# UC San Diego
## UC San Diego Electronic Theses and Dissertations

**Title**

Tonal Dimensions of Morphological Complexity

**Permalink**

https://escholarship.org/uc/item/0h93p87m

**Author**

Kaldhol, Nina Hagen

**Publication Date**

2024

**Supplemental Material**

https://escholarship.org/uc/item/0h93p87m#supplemental

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA SAN DIEGO

**Tonal Dimensions of Morphological Complexity**

A dissertation submitted in partial satisfaction of the
requirements for the degree
Doctor of Philosophy

in

Linguistics

by

Nina Hagen Kaldhol

Committee in charge:

    Professor Sharon Rose, Chair
    Professor Farrell Ackerman, Co-Chair
    Professor Gabriela Caballero
    Professor Sarah Creel

2024

The dissertation of Nina Hagen Kaldhol is approved, and it is acceptable in quality and form for publication on microfilm and electronically.

University of California San Diego

2024

DEDICATION

For the peoples of Sudan, with the hopes of peace.

TABLE OF CONTENTS

# LIST OF ABBREVIATIONS

Abbreviations in this dissertation follow the Leipzig Glossing Rules, with the following additions.

| | | | | |
|---|---|---|---|---|
| CL | Class | | SM | Subject marker |
| CLT | Cleft | | SS | Secondary stem |
| CPL | Completive | | TEL | Telic |
| DEP | Dependent | | VEN | Ventive |
| DPC | Dependent clause marker | | II | Class II |
| FV | Final vowel | | H | High tone |
| ITV | Itive | | L | Low tone |
| OM | Object marker | | M | Mid tone |
| REC | Recent | | S | Superhigh tone |
| RTC | Root Clause | | | |

## LIST OF SUPPLEMENTAL FILES

- Kaldhol_Supplementary_Tira_nouns.xlsx

- Kaldhol_Supplementary_Tira_verbs.xlsx

LIST OF FIGURES

# LIST OF TABLES

ACKNOWLEDGEMENTS

landson, Zaya Gooding, Bianca Castueras, Alejandro Dauguet, and Paulina Fernandez-Reyna. Thank you all for participating and for being such a joy to work with!

During my time at UC San Diego, I have had the chance to work on multiple languages, and besides Himidan, I would like to thank Titus Kunda (a native speaker of Rere) as well as Fadumo Jama and Ali Osman Egeh (native speakers of Somali) for collaborating with me on uncovering various aspects of the grammar of their languages, and for helping me grow as field researcher.

One of the great things about the Department of Linguistics at UC San Diego is the amount of people working on tone systems in a diverse set of languages spoken across the world. For inspiring discussions on various exciting tonal phenomena, I would like to thank Yuan Chai, Gabriela Caballero, Claudia Duarte-Borquez, Marc Garellek, Justin McIntosh, Neşe Demir Nalcı, Michael Obiri-Yeboah, Sharon Rose, Anthony Struthers-Young, and Michelle Yuan.

A number of professors at UC San Diego has contributed to my academic development in various ways without actually being on my committee, and I am grateful for the support, training, and inspiration I have received from Will Styler, Marc Garellek, Eric Baković, Emily Clem, Michelle Yuan, and Ivano Caponigro.

Pursuing a PhD degree is much easier when you share the experience with a fun cohort, and I would like to thank Maxine Van Doren, José Armando Fernández Guerrero, Ray Huaute, and Seoyeon Jang for being the best cohort there is! I will miss our group hikes, laughs, and other adventures.

Other people that have made my time at UC San Diego great in social as well as academic ways include Rachel Miles, JJ Lim, September Cowley, Alex Rodriguez, Catherine Arnett, Olivia Griffin, Ben Lang, Matthew Zaslansky, Ebru Evcen, Kati Hout, and Adam McCollum. I will miss you all!

VITA

| | |
|---|---|
| 2024 | Ph.D. in Linguistics, University of California San Diego |
| 2017 | MPhil in Linguistics, University of Oslo |
| 2015 | BA in Linguistics, University of Oslo |

PUBLICATIONS

Kaldhol, Nina Hagen, Sharon Rose, and Mark Simmons (Accepted). "Prosody of topic and focus in Tira". Accepted to the *Proceedings of the Cross-disciplinary workshop on information structure in African languages*.

Kaldhol, Nina Hagen and Sverre Stausland Johnsen (To appear). "There is no 'one High tone per word' rule in Somali". In Köhnlein and Iosad (eds.): *Synchronic and diachronic aspects of tonal accent*. Oxford: Oxford University Press.

Kaldhol, Nina Hagen (2024). "A Typology of Tonal Exponence". *Morphology* 34.3, pp. 321–367. https://doi.org/10.1007/s11525-024-09427-w

Johannessen, Janne Bondi, Björn Lundquist, Yulia Rodina, Eirik Tengesdal, Nina Hagen Kaldhol, Emel Türker, and Valantis Fyndanis (2024). "Cross-linguistic effects in grammatical gender assignment and predictive processing in L1 Greek, L1 Russian, and L1 Turkish speakers of Norwegian as a second language". *Second Language Research*. https://doi.org/10.1177/02676583241227709

Kaldhol, Nina Hagen (2021). "Gender and headedness in nominal compounds in Somali". In: Akinlabi, Akinbiyi, Lee Bickmore, Michael Cahill, Michael Diercks, Laura J. Downing, James Essegbey, Katie Franich, and Laura McPherson (eds.). *Celebrating 50 years of ACAL: Selected papers from the 50th Annual Conference on African Linguistics*. (Contemporary African Linguistics 7). Berlin: Language Science Press. https://doi.org/10.5281/zenodo.5578772

Kaldhol, Nina Hagen and Björn Köhnlein (2021). "North Germanic Tonal Accent is Equipollent and Metrical: Evidence from Compounding". In: Bennett, Ryan, Richard Bibbs, Mykel Loren Brinkerhoff, Max J. Kaplan, Stephanie Rich, Amanda Rysling, Nicholas Van Handel, and Maya Wax Cavallaro (eds.). *Proceedings of the Annual Meeting on Phonology 2020*. https://doi.org/10.3765/amp.v9i0.4913

Kaldhol, Nina Hagen and Sverre Stausland Johnsen (2021). "Grammaticalization in Somali and the development of morphological tone." In: Farrell, Patrick (ed.). *Proceedings of the 95th Annual Meeting of the Linguistic Society of America* 6.1. https://doi.org/10.3765/plsa.v6i1.4993

Kaldhol, Nina Hagen (2021). "Grammatical gender agreement with nominal compounds in Somali". *San Diego Linguistics Papers* 8.

Kaldhol, Nina Hagen (2017). "The Oslo Dialect of Somali: Tonal adaptations of Norwegian loanwords." Master's thesis, University of Oslo.

ABSTRACT OF THE DISSERTATION

**Tonal Dimensions of Morphological Complexity**

by

Nina Hagen Kaldhol

Doctor of Philosophy in Linguistics

University of California San Diego, 2024

Professor Sharon Rose, Chair
Professor Farrell Ackerman, Co-Chair

The overarching goal of this dissertation is to advance our understanding of linguistic tone and the role it plays in the organization of morphological systems. This topic is explored through a typological study, a case study, and a comparative study.

The first study presents a typology of tonal exponence, couched within an Abstractive Word-and-Paradigm approach to morphology. It builds on previous studies on exponence typology by extending it to the study of tone, and explores deviations from form-function isomorphism, polyfunctionality, morphomic distributions, paradigmatic layers, and inflectional class organization. It is argued that the attested diversity of

form-function mappings constitutes an empirical argument for a paradigm-based view of morphology, where the range of encoding strategies are treated as equivalent, as opposed to choosing form-function isomorphism as the theoretical 'ideal'.

The second study contributes to the documentation of tone and morphology in Tira (Heiban; Sudan), a previously understudied language. It is shown how tonal and non-tonal exponents interact in distinguishing verb forms in Tira. The system exhibits complexity of exponence in the sense that there is non-isomorphism between form and function; the meaning of the verb forms is distributed across different markers. It is argued that to understand the nature of the system, both the syntagmatic and the paradigmatic dimension needs to be addressed, and an analysis is proposed by identifying a set of implicative relations, zones of interpredictability, and principal parts.

The third study is a comparative morphological study of the West Heiban languages Tira and Moro. It presents novel data illustrating subject and object marking on verbs in Tira and compares this to previously published works on Moro and the Central Heiban languages. Based on similarities and differences across the verb systems, Moro is argued to be innovative in several areas, and a series of diachronic developments are proposed to account for these facts. It is proposed that Moro has undergone a *tonally conditioned constructional change* whereby prefixed object markers became suffixes in verb forms associated with a specific tone pattern. This shows that tone may play an active role in language change and contribute to the reorganization of constructions.

# Introduction

The overarching goal of this dissertation is to advance our understanding of linguistic tone and the role it plays in the organization of morphological systems. This topic is explored from three different angles:

- a typological study

- a case study

- a comparative study

The first study takes a birds-eye view of the topic, and explores cross-linguistic diversity in how tone is used in morphological systems across the world. The second study narrows the focus and provides a detailed analysis of one specific system, namely that of Tira (Heiban; Sudan). It shows how tonal and non-tonal exponents interact in complex ways to distinguish verb forms in this language. The third study compares the morphological systems of the two West Heiban languages Tira and Moro, proposes a set of historical developments that might have led to the synchronic systems, and discusses the role of tone in diachrony. The chapters of the dissertation are the following, with Chapter 2 providing a background on tone in Tira as a set up to Chapters 3 and 4:

- Chapter 1: A typology of tonal exponence

- Chapter 2: Tone in Tira: an overview

- Chapter 3: Dimensions of morphological complexity in the Tira verb

- Chapter 4: Tonally conditioned constructional change in West Heiban

Chapter 1 contributes to linguistic typology and morphological theory by presenting a typology of tonal exponence. Couched within an Abstractive Word-and-Paradigm approach to morphology, this study builds on previous studies on exponence typology and morphological organization by extending it to the study of tone. About half the

languages of the world have tone systems, and tone is an important dimension in the morphologies of numerous languages. Tone is therefore a necessary part of a comprehensive typology of exponence. This chapter shows that like segmental exponents, tonal exponents may be involved in a diversity of form-function mappings, but they also pose unique challenges due to their autosegmental nature. This study aims to advance our understanding of the role of tone in the organization of morphological systems by addressing deviations from form-function isomorphism, polyfunctionality, morphomic distributions, paradigmatic layers, and inflectional class organization. The broader claim made in this chapter is that the attested diversity of form-function mappings constitutes an empirical argument for a paradigm-based view of morphology, where the attested diversity is taken at face value and the range of encoding strategies are treated as equivalent, as opposed to choosing form-function isomorphism as the theoretical 'ideal'.

Chapters 2 and 3 are dedicated to the documentation and analysis of Tira, a previously understudied Heiban language spoken in the Nuba Mountains of Sudan. Chapter 2 discusses previous literature on Tira, provides background information about the Tira Language Project, and lays out an overview of the tone system, including details about lexical tone and tonological processes in the language, as a lead-in to Chapter 3. Chapter 3 documents and analyses the verb morphology of Tira. It is shown that verb forms in Tira are distinguished by a combination of tonal exponents, morphomic final vowels, prefixes and auxiliaries. The system exhibits complexity of exponence in the sense that there is non-isomorphism between form and function; the meaning of the verb forms are distributed across different markers. It does not seem to be possible to identify "main" and "subsidiary" exponents, rather, there are different pieces varying independently of each other, and each exponent taken individually has low functional value. However, the distributions of forms across inflectional classes reveal patterns

of organization that allow for inferences about inflectional class membership. Furthermore, the system is organized in a maximally discriminable way, without the need to identify classic morphemes to achieve unambiguous paradigmatic contrasts among the verb forms. It is shown that in order to understand the nature of the system, we need to take both the syntagmatic and the paradigmatic dimension into account. The broader claim made in this chapter is consequently that morphological theory needs to integrate both dimensions.

Chapter 4 is a comparative morphological study of the West Heiban languages Tira and Moro. It presents novel data illustrating subject and object marking on verbs in Tira, and compares this to previously published works on Moro and the Central Heiban languages. Based on similarities and differences across the verb systems, Moro is argued to be innovative in several areas, and a series of diachronic developments are proposed to account for these facts. It is proposed that Moro has undergone a *tonally conditioned constructional change* whereby prefixed object markers became suffixes in verb forms associated with a specific tone pattern. This chapter thus contributes to the study of tone within historical linguistics by showing that tone may play an active role in diachrony and condition morphotactic change. It further discusses broader questions about explanations in linguistics, such as the interplay between synchrony and diachrony, and the nature of cognitively realistic accounts.

Together, these chapters provide advances in our understanding of the role of tone in morphological organization. Each study investigates this topic from its own perspective, and in each case, the chapters touch on larger issues in linguistics and make broader claims. The dissertation thus contributes to linguistic theory, typology, historical linguistics, as well as the documentation of Tira, and it is my hope that it will inspire novel ways of investigating tone systems across the globe.

# Chapter 1

# A typology of tonal exponence

## 1.1  Introduction

The study of exponence typology has revealed a great diversity in the way languages encode grammatical information on words (Caballero and Harris 2012; Carroll 2022; Harris 2017; Matthews 1974/1991). From the exponence types originally proposed by Matthews (1974/1991) to the complex networks of exponence relations laid out by Carroll (2022), we know that languages vary greatly in the extent to which they exhibit *complexity of exponence*, i.e. deviations from form-function isomorphism. Carroll (2022) argues for a typological-functional approach in which exponence is conceptualized as *informativeness*, where the informativeness of a given exponent for morphosyntactic properties emerges from its distribution across a morphological paradigm. This notion of exponence as informativeness is in line with paradigmatic approaches to morphological analysis (e.g. Blevins 2016), which are concerned with how inflected word forms are embedded in relational systems. Under such an approach, the objects of study are patterns within and across paradigms of which speakers may make use, e.g. to extract information about the grammatical properties of a word form given a specific formative.

The present chapter aims to extend the study of exponence typology to the study of morphological tone, and as such, this chapter makes three key contributions: Firstly, while exponence typology (e.g. Carroll 2022) has focused largely on segmental morphology, the present chapter aims to extend this typology by tackling the unique challenges posed by suprasegmental morphology, focusing on tonal exponence specifically. About half the languages of the world have tone systems (Hyman 2011, p. 198), and tone is an important dimension in the morphologies of numerous languages (see e.g. Palancar and Léonard 2016), and therefore a necessary part of a comprehensive typology of exponence.

Secondly, the present chapter aims to advance our understanding of the typology of tone by incorporating the insights from exponence typology. A first step towards a typology of morphological tone under a paradigmatic perspective was presented by Palancar (2016). The present chapter builds on this approach by laying out a more comprehensive set of form-function mappings and interactions between tonal and non-tonal formatives. It provides a fine-grained taxonomy for language-particular as well as cross-linguistic analysis of tonal exponence, informed by recent advances in exponence typology.

Finally, the broader goal of this work is to show how the attested diversity pose a challenge for morphological theory. The chapter presents a comprehensive taxonomy of strategies for encoding grammatical information on words, and shows that none of these strategies is more or less basic or "natural" than another. The present work is thus grounded in a theoretical approach to morphology that is *paradigm-based* and *abstractive* in nature (Blevins 2006), and shows how this approach provides a unified way of capturing the attested diversity in morphological organization, without giving any single encoding strategy a special theoretical status.

### 1.1.1 An illustrative example

In this chapter, we will explore the cross-linguistic diversity in how tonal formatives may map onto meaning, either alone or in conjunction with non-tonal formatives. As a starting point, consider the Somali data in Table 1.1. Here, an acute accent *é* indicates a High tone; Low tones are left unmarked. These examples illustrate that TAM marking can be tonal (a) or segmental (b-c) or both (d-e). The examples in (d-e) show that the progressive is marked by the suffix *-ay* co-occurring with a High tone on the final mora of the stem.

**Table 1.1**: TAM marking in Somali (Cushitic; the Horn of Africa) (Personal field notes; Ali Osman Egeh, native speaker p.c.; see also Kaldhol and Stausland Johnsen 2021, p. 595)

|     | Forms of *keen* 'bring' | Morphosyntactic properties | Exponents |
|-----|-------------------------|----------------------------|-----------|
| a.  | kéen                    | imperative                 | Penultimate H |
| b.  | keen-**aa**             | present                    | *-aa* |
| c.  | keen-**ay**             | past                       | *-ay* |
| d.  | keén-**ay**-aa          | (present) progressive      | *-ay*, a H on final mora of stem |
| e.  | keén-**ay**-ay          | (past) progressive         | *-ay*, a H on final mora of stem |

To tackle these kinds of form-function mappings and more, the present chapter explores how the research in exponence typology applies to the typology of morphological tone. It will be shown that like segmental exponents, tonal exponents may be involved in a diversity of exponence relations correlative with their informativeness about morphosyntactic properties. This is illustrated with a rich typology with examples from a set of diverse languages. I show that conceptualizing morphological exponence as *informativeness* provides us with the tools for conducting more fine-grained analyses of morphological tone, both within and across languages. It allows us to analyze the role of tone in morphological organization in a *non-aprioristic* way, and demonstrate that no single exponence strategy has a special theoretical status as more 'basic' than the others.

### 1.1.2 A note on transcription conventions

The present chapter discusses data from a variety of different languages, and follows the transcription conventions used in the original sources (unless indicated otherwise). In most cases, these follow the IPA conventions of using diacritics on the

tone-bearing segment, e.g. *é* for a High tone and *è* for a Low tone. Deviations from these conventions will be commented on and explained along the way.

### 1.1.3   Outline of chapter

This chapter is organized as follows: Section 1.2 introduces exponence typology and illustrates five basic exponence types discussed in the literature, which have motivated paradigm-based and abstractive approaches to morphology, discussed in Section 1.3. Section 1.4 moves on to tonal exponence, and presents examples illustrating how tone may be involved in any of the five basic exponence types. Section 1.5 provides a more nuanced picture by discussing various types of co-exponence and overlap of information. Section 1.6 introduces the complexity that arises when there are different types of *polyfunctional exponence* and *morphomic distributions*. Section 1.7 adds another dimension of complexity to the picture, namely inflectional classes. Section 1.8 concludes.

## 1.2   Background: Exponence typology

In the tradition of Matthews (1974/1991), the term *exponence* refers to the form-function mappings that emerge from the distribution of formatives within and across morphological paradigms. The starting point for the present chapter is the five-way typology of exponence types listed in Table 1.2 (based on Matthews 1974/1991; see also Carroll 2016).[1]

---

[1]Exponence types may be discussed as mappings from function to form (e.g. Stump 2014), or from form to function; the latter is in line with the idea of exponence as informativeness (see Section 1.3.2), which is how it is conceptualized in the present chapter.

**Table 1.2**: Exponence types

| Exponence type | Form-function mapping |
| --- | --- |
| Simple exponence | one-to-one |
| Cumulative exponence | one-to-many |
| Multiple exponence | many-to-one |
| Zero exponence | zero-to-one |
| Empty exponence | one-to-zero |

The five types are diagrammed in Table 1.3, where formatives are represented with a $\mu$, and morphosyntactic properties are represented with a P. The different types will be illustrated in turn below.

**Table 1.3**: Schematic representations of exponence types (adapted from Blevins 2016, p. 53)

|  | Simple | Cumulative | Multiple | Empty | Zero |
| --- | --- | --- | --- | --- | --- |
| Properties | P | $P_1 \dots P_n$ | P | – | P |
|  | \| | \| | \| |  |  |
| Forms | $\mu$ | $\mu$ | $\mu_1 \dots \mu_n$ | $\mu$ | – |

We will begin by considering the simplest types of exponence, in which there is a one-to-one mapping between form and function—what Matthews (1974/1991) refers to as *simple exponence*. This is illustrated here with Turkish nominal morphology: as the examples in Table 1.4 show, case and number in Turkish are marked separately and in a compositional way, by dedicated suffixes (e.g. plural *-ler* and accusative *-i*).

This simple one-to-one mapping between form and function is embodied in the traditional structuralist notion of the morpheme (e.g. Bloomfield 1933). In the event that simple exponence emerges from the contrasts within a paradigm, the paradigm is organized in a "morphemic" way. However, this is only one of many possible form-function mappings attested cross-linguistically. Arkadiev and Gardani (2020) contrasts

**Table 1.4**: Simple exponence in Turkish (Data from Lewis 2001, p. 28)

| 'house' | SG | PL |
| --- | --- | --- |
| NOM | ev | ev-ler |
| ACC | ev-i | ev-ler-i |
| GEN | ev-in | ev-ler-in |
| DAT | ev-e | ev-ler-e |
| LOC | ev-de | ev-ler-de |
| ABL | ev-den | ev-ler-den |

the Turkish data in Table 1.4 with the Lithuanian data in Table 1.5 (see also Plank 1991 for a similar comparison between Turkish and Latin). In both languages, there are two number values and six case values, yielding twelve word forms in total. But unlike Turkish, Lithuanian case and number are expressed together, such that there is only one suffix per word form. For example, the suffix *-us* marks both the plural and the accusative, and this suffix cannot be segmented further. In this case, there is *cumulative exponence,* that is, a one-to-many mapping between form (e.g. *-us*) and function (e.g. plural and accusative).

**Table 1.5**: Cumulative exponence in Lithuanian (Arkadiev and Gardani 2020, p. 3)

| 'city' | SG | PL |
| --- | --- | --- |
| NOM | miest-as | miest-ai |
| ACC | miest-ą | miest-us |
| GEN | miest-o | miest-ų |
| DAT | miest-ui | miest-ams |
| LOC | miest-e | miest-uose |
| INS | miest-u | miest-ais |

The opposite of cumulative exponence is *multiple exponence* (which is the term used by contemporary authors for Matthews' *extended exponence*), which involves a many-to-one mapping between form and function. It has been defined as "the occur-rence of multiple realizations of a single feature, bundle of features, or derivational

category in more than one position in a domain” (Caballero and Harris 2012; see also Harris 2017, p. 9). An example from Archi is provided in (1). Here, there are three possessive pronouns, all showing gender agreement (class II). The first (**d**-*is* 'my') has an agreement prefix, the second (*at:o*-**r** 'yours') has an agreement suffix, and the third (**d**-*isso*-**r** 'mine') has both; this final example in (1b) is an instance of multiple exponence.

(1) Multiple exponence in Archi (Nakh-Daghestanian)

   a. **d**-is   ɬənnol   anži-liši         u<r>q'a, a   at:o-**r**?
      **II**-my wife-ABS Makhachkala-LOC left<II>   and yours.ABS-**II**
      'My wife left for Makhachkala, and yours?'

   b. A   **d**-isso-**r**      c'uru-ši.
      And **II**-mine-**II**.ABS Curib-LOC
      'Mine - for Curib.'                                 (Harris 2017, p. 3)

Multiple exponence has been controversial because it was predicted by some not to exist; for example, Halle and Marantz (1993, p. 138) claim that “there is no 'multiple exponence' of features from a single syntactic or morphological node”. Harris (2017) provides a thorough overview of the literature and on what sorts of phenomena would count as “true” multiple exponence. The main criterion she sets up for identifying convincing cases of multiple exponence is that both exponents need to be attested independently of each other (Harris 2017, pp. 17–20), as in the Archi example in (1) above. In contrast, circumfixes are typically not considered to be instances of multiple exponence, if both components of a circumfix, though not realized adjacently, always co-occur and are not attested independently of each other; Harris (2017, p. 17–20) uses the term “bipartite morpheme” for data of this kind.

The final two types of exponence discussed here involve mappings with zero. In the case of *zero exponence*, the *absence* of form is meaningful. This can be illustrated by returning to the Turkish data in Table 1.4 above. Every inflectional value except the singular and the nominative has a dedicated suffix; this means, in turn, that the *absence*

of a plural suffix *-ler* indicates that the word form is singular, and the *absence* of a case suffix indicates that the word form is nominative.

The concept of "zero morphemes", is, as Trommer puts it, "one of the ideologically most loaded subjects in theoretical morphology" (Trommer 2012, p. 326). For a discussion of 'zero markers' and 'zero exponence' in different morphological frameworks, see Blevins (2016, pp. 56–57), who argues that "the appeal to 'zeros' can be seen as a means of compensating for the rigidly syntagmatic character of the Post-Bloomfieldian model, which has no provision for any type of paradigmatic comparison or deduction" (Blevins 2016, p. 56). For the present purposes, zero exponence is conceptualized paradigmatically as resulting from contrasts between forms in the system.

*Empty exponents*, or empty morphs, are pieces of form that do not realize any morphosyntactic properties, but instead mark different types of morphological constructions. An example of this is the semantically empty linking elements found in compounds in many languages (see e.g. Bauer 2012). One example of such a language is German, for which the linking elements *-n-* and *-s-* are illustrated in Table 1.6.

**Table 1.6**: Empty exponents in German compounds (Blevins 2016, p. 54)

|            | -n-            | -s-           |
|------------|----------------|---------------|
| NOM SG     | Spinne         | Liebe         |
| NOM PL     | Spinnen        | –             |
| Compound   | Spinne**n**netz | Liebe**s**brief |
|            | 'spider (web)' | 'love (letter)' |

Blevins (2016, pp. 54–55) explains that while the *-n-* in *Spinne-n-netz* 'spider web' is formally identical to the plural *-n* in *Spinnen* 'spiders', it occurs in the compound regardless of the number inflection of the compound. The *-s-* in *Liebe-s-brief* 'love letter' is formally identical to two inflectional markers in German, but it cannot be an instance of either, because *\*Liebes* is not a possible form: first, while there is a plural marker

-s, *Liebe* is an abstract noun without a plural form (and the corresponding count noun interpretation would have a plural form in *-en*). Second, while there is a genitive marker *-s*, *Liebe* is a noun of the feminine gender, whose singular forms lack case suffixes (the genitive form is simply *Liebe*). A similar discussion is found in Bauer (2012, p. 346), who provides the example *Liebe-s-lied* 'love song' and concludes that the linking element here "is thus simply that, and cannot be related to any other inflectional form".

While the defining property of an empty exponent is that it is semantically empty, the present work focuses on cases in which such markers also satisfy a second criterion: the distribution of the markers is not conditioned by extramorphological (phonological, semantic or syntactic) factors. We therefore leave aside cases in which e.g. phonological analyses are possible, such as the augmentative syllable found in many Bantu languages that require a word or stem to be at least two syllables (e.g. Ndebele *yi-* as in *yi-dl-a* 'eat!'; Hyman, Inkelas, and Sibanda 2009, pp. 8–9).

Although linking elements and related phenomena, such as the theme vowels in Romance (see e.g. Blevins 2016, p. 53) typically are considered semantically empty, Blevins (2016, p. 55) points out that they do serve a function in the context of the system they are embedded in: for example, linking elements convey information about construction type.

The form-function mappings in Table 1.2 are not intended to form an exhaustive list; combinations of these exponence types are possible, and exponence relations can get quite complex. For this reason, *complexity of exponence* is considered a distinct dimension of morphological complexity (Anderson 2015; Arkadiev and Gardani 2020; Stump 2017), and is one of the ways in which languages exhibit cross-linguistic diversity in their organization. An illustrative case is found in the verbal morphology of Komnzo (Yam; Southern New Guinea); the example illustrated in Figure 1.1 shows the form-function mappings found in the word-form *yfathwroth* 'they hold him away'.

