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## Guttural syneresis in Tigrinya and Tigre

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The Elements  $|I,U|$  of Element Theory (Kaye et al. 1985) surface as glides  $[j,w]$  when associated to positions other than the syllabic nucleus. Glide-like behavior is predicted to occur for the third element  $|A|$ , too; yet low glides are not common cross-linguistically. In this paper, we show that in Tigre and Tigrinya, the low guttural consonants involve  $|A|$  and function like low glides. They exhibit the process of syneresis – merger with a preceding homorganic vowel in open syllables – which is otherwise typical of high glides. Furthermore, the facts argue for an economy-based view of syneresis, whereby two homorganic elements are realized in one if possible.

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## 1 Introduction

In this paper, we discuss facts from the two Ethiosemitic languages of Eritrea, Tigrinya and Tigre. The facts are relevant to the discussion of hiatus resolution and the analogy between the basic elements [I,U,A] of Element Theory (Kaye et al. 1985; Backley 2011). We propose an OCP-motivated process that we call “guttural syneresis”, which places gutturals on a par with glides. In this introduction, we explain the term syneresis and present the basic claims of Element Theory.

Syneresis and dieresis are traditional terms for the pronunciations of an underlying hiatus in one or two syllables, respectively. The terms are very much in use in studies of hiatus resolution in French (e.g. Kelly 2015; Côté 2018; and references therein). In some dialects of this language, the pronunciation of morphologically complex words with monosyllabic bases oscillates between syneresis and dieresis, when the stem ends in a high vowel and the suffix is vowel initial (1a-c).<sup>1</sup>

### (1) Syneresis and dieresis in French

		syneresis	dieresis
a.	/li-e/ ‘tie-INF’	[lje]	[lije]
	/si-ε/ ‘saw-PST.IMP.3SG’	[sje]	[sije]
b.	/lu-e/ ‘rent-INF’	[lwe]	[luwe]
	/ʒu-ε/ ‘toy-N’	[ʒwε]	[ʒuwe]
c.	/my-e/ ‘shed-INF’	[mʏe]	[myʏe]
	/ty-õ/ ‘kill-1PL’	[tʏõ]	[tyʏõ]

In French words like those in (1a-c), both syneresis and dieresis involve a glide (though more or less perceptively, depending on the high vowel). Because of this, there are two possible views of syneresis. According to one view (2a), syneresis is just a fancy Latinate name for the common hiatus resolution strategy of gliding, whereby hiatus is resolved through the gliding of the first vowel: /i/ is transformed into [j]. According to a second, more sophisticated view (2b), dieresis is a condition on syneresis: the glide is first formed to separate the two vowels and then the vowel is syncopated. Informally, one may say that the second stage in this derivation is motivated by economy: since the vowel is already expressed by the glide, it needn’t be expressed also in the preceding syllabic nucleus. In other words, the glide can stand for both itself and the preceding homorganic vowel.

### (2) Two views of syneresis

- a. /li-e/ → [lje] (gliding)
- b. /li-e/ → /lije/ (glide formation) → [lje] (“economy”)

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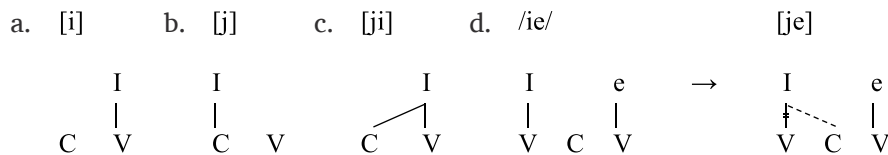
<sup>1</sup> For hiatus and its resolution strategies cross-linguistically, see Casali (2011). For an OT analysis of glide formation, see Staroverov (2014). Syneresis occurs more or less often depending on the glide (Kelly 2015).

The Ethiosemitic facts in this paper cannot be understood without the economic considerations of the second view. They thus argue for a view of syneresis as avoidance of adjacent similar, but distinct elements through the realization of both elements in one.

Most approaches to the Consonant/Vowel distinction consider that high vowels are featurally identical to their corresponding glides, the only difference being syllabification (Kaye & Lowenstamm 1984; Guerssel 1986; see also Lampitelli To appear; Levi 2011 for an overview). That is, the consensus is that the same element may be realized as a high vowel [i] or a glide [j], depending on whether it is the head of the syllabic nucleus or not (in which case it is an onset, a coda or an offglide or onglide in a diphthong).

In Element Theory (ET; Kaye et al. 1985; Backley 2011) – the approach that is adopted in this paper – all vowels and glides are combination of three basic elements: |I|, |U|, |A|. An element |I| associated to a nucleus will give [i] (3a), but when associated to a non-nucleus it surfaces as [j] (3b). A single |I| can be associated to more than one position, as in (3c). Thus, glide formation and the syneresis process can then be represented as in (3d): the element |I| spreads from a V-slot to a C-slot, and is then dissociated from the V-slot.

(3) C/V distinction in Element Theory, syneresis



It is important to clarify the following point. The ET view in (3) does *not* imply that the corresponding glides and vowels are necessarily derived from the same underlying representation. Most researchers who practice ET hold that *syllabification is lexical* (for argumentation and references see Scheer 2004: 1–4 among other places). Any of the representations in (3) can be underlying; but crucially, [j] and [i] result from the same element associated to *distinct* syllabic positions (see Backley & Nasukawa 2010 a.o.). Of course, phonological processes can alter the association of an element, thereby deriving [i] from /j/ or [j] from /i/.<sup>2</sup>

So far, we have discussed the high vowels and glides. Non-high vowels, in turn, more rarely alternate with a non-high glide; lowness (or openness), expressed in ET by the element |A|, does not have a clear non-nuclear counterpart like |I| and |U|. Indeed, |A| often stands in the way of glide formation. For instance, in French, hiatuses involving an initial high vowel often emerge with an optional glide, e.g., [tʁu(w)e] ‘make a hole’, and [tʁi(j)äg] ‘triangle’; but no glides occur

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<sup>2</sup> In this, ET differs from most approaches (e.g., Levi 2011 a.o.), which do not admit underlying syllabic structure. Such approaches then have to assume that the difference between a vowel and its corresponding glide is featural, e.g., [ $\pm$ consonantal]. Other analyses go as far as assuming that glides can be [ $\pm$ consonantal] (e.g. Hall’s 2017 analysis of Middle High German). We assert that such distinctions are not necessary in ET.

if the first vowel is non-high, e.g. [ʒeã] ‘giant’, [neõ] ‘neon’, [pei] ‘country’, [boa] ‘boa’, [noel] ‘Christmas’, [ãðʋoid] ‘android’, [æɛʋ] ‘ventilate.PRS’ or [kaid] ‘local leader’. Since in ET mid vowels involve |A|, one can conclude that the presence of |A| blocks glide formation.

That is not to say that the element |A| cannot be part of the make-up of a consonantal sound. Like |I| above, |A| can also associate to both V-slots and C-slots. An |A| associated to a C-slot is often considered to be involved in the structure of guttural consonants (e.g. Angoujard 1995). Accordingly, one expects that such low consonants should behave in a parallel way to high glides. This paper discusses one such parallel. In both Tigrinya and Tigre, sequences of a low vowel followed by a guttural consonant undergo economy-based syneresis, just like sequences of /ij, uw/. In other words, gutturals behave like glides.<sup>3</sup>

The paper is structured as follows. In section 2, we start by introducing the facts of Tigre and Tigrinya on which the paper focuses (2.1). Then we discuss the syneresis facts (2.2) and what we call opaque syneresis (2.3). Section 3 is devoted to the formal analysis: first we introduce the theoretical tools (3.1) and lay out the general principles of our analysis (3.2). We then illustrate the application of the analysis to data: we deal with epenthesis and lowering (3.3.1), trans-guttural harmony (3.3.2), and syneresis (3.3.3). Section 4 concludes the paper.

## 2 Facts of Tigre and Tigrinya

### 2.1 Generalities

Like all other Semitic languages, Tigre (e.g. Raz 1983) and Tigrinya (Leslau 1941) exhibit a templatic system, whereby verbs combine two basic ingredients: a root and a template. Roots consist of a sequence of three “radicals”, most commonly consonants.<sup>4</sup> These do not appear in a fixed syllabic structure. Instead, that structure, along with the vowels of the item (and optionally other fixed affixal material), are provided by the template (see Faust & Lampitelli 2023 for an overview, as well as the literature cited therein for additional details).

