterns as illustrated in the foregoing discussion.

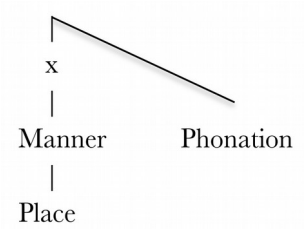
5 TARGET-ORIENTED SPREADING IN ELEMENT THEORY

We will couch our analysis within Element Theory (Backley 2011, Kaye, Lowenstamm & Vergnuad 1985, Scheer & Kula 2018), which assumes a small number of privative features viz. |A I U ʔ H L|, utilized within both consonantal and vocalic representations. Given this small set of primes, one pursuit of Element Theory (ET) is to find ways to in-

22 Recall that /-a:/ used as an adjectival suffix did undergo nasalisation, with examples where it surfaces as oral after oral stems, but as nasal following a stem-final nasal. This suggests some possible analyses. Either, the operation of nasal spreading may be different in nominal vs. verbal forms, or particular affixes can somehow be distinguished with respect to whether they are nasalisable or not. We sketch a possible analysis in section 5. This said though, a more detailed investigation of the tense-aspect system of Saraiki would no doubt be beneficial for a fuller understanding of the role of nasalisation in the system.

crease the expressive power of this small set, by the use of either headedness or different structural configurations, that allow the same element to assume different characteristics. One development in this vein has been the use of enriched geometric representations grounded in dependency relations (van der Hulst 1995, Kula 2002, 2008, Botma 2004, Liu & Kula 2020). A simplified version of the structure we will assume is given in (32) below, where manner and place are in immediate dependency, while phonation, in the right branch, is in a branching dependency relation with the rest of the structure. A branching dependent position is deemed to have a looser relation with the rest of the structure, manifested by different spreading patterns, including the ability for an element in this position to totally detach onto an external target. By contrast, elements in immediate dependency remain more stable in their spreading patterns (see e.g. the analysis of Derived Environment Effects in Kula 2008). This allows more mobile elements, expressing laryngeal specifications (and mobile features like tone), to be expressed in the phonation node.

(32) Representational dependency relations



This contrast between types of dependency relations will be crucial for expressing the two contrasting types of nasal spreading in Saraiki. The element used to represent nasality is |L|, and it is well established in the literature that this same element also, in addition, represents voicing and tone (Nasukawa 1998, 2005, Kula 2002, Botma 2004, Botma, Kula & Nasukawa 2011, Kula 2012). We will represent nasals in Saraiki as having an |L| in a branching dependency position, at the sub-segmental level, as a way of

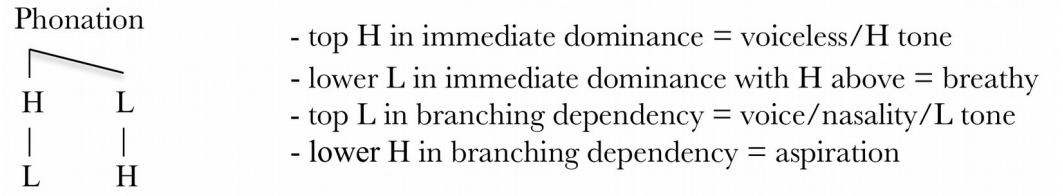
accounting for the pervasive spreading ability of |L| in this language. Cross-linguistically, nasals are more naturally represented as having |L| in an immediate dominance relation, in the position labeled as manner in (32). We argue that spreading can be of two types in Saraiki: One involves a standard iterative process from one segment to the next, where |L| spreads from one branching dependency position to another, while the other is end target oriented. As the spreading is rightward in the latter, the end of the word offers a natural domain edge that acts as a target for nasal spreading.

As discussed and shown above, plosives, implosives and fricatives are blockers of nasal spreading in Saraiki. An understanding of why this group of sounds are blockers requires a more detailed structure than that given in (32), and we will provide only an outline of it here, but see Liu and Kula (2020) for a more detailed exposition. Essentially, the idea is that, as the two elements |L| and |H| represent voicing, voiceless, aspiration, breathy voice, nasality, low tone and high tone, all of which, barring tone, are active oppositions in Saraiki, there is need to have further structure within the Phonation branch in order to capture these oppositions. Different languages would only use subsets of these oppositions as required. For Saraiki, obstruents require 4 oppositions and therefore maximally use the branching structure in Phonation. Each branch within Phonation has the two elements in immediate dominance as in (33) below. The blocking effect of obstruents is then captured as a lack of space to place a nasality |L| in obstruents. Liquids are also blockers, but do not have contrastive voicing, although they have breathy voiced variants. We treat them as represented by only the first branch in (33), where |H| immediately dominates |L|. Since their one |L| position is occupied in order to express breathiness, they cannot assume another |L| in this structure to interpret as nasality. By contrast, approximants do not have breathy counterparts and therefore have an empty |L| slot that a spreading |L| can consume and since this cannot be interpreted as breathiness, it is interpreted as nasality. There is a small quirk here in that, based on its patterning, we treat [ʊ] as an approximant rather than a fricative. However, its intermediate status between approximant and fricative is seen in the fact that it has a breathy variant and so

its representation must capture this by having |L| in immediate dominance in (33), but also an |L| position in branching dependency but with no further dependent, i.e. no |H| in branching dependency since, with spontaneous voicing, it has no voiceless counterpart.[23] This |L| branching dependency position is then available for nasality.