[2|3   PL]   >  [3   SG   MASC]   NPST   IPFV        AND

y-              fath              -wr              -o              -th
'They hold him away.'
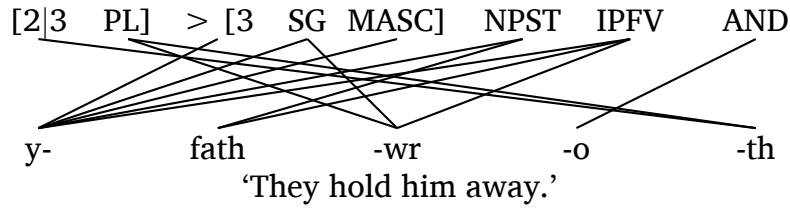
**Figure 1.1**: Complexity of exponence in Komnzo (Yam; Southern New Guinea) (figure reproduced from Döhler 2019, p. 178)

This verb form contains five formatives: *y-*, *fath*, *-wr*, *-o*, and *-th*. The only one-to-one mapping in this verb is between the form *-o* and the function andative. The other formatives are all mapped to multiple functions, and conversely, several functions (e.g., the imperfective) are marked by multiple formatives.

The degree to which languages exhibit such complexity of exponence is a parameter of cross-linguistic variation, and thus in and of itself constitutes a topic within morphological typology as well as a challenge for morphological theory across frameworks. While we could have imagined that all languages organized their words in an isomorphic way, with one-to-one mappings between forms and functions, and where stems and exponents combine in a compositional way (i.e. a "morphemic" organization), the picture that emerges when considering cross-linguistic variation is much more diverse. This diversity in morphological organization is among the empirical facts that have motived paradigm-based and abstractive approaches to morphological analysis, which will be discussed in more detail in the next section.

## 1.3   Guiding assumptions

### 1.3.1   Abstractivist Word-and-Paradigm morphology

In order to tackle the attested diversity in form-function mappings, a morphological framework is needed which is compatible with the attested non-isomorphism.

As discussed by Matthews (1974/1991), non-isomorphism is among the empirical facts which motivated a Word-and-Paradigm approach to morphology. The present chapter adopts Word-and-Paradigm in the sense of Blevins (2016). Within this framework, there is no expectation for one-to-one mappings between the formatives and the morphosyntactic properties they mark. There is still a correlation between the individual properties and the formatives, but it is not expected to be one-to-one or *morphemic* in nature, and "this looser property-form correlation is termed (MORPHOLOGICAL) EXPONENCE" (Blevins 2016, p. 52).

The one-to-one mapping of simple exponence (discussed in Section 1.2) corresponds to the structuralist concept of a "morpheme", but within the Word-and-Paradigm framework, there is nothing normative about this particular mapping (Blevins 2016, p. 53). What we see cross-linguistically is great diversity in how grammatical information is encoded on words. Instead of analyzing some encoding strategies as "deviations" from an *a priori* given morphemic or agglutinative "ideal", the Word-and-Paradigm approach provides a unified framework for the attested diversity in morphological organization.

In a Word-and-Paradigm model, *words* are the minimal meaningful elements of grammatical systems. The objects of morphological analysis are the fully inflected word forms and how they are embedded into a larger relational system. Under an *abstractive* approach to Word-and-Paradigm morphology (in the sense of Blevins 2006), stems and exponents are understood as abstractions over a lexicon of word forms which exhibit a network organization which may differ widely across languages (see e.g. Sims 2020, who demonstrates this with graph-theoretic tools). As abstractive approaches assume surface patterns as the unit of comparison, they are arguably to be preferred for linguistic typology; they allow for a *non-aprioristic* approach to morphological analysis, as there is no expectation of compositionality or a direct correspondence between forms

and functions. In this sense, an abstractive approach allows each system to be described on its own terms.

An abstractive approach to morphological analysis contrasts with *constructive* approaches, in which surface word forms are built from sub-word units, and where morphological analysis proceeds by segmenting word forms, classifying the resulting sub-word units (e.g. morphemes), and proposing rules for reassembling the word forms (see Blevins 2006, 2016 for more on the abstractive-constructive distinction). Within constructive approaches, words represent the output of morphological derivations, and therefore have no status as permanent lexical units. The derivation of a given form has no access to 'paradigmatic' information about other word forms. Thus the *relations* between full surface forms is not considered the object of study, and some even dismiss paradigms as epiphenomena (e.g. Embick and Marantz 2008).

Abstractivist paradigm-based approaches were the response to developing a general theory of exponence types for segmental exponence. The present article exploits the flexibility of this independently needed approach to suprasegmental phenomena (in conjunction with segmental phenomena). In the present chapter, inflectional paradigms are considered to be objects of linguistic analysis that allow us to explore cross-linguistic variation at the level of morphological organization (see e.g. Ackerman and Malouf 2013 for arguments and discussion). Irrespective of the informing perspective of this article, it should be recognized that any theory of tone and exponence would need to address the diversity of phenomena presented here.

### 1.3.2 Exponence as informativeness

In recent years, the foundation laid by Matthews (1974/1991) has been built on in several works on exponence typology (Caballero and Harris 2012; Carroll 2022; Harris 2017), which have advanced our understanding of the possible ways in which lan-

guages organize their morphological systems. Carroll (2022) conceptualizes exponence as the *informativeness* of a given formative for a given inflectional category (e.g. case or number), and defines this informally as "what information does a language learner or hearer have about the (grammatical) meaning of a word given this formative" (p. 6). Consider the examples in Table 1.7.

**Table 1.7**: Case marking in Archi (Nakh-Daghestanian) (Chumakina, Bond, and Corbett 2016, p. 26)

| | *baˤkʼ* 'ram' | Singular | Plural |
|---|---|---|---|
| a. | Absolutive | baˤkʼ | baˤkʼ-ur |
| b. | Ergative | beˤkʼ-iri | baˤkʼ-ur-čaj |
| c. | Genitive | beˤkʼ-iri-n | baˤkʼ-ur-če-n |
| d. | Dative | beˤkʼ-iri-s | baˤkʼ-ur-če-s |
| e. | Causal | beˤkʼ-iri-š:i | baˤkʼ-ur-če-š:i |
| f. | Comitative | beˤkʼ-iri-ɬ:u | baˤkʼ-ur-če-ɬ:u |
| g. | Comparative | beˤkʼ-iri-χur | baˤkʼ-ur-če-χur |
| h. | Partitive | beˤkʼ-iri-qˤiš | baˤkʼ-ur-če-qˤiš |
| i. | Similative | beˤkʼ-iri-qˤdi | baˤkʼ-ur-če-qˤdi |
| j. | Substitutive | beˤkʼ-iri-kɬʼena | baˤkʼ-ur-če-kɬʼena |

To illustrate the notion of informativeness, Carroll (2022, p. 10) notes that multiple formatives within a given inflected word-form in Table 1.7 may be informative for case: for example, the singular forms exhibit stem alternations, where *baˤkʼ* is found in the absolutive case, and *beˤkʼ* is found in all non-absolutive or 'oblique' case forms. The oblique singular forms are also characterized by a stem formant *-iri*, and thus both *beˤkʼ* and *-iri* provide the information that the word-form is in one of the oblique cases. There may additionally be a dedicated case marker, e.g. *-n* for the genitive.

Furthermore, the stem alternant *beˤkʼ* and the oblique stem formant *-iri* are also informative for number, as they are only found in the singular cells of the paradigm. The plural forms have two oblique stem formants: *-čaj*, which is only found in the ergative, and *-če*, which is found in the non-absolutive and non-ergative forms. In addition, there

is a dedicated plural marker *-ur,* which itself is informative for number, but not case (given that it is found in all case forms across the plural cells).

Thus the organization of Archi case paradigms shows that complexity of exponence is a type of attested morphological organization, and points to the need for paradigmatic contrast in morphological analysis. The lack of form-function isomorphism allows us to illustrate the usefulness of conceptualizing exponence in a functional way as *informativeness,* emerging from the distributions of the different formatives across the paradigm. Informativeness allows for the determining of exponence mappings unambiguously for a given language, and is therefore well suited to typological studies.

## 1.4   Tonal exponence

The study of exponence typology has taught us that "[l]anguages abound in relations between form and content that are complex in the basic sense of violating the most natural way of expressing the one by the other" (Anderson 2015). That is, form-function isomorphism is only one of many attested strategies for encoding grammatical information on words, and while our theoretical expectations may lead us to conceptualize isomorphism as more 'natural' or 'basic', an examination of the rich diversity found in natural languages reveals a far more complex situation.

Section 1.2 presented five basic exponence types, and the aim of the present section is to show the same diversity in exponence relations illustrated with tonal formatives. The present work takes inspiration from previous studies of grammatical tone that have shown that tonal morphology can do anything that non-tonal morphology can do (Hyman 2016, p. 16), e.g. mark any morphosyntactic category, such as case, number, and TAM (Monich 2020). Here, I will take a different perspective and extend this line

of inquiry to the study of exponence typology, and demonstrate that like segmental exponents, tonal exponents may be involved in a large range of form-function mappings. However, they also pose unique challenges due to their autosegmental nature (see e.g. Hyman 2011 on this point from a phonological perspective). The next subsections illustrate how tonal and non-tonal formatives may be distributed across morphological paradigms and interact in complex ways.

### 1.4.1 Phonological considerations

Before we begin our exploration of how tonal formatives map onto meaning, we will discuss aspects of their phonological realization. Let us first consider a case in which tone is a phonological property of grammatical markers. In Northern Otomi (Oto-Manguean, Mexico), tone is used to contrast different inflectional markers in the same way it is used to distinguish different lexical items; this is illustrated with the word pair in (2) and the grammatical markers *dá/da* and *gí/gi* in (3) (High tones are marked with an acute accent, Low tones are left unmarked).

(2) Tone distinguishing lexemes in Otomi (Oto-Manguean, Mexico)

    a. *'bóts'e* (H) 'religious offering' – *'bots'e* (L) 'basket, ribcage'

    b. *dó'yo* (H) 'bone' – *do'yo* (L) 'hotplate to heat tortillas'

                                                  (Palancar 2016, p. 113)

(3) Tone distinguishing grammatical markers in Otomi (Oto-Manguean, Mexico)

    a. *dá* vs. *da* (Palancar 2016, p. 113)

        i.  d**á**=tsot'e            ii.  d**a**=zot'e
            1.CPL=arrive.there        3.IRR=SS/arrive.there
            'I arrived there.'              'S/he'll arrive there.'

b. *gí* vs. *gi* (Palancar 2016, p. 113)

   i.  **gí** = tsot'e           ii.  **gi** = tsot'e
      2.INC.PL = arrive.there         2.IRR = arrive.there
      'You arrive there.'            'You'll arrive there.'

The data in (3) are not examples of tonal exponence, but rather a case where the grammatical formatives themselves have tone inherently, just as they have both a consonant and a vowel inherently. In Palancar's (2016) terminology, tone is simply a phonological property of the grammatical markers, a mechanism to keep the markers phonologically distinctive.

Tonal exponents are different from segmental exponents in that they need a host to be realized (the same is true of other subsegmental exponents, such as morphological labialization, palatalization and nasalization; see e.g. Akinlabi 2011). This host may be a stem or another segmental formative. An example of this is provided in (4): a tonal associative marker is realized on the first of two nouns in an associative construction in Central Igbo (Igboid, Nigeria).

(4)   /àgbà/ + H + /èŋwè/ → àgbá èŋwè 'jaw of monkey'

     (Hyman and Schuh 1974, p. 99)

An example of a tonal exponent associating to another grammatical marker is the High tone marking a third person possessor in Otomi: this High tone associates phonologically to the mora immediately preceding the possessed noun (Palancar 2016, p. 114). This mora may belong to a determiner, as in (5a), or a preposition, as in (5b).[2]

---

[2]The conventions of interlinear glossing are faced with a challenge when there are patterns of the kind in (5): here, I simply follow the glossing convention used by Palancar (2016). In the present chapter, starting in Section 1.4.2, I develop a different approach to capturing attested form-function mappings that is intended to do justice to the multidimensional nature of data of this kind.

(5) A tonal exponent associating to grammatical markers in Otomi (Oto-Manguean, Mexico)

 a. n**ó**=r       bötsi
  &lt;**3.POSS**&gt;DEF.SG=SG child
  'His/her/their child.' (cf. *no=r bötsi* 'the child')

 b. k**á**=r       méxá
  &lt;**3.POSS**&gt;on=SG table
  'On his/her/their table.' (cf. *ka=r méxá* 'on the table')

 (Palancar 2016, p. 114)

Tonal exponents may also co-occur with non-tonal exponents to express a single morphosyntactic function (see e.g. Rolle 2018, pp. 33–34). Consider the Hausa data in Table 1.8. Each word has a lexical tone pattern (listed to the left), but in the ventive forms (to the right), the verbs take a distinct ventive tone pattern, which is all High regardless of the noun's lexical tone. In addition, there is a ventive suffix *-óː*.

**Table 1.8**: Ventive marking in Hausa: -óː and a High tone stem pattern (Newman 2000, p. 663, transcriptions adapted)

|    |     | Lexical tone |     | Ventive |          |
| -- | --- | ------------ | --- | ------- | -------- |
| a. | LH  | fìtáː        | H   | fít-óː  | 'go out' |
| b. | HL  | fádì         | H   | fád-óː  | 'fall down' |
| c. | HLH | gángàráː     | H   | gángár-óː | 'roll down' |

In Hausa, the High tone realized over the verb is a component of the ventive marking. But in this case, tone is not the sole exponent of grammatical information, but rather, a co-exponent of it, together with the segmental form *-óː* (which itself bears a High tone). There are different ways of analyzing data of this kind depending on one's framework (see e.g. Inkelas and Zoll 2007 and Trommer 2024); from the perspective of informativeness taken here, what matters is that both the stem tone and the suffix provide the information that the verb is in the ventive form.

The Hausa example is relatively straightforward in that the information provided by the tonal formative is the same as the information provided by the segmental formative, but we return to the issue of co-exponence in Section 1.5, where I show that in such cases, multiple form-function mappings are possible.

The data discussed in the present section illustrate that we need to distinguish between tonal *association* and tonal *exponence*; while association is about the phonological mapping between tones and tone-bearing units, exponence is about how forms map onto meaning. The schematic representations in Figure 1.2 may make these different patterns clearer. These figures illustrate three different situations of a tone being phonologically associated to some segmental formative. T indicates a tonal exponent (a single tone or a tonal melody), V indicates a vowel (or any other Tone-Bearing Unit), P indicates a grammatical (e.g. morphosyntactic) property, the black lines indicate the phonological mapping between tonal and non-tonal formatives, and the thick, gray lines indicate the mapping between forms and functions. In addition, subscript indices indicate which forms (Ts and Vs) are mapped onto which functions (Ps). These figures combine the notation for form-function mappings with the tools of autosegmental phonology (Goldsmith 1976) by representing the tones on their own tier, independently of the vowels and consonants. However, unlike the typical use of autosegmental representations, this formalization is not intended as an analysis of how words can be built incrementally, but to represent the formatives of inflected word forms and how they map onto meaning.

In Figure 1.2 (a), the tonal and segmental formatives are simply a part of the same unit. In (b), the tonal exponent and its host mark different grammatical information. In (c), there is a segmental formative $V_i$ expressing property $P_i$ which has its own inherent tone $T_i$, but in addition, there is a tonal co-exponent $T_i$ realized on another host $V_j$, which itself conveys a different property $P_j$.

$$
\begin{array}{ccc}
T_i & T_j & T_i \quad T_i \\
| & | & | \quad\;\; | \\
V_i & V_i & V_i \;/\; V_j \\
| & | \;\diagdown & | \\
\text{a.} \quad P_i & \text{b.} \quad P_i \quad P_j & \text{c.} \quad P_i \quad P_j
\end{array}
$$
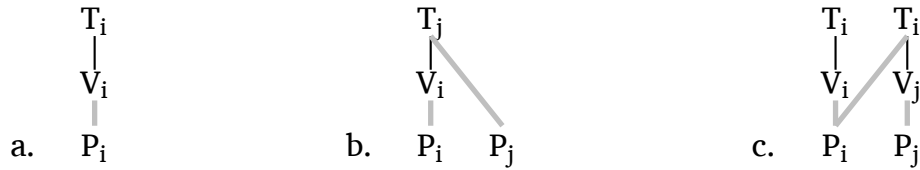
**Figure 1.2**: Tonal association. (a) Tone as a phonological property of a grammatical marker. (b) A tonal exponent realized on another exponent. (c) Tone as a co-exponent realized on another exponent.

To summarize, we need to distinguish between tonal *association* (how tones map onto form) and tonal *exponence* (how tones map onto meaning), and whether tone is the *sole exponent* of a grammatical meaning or a *co-exponent* of grammatical meaning. With this in mind, we now move on to the question of how tones may be involved in different exponence types.

## 1.4.2   Tones involved in simple exponence

As explained in Section 1.2, simple exponence refers to cases in which there is a one-to-one relationship between form and function. Locative marking in Jamsay, illustrated in Table 1.9, is an example of this type.

**Table 1.9**: Tonal locative marking in Jamsay (Dogon, Mali/Burkina Faso) (Heath 2008, p. 107)

|    | Bare stem | Tone | Locative | Tone |    |
|----|-----------|------|----------|------|----|
| a. | ká: | H | kâ: | $\widehat{\text{HL}}$ | 'mouth' |
| b. | úró | HH | úrò | HL | 'house' |
| c. | gɔ̌: | $\widehat{\text{LH}}$ | gɔ̂: | $\widehat{\text{LHL}}$ | 'granary' |
| d. | nùmó | LH | nùmô: | $\text{LH}\widehat{\text{L}}$ | 'hand' |

The bare stems in Table 1.9 have one of two lexical tone melodies, High or Low-High, spread out over either one or two syllables, yielding the four surface tone patterns H, HH, $\widehat{\text{LH}}$ and LH (where the joining bar represents a contour tone over a

single syllable). When comparing the lexical tones to the corresponding locative tone patterns, we see that there is an extra Low tone at the end of the locative forms. This Low tone is thus the exponent of the locative function.[3]

In the case of tonal alternations on stems, there are at least two ways of conceptualizing the data, depending on one's perspective. We can think of them as stem alternations, or as "tonal affixes" that are concatenated with lexical tones on a tonal tier. In some cases there are clear arguments for one analysis over the other, and in the Jamsay case, the fact that the Low tone exponent occurs on the right edge and combines with the lexical tone warrants an analysis of this marker as a tonal suffix.

From an abstractive perspective, the distinction is not as important as exponents are considered to be emergent properties of paradigmatic contrasts. However, the patterns that motivate the distinction are interesting from both a diachronic and a synchronic perspective; we would expect alternations of the kind in Table 1.9 when a tonal exponent is the result of tonal stability after the loss of an affix that also had segmental material. Whether or not speakers analyze the patterns in this way is a question for psycholinguistics, but regardless, the distinction between tonal affixes and tonal stem formants is a useful one to keep in mind for the tone analyst.

The formalization in Figure 1.3 illustrates simple exponence as exemplified by the locative form of 'hand' in Jamsay.
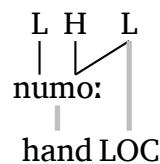


**Figure 1.3**: Simple exponence in Jamsay: L tone marking the locative

---

[3]The difference between Table 1.9 (a) and (b) can be captured as follows: in (a), there are two tones associating to one Tone-Bearing Unit (TBU), hence the resulting falling tone. In (b), there are two tones and two TBUs, and the output [H.HL] is simplified to [H.L].

The locative Low tone in Jamsay is *additive* in that it combines with the lexical tones; tonal exponents may also be *replacive* (Welmers 1973, pp. 132–133) and overwrite lexical tones. For example, the imperative forms of verbs in Hausa are formed by replacing lexical tones; this is illustrated in Table 1.10, which shows that verbs with different lexical tones (to the left) all neutralize to a Low-High tonal melody in the imperative (to the right). The Low-High melody associates to tone-bearing units from right to left, with the Low tone being multiply linked if there are more than two syllables.

**Table 1.10**: Tonal imperative marking in Hausa (Chadic) (Newman 2000, pp. 262–263,601; Newman 1986, p. 256, transcriptions adapted)

|     | Lexical tone |         | Imperative tone |         |                   |
| --- | --- | --- | --- | --- | --- |
| a.  | H   | kwá:ná  | LH  | kwà:ná  | 'spend the night' |
| b.  | HL  | tá:ʃì   | LH  | tà:ʃí   | 'get up'          |
| c.  | HLH | káràntá: | LH | kàràntá: | 'read'           |
| d.  | LHL | sùnkújà | LH  | sùnkùjá | 'bend down'       |

While the Jamsay example in Table 1.9 illustrated simple exponence with a single tone, the Hausa data in Table 1.10 illustrate a case in which the tonal formative consists of two tones (Low and High). This is still a case of a one-to-one relationship between form and function, but the form here is a tonal melody {LH} rather than a single tone (in this sense, tones are like segments: for example, the English suffix *-ity* is a single exponent although it has three segments; in the same way, the imperative LH marker in Hausa is a single tonal formative consisting of two tones). The resulting form-function mapping is illustrated in Figure 1.4.

## 1.4.3   Tones involved in cumulative exponence

Table 1.11 illustrates verbal morphology in Iau (Lakes Plain, West Papua), where each tone pattern marks two functions, and the tone patterns cannot be decomposed
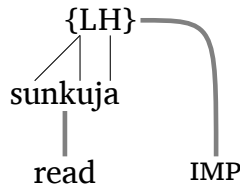
**Figure 1.4**: A {LH} melody marking the imperative in Hausa

into one tone (or tonal melody) per function. This is an example of *cumulative exponence* (e.g. Mid tone for durative and resultative). Figure 1.5 gives a representation of the resulting one-to-many mapping between form and functions.

**Table 1.11**: Tonal aspect marking in Iau (Lakes Plain, West Papua) (Data from Bateman 1990; adapted by Hyman and Leben 2020)

| 'come' | Telic | | Totality of action | | Resultative | |
|---|---|---|---|---|---|---|
| Punctual | bâ | HL | bá | H | bà̀ | LM |
| Durative | bâ̄ | HLM | bà̀ | ML | bā | M |
| Incompletive | bâ | HM | bá̋ | HS | | |
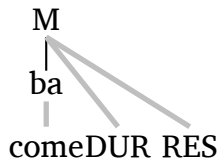


**Figure 1.5**: Cumulative exponence in Iau: M tone marking durative and resultative

Because the tone patterns in Table 1.11 cannot be decomposed further, they also provide examples of tonal melodies as single pieces of form mapping onto multiple functions. For example, {HLM} is a single tonal formative marking durative and telic. If one tentatively segments {HLM} into, say, a telic H tone and a durative LM tone, this would not make any predictions beyond this paradigm cell (while all telic forms begin in a High tone, it is not the case that all durative forms end in a LM tone). Figure 1.6 captures the resulting form-function mapping.
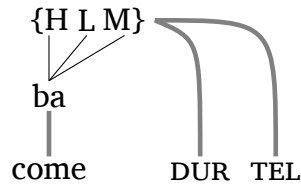
**Figure 1.6**: Cumulative exponence in Iau: a {HLM} melody marking durative and telic

Judging from the data in Bateman (1990), there is no evidence for individual morphemes, e.g. a punctual morpheme or a telic morpheme. Under the present terminology, the aspect tone patterns in Table 1.11 are thus true examples of cumulative exponence rather than fused forms.[4]

### 1.4.4   Tones involved in multiple exponence

We now turn to examples of multiple exponence. Consider the data in Table 1.12, which illustrate a subset of case marking strategies in Rere.

**Table 1.12**: Selected case marking strategies in Rere (a.k.a. Koalib; Kordofanian, Sudan) (Personal field notes; Titus Kunda, native speaker, p.c.)

|    | Nominative | Tone | Accusative | Tone | Suffix |              |
| -- | ---------- | ---- | ---------- | ---- | ------ | ------------ |
| a. | çʊ́ɲɖàŋ     | HL   | çʊ́ɲɖàŋ-á   | HL   | **-á** | 'lion'       |
| b. | líðɾì      | HL   | lìðɾì      | **LL** | none | 'thumb'      |
| c. | kwóɾtò     | HL   | kwòɾtò-á   | **LL** | **-á** | 'rich person' |

---

[4]Hyman and Leben (2020) refers to the data in Table 1.11 as *portmanteau* tonal melodies. However, when Hockett proposed the term *portmanteau morph* in his paper "Problems of Morphemic Analysis" (Hockett 1947), it was intended to capture cases in which two (or more) independently attested morphemes are realized as one form. He provided an example from French, where *à* 'to' and *le* 'the (masc.)' do not combine to *à le*, but rather the single form *au* 'to the (masc.)'. It is useful to distinguish cases like the French example *au*, in which the two exponents *à* and *le* are independently attested, from cases such as the Iau data in Table 1.11, in which there is only ever one form, but it always realizes two functions, i.e. there is cumulative exponence (see Matthews 1972, pp. 65–72 for discussion).

In Table 1.12 (a), the accusative case is marked by a suffix (which consists of a vowel and a High tone: -á), while in (b), it is marked by a tone change (HL to LL). Both types are examples of *simple exponence,* the second type involving tone only. However, in (c), both case marking strategies co-occur, an instance of *multiple exponence* (where both realizations are found within the word). The formalization in Figure 1.7 captures the resulting many-to-one mapping between form and function; here, there are two exponents that redundantly provide the information that this word form is in the accusative case.
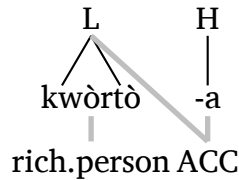


**Figure 1.7**: Multiple exponence in Rere: L tone and -á marking the accusative

To distinguish multiple exponence from other types of co-exponence, I follow Harris (2017, pp. 7–23) in using the heuristic that each exponent needs to be attested independently of each other (see also Section 1.2). While in isolation, the example in Figure 1.7 could have been analyzed as a single exponent (perhaps /-ⓛá/, where ⓛ indicates a floating Low tone that docks onto the stem and replaces the lexical tone), it is the fact that each exponent (the Low tone and the suffix -á) is attested independently of each other that makes this a case of multiple exponence.

The Rere case marking system is more complex than what is indicated here (see Quint and Allassonnière-Tang 2022), and will be returned to in section 1.6 on polyfunctionality. For the present purposes, the data in Figure 1.7 serves to illustrate an example of a many-to-one mapping between form and function within an inflected word-form. For more examples of tonal and non-tonal formatives interacting in a relationship of

multiple exponence, see Fedden (2016); Harris (2017, pp. 71–87). In Section 1.5, we will turn to other types of co-exponence.[5]

### 1.4.5 Toneless as zero exponence

As discussed in section 1.2, *zero exponence* refers to cases in which the *absence* of form is meaningful. This can be understood paradigmatically: for example, in the English word pair *cat–cats*, a paradigmatic contrast occurs in which the absence of the plural suffix *-s* in the form *cat* indicates that the word form *cat* is singular.