In what follows, to convey the form imposed by a template, we will use the letters Q,T,L as stand-in variables for the positions of the three radicals within the template. To illustrate both the morphological terms and our encoding of these terms, consider the Tigrinya example in (4a). The root of the verb ‘to whip’ consists of the radicals <g,r,f>. These are syllabified and vocalized depending on the template they are merged into. In the PRF, the template corresponds to QATiL. The vowel between the first two radicals is /ʌ/, and the one between the second and

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<sup>3</sup> In this context, it is interesting to mention Faust & Loiseau’s (To appear) phonological sketch of the Papuan language Tuwari. The authors submit that the pharyngeal [ʕ] occurs predictably to break up hiatuses involving non high vowels, e.g. /uea/ ‘mountain’ → [weʕa]. To be sure, next to the high vowels [i,u] one finds homorganic [j,w], e.g. /kria/ ‘fifth daughter’ → [krija].

<sup>4</sup> Quadriradical and biradical roots exist, too; see for instance Faust & Lampitelli (2023).

the third radical is /i/. Similarly, the IMPRF template is QATTiL where the second radical is geminated and the second vowel is /i/.

What distinguishes one verb from another is the radicals. That said, the vowels and the syllabic structure of the different verbal stems may change slightly from verb to verb, always as a result of the surrounding consonants. For instance, all verbs in (4) have two low vowels in the DEP.PRF stem; the vocalization <Λ/a,i> in the PRF; and gemination of the second consonant in the IMPRF, with a vocalization <Λ/a,i> (the slight deviations from these generalizations in (4d) will be explained in due course). The quality of the low vowel is influenced by the presence of an adjacent guttural – here [ʔ,ʕ,ħ] – a fact to which we return below.

(4) Tigrinya verbal stems

	DEP.PRF	PRF	IMPRF	
a.	gʌrʌf-	garif-	-garrif	‘whip’
b.	samaʕ-	samiʕ-	-sammiʕ	‘hear’
c.	ʔasar-	ʔasir-	-ʔassir	‘arrest’
d.	sahab	sihib-	-sihib	‘pull’

The vocalic systems of Tigre and Tigrinya are quite similar. In both languages, one finds six full vowel qualities [a,ʌ,i,u,e,o] and a weak vowel [i]. The latter is considered weak because it exhibits a distribution typical of an epenthetic vowel: it is only present in positions where its absence would result in a phonotactic impossibility.<sup>5</sup> For instance, the Tigre imperative is identical to the jussive form, to the exclusion of the person prefix, as (5a) illustrates. When the absence of that prefix would lead to an initial cluster, that cluster is broken by [i] (5b,c).

(5) Tigre Jussive vs. Imperative

	2-JUSS	IMP	
a.	ti-mazzin	mazzin	‘weigh’
b.	ti-fgar	fiGAR	‘leave’
c.	ti-kʔnasʕ	kʔinasʕ	‘get up’

Initial clusters are separated by the same vowel in Tigrinya (triconsonantal clusters are also banned, see section 2.3). In addition, neither language exhibits [i] in VC<sub>1</sub>-C<sub>2</sub>V, if it allows for VC<sub>1</sub>C<sub>2</sub>V.

The question whether all [i] vowels can be regarded as epenthetic is beyond the scope of this paper. Our analysis will side with the epenthetic view, e.g. Buckley (1994; 2000), Denais (1990), Berhane (1991) in a specific sense that will be elaborated upon in due course. Additionally, opinions differ regarding the underlying length of vowels other than [ʌ,i], with some scholars believing that all of them are long (Lowenstamm 1991). For Tigrinya, Buckley (1997) argues

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<sup>5</sup> For two very specific exceptions, see below.

quite convincingly that this is not the case, and all vowels are equally phonologically short. For Tigre the facts are less clear; but the question is tangential to the present purpose. There are optional lowering and rounding harmonies in Tigre (Faust 2017b), which are also mostly irrelevant for our present purpose.

As already encountered in (4) for Tigrinya, the consonantal inventories of both languages include a class of sounds known as gutturals. In both languages, that group includes two glottals [ʔ,h] and two pharyngeals [ʕ,ħ]. The guttural-induced lowering process shown in (4) for Tigrinya is true for Tigre, too. When, on the basis of a form without a guttural, one expects a vowel [ʌ] to occur either after an onset guttural or before a word-final guttural, one finds [a] instead.

Unlike other consonants, gutturals in both languages are barred from the internal coda position. For instance, on the basis of the Tigre forms in (6a), one would expect the first consonants of the JUSS verbal stem in (6b,c) to be internal codas. Instead, they are followed by the epenthetic [i] (in bold):

(6)	Tigre Perfective vs. Jussive		
	PRF-3MSG	2-JUSS	
a.	fagr-a	ti-fgʌr	‘leave’
b.	ħatʰb-a	ti-ħitʰʌb	‘wash’
c.	harb-a	ti-ħirʌb	‘flee’

Similarly, while most consonants may geminate in both languages, for the same reason that gutturals cannot be internal codas they may not geminate (the first part of a geminate is an internal coda). As mentioned, in both Tigre and Tigrinya, gutturals do occur as *final* codas, e.g. the imperative [simaʕ] ‘hear.M’ (homophonous in both languages). Notice the lowering, cf. Tigre [figʌr] in (5b).

Both languages also display “guttural transparency”, or “trans-guttural harmony”. In cases where one expects [iGV<sub>α</sub>] or [V<sub>α</sub>Gi] – where G stands for guttural and V for any vowel – one finds [V<sub>α</sub>GV<sub>α</sub>]. For example, the prefix in (7a) is vocalized with the vowel [i], but in (7b,c) it is more often than not realized with the same quality [a] as the post-guttural vowel. Compare also (7d) to (7e,f).

(7)	Trans-guttural harmony in Tigrinya				
	2-PRF		IMP		
a.	ti-garrif	‘whip’	d.	girʌf	‘whip’
b.	ta-harrid	‘slaughter’	e.	mahar	‘teach’
c.	ta-hadim	‘escape’	f.	saʔal	‘ask’

The opposite direction of harmony is illustrated by the interaction of trans-guttural harmony with the ban on internal guttural codas. For instance, the underlying form /ʔʌsmiʕ-ka/ ‘make.listen.

PRF-2MSG' surfaces as [ʔasmiʕika]: the internal coda guttural is resolved through epenthesis of a harmonized vowel.

Whenever the conditions for this harmony hold, it can, but does not have to apply (for more examples, see below). We encountered no cases in which it was impossible. The only *target* of the process is *potential* [i]; that is, all of the vowels which result from trans-guttural harmony were also pronounceable as [i]. For instance, the Tigrinya form [ʕamiʕ-u] 'he heard' cannot be pronounced [ʕamuʕu]. That said, any vowel – not only low vowels – can be the source of trans-guttural harmony. For instance, causative verbs in both languages are formed with the prefix [ʔa-], and display the vocalization <i> in the imperative and imperfective paradigms, e.g. [ʔabsil] 'cook.IMP.M'. The feminine form is [ʔabsil-i] 'cook.IMP-F'. In Tigrinya verbs with a final guttural, the quality of the suffixal vowel can optionally occur on both sides of the guttural. For example, [ʔafrih] 'frighten.IMP.M' has the feminine form [ʔafrih-i] ~ [ʔafrih-i].

Both trans-guttural harmony and the ban on coda gutturals interact with guttural syneresis in a non-trivial way. We turn to syneresis in the next section.

## 2.2 Syneresis facts

The facts from Tigre and Tigrinya exhibit a form of syneresis which specifically argues for the “economy”-based view from the introduction.

Before we turn to gutturals, consider first the facts from the inflection of 1<sup>st</sup> and 3<sup>rd</sup> persons of the two Tigrinya PRF paradigms in (8).<sup>6</sup> The forms in this paradigm always carry a suffix. The 1PL suffix is C-initial, but the other suffixes are V-initial. In the verb in (8a), which involves a regular triconsonantal root, neither suffix affects the base. In contrast, the verb in (8b) is formed using what is commonly referred to as a “weak” root, involving a final unstable element, which we will assume is the element |I|. <sup>7</sup> Consequently, the base is slightly altered depending on shape of the suffix. If the suffix is C-initial, the radical |I| merges with the /i/ vocalization into a long [i:]. Before V-initial suffixes, in turn, only the radical |I| survives in the form of a glide; the vocalization /i/ is syncopated. Slightly more abstractly, for an underlying sequence /satiI-u/, for instance, one finds [satju].

(8) Tigrinya PRF paradigms for √grf 'whip' and √stI 'drink'

a. √grf				b. √stI				
		1	3		1	3		
	SG	M	gʌrif-e	gʌrif-u	SG	M	sʌtj-e	sʌtj-u
		F		gʌrif-a		F		sʌtj-a
	PL	M	gʌrif-na	gʌrif-om	PL	M	sʌti:-na	sʌtj-om
		F		gʌrif-en		F		sʌtj-en

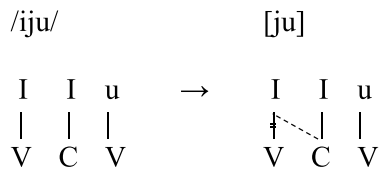
Crucially, forms like [satju] underlyingly involve two |I| elements, originating in two different morphemes: the vocalization /i/ followed by the root |I|. Unlike in the French case from the

<sup>6</sup> 2<sup>nd</sup> person forms are omitted because they present an unrelated complication, and we want to focus on the relevant facts.