Another important fact in these representations is that since Saraiki does not have tone – which is also represented by H and L in Element Theory – it automatically interprets the spreading |L| as nasality (rather than tone).[24] (33) gives one possible representation of |L| and |H| in the phonation branch and the assumed element interpretations. Liquids and approximants would consist of only the immediate dominance relations with the approximants /j/ and /ɦ/ further missing the |L|.

(33) Micro structure in phonation



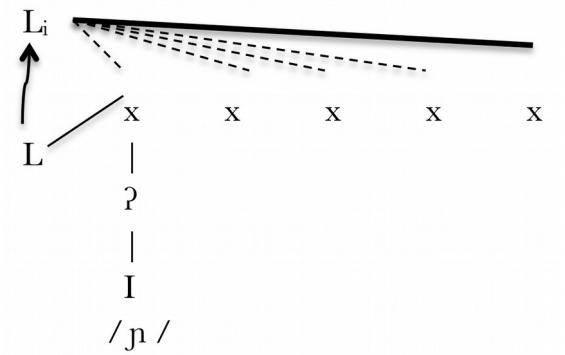
Regressive nasal spreading is straightforward and involves the iterative spreading of |L| into segments that have the top |L| position empty within phonation which includes vowels, liquids and approximants. Progressive nasal assimilation is a bit more complex, in that it undergoes targeted domain-based nasal spreading, where |L| aims to attach to

23 We thank a reviewer for raising discussion around this segment. Although the breathy variant of /ʋ/ is distributionally much less frequent, as can also be seen from our data, it would be too strong to say it is absent. The proposed representation of /ʋ/ nicely captures its intermediate status between approximant and fricative – on the one hand, it behaves like an approximant in being nasalised, and on the other hand, it behaves like a fricative in having a breathy contrast.

24 This is not to say that we predict that tone languages are unlikely to have the nasal spreading patterns we see here, as one reviewer notes, but simply to say that there is no ambiguity of interpretation in Saraiki. This is because |L| can only be interpreted as nasality in this case, implying a much leaner analysis with no stipulations that may, perhaps, be required in a tone language. Furthermore, given the cross-linguistic rarity of interaction between tone and nasality, contra that between tone and voicing, the issue may also only be superficial in tone languages as well. See discussion, survey and more detailed development of the representation of the interaction between voicing, nasality and tone in Liu (2020) and Liu & Kula (2020).

the final segment of the word – the head of the (word) domain in Government Phonology terms, indicated by the final nucleus – and is arrested if, along the way, it crosses a blocker. The spreading process targets the domain-final segment and is in this sense not applied iteratively, but nevertheless still violates line crossing on its way to its domain-final target. Because stress is a blocker of nasal spreading, and we assume that stress is represented on a higher prosodic projection, like tone, we will further argue that the position of the top |L| in the phonation branch, which is also the position of a tone element in tone languages, lends itself well to being projected to a higher prosodic level. This is an assumption already independently developed for tone in Kula (2012). |L| then spreads rightwards and leftwards from this prosodic position. This implies a double operation where the projected |L| can be viewed as a copy of the spreading nasal |L| at the melodic level, as also argued for tone in Kula (2012).

(34) Target-oriented spreading



In bi-directional spreading, the contrasting nasal spreading processes still apply as they do independently. If regressive nasal spreading has already applied to possible targets of progressive nasal spreading, progressive spreading still applies, in this sense then applying vacuously to those segments already nasalised by regressive spreading. This is not to say that there is ordering in the application of the two nasal spreading processes, but rather that they both apply only when their conditions are met. In this sense, it is not quite precise to say that progressive spreading applies vacuously to already nasalised

targets, as this suggests regressive spreading is prior to progressive spreading, which is not what is intended. However, given the cases of bi-directional spreading in examples like (24), where a penult stressed syllable acts as a blocker of nasal spreading, but is somewhat neutralized by (simultaneous) leftward and rightward spreading, we must assume that progressive spreading targets the rightmost non-nasalised target.[25] By so doing, it continues to satisfy the requirement that it creates a nasal domain until the end of the word.