The present section explores a parallel between zero exponence and the concept of *tonelessness*. In a language with a tone system, there may be a difference between the number of phonetic surface tones and the number of phonological tones. For example, there are several possible analyses to consider for a system with a set of two surface tones High and Low, where the analytical choice depends on whether one or both tones are active in the phonology (i.e. being referenced by phonological rules): the phonological contrast may be one of High vs. Low (e.g. Aghem; Hyman 1987), or it may be High vs. toneless (∅) (e.g. Haya; Hyman and Byarushengo 1984), or Low vs. ∅ (e.g. Engenni; Hyman 2000). For overviews and discussion, see e.g. Hyman (2000); Yip (2002, ch. 2).

Tonelessness as a phenomenon opens up the possibility of a paradigmatic contrast between word-forms that have tones versus those that lack them altogether, in which case we can consider tonelessness as a form of zero exponence. This idea necessitates a higher level of abstraction than what is found when the paradigmatic contrast

---

[5]One question that arises is whether purely tonal multiple exponence is possible, i.e. whether there are cases in which multiple tonal exponents attested independently of each other may co-occur within the same word. I am not aware of any such examples, but that does not mean it does not exist. Some Bantu languages have TAM forms to which two High tones are assigned (e.g. the simple infinitive in Ikorovere Makua; Cheng and Kisseberth 1979). To my knowledge, however, the two High tones always co-occur and therefore would not meet the criterion set in Section 1.2, where we said that each exponent needs to be attested independently of each other to be a true case of multiple exponence.

involve the presence or absence of a segmental affix, as the absence of tone does not entail the absence of *pitch*. As Hyman points out, "it is not always clear whether the non-H tone of a two-level system should be analyzed as /L/ or /∅/. In addition, different phonologists have taken the position that there should be full specification in underlying representations" (Hyman 2009, p. 224). Furthermore, a pitch difference involved in a paradigmatic contrast is informative regardless of the phonological objects proposed by the analyst. With these caveats in mind, the goal of the present section is to explore what tonelessness as zero exponence might look like, if tonelessness is taken to exist. This will be illustrated by the case marking system of Somali (Cushitic, Horn of Africa).

Somali is analyzed as having a tone system in which the tone-bearing unit is the mora, and where moras are either High-toned (H) or toneless (∅, realized with low pitch) (Hyman 1981). Further, it is analyzed as having a case system of the type *marked nominative* (Mous 2012), in which nouns marked for the nominative case contrasts with an unmarked base form (called the *absolute case* in Cushitic studies, dating back to Moreno 1939). The examples in Table 1.13 illustrate absolute and nominative forms of four nouns; a High tone is marked by an acute accent (*á*) and the absence of tone is left unmarked.

**Table 1.13**: Case marking in Somali (Cushitic, Horn of Africa) (Adapted from Andrzejewski 1964)

|    | Absolute case (High tone) | Marked nominative (toneless, ∅) |            |
|----|---------------------------|----------------------------------|------------|
| a. | sán                       | san                              | 'nose' (M) |
| b. | más                       | mas                              | 'snake' (M) |
| c. | rún                       | run-i                            | 'truth' (F) |
| d. | láf                       | laf-i                            | 'bone' (F) |

As illustrated in Table 1.13 (a-b), a subset of nouns are toneless in the nominative form, while the absolute case form has a High tone. The data in (c-d) illustrate that a subset of nouns have a nominative suffix -*i*, demonstrating that nominative forms are marked.[6] The nominative forms in (a-b) thus exhibit the tonal equivalent of zero exponence, where the absence of tone is meaningful and marks a grammatical function. This can be formalized as in Figure 1.8; note that the ∅ symbol here simply is meant to capture the paradigmatic contrast between the absolute and nominative forms, rather than to indicate the presence of a (silent) object. The figure is meant to capture that the absence of a High tone is informative; it indicates that this word-form is in the nominative case.[7]

$$
\begin{array}{c}
\emptyset \\
\diagdown \\
\text{san} \\
| \\
\text{nose NOM}
\end{array}
$$
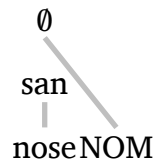
**Figure 1.8**: Toneless as zero exponence in Somali

Toneless moras in Somali are realized with low pitch, and the analysis of the Somali tone contrast as privative (High vs. ∅) rather than High vs. Low is ultimately an analytical matter rather than an empirical one; the main motivation for the privative analysis is that the whole system can be described by referring to the distribution of the High tone only (Hyman 1981); i.e., the Low tone is not involved in any phonological processes. Somali is thus ambiguous in this sense, and may be analyzed as having underlyingly toneless units that are realized with low pitch due to Low tones being

---

[6]The co-occurence of tonelessness and a suffix -*i* in Table 1.13 is not an instance of multiple exponence under Harris' (2017) heuristic, because the -*i* is not attested independently.

[7]The present work is concerned with identifying the form-function mappings that arise from paradigmatic relationships between inflected word-forms, but it is worth mentioning that a constructive analysis (in the sense of Blevins 2006) of case marking in Somali is made by Green and Lampitelli (2022). They propose a process of subtractive grammatical tone, or grammatically conditioned High tone deletion (one of the types of grammatical tone as defined by Rolle 2018, p. 2).

filled in by the phonology, in which case the surface paradigmatic contrast is between High and Low, not High and toneless. As mentioned above, the goal of this section is not to discuss whether analyses in terms of tonelessness are necessary, but what tonelessness as zero exponence looks like, if tonelessness is taken to exist.

### 1.4.6   Tones as empty exponents (construction markers)

An example of *empty exponents* is the linking elements found in compounds in many languages, as introduced in section 1.2 above. These are pieces of form that do not realize morphosyntactic properties, but rather mark construction type.

The examples in Table 1.14 illustrate that in Urban East Norwegian, such linking elements can be segmental and/or tonal. Following Kristoffersen (1992), there are several types: *-s-* (a), a High tone realized on the first element of the compound (b), *-s-* and a High tone (c), or *-ə-* with a High tone (d) (the High tones combine with Low tones to create Falling tones, indicated with a circumflex: *ê*). They contrast with compounds with no linking element, as in (e). Yet other compounds show variable behavior and are acceptable both with and without a linking element, as in (f).[8]

A formalization of the one-to-zero mapping between form and function found with the tonal linking element exemplified in Table 1.14 (b) is provided in Figure 1.9. This figure is meant to capture that empty exponents do not mark any morphosyntactic properties. From the perspective of informativeness, however, formatives are never truly empty; they may provide lexical, derivational, or inflectional information. In this

---

[8]Here, I assume Kristoffersen's (2000) phonological analysis: there is a tone contrast on syllables with primary stress. The Low tone is a part of the stress realization system, while the High tone may be lexically associated to stems, sponsored by an affix, or mark construction types, such as compounds (for alternative analyses, see e.g. Kaldhol and Köhnlein 2021; Lahiri, Wetterlin, and Jönsson-Steiner 2005; Wetterlin and Lahiri 2012). In the Scandinavian philological tradition, the Low tone is indicated with a superscript 1 (for "Accent 1"), and and the High tone is indicated with a superscript 2 ("Accent 2") (see e.g. Kristoffersen 2000).

**Table 1.14**: Linking elements in Norwegian compounds (adapted from Kristoffersen 1992; translations added)

|    | 1st member | 2nd member | Compound | Linking element |
|----|------------|------------|----------|-----------------|
| a. | ˈdòːp      | ˈhândlıŋ   | ˈdòːp-**s**-ˌhɑndlıŋ | -s- |
|    | 'baptism'  | 'action'   | 'baptismal service'  |     |
| b. | ˈlỳːs      | ˈfɛ̀st     | ˈlŷːs-ˌfɛst | Ⓗ |
|    | 'light'    | 'party'    | 'festival of lights' |     |
| c. | ˈkʰʋɛ̀l    | ˈmɑ̀ːt     | ˈkʰʋêl-**s**-ˌmɑːt | Ⓗ-s- |
|    | 'evening'  | 'food'     | 'supper'  |     |
| d. | ˈsɑ̀ns     | bəˈdɾɑ̀ːg  | ˈsâns-**ə**-bəˌdɾɑːg | Ⓗ-ə- |
|    | 'sense'    | 'deception'| 'hallucination' |     |
| e. | ˈfɛ̀st     | ˈlỳːs      | ˈfɛ̀st-ˌlyːs | none |
|    | 'party'    | 'light'    | 'party lights' |     |
| f. | ˈbìːl      | ˈtʰʉ̀ːɾ    | ˈbîːl-ˌtʰʉːɾ ∼ ˈbìːl-ˌtʰʉːɾ | variable |
|    | 'car'      | 'trip'     | 'car ride' |     |

case, the 'linking tones' mark that these words are compounds, and the linking tones are thus informative for the morphological construction involved.
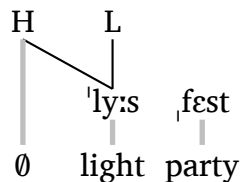


**Figure 1.9**: A High tone as a morphosyntactically empty exponent in Norwegian

The example in Table 1.14 (c) above includes two linking elements that are attested independently of each other, namely the *-s-* and the High tone. This is thus a case of tone being an empty co-exponent, i.e. it does not realize any morphosyntactic properties, but marks the construction type together with a non-tonal formative, in a relationship of multiple exponence.

Under Kristoffersen's (1992) analysis of compounds, the linking elements are "morphemes" introduced by rules. A few notes on this analysis are in order here. First,

the fact that the linking elements lack meaning suggests that they are not morphemes in the traditional sense. They are also not exponents of morphosyntactic properties; rather, they are markers of the construction type. Second, the distribution of the linking elements in Norwegian is complex, and like in other Germanic systems that have them (see e.g. Krott, Baayen, and Schreuder 2001 for Dutch; Krott et al. 2007 for German), it is nontrivial to predict which compounds get a linking element, and if so, which one. Because of this, Kristoffersen (1992, p. 50) regards them as being lexically marked. He proposes morphological rules that introduce the linking elements, and these rules apply to lexical items that are marked for having those rules applying to them (p. 51–53). This seems circular, and one might, on a conceptual basis, question the usefulness of proposing a rule-based analysis of something that is of a fundamentally probabilistic character.

It is the lack of function that is definitional for empty exponents, so we can imagine a case in which we have linking elements whose distribution is predictable. In fact, the tone patterns (or "tonal accents") of compounds across Scandinavian varies in this respect. In some dialects, including Urban East Norwegian, compounds show variable accent assignment. In other dialects, including Central Swedish, all compounds receive Accent 2, regardless of the presence or absence and type of segmental linking element. In such cases, the surface tone pattern can be analyzed as prosodic and post-lexical assignment of Accent 2 (see e.g. Riad 2006). However, from the perspective taken here, the possibility of a phonological analysis does not preclude a morphological analysis; even in cases where constructional markers are predictable by independent factors, they are still *also* informative for construction type.

### 1.4.7   Section summary

The present section has demonstrated that tone can be involved in all exponence types introduced in section 1.2: simple exponence, cumulative exponence, multiple exponence, zero exponence, and empty exponence. We have seen that there are many ways in which tonal formatives may indicate grammatical information: through form-function isomorphism or different types of deviations from it; either alone or in conjunction with non-tonal formatives. While this five-way typology served well as a starting point, these exponence relations do not capture the full picture. We now move beyond these five main types and consider more complex form-function mappings.

## 1.5   Verbose exponence and overlapping distributions

Carroll (2022) proposes the term *verbose exponence* to refer to cases in which multiple formatives are sensitive to some common information. There are many possible types of overlap between the information provided by different formatives within a given word; the term *verbose exponence* is thus an umbrella term for many different exponence types. In this section, we will explore some of this diversity, including types of overlapping exponence and distributed exponence. In the typology presented by Carroll (2022), only segmental morphology is included, and inflected word-forms are explicitly treated as sequences of formatives, provided as a list or set (Carroll 2022, pp. 3–4). The present chapter builds on this work by extending it to the study of tonal exponence, which cannot readily be analyzed as belonging to a sequence of formatives due to its autosegmental nature. In what follows, we will explore the interplay between tonal and non-tonal formatives. In Section 1.5.1, we will explore different type of co-exponence. In Section 1.5.2, we will discuss overlap of information, and in Section 1.5.3, we turn to distributed exponence.

## 1.5.1  Types of co-exponence

We have seen that tone can be the sole exponent, or a co-exponent of morphosyntactic properties alongside non-tonal ones.  It is worth clarifying the possible relationships between co-exponents in more detail, and here, we will focus on three dimensions: whether or not the formatives involved provide the same information, whether or not they are attested independently of each other, and whether or not they are realized adjacently to each other.

Examples of tonal and non-tonal exponents co-occuring include the High tone and the suffix *-ay* marking the progressive in Somali (Table 1.1; e.g. *ke**é**n-**ay**-aa* 'bring (present progressive)'), or the High tone and the suffix *-ó:* marking the ventive in Hausa (Table 1.8; e.g. *gángár-ó:* 'roll down (ventive)').  In these cases, the tonal formative provides the same information as the non-tonal formative, and we can consider them to be co-exponents.

Under a constructive approach to morphological analysis, one could analyze the High tone of the Somali progressive as being triggered by the progressive suffix *-ay*, and the High tone of the Hausa ventive as being triggered by the ventive suffix *-ó:*. In this sense, these examples are conceptually different from the example of multiple exponence in Rere, which were illustrated in Table 1.12 (e.g. *kwòrtò-á* 'rich person (accusative)'), where both the tonal and non-tonal accusative exponent (Low tone and *-á*) are attested independently of each other. These data do not straightforwardly lend themselves to an analysis in which one formative is triggered by the other. It is for this reason that we in Section 1.2 introduced the heuristic that the formatives involved in a relationship of co-exponence need to be attested independently of each other for the example to count as "true" instances of multiple exponence.

Tones are famous for their autosegmental nature and—as Hyman (2016, p. 16) puts it—their "ability to wander". Thus it is not uncommon for a tonal exponent to end

up on a different marker than its segmental co-exponent. For example, the data in (6) illustrate High tone shifting in Giryama. The verb forms with a 1SG subject in (6a) have a prefix *ni-* and no tone, while the verb forms with a 3SG subject in (6b) have a prefix *a-* and a High tone. The High tone is realized on the penultimate mora of the phrase, which means that unless the verb is phrase-final, the High tone ends up on a different word. Although realized non-adjacently, the two components of the 3SG subject marker always co-occur in expressing 3SG subject in this TAM, and so this example would not count as multiple exponence based on the heuristic used above. From a perspective of informativeness, however, this is a clear example of a tonal and non-tonal exponent providing the same information.

(6)   Person marking in Giryama (Bantu; Kenya)

    a.   All L tone

       'I want...'

       **ni**-na-maal-a

       **ni**-na-mal-a ku-guul-a       '...to buy'

       **ni**-na-mal-a ku-gul-a ŋguuwo  '...to buy clothes'

    b.   H tone on penultimate mora

       'He/she wants...'

       **a**-na-ma**á**l-a

       **a**-na-mal-a ku-gu**ú**l-a       '...to buy'

       **a**-na-mal-a ku-gul-a ŋgu**ú**wo  '...to buy clothes'
       (Volk 2011, p. 19; see also Hyman and Leben 2020, p. 199)

To summarize, tonal and non-tonal formatives may function as co-exponents and provide the same information, they may or may not be attested independently of each other, and may or may not be realized adjacently to each other. The next

sections discusses examples where co-exponents provide overlapping, but not identical information.

## 1.5.2  Subset of information

When a morphosyntactic property is marked by multiple formatives, but one or more of those forms also mark other properties, there may be different types of overlap between the information provided by the formatives involved. Different types of overlap and its relationship to redundancy have been discussed in the literature (Caballero and Harris 2012; Caballero and Inkelas 2013; Caballero and Kapatsinski 2015; Carroll 2022; Harris 2017); here, we will focus on what is called *partially superfluous multiple exponence* by Caballero and Harris (2012) or *subset verbose exponence* by Carroll (2022), in which there is at least one formative which does not make any unique semantic or syntactic contribution to the inflected word form.

For an example of a case in which the information provided by a tonal formative is a subset of the information provided by another formative, consider the data in Table 1.15.

**Table 1.15**: Subject marking in Chimwiini (Bantu; Somalia) (Hyman 2016, p. 34; Kisseberth and Abasheikh 2011)

|   | SG |        |              |     | PL |        |                |
|---|----|--------|--------------|-----|----|--------|----------------|
| 1 | n- | ji:lé  | 'I ate'      |     | chi- | ji:lé | 'we ate'       |
| 2 |    | ji:lé  | 'you (sg) ate' |   | ni-  | ji:lé | 'you (pl) ate' |
| 3 |    | jí:le  | 's/he ate'   |     | wa-  | jí:le | 'they ate'     |

Here, all first and second person forms (regardless of number) are marked by a final High tone, while third person forms are marked by a penultimate High tone. In this case, tone is the exponent of person (a final High tone marking first or second person,

$$H^{Pen}$$

wa-    ji:le

PL    3    eat
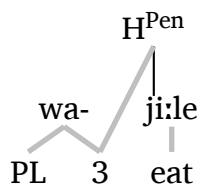
**Figure 1.10**: Subset exponence in Chimwiini

and a penultimate High marking third person), although it is not the only exponent of person: the prefixes mark person as well as number.[9]

Third person is marked twice on the 3PL form: once on the prefix (which also indicates number), and once through the penultimate High tone. This is indicated in the representation in Figure 1.10. The High tone has a superscript which indicates its location (penultimate) to capture that the meaning does not just result from its form (High tone), but also where the tone associates. This is a case of partially superfluous multiple exponence; both the prefix and the tone marks third person, but the prefix also provides additional information about number (i.e. plural).[10]

## 1.5.3 Distributed exponence

Distributed exponence involves multiple markers co-occurring, and is therefore reminiscent of multiple exponence, but it differs from it in that "more than one formative is required to provide a fully specified reading of a feature or category" (Carroll 2022, p. 2). Distributed exponence is found e.g. throughout the Yam family, in lan-

---

[9]Note that these generalizations hold for subject marking in the past and present tenses in Chimwiini; other TAM forms have a consistent tone pattern (either final High or penultimate High) across person/number combinations (Kisseberth and Abasheikh 2011). Therefore, the tone patterns are informative for TAM as well, a fact we abstract away from here.

[10]The tonal person distinction is redundant only in the parts of the paradigm in which there is a prefix that marks both person and number. In the 2SG and 3SG forms, however, there are no overt person/number prefixes. This is thus a case of zero exponence, which we have conceptualized paradigmatically in the present chapter (i.e. as emerging from the contrast between different forms in the paradigm). The lack of a person marker here indicates *either* 2SG *or* 3SG, but the the ambiguity of person value introduced by the lack of an overt person/number marker is resolved by the tonal exponent.

guages such as Ngkolmpu (Carroll 2016) and Komnzo (Döhler 2019). An example is provided in Table 1.16, which illustrates number marking in Nen.

**Table 1.16**: Distributed exponence: 3rd person present forms of *tromngr* 'be erected' in Nen (Yam; New Guinea) (Evans 2015, p. 568)

| | Number value | Word form |
|---|---|---|
| a. | SINGULAR | y-trom-ngr |
| b. | DUAL | yä-trom-aran |
| c. | PLURAL | yä-trom-ngr |
| d. | LARGE PLURAL | y-trom-aran |

The formatives involved in Table 1.16 are informative for the category number, but information from multiple formatives are required to disambiguate potential readings: for example, *yä-* indicates that the word form is either dual or plural, and *-ngr* indicates that the wordform is either singular or plural. When the two formatives co-occur in (c), they disambiguate each other's function: together, they indicate plural. We can abstract over these data as in Table 1.17; this table indicates the distribution of four formatives (A, B, C, and D) across a paradigm with four cells and four morphosyntactic properties (P$_{1-4}$). Given the formatives' distribution, each one is ambiguous on its own, but has its function disambiguated by the other formative within the same word.

**Table 1.17**: Distributed exponence: an abstraction

| Formative 1 | Formative 2 | Property |
|---|---|---|
| A | C | P$_1$ |
| A | D | P$_2$ |
| B | C | P$_3$ |
| B | D | P$_4$ |

A case of tone involved in distributed exponence is found in the TAM system of Rere, illustrated by the verb *bubl-* 'wrestle' in Table 1.18. These verb forms have the

same structure, which involves a noun class marker (*kwʊ-*), an auxiliary (*m* or Ⓗ), and the verb root suffixed by a final vowel (-*è* or -*í*). There are two types of auxiliaries illustrated here: *m* in (a-b), and a floating High tone Ⓗ in (c-d), which associates to the noun class marker *kwʊ-* (CL). The Ⓗ indicates that the verb form is either the conditional or the imperfective (a set of meanings which cannot be unified as a semantically natural class). On its own, the Ⓗ is thus ambiguous, but in combination with the final vowel (FV) -*è* it indicates conditional, and with the final vowel -*í* it indicates imperfective. The meaning of the final vowels is also underdetermined as they have other functions elsewhere; when they are used in verb forms which contain the perfect marker *m*, they mark the distinction between remote and recent.[11][12]

**Table 1.18**: Tone involved in distributed exponence in Rere (Personal field notes; Titus Kunda, native speaker, p.c.; see also Rose 2021)

|   | CL-AUX wrestle-FV | Tone | TAM value |
|---|---|---|---|
| a. | kwʊ̀-**m** bùbl-**è** | L L-L | Remote perfect |
| b. | kwʊ̀-**m** bùbl-**í** | L L-H | Recent perfect |
| c. | kwʊ̀-Ⓗ bùbl-**è** → [kwʊ́ bùblè] | **H** L-L | Conditional |
| d. | kwʊ̀-Ⓗ bùbl-**í** → [kwʊ́ bùblí] | **H** L-H | Imperfective |

To represent distributed exponence, I will combine conventions developed for related, but different phenomena in other languages, and modify them slightly to fit the phenomenon under consideration here. First, the polyfunctionality of each marker can be captured by the use of the logic operator ∨ (see Stump 2014, p. 84), that is,

---

[11]A potential alternative analysis would be that the Ⓗ marks the Irrealis, in which case only the meaning of the suffixes are underdetermined, and is disambiguated by the auxiliary they combine with. However, this analysis does not make predictions beyond these forms as other TAM forms typically associated with Irrealis cross-linguistically (e.g. the imperative or interrogative) are not marked with a Ⓗ in Rere.

[12]Note that the examples in Table 1.18 illustrate periphrastic expressions rather than synthetic forms. Given that the morphosyntactic property set associated with each periphrastic verb form is distributed among its parts, I treat these as instances of periphrasis as inflection, following e.g. Ackerman and Stump (2004) (see also Ackerman, Stump, and Webelhuth 2011; Bonami 2015; Brown et al. 2012).

we can gloss the (H) as IPFV∨COND, the suffix -è as REM∨COND, and the suffix -í as IPFV∨REC. Second, we need a way to capture the dependency between these formatives, that is, the fact that they disambiguate each other's function by co-occurring within the same word.[13] In order to do this, I adopt the conventions developed by Carter (2023) for the analysis of polyfunctional markers in Ket: dependency arrows represent the information that the formatives provide about each other, and strikeout indicates which function is ruled out. This is illustrated in Figure 1.11, a representation of (d) in Table 1.18. While Carter (2023) focuses on unidirectional relationships between different markers, the relationship in the case of distributed exponence is bidirectional. The modification used here to capture this is simply to use a bidirectional arrow. While these conventions have been developed for segmental morphology, they are extended here to tonal morphology, and we need a multidimensional diagram in which we can capture the autosegmental nature of the tonal exponents. As in previous figures in this chapter, I have used color coding to distinguish between associations between tones and TBUs (in black) and form-function mappings (in gray).
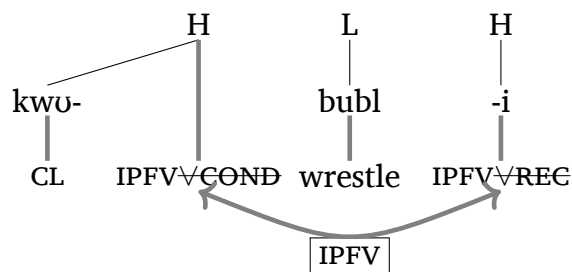


**Figure 1.11**: Distributed exponence in Rere

In this example, tone is a co-exponent alongside segmental ones. One question that arises is whether multiple tonal exponents may co-occur in a relationship of dis-

---

[13]It is not the case that any combination of the two polyfunctional markers are possible (e.g. conditional and recent), and this is simply a fact about the Rere TAM morphology; the remote/recent distinction is only found in the perfect forms, and elsewhere, the same suffixes are co-opted to indicate a different distinction.

tributed exponence. I am not aware of any such examples, but if it exists, it would surface as tonal melodies which would be decomposable into independent components that are polyfunctional on their own, but disambiguate each other's functions.

### 1.5.4 Section summary

This section explored the interplay between tonal and non-tonal co-exponents, ranging from cases in which they contribute the same information and always co-occur, to cases of subset exponence and distributed exponence. The latter case always involves a type of polyfunctionality, and we turn to polyfunctional exponence next.[14]

## 1.6 Polyfunctionality and morphomic distributions

The present section moves further beyond the exponence types addressed so far and explores in depth a topic briefly introduced in Section 1.5, namely cases in which one or more exponents are *polyfunctional*. There are different types of polyfunctional exponence (see e.g. Stump 2014), which may interact with other types of exponence in complex ways. Here, we will discuss morphomic distributions as well as the distinction between polyfunctionality within and across paradigms.

To the extent that these phenomena have been discussed in previous typologies of grammatical tone, they have received different labels, e.g. *Paradigmatic Grammatical Tone* (Rolle 2018) or *morphological tone* (Palancar 2016). However, the phenomena

---

[14]All of the examples explored in the present chapter involve tonal and/or segmental formatives and their interactions. However, tonal formatives may also co-occur with other suprasegmental formatives in different types of form-function mappings. A case in point is Dinka, in which singular-plural distinctions may be conveyed by tone alone, vowel length alone, or a combination of suprasegmental and/or segmental distinctions (tone, vowel length, voice quality, vowel quality, consonantal changes) (Ladd, Remijsen, and Manyang 2009). This is beyond the scope of the present chapter, but a complete typology would incorporate such examples as well, laying out how different suprasegmental formatives may interact in their informativeness for grammatical properties.

in question have clear parallels in non-tonal morphology (e.g. polyfunctionality and morphomic distributions) and there is thus a body of literature to engage with and build off of when analyzing their tonal equivalents. In this section, I will aim to do just that, as well as provide a more fine-grained typology of the different interactions that may occur when polyfunctional tones interact with non-tonal formatives in different ways.

Although the aim of the present chapter is exploratory, and no claims of frequency of distributions are made, it is worth asking whether the phenomena discussed in this section are rare—given their infrequent mentioning in previous literature on tone—or simply unreported, perhaps because our theories do not lead us to expect them.[15]

## 1.6.1 Tonal morphomes

Among the types of polyfunctional exponence discussed by Stump (2014) is one involving *morphomes*, which refers to cases in which a given form is associated with a set of functions that do not form a natural class. Morphomes are particularly interesting because they tap into one of the major differences between morphological theories: they have been argued to constitute patterns not motivated by phonology, syntax, or semantics, and thus to be examples of *morphology by itself* (Aronoff 1994). The existence of morphomes therefore pose a challenge for frameworks that adopt an architecture of grammar in which there is no autonomous morphology, e.g. most frameworks growing out of the Chomskyan tradition (see Luís and Bermúdez-Otero 2016 for discussion and analyses across different frameworks). In his typology of morphomes, Herce (2020) finds this phenomenon in 30 genetically independent stocks across the world, and con-

---

[15]This is important because previously reported rarities have sometimes turned out to be quite prevalent, with consequences for theoretical proposals: examples include multiple exponence (Harris 2017) and overabundance (Thornton 2019).

cludes that it "cannot be dismissed lightly as an accidental quirk of a few languages" (Herce 2020, p. 359). If tone can do anything that non-tonal morphology can do (Hyman 2016, p. 16), we would expect it to be able to show morphomic distributions as well, and indeed this is the case.