<sup>7</sup> See a.o. Faust (2016; 2017a).

introduction, because of the bi-morphemic nature of the homorganic sequence, we have clear evidence that a possible sequence /ii/ or /ij/ is reduced to /j/ before a vowel. Given that /i/-deletion is not a general process, and only occurs in /iIV/ sequences, one may conclude that Tigrinya provides motivation for an economy-based view of syneresis. A vowel followed by a homorganic glide is merged with it, and only the glide survives, “standing for” both the vowel and itself:

(9) Bi-morphemic |I| syneresis



As will be claimed below, this economy-based view of syneresis paints it as a manifestation of the OCP, that is, the need to avoid adjacent similar or identical entities.

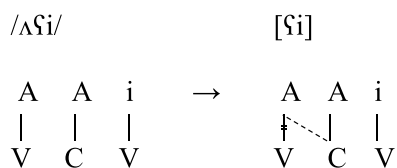
A perfectly parallel process occurs whenever a sequence /ΔG/ is found in the same environment, i.e. before a vowel (again, G = guttural). To illustrate, take the Tigrinya imperative forms in (10). The form in (10a) has a non-guttural final radical. The lexical vowel preceding it is unsyncoated when the V-initial suffix is added. In contrast, that same vowel is syncoated in the same environment when the third radical is a guttural (10b-d). The facts are identical in Tigre.

(10) /ΔGV/ => CGV in Tigrinya imperatives

	IMP.M	IMP-F	
a.	girΔf	girΔf-i	‘whip’
b.	niβaħ	niβħ-i	‘bark’
c.	simaʕ	simʕ-i	‘hear’
d.	gilah	gilħ-i	‘uncover’

It is not coincidental that /Δ/ is syncoated before a guttural in exactly the same position as /i/ is syncoated before a glide /j/. By analogy to both French and the Tigrinya facts from (8b), one may conclude that (10) is a case of “guttural syneresis”: a low vowel is syncoated before a guttural because the guttural can “stand for” both that vowel and itself. Jumping ahead a little, below we will be following the Element Theory stance according to which both gutturals and low vowels involve the element |A|. Guttural syneresis would be analogous to |I|-syneresis:

(11) Bi-morphemic |A| syneresis (to be refined below)



As in the case of the front sequence /iI/, here again the morphological origins of the two members of the fused sequence are different: /ʌ/ belongs to the stem vocalization, /ʕ/ to the root. And yet they are realized in one segment, the consonant, when possible. Indeed, their different origins are more blatant in the guttural case. While in the /j/-final case one might still want to derive the /j/ from the vocalization /i/, there is no way to derive four different guttural “glides” from one /ʌ/.<sup>8</sup>

An identical phenomenon occurs in Tigre imperfectives, though some abstraction is necessary to understand the similarity. With regular roots, this template has a medial geminate and the vocalization <ʌ,i> (12a). If the medial radical is a guttural, and only then, one finds that that the vowel /ʌ/ is syncopated. The reason lies in the abovementioned fact that gutturals cannot geminate. As a result, the underlying form of e.g. (12b) can be thought of as /-sʌʕiI/, rather than \*/-sʌʕʕiI/. This creates the sequence CʌGV, which accordingly undergoes guttural syneresis.<sup>9</sup>

(12) /CʌGV/ => CGV in Tigre imperfectives

2-IMP.M

- a. (ti-)fʌggir ‘whip’
- b. ti-sʕiI ‘ask’
- c. ti-tʕin ‘load’
- d. ti-shik ‘uncover’

Clearly, the syncope of the low vowel in these cases is a reaction to its similarity to the following consonant. Thus, both |I| and |A| synereses might be regarded as motivated by the OCP. Indeed, according to Bye (2011), merger of adjacent identical nodes – the fusion of elements in our case – is one way of satisfying the OCP.

We have been advocating for an “economic” view of syneresis, one whose logic is the avoidance of adjacent similar segments when both can be realized as one segment. In some cases, this many-to-one relation poses a problem, in that it leaves behind a phonotactically problematic situation, which must itself be repaired.

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<sup>8</sup> While the parallel is clear between (9) and (11), there is also an asymmetry between the two scenarios. In (9), syneresis applies to /i/ only before the melodically identical /j/; but in (11) it applies to /ʌ/ before any of the four gutturals, that is, before any of the four consonants containing |A| alongside other phonological primes (as we will explain below). In an ET analysis, palatal consonants like [ʃ], for instance, also contain |I|, and so one can wonder why /i/ does not syncopate before /ʃ/, too. A similar problem arises with ejectives in Tigre. As explained in Lowenstamm & Prunet (1988) and Faust (2017b), /ʌ/ is lowered into [a] by ejectives, too, suggesting that ejectives also have the element |A|. But there is never syneresis before ejectives. Presumably, there is a structural difference between ejectives and gutturals – see Bellem (2007:102–153) for how exactly this can be implemented in ET. That as it may be, the parallel between (9) and (11) is indeed not perfect, and the grammar must make reference to slightly different scenarios involving |I| and |A|.

<sup>9</sup> As shown, the prefix is optional in regular verbs, but the syncope in guttural-medial stems renders it obligatory – for a formal analysis see Faust (2015).

### 2.3 Opaque Syneresis

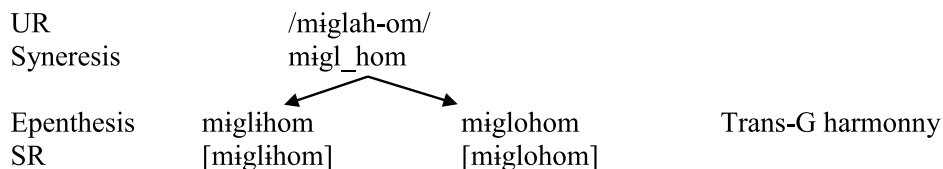
Consider the Tigrinya gerunds below and their suffixed form. As shown by the first line in (13), this form has a template miQTaL, with the low vowel /a/ as its lexical vowel. This vowel remains intact upon suffixation in regular verbs (13a). But when the last radical is a guttural (13b-d), suffixation creates a sequence /CaG-V/. Instead of giving  $CGV_{\alpha}$  as above, one finds  $CV_{\alpha}GV_{\alpha}$ , with identical vowels flanking the guttural. In these cases, an alternative form exists with [i] instead of the harmonized vowel.

(13) Action nouns in Tigrinya

	GER		GER + POSS	
a.	mi-graf	‘whipping’	mi-graf-u	‘his whipping’
b.	mi-nbaħ	‘barking’	mi-nbuħ-u ~ mi-nbiħ-u	‘his barking’
c.	mi-smaʃ	‘hearing’	mi-smeʃ-ej ~ mi-smiʃ-ej	‘my hearing’
d.	mi-glah	‘uncovering’	mi-gloh-om ~ mi-gliħ-om	‘their uncovering’

In order to understand these forms, one must first consider that the alternation site cannot be syncopated, or it will leave behind a triconsonantal cluster, e.g. /miglah-om/ => \*[migħhom]. Yet syneresis is not blocked. Rather, as in (14), it applies, and the triconsonantal cluster it creates is repaired in one of two ways, either through [i]-epenthesis rule or through trans-guttural harmony. Thus, syneresis is “blind”: it applies to the /aGV/ sequence without knowledge of the problem it causes.

(14) Action nouns in Tigrinya – opaque derivation



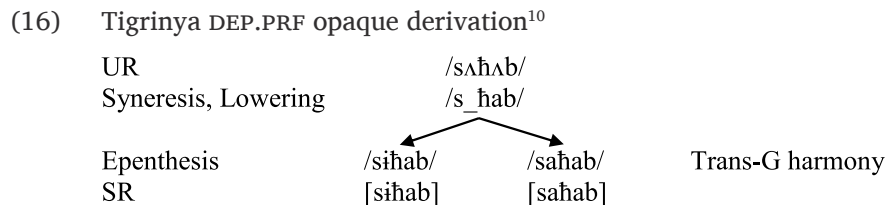
The derivation in (14) is opaque because it requires the ordering of syneresis before epenthesis/trans-guttural harmony.

Opaque syneresis is also encountered when the medial radical is a guttural. In the DEP.PRF forms of Tigrinya, the vocalic pattern is  $\Lambda$ - $\Lambda$ . Thus, the guttural is flanked by two lexical vowels as in (4d), repeated as (15d) below:

(15) Tigrinya DEP.PRF stems

	DEP.PRF	
a.	gʌrʌf-	‘whip’
b.	sʌmʌʃ-	‘hear’
c.	ʔʌsʌr-	‘arrest’
d.	sʌħab- (~ siħab-)	‘pull’

From a rule-based perspective, [saħab-] can be derived as follows. First, syneresis deletes the vowel preceding the guttural. Then epenthesis or trans-guttural harmony fill the position of that vowel, which must be filled:



The derivation in (16) can be regarded as a duke-of-York scenario: a low vowel is first deleted, and then the position gets filled with a low vowel by harmony. We will argue in the analysis in 3.3.3 below that the ordering between syneresis and epenthesis/trans-guttural harmony is not stipulated, but can be derived from general principles.