Non-myopic nasal spreading is thus domain controlled, with global reach within a word, while myopic spreading is iterative and not domain controlled.[26] The assumption that the nasal feature – here element |L| – is represented at the sub-syllabic level is a crucial ingredient that facilitates the attested spreading patterns.[27] The significant component of any analysis is that it must have a non-myopic harmony-driver for progressive spreading, and reaching the word-final edge cannot be done in a gradient and irreversible fashion, as, for example, a HS account would do.

With respect to the examples in (25-29), to do with inherent oral versus nasal suffixes, where the former do not under any circumstances, undergo nasalisation, and

25 This is a less elegant assumption, but also recall that these are the examples, (see 24b), where there is variation among speakers, so that for some speakers there is no nasalisation in the first syllable of forms like *nĩˈṽ-ã:-ṽ-ĩn* 'bow (3rd pl.)'. Progressive nasal spreading may in this case be a phonetic rather than a phonological effect. If it is simply phonetic, then we would (more preferably) continue to assume that in these examples, progressive nasal spreading is blocked by stress, as it targets the domain final segment, unaware of any previously applied regressive spreading.

26 This contrast in the application of the same process within the same language is also seen in other phenomenon, particularly at the prosodic level. In tone, for example, there are many examples of contrasting domains of H-tone spreading within the same language, as we see in Bemba (Bantu) where bounded H-spreading affects a maximum of three syllables, while unbounded H-spreading spreads a high tone to the end of the domain (Kula & Bickmore 2015). In this case, there are contrasts in prosodic phrasing determining one spreading pattern from another. Importantly, in the cases where ternary spreading applies, there are following possible targets/undergoers that H-spreading does not apply to.

27 As a reviewer notes, the contextualization of the findings in this paper in the broader context of analyses of feature spreading is important as a way of investigating implications for theories of spreading, We leave this to a future occasion. We have here focused on laying out the facts of nasal spreading in Saraiki and offering an analysis in our preferred theoretical model. With the analysis offered, we hope to show that the pattern can be adequately formalized but set aside for the meantime how this can be extended to other spreading contexts and indeed how previous analyses of spreading would have to be reconsidered to include the current patterns.

which we described as owing to paradigmatic effects, these would somehow need to be represented in the system. There would have to be some interaction between morphology and phonology, and whose marking may well be shared between these two components. One approach would be to allow phonology to only apply to particular morphological categories, i.e. the triggers could be morphologically marked and therefore only affect particular morphemes. This disaggregation between different morphological forms, based on morphological reasoning (paradigm effects), could imply/be marked by different internal phonological representations. In this case the specific /a:, e:, o:, i:, u:/ suffixes, that fail to undergo nasalisation, could already contain an |L|. There is some indirect precedent for this in that, some element representation proposals, in reconciling the fact that vowels are grouped together with sonorants in having spontaneous voicing, represent vowels as also having an |L|, see e.g. Botma (2004), Botma and Smith (2006). If the oral suffixes in (25-29) are, for morphological reasons, represented as phonologically containing |L|, then because of this, they could then not acquire another |L| for nasality, since the nasal |L| position would already contain an |L| that is interpreted as sonorancy. Obviously more thinking around the interaction of morphology and phonology is needed to streamline possible analyses, but it seems to us feasible that either morphological information may be phonologized or phonology can directly read and react to morphological information. We leave this very interesting case to future work and exploration of the interface.[28]

The non-local target-oriented nasal spreading pattern discussed here has some parallels with Nevins' (2010) analysis of vowel harmony as an essentially non-strictly local process where one segment (the value-seeker) searches for another segment (the value-source) from which it copies a feature, and which may be at different language specifically defined distances. Nevins defines what he terms *distance parameters* along which

28 An important and relevant point in this argumentation, we would say, is that what licenses specific structures/element configurations is also directly related to the specific enriched nasal system of the language. Some historical development of nasals and context is given in section 6 below. This would, in this sense, not be suggesting that such representations would be in common use in less nasal rich languages.

languages may vary with respect to how far they can search for a feature, or indeed on a par with syntax, what barriers they are allowed to cross in their search for a feature, and in this way captures long distance effects. Furthermore, the value-seeker approach offers a potential way of capturing the phonology-morphology interaction alluded to above, particularly in relation to the homophonous suffixes, although it leads to a quite different conceptualisation of the data. This would imply treating suffixes, in progressive nasal spreading, as the value seekers, in which case we could specify (based on morphological grouping or other motivation), which suffixes would be value seekers and which not. In this case, suffixes with blockers, e.g. {*-ʌp, -ʌk, -iːɟ*} and those that do not undergo nasalisation, e.g. all cases in (25-29) {*-uː, -eː. -iː, -oː, -aː*}, are all non-value seekers, i.e. are neutral with respect to seeking a nasality value. By contrast, all those described as 'undergoers' e.g. {*-aː, -iː, -ɪn, -ɪm, -aː-* } are value seekers. This approach obviates the non-myopic interpretation of the data as it does not assume the spreading of a nasal feature from the stem to the suffix. A more detailed exploration of this possible alternative analysis, which we leave to future consideration, would have to integrate the regressive spreading pattern which does not necessarily only target affixes.