An example of tones being polyfunctional and exhibiting morphomic distributions within a paradigm is found in Tlatepuzco Chinantec. Consider the data in Table 1.19. Here, tone is marked by superscript numbers 1 (High), 2 (Mid) and 3 (Low); numbers 31 and 32 indicate contour tones (High rising and Mid rising, respectively). The prefix $ka^3$- marks past tense, and the root $hú\textipa{P}$ 'bend' is marked tonally for person. The pronouns distinguish six person/number values, but the stem $hú\textipa{P}$ only shows three forms (3, 31, and 2).[16]

**Table 1.19**: Tonal morphomes in Tlatepuzco Chinantec (Oto-Manguean, Mexico) (Merrifield and Anderson 2007; Baerman and Palancar 2014, p. 47)

| 1SG | $ka^3$- | $hú\textipa{P}^3$ | $hní^2$ | 'I bent it' |
| 1PL.INCL | $ka^3$- | $hú\textipa{P}^{31}$ | $hniaŋ^1$ | 'we (INCL) bent it' |
| 1PL.EXCL | $ka^3$- | $hú\textipa{P}^{31}$ | $hnie\textipa{P}^1$ | 'we (EXCL) bent it' |
| 2SG | $ka^3$- | $hú\textipa{P}^3$ | $\textipa{P}niŋ^2$ | 'you (SG) bent it' |
| 2PL | $ka^3$- | $hú\textipa{P}^3$ | $\textipa{P}nia\textipa{P}^{32}$ | 'you (PL) bent it' |
| 3 | $ka^3$- | $hú\textipa{P}^2$ | $dsa^2$ | 'she, he, they bent it' |
| | PST- | bend | PRO | |

The tones 3 (Low) and 31 (High rising) are both polyfunctional within this paradigm because they can be associated with different person/number values: for example, the stem has tone 3 in the 1SG, 2SG, and 2PL forms. This distribution is morphomic because it cannot be captured as a natural class to the exclusion of the morphosyntactic property sets associated with the remaining paradigm cells

---

[16]The patterns cannot be phonologically predicted. Even if the fact that tone 31 always precedes 1 can be derived phonologically, the other forms cannot be: tone 2 on the pronominal can be preceded by either 2 or 3, and tone 3 on the root can be followed by either 2 or 32.

(1PL.INCL/EXCL and 3). Additionally, the distribution of tonal formatives are different in other aspectual forms. There are three aspectual stems from which all aspect forms are built, namely the present, future, and completive (for example, the past tense forms in Table 1.19 are built on the completive stem forms, with a past tense prefix $ka^3$-; see Baerman and Palancar 2014, p. 47 for additional details). Table 1.20 illustrates the stem tone alternations of 'bend' for all three aspectual stems.[17]

**Table 1.20**: Stem tone alternations of *húʔ* 'bend' (Baerman and Palancar 2014, p. 48)

|      | 1SG | 1PL | 2 | 3 |
|------|------|------|------|------|
| PRS | húʔ$^{32}$ | húʔ$^{32}$ | húʔ$^{32}$ | húʔ$^2$ |
| FUT | húʔ$^{31}$ | húʔ$^{31}$ | húʔ$^{31}$ | húʔ$^2$ |
| CPL | húʔ$^3$ | húʔ$^{31}$ | húʔ$^3$ | húʔ$^2$ |

This is a case of tonal polyfunctionality leading to syncretism, i.e. a case in which multiple paradigm cells have identical word-forms ($ka^3$-*húʔ$^3$* is found in three paradigm cells).[18] However, syncretism is not a necessary outcome when polyfunctionality is involved. The next section presents cases in which polyfunctional markers have their function disambiguated by other exponents occurring within the same word-form.

## 1.6.2 Tonal morphomes as co-exponents

Tones may exhibit morphomic distributions yet have their function disambiguated by other formatives. One example comes from Choguita Rarámuri, as documented and analyzed by Caballero and German (2021). The examples in Table 1.21 illustrate different forms of the verb *biʔw–a* 'to clean' (where *–a* is a transitivizer suffix),

---

[17]Further complicating the system in Chinantec is that verb lexemes fall into different classes with respect to the distribution of tonal formatives. We will return to this in Section 1.6.3.

[18]Note that the potential ambiguity introduced by the syncretism is avoided by the presence of pronouns.

and shows that it receives Low tone in one set of forms (called *neutral constructions*), and High-Low tone in another set of forms (called *shifting constructions*).[19]

**Table 1.21**: Morphomic distributions in Choguita Rarámuri (Uto-Aztecan, Mexico) (Caballero and German 2021, p. 165).

| | Neutral constructions | | | | Shifting constructions | | |
|---|---|---|---|---|---|---|---|
| a. | biʔˈw–à–ko | L | Past egophoric | e. | biʔˈw–â–mo | HL | Future singular |
| b. | biʔˈw–à–lo | L | Past | f. | biʔˈw–â–ʃi | HL | Imperative plural |
| c. | biʔˈw–à–i | L | Imperfective | g. | biʔˈw–â | HL | Imperative sg. |
| d. | biʔˈw–à–a | L | Present progressive | h. | biʔˈw–âa–ru | HL | Past passive |

Caballero and German (2021, p. 167) argue that the distinction between the two sets of verb forms in Table 1.21 is morphomic because whether a given construction belongs to one set or the other is "determined not by morphosyntactic inflectional features nor by any semantic or phonological principles but rather by purely morphological properties". Although the distribution of tone is morphomic, the inflected word-forms are distinguished from each other straightforwardly by the presence of suffixes.

We can compare this to a slightly more complex system. In Modo (Central Sudanic, Sudan), verbs index the person and number values of subjects through a combination of tonal and non-tonal formatives. The final syllable of a verb root has a lexical tone, either High or Low, while the tone of the initial syllable hosts an inflectional tone (Andersen 1981, pp. 42–45); this is illustrated in Table 1.22 with the verb *ubà* 'to sing', which has a lexical Low tone, and in Table 1.23 with the verb *edí* 'to be', which has a lexical High tone.

---

[19]The neutral/shifting distinction refers to how these morphological constructions affect stress patterns in lexically unstressed roots; this particular verb is lexically stressed and so there are no stress shifts. The Rarámuri system exhibits complex interactions between stress and tone, which for reasons of space will be left out here. The interested reader is referred to Caballero and German (2021) for details.

**Table 1.22**: Person/number marking of *ubà* 'to sing' in Modo (Central Sudanic; Sudan) (Andersen 1981, p. 44)

|   |     | SG   | Stem tone |     | PL     | Stem tone |
|---|-----|------|-----------|-----|--------|-----------|
| 1 | m-  | úbà  | HL        | d-  | ùbà    | LL        |
| 2 |     | úbà  | HL        |     | úbà-ké | HL        |
| 3 |     | ùbà  | LL        |     | ùbà    | LL        |

**Table 1.23**: Person/number marking of *edí* 'to be' in Modo (Andersen 1981, p. 45)

|   |     | SG   | Stem tone |     | PL     | Stem tone |
|---|-----|------|-----------|-----|--------|-----------|
| 1 | m-  | édí  | HH        | d-  | èdí    | LH        |
| 2 |     | édí  | HH        |     | édí-ké | HH        |
| 3 |     | èdí  | LH        |     | èdí    | LH        |

A schematized version of the inflectional formatives in Tables 1.22–1.23 is provided in Table 1.24; this shows that the person and number of the subject are marked through a combination of affixes and tonal formatives.

**Table 1.24**: Person/number marking in Modo: schematized

|   |     | SG  |     | PL     |
|---|-----|-----|-----|--------|
| 1 | m-  | H   | d-  | L      |
| 2 |     | H   |     | H -ké  |
| 3 |     | L   |     | L      |

If we first look solely at the tonal formatives, we see that the High tone is found in the paradigm cells listed in (7a), and the Low tone is found in the paradigm cells listed in (7b). Neither can be captured as a natural class—that is, there is no way of unifying 1SG, 2SG and 2PL to the exclusion of 1PL, 3SG and 3PL—and thus the distributions of these formatives are morphomic.

(7)   The morphomic distribution of the tonal formatives

a. High tone: 1SG, 2SG, 2PL

b. Low tone: 1PL, 3SG, 3PL

From a phonological perspective, inflectional and lexical tones combine in a straightforward way (e.g. inflectional High + lexical Low → [HL]), and Hyman uses the Modo data as an example of a case in which "segmenting the tones by morpheme is straightforward" (Hyman 2016, p. 19). Here, I would like to revise this observation and say that segmenting the tones by lexical tone and *morphomic* tone is straightforward. What is interesting about the Modo data is how the relatively simple set of formatives in Table 1.24 come together to exhibit a high degree of complexity of exponence. We will therefore look at these complexities in a little more detail.

If a stem tone formative co-occurs with a non-tonal one within the same word form, its function can be disambiguated, as each segmental affix shows a limited distribution across the paradigm and thus has a clear function: *m-* means 1SG, *d-* means 1PL, and *-ké* means 2PL. This is thus a case of a tonal morpheme functioning as a co-exponent with a non-tonal formative, where the information provided by the tonal morpheme is both ambiguous and redundant, and its ambiguity is resolved by the non-tonal formative. This is illustrated by the schematization in Figure 1.12.
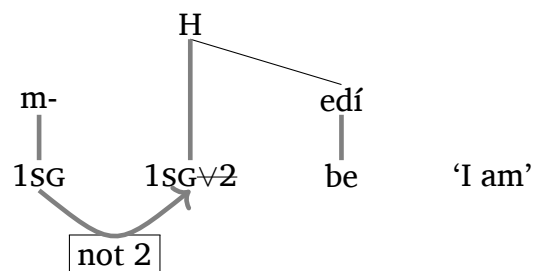


**Figure 1.12**: A non-tonal formative disambiguating the function of a tonal morpheme

In contrast, the lack of a prefix is informative for person, but ambiguous: it tells us that the verb form is in either the second or third person. This ambiguity of person

50

L

∅                                    edí

2∨3          1PL∨3          be          'He/she/they are'

3
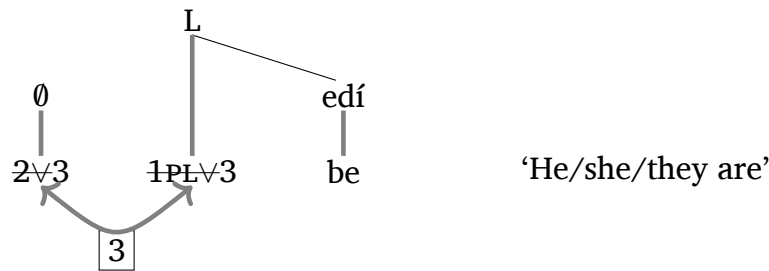
**Figure 1.13**: Distributed exponence in Modo

value introduced by the lack of an overt person/number marker is resolved by the tonal

exponent: for example, a Low tone exponent indicates that the verb form is either 1PL or

third person, and the only person value shared by the lack of a prefix and the presence

of a Low tone is third person. Thus in combination, the two formatives resolve each

other's function; that is, this is a case of distributed exponence (although one of the

formatives in question is zero). This is schematized in Figure 1.13, which also indicates

that the third person form is unmarked for number.

Morphomic tones may also co-occur with other morphemes. A case in point is

the 'Melodic Tone' in Bantu (see Odden and Bickmore 2014 and papers therein). While

the details differ somewhat across Bantu languages, the Melodic Tones form a part of the

verbal inflection system, and typically occur in a set of TAM forms which do not form a

natural class. A Melodic Tone may be the sole exponent of a given TAM value in some

word-forms, and in other cases, there may be other exponents as well. An illustrative

example is found in Cilungu, a Bantu language spoken in Zambia and Tanzania. The

Cilungu verbal template is provided in (8). This shows that TAM markers can occur

both before and after the root. Additionally, there is a final vowel whose quality (*-a* or

*-e*) differ across TAM forms.[20]

---

[20]In (8), V = verb, SM = subject marker, TAM = tense/aspect/mood, MS = macro-stem, OM = object marker, NEG = negative, DERIV = derivational suffixes, FV = final vowel.

(8)  Verbal template of Cilungu (Rolle and Bickmore 2022, p. 200)

$[_V$ SM (NEG) **TAM** $[_{MS}$ (OM) $[_{STEM}$ ROOT (DERIV) **TAM FV** $]]]$

Melodic tones are introduced in a subset of TAM forms. The example in (9) illustrates the Yesterday Past Progressive, which is characterized by a prefix *á-* (whose tone spreads one mora to the right), a suffix *-ang*, and the final vowel *-a*, in addition to a Melodic High on the final mora. Rolle and Bickmore (2022) formalize this tone as $(H)^F$ (a floating High tone with its location indicated through a superscript F for Final).

(9)  Yesterday Past Progressive in Cilungu

/tú-**á**-mu-ziik-il-**ang-a** $(H)^F$/ → tú-**á**-mu-ziik-il-**ang-á** → [twáámúzììkìlààngá]

SM-**TAM**-OM-root-DERIV-**TAM-FV TAM**

'we were burying for him/her'

(Bickmore 2007, p. 212; Rolle and Bickmore 2022, p. 203)

The location of the melodic High depends on TAM. The example in (10) illustrate the Remote Perfect, which is characterized by a prefix *a-*, a final vowel *-a*, and a Melodic High which associates to the second mora of the stem and the following moras up until the final one, indicated as $(H)^{2-F}$ (additionally, the tone of the subject marker spreads once to the right).

(10)  Remote perfect in Cilungu

/yá-**a**-sukilil-**a** $(H)^{2-F}$/ → yá-a-su**kílíl-á** → [yáásùkílílá]

SM-**TAM**-root-**FV TAM**

'they have already accompanied'

(Bickmore 2014, p. 48; Rolle and Bickmore 2022, p. 204)

Rolle and Bickmore (2022) present an overview of TAM exponents and show that they are distributed across paradigm cells which do not form a natural class: "It is not possible to associate an individual grammatical tone pattern with a consistent semantic

meaning by itself in the absence of segmental co-exponents" (Rolle and Bickmore 2022, p. 204).

This is a descriptive generalization that does not follow from any specific theoretical assumptions, but can be accommodated by making some, such as acknowledging a *morphomic layer* (Aronoff 1994, pp. 22–29) in the architecture of the grammar. The distribution of TAM tone in Cilungu is morphomic, and like the Rarámuri and Modo data above, there are other exponents (different affixes) that disambiguate the meaning of the construction as a whole. These exponents may themselves be morphomic, and the meaning of the verb form may be distributed across multiple formatives. A case in point is the final vowels. The final vowel is *-e* if there is a suffix *-il* (in the Far Past, the Far Past 2, the Yesterday Past, the Recent Past, and the Perfect), and in the Subjunctive (Rolle and Bickmore 2022, p. 205). There is nothing to unify this set of functions to the exclusion of the remaining ones, in which the final vowel is *-a*.

Downing and Mtenje (2017, p. 208) points out that the issue of where in the grammar the grammatical tone patterns are represented "has, surprisingly, received no attention in the literature on Bantu morphosyntax, as far as we know, and relatively little attention in the phonology literature analyzing grammatical tone patterns". Bickmore (2022) considers different options under "a model where the morpho-syntax precedes and feeds a phonology component" (p. 2) and discusses some of the complications stemming from the long list of TAM forms that would need to be referenced by different rules. One fruitful avenue of exploration for such data might be a model that contains a morphomic layer (as proposed by Aronoff 1994, pp. 22–29).

### 1.6.3  Polyfunctionality within and across paradigms

It is useful to distinguish between polyfunctionality within a paradigm, which is what we have focused on so far in the present section, and polyfunctionality *across*

paradigms. Consider the examples of tonal case marking in Rere provided in Table 1.25, which illustrates tonal polyfunctionality across paradigms of different (classes of) lexemes. Note that this is a subset of many case marking strategies: others were introduced in section 1.4.4 (see also Quint and Allassonnière-Tang 2022).

**Table 1.25**: Tonal polyfunctionality across paradigms in Rere nouns (Personal field notes; Titus Kunda, native speaker, p.c.)

|    | Nominative | Tone | Accusative | Tone |            |
|----|------------|------|------------|------|------------|
| a. | ʈáɽá       | HH   | ʈàɽà       | LL   | 'shepherd' |
| b. | ámlà       | HL   | ámlá       | HH   | 'trap'     |
| c. | kwìɟì      | LL   | kwíɟì      | HL   | 'person'   |

These data illustrate that the three tone patterns High-High, High-Low, and Low-Low are found on nominative forms as well as on accusative forms. For each noun in Table 1.25, its tone pattern illustrates simple exponence *within* the inflected word form— e.g. Low-Low for the accusative in (a)—but when comparing *across* word forms, the tone patterns themselves are polyfunctional, and mark different functions on different nouns. Thus it is not the case that one can identify a single accusative tone pattern, or a single nominative tone pattern. Moreover, the complexities of the data (as laid out in more detail by Quint and Allassonnière-Tang 2022) cannot readily be accounted for as predictable realizations of a single underlying form, e.g. by separating inflectional and lexical tones.

Another example comes from Chinantec. In Section 1.6.1, we introduced aspect and person marking in Tlatepuzco Chinantec. The distribution of tonal formatives of the verb *húʔ* 'bend' was given in Table 1.20, and schematized forms are provided in Table 1.26. The paradigmatic structure found with the verb 'bend' is one of many possible patterns; verb lexemes fall into different classes with respect to the distribution of tonal

formatives. In Table 1.27 and Table 1.28, the stem tone distribution associated with two other verb classes are illustrated.

**Table 1.26**: Stem tone alternations of *húʔ* 'bend' (Baerman and Palancar 2014, p. 48)

|     | 1SG | 1PL | 2  | 3 |
|-----|-----|-----|----|---|
| PRS | 32  | 32  | 32 | 2 |
| FUT | 31  | 31  | 31 | 2 |
| CPL | 3   | 31  | 3  | 2 |

**Table 1.27**: Stem tone alternations of *ʔnai* 'sell something' (Baerman and Palancar 2014, p. 48)

|     | 1SG | 1PL | 2 | 3  |
|-----|-----|-----|---|----|
| PRS | 32  | 2   | 2 | 32 |
| FUT | 31  | 1   | 1 | 3  |
| CPL | 3   | 1   | 1 | 3  |

**Table 1.28**: Stem tone alternations of *kieg* 'lie down' (Baerman and Palancar 2014, p. 48)

|     | 1SG | 1PL | 2  | 3 |
|-----|-----|-----|----|---|
| PRS | 2   | 2   | 32 | 2 |
| FUT | 1   | 31  | 31 | 3 |
| CPL | 2   | 31  | 3  | 2 |

These data illustrate that in Chinantec, tone is polyfunctional both within and across paradigms. Consider the distribution of tone 3, for example. Tone 3 is found in the first person singular and second person forms of the completive in Table 1.26. In table 1.27, tone 3 is found in the first person singular and third person cells of the completive, as well as the third person future cell. In Table 1.28, tone 3 is found in the second person completive, and the third person future. It is not the case that

we can assign a consistent function to tone 3 or any other tone, or for that matter, a consistent tone to any given morphosyntactic property set (such as the first person singular completive). In fact, Baerman and Palancar (2014) show that all tones—1, 2, 3, 31 and 32—are used for all possible property sets.[21]

While the examples discussed previously in the present chapter have illustrated different types of exponence relations within single word-forms, and is the result of analyzing how information is indicated through patterns in morphological paradigms of single lexemes (or a single class of lexemes), the Rere and Chinantec data in the present section illustrates that another dimension of complexity is added when considering paradigms of multiple lexemes. Such lexemes may fall into different *inflectional classes*, and the role of tone in the organization of inflectional classes will be discussed further in Section 1.7.

## 1.6.4   Section summary

In the present section, we further expanded the five-way typology introduced in section 1.2 to discuss a series of more complex deviations from form-function isomorphism, including different kinds of polyfunctionality and morphomic distributions. I aimed to extend the study of these morphological phenomena to the study of tone, and to illustrate a rich set of interactions between tonal and non-tonal formatives. Next, we introduce an additional layer of complexity, namely the one added in languages with inflectional class systems.

---

[21]The lack of form-function isomorphism in Tlatepuzco Chinantec is striking, but as Baerman and Palancar (2014) point out, this does not mean that the distribution of tone is completely random; in fact, "only" 70 different paradigm types are attested, which allows them to investigate interpredictability between forms. We will return to this way of analyzing morphological organization in Section 1.7.3.

## 1.7 Inflectional classes and paradigmatic layers

An inflectional class is defined as "a set of lexemes whose members each select the same set of inflectional realizations" (Aronoff 1994, p. 64); a language has multiple inflectional classes when there is more than one realization for a given morphosyntactic property set. Such systems thus present us with another kind of deviation from form-function isomorphism; so far, we have focused on the internal organization of words by looking at the organization of paradigms of single lexemes (or classes of lexemes); we now turn to comparisons *across* such classes. As we will see, inflectional formatives are not just informative for morphosyntactic properties in such cases, but also for inflectional class membership.

### 1.7.1 Inflectional classes distinguished by tone

For the present purposes, we will adhere to a strict interpretation of the term *inflectional class*, where it is reserved for cases in which class membership (and thus the realizations of the exponents in question) is not determined by any independent factors, such as phonological, semantic, or syntactic ones. In such cases, the classes are only relevant for the morphology and no other components of the grammar, and this is an instance of *morphology by itself* in the sense of Aronoff (1994). As Corbett puts it: "If there were outside motivation, this might allow an analysis in terms of sub-categories, each with a single type of inflection, and hence no need for inflectional classes" (Corbett 2009, p. 6). For example, if a lexeme's inflectional realizations can be predicted by its phonological properties, there is no need to postulate inflectional classes. Even when inflectional classes cannot be categorically predicted based on extramorphological factors, there may still be partial and gradient motivation for the classes, usually related to their diachronic origin (see Beniamine and Bonami 2023 for a recent overview).

An example of a language with inflectional classes distinguished by tone is Gulmancema (Niger-Congo, Gur; Burkina Faso). In this language, tone marks tense-aspect (perfective, imperfective, and aorist). Which tone performs which function differs across lexemes independent of any phonological, syntactic or semantic factors, and verbs fall into 80 inflectional classes (Baerman et al. 2023, based on Naba 1994). Some of these classes are distinguished solely by their tone patterns, others by their affixes as well. Examples of the former are illustrated in Table 1.29, and we will return to the latter below.

**Table 1.29**: Inflectional classes made by tone in Gulmancema (Niger-Congo, Gur; Burkina Faso) (Naba 1994, pp. 363–377; Baerman, Brown, and Corbett 2017, pp. 22–23).

|      | 'question' | 'empty' | 'figure out a riddle' | 'grill' | 'read' | 'roll' | 'set off on route' | 'rinse mouth' |
|------|-----------|---------|-----------------------|---------|--------|--------|--------------------|---------------|
| PFV  | bágí      | báadì   | bundì                 | púlí    | cógì   | bilnì  | bòbí               | cùgì          |
| IPFV | bágì      | báadí   | bundí                 | púlì    | cógí   | bilní  | bobì               | cugì          |
| AOR  | bágì      | báadí   | bundí                 | púlí    | cógì   | bilnì  | bòbì               | cùgì          |
| PFV  | HH        | HL      | $L_2$L                | HH      | HL     | $L_2$L | LH                 | LL            |
| IPFV | HL        | HH      | $L_2$H                | HL      | HH     | $L_2$H | $L_2$L             | $L_2$L        |
| AOR  | HL        | HH      | $L_2$H                | HH      | HL     | $L_2$L | LL                 | LL            |

There is a three-way tone contrast between a High tone, a Low tone, and a Low tone which assimilates to a preceding High tone, labeled as $L_2$. These combine on bisyllabic verb stems to the tone patterns HH, HL, LL, LH, $L_2$H, or $L_2$L.[22]

Baerman, Brown, and Corbett (2017, pp. 22–23) discuss whether it is possible to derive these tone patterns from the underlying tones of the roots combined with inflectional tone, and argue that the answer is 'no'. They first propose a provisional

---

[22]The behavior of $L_2$ may warrant an analysis in terms of tonelessness, that is, the TBUs in question may be underlyingly unspecified for tone, and realized with low pitch unless preceded by a High tone, in which case that High tone spreads onto the toneless TBU.

analysis of the first three verbs to illustrate what this might have looked like: in each of these verbs, the initial tone is the same throughout the paradigm, while the final tone is either High in the perfective and Low in the imperfective/aorist or vice versa. While this could have been analyzed as resulting from three different lexical tone patterns combining with a rule of tonal polarity (switching the final tone of the perfective to form the imperfective and aorist, or vice versa), this cannot account for the remaining types. In 'grill', 'read', and 'roll', the aorist patterns with the perfective instead of the imperfective; in 'rinse mouth', the final tone is the same across all aspect forms. Furthermore, in the last two verbs in the table, the initial tone alternates, a pattern not seen with the other verbs. In conclusion, "[n]o system of rules will derive the variety of patterns from a single underlying tonal configuration, so there is no way to tease apart lexical and inflectional tone. We thus have inflectional classes determined by tone" (Baerman, Brown, and Corbett 2017, p. 23).

Some terminological discussion is in order here, as the term *tonal class* has been used in different ways by different authors; Palancar (2016) uses it in the sense of inflectional classes determined by tone (however, the examples provided are languages in which tonal and non-tonal formatives interact in inflectional classes; we will return to this below). When there are inflectional classes determined by tone, different classes of words have different tonal realizations for morphosyntactic property sets, and one cannot derive the variety of patterns from a single underlying tonal configuration (root tone plus inflectional tone). In the Bantu literature, *tone class* refers to a division of verbs based on the analysis of the underlying tone of the verb root, typically /H/ vs. /L/ (or /H/ vs. Ø, or /L/ vs. Ø); see e.g. the overview in Marlo (2013). It is useful to distinguish between cases in which verbs have different underlying root tones and cases of inflectional classes made by tone, in which there is no "underlying tone". While underlying root tones and inflectional tones may interact in complex ways, as in many

59

Bantu languages, this is, at least conceptually, a different phenomenon from systems in which one cannot predict the surface tones from the underlying (lexical) tone and the inflectional tone.