A third case of opacity involves the ban on internal guttural codas, as well as L-to-R trans-guttural harmony. The Tigrinya form /sΛmΛʕku/ ‘hear.DEP.PRF-1sg’ is realized [sΛmΛʕaku] in order to avoid an internal guttural coda. This creates the environment for guttural syneresis, which does *not* apply in this case, \*[sΛmʕaku].<sup>11</sup> The rule ordering provided above covers this fact, too. Since syneresis is positioned before the other rules, and its environment – an open syllable – is not met with in /sΛmΛʕku/, it does not apply. Later, when epenthesis or trans-guttural harmony apply to resolve the coda guttural, it is too late for syneresis to apply. It will be shown below that this case of counter-feeding opacity carries consequences for the logic that we use to motivate the ordering of operations.

In the opaque cases above, it is clear why syneresis is followed by epenthesis: syneresis gives rise to phonotactically problematic sequences. But there are also cases in which the absence of syncope is not as straightforward. The Tigrinya imperfective, like the Tigre one in (12) above, generally employs the template -QATTiL, with a medial geminate. Also like in Tigre, gutturals cannot be geminated. They are simplified in this position, and like in Tigre, the /Λ/ disappears; but unlike in Tigre, the vocalic *position* persists, displaying weak/epenthetic [i]. The same is true in the PASS-PRF, whose template is ti-QATiL.

<sup>10</sup> Lowering could also apply before syneresis, giving the same result. This detail is orthogonal to the discussion.

<sup>11</sup> The parallel form in the Tigre PRF is [samʕako] ‘I heard’. However, the unsuffixed PRF base in Tigre always lacks the second stem vowel, regardless of the identity of the final C: one finds both [samʕa] ‘he heard’ and [fagra] ‘he left’ (Raz 1980), cf. Tigrinya [sΛβΛʕΛ] ‘he broke’. The form [samʕako] ‘I heard’ is probably not underlyingly /sΛmΛʕko/ in Tigre.

- (17) Unexpected /C<sub>1</sub>GV/ => [CiGV] in Tigrinya
- |    | 2-IMPRF   |         | PASS-PRF            |         |
|----|-----------|---------|---------------------|---------|
| a. | ti-garrif | ‘whip’  | ti-garif            | ‘whip’  |
| b. | ti-sihib  | ‘pull’  | ti-sihib ~ ti-sihib | ‘pull’  |
| c. | ti-mihir  | ‘teach’ | ti-mihir ~ ti-mihir | ‘teach’ |
| d. | ti-si?il  | ‘ask’   | tisi?il ~ ti-si?il  | ‘ask’   |

The phonotactic constraints of Tigrinya do not rule out full syncope, e.g. [tishib]/[tishib] etc., as in Tigre (12); and yet, the position that is usually the target of syncope persists. Importantly, while one can conceive of an analysis with abstract, non-surface true gemination of the guttural in the IMPRF, the same view cannot account for the PASS-PRF, which does not involve gemination.

We have been arguing in this data section for a process of “guttural syneresis” in Tigre and Tigrinya, motivated by considerations of economy. The first of two similar segments belonging to two different morphs is deleted under well-defined conditions. The Tigrinya case in (17) pushes this view even further: in those cases, syneresis applies even though the position it leaves behind ends up still being realized (see some speculation on a possible reason below). In this sense, the fusion of the two similar segments is a condition for full syncope to apply, but it is independent from its actual application.

In this context, it is important to mention another phonotactically surprising effect found in Tigrinya gerunds of “Type C”. Type A gerunds have been shown in (13) above, with their template miQTaL. One is repeated in (18a). Type B verbs are characterized by medial gemination throughout their inflection. As shown in (18b), this is also the case in the gerund which, due to gemination, exhibits another vowel [i]. Verbs of Type C are characterized by a vowel [a] after the first radical throughout their inflection. One would therefore expect a gerund [miQaTaL]. Instead, one finds [miQiTaL] (18c).

- (18) Cooccurrence restriction on two low /a/s
- |    | DEP.PRF  | GER       |         |
|----|----------|-----------|---------|
| a. | garrif-Λ | mi-graf   | ‘whip’  |
| b. | baddal-Λ | mi-biddal | ‘hurt’  |
| c. | barak-Λ  | mi-birak  | ‘bless’ |

This pattern is similar to the syneresis discussed above, in that it features an interaction between two low elements. Here, too, the first of two heteromorphemic low elements is deleted. It is different from that pattern in that it holds non-locally and between two low vowels, as opposed to between a low vowel and an immediately adjacent G. At the same time, it joins the facts from (17) in exhibiting the replacement of the first element by the weak vowel [i], even though this vowel is not necessary for phonotactic reasons. Indeed, \*[mibrak] would not pose a phonotactic problem.

To summarize, based on the observations made so far, roots with gutturals are involved with the following processes:

## (19) Guttural-related processes (examples from Tigrinya unless noted)

<i>process</i>	<i>affects</i>	<i>environment</i>	<i>example</i>
a. Epenthesis	GC	G_C	/ti-ħtʰʌb/ → [ti-ħitʰʌb/]
b. Lowering to [a]	/ʌ/	G_ _G#	/ʕarif-u/ → [ʕarifu] /tismaʕ/ → [tismaʕ]
c. Trans-G Harmony	[i] <sup>12</sup>	_GV VG_C	[siħab] → [saħab] [ti-ħarrid] → [ta-ħarrid] /ʔasmiʕ-ka/ → [ʔasmiʕika]
d. Syneresis	/ʌ,a/	_GV	/ti-sʌhib/ → [ti-ʃhib] (Tigre) /mismaʕ-u/ → [mismuʕ-u] <sup>13</sup>

In the next section we present a formal analysis of these effects.

### 3 Formal Analysis

#### 3.1 Theoretical tools

As already mentioned, our analysis assumes that gutturals and vowels share a phonological prime, i.e. the Element |A|, which in ET is one of the resonance Elements. With Angoujard (1995) (see also Backley 2011:84–87; Bellem 2007), we assume the elemental make-up of gutturals in (20). The difference between pharyngeals on the one hand and laryngeals and uvulars on the other is expressed through the notion of headedness: only the former are headed by |A| (head Elements are underlined). (Nota: /χ,ʁ/ are unattested in Tigrinya and Tigre.)<sup>14,15</sup>

## (20) Representation of gutturals

[ʔ]	[h]	[ħ]	[ʕ]	[χ]	[ʁ]
x	x	x	x	x	x
<u>A</u>	A	<u>A</u>	<u>A</u>	A	A
v	v	v	v	<u>v</u>	<u>v</u>
<u>ʔ</u>		ʔ	ʔ	ʔ	ʔ
	<u>h</u>	h	h	h	h
		L		L	

<sup>12</sup> The square brackets here and in the example column convey our neutral position on whether these [i]s are sometimes, always, or never epenthetic.

<sup>13</sup> As explained in (13) and (14), this form first undergoes syneresis and then epenthesis or trans-guttural harmony.

<sup>14</sup> Accounts in ET differ regarding the use of the empty element v. This issue is irrelevant for the present purpose.

<sup>15</sup> An anonymous reviewer points out that not all researchers consider gutturals to be a natural class. For instance, Shahin (2011) argues for language-specific representations of gutturals. That said, gutturals in Tigrinya and Tigre clearly behave like a natural class with respect to lowering, transparency and syneresis.

That all gutturals contain the Element |A| is assumed in all previous treatments of Tigrinya or Tigre in ET (e.g. Lowenstamm & Prunet 1985, Faust 2017b). The same studies use the headed vs. non-headed distinction to formalize the opposition between the two low vowels: [ʌ] is the realization of non-headed |A|, whereas [a] has headed |A|:

(21) Representation of [ʌ] and [a]

[ʌ]	[a]
x	x
A	<u>A</u>
<u>v</u>	v

In order to simplify the representations, in the remainder of the paper, gutturals as well as vowels [ʌ, a] are represented solely by the element |A|; we abstract away from the other elements.

Following Backley (2011), the epenthetic vowel [i] is the phonetic realization of an empty space in the representation, i.e. absence of Elements (see also Faust 2014 for the epenthetic vowel of Tigre):

(22) Representation of the epenthetic [i]

[i]
x
—

It is important to note that, since ET is a theory of the phonological representations of segments, the mapping from underlying to surface forms may be influenced by language-specific principles. For instance, in one language, a given natural class, say coronals, may contain the element |A|, whereas the same natural class in another language contains element |I| (see Backley 2011). In this sense, ET is certainly closer to feature-based theories, such as Chomsky & Halle (1968) or Clements and Hume (1995), than to phonetics-grounded approaches to phonology such as Archangeli & Pulleyblank (1994) or Flemming (2001). Language-specific phonetics-phonology mappings are especially important for the understanding of (22), where the vowel [i] is the *phonetic* realization of an empty set – other languages realize the empty set in other ways.