6 DIACHRONIC DEVELOPMENT OF NASALS IN SARAIKI

As a final discussion in our wider understanding of the Saraiki nasal system, we briefly look at how nasal vowels developed diachronically in Saraiki, although our thinking on this is still tentative. As pointed out earlier, Saraiki is a quantity-sensitive language, which has phonemic long and short vowels. In the above discussion, we have seen examples of long vowels which have an oral-nasal contrast at the phonemic level. As is widely attested cross-linguistically, nasal consonants can be lost historically while preserving the nasal feature on a preceding vowel (Hajek 1997). According to Ohala and Ohala (1991) in their discussion of Hindi, deletion of nasal consonants preceded by long vowels occurred at the historical stage of transition from Middle Indo-Aryan to New

Indo-Aryan.[29] According to discussion in Masica (1991), the Old Indo Aryan period dates back to 1500 BC to 600 BC, while Middle Indo-Aryan spans over 600 BC to 1000 AD. Modern Indo-Aryan is post 1000AD. Examples like those given in (35) below are suggestive of nasal deletion. In these examples, the origin of Saraiki words have been traced back to the Sanskritic stage as discussed in Turner (1966), where nasal consonants are present.

(35)	Saraiki	gloss	Sanskrit
a.	bʱõẽ:	'earth'	bhu:m
b.	ʈʰã:	'place'	stan > than
c.	pã:	'itching'	paman > Pr. pama
d.	ũ:	'that/he'	amu, amussa, asau, ahõ
e.	ɖʱũ:	'smoke'	dhuma

Contrary to the patterns seen in (35) however, there are many words in Saraiki which do not have a nasal consonant in their cognate Sanskritic/Prakrit forms, but which nevertheless have nasal vowels in modern dialects. We must thus assume, either another source of nasal vowels yet to be identified, or that this is simply a reflection of the expansion of nasal vowels once they had developed in the language. Some examples of such words along with their Sanskritic or Prakritic forms are given below in (36).

29 For short vowels that became nasalised, Ohala and Ohala (1991) argue that this was as a result of an intrusive nasal. Nasalisation of short vowels by contrast happened much later than that of long vowels, in the New Indo-Aryan era. (*New Indo-Aryan* rather than *Modern Indo-Aryan* is the standard term used in the literature). Although we can draw parallels between Hindi and Saraiki, because they are highly related and belong to the same language family, we cannot equate them, since, as would be expected, they end up with currently different surface forms, despite being derived from the same roots.

(36)	Saraiki	gloss	Sanskrit/Prakrit	
a.	cʰã:	‘shade’	chaja, chaa, chaya	
b.	pũ:	‘pus’	pu:ti	> Pr. pu:i[30]
c.	ɠã:	‘cow’	ɠaʊa	
d.	ɖ̪ʱã:	‘bath’	dhavati	> Pr. dhavai[31]
e.	bʱã:	‘like’	bhati	> Pr. bhai

These data show a wider trend of Sanskrit or Prakrit words, with the approximants [j] or [ʊ] in the onset of the word-final syllable, undergoing nasalisation in modern Saraiki. There may be a connection between the loss of a syllable and the addition of nasality.

Unsurprisingly, given that we have treated [ɦ] as an approximant, there is historically a close relationship between [ɦ] and nasality, which would otherwise be difficult to explain if it was categorized as a fricative. [ɦ] somehow licensed intrusive nasalisation in word-final position. In most of the words of Saraiki where [ɦ] occurs in word-final syllables, intrusive nasalisation accompanies it, as the data in (37a-b) show, triggering regressive nasal spreading to the preceding vowel. Alternatively, as in (37c-e), [ɦ] does not surface but instead nasalisation surfaces, suggesting a nasalised [ɦ] that is then deleted, but leaving its nasality behind, just like with nasal consonants.

(37)	Saraiki	gloss	Sanskrit/Prakrit
a.	/lã:ɦ̃/	‘rope’	/rassi/
b.	/kã:ɦ̃/	‘a bush’	/kasa/ ‘a kind of grass’
c.	/tã:/	‘then’	/tatha:/, /taha/
d.	/ũ:/	‘that/he’	/amu, amussa, asau/, /ahõ/
e.	/bʱũ:/	‘chaff’	/busa/ > Pr. buha > bũɦ̃ > bhu

30 It is assumed that since intervocalic /t/ was lost in the Prakrit stage, the development of this word is; Sk. *pu:ti* > Pr. *pu:i* > Sr. *pũ:* (Turner 1966).