## 1.7.2 Inflectional classes distinguished by both tonal and non-tonal formatives

Inflectional classes may be distinguished by tonal formatives alone, or a combination of tonal and non-tonal formatives. The Gulmancema verbs illustrated in Table 1.29 represent only a subset of inflectional classes in this language. Others are distinguished by suffixes as well, and these are exemplified in Table 1.30. The suffixes involved are *-ni, -di, -li* and *-gi,* and while *-gi* only ever occurs in the imperfective, the other suffixes can occur in any paradigm cell and are thus polyfunctional.[23]

**Table 1.30**: Inflectional classes in Gulmancema continued (Naba 1994, pp. 358–374; Baerman, Brown, and Corbett 2017, pp. 115–16)

| | 'tap on the head' | 'return' | 'do' | 'pass' | 'love' | 'hear' | 'fall' | 'give birth' | 'plant' | 'lick' |
|---|---|---|---|---|---|---|---|---|---|---|
| AOR | tuà | goá | tié-ní | cié | bua | gbà-dì | bà | ma | bù-lì | liâ |
| IPFV | tua-ní | goâ | tie | cié-dí | buà | gbà | baà-lí | ma | bu | liá-gí |
| PFV | tuà | goá-ní | tié-nì | ciê | bua-dì | gba-dì | bà | ma-lì | bù-lí | liá |

When laying out a typology of the paradigmatic structure of inflectional classes, Baerman, Brown, and Corbett (2017, pp. 100–116) distinguish between allomorphic

---

[23]The tone on the suffixes does not seem to be predictable by the segmental shape of the prefixes (for example, there is both *-dí* and *-dì*), or by independent factors such as the tone pattern of the stem (both High- and Low-toned suffixes are found after stems ending in any tone), so the tone patterns can be analyzed as being properties of the paradigm cells and the associated word forms holistically, as opposed to be being inherent parts of the suffixes.

classes (which are distinguished based on the *shape* of the exponents in question) and distributional classes (which are distinguished by the *distribution* of the exponents). They provide the Gulmancema data in Table 1.30 as an example of a system in which the two combine: the different inflectional classes are distinguished by the shape of the suffix in question (*-ni, -di, -li, -gi*, or none) as well as the distribution of the suffix (if any) across the paradigm—the three suffixes *-ni, -di* and *-li* occur in three different distributions: in the imperfective, the perfective, or the perfective as well as the aorist.

The distribution and shape of the suffixes are independent of the tone patterns associated with the paradigm cells. This is illustrated in Table 1.31, which shows two different verbs with the same suffix, but different stem tone patterns, and in Table 1.32, which shows two different verbs with different suffixes, but the same tone pattern. Finally, Table 1.33 shows two different verbs with the same suffix and the same stem tone patterns, but with the suffix showing different distributions. In Gulmancema, the tonal formatives seem to operate independently from the segmental ones, and the next section explores this type of system further.

**Table 1.31**: Same suffix, different tones (Naba 1994, p. 358)

|      | 'return' | 'mature' |
| ---- | -------- | -------- |
| AOR  | goá      | bè       |
| IPFV | goâ      | be       |
| PFV  | goá-ní   | bè-ní    |

**Table 1.32**: Different suffixes, same tones (Naba 1994, pp. 359–360)

|      | 'to eat plenty' | 'lick'  |
| ---- | --------------- | ------- |
| AOR  | guô             | liâ     |
| IPFV | guó-dí          | liá-gí  |
| PFV  | guó             | liá     |

**Table 1.33**: Different distribution of suffix, same tones (Naba 1994, pp. 358–360)

|       | 'mature' | 'belch' |
|-------|----------|---------|
| AOR   | bè       | biè     |
| IPFV  | be       | bie-ní  |
| PFV   | bè-ní    | biè     |

### 1.7.3 Paradigmatic layers and morphological organization

Previous research on inflectional class typology has taught us that when there is distributed or multiple exponence, the possibility arises that different formatives may vary independently of each other, such that a single lexeme simultaneously belongs to multiple inflectional classes (Baerman 2013), giving rise to multiple *paradigmatic layers* (Brown and Hippisley 2012). For example, Russian nouns fall into a set of inflectional classes based on the form of case and number suffixes, but in addition, they fall into a separate set of classes based on their stress patterns. Given that the two classes partly cross-cut each other, they have been analyzed as two independent layers of morphological organization (Brown and Hippisley 2012; Parker and Sims 2020). Other examples include segmental affixes and inflectional stress in Greek nouns (Sims 2015, Chapter 5) as well as prosodic structure, stem augments, and suffixes in verbs in Pitjantjatjara (Pama-Nyungan; Australia) (Wilmoth and Mansfield 2021).

If tone can do anything that non-tonal morphology can do (Hyman 2016, p. 16), we would expect them to be able to form independent paradigmatic layers as well, and indeed this is the case. Morphological systems in which there are both tonal and non-tonal paradigmatic layers are particularly pervasive across Oto-Manguean, as discussed by e.g. Palancar (2016), Baerman (2014), and different authors contributing to the special issue of *Amerindia* on inflectional class complexity across Oto-Manguean (Baerman, Palancar, and Feist 2019). For example, Woodbury (2019) shows that in

the Chatino languages, tonal and non-tonal marking of aspect/mood form two different paradigmatic layers that vary independently of each other. Each verb thus belongs to two inflectional classes at once, one based on tone patterns, and one based on prefix patterns. Outside of Oto-Manguean, a complex example of a system with tonal and non-tonal paradigmatic layers is found in Asama (Northern Ryukyuan, Japonic; Japan) as documented and analyzed by Lévêque and Pellard (2023). For reasons of space, I will focus on one type of system which illustrates the basic principles, namely Chiquihuitlán Mazatec (Oto-Manguean; Mexico), as analyzed by Ackerman and Malouf (2013), based on Jamieson (1982).

In Chiquihuitlán Mazatec, verbs are inflected for aspect and person along three dimensions: tones, final vowels, and stem formatives. An example is provided in Table 1.34, showing a partial paradigm for 'remember'. Tones are marked by superscript numbers (from 1 = High to 4 = Low).

**Table 1.34**: Positive paradigm for $ba^3se^2$ 'remember' (Ackerman and Malouf 2013, p. 447; Jamieson 1982, p. 166)

|  | Neutral | | Incompletive | |
|---|---|---|---|---|
|  | SG | PL | SG | PL |
| 1INC |  | $\check{c}a^2s\tilde{e}^2$ |  | $\check{c}a^4s\tilde{e}^{42}$ |
| 1 | $ba^3sæ^1$ | $\check{c}a^2s\tilde{\imath}^{24}$ | $kua^3sæ^1$ | $\check{c}a^4s\tilde{\imath}^{24}$ |
| 2 | $\check{c}a^2se^2$ | $\check{c}a^2s\tilde{u}^2$ | $\check{c}a^4se^2$ | $\check{c}a^4s\tilde{u}^2$ |
| 3 | $ba^3se^2$ | | $kua^4se^2$ | |

Each verb simultaneously belongs to three different inflectional classes distinguished by tones, final vowels and stem formatives, respectively. There are six tonal classes, ten final vowel classes, and 18 stem formative classes. The available tone patterns, final vowels, and stem formatives yields 6 x 10 x 18 = 1080 logically possible combinations (or "meta-classes"). Of these, only 109 are reported to be attested, and some of these classes have more members than others. Still, Ackerman and Malouf

(2013, p. 448) show that there is little predictability among the classes: "knowing the class membership in one dimension does little to help predict the class membership in another", i.e. they form independent paradigmatic layers.

Ackerman and Malouf (2013) further show that despite the high morphological complexity of Mazatec, with little form-function isomorphism both within and across paradigms, inflected word forms are organized by a network of implicational relations that license reliable inferences between them. We will not recapitulate all the details of their analysis here, but we will make a few remarks on the organizations of the tonal layer based on Table 1.35, which provides schematized tone patterns of the different tonal classes.

**Table 1.35**: Chiquihuitlán Mazatec neutral aspect tone patterns (Ackerman and Malouf 2013, p. 449; Jamieson 1982, p. 148)

| | 1SG | 2SG | 3 | 1INC | 1PL | 2PL |
|---|---|---|---|---|---|---|
| A | 3-1 | 3-1 | 3-1 | 3-31 | 3-14 | 3-1 |
| B1 | 1-1 | 2-2 | 2-2 | 2-2 | 2-24 | 2-2 |
| B2 | 3-1 | 2-2 | 3-2 | 2-2 | 2-24 | 2-2 |
| C | 1-43 | 14-3 | 3-24 | 14-42 | 14-34 | 14-3 |
| D1 | 1-1 | 3-2 | 3-2 | 3-2 | 3-24 | 3-2 |
| D2 | 3-1 | 3-2 | 3-2 | 3-2 | 3-24 | 3-2 |

The paradigms are organized in such a way that the tones found in a given cell provide some information about the tones found in other cells. For example, the 1PL and 2PL tone patterns are informative for each other such that the 1PL tones are the same as the 2PL tones except there is an additional tone 4 at the end. Moreover, the tone patterns found in class C are only ever found in class C, so knowing any form of a verb in this class (e.g. the 1SG form with its 1-43 tone) uniquely identifies this inflectional class, which allows one to predict the remaining forms. Although both class A, B2, and D2 have tone 3-1 in the 1SG cell, they have different tone patterns in the 2SG cell

(3-1, 2-2, and 3-2, respectively), so knowing both forms serves to disambiguate and is diagnostic of tone class membership.

Mazatec is an example of a language in which tone functions as a co-exponent of morphosyntactic properties alongside non-tonal ones (stem formatives and final vowels), where tonal and non-tonal formatives form separate sets of inflectional classes. That is, the tonal exponents form their own independent paradigmatic layer. Looking at the data in terms of informativeness, the tonal (and non-tonal) formatives are informative for morphosyntactic properties, but also for inflectional class, such that knowing the tones of one inflected verb form reduces the uncertainty when predicting an unknown form of the same verb. The Mazatec case thus provides a clear example of what we have seen throughout the chapter, namely the importance of morphological *organization* in analysis.

### 1.7.4   Section summary

The goal of the present section was to illustrate the morphological role of tone in the organization of inflectional classes, and to demonstrate how tonal and non-tonal formatives may interact. This has shown yet another way in which attested morphological systems deviate from form-function isomorphism in the way they are organized, namely *across* paradigms (of different lexemes or classes of lexemes), not just within them. In such systems, exponents can be analyzed not only in terms of their informativeness for morphosyntactic properties, but also for their informativeness about inflectional class membership.

## 1.8 Concluding remarks

This chapter has built on previous work on the typology of morphological tone under a paradigmatic perspective (Palancar 2016) by incorporating insights from exponence typology (e.g. Carroll 2022) as well as from the study of polyfunctionality (e.g. Stump 2014), morphomes (e.g. Herce 2020), and inflectional class typology and paradigmatic layers (e.g. Baerman 2013; Parker and Sims 2020). Previous research on exponence typology has shown the usefulness of thinking about exponence as information encoding, where the informativeness of different formatives emerges from patterns of distributions across paradigms. This allows us to capture the many form-function mappings that are found cross-linguistically in a *non-aprioristic* way, as opposed to describing natural language data as deviations from an isomorphic "ideal". While this has previously been shown for segments (Carroll 2022), the present chapter has extended this typology and incorporated suprasegmental morphology, specifically morphological tone. Conceptualizing tone this way and demonstrating the diversity of ways in which tonal formatives may be distributed across morphological paradigms has allowed us to deepen our understanding of the role of tone in the organization of morphological systems. This way, we have embedded the study of morphological tone within a broader study of morphological organization.

I have aimed to develop a precise typology of tonal exponence, and have shown that when analyzing the morphological role of tone, several aspects need to be considered: whether the tonal exponent is a single tone or a tonal melody, whether tone is the sole exponent of a morphosyntactic property or one of multiple exponents, and how each tonal and/or non-tonal exponent map onto grammatical meaning. Table 1.36 provides a summary of the exponence types presented in this chapter, with references to the relevant examples. What emerges from the attested diversity is a taxonomy

of morphological organization, based on paradigmatic contrasts. With this taxonomy, we have established an empirical argument for a paradigm-based view of morphology (Blevins 2016), where we take the attested diversity at face value and treat the range of encoding strategies as equivalent, as opposed to choosing form-function isomorphism as the theoretical 'ideal'.

**Table 1.36**: A taxonomy of grammatical organization, with reference to the types of tonal exponence presented in this chapter

| Types of tonal exponence | Example |
| --- | --- |
| Simple exponence | Locative marking in Jamsay (Table 1.9) |
| Cumulative exponence | Aspect marking in Iau (Table 1.11) |
| Multiple exponence | Case marking in Rere (Table 1.12) |
| Zero exponence | Case marking in Somali (Table 1.13) |
| Empty exponence | Linking elements in Norwegian (Table 1.14) |
| Subset exponence | Subject marking in Chimwiini (Table 1.15) |
| Distributed exponence | TAM marking in Rere (Table 1.18) |
| Tonal morphomes | Subject marking in Tlatepuzco Chinantec (Table 1.19) |
| Tonal morphomes as co-exponents | Person marking in Modo (Table 1.24) |
| Inflectional classes made by tone | Aspect marking in Gulmancema (Table 1.29) |

In the present chapter, I have taken an abstractive approach to morphological analysis (Blevins 2006), and conceptualized tonal exponents as abstractions emerging from patterns across paradigms. In such an approach, there is no inherent expectation that words will be structured in a compositional way, with the meaning of the word being equal to the sum of its parts. Inspired by Carroll's (2022) conceptualization of exponence as *informativeness* of a given formative for morphosyntactic properties, I have been able to lay out the attested types of tone-function mappings in a non-aprioristic way. It is my hope that the approach developed here will prove fruitful for future description of the tonal morphology of particular languages, for cross-linguistic comparison of the role of tone in morphological organization, and for different theories of exponence and morphological complexity.

Most previous works on the typology of morphological or grammatical tone take a constructive approach to morphological analysis, and is concerned with providing rules for building inflected word forms, thus focusing on topics relevant to this conceptualization of morphology, such as cyclicity and dominance effects (Rolle 2018), whether to conceptualize grammatical tone as item-based or process-based (Sande 2023), or how to analyze replacive tone as concatenative morphology (Trommer 2024). A bold claim made within Concatenativist approaches to morphology is that "Morphology = Concatenation + Phonology" (e.g. Trommer 2024). For example, Bye and Svenonius (2012) propose that all non-concatenative morphology is epiphenomenal, and can be analyzed as the surface result of an underlying concatenation of phonological content in a linear order which directly reflects syntactic hierarchy. With respect to tonal morphology, the authors illustrate this with the locative Low tone in Jamsay (discussed here in 1.4.2). But as we have seen in the present chapter, the tonal locative marking in Jamsay illustrates just one of many attested roles that tones may play in the organization of morphological systems cross-linguistically. A challenge for the constructive approach to morphological analysis is to develop a unified account of the diversity of phenomena addressed in this chapter, i.e. non-isomorphic form-function mappings, different possible overlaps between the information provided by a tonal formative and its co-exponent(s), the role of tone in inflectional class organization, and paradigmatic layers.

The present work has discussed a range of deviations from form-function isomorphism both within and across paradigms. This opens up several questions for future research: what is the frequency of the different exponence types across languages, and what might explain this? How do the different exponence types develop within different morphological systems? Are they all diachronically stable?

Thinking about exponence as informativeness helps us understand the diversity of ways in which languages organize their morphologies. It lays out the design space which morphological typology will have to explain, and opens up new questions for learning, processing, and diachrony.

Chapter 1, in full, is a reprint of the material as it appears in Kaldhol, Nina Hagen. 2024. "A Typology of Tonal Exponence". *Morphology* 34.3, pp. 321–367. The dissertation author was the primary investigator and author of this paper.

# Chapter 2

# Tone in Tira: an overview

This chapter presents an overview of the tone system of Tira. The goal is to lay out an analysis of the tone system, to establish the background needed for the remaining chapters of the dissertation, and to identify some open questions for future research. Section 2.1 provides information about the Tira language, a summary of previous literature on tone in Tira, and background about the project of which the present work is a part. Section 2.2 establishes the surface tone contrast in Tira and discusses the attested lexical tone patterns. Section 2.3 presents an overview of the tonological processes in the language. Finally, Section 2.4 concludes.

## 2.1 Background

Tira (aka. Tiro or Thiro; ISO: tic) is a Niger-Congo language of the Heiban family (Schadeberg 1981a), spoken in the Nuba Mountains in Sudan. To our knowledge, there is no reliable census or estimate to determine the number of speakers. Scholars disagree about the external classification of the Heiban languages (see e.g. Dimmendaal 2018); for more detail, see Chapter 4.

### 2.1.1 Previous literature on Tira

Previous literature presenting primary Tira data includes a short grammar by Stevenson (1942/2009), a master's thesis by Watters (1993), and a conference presentation by Alaki (2017). In addition, word lists are provided in some sources (Guest 1995), and the language is included in larger surveys of Heiban (Schadeberg 1981a), or more broadly, of the languages of the Nuba Mountains (e.g. Stevenson 1961, 1964). The present discussion will be limited to those two works who go in depth, namely Stevenson (1942/2009) and Watters (1993), focusing on what they have to say about tone.

While Stevenson (1942/2009) had discovered some tonal minimal pairs in Tira, including the ones in (11), he did not go into much detail about the tone system. One page is dedicated to a discussion about possible tone or stress and its relationship to intonation, where he observes that "inherent tone plays little part in distinguishing words" (Stevenson 1942/2009, p. 17). He admits that the details would still need to be worked out, but tentatively concludes that "Tira is not a tone language in the fullest sense of the term" (Stevenson 1942/2009, p. 17).

(11)  Tonal minimal pairs provided by Stevenson (1942/2009, p. 87)

| *motion from* | *motion to* | |
| --- | --- | --- |
| trudho | trudho (falling tone) | get up |
| aŋtho | aŋtho (rising tone) | go in, out |

In contrast, tone is the main topic tackled by Watters (1993), who shows that "Tira has phonologically significant, contrastive pitch" (Watters 1993, p. 88) and therefore concludes that Tira *is* in fact a tone language. Examples of minimal pairs are provided in (12). The work focuses on the phonology of tone in Tira and is dedicated to establishing surface tone contrasts, investigating tonological processes, and working out autosegmental analyses. The thesis also mentions some tone-morphology interactions, but is mainly focused on phonological effects (such as tonal stability after vowel deletion due to hiatus between a root and an affix; see Section 2.3.3 for more on this).

(12)  Examples of tonal minimal pairs provided by Watters (1993, p. 73)
  a.  lùɾɔ̀ 'testicle'
      lùɾɔ́ 'goat dung'
  b.  lápɔ̀ 'we (INC) brought'
      làpɔ̀ 'they brought'

The nominal tone melodies reported by Watters (1993) are exemplified in (13), where they are listed based on the number of syllables of the noun.

(13) Surface nominal tone patterns documented by Watters (1993, pp. 98-105)

    a. Monosyllabic nouns:

        L   lɔ̀n   'crop'

        H   ŋɛ́n   'dog'

        R   ŋɛ̌n   'country'

        F   ŋâw   'water'

    b. Disyllabic nouns:

        LL   yàbà   'stars'

        HH   ɔ́bɔ́   'eight'

        LH   lùɾɔ́   'goat dung'

        HL   nánà   'mother'

        HF   áɾû   'shield'

        LF   ìlêð   'hoe'

    c. Trisyllabic nouns:

        LLL   àlàcì   'wool'

        HHH   ŋícɔ́lɔ́   'squirrel'

        HHF   ɛ́ðíɲên   'sun'

        LHL   àmbátì   'robber'

        LHF   ùlíŋê   'night'

As we will see below, this is partially, but not fully in line with our own findings: Firstly, there are only derived Rising tones in our data set (see Section 2.3.1); where Watters has R tone, we have H. Secondly, where Watters has HHF we have LLH (e.g. *ɛ́ðíɲên* vs. *àðə̀nén* 'sun'), and where Watters has LHF we have LHH (e.g. *ùlíŋê* vs. *ùlíŋɛ́* 'night'). Finally, we have two more tone patterns attested on trisyllabic nouns, namely LLF, as in *ðàlgàɾâj* 'hyena', and HLL, as in *kámàɾà* 'friend, buddy' (though this is marginal and restricted to this single lexical item). We will return to our own dataset in Section 2.2. At this point, we do not know whether the differences between her find-

ings and ours are due to between-speaker variation (e.g. different dialects or sociolects), language change, or simply due to a difference in our methodologies, such as the type of carrier phrase.

Watters (1993) analyzes the data in (13) as the result of seven lexical tonal melodies associating to nouns of different lengths predictably, as in Table 2.1. Under Watters' analysis, there are two HL tone patterns (HL and *HL) and two LHL tone patterns (LHL and L*HL), which are distinguished by how they associate to TBUs, with the *H extending over more than one syllable and combining with a following L to create a contour tone (see Watters 1993, pp. 107–111 for discussion).

**Table 2.1**: Watters' analysis of nominal tone patterns (Watters 1993, pp. 98-105)

|      | σ              | σ σ            | σ σ σ          |
|------|----------------|----------------|----------------|
| L    | L              | LL             | LLL            |
|      | lɔn            | yàbà           | àlàcì          |
|      | 'crop'         | 'stars'        | 'wool'         |
| H    | H              | HH             | HHH            |
|      | ŋén            | ɔ́bɔ́           | ŋícɔ́lɔ́        |
|      | 'dog'          | 'eight'        | 'squirrel'     |
| LH   | L͡H            | LH             | –              |
|      | ŋěn            | lùɾɔ́          |                |
|      | 'country'      | 'goat dung'    |                |
| HL   | H͡L            | HL             | –              |
|      | ŋâw            | nánà           |                |
|      | 'water'        | 'mother'       |                |
| *HL  | –              | HF             | HHF            |
|      |                | áɾû            | ɛ́ðíɲên        |
|      |                | 'shield'       | 'sun'          |
| LHL  | –              | LF             | LHL            |
|      |                | ìlêð           | àmbátì         |
|      |                | 'hoe'          | 'robber'       |
| L*HL | –              | –              | LHF            |
|      |                |                | ùlíŋgê         |
|      |                |                | 'night'        |

According to Watters (1993, pp. 78–84), the tonological processes in Tira include downtrends, pitch lowering from depressor consonants (Watters 1993, pp. 78–84), and some tonal effects of the segmental phonology, such as tonal stability after vowel deletion or glide formation (Watters 1993, pp. 59-66). In our own data, we have also found some downtrends as well as tonal stability (see Section 2.3), but we have not seen any evidence of depressor consonants.

## 2.1.2 The Tira Language Project

The data presented in the remainder of this chapter was collected between 2020–2024 as a part of the Tira Language Project, a collaboration between the native Tira speaker Himidan Hassen and researchers at UC San Diego and UC Berkeley: Sharon Rose, Peter Jenks, Mark Simmons, and the present author. In addition, we have had the help of a total of 14 undergraduate research assistants participating through the *Program for Undergraduate Research in Linguistics* (PURL) at UC San Diego, who have worked on the project for three to six months each on tasks such as data annotation and transcription. Himidan's language biography is outlined in Section 2.1.3.

The Tira Language Project started out in the summer of 2020. This was a time where linguists doing language documentation had to rethink their methodologies because of the travel restrictions that were put in place due to the global COVID-19 pandemic, which made it impossible to do fieldwork in the traditional sense. During this time, linguists continually discussed the challenges and advantages of so-called "remote fieldwork", i.e. primary data collection mediated by alternative methods such as video-conferencing tools, e.g. Zoom (see e.g. Leemann et al. 2020; Williams et al. 2021 and the special issue of *Linguistics Vanguard* edited by Sneller 2022).

The database we have built for the Tira Language Project is the result of such "remote fieldwork" in that the data collection is based on meetings taking place over

Zoom. Over the years, Himidan has met for about an hour or two a week with one or more of the collaborating researchers, sometimes with the full team. During this time, he has recorded narratives which we have analyzed together, and in addition, a large portion of the database is the result of elicitation by translation, targeting various aspects of the grammar of the language. Himidan has a Lapel microphone and records the meetings in WAV (24-bit 44.1 kHz) using Audacity, ensuring good audio quality. In addition, we record the meetings through Zoom as a backup. This practice has proven helpful from time to time when there have been issues with the primary recordings, but the Zoom recordings are subject to audio processing and filtering and therefore cannot be used for acoustic research.

In general, we have found that while "remote fieldwork" has some clear limitations, it works well for certain types of data, as long as one is mindful about its limitations and the types of research questions one can ask. While it would have been hard to gather naturalistic conversational data due to the latency affecting the flow of speech and turn-taking (see e.g. Seuren et al. 2021), it works well for simpler tasks such as elicitation by translation. As for the narratives, the ideal would have been to record two or more Tira speakers telling stories in a naturalistic setting, but in lieu of this opportunity, a good alternative was to ask Himidan to narrate stories with a potential future online audience in mind. At the moment, the ideal fieldwork scenario is impossible for Tira, as it is not safe to travel in Sudan. What we are presenting here, although not without limitations, therefore makes important progress in the description and documentation of the language which would not otherwise have been possible.

In the ideal case, we would have data from multiple speakers, such that we would be able to replicate the main findings as well as to document between-speaker variation. However, we have not been successful in recruiting more speakers, and travel to the Nuba Mountains or other areas of Sudan where there are diaspora communities of Tira

speakers has not been possible, first due to the COVID-19 pandemic, and then due to escalating conflict and civil war within Sudan. Given that there are few sources on Tira from before, the present work is still a valuable contribution to the field, but it should be kept in mind that what we are describing is Himidan's idiolect.

We have compared our findings and Himidan's idiolect to what has been documented in previous works, and when there is overlap in terms of topic (e.g. tone or morphology) or the lexical items discussed, we have found that with very few exceptions, Himidan's linguistic system is in line with the previous work. For example, we have found the same number and types of noun classes as Stevenson (1942/2009, p. 28), as well as the verbal inflection classes which his data is hinting at (Stevenson 1942/2009, p. 61). Regarding the tone system, we already discussed some similarities and differences between our findings and those of Watters (1993) above. These differences may be due to a number of factors which at the moment we cannot disentangle, e.g. dialect variation or language change, but seem minor when the other similarities between works are taken into account. Therefore, while there could have been a risk of e.g. incomplete acquisition (Montrul 2008) or language attrition (Seliger and Vago 1991), there is no evidence of this based on what we have found.

In addition to narratives and elicitated data, our database contains recordings of Himidan reading written Tira texts. The Tira language has an orthography which was developed by the community, and this is taught in schools. We have been working with one of the books developed for teaching the Tira alphabet and spelling conventions. An excerpt from a story narrated by Himidan is provided in (14), and the example in (15) is from the Tira spelling book.

(14) *Ne ngizini utizi ngarrtte, "ttuli an ngi elo".*

nὲ   ŋìðəní   ŋ-úʈìð-ì   ŋ-árʈ-ὲ   ʈòlé   àn   íɲí   έlɔ̀
then (CLŋ)hare 3SG-call-FV 3SG-say-FV (CLʈ)lion FOC 1SG (CLk)God
'The hare spoke in a deep voice and called out to the lion: "Lion, listen, it is me,

God."'

From the story about the hare, the lion, and the fox

(15) *Sohinggo satahan sabrra ngemettere.*

sàɾíŋgɔ́   s-áʈàɾàn s-á   ábr-à   ŋàmʈὲɾὲ
(CLs)donkey CLs-small CLs-AUX jump-FV (CLŋ).frolicking
'Little donkeys jump around frolicking.'