Empty positions are a central tenet in Government Phonology (GP, Kaye et al. 1990; Charette 1991) and its offspring Strict CV (Lowenstamm 1996; Scheer 2004). In Strict CV, the skeletal level of representation consists of a strict iteration of CV units. Consequently, there is always an empty V-slot between two phonetically-adjacent consonants (e.g. American English [paɪ<sub>∅</sub>ri] *party*), as well as after final consonants (English [pet<sub>∅</sub>] ‘pet’). As in all currents of GP, such empty

nuclei can be subject to the lateral relation known as Proper Government (23a), in which case they are silenced due to the Empty Category Principle (ECP, 23b):<sup>16</sup>

(23) Government and ECP

a. Proper Government:

Nucleus A properly governs nucleus B iff A and B are adjacent on the nuclear projection and A is contentful.

b. Empty Category Principle:

An empty nucleus may be phonetically non-interpreted iff it is properly governed.

In other words, Proper Government allows for an empty nucleus to remain empty, and its absence calls for the insertion of non-lexical features. Licensing (Scheer & Ségéral 2001), in turn, determines whether a position can be associated to lexical features. While definitions vary, we adopt the following definition:

(24) Licensing

Licensing is a strengthening lateral force emanating from a full nucleus and targeting either its onset or the preceding nucleus. A licensed position can be associated to lexical features.

The distinction between empty V-slots on the one hand and slots with a melody on the other is crucial to our analysis: as will be shown below, it allows us to distinguish DEP.PRF [ʃarʌf] from IMP.M [ʃirʌf]. In the former, /ʌ/ is present after the guttural and lowered to [a]; in the latter, the nucleus after the guttural is empty and is therefore realized as [i].

Finally, a note must be added regarding the notion of *order of operations*. Both Strict CV and its predecessor Government Phonology are principally theories of phonological representation. They deal first and foremost with well-formed and ill-formed phonological structures. In that, the theories themselves have nothing to say about the tool of rule ordering, illustrated in (14) and (16) above; they are compatible with rule ordering. That is not to say that *proponents* of those theories do not have opinions regarding rule ordering. One such common opinion is expressed in e.g. Kaye (1992), namely that “rules apply”: operations take place whenever their environment is met, and keep taking place until there are no more ill-formedness problems to address. As Scheer (2011: 425–426) further explains, using the term “constraint” rather than “rule”:

“Constraints in Government Phonology thus apply whenever a form may be modified by them, but with no extrinsic ranking or ordering[...] the set of constraints is [...] (simultaneously and) iteratively applied to the string that is submitted to interpretation, and computation ends when no further modification can be made. [...] To use serial vocabulary, this system is thus able to handle a feeding relationship (the input for the application of a constraint is created by the modification of the input string by another constraint), but no other (i.e. bleeding,

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<sup>16</sup> The definitions in (23) are simplified versions of those found in the GP and Strict CV literature.

counter-feeding, counter-bleeding). A difference must therefore be made between serial computation as in GP and serialism as such. In the former, computation is serial in the sense that constraints may apply to the same string several times, and that intermediate steps may exist, whereas in the latter there is no extrinsic or logical ordering of instructions.”

In other words, while a feeding relation can be created by the “rules apply” stance, it is derived from this basic premise, rather than posited *ad-hoc*. In this sense, according to Kaye, rule ordering is not a tool of linguistic analysis. As we will see below, the order of operations in our analysis is on the whole compatible with this view (with a slight complication).

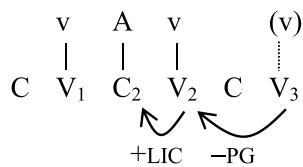
In the next section, we provide the principles that we employ to account for the Ethiosemitic data.

## 3.2 Principles of the analysis

### 3.2.1 Ban on gutturals in internal codas in Tigrinya/Tigre

The ban on gutturals in internal codas in Tigrinya/Tigre can be formalized, in Strict CV, using the notion of licensing. Gutturals need to be licensed by the following V-slot, which must be phonetically realized. Presumably, this requirement is due to an inherent weakness of gutturals; Licensing strengthens their position.<sup>17</sup> In (25), licensing occurs between  $V_2$  (the licensor) and  $C_2$  (the licensee). As will be shown below, even if the following  $V_3$  is full, and in principle may silence the licensor  $V_2$ , the latter is realized in order to support the guttural.

(25) Licensing of G word-internally



In other words, in the case of gutturals, *licensing overrides government*.<sup>18</sup>

In section 3.3, we show that the need to license gutturals word-internally can trigger epenthesis. In the next section, in turn, we show that the configuration in (25) turns out to be crucial for our analysis.

### 3.2.2 The OCP and /A+A/ sequences

Recall our analysis of |I| syneresis in Tigrinya, in (9) above: two underlying identical elements are realized in one. We attributed this to the Obligatory Contour Principle (OCP, McCarthy 1981),

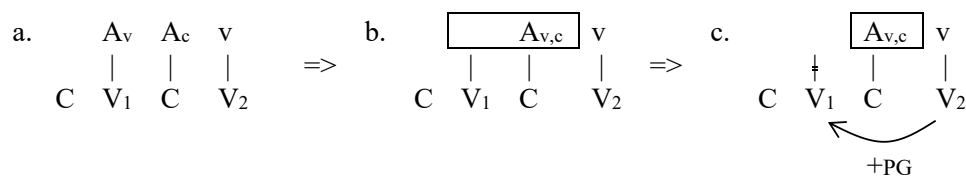
<sup>17</sup> We know of no study that defines this supposed weakness in a satisfactory matter, though see some ideas in Angoujard (1995) and Walker & Rose (2015).

<sup>18</sup> This cannot be a general principle in Strict CV. In many languages, codas – that is, Cs situated before empty V-slots – are lost or lenited. If licensing always overrode government, epenthesis would always occur to avoid this lenition.

which prohibits two adjacent, identical items; and to the possibility of multiple correspondence (Benua 1995; McCarthy 1995; Burzio 1998 a.o.), that is, the realization of two underlying segments in one surface segment – a many-to-one, UR to SR relation.

We repeat our analysis of  $|A|$ -syneresis below, this time expressing this relation with diacritics.<sup>19</sup> A sequence of two adjacent elements  $|A|$  violates the OCP (26a). The repair strategy consists of fusing the two  $|A|$ s (see the square box in (26b)). Because of this fusion, the association to  $V_1$  can be undone, as in (26c).

(26) Syneresis:  $/A_v + A_c/$

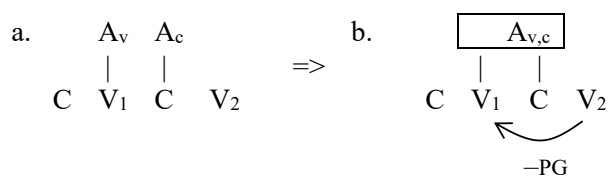


d.  $/ti-s\Lambda h\dot{i}b/ \rightarrow [ti-s\dot{h}ib]$  (Tigre) (cf. 19d)

Once again, the passage from (26b) to (26c) can be regarded as guttural syneresis, that is, the joint realization of two similar, adjacent elements. And again, in the context of Tigre and Tigrinya, it must be admitted that economy is at play: the two elements cannot be reduced to one at the underlying level, as they are heteromorphemic.

We assume that fusion always applies among two adjacent  $|A|$ s. In contrast, for dissociation to occur, two conditions must hold. The first is already shown in (26c): for a  $V$ -slot to be dissociated, it must be governed by the following nucleus. If  $A_v$  is not governed, as in (27) below, dissociation does not occur. This, we submit, is the configuration that results in Lowering, presumably due to the longer stretch of structure which the element  $A$  occupies.<sup>20</sup>

(27) Lowering:  $/A_v + A_c/$



c.  $/tisma\Lambda\dot{s}/ \rightarrow [tisma\dot{s}]$  (Tigrinya) (cf. 19b)

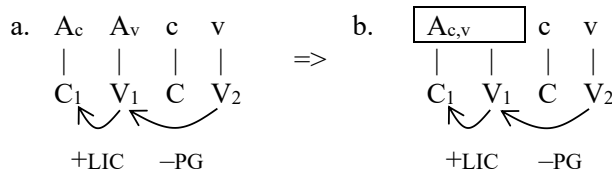
<sup>19</sup> These diacritics serve a mere descriptive goal; they have no status at the morpho-phonological level.