31 We assume that the Sanskrit word *dhavati* first changed into Prakrit *dhavai* which later on lost its last syllable, and then nasality was inserted as compensation.

Substitution of [s] with [ɦ] is very common in the Indo-Aryan languages (Masica 1991), as well as being a well attested cross-linguistic sound change. The further change that the Saraiki data suggest though, is a change from [ɦ] to a nasalised [ɦ̃], implying either of the historical trajectories in (38) below.

(38) Saraiki nasalisation development with [ɦ]

a. /s/ > /ɦ/ > /ɦ̃/ > ~

b. /s/ > /ɦ/ > /nɦ / > /ɦ̃/ > ~

There are therefore words in the lexicon of Saraiki that have a word-final /ɦ̃/ that is not the result of nasal spreading, suggesting that both /ɦ/ and /ɦ̃/ are lexically specified. The two sounds are however in complementary distribution, with the lexical variant of /ɦ̃/ only occurring word-finally from its historical development, while /ɦ/ occurs in both onset and coda positions but can be the target of nasal spreading, as already discussed.[32]

CONCLUSION

In this paper, we have provided evidence that non-myopic spreading does exist, despite its rarity cross-linguistically (but see also the other cases discussed above). We have shown that non-myopic nasal spreading occurs alongside myopic nasal spreading in Saraiki, and consider this not to be accidental, but rather as a reflection of the markedness relation between the two types of processes. Myopic spreading is more unmarked and hence its wider distribution typologically, in contrast to the more marked non-myopic spreading, with the latter in a language system implying the former. We consider as crucial the whole segmental, and particularly, the laryngeal system of the language in li-

32 As /ɦ̃/ is a result of nasal spreading, whether diachronically or synchronically, we do not treat it as an independent phoneme but as an allophone of [ɦ]. This may perhaps be a contentious issue, which we leave to future investigation, but we assume that words ending in /ɦ̃/ are ones where the change did not progress further to leave only nasalisation. Needless to say, a fuller exposition of the development of nasals in Saraiki is needed, particularly given the current complexity of nasal spreading processes in modern dialects.

censing what is otherwise a rare phenomenon, and would view this as strong support of the importance of investigating whole language phonologies, while not losing sight of cross-linguistic patterns.

Our analysis of the non-myopic spreading pattern has crucially relied on enriched representations, where based on the distribution of sounds within the language system of Saraiki, nasals are best captured as involving a sub-syllabic feature which is part of a sub-structure within the phonation node. From this vantage point, nasality – on a par with tone in tone languages – is represented almost like a prosodic feature, allowing its long distance spreading pattern to find satisfactory explanation.

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DISCUSSION WITH ADAM G. MCCOLLUM

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McCollum, Adam G. 2020. discussion in: Kula, N. C. & Syed N. A. (auth.) "Non-Myopic Nasal Spreading in Saraiki". *Radical: A Journal of Phonology*, 1, 173-178.

The issue of locality has been and will almost certainly continue to be one of the cornerstones of phonological theory. Wilson's (2003, 2006) claim that unbounded feature spreading is myopic provides a point of departure for any formal analysis of harmony and feature spreading. Since one of the goals of a generative theory of linguistics is to fit the model's predictions to actual linguistic patterns, restricting the expressivity of a theory is a perennial point of discussion, and local, myopic operations are less expressive. In recent work, the expressivity of phonological patterns has been the source of much computational research from formal language theoretic perspectives (e.g. Chandlee 2014; Chandlee & Heinz 2018; Chandlee et al. 2018; Heinz 2018; Heinz & Lai 2013; Jardine 2016, 2017). This work has found that, by and large, the mapping from underlying to surface forms is decidedly simpler than the expressivity of ordered rules in SPE, which are regular in the Chomsky Hierarchy (see also Johnson 1972; Kaplan & Kay 1994). Heinz (2018) observes that Wilson's myopia generalization is effectively equivalent to the subregular class of subsequential functions. In a subsequential function, the output realization of some symbol is conditioned upon information a potentially unbounded distance in one direction, but not both. This contrasts with tonal patterns that Jardine (2016) calls *unbounded circumambient*. In *unbounded circumambient* patterns, the realization of some symbol is contingent on information a potentially unbounded distance in both directions (see also Heinz & Lai 2013 and McCollum et al. 2020 for discussion).

In derivational formalisms, if contradirectional feature spreading patterns are al-

lowed, then Wilson's claim is that the surface value of some feature [F] in some position must be dependent on either a rightward or leftward (iterative) spreading rule but not both. Additionally, the rule that affects [F] must not be able to look ahead to evaluate the viability of harmony on downstream targets. If the realization of [F] depends or multiple contradirectional rules, or a single rule that can see other potential targets, then the derivation is no longer myopic.