From the Tira spelling book

The outcome of the project is about 200 hours of recorded material, and works on several topics of the Tira grammar, including nominal morphology, such as noun class and case marking; verbal morphology, such as the number, type and ordering of extension suffixes (Simmons 2022a), TAM and deixis marking (Kaldhol 2023) and participant marking (Hassen, Kaldhol, and Rose 2021); topic and focus and its relationship to the syntax (Jenks, Hassen, and Rose 2022) and the prosodic structure of the language (Kaldhol, Rose, and Simmons Accepted); content questions (Hassen et al. 2021); possessor raising (Simmons 2022b); inalienable possessives (Rose 2023); and morphologically constrained vowel harmony (Simmons 2023). In addition, Mark Simmons is in the process of developing the tool *Zugubul*, an automatic speech recognition model which annotates audio files in ELAN. The tool has been trained on a database of ELAN files annotated by us, and is now capable of transcribing Tira in the IPA.

## 2.1.3   Himidan's language biography

Himidan was born in 1991 in the village Komo, to the East of Kauda. He speaks Tira, Arabic, English, and Swahili. He grew up speaking Tira, and also used Arabic

when interacting with other Nuba communities, such as the Otoro people who lived nearby. When he was ten years old, he started Kumo Primary School, where he learned to read and write. Although they spoke Tira in school, Arabic was the main language used for reading and writing. He also started learning written English at this time. After two years at Kumo Primary School, he transferred to the Catholic Missionary School in Gidel, where students as well as teachers were from many Nuba communities, including Kadugli, Koalib, Moro, and Otoro. Here, he took his first Tira class, and learned to read and write Tira. Other subjects were taught in English and Arabic. Himidan explains that he got plenty of practice speaking English at this time, as there was a social incentive for it: everyone knew how to speak Arabic, but you were considered bright if you were able to speak English well, and it was seen as fun and interesting.

At the age of 14, Himidan moved to Kakuma refugee camp in Kenya, partly because of tensions in the Nuba Mountains, and partly for education. He lived in Kenya from 2005–2014, where he learned Swahili. During these years, he used both spoken and written Tira, Arabic, English, and Swahili, colloquially as well as in school. From 2009-2012 he left Kakuma and attended high school in Nakuru in Central Kenya. In Nakuru, he mostly used English and Swahili. In 2013, he went back to Kakuma and started teaching high school (biology, chemistry and mathematics) and primary school (mathematics and social studies), with English and Swahili as the languages of instruction. He still used Tira and Arabic extensively during his free time.

At the age of 23, he was admitted to a resettlement program and moved to Canada, where he completed a degree in economics and political science. Today, he still lives in Canada, and while the language he speaks most often is English, he still speaks Tira regularly as he calls his family three-four times per week. In addition, he speaks Arabic regularly with people from other Nuba communities in Canada, and Swahili with friends from Kenya.

## 2.2   Lexical tone

We now move on to presenting an analysis of the tone system of Tira, focusing on the key facts that serve as background for the remaining chapters of the dissertation.

Tone is contrastive in Tira, and can be used to distinguish between different lexemes, or different forms of the same lexeme. This is illustrated by the minimal pairs listed in (16)–(17), two word pairs which differ tonally.

(16)   Tone distinguishing lexemes

  ìjɔ̀   'shepherd'   LL

  íjɔ́   'fire'          HH

(17)   Tone distinguishing forms of the same lexeme

  vɽ́ð-ɔ́   'throw away'      HH

  vɽ̀ð-ɔ́   'throw towards'   LH

We have seen no evidence of lexical tone on verbs so far, so the present discussion will be focused on lexical tone on nouns, and is based on our current database of about 200 noun lexemes. Their nominal tone patterns were determined by using carrier phrases of the kind in (18), where the noun is followed by a predicate, which is a target of noun class agreement. There is a process of final lowering at utterance boundaries in Tira, and this carrier phrase ensures that the nominal tone pattern is unaffected by this lowering. Instead, the final High tone of the predicate (otherwise *CL-ɔ̀l-á*; *CL-tʃəl-ó*) becomes Low.

(18)   Carrier phrases used to determine tone pattern and noun class

  a. t̪òlé  t̪-ɔ̀l-à
    (CLt̪)lion CLt̪-tall-FV
    'The lion is tall.'

  b. mùðù   k-ɔ̀l-à
    (CLk)leopard CLk-tall-FV
    'The leopard is tall.'

c. ɛ́lê        kì-tʃə̀l-ò
   (CLk)king CLk-good-FV
   'The king/chief is good.'

d. nɛ́lê        nì-tʃə̀l-ò
   (CLn)kings CLn-good-FV
   'The kings/chiefs are good.'

There are three basic tones, High, Low and Falling, which combine into the lexical tone melodies illustrated in (19)–(21), where they are sorted based on the number of syllables of the noun. There is no evidence that the mora is relevant in Tira, and we therefore assume that the Tone-Bearing Unit (TBU) is the syllable.

(19)   Tone in monosyllabic nouns

   H   ðé   'hand'

   L   ðù   'heart'

   F   ðô   'stick'

(20)   Tone in bisyllabic nouns

   HH   íjɔ́   'fire; gun'

   LL   ìjɔ̀   'shepherd'

   HL   árò   'chicken'

   LH   ìlɛ́ð   'hoe'

   HF   ŋúɽî   'axe'

   LF   ɛ̀râð   'cloth'

(21)   Tone in trisyllabic nouns

    HHH   lípíjó        'mushroom sp.'

    LLL   làvàrà        'stick'

    HLL   kámàɽà       'friend'

    LHH   lùbúʈú       'dove'

    LLH   lùr̀ìjɔ́       'cucumber'

    LLF   ðàlgàrâj      'hyena'

    LHL   ðɜ̀ríbì        'pen (for animals)'

In Table 2.2, the frequency of each surface tone pattern is listed.  The most common tone patterns in our database are High (H, HH, and HHH), Low (L, LL, and LLL), and Low-High (LH and LLH).

Table 2.2: Nominal tone patterns in Tira and their frequency in our database

| Surface tone pattern | Number of nouns |
| --- | --- |
| [H] | 10 |
| [L] | 3 |
| [F] | 3 |
| [H.H] | 36 |
| [L.L] | 50 |
| [L.H] | 48 |
| [H.L] | 5 |
| [L.F] | 3 |
| [H.F] | 5 |
| [H.H.H] | 4 |
| [L.L.L] | 16 |
| [L.L.H] | 14 |
| [H.L.L] | 1 |
| [L.H.H] | 6 |
| [L.H.L] | 4 |
| [L.L.F] | 3 |
| [L.L.L.L] | 2 |
| Total | 213 |

82

While a subset of the nominal tone patterns could be analyzed as a limited set of tonal melodies linked to syllables in a predictable manner, from either left to right or right to left (along the lines of Watters' 1993 analysis, sketched in Table 2.1), this approach would not account for all of the surface tone patterns. For example, the existence of both LHH and LLH shows that we are not simply dealing with a LH melody associating from left to right (LHH) or right to left (LLH), as both are attested.

Note that Falling tones are limited in distribution to the final syllable of a word. The examples in (20) show that all logically possible combinations of H, L, and F on bisyllabic nouns are attested except the combinations where the F tone occurs first (FH and FL). That is, all six predicted bisyllabic melodies with F restricted to final position are attested. We therefore conclude that F is a contrastive tone, but restricted in distribution.

In (22), we list the tone patterns that are unattested as lexical tone patterns on trisyllabic nouns, but logically possible combinations of the three basic tones H, L and F (assuming that Falling tones may occur word-finally only).

(22)   Unattested lexical tone patterns in trisyllabic nouns

    a.   HHL

    b.   HLH

    c.   HHF

    d.   LHF

    e.   HLF

It is unclear what the significance of these unattested tone patterns are. There are relatively few trisyllabic nouns in our database, and most of them have a LLL or LLH tone pattern; thus it is possible that the forms in (22) simply are accidental gaps. Note also that while these tone patterns are unattested as lexical tone patterns, HHL,

HLH and HLF are attested as surface tone patterns after High tone spreading or docking to LHL, LLH, or LLF words, respectively. High tone spreading and docking will be discussed in more detail below.

There is no evidence that the Falling tone only maps to closed syllables with final sonorants; it is also found on open syllables (e.g. *ŋúꞵî* 'axe'). That is, there is no evidence that the syllables bearing Falling tones are bimoraic, with the mora as the TBU and the Falling tones being reducible to a High and a Low tone each associating to its own mora.

Furthermore, there is no evidence that the Falling tones are predictable realizations of High or Low tones in a given context. Consider the fact that all three tonal melodies [HH], [HF] and [HL] are attested. One could have proposed that the [HF] and [HH] tone patterns are two different realizations of an underlying /H/ tone pattern, but such an analysis would require that one identifies an independent factor that conditions the realizations [HF] and [HH]. If it were the case that the [HF] melody were limited to nouns ending in a closed syllable, for example, while the [HH] melody were limited to nouns ending in an open syllable, then the difference in surface tone pattern would have been predictable by syllable structure. However, the two surface tone patterns are found on words with comparable syllable structures, and there does not seem to be any independent factors that condition the two realizations. The examples in (23) illustrate this.

(23)

|      | VCV   | VCVC    |
|------|-------|---------|
| [HH] | élɔ́  | ámál    |
|      | 'God' | 'boy'   |
| [HF] | élê   | ɔ́rɔ̂ð |
|      | 'king'| 'curse' |

Similarly, one could have proposed that the [HF] and [HL] tone patterns are two different surface realizations of an underlying /HL/ tone pattern, but as the examples in (24) illustrate, both the [HF] and [HL] tone patterns are found on CVCV words. The [HL] tone pattern is unattested on words ending in a closed syllable, but this could just be accidental gap, as the [HL] tone pattern is only found on five nouns in our database.

(24)

|        | (C)VCV | (C)VCVC |
|--------|--------|---------|
| [HF]   | ŋúɽî   | ɔ́rɔ̂ð   |
|        | 'axe'  | 'curse' |
| [HL]   | ðɔ́ɾà   | –       |
|        | 'fence' |        |

A complete list of the 213 noun lexemes in our database is provided in the Supplementary materials.

## 2.3 Tonological processes

The present section gives a preliminary overview of the main tonological processes in Tira, namely contour formation, floating tone docking, High tone stability, and High tone spreading. This is not intended as an exhaustive analysis of the tone system in Tira, but presents preliminary analyses of the phenomena that are considered to be necessary background for the upcoming chapters.

### 2.3.1 Contour formation

There are two surface contour tones in Tira, a Falling and a Rising tone. While the Rising tone is always derived, the Falling tone is found among the lexical tone patterns as well (see Section 2.2). Table 2.3 illustrates a derived Rising tone ($\widehat{\text{LH}}$).

**Table 2.3**: The association of the LH imperative ventive tone pattern

|     |         |          | Stem tone | Suffix tone |
|-----|---------|----------|-----------|-------------|
| a.  | mùt̪ə̀n-ɔ́ | 'smell'  | LL        | H           |
| b.  | kìð-ɔ́   | 'open'   | L         | H           |
| c.  | p-ɔ̌     | 'beat'   | -         | **L͡H**     |

As will be discussed further in Chapter 3, imperative ventive forms of verbs have Low-toned stems and a High-toned final vowel. In Table 2.3c, however, the root is asyllabic and voiceless (*p*) and thus not tone-bearing, and the Low stem tone is instead realized on the final vowel. The Low tone combines with the High tone on the final vowel, creating a surface Rising tone (-ɔ̌).

The data in (25) illustrate an example of a derived Falling tone. In (25a), a High-toned auxiliary (*á*) is followed by a Low-toned person marker -*l̀*, which syllabifies as coda, and the two tones combine to a surface Falling tone. In this case, the Falling tone is the result of the concatenation of the two tonal primitives High and Low. For comparison, a verb form without the person marker -*l̀* is included in (25b), showing High-toned auxiliary *á* (whose High tone spreads to the verb stem as expected—see Section 2.3.4 for details).

(25)   H and L combining

    a.  ŋg-**á-l̀**        vəlɛ̀ð-à → [ŋg**âl̀** vəlɛ̀ðà]
       CL.g-AUX-3PL.SBJ pull-FV
       'They will pull him/her (g-class) away' (IPFV.ITV)

    b.  ŋg-**á**       vəlɛ̀ð-à → [ŋg**á** və́lɛ̀ðà]
       CL.g-AUX pull-FV
       'He/she (g-class) will pull st. away' (IPFV.ITV)

In Table 2.4, nominative and locative forms of nouns with different tone patterns are provided. These examples show that there is a High tone locative marker in Tira, com-

bining with the lexical tone patterns at the left edge. The example in (b) shows that when the High tone locative marker associates to a LH noun, a surface Falling tone is created on the initial syllable. This can be captured as floating tone docking, discussed further in Section 2.3.2.

**Table 2.4**: Tonal locative marking

|    | Nominative |     | Locative |     |             |
|----|------------|-----|----------|-----|-------------|
| a. | lɔ̀mɔ̀      | LL  | lɔ́mɔ̀    | HL  | 'food'      |
| b. | lɛ̀ré      | LH  | lɛ̂ré    | H͡LH | 'bowl'      |
| c. | nírí       | HH  | nírí     | HH  | 'troughs'   |
| d. | ŋ̀ùɽdʒɛ̀n  | LLL | ŋ́úɽdʒɛ̀n | HLL | 'calabashes'|
| e. | nàɽàŋgár   | LLH | náɽàŋgár | HLH | 'beds'      |

When discussing lexical tone patterns in Section 2.2, we saw that Falling tones are restricted to the final syllables of words. The example in Table 2.4b shows that Falling tones may occur word-initially when they are derived (see also Section 2.3.3).

## 2.3.2 Floating tone docking

Certain words and grammatical markers affect the surface tone pattern of the following word; for example, there is a focus marker *àn* which itself is Low-toned, but contributes a High tone which is realized on the following word. This can be captured as a floating High tone: $àn^{(H)}$. This is illustrated in (26)–(30) with nouns of different lengths and tone patterns.

(26) àn⁽ᴴ⁾ mùðù       k-ɛ̂          → [àn múðù kɛ̂]      /Ⓗ+LL/ → [HL]
     FOC  (CLk)leopard CLk-DEM.PROX
     'This is a leopard.'

(27) àn⊛ ðùɽár    ð-ɛ̂        → [àn ðúɽár ðɛ̂]      /Ⓗ+LH/ → [HH]
     FOC (CLð)tiger CLð-DEM.PROX
     'This is a tiger.'

(28) àn⊛ èdə̀ɽɔ̀l   j-ɛ̂        → [àn édə̀ɽɔ̀l jɛ̂]     /Ⓗ+LLL/ → [HLL]
     FOC (CLj)tortoises CLj-DEM.PROX
     'These are tortoises.'

(29) àn⊛ àɽàŋgár  j-ɛ̂        → [àn áɽàŋgár jɛ̂]     /Ⓗ+LLH/ → [HLH]
     FOC (CLj)bed CLj-DEM.PROX
     'This is a bed.'

(30) àn⊛ írí      k-ɛ̂        → [àn írí kɛ̂]        /Ⓗ+HH/ → [HH]
     FOC (CLk)trough CLk-DEM.PROX
     'This is a trough.'

There is a process of High tone spreading in Tira (see Section 2.3.4), but as these examples show, floating High tones do not spread after docking; for example, the surface tone pattern in (26) is [HL], not [HH]. There is no downstep between the floating High tone and any High tones on the noun it docks onto; for example, the surface tone pattern in (27) is [HH], not [H↓H]. If the noun already begins in a High tone, as in (30), there is no evidence of the floating High tone.

### 2.3.3  High tone stability

When a vowel is deleted, its tone may remain, a process know as tonal stability (Yip 2002). One example of this in Tira is vowel deletion as a means of hiatus resolution. When there is vowel hiatus, it may be resolved by vowel deletion or vowel coalescence. In both cases, two underlying vowels surface as one, and the number of TBUs are reduced from two to one. In this section, we will see that if any of the two vowels involved are associated with a High tone, then that High tone surfaces even after vowel deletion. That is, there is High tone stability. Low tones are instead deleted along with their vowels.

Before illustrating tonal stability, I will lay out the basic generalizations about hiatus resolution. Hiatus between the final vowel of a verb and an object marker is exemplified in (31). The final vowels are a part of the TAMD realization system in Tira, and their quality depends on TAMD values (here the perfective ventive) and inflection class (see Chapter 3 for details). This allows us to vary the vowel quality when investigating what happens in hiatus contexts. The data in (31a-d) illustrate vowel deletion, where the first of two underlying vowels delete. We can hypothesize that it is the first vowel which deletes in (31e) as well, although there is no evidence for it because the two underlying vowels are identical. An example of vowel coalescence is provided in (31f), where two underlying vowels fuse to another surface vowel.

(31)   Vowel hiatus between FV and OBJ

    a.   k-àŋ-**ú-á**ŋà     → [kàŋ**á**ŋà]     /u a/ → [a]
       CLk-see-FV-2SG.OBJ
       's/he saw you' (cf. *kàŋú* 's/he saw so.')

    b.   kə̀-ɲèlàtʃ-**í-á**ŋà     → [kə̀ɲèlàtʃ**á**ŋà]     /i a/ → [a]
       CLk-tickle-FV-2SG.OBJ
       's/he tickled you' (cf. *kə̀ɲèlàtʃí* 's/he tickled so.')

    c.   kə̀-və̀lèð-**ɔ́-á**ŋà     → [kə̀və̀lèð**á**ŋà]     /ɔ a/ → [a]
       CLk-pull-FV-2SG.OBJ
       's/he pulled you towards' (cf. *kə̀və̀lèðɔ́* 's/he pulled st.')

    d.   k-àŋ-**ú-í**ŋì     → [kàŋ**í**ŋì]     /u i/ → [i]
       CLk-see-FV-1SG.OBJ
       's/he saw me'

    e.   kə̀-ɲèlàtʃ-**í-í**ŋì     → [kə̀ɲèlàtʃ**í**ŋì]     /i i/ → [i]
       CLk-tickle-FV-1SG.OBJ
       's/he tickled me'

    f.   kə̀-və̀lèð-**ɔ́-í**ŋì     → [kə̀və̀lèð**ɛ́**ŋì]     /ɔ i/ → [ɛ]
       CLk-pull-FV-1SG.OBJ
       's/he pulled me towards'

We now turn to the relevance of hiatus resolution for the tone system. Hiatus resolution leads to a reduction of the number of TBUs from two to one. In such cases, tones may either be deleted along with their vowels, or remain stable after hiatus resolution. The examples in (32)–(33) illustrate two vowel-final prefixes with different tones (High or Low) before nouns of different tone patterns. The High-toned prefix is the genitive marker *Cɛ́-*, where the C is a consonant whose shape is determined by agreement with the preceding noun (*l-* in (32a), and *ŋ-* in (32b)). The Low-toned prefix in (33) is a locative case prefix *nɛ̀-*.

(32)   The genitive marker *Cɛ́-*

    a.  lòðà        **l-ɛ́**-ðùɽár
        (CLl)bone CLl-GEN-(CLð)tiger
        'bone of a tiger'

    b.  ŋòðà        **ŋ-ɛ́**-ðùɽár
        (CLŋ)bones CLŋ-GEN-(CLð)tiger
        'bones of a tiger'

(33)   The locative marker *nɛ̀-*

    a.  **nɛ̀**-lɛ̀vɘ́r
        LOC-(CLl)field
        'in the field'

    b.  **nɛ̀**-lɛ̀vàvrì
        LOC-(CLl)bicycle
        'on the bicycle'

Table 2.5 shows these prefixes before vowel-initial nouns of different tone patterns, and Table 2.6 shows the corresponding tone patterns. This illustrates the tonal outcome of vowel deletion: If the prefix is High-toned, the High tone remains stable and combines with the lexical tone patterns of the noun (e.g. /H-LH/ → [FH], with

contour formation on the first syllable). If the prefix is Low-toned, this Low tone is deleted along with the vowel (e.g. /L-HL/ → [HL]).[1]

**Table 2.5**: Genitive and locative forms of vowel-initial nouns with different lexical tones

|           | ìndɔ̀   | àré    | árò      | ɛ́rɛ́    |
|-----------|---------|--------|----------|---------|
| GEN Cɛ́-  | C-índɔ̀ | C-âré  | C-árò    | C-ɛ́rɛ́  |
| LOC nɛ̀-  | n-ìndɔ̀ | n-àré  | n-árò    | n-ɛ́rɛ́  |
|           | 'drum'  | 'table'| 'chicken'| 'fence' |

**Table 2.6**: Schematized tone patterns

|     | LL  | LH  | HL  | HH  |
|-----|-----|-----|-----|-----|
| H-  | HL  | FH  | HL  | HH  |
| L-  | LL  | LH  | HL  | HH  |

Based on these data, we can conclude that if a High-toned vowel is deleted due to hiatus, its High tone survives; i.e., there is High tone stability. There is no evidence of Low tone stability in Tira.

## 2.3.4  High tone spreading

Tira has a process of cross-word High tone spreading. The examples in (34)–(35) show that 'sheep' exhibits a tonal alternation, and is realized as Low-toned (*ðàŋàlà*) after a verb form ending in a Low tone, but begins in a High tone (*ðáŋàlà*) after a verb form ending in a High tone.

(34) àprí    j-á     vɛ́lɛ̀ð-**à** ðàŋàl -à
     (CLj)boy CLj-AUX pull-FV (CLð)sheep-ACC
     'The boy will pull the sheep (away)' (IPFV.ITV)

---
[1]Note that this rests on the assumption that the vowel-zero alternations are due to deletion of a vowel before another vowel in Table 2.5, not insertion of a vowel before a consonant in (32)–(33).

(35) àprí    j-á      vèlèð-**ɔ́** ☐ðáŋàl☐-à
     (CLj)boy CLj-AUX pull-FV (CLð)sheep-ACC
     'The boy will pull the sheep (towards)' (IPFV.VEN)

We analyze this as High tone spreading in (35) as opposed to Low tone spreading in (34) because of the existence of words such as *ðɔ́rà* 'fence', which do not alternate, but is realized as High-Low in both contexts. This is illustrated in (36)–(37) (a hypothesized process of Low tone spreading would predict the form *ðɔ̀rà* in (36), but instead, we see *ðɔ́rà*).[2]

(36) láɾò      l-á     r̃lànḍ-**à** ☐ðɔ́rà☐
     (CLl)chickens CLl-AUX close-FV (CLð)fence
     'The chickens will close the fence' (IPFV.ITV)

(37) láɾò      l-á     r̃lànḍ-**ɔ́** ☐ðɔ́rà☐
     (CLl)chickens CLl-AUX close-FV (CLð)fence
     'The chickens will close the fence (far)' (IPFV.VEN)

High tones spread across words in Tira, from the final syllable of one word to the next; in contrast, there is no High tone spreading within words; this was illustrated by the tonal locative marker in Table 2.4 above, and is further illustrated in (38) with the genitive marker.

(38) No High tone spreading from the genitive prefix

   a. lòðà      l-**ɛ́**-ðàŋàl
      (CLl)bone CLl-GEN-(CLð)sheep
      'bone of sheep'

   b. lòðà      l-**ɛ́**-ðùɾár
      (CLl)bone CLl-GEN-(CLð)tiger
      'bone of tiger'

There are prosodic or syntactic domains within which High tones can spread, but they do not spread across those domains. The examples in (34)–(35) above illustrated

---

[2]The tonal alternations on the verb roots in (34)–(37) will be addressed in Chapter 3, where it is argued that there is High tone spreading from the auxiliary in (34), and that the lack of High tone spreading in (35) is construction-specific.

High tone spreading from a verb to its object. The examples in (39) illustrate High tone spreading from one object to another in a double object construction.

(39)  High tone spreading in double object constructions

    a.  l-á       ŋátʃ-à   ùrnɔ̀          ŋɔ̀mɔ̀
       CLl-AUX give-FV (CLk)grandfather (CLŋ)food
       'They will give grandfather food.'

    b.  l-á       ŋátʃ-à   dìjɔ́→      ŋɔ́mɔ̀
       CLl-AUX give-FV (CLr)cow (CLŋ)food
       'They will give the cow food.'

The examples in (40) illustrate High tone spreading within the noun phrase, from the gerund *ðɛ́vɔ́ɽɔ́* 'returning' to its object *àdám* 'book'.

(40)  High tone spreading within the noun phrase

    a.  àdám      jì-tʃəl-ò
       (CLj)book CLj-good-FV
       'The book is nice.'

    b.  ðɛ́-vɔ́ɽ-ɔ́→      ádám    ðì-tʃəl-ò
       (CLð)-return-FV (CLj)book CLð-good-FV
       'Returning the book is nice.'

The examples in (41) illustrate High tone spreading in an (O)AuxSV construction; the example in (41a) shows that the nominative tone pattern of *rɔ̀mɔ̀tʃɔ̀* 'men' is all Low; in (41b), it surfaces as HLL after a H-toned auxiliary.

(41)  High tone spreading from Aux to S

    a.  rɔ̀mɔ̀tʃɔ̀ r-á       vɛ́lèð-à ðèdɔ̀ɽɔ̀
       (CLr)men CLr-AUX pull-FV (CLð)root
       'The men will pull the root away tomorrow.'        IPFV.ITV

    b.  ð-á→      rɔ́mɔ̀tʃɔ̀ vɜ̀lèð-à
       CLð-AUX (CLr)man pull-FV
       'The men will pull it (ð-class) away.'        IPFV.ITV

In contrast, there is no High tone spreading from the initial constituent of a sentence, i.e. the topic; this is shown with subject topics in (42), and object topics in (43). In all cases, the verb begins with a Low tone (on the noun class marker), regardless of the tone pattern of the preceding noun. The same is true in (44), where the head noun of the topic is modified by an attributive adjective whose High tone does not spread to the predicate. See also Kaldhol, Rose, and Simmons (Accepted) for more on information structure and prosody in Tira.

(42) No High tone spreading from topic to verb (SVO)

    a. ðàŋàl     ðə̀-və̀lɛ̀ð-ɔ́ áprí-ɲá
       (CLð)sheep CLj-pull-FV (CLj.boy-ACC
       'The sheep pulled the boy'

    b. àprí     jə̀-və̀lɛ̀ð-ɔ́ ðáŋàl-à
       (CLlj)boy CLj-pull-FV (CLð).sheep-ACC
       'The boy pulled the sheep'

(43) No High tone spreading from topic to verb (OVS)

    a. àprí     jə̀-və̀lɛ̀ð-ɔ́ ðáŋàl
       (CLj)boy CLð-pull-FV (CLð).sheep
       'The sheep pulled the boy (as for the boy, the sheep pulled him)'

    b. ðàŋàl     ðə̀-və̀lɛ̀ð-ɔ́ áprí
       (CLð)sheep CLj-pull-FV (CLj.boy
       'The boy pulled the sheep (as for the sheep, the boy pulled him)'

(44) ŋìðə̀ní    ŋə́-rə̀mn-á̀    ŋ-ìrdɛ̀tʃ-í ʈólè-ɲá      ánò
    (CLŋ)hare CLŋ-weak-FV CLŋ-fool-FV (CLʈ)lion-ACC PART
    'The weak hare fooled the lion.'

To summarize, cross-word High tone spreading is a lexically general and productive tonological process in Tira, taking place within certain domains, but not across them. We will not attempt to give an extensive analysis of these domains here, and the interested reader is referred to Jenks, Hassen, and Rose (2022) and Kaldhol, Rose, and Simmons (Accepted).