<sup>20</sup> It is common that longer sequences of vowels are pronounced more peripherally than short ones. For instance, Faust & Lampitelli (2020) show that in Qaraqosh Neo-Aramaic (Khan 2002), short  $/i/$  is realized  $[i]$  and long  $/i:/$  is realized  $[i:]$ . Similarly, in both Modern Hebrew and Portuguese, unstressed singleton  $/a/$  is pronounced in the region of  $[\Lambda]$ , but when two concatenated singletons unite, one hears  $[a(:)]$  (Faust 2021). For instance, Portuguese  $[k\acute{a}z\epsilon]$  ‘house’ +  $[\epsilon z\acute{u}l]$  ‘blue’ gives  $[k\acute{a}zaz\acute{u}l]$ , and Modern Hebrew  $/kav-u/$  ‘they turned off’ can be realized  $[kavu]$  or  $[k\acute{a}vu]$ , whereas  $/kaav-u/$  ‘they hurt’ can be realized  $[ka.avu]$  or  $[kavu]$ , but not  $[k\acute{a}vu]$ .

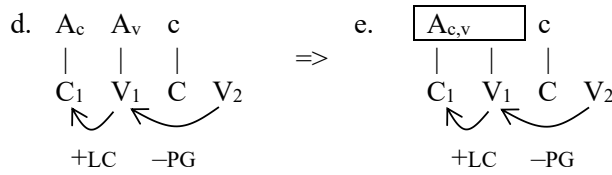
Thus, the same process – fusion – underlies both syncope and lowering.

The second condition for dissociation is that the nucleus must not be the licenser in a self-licensing domain. This configuration is encountered when the reverse order of  $|A|$ s occurs  $/A_c + A_v/$ , as in (28). The position occupied by  $|A_v|$ ,  $V_1$ , licenses the preceding  $C_1$ . After fusion occurs, a self-licensing domain is formed, whereby the fused element is its own licenser. Dissociation – that is, syncope of the vowel, or “guttural syneresis” – is blocked. Note that this occurs regardless of whether the next nucleus ( $V_2$ ) is occupied (28a,b) or not (28d,e).

(28) Lowering:  $/A_c + A_v/$



c.  $/\zeta\Delta r\text{if-u}/ \rightarrow [\zeta\text{arifu}]$  (Tigrinya) (cf. 19b)



f.  $/t\_sh\Delta b/ \rightarrow [t\text{ishab}]$  (Tigrinya)

Overall, our analysis builds, on the one hand, on the OCP, and on the other on two independently-motivated principles: government and licensing. The OCP militates in favor of avoiding surface  $A_v + A_c$  or  $A_c + A_v$  sequences, whereas government and licensing manage the association of  $A_v$  and/or  $A_c$  to the templatic slots.

Of course, the representations in this subsection are symbolic and shorthand. As (20) above shows, while gutturals all share  $|A|$ , they differ from each other in the other elements they involve; and as (21) shows, the two vowels that are the target of syneresis differ with respect to headedness. In addition, both Tigre and Tigrinya exhibit the mid vowels  $[e,o]$ , which according to ET involve the element  $|A|$ , combined with  $|I|$  and  $|U|$  respectively; but these vowels do not undergo syneresis. We assume here that under government and irrespective of its head status, an  $|A|$  element associated to a vowel can be realized in the following guttural consonant regardless of the difference between gutturals. That government is a condition on this type of syncope follows from the basic premise of Strict CV, namely that government is an inhibiting force. At the same time, if  $|A|$  is part of a more complex vocalic expression, the creation of this one-to-many,

UR-to-surface relation is blocked. Plausibly, this blocking is motivated by the presence of other elements in the vowel. If, say, /eɣ/ were to fuse, the fusion would be incomplete: only the |A| element in the mid vowel would be fused with that of the guttural.

The following sections briefly illustrate the application of the above configurations to each of the examples from Tigre and Tigrinya.

### 3.3 Application to data

In this section, we show how the analysis is applied to each of the morphological scenarios presented in section 3.2.2. Because these are technical issues of application, and our main claim in this paper is the mere existence of guttural syneresis, we chose to alleviate the paper by providing only shorthand representations of each scenario. The following shorthand symbols will be used:

(29) Symbols

- a. Empty nucleus = C\_C (underscore)
- b. Empty nucleus that must be realized = C•C (rectangular dot)
- c. Fused segments = **VC** or **CV** (shading)

The order of application of each operation follows from the GP principle “rules apply”. This is illustrated in (30). First, because a low vowel is adjacent to a guttural, it is fused in order to satisfy the OCP (and /ʌ/ is lowered to /a/). This creates the environment for Dissociation, which empties a nucleus that must be realized. That nucleus is realized either through epenthesis or through trans-guttural harmony (henceforth TGH). Crucially, at no point in the derivation is there a need to establish an arbitrary order, because the environment for each operation is always and only created by the application of another:

(30) Order of operations

	Fusion	Dissociation & Epenthesis	Realization ([i]/TGH)
a.	$\#C\Lambda GV_2 \rightarrow \#CaGV_2$	$\rightarrow \#C\bullet GV_2$	$\rightarrow \#CiGV_2 \sim \#CV_2GV_2$
b.	$\#C\_CV_2$	$\#C\_CV_2$	$\#C\bullet CV_2$

Both examples in (30) further illustrate what has been shown above, namely that Tigre and Tigrinya do not allow for initial clusters. If the first nucleus is empty, it must be subject to epenthesis.<sup>21</sup>

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<sup>21</sup> There is a standard account for such languages in Strict CV, established in Lowenstamm (1999) and Scheer (2004). These always have an initial empty CV which requires government from the first nucleus of the word.

### 3.3.1 Epenthesis and Lowering

Let us now consider examples beginning with two empty nuclei, like those of the 2-JUSS in (6) above. In (31a), we examine a form without gutturals. Fusion and lowering do not apply. The first empty nucleus is slated to be realized, but the medial one is governable and has no role to fill. It may therefore remain empty. Realization then follows through regular epenthesis. In (31b), we examine a form with a stem-initial guttural. The sole difference from (31a) concerns the medial empty nucleus which, regardless of the status of the next nucleus, must be realized in order to license the guttural. Both it and the first empty nucleus are realized through epenthesis.

(31) Epenthesis

	a.	t_-f_gAr_	b.	t_-h_tAb_
Fusion		t_-f_gAr_		t_-h_tAb_
Dissociation		t_-f_gAr_		t_-h_tAb_
Epenthesis		t•-f_gAr_		t•-h•tAb_
Realization [i]/TGH		ti-f_gAr_		ti-hitAb_
		[tifgAr]		[tihitAb]

In (32) we examine lowering in the same template with a stem-final guttural (32a) and a stem-medial one (32b,c). With respect to epenthesis, both behave like (31a). However, both are also subject to fusion, because they involve a guttural adjacent to a low vowel /ʌ/; and therefore, both result in the concomitant lowering of the stem vowel. Neither case of fusion results in Dissociation: in (32a,b) the relevant nucleus is not governed, since the following nucleus is empty; and in (32c), while the position of /ʌ/ is governed, the fused domain is a self-licensing domain.

(32) Epenthesis and Lowering

	a.	t_-s_mʌʃ_	b.	t_-s_hʌb_	c.	t_-s_hʌb-i
Fusion		t_-s_mʌʃ_		t_-s_hʌb_		t_-s_hʌb-i
Dissociation		t_-s_mʌʃ_		t_-s_hʌb_		t_-s_hʌb-i
Epenthesis		t•-s_mʌʃ_		t•-s_hʌb_		t•-s_hʌb-i
Realization [i]/TGH		ti-s_mʌʃ_		ti-s_hʌb_		ti-s_hʌb-i
		[tismaʃ]		[tishab]		[tishabi]

One may wonder why the final guttural in (32a), unlike word-medial gutturals, does not require licensing. We will not have much to say about this question. It is well-known that final codas behave differently from medial ones, and that is a problem for any approach. Strict CV (like all other currents of GP) is especially equipped to deal with such asymmetries, because phonetically-final C's are in fact followed by empty V-slots. It has been proposed (e.g. Scheer & Ziková 2010) that these final empty nuclei have licensing potential, even when they may not govern.

Although a relevant example was already encountered in (31), it is important to emphasize that the presence of a guttural is not, by itself, a sufficient condition for lowering to apply to a following nucleus. That nucleus must be underlyingly associated to an /Λ/, such that fusion can apply to it. To illustrate, compare the IMP /ʕ\_rΛf/ → [ʕirΛf] and DEP.PRF /ʕΛrΛf-/ → [ʕarΛf]. The derivations of these two forms are provided in (33).

(33)	[ʕirΛf] vs. [ʕarΛf]		
		a.	ʕ_rΛf_
		b.	ʕΛrΛf_
	Fusion		ʕ_rΛf_      ʕarΛf_
	Dissociation		ʕ_rΛf_      ʕarΛf_
	Epenthesis		ʕ•rΛf_      ʕarΛf_
	Realization [i]/TGH		ʕirΛf_      ʕarΛf_
			[ʕirΛf]      [ʕarΛf]

Before we move to syneresis, a short excursion is due regarding the third phenomenon from (19) above, trans-guttural harmony.