In constraint-based formalisms like OT and HG, constraining the input-output mapping is no simple matter. As recognized by Wilson and others (e.g. Lombardi 1999; Baković 2000), the global nature of evaluation in OT allows for more computationally complex patterns, e.g. putatively pathological patterns like *sour grapes* and *majority rules*. If Wilson's claim is right, then additional stipulations or a restructuring of the formal architecture are necessary to constrain the predicted typology of segmental feature spreading in constraint-based models. If, however, Wilson's claim is not axiomatic of segmental feature spreading, then the some proposed constraints on the grammar, like targeted constraints and Harmonic Serialism are unnecessary (Wilson 2003; McCarthy 2009). The properties of any formalism, derivational, constraint-based, or formal language theoretic in nature, are intimately connected to the issue of locality/myopia, and as a result, to the authors' claims regarding Saraiki.

In addition to the formal issues related to myopia, the empirical claim in Jardine (2016) is also significant here. Jardine claims that tonal patterns are computationally more expressive than segmental patterns. If progressive nasal spreading in Saraiki exhibits the sort of non-myopia claimed, this would suggest that any distinctions in the complexity of segmental and tonal patterns are far less salient. In fact, this claim is supported by McCollum et al. (2020), drawing on data from a number of languages that exhibit non-myopic vowel harmony. Of the patterns discussed there, all exhibit some additional, complicating properties, e.g. partial spreading in Tutrugbu and Liko (McCollum et al. 2020; Wit 2015), or trigger deletion, in Yaka (Hyman 1998). If the Saraiki pattern is consistent with the authors' interpretation, this would exemplify a more straightfor-

ward sour grapes pattern. Extant work on non-myopic feature spreading has been largely limited to vowel harmony (Hyman 1998; Wit 2015; McCollum & Essegbey 2018; Essegbey 2019; McCollum et al. 2020), although Ryan (2017:§4) discusses retroflex spreading in Sanskrit, and Stanton (2020) speculates that constraints on non-myopic nasal spreading in Gurindji produce long-distance nasal cluster dissimilation. If Saraiki exhibits the sort of non-myopic spreading attested among some vowel harmonies, then this would suggest further similarities between vowel and vowel-consonant harmonies.

Despite the theoretical significance of the proposal, I am simply not convinced that Saraiki exhibits the pattern the authors claim. My reticence stems from two sources. First, in Section 4, two types of blocking configurations are described – low-sonority segments (obstruents and liquids), and stress. In every form adduced to demonstrate progressive harmony, the trigger and target, as well as the target and blocker are segmentally adjacent. In the absence of long-distance blocking effects, the data do not definitively support Saraiki as sour grapes harmony; it is necessary to see the effect of a blocker on non-adjacent vowels and approximants. In constraint-based formalisms, if the application of nasal harmony on some segment x depends on some immediately following segment, y, then a highly-ranked constraint, *x̃y, is sufficient to block harmony regardless of harmony-driver. In a rule-based formalism, the harmony rule needs to include only the immediately following segment in the context of the rule. There is no need for parenthesis star notation or any other formal device to encode unbounded lookahead. Thus, given the data at hand, it is not possible to definitively argue that progressive spreading in Saraiki is non-myopic.

It is possible that the Saraiki pattern is non-myopic – the sort of local blocking pattern attested in the data is compatible with either a relatively simple myopic progressive nasal spreading pattern or a more expressive sour grapes pattern. In the absence of long-distance blocking, though, the data do not uniquely support a sour grapes interpretation. Further, given the strong tendency toward myopic spreading, there is little reason, given

the present evidence, to interpret the Saraiki pattern as non-myopic.

Second, in key places there is too much inconsistency (or perhaps just variation) to make the sort of generalizations offered tenable. This is distinct from the issue of interpretation just noted. As an example, if we accept Kula & Syed's claim that progressive harmony is blocked by low sonority segments (obstruents and liquids) as well as the stressed syllable, the failure of harmony on the first-syllable vowel in (21a) [mɪ.ˈlã:.ʊ̃ʌ̃ɳ] is accounted for, due to the immediately following stressed syllable. If nasalized vowels immediately before the stressed syllable are dispreferred, then the failure of progressive spreading in (21a) is straightforward.

However, the data do not demonstrate a set of clear generalizations about blocking. In (21) progressive harmony does not apply up to the stressed syllable, but in (24) it does. Observe in (24d), [mə̃.ˈʊ̃ã:.ʊ̃ʌ̃ɳ], that the first-syllable vowel is, in fact, nasalized, despite the presence of an immediately following stressed syllable. Kula & Syed suggest that the application of progressive harmony in (24) is due to a general preference for one single uninterrupted span of nasality across the word. Since there are no segmental blockers in (24), progressive harmony can apply up to the stressed syllable.