## 2.4   Chapter summary

This chapter has provided background on the Tira language and the Tira Language Project, and presented an overview of the tone system of Tira. This establishes the necessary background for the present work, including the attested surface tone contrasts and lexical tone patterns and the basic tonological processes in the language: contour formation, floating tone docking, High tone stability, and High tone spreading.

# Chapter 3

# Dimensions of morphological complexity in the Tira verb

Morphological complexity has many dimensions (see e.g. Ackerman and Malouf 2013; Stump 2017). One of these is *complexity of exponence*, i.e. form-function mismatches in the mapping between morphosyntactic properties and exponents. As Anderson (2015) puts it: "languages abound in relations between form and content that are complex in the basic sense of violating the most natural way of expressing the one by the other". This chapter presents novel data illustrating the organization of the verbal morphology of Tira. It is shown how morphosyntactic property sets are realized on lexemes through a combination of tonal exponents, morphomic final vowels, prefixes and auxiliaries. As a starting point, consider the paradigm in Table 3.1, illustrating different forms of the verb *vəlɛð* 'pull'.[1]

**Table 3.1**: Paradigm for the verb *vəlɛð* 'pull'

| *vəlɛð* 'pull' | Itive (away) | | Ventive (towards) |
| --- | --- | --- | --- |
| IMP | *vǝ́lɛ́ð-ɔ́* | | *vǝ̀lɛ̀ð-á* |
| | pull-FV | | pull-FV |
| IPFV | *l-á vǝ́lɛ̀ð-à* | | *l-á vǝ̀lɛ̀ð-ɔ́* |
| | CL-AUX pull-FV | | CL-AUX pull-FV |
| PFV | *l-à vǝ́lɛ̀ð-ɛ̀* | | *lǝ̀-vǝ̀lɛ̀ð-ɔ́* |
| | CL-AUX pull-FV | | CL-pull-FV |
| DEP | *ŋǝ̀-vǝ́lɛ̀ð-ɛ̀* | | *ŋǝ̀-vǝ́lɛ̀ð-à* |
| | SBJ-pull-FV | | SBJ-pull-FV |
| INF | | *ðǝ́-vǝ́lɛ́ð-á* | |
| | | INF-pull-FV | |

The morphosyntactic properties (e.g. imperfective or ventive) are not indicated by dedicated markers. Instead, the different verb forms are distinguished in a variety of ways: First, each verb form has a final vowel suffix; there are three for this verb (*-ɔ*, *-a*, *-ɛ*). Second, each verb form has a particular tone pattern (e.g. HH-H for the imperative itive, and LL-H for the imperative ventive). Third, a subset of the verb forms have a preverbal auxiliary *a*. Fourth, some verb forms have a noun class agreement marker

---

[1] CL = noun class marker, FV = final vowel.

(illustrated here with the *l*-class), whereas others have a pronominal subject marker (illustrated here with the 3SG.SBJ marker *ŋə̀-*).

The distribution of the final vowels across the paradigm is such that one cannot assign a single morphosyntactic property to any of them (for example, the *-ɔ* is found in the imperative itive cell and the imperfective ventive cell, among others), i.e. they are *polyfunctional*. Furthermore, we will show that verbs fall into six different inflectional classes that differ in the quality and distribution of the final vowels, leading to even more deviations from form-function isomorphy. Despite the high complexity of exponence, there is an internal logic to the organization, and I will argue that there are four keys to understanding the nature of the verb system:

- Morphosyntactic properties are not associated with individual exponents; the meaning of the verb forms are distributed across different tonal and non-tonal markers.

- The final vowels form their own paradigmatic layer in the sense that they vary across inflectional classes, thus showing behavior that is independent of the other exponents.

- There is no "main" exponent; each exponent contributes variable types of information, and the functional load of each exponent varies with inflectional class.

- The distributions of forms across inflectional classes reveal patterns of organization that allow for inferences about inflectional class membership.

The chapter is organized as follows: In Section 3.1, we provide background on the marking of verbal deixis in Tira and make comparisons to similar phenomena in related languages. In Section 3.2, we discuss the formal encoding of inflectional categories on verbs in Tira, focusing on the syntagmatic generalizations, i.e. the structure and organization of individual verb forms. Section 3.3 provides a tonal analysis, and shows that while some stem tone alternations are phonologically conditioned, it is not the case that by accounting for the phonology, we can identify a set of isomorphic markers combining in a compositional way. That is, one cannot identify one marker for each

morphosyntactic property (e.g. one ventive marker and one imperfective marker). In Section 3.4, we move on to discuss how the inflected verb forms are embedded into a larger, relational system, and lay out the principles of paradigmatic organization. Section 3.5 concludes by reflecting on the interplay between the syntagmatics and paradigmatics in Tira.

As argued by Saussure (1916/2013), language has both a syntagmatic and a paradigmatic dimension. Many modern morphological theories have traditionally focused solely on the explanatory utility of syntagmatic organization and hypothesize that paradigmatic organization is essentially epiphenomenal (see e.g. Embick and Marantz 2008). Under such an approach, the nature of syntagmatic organization is also assumed to reflect internal structure that is, in an abstract way, construed as morphemic: markers are assumed to realize morphosyntactic (and derivational) properties or features. Other approaches (e.g. Blevins 2016) have focused on the interdependence between the syntagmatic and paradigmatic dimensions, hypothesizing that each provides explanations for different aspects of morphological organization. On such accounts, syntagmatic organization serves a discriminative function permitting related words to be distinguished from one another to reveal paradigmatic patterns of contrast: the markers need not be construed as realizing particular morphosyntactic properties, but rather, the syntagmatic organization can be associated with the meaning of the whole word.

The extensive lack of form-function isomorphy in the Tira verb system can be interpreted as an empirical argument for a Word-and-Paradigm approach to morphology, where there is no expectation that languages should build their words by combining formatives in a compositional way. Further, the organization of the Tira verb morphology shows that neither the syntagmatic nor the paradigmatic dimension can be ignored if we want to fully understand how the system functions. The broader claim made in this chapter is consequently that morphological theory needs to integrate both dimensions.

## 3.1 Background

Tira is a Heiban language spoken in the Nuba Mountains of Sudan. Previous work on the language includes a grammar sketch by Stevenson (1942/2009), a master's thesis on tone by Watters (1993), and a conference presentation on the phonology by Alaki (2017), as well as a word list in Schadeberg's (1981a) comparative study of the Heiban languages. The present work provides novel data gathered and analyzed in collaboration with the native speaker Himidan Hassen. We build on prior work on Tira by providing a more comprehensive description and analysis of the verbal morphology, and addressing how tone plays a role in the morphology.

Verbs in Tira are marked for different values of TAM (Stevenson 1942/2009, pp. 58-77), and previous sources also mention the marking of directional deixis on verbs (Stevenson 1942/2009, pp. 86–87; Watters 1993, pp. 119–122). In our own work, we have found that TAM and deixis are intricately linked, and that all verbs are marked for a two-way deixis distinction whose exact semantic interpretation depends on context as well as the lexical semantics of the verb. Consider first the examples in (45)–(46), which illustrate spatial and directional deixis.

(45) Spatial deixis

   a. Neutral/proximal
      i. *vráð-ɔ́* 'sweep!'
      ii. *mɛ́ð-ɔ́* 'plait!'

   b. Distal
      i. *vràð-á* 'sweep! (far)'
      ii. *mɛ̀ð-á* 'plait! (far)'

(46)   Directional deixis

    a.  Itive
        i.  *vɔ́lɛ́ð-ɔ́* 'pull! (away)'
        ii.  *dɔ́ŋð-ɔ́* 'push! (away)'

    b.  Ventive
        i.  *vɔ̀lɛ̀ð-á* 'pull! (towards)'
        ii.  *dɔ̀ŋð-á* 'push! (towards)'

These examples show that both types of deixis are associated with two values: Examples of spatial deixis are provided in (45) and are associated with the two values proximal and distal. Examples of directional deixis are provided in (46) and are associated with the two values itive (away) and ventive (towards). Note that the same morphological marking is used for each type of deixis: the proximal value is marked the same way as the itive value (the imperative proximal/itive is High-toned and ends in the vowel -ɔ), and the distal value is marked the same way as the ventive value (the imperative distal/ventive has a Low-toned stem and a High-toned final vowel -*a*).

In addition, some verb forms—such as the perfective—can be marked for associated motion, i.e. the marking of a single verb such that it expresses two events: a main event and a translocative motion event (see e.g. Guillaume and Koch 2021 for typological studies of this topic). This is illustrated in (47)–(48). The example in (47) illustrates the itive/ventive distinction on the directional verb 'pull'. In (48), the itive form of the non-directional verb *mɛð* 'plait' is used to indicate associated motion, i.e. a translocative motion event (of leaving) in addition to the main event.[2]

(47)   Itive as directional deixis

    a.  l-à        vɔ́lɛ̀ð-ɛ̀ ðɛ̀dɔ̀ɾɔ̀
       CLl-AUX pull-FV (CLð)root
       'They pulled the root (away).' (PFV.ITV)

    b.  lɔ̀-vɔ̀lɛ̀ð-ɔ́   ðɛ́dɔ̀ɾɔ̀
       CLl-pull-FV (CLð)root
       'They pulled the root (towards).' (PFV.VEN)

---

[2]In the present work, noun class is glossed as CL followed by the shape of the consonant used by the noun class agreement marker (e.g. *l-* or *ð-*). Agreement targets (e.g. verbs) and agreement controllers (nouns) are distinguished by including the noun class of the controller in parentheses.

(48)  Itive as associated motion

    a.  l-à       mɛ́ð-ɛ̀   ðár
       CLl-AUX plait-FV (CLð)rope
       'They made rope (and left).' (PFV.ITV)

    b.  lə̀-mɛ̀ð-ɔ́    ðár
       CLl-plait-FV (CLð)rope
       'They made rope (here/neutral).' (PFV.VEN)

Here and in what follows, we will gloss and refer to the two-way deixis distinction as itive vs. ventive, but this is just a shorthand for the different types of semantic interpretations of this morphological marking.

Directional deixis and associated motion is attested in other Kordofanian languages as well, e.g. the related West Heiban language Moro. In Moro, a semantically neutral form is distinguished from a marked ventive form by tonal and non-tonal formatives which differ across TAM (Jenks and Rose 2015; Jenks et al. Forthcoming; Rose 2013; see also Chapter 4). Stevenson (1943/2009, pp. 234–291) shows that in the Central Heiban language Otoro, verbs are marked for directional deixis or associated motion by different final vowels; there might be a tonal difference as well, but tone is not marked in the grammar. Other Kordofanian language families for which directional deixis and associated motion are reported include the Katla languages Tima and Julut. In these languages, there is a ventive suffix which is used for directional deixis or associated motion, *-Vŋ* (with an underspecified vowel) in Tima (Alamin, Schneider-Blum, and Dimmendaal 2012) and *-aŋ* in Julut (Nüsslein 2020, p. 185) (note that associated motion is referred to as *alloying* in these works). Verbal deixis thus seems to be a property of the languages of the region, but the semantic details as well as the formal encoding varies across languages.

## 3.2   Syntagmatic generalizations

The present section lays out the syntagmatic generalizations pertaining to inflected verb forms in Tira. That is, we will focus on the internal structure and organization of each individual inflected verb form. A verb form consists minimally of a root (e.g. *vəlɛð* 'pull') and a final vowel (*-ɔ, -u, -i, -a* or *-ɛ*); that is, verb roots are bound. In a addition, there is a set of extension suffixes which typically change the valence of the verb (e.g. passive, benefactive, etc.), and intervene between the root and the final vowel. Following work on other Niger-Congo languages, the domain consisting of any and all extension suffixes—but excluding the final vowel—will be referred to here as the *derivational stem* (see e.g. Nurse 2007, p. 251). This unit, illustrated in (49), forms its own domain for tone assignment in Tira. The derivational stem plus the final vowel is called the *inflectional stem,* illustrated in (50). This will be of less importance for the present purposes, but it is the domain for morphologically constrained rounding harmony (Simmons 2023). We will refer to the derivational stem as *verb stem* for short.[3]

(49)   Derivational stem: root(-EXT)

(50)   Inflectional stem: root(-EXT)-FV

The present section is organized as follows. We will begin by discussing the structure of basic synthetic verb forms in Section 3.2.1, followed by periphrastic verb forms in Section 3.2.2. Section 3.2.3 presents the final vowels in more depth, and explains the inflectional class system in Tira. An interim summary is provided in Section 3.2.4, before we address forms with extension suffixes in 3.2.5.

---

[3]Unlike what has been proposed for e.g. Bantu (Nurse 2007, p. 251) and the Heiban language Moro (Rose 2013), it is not the case that preverbal object markers combine with the inflectional stem to form a macrostem; rather, they are bound to the preceding auxiliary if one is present (this analysis is based on patterns of hiatus resolution as well as High tone spreading; see Chapter 2). Object markers will be discussed in Chapter 4.

### 3.2.1 Synthetic verb forms

Synthetic verb forms in Tira, i.e. inflected forms which consist of one word only, include imperatives, the perfective ventive, the dependent forms, and the infinitive. We will discuss their structure in turn.

#### 3.2.1.1 Imperative forms

There are two imperative forms distinguished by verbal deixis. Both consist of a stem and a final vowel, and they have different tone patterns. The examples in (51) show imperative forms of verb stems of different lengths—trisyllabic, disyllabic, monosyllabic, and asyllabic. Based on these patterns, we can conclude that both imperative forms have a High-toned final vowel, and that the imperative itive has a High-toned stem, while the imperative ventive has a Low-toned stem. If the stem is asyllabic and thus not tone-bearing, as in (51d), the L-H melody of the imperative ventive is realized on the final vowel itself, creating a Rising tone.

(51)

| | Itive | | Ventive | | |
|---|---|---|---|---|---|
| a. | tʃíŋgə́lál-í | HHH-H | tʃìŋgə̀làl-á | LLL-H | 'tickle' |
| b. | və́léð-ɔ́ | HH-H | və̀lèð-á | LL-H | 'pull' |
| c. | dɔ́ŋð-ɔ́ | H-H | dɔ̀ŋð-á | L-H | 'push' |
| d. | p-ɔ́ | H | p-ɔ̌ | L͡H | 'beat' |

The examples in (52) show verbs with different final vowels. The final vowel of the imperative itive of the attested verbs in our database is either *-ɔ, -u,* or *-i,* and the final vowel of the imperative ventive is either *-a* or *-ɔ.*[4]

---

[4]The stem vowel alternation between *və́ʈ-í* and *vɔ̀ʈ-ɔ́* 'return (s.t.)' is due to morphologically constrained rounding harmony; see Simmons (2023) for details.

(52)

|  | Itive | Ventive |  |
|---|---|---|---|
| a. | dɔ́ŋð-ɔ́ | dɔ̀ŋð-á | 'push' |
| b. | váɾ-ú | vàɾ-á | 'escape' |
| c. | úr-ú | ùr-ɔ́ | 'climb down' |
| d. | vɔ́ɽ-í | vɔ̀ɽ-ɔ́ | 'return (s.t.) |
| e. | kɔ́ltʃ-í | kɔ̀ltʃ-á | 'spread' |
| f. | víð-ɔ́ | vìð-ɔ́ | 'throw' |

### 3.2.1.2  The perfective ventive

The perfective ventive form is the only synthetic verb form of the main clause indicative forms.  Here, we will focus on third person forms, where there is a noun class marker; for first and second person forms there is instead an overt pronominal (see Chapter 4).  The noun class marker is polyfunctional in the sense that it serves an agreement function with a co-occurring nominal and a pronominal function in the absence of one.  The perfective ventive form consists of a noun class marker followed by the stem and a final vowel; the noun class marker indexes the noun class of the topic of the sentence, regardless of its syntactic function (see also Chapter 4).  The example in (53) illustrates noun class indexing with a subject topic from the *l*-class, while the example in (54) illustrates noun class indexing with an object topic from the ð-class.  For more details on the word order facts, see Jenks, Hassen, and Rose (2022) and Kaldhol, Rose, and Simmons (Accepted).

(53)  Noun class indexing of a subject topic (SVO)

**láɾò**　　　lə̀-rlànd̯-ɔ́　ðɔ́ɾà
(CLl).chickens CLl-close-FV (CLð).fence
'The chickens closed the fence'

(54)  Noun class indexing of an object topic (OVS)

**ðɔ́ɾà**　　　ðə̀-rlànd̯-ɔ́　láɾò
(CLð).fence CLð-close-FV (CLl).chickens
'As for the fence, the chickens closed it'

The remaining examples will be illustrated with the *l*-class marker; this is the plural marker in the *k-/l-* noun class pairing, found with most nouns referring to human beings, tribal names, as well as some animals (Stevenson 1942/2009, p. 19). As the examples in (55) show with stems of different lengths, the noun class marker and the stem are Low-toned, and the final vowel has a High tone.

(55)   a.   lə̀-tʃìŋgə̀làl-í   L-LLL-H   'tickle'
        b.   lə̀-və̀lɛ̀ð-ɔ́     L-LL-H    'pull'
        c.   lə̀-dɔ̀ŋð-ɔ́     L-L-H     'push'
        d.   lə̀-p-ɔ́         L-H       'beat'

Different verbs have different final vowels in the perfective ventive; *-ɔ, -u,* or *-i.* Examples are illustrated in (56). Note that the final vowel of the perfective ventive for any given verb is the same as what we saw for the imperative itive forms above.[5]

(56)   a.   lə̀-dɔ̀ŋð-ɔ́   'push'
        b.   lə̀-vàɾ-ú    'escape'
        c.   l-ùr-ú      'climb down'
        d.   lə̀-vɔ̀ɽ-í     'return (s.t.)'
        e.   lə̀-kə̀ltʃ-í   'spread'
        f.   lə̀-vɽ̀ð-ɔ́    'throw'

### 3.2.1.3 The dependent form

The dependent form is a verb form which is unmarked for TAM, and is the head of a subordinate or dependent clause as a complement of certain verbs (e.g. 'tell, try, allow'), or of a clause indicating a sequence of actions (Stevenson 1942/2009, pp. 72–75), i.e. in clause chaining constructions. The example in (57) illustrates a dependent form after the verb *arṯ* 'tell', and in (58)–(59), examples of clause chaining are provided. In the dependent forms, there is no noun class agreement; instead, there is a marker which indexes person/number values of the subject (here 3PL and 3SG).

---

[5]The vowel of the noun class marker *lə̀-* is frequently deleted before another vowel, hence the form *l-ùr-ú* in (56c).

(57) árʈ-ɔ́-l **lɜ̀-vɜ̀ɽ-ì** àdàm
     tell-FV-3PL.OBJ 3PL-return-FV (CLj)book
     'Tell them to return the book.' (DEP.ITV)

(58) l-ìj-ɔ́ ŋɔ́mɔ̀ nɛ̀ **lɜ̀-vɜ̀lɛ̀ð-ɛ̀** èdɔ̀ɽɔ̀
     CLl-eat-FV (CLŋ)food COMP 3PL-pull-FV (CLj)roots
     'They (l-class) ate food and they pulled roots.' (DEP.ITV)

(59) k-ìj-ɔ́ ŋɔ́mɔ̀ nɛ̀ **ŋɜ̀-néð-ɛ̀** ʈ-ɔ́ ŋáv-ɛ̀
     CLk-eat-FV (CLŋ)food COMP 3SG-refuse-FV drink-FV (CLŋ)water-ACC
     'He (k-class) ate food and he refused to drink water.' (DEP.ITV)

The tone patterns of the dependent forms are conditioned by the person/number of the subject. Table 3.2 shows that the stem tone is LL when the subject is 1PL.EXCL or 3PL; otherwise, it is HL. Note that there is nothing about the tone of the preceding subject marker that would condition this; for example, the 1DU.INCL marker *lɜ̀-* and the 3PL marker *lɜ̀-* are identical, yet the stem tone is HL after the former and LL after the latter. Further, there is nothing that will semantically unify the two forms with the LL tone pattern, 1PL.EXCL or 3PL, as natural class; that is, the distribution of these tone patterns are morphomic.[6]

The dependent forms are distinguished by verbal deixis. The itive and ventive forms differ in their final vowels only; the tone patterns are the same across the two deixis forms. The examples in (60)–(61) illustrate the tone patterns of the dependent forms with stems of different lengths. Notice that when the verb stem is asyllabic, as in (60d), the High tone is realized on the 3SG marker.

---

[6]One could potentially analyze the tonal alternations in Table 3.2 as being due to either (i) a floating Low tone contributed by the 1PL.EXCL and 3PL markers which would associate at the left edge of the root and overwrite the stem tone, or (ii), a floating High tone contributed by all the other markers, and associates at the left edge of the verb. This analysis would predict that if a word could intervene between the subject marker and the verb root, the floating tone would dock on that intervening word instead. However, this is not possible in Tira, and thus there is no way of testing this hypothesis.

**Table 3.2**: Dependent forms

| *vəlɛð* 'pull' | Itive | Ventive | Tone |
|---|---|---|---|
| 1SG | ɛ̀-vɛ́lɛ̀ð-ɛ̀ | ɛ̀-vɛ́lɛ̀ð-à | L-HL-L |
| 2SG | à-vɛ́lɛ̀ð-ɛ̀ | à-vɛ́lɛ̀ð-à | L-HL-L |
| 3SG | ŋə̀-vɛ́lɛ̀ð-ɛ̀ | ŋə̀-vɛ́lɛ̀ð-à | L-HL-L |
| 1DU.INCL | lə̀-vɛ́lɛ̀ð-ɛ̀ | lə̀-vɛ́lɛ̀ð-à | L-HL-L |
| 1PL.INCL | lə̀-vɛ́lɛ̀ð-ɛ̀-ɍ | lə̀-vɛ́lɛ̀ð-à-ɍ | L-HL-L-H |
| 1PL.EXCL | ìɲà-vəlɛ̀ð-ɛ̀ | ìɲà-vəlɛ̀ð-à | LL-⎡LL⎤-L |
| 2PL | ìɲá-vɛ́lɛ̀ð-ɛ̀ | ìɲá-vɛ́lɛ̀ð-à | LH-HL-L |
| 3PL | lə̀-və̀lɛ̀ð-ɛ̀ | lə̀-və̀lɛ̀ð-à | L-⎡LL⎤-L |
| | SBJ-stem-FV | SBJ-stem-FV | |

(60) 3SG Dependent forms

| | | Itive | | Ventive | | |
|---|---|---|---|---|---|---|
| | a. | ŋə̀-tʃíŋgə̀làl-ì | L-HLL-L | ŋə̀-tʃíŋgə̀làl-à | L-HLL-L | 'tickle' |
| | b. | ŋə̀-vɛ́lɛ̀ð-ɛ̀ | L-HL-L | ŋə̀-vɛ́lɛ̀ð-à | L-HL-L | 'pull' |
| | c. | ŋə̀-dɔ́ŋð-ɛ̀ | L-H-L | ŋə̀-dɔ́ŋð-à | L-H-L | 'push' |
| | d. | ŋə́-p-ɛ̀ | H-L | ŋə́-p-ɔ̀ | H-L | 'beat' |

(61) 3PL Dependent forms

| | | Itive | | Ventive | | |
|---|---|---|---|---|---|---|
| | a. | lə̀-tʃìŋgìlàl-ì | L-LLL-L | lə̀-tʃìŋgìlàl-à | L-LLL-L | 'tickle' |
| | b. | lə̀-və̀lɛ̀ð-ɛ̀ | L-LL-L | lə̀-və̀lɛ̀ð-à | L-LL-L | 'pull' |
| | c. | lə̀-dɔ̀ŋð-ɛ̀ | L-L-L | lə̀-dɔ̀ŋð-à | L-L-L | 'push' |
| | d. | lə̀-p-ɛ̀ | L-L | lə̀-p-ɔ̀ | L-L | 'beat' |

The examples in (62) illustrate the 3SG dependent forms with verbs that have different final vowels. The itive is marked by either *-ɛ* or *-i*, while the ventive is marked by either *-a* or *-ɔ*.

(62)

| | | Itive | Ventive | |
|---|---|---|---|---|
| | a. | ŋə̀-dɔ́ŋð-ɛ̀ | ŋə̀-dɔ́ŋð-à | 'push' |
| | b. | ŋə̀-váɾ-ì | ŋə̀-váɾ-à | 'escape' |
| | c. | ŋ-úɾ-ì | ŋ-úɾ-ɔ̀ | 'climb down' |
| | d. | ŋə̀-vɔ́ɽ-ì | ŋə̀-vɔ́ɽ-ɔ̀ | 'return (s.t.) |
| | e. | ŋə̀-kə́ltʃ-ì | ŋə̀-kə́ltʃ-à | 'spread' |
| | f. | ŋə̀-víð-ɛ̀ | ŋə̀-víð-ɔ̀ | 'throw' |

### 3.2.1.4 The infinitive

Tira has a verb form which Stevenson (1942/2009, pp. 70–72) describes as having functions corresponding roughly to the English infinitive (e.g. 'to dance'), or a deverbal noun or gerund ('dancing'). Following Stevenson, we will refer to this form as the infinitive here. It is not marked for TAM or verbal deixis and there is no subject agreement. It has some properties shared by nominals: for example, it can function as the subject of a sentence and control noun class agreement, as in (63) (parentheses is used to indicate that the infinitive is the agreement controller, not the agreement target). It is used after certain verbs, e.g. 'like', illustrated in (64).

(63) **ð-ábúð-á**      ðì-tʃə̀l-ò
(CLð)-dance-FV CLð-good-FV
'Dancing is nice.'

(64) l-àmìɲ-í    **ð-ábúð-á**
CLl-like-FV (CLð)-dance-FV
'They like to dance.'

The examples in (65) show the tone patterns of infinitive forms with verbs of different lengths. They show that the entire word form is High-toned.

(65)  a.  ðə́-tʃíŋgə́lál-á   H-HHH-H   'tickle'
      b.  ðə́-və́léð-á      H-HH-H    'pull'
      c.  ðə́-dóŋð-á       H-H-H     'push'
      d.  ðə́-p-ɔ́          H-H       'beat'

The examples in (66) show infinitive forms of verbs with different final vowels, either -*a* or -*ɔ*. As we will see in Section 3.2.3, verbs fall into different inflectional classes based on the quality and distribution of the final vowels. Whether one analyzes the forms in (66) as infinitives (a type of verb form) or deverbal nouns, their final vowel is determined by the inflectional class of the corresponding verb. Therefore, they are included in the present discussion.

(66)  a.  ðɔ́-dɔ́ŋð-á    'push'
      b.  ðɔ́-váɾ-á     'escape'
      c.  ð-úr-ɔ́       'climb down'
      d.  ðɔ́-vɔ́ɾ-ɔ́    'return (s.t.)'
      e.  ðɔ́-kɔ́ltʃ-á   'spread'
      f.  ðɔ́-víɾð-ɔ́    'throw'

### 3.2.1.5  Section summary

A summary chart of the synthetic verb forms discussed so far is provided in Table 3.3. Here, the stem tone is underlined. There is a three-way tone contrast on stems, such that they are either all High (indicated here as HH), all Low (LL), or High-Low (HL), and if the verb stem has more than two TBUs, the final tone extends across the entire verb stem. We now move on to discuss periphrastic verb forms, which have an additional preverbal TAMD auxiliary.