### 3.3.2 Trans-guttural harmony

We will not have much to say in this paper about the logic behind trans-guttural harmony, also known as guttural transparency. Still, it is important to note what has been said.

Walker & Rose (2015), henceforth W&R, is an important crosslinguistic study of the topic.<sup>22</sup> W&R point to three generalizations that any account must express. First, in some languages – like Tigrinya – trans-consonantal harmony is restricted to gutturals; second, pharyngeals and laryngeals can behave differently; and third, trans-guttural harmony may lower the vowels on both sides of the guttural (unlike in Tigrinya, where /CGi/ is realizable as [CiGi]). They survey preceding work, arguing against such ideas as “guttural” being the least marked place of articulation (Lombardi 2002) or the affected vowel being “intrusive” (Hall 2006). A third view, represented by Rose (1996), is one which assumes that gutturals lack some aspect of the feature geometric structure, such that one vowel may affect another through them. This view, W&R claim, is incompatible with gutturals sometimes lowering adjacent vowels.

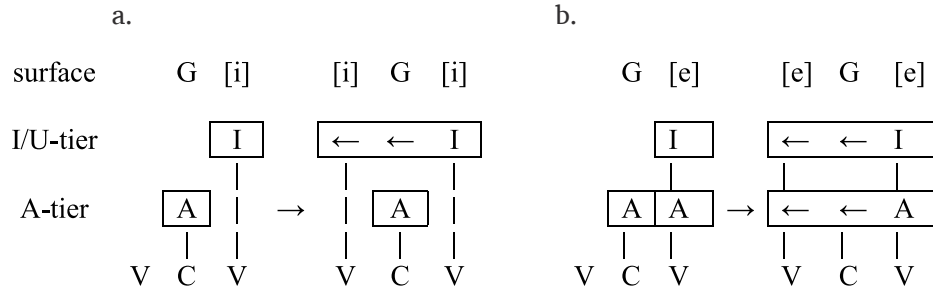
Angoujard (1995) is not reviewed by W&R, but presents a similar view to Rose (1996). It is important to mention here as it also adopts Element Theory, and argues that trans-guttural harmony follows from the basic tenet of this theory. For Kaye et al. (1985), the element |A| is placed on a different tier than |I,U|. Thus, a consonant with only this vocalic element cannot stand in the way of |I| or |U| spreading (34a). Presumably, when [e,a,o] spread across a guttural

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<sup>22</sup> Unfortunately, the study has not been published and is available only in the form of a conference handout.

(34b), there is a fusion of the |A| tier of all three positions (Angoujard does not discuss such cases).

(34) Trans-guttural harmony in ET



While Angoujard’s assertion makes general sense, it is extremely underdeveloped in the context of the larger theory. In ET, other consonants are also composed of elements like |U, I, A|. By the logic in (34), a consonant with no element |A|, e.g. fricative [f], would be transparent to |A|-spreading just as [ħ] is transparent to |I|-spreading. This prediction is not borne out crosslinguistically.

Back to W&R, these authors adopt a more phonetically-grounded approach, and relate the phenomenon to vowel harmony in general. First, it is assumed that harmony is driven by a constraint  $*V_{\alpha}CV_{\beta}$ . Then, following Esling (2005), gutturals are designated as belonging to “the laryngeal vocal tract” whereas other consonants belong to “the oral vocal tract”. It is proposed that there is a constraint against transparent oral consonants, as well as one against any transparent consonant; but there is no constraint against transparent laryngeal consonants. Thus, in some languages VGV remain unprotected from the harmony constraint  $*V_{\alpha}CV_{\beta}$ . This view, which is more or less a restatement of the facts, also runs into difficulties when faced with languages in which gutturals, but not regular consonants, *block* harmony – as is the case of the rounding harmony in Tigre discussed in Faust (2017b).

That aside, it might be tempting to extend R&S’s analysis to guttural syneresis. If  $*V_{\alpha}CV_{\beta}$  is taken to designate a markedness problem, then not only harmony, but also syneresis is a solution to that problem. Concretely, a sequence / $\Delta$ Gi/ or /aGi/, problematic due to  $*V_{\alpha}CV_{\beta}$ , is resolved through syneresis [Gi], that is, the joint realization of /aG/ or / $\Delta$ G/. The same view would explain why before a word-boundary there is never guttural syneresis, e.g. /sm $\Delta$ f/ → [sim $\Delta$ f], not \*[simi $\Delta$ f]: there simply is no  $*V_{\alpha}CV_{\beta}$  problem to solve. As for the restriction of trans-guttural harmony in Tigre and Tigrinya to target [i], this can be attributed to the weakness of this vowel, which can be formalized as the lack of lexical features. A constraint of faithfulness to vocalic features can protect vowels other than [i] from undergoing harmony through a guttural.

Nevertheless, this reasoning is not without problems, either. First, since the driving force behind syneresis is taken to be a constraint against  $V_{\alpha}CV_{\beta}$ , one does not expect syneresis between identical vowels. In the Ethiosemic case at hand, /mism $\Delta$ f-a/ ‘hearing-3FSG’ is expected to

surface consistently without syneresis [mɪsmaʕa]. That syneresis [mɪsmiʕa] is an option in this case shows that the syneresis is not a repair to  $V_{\alpha}CV_{\beta}$ . Second, extending the harmony account to syneresis is clearly overshoot, in the sense that syneresis also occurs in /ijV/ sequences, and glides like /j/ are in fact one of the consonants least likely to allow for harmony; it is unlikely that they would be subject to  $*V_{\alpha}CV_{\beta}$  more than other consonants. Third, and most importantly for our present purpose, regardless of whether the link is made or not, there still needs to be an account of the restriction of guttural syneresis to low vowels.

In the next section, we offer such an account.

### 3.3.3 Syneresis

The simplest case of syneresis is repeated from (10) above in (35) below. The underlying /ʌ/ is deleted in an open syllable followed by a guttural.

(35) /ʌGV/ => CGV in Tigrinya imperatives

	IMP.M	IMP-F	
a.	gɪrʌf	gɪrʌf-i	‘whip’
b.	nɪβʌħ	nɪbħ-i	‘bark’
c.	sɪmaʕ	sɪmʕ-i	‘hear’
d.	gɪlah	gɪlh-i	‘uncover’

The derivation is given in (36). Fusion applies and lowers the vowel, which is subsequently dissociated because its position is governed. As in (31) above, the first of two initial empty nuclei is realized, and the second remains silent under government. The guttural is still highlighted as a graphic reminder of it standing in multiple correspondence to both itself and the fused low vowel, as in (26) above. (36b) further shows that syneresis applies regardless of the quality of the following vowel, and specifically when the vowel of the suffix is the FPL /-a/ just mentioned.

(36) Guttural syneresis

	a.	s_mʌʕi	b.	s_mʌʕa
Fusion		s_mʌʕi		s_mʌʕa
Dissociation		s_m ʕi		s_m ʕa
Epenthesis		s•m ʕi		s•m ʕa
Realization [i]/TGH		sim ʕi		sim ʕa
		[simʕi]		[simʕa]

We have also encountered two types of “opaque syneresis”. In the first one, an underlying low vowel disappeared under government, but its position was nevertheless realized through epenthesis or TGH. This type occurs in the first three examples in (37). In (37a), after fusion and dissociation, the dissociated position is the third in a left-aligned sequence of three empty nuclei. Such sequences must be subject to two epentheses: [C•C•C\_C] or [C•C\_C•C]. In Ethiosemitic, it is

always the second option of the two, possibly in order to avoid two [i]s in a row, \*[misimʕu]. The second /ɾ/ precedes a guttural, and is realized either through epenthesis or through TGH. (37b,c) show the similar case of the neutralization of /s\_ħʌb/ and /sʌħʌb/, both realized [saħab]. By the application of dissociation, the two URs are neutralized, and both are expected to be realizable either with epenthesis or with TGH.<sup>23</sup>

The second type of opaque syneresis involved apparent underapplication of the process after an underlying internal coda guttural. It appears in (37d). The guttural in the internal coda sees the ɾ inserted immediately after it by epenthesis, in order for it to be licensed. This occurs after fusion and dissociation, so the output form [sʌmaʕaku] looks like a counter-example to syneresis.<sup>24</sup>

(37) Opaque guttural syneresis I

	a.	m_s_maʕu	b.	s_ħʌb
Fusion		m_s_maʕu		s_ħʌb
Dissociation		m_s_m_ʕu		s_ħʌb
Epenthesis		m•s_m•ʕu		s•ħʌb
Realization [i]/TGH		mis_muʕu ~mismiʕu		saħab (~siħab)
		[mis_muʕu]~[mismiʕu]		[saħab] (~[siħab])
	c.	sʌħʌb	d.	sʌmaʕ_ku
Fusion		saħab		sʌmaʕ_ku
Dissociation		s_ħʌb		sʌmaʕ_ku
Epenthesis		s•ħʌb		sʌmaʕ•ku
Realization [i]/TGH		saħab (~siħab)		sʌmaʕaku (~sʌmaʕiku)
		[saħab](~[siħab])		[sʌmaʕaku] (~[sʌmaʕiku])

As stated, the order of rules is dictated by the “rules apply” view. However, the derivations in (37b-d) do raise an issue regarding this view. In both (37b,c), the situation created by TGH /saħab/ could be regarded as identical to the environment of application of fusion and dissociation. Since “rules apply”, the low vowel before the guttural should syncopate, and then there should be epenthesis through TGH, and then syncope of the epenthetic vowel – and the derivation would never end: /saħab/ → /s•ħab/ → /saħab/ → /s•ħab/ → /saħab/ → /s•ħab/ etc. (37d), in turn, is even worse: once TGH has applied to give /samaʕaku/, the reapplication of syncope is expected to yield \*[samʕaku], with which the derivation should end.