In Optimality Theoretic terms, we might conclude that a constraint against [-nasal] segments following [+nasal] segments, *[+nasal][-nasal], outranks the ban on nasalized vowels immediately before the stressed syllable, *Ṽ.ˈσ. The constraint *[+nasal][-nasal] is itself outranked by a constraint banning nasalization of vowels preceding an obstruent or liquid, *ṼT. While this sort of analysis can make sense of the examples in (21) and (24), it cannot explain the failure of harmony in (20). In (20b), [mə.ˈʊa:.ʊe:], harmony fails to apply even though no obstruents or liquids are present, making it possible to extend nasality across the entire word. The authors suggest that progressive harmony in these cases is, in some sense, parasitic on regressive harmony. In (24d) [mə̃.ˈʊ̃ã:.ʊ̃ʌ̃ɳ], the word-final nasal spreads its nasality leftward up to the stressed syllable, but in (20b) [mə.ˈʊa:.ʊe:], no such nasal trigger is present.

Problematically, there is no general reason to analyze progressive spreading as para-

sitic on regressive spreading. In (18a) [nã-ʊ̃-ẽ], progressive spreading obtains even though the word-initial segment is the trigger, precluding any possible leftward spreading. In (18b) [kəɳã-ʊ̃-ẽ], nasality spreads rightward despite the failure of leftward spreading to the unstressed initial syllable, even though the authors report that the initial vowel is nasalized in the unaffixed form [kãɳ]. From these examples we see that progressive spreading is not generally dependent on regressive spreading, which renders their interpretation of (24) questionable. Perhaps regressive spreading is only optionally blocked by the stressed syllable. This is somewhat orthogonal to the issue of non-myopia, but highlights the challenge posed by the data. In short, I simply find the analytical waters a bit too murky for much inference.

Finally, I want to make it clear that I do not question the authors out of some prior theoretical commitment. My goal is not to shoehorn the data to fit any beloved theoretical commitment of my own. My research has been working on the issue of non-myopic spreading, not to dismiss it, but to understand what it tells us about phonology. For that reason, I am immensely interested in Saraiki, but do not find sufficient evidence to come to the same conclusion as the authors.

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Faculty Publication Series 41. **McCollum**, Adam G., Eric Baković, Anna Mai, and Eric Meinhardt. 2020. Unbounded circumambient patterns in segmental phonology. *Phonology* 37: 215–255. **McCollum**, Adam G, and James **Essegbey**. 2018. Unbounded harmony is not always myopic: Evidence from Tutrugbu. In *35th West Coast Conference on Formal Linguistics*, ed. by Wm. G. Bennett, Lindsay Hracs, and Dennis Ryan Storoshenko, 251–258. Cascadilla Proceedings Project. **Ryan**, Kevin. 2017. Attenuated spreading in Sanskrit retroflex harmony. *Linguistic Inquiry* 48: 299–340. **Stanton**, Juliet. 2020. Gurindji nasal cluster dissimilation as trigger deletion. *Journal of Linguistics* 56: 157–195. **Wilson**, Colin. 2003. *Analyzing unbounded spreading with constraints: Marks, targets, and derivations*. Ms., University of California, Los Angeles. **Wilson**, Colin. 2006. Unbounded spreading is myopic. paper presented at *Current Perspectives on Phonology Workshop, Phonology Fest*. available at: https://linguistics.ucla.edu/people/wilson/Myopia2006.pdf **Wit**, Gerrit de. 2015. *Liko phonology and grammar*. Doctoral dissertation, Leiden University.

DISCUSSION WITH STEPHEN NICHOLS

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Nichols, Stephen. 2020. discussion in: Kula, N. C. & Syed N. A. (auth.) "Non-Myopic Nasal Spreading in Saraiki". *Radical: A Journal of Phonology*, 1, 179-182.

In this paper, Kula & Syed discuss newly-collected data on nasal spreading from Saraiki, an Indo-Aryan language of central Pakistan, which constitute a challenge to previous claims in the phonological literature that non-myopic nasal spreading does not exist.

The authors show that regressive nasal spreading behaves uncontroversially, propagating iteratively and myopically from right to left until a blocker (an obstruent, liquid or stress) is encountered. Progressive nasal spreading, however, is claimed to be *non*-myopic, applying in an all-or-nothing fashion, failing if a blocking segment is encountered at any point to the right of the trigger within the word, i.e. be it locally or non-locally. The authors make a strong case that this is indeed truly non-myopic and that we must therefore reconsider the wider typology of this phonological phenomenon.

There remain certain aspects to be clarified or verified by further data collection and acoustic and articulatory analysis. Nevertheless, the introduction of novel and challenging data into the debate over the nature of nasal spreading and harmony more generally is most certainly welcome.