We can envisage several ways of overcoming this difficulty. The first is already hinted at in the use of shading in (37). If somehow the result of TGH can be regarded as different from

<sup>23</sup> In fact, TGH is generalized in cases like (37b,c); we have not encountered cases like [siħab]. But we expect them to be possible.

<sup>24</sup> Here, too, we are unaware of an alternative to TGH with [i].

a fused element A, one could specify the operation of syncope such that the result of TGH can neither trigger it nor undergo it. A related solution would be to attribute epenthesis/TGH to “phonetic implementation”, i.e. to a later stage in the production process, one which cannot feed phonology. In other words, phonology designates which nuclei have to be realized, but their realization is determined by the phonetics. Another, possibly less attractive solution is to disallow the repeated application of operations. We leave the discussion at that, since – as already mentioned – the main goal of this paper is to argue for the existence of guttural syneresis, and less so for a specific analysis thereof.<sup>25</sup>

For the sake of completeness, it is worth including an example where neither syneresis nor TGH apply. Consider the PASS-PRF-3PL form /ti-sʌmiʃ-u/ ‘they were heard’ with a third guttural radical in (38). Underlyingly, there is no illicit sequence of two |A|s, and thus no fusion and no dissociation. Therefore, the vocalic position before the guttural is not empty, and does not require filling through either epenthesis or harmony.

(38) Guttural preceded by non-low lexical vowel

	t_-sʌmiʃ-u
Fusion	t_-sʌmiʃ-u
Dissociation	t_-sʌmiʃ-u
Epenthesis	t•-sʌmiʃ-u
Realization [i]/TGH	ti-sʌmiʃ-u
	[tisʌmiʃu]

This example illustrates another possible point of difference between our account and W&R’s. In their account, the limitation of TGH to target [i] depends on the featural make up of this vowel; in ours, it follows from the nucleus otherwise realized as [i] being an empty nucleus. TGH is then mere copy-epenthesis, relatively common cross-linguistically (Faust 2024). Crucially, if our view is to be adopted, then syneresis cannot be reduced to the harmony resulting from a constraint  $*V_{\alpha}CV_{\beta}$ ; rather, syneresis is a *condition* on the application of harmony.

To further bolster this point, we return to the two surprising cases from Tigrinya where syneresis applied without the deletion of the first vowel. Instead, the vowel is replaced by [i], even though the realization of the position was not phonotactically necessary. The first case was /tisʌhib/ => [tisihib] ~ [tisihib], ‘pull.PASS.PRF’, \*[tishib], with the optional trans-guttural harmony; and the second was /mibarak/ => [mibirak] ‘blessing’, \*[mibrak], with the

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<sup>25</sup> In this context, it is worthwhile to repeat what was already stated above, namely that Strict CV/ GP is completely compatible with arbitrary rule ordering. While the “rules apply” stance features in foundational GP papers like Kaye (1992), we are unaware of any GP/ Strict CV paper that provides (theory-internal or external) motivation for it. Indeed, if enough effort were devoted to the exploration of its predictions, the problem of loops like the one described here would probably have surfaced.

co-occurrence of two heteromorphemic /a/s across a non-guttural C. As shown in (39), our analysis so far does *not* predict the realization of the underlined vowel.

(39) Opaque guttural syneresis – II

	a.	t_ <u>s</u> ahib	b.	m_ <u>b</u> arak
Fusion		t_ <u>s</u> ahib		m_ <u>b</u> arak
Dissociation		t_ <u>s</u> hib		m_ <u>b</u> rak
Epenthesis		t_• <u>s</u> hib		m_• <u>b</u> rak
Realization [i]/TGH		ti- <u>s</u> hib ~ ti- <u>s</u> hib		mi- <u>b</u> arak

At present we do not have an insightful explanation for the retention of the position. The main difference between these forms and the IMP form in (36) /s\_mʌʕi/ → [simʕi] is that in the former cases, the deleted |A| is stem-initial. Thus, one possible way to understand these forms is that of Buckley (2000), according to whom there is a group of templates in Tigrinya for which a morpheme-specific constraint can require the alignment of the stem and the syllable, ruling out for instance /tisʌhib/ => [tishib]. Tigre, for which this phenomenon is not recorded, would simply not have this morpheme-specific requirement.

Whatever the explanation for these forms may be, crucially for our purpose, it is important to note that the OCP effect holds even though the position is not deleted, and even across an intervening non-guttural consonant; this emphasizes once more the relation between syneresis and the OCP, as well as the unlikelihood of reducing guttural syneresis to harmony issues.

In (40), we summarize the effects encountered above:

(40) VG, GV, VGV sequences in Tigrinya/Tigre

A <sub>v</sub> +A <sub>c</sub>	
	±PG
	–PG
	+PG
A <sub>v</sub> :	lowering, no syneresis
A <sub>c</sub> :	licensed by final V
ex.	/t_s_mʌʕ/ → [tismaʕ]
	/s_mʌʕ-i/ → [simʕi]
	/m_s_m_ʕ-u/ → [mismʕu] ~ [mismuʕu]
A <sub>c</sub> +A <sub>v</sub>	
	±PG
A <sub>c</sub>	fusion, self-licensing
A <sub>v</sub>	lowering, no syneresis
ex.	/ʕʌrifu/ => [ʕʌrifu]

To conclude, we have argued that two adjacent |A| elements fuse in order to avoid an OCP violation. This leads to the lowering of the nucleus associated to |A|. In addition, if that nucleus is syncopatable, economy considerations lead to its syncope, as it can be realized in the consonant. This process is very similar to the syneresis familiar from French, whereby homorganic vowel-

glide sequences are reduced to the glide; except that in the Tigre and Tigrinya cases, the glides are gutturals.

## 4 Concluding remarks

Element Theory (Kaye et al & 1985; Backley 2011) builds all vocalic expressions with three elements |I,A,U|. A well-known asymmetry exists nevertheless between |I,U| on the one hand and |A| on the other: while the former often glide, cases of a glide |A| are few and far between, if attested at all. This asymmetry is not predicted by the system.

While cross-linguistically the asymmetry is undeniable, we have shown here one type of circumstance in which there is in fact a *symmetry* between |A| and the two other elements |I,U|. In the two northern Ethiosemitic Languages Tigre and Tigrinya – the only Ethiosemitic languages to have preserved gutturals – low vowels are syncopated in open syllables before these sounds, just like /i/ is syncopated before /j/. Both alternations are analogous to what in French is called “syneresis”, a technical term for a more widespread phenomenon of gliding. If so, gutturals in Tigre and Tigrinya behave on a par with glides, partially confirming the prediction of Element Theory. Possibly, the absence of guttural sounds from most languages accounts for the lack of more widespread effects of |A| “glides”.

Importantly, all of the cases of syneresis that we have encountered involved homorganic adjacent elements that are heteromorphemic. In that, they support an economy-based view of syneresis, whereby first the two elements merge, and then they are both realized in the consonant.

It remains to be seen what other parallels can be drawn between gutturals and glides. One place to look is those languages, like Modern Hebrew or Gurage languages, where gutturals have been lost, leaving behind a vowel [a].

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## Abbreviations

1 = First person, 2 = Second person, 3 = Third person, DEP.PRF = dependent perfective, DEP.IMPRF = dependent imperfective, F = feminine, GER = gerund, JUSS = jussive, INF = infinitive, IMP = imperative, IMPRF = imperfective, LIC = licensing, M = masculine, PASS = passive, PG = proper government, PL = plural, POSS = possessive, PRF = perfective, PST = past, SG = singular, SR = surface representation, TGH = trans-guttural harmony, UR = underlying representation.

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## Competing interests

The authors have no competing interests to declare.

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