One difficulty the authors seem to face in teasing certain issues apart – through no fault of their own, I hasten to add – is the constraints that the language imposes on testing all desirable environments, combinations of segments and prosodic and morphological structures. In this regard, it may prove a fruitful future endeavour to test unattested or unavailable forms in a follow-up nonce-word experiment with linguistically-naïve participants.

Below I provide some additional comments on the paper, some of which were also raised during the review process in one form or another.

Firstly, in §4.2, the authors ascribe the consistent contrast between oral and nasal vowels in certain verbal suffixes to a paradigm effect. As the authors themselves note, the lack of a corresponding nasal suffix /-õː/ to the oral second person plural imperative suffix /-oː/ poses potential problems for the internal consistency of such a paradigm-effect-based account. Although the authors here adopt an Element-Theoretic framework which employs monovalent features, this behaviour – along with that of those suffixes which alternate between oral or nasal segments according to context – might be explained in alternative theoretical approaches by invoking a pseudo-ternary contrast in suffix-vowel representations between [+nasal], [-nasal] and [Ønasal]. Moreover, this is plausibly easily acquired by the learner since the absence or presence of nasality is inherent for some vowels and context-dependent for others.

Note that, since it was raised during the review process, the authors have responded to this possibility in their paper in footnote 21.

Secondly, considering the examples given throughout the paper, I wonder whether, one might be able to make the argument in an alternative analysis that, in Saraiki, nasality is not able to spread from onsets alone, as long as morphological structure is taken into account. In addition, this could perhaps eliminate the restriction on progressive nasal spreading to polymorphemic items.

As far as I can tell, the only potential example of onsets triggering (progressive) nasal spreading are found in (24). However, the authors acknowledge that there is variation as to whether this first vowel is nasalised (for example, /nɪˈʊaːʊʌɳ/ may be realised as either [nĩˈʊ̃ãːʊ̃ʌ̃ɳ] or [nɪˈʊ̃ãːʊ̃ʌ̃ɳ]) and so it is possible that any nasalisation in this context may be due to coarticulation since the vowel finds itself flanked by nasal segments.

On this basis, a rough (not unproblematic) sketch of an alternative analysis follows.

There exists rhyme-internal nasal concord which occurs before resyllabification across morpheme boundaries in addition to which syllable-internal nasal concord and rhyme-to-rhyme or syllable-to-syllable nasal spreading apply after resyllabification. A nasal rhyme is able to spread nasality to the onset and a nasal rhyme or syllable to spread nasality bidirectionally unless impeded by a non-nasalisable segment in the coda or the onset. This would give progressive nasal spreading the appearance of possessing a non-myopic look-ahead ability but this would in fact be local on the level of the syllable as only the next syllable would be visible.

It will be especially interesting to see if progressive nasal spreading – in particular, in items such as [nĩˈʊ̃ãːʊ̃ʌ̃ɳ] – is phonetically gradient or phonologically categorical as this may have implications for any phonological analysis.

Following spreading, onsets would be permitted to disagree in nasality with the rhyme, which would halt regressive spreading; nasalisable onsets, however, would still be nasalised and, in such cases, nasality would propagate leftwards. Thus, we find [d̪ʱãːm] with nasalisation since [m] is found in the coda but [maː] without as [m] occurs in the onset. In the polymorphemic form [d̪ʱãːm.-ãː], nasality is able to first spread to the preceding vowel since [m] has yet to be resyllabified from the coda into the following onset. However, this could be argued against by the lack of spreading in the related example [d̪ʱəˈm-iːcaːɽ], though perhaps this is expected given the placement in this word of stress, which blocks the propagation of nasality. However, if nasality were not allowed to spread from onsets, and the [m] in [d̪ʱəˈm-iːcaɽ] was in fact in the onset before spreading, it would not be a case of sour grapes since [m] would not have been in a position to initiate spreading in the first place.

Lastly, if progressive nasal spreading from onsets in polymorphemic items is in fact possible, what would happen with forms such as /nɪʊ/ ‘bow’ or /neː/ ‘take lead’ upon suffixation? As far as I can tell, such examples are absent from the data presented in the

article.[33] Presumably, if stress were not in a position to prevent this, based on the arguments given in the paper, nasality would be expected to spread progressively if the suffix(es) lacked blockers and would – in a case of sour grapes – be prevented from spreading if the suffix(es) contained blockers? In other words, in cases of progressive nasal spreading from roots or stems to suffix, is the trigger always required to be directly adjacent to the suffix? Contrary to instances such as [niːl-aː] where progressive nasal spreading does not apply, would forms of the shape /nɪʊ-aː/ surface as [nĩʊ̃-ãː], for example?[34]

33 Certain examples in §4, e.g. (15) and (17), are similar to this except that the trigger occurs in either the coda or the nucleus. My apologies if have overlooked the relevant examples in the article.

34 That is, even if that particular word is infelicitous for non-phonological reasons – perhaps this is another case where there is an unfortunate lacuna.