**Table 3.3**: Synthetic verb forms: a summary

|         | *vəlɛð* 'pull'                  | Tone                | Final vowel |
|---------|---------------------------------|---------------------|-------------|
| IMP.ITV | *vɔ́lɛ́ð-ɔ́*                      | <u>HH</u>-H         | -ɔ/-u/-i    |
| IMP.VEN | *vɔ̀lɛ̀ð-á*                      | <u>LL</u>-H         | -a/-ɔ       |
| PFV.VEN | *là-vɔ̀lɛ̀ð-ɔ́*                  | L-<u>LL</u>-H       | -ɔ/-u/-i    |
| DEP.ITV | *ŋɑ̀-vɔ́lɛ̀ð-ɛ̀ /là-vɔ̀lɛ̀ð-ɛ̀*   | L-<u>HL</u>-L/L-<u>LL</u>-L | -ɛ/-i |
| DEP.VEN | *ŋɑ̀-vɔ́lɛ̀ð-à/là-vɔ̀lɛ̀ð-à*     | L-<u>HL</u>-L/L-<u>LL</u>-L | -a/-ɔ |
| INF     | *ðɔ́-vɔ́lɛ́ð-á*                   | H-<u>HH</u>-H       | -a/-ɔ       |

## 3.2.2  Periphrastic verb forms

There is a set of periphrastic verb forms in Tira which contains a preverbal TAMD auxiliary. The examples in (67)–(68) show that the auxiliary indexes the noun class of the topic of the sentence, regardless of its syntactic function. The example in (67) illustrates a subject topic; here, the subject occurs in initial position, and the object follows the verb form. The example in (68) illustrates an object topic; here, the object

occurs in initial position, and the subject intervenes between the auxiliary and the verb stem. Note that the auxiliary shows noun class agreement with the topic, regardless of its syntactic function. For more details on the word order facts, see Chapter 4 and Jenks, Hassen, and Rose (2022) and Kaldhol, Rose, and Simmons (Accepted).

(67)  S Aux V O

láɾò          **l-á**      **r̀lànd̠-ɔ́** ðɔ́ɾà
(CLl)chickens CLl-AUX close-FV (CLð)fence
'The chickens will close the fence' (IPFV.VEN)

(68)  O Aux S V

ðɔ́ɾà          **ð-á**      láɾò          **r̀lànd̠-ɔ́**
(CLð)fence CLð-AUX (CLl)chickens close-FV
'As for the fence, the chickens will close it' (IPFV.VEN)

The three basic periphrastic forms in Tira are the imperfective itive, imperfective ventive, and the perfective itive. These are distinguished from each other by their tone pattern, and often (but not always) also by their final vowel. The examples in Table 3.4 show the tone patterns of these three periphrastic expressions with verb stems of different lengths.

Table 3.4: Tone patterns in periphrastic verb forms.

| IPFV.ITV | | IPFV.VEN | | PFV.ITV | | |
|---|---|---|---|---|---|---|
| lá tʃíŋgàlàl-à | H HLL-L | lá tʃìŋgàlàl-í | H LLL-H | là tʃíŋgàlàl-ì | L HLL-L | 'tickle' |
| lá vǝ́lɛ̀ð-à | H HL-L | lá vǝ̀lɛ̀ð-ɔ́ | H LL-H | là vǝ́lɛ̀ð-ɛ̀ | L HL-L | 'pull' |
| lá dɔ́ŋð-à | H H-L | lá dɔ̀ŋð-ɔ́ | H L-H | là dɔ́ŋð-ɛ̀ | L H-L | 'push' |
| lá p-ɔ̀ | H L | lá p-ɔ́ | H H | lá p-ɛ̀ | H L | 'beat' |

These tone patterns will be discussed in more detail in Section 3.3, but a few preliminary generalizations are as follows: the two itive forms have Low-toned final vowels while the imperfective ventive has a High-toned final vowel. The stem tone of both itive forms is H(L), and the imperfective ventive stem is Low-toned. Both imperfective forms have a High-toned auxiliary, while the perfective itive has a Low-toned

auxiliary, except when there is an asyllabic stem, where it is instead High-toned. The tone patterns associated with asyllabic stems are addressed in more detail in Section 3.3.3.

Table 3.5 presents periphrastic forms of verbs from different inflectional classes, illustrating the final vowels that are found for each verb form. The perfective ventive (a synthetic form) is repeated here for comparison.

**Table 3.5**: Periphrastic forms of verbs from different inflectional classes (with the perfective ventive added for comparison)

| IPFV.ITV CL-AUX stem-FV H H(L)-L | IPFV.VEN CL-AUX stem-FV H L(L)-H | PFV.ITV CL-AUX stem-FV L H(L)-L | PFV.VEN CL-stem-FV L-L(L)-H | |
|---|---|---|---|---|
| l-á dɔ́ŋð-à | l-á dɔ̀ŋð-ɔ́ | l-à dɔ́ŋð-ɛ̀ | lə̀-dɔ̀ŋð-ɔ́ | 'push' |
| l-á váɾ-à | l-á vàɾ-ú | l-à váɾ-ì | lə̀-vàɾ-ú | 'escape' |
| l-á úr-ɔ̀ | l-á ùr-ú | l-à úr-ì | l-ùr-ú | 'climb down' |
| l-á vɔ́ʈ-ɔ̀ | l-á vɔ̀ʈ-í | l-à vɔ́ʈ-ì | lə̀-vɔ̀ʈ-í | 'return (s.t.)' |
| l-á kə́ltʃ-à | l-á kə̀ltʃ-í | l-à kə́ltʃ-ì | lə̀-kə̀ltʃ-í | 'spread' |
| l-á vɾ́ð-ɔ̀ | l-á vɾ̀ð-ɔ́ | l-à vɾ́ð-ɛ̀ | lə̀-vɾ̀ð-ɔ́ | 'throw' |

For transparency, we will mention a few other attested verb forms which seem to be built off of the previously discussed verb forms, and which therefore will be left out of the remaining discussion. The examples in (69) illustrate future progressive forms, which have the same final vowels as the imperfective forms (*-a* in the itive and *-ɔ* in the ventive). These forms also have a prefix *ðə́-*, and the locational/existential copula verb *v* is used as an auxiliary verb. The examples in (70) illustrate the use of the same copula as an auxiliary verb in the past perfect construction; here, the auxiliary verb combines with the two perfective forms discussed earlier. In (69), the imperfective itive form of *v* is used (*lá và*), and in (70), the perfective form of *v* is used (*lə̀vî*). In each case, the verb forms discussed previously are reused for different purposes in combination with other markers.

112

(69)  Future progressive

    a.  l-á      v-à      ðə́-vəlèð-à    èdɔ̀ɽɔ̀    àn    j-íṭ-ɔ̀
        CLl-AUX COP-FV PROG-pull-FV (CLj)roots when 1SG-arrive-FV
        'They will be pulling roots away when I arrive.' (FUT.PROG.ITV)

    b.  l-á      v-à      ðə́-vəlèð-ɔ́    édɔ̀ɽɔ̀    àn    j-íṭ-ɔ̀
        CLl-AUX COP-FV PROG-pull-FV (CLj)roots when 1SG-arrive-FV
        'They will be pulling roots towards when I arrive.' (FUT.PROG.VEN)

(70)  Past perfect

    a.  lə̀-v-í      l-à      və́lèð-ɛ̀ èdɔ̀ɽɔ̀    nɛ́    ṭìm-íŋì
        CLl-COP-FV CLl-AUX pull-FV (CLj)roots COMP arrive-1SG
        'They had pulled the roots away when I arrived.' (PST.PRF.ITV)

    b.  lə̀-v-í      lə̀-vəlèð-ɔ́ édɔ̀ɽɔ̀    nɛ́    ṭìm-íŋì
        CLl-COP-FV CLl-pull-FV (CLj)roots COMP arrive-1SG
        'They had pulled the roots towards when I arrived.' (PST.PRF.VEN)

There is no evidence that the TAMD auxiliaries—the *a* markers—are verbs, and to our knowledge, there is no corresponding copula or lexical verb *a* in Tira. The TAMD auxiliaries may therefore be considered a type of preverbs or particles, and are different from auxiliary verbs like the copula *v*: while auxiliary verbs are inflected for TAMD and thus may be preceded by a TAMD auxiliary *a*, as in (69), the TAMD markers themselves are never preceded by another *a*. That is, the TAMD markers are not verbs, but pieces of inflection. Note that the fact that the TAMD auxiliaries show noun class agreement is not enough evidence to posit that they are verbs; noun class agreement is not found exclusively with verbs in Tira, but also e.g. demonstratives and the genitive marker (Stevenson 1942/2009, pp. 18–31). Furthermore, verbs behave differently from the TAMD markers with respect to noun class agreement; verbs do not show noun class agreement with first or second person pronominals, while the TAMD markers do; the examples in (71)–(72) illustrate this difference. Subject and object pronominals are discussed in more detail in Chapter 4.

(71)  a.  **á**-vəlèð-ɛ́-ŋì
          **2SG.SBJ**-pull-FV-1SG.OBJ
          'You pulled me (towards).' (PFV.VEN)

      b.  **ɲá**-vəlèð-ɛ́-ŋì
          **2PL.SBJ**-pull-FV-1SG.OBJ
          'You all pulled me (towards).' (PFV.VEN)

(72)  a.  **á-g-**á-ŋì                 vəlèð-ɛ̀
          **2SG.SBJ-CLg-**AUX-1SG.OBJ pull-FV
          'You pulled me (away).' (PFV.ITV)

      b.  **ɲá-l-**á-ŋì                vəlèð-ɛ̀
          **2PL.SBJ-CLl-**AUX-1SG.OBJ pull-FV
          'You all pulled me (away).' (PFV.ITV)

On the one hand, the TAMD auxiliaries are syntactically independent from the verb stem, as evidenced by the example in (68) above and (72). On the other, the auxiliaries are a part of the TAMD marking system and thus a part of constructions which contrast paradigmatically, as shown in Table 3.5. This is thus an example of periphrasis as morphology (see e.g. Ackerman, Stump, and Webelhuth 2011; Bonami 2015; Brown et al. 2012), where a set of constructions live a "dual life" and needs to be understood both syntagmatically and paradigmatically. Table 3.6 summarizes the properties of the periphrastic forms we include in the remaining discussion.

**Table 3.6**: Periphrastic verb forms: a summary

|         | *vəlɛð* 'pull') | Tone    | Final vowel |
|---------|-----------------|---------|-------------|
| PFV.ITV | *là və́lèð-ɛ̀*  | L <u>HL</u>-L | -ɛ/-i |
| IPFV.ITV| *lá və́lèð-à*   | H <u>HL</u>-L | -a/-ɔ |
| IPFV.VEN| *lá vəlèð-ɔ́*   | H <u>LL</u>-H | -ɔ/-u/-i |

114

### 3.2.3  Final vowels

We have seen that for the verb forms associated with each morphosyntactic distinction, there are two or three possible final vowels. Table 3.7 lists all the possible final vowels in each paradigm cell.

**Table 3.7**: Final vowels

|      | Itive (away) | Ventive (towards) |
|------|--------------|-------------------|
| IMP  | -ɔ/-u/-i     | -ɔ/-a             |
| IPFV | -ɔ/-a        | -ɔ/-u/-i          |
| PFV  | -ɛ/-i        | -ɔ/-u/-i          |
| DEP  | -ɛ/-i        | -ɔ/-a             |
| INF  |              | -ɔ/-a             |

However, it is not the case that every combination is attested. For example, there is no verb that has the final vowel *-ɔ* in the imperative itive and the vowel *-u* in the imperfective ventive; instead, the final vowel of the imperative itive is always the same as the final vowel of the imperfective ventive. Verbs fall into six different inflectional classes, and these constitute a limited set of the logically possible combinations of the final vowels. In (73)–(78), each class is illustrated by an exemplary verb. Shading indicates the distribution of final vowels within each paradigm; if two paradigm cells have the same shading, it means that they have the same final vowel in that particular class (the shading does not match the vowel quality across paradigms; this is to illustrate the distributions and patterns of contrast rather than the vowel qualities themselves). As these examples show, the quality and distribution of the final vowels differ across inflectional classes, but the tone patterns remain the same. This means that the final vowels are informative for different properties than their tones, and in Section 3.3, we therefore treat the tones on the final vowels as independent exponents. We will return to the organization of paradigms in Section 3.4.[7]

---

[7]The classes are labeled based on our analysis of the principal parts; see Section 3.4.3.

(73) | | Itive (away) | Ventive (towards) | *dɔŋð* 'push' (*aɔ*-class) |
|---|---|---|---|
| IMP | dɔ́ŋð-ɔ́ | dɔ̀ŋð-á | |
| IPFV | l-á dɔ́ŋð-à | l-á dɔ̀ŋð-ɔ́ | |
| PFV | l-à dɔ́ŋð-ɛ̀ | lɛ̀-dɔ̀ŋð-ɔ́ | |
| DEP | ŋɛ̀-dɔ́ŋð-ɛ̀ | ŋɛ̀-dɔ́ŋð-à | |
| INF | ðɔ́-dɔ́ŋð-á | | |

(74) | | Itive (away) | Ventive (towards) | *var* 'escape' (*au*-class) |
|---|---|---|---|
| IMP | váɾ-ú | vàɾ-á | |
| IPFV | l-á váɾ-à | l-á vàɾ-ú | |
| PFV | l-à váɾ-ì | lɛ̀-vàɾ-ú | |
| DEP | ŋɛ̀-váɾ-ì | ŋɛ̀-váɾ-à | |
| INF | ðɔ́-váɾ-á | | |

(75) | | Itive (away) | Ventive (towards) | *ur* 'climb down' (*ɔu*-class) |
|---|---|---|---|
| IMP | úr-ú | ùr-ɔ́ | |
| IPFV | l-á úr-ɔ̀ | l-á ùr-ú | |
| PFV | l-à úr-ì | l-ùr-ú | |
| DEP | ŋ-úr-ì | ŋ-úr-ɔ̀ | |
| INF | ð-úr-ɔ́ | | |

(76) | | Itive (away) | Ventive (towards) | *vɜɽ* 'return (s.t.)' (*ɔi*-class) |
|---|---|---|---|
| IMP | vɔ́ɽ-í | vɔ̀ɽ-ɔ́ | |
| IPFV | l-á vɔ́ɽ-ɔ̀ | l-á vɜ̀ɽ-í | |
| PFV | l-à vɔ́ɽ-ì | lɛ̀-vɜ̀ɽ-í | |
| DEP | ŋɛ̀-vɔ́ɽ-ì | ŋɛ̀-vɔ́ɽ-ɔ̀ | |
| INF | ðɔ́-vɔ́ɽ-ɔ́ | | |

(77) | | Itive (away) | Ventive (towards) | *kə́ltʃ* 'spread' (*ai*-class) |
|---|---|---|---|
| IMP | kə́ltʃ-í | kə̀ltʃ-á | |
| IPFV | l-á kə́ltʃ-à | l-á kə̀ltʃ-í | |
| PFV | l-à kə́ltʃ-ì | lɛ̀-kə̀ltʃ-í | |
| DEP | ŋɛ̀-kə́ltʃ-ì | ŋɛ̀-kə́ltʃ-à | |
| INF | ðɔ́-kə́ltʃ-á | | |

(78) | | Itive (away) | Ventive (towards) | *vrð* 'throw' (*ɔɔ*-class) |
|---|---|---|---|
| IMP | vɾ́ð-ɔ́ | vɾ̀ð-ɔ́ | |
| IPFV | l-á vɾ́ð-ɔ̀ | l-á vɾ̀ð-ɔ́ | |
| PFV | l-à vɾ́ð-ɛ̀ | lɛ̀-vɾ̀ð-ɔ́ | |
| DEP | ŋɛ̀-vɾ́ð-ɛ̀ | ŋɛ̀-vɾ́ð-ɔ̀ | |
| INF | ðɔ́-vɾ́ð-ɔ́ | | |

The reason for analyzing these six patterns as inflectional classes (i.e. purely morphological) is that the choice of final vowel does not seem to be conditioned by any extramorphological factors, such as syntactic ones (e.g. transitivity), semantic ones (e.g. a difference between stative verbs, motion verbs, or the like), or phonological ones (e.g. the types of consonants or vowels preceding the final vowel, the number of syllables in the stem). This is illustrated in (79)–(81) with a selection of possible conditioning factors and the two imperative forms. As further evidence for the essentially morphological nature of these inflectional classes, the current verb database is included in the Supplementary Materials.

(79)  No syntactic conditioning (valency by final vowels)

|  | *-ɔ/-a* | | | *-ɔ/-ɔ* | | |
|---|---|---|---|---|---|---|
| Transitive | dɔ́ŋð-ɔ́ | dɔ̀ŋð-á | 'push (st.)' | vɾ́ð-ɔ́ | vɾ̀ð-ɔ́ | 'throw (st.)' |
| Intransitive | míɲ-ɔ́ | mìɲ-á | 'exit' | ánṭ-ɔ́ | ànṭ-ɔ́ | 'enter' |

(80)  No semantic conditioning (deictic semantics by final vowels)

|  | *-ɔ/-a* | | | *-ɔ/-ɔ* | | |
|---|---|---|---|---|---|---|
| Directional | dɔ́ŋð-ɔ́ | dɔ̀ŋð-á | 'push (st.)' | vɾ́ð-ɔ́ | vɾ̀ð-ɔ́ | 'throw' |
| Spatial | álɔ́ŋ-ɔ́ | àlɔ̀ŋ-á | 'sing' | úrmúð-ɔ́ | ùrmùðɔ́ | 'laugh' |

(81)  No phonological conditioning (root segments by final vowels)

| *-i/-a* | | | *-i/-ɔ* | | |
|---|---|---|---|---|---|
| ɔ́ɾdʒɛ́tʃ-í | ɔ̀ɾdʒɛ̀tʃ-á | 'help' | vɔ́lɛ́tʃ-í | vɔ̀lɛ̀tʃ-ɔ́ | 'visit' |
| ámíɲ-í | àmìɲ-á | 'like' | ɾ́lɛ́ɲ-í | ɾ̀lɔ̀ɲ-ɔ́ | 'chase' |

What these examples show is that for each factor considered (e.g. deictic semantics), the possible values (e.g. directional and spatial) are attested with multiple inflectional classes (e.g. *-ɔ/-a* and *-ɔ/-ɔ*). This means that one cannot predict one factor from the other; that is, the final vowel qualities are not conditioned by any of these factors, at least not when each factor is examined individually (given the amount of inflectional classes and possible factors, one would need a larger dataset than 100 verbs to determine whether they work together to condition the final vowels in a probabilistic way).

117

Our hypothesis concerning the postulation of inflection classes amounts to the claim that in default of identifying independent factors determining the observed differences in final vowel distributions, the phenomenon represent an instance of morphology itself (in the sense of Aronoff 1994).[89]

## 3.2.4 Interim summary

What we have seen so far in the present section, is that different verb forms are distinguished through a combination of tonal exponents, final vowels, prefixes, and auxiliaries, forming both synthetic and periphrastic expressions. The paradigm which has emerged so far is illustrated by the verb 'pull' in Table 3.8. Here, the noun class markers are represented by a C, and the subject markers of the dependent forms are represented by an X, to capture that these are variables.

Table 3.9 shows the tone patterns associated with each cell in the paradigm. Before analyzing the tone patterns of these forms in more detail, we will discuss how verb forms with extension suffixes are built.

---

[8]It should be noted that there seems to be a correlation between roots ending in a palatal segment and the final vowel -*i*; for example, 14 of the 15 verbs in the -*i*/-*a* class in our sample ends in a palatal consonant. However, the correlation is not perfect, and so palatals and -*i* do not seem to condition each other as the final vowel -*i* is found after other segments as well (e.g. *tʃíŋgálál-í* 'tickle', *dʒíð-í* 'milk', *vɟr̩-í* 'return st.'), and further, -*i* is not the only final vowel found after palatals, but also -*ɛ*, -*a* and -*ɔ* (e.g. the three periphrastic forms of exit: *là mín-ɛ̀, lá mín-à, lá mìn-ɔ́*). In fact, the only final vowel not attested after a palatal consonant is -*u*. That is, even though this correlation seemed like a promising phonological generalization at first, it does not hold up in such a way that we can dispense of (a set of) the morphologically determined inflectional classes.

[9]We should note that there is a seventh pattern which is identical to the *au*-class in (74) above except that there is a final vowel -*o* instead of -*u*. We use these two vowel symbols to transcribe two speech sounds that are very similar acoustically, and we have yet to determine whether they are in contrastive distribution or not. Therefore, these two classes were tentatively merged pending more research on the relationship between these two vowels in Tira. The choice of merging them rather than splitting them is an effort to err on the side of caution in the sense of avoiding an unnecessary proliferation of inflectional classes.

118

**Table 3.8**: Verb forms in Tira: a summary

| *vǝlɛð* 'pull' | Itive | Ventive |
|---|---|---|
| IMP | *válɛ́ð-ɔ́* <br> pull-FV | *vǝ̀lɛ̀ð-á* <br> pull-FV |
| IPFV | *C-á válɛ̀ð-à* <br> CL-AUX pull-FV | *C-á vǝ̀lɛ̀ð-ɔ́* <br> CL-AUX pull-FV |
| PFV | *C-à válɛ̀ð-ɛ̀* <br> CL-AUX pull-FV | *Cǝ̀-vǝ̀lɛ̀ð-ɔ́* <br> CL-pull-FV |
| DEP | *X-válɛ̀ð-ɛ̀ /X-vǝ̀lɛ̀ð-ɛ̀* <br> SBJ-pull-FV | *X-válɛ̀ð-à /X-vǝ̀lɛ̀ð-à* <br> SBJ-pull-FV |
| INF | | *ðɔ́-válɛ́ð-á* <br> INF-pull-FV |

**Table 3.9**: Verb tone patterns in Tira: a summary

| | Itive | Ventive |
|---|---|---|
| IMP | HH-H | LL-H |
| IPFV | H HL-L | H LL-H |
| PFV | L HL-L | L-LL-H |
| DEP | L-HL-L/L-LL-L | L-HL-L/L-LL-L |
| INF | H-HH-H | |

## 3.2.5 Extension suffixes

Tira has a set of valence-changing suffixes which occur between the verb root and the final vowel. While the present work is concerned mainly with underived (root) verbs, forms with extension suffixes are discussed briefly here to show how they affect or are affected by the TAM and deixis marking. The examples in (82)–(83) illustrate the verb *kɔṯ* 'braid, plait, weave' with its corresponding reflexive/passive form *kɔṯ-in*.

(82) **lǝ̀-kɔ̀ṯ-ɔ́** írɔ́ í-j-ùn
CLl-braid-FV (CLj)hair POSS-CLj-3SG
'They braided her hair.' (PFV.VEN)

(83) **lǝ̀-kɔ̀ṯ-ìn-ɔ́**
CLl-braid-**REFL**-FV
'They braided themselves.' (PFV.VEN)

The examples in (84)–(85) illustrate the full paradigms of *kɔt̪* and its reflexive counterpart *kɔt̪-in*. The final vowel set in (84) is different from the one in (85); this is because the extension suffixes determine the inflectional class (see Simmons 2022a, 2023). With respect to tone, these data illustrate that the extension suffixes are atonal in the sense that they do not contribute tones or alter the tone patterns; rather, they are included in the same domain as the verb root with respect to tone assignment. For example, the derivational stem (here the root and the passive suffix) is all High in the imperative itive and all Low in the imperative ventive. Thus the reflexive verb *kɔt̪-in* receives the same tone patterns as disyllabic root verb; this is illustrated with *mut̪ən* 'smell' in (86), a verb from the ɔɔ-class. We will explore the verb stem domain further in Section 3.3.

(84)

|  | Itive | Ventive |  |  |
|---|---|---|---|---|
| IMP | kɔ́t̪-ɔ́ | kɔ̀t̪-á | H-H | L-H |
| IPFV | l-á kɔ́t̪-à | l-á kɔ̀t̪-ɔ́ | H H-L | H L-H |
| PFV | l-à kɔ́t̪-ɛ̀ | lɘ̀-kɔ̀t̪-ɔ́ | L H-L | L-L-H |
| DEP | ŋ̀-gɔ́t̪-ɛ̀ | ŋ̀-gɔ́t̪-à | L-H-L | L-H-L |
| INF | ðɘ́-kɔ́t̪-á |  | H-H-H | |

(85)

|  | Itive | Ventive |  |  |
|---|---|---|---|---|
| IMP | kɔ́t̪ín-ɔ́ | kɔ̀t̪ìn-ɔ́ | HH-H | LL-H |
| IPFV | l-á kɔ́t̪ìn-ɔ̀ | l-á kɔ̀t̪ìn-ɔ́ | H HL-L | H LL-H |
| PFV | l-à kɔ́t̪ìn-ɛ̀ | lɘ̀-kɔ̀t̪ìn-ɔ́ | L HL-L | L-LL-H |
| DEP | ŋ-gɔ́t̪ìn-ɛ̀ | ŋ-gɔ́t̪ìn-ɔ̀ | L-HL-L | L-HL-L |
| INF | ðɘ́-kɔ́t̪ín-ɔ́ |  | H-HH-H | |

(86)

|  | Itive | Ventive | | |
| --- | --- | --- | --- | --- |
| IMP | mút̪ə́n-ɔ́ | mùt̪ə̀n-ɔ́ | HH-H | LL-H |
| IPFV | l-á mút̪ə̀n-ɔ̀ | l-á mút̪ə̀n-ɔ̀ | H HL-L | H LL-H |
| PFV | l-à mút̪ə̀n-ɛ̀ | lə̀-mùt̪ə̀n-ɔ́ | L HL-L | L-LL-H |
| DEP | ŋə̀-mút̪ə̀n-ɛ̀ | ŋə̀-mút̪ə̀n-ɔ̀ | L-HL-L | L-HL-L |
| INF | ðə́-mút̪ə́n-ɔ́ | | H-HH-H | |

In Moro, another West Heiban language, the causative suffix imposes its own tonal melody to the verb (Strabone and Rose 2012). Similarly, in the Central Heiban language Rere/Koalib, a subset of extension suffixes—the benefactive and malefactive—impose their own tonal melody to the verb (Quint 2010). In Tira, however, none of the extension suffixes show this property, and instead, they are included within the same domain as the verb root—the derivational stem—for the purpose of tone assignment.

In Table 3.10, all of the attested extension suffixes are listed, as well as the inflectional class they assign. Each suffix is illustrated on the verb *vəlɛð* 'pull' and *vrð* 'throw' in their imperfective forms. These forms show that (i) when verbs are derived with the causative suffix, the resulting lexeme is in the *ɔi*-class, while benefectives and passives are in the *ɔɔ*-class, regardless of the inflectional class the root verb belongs to; (ii) when verbs are derived with the antipassive suffix, the resulting lexeme is in either the *au*-class or *ɔu*-class, depending on which inflectional class the root verb belongs to; (iii) when verbs are derived with the pluractional or the applicative suffix, the resulting lexeme is in either the *aɔ*-class or *ɔɔ*-class, depending on which inflectional class the root verb belongs to; and (iv) the vowel of the pluractional and the applicative suffix (*a* or *ɔ*) is determined by the inflectional class of the verb root (a type of morphological

conditioning of derivational suffix allomorphy). For more details, see Hassen and Rose (2024) and Simmons (2022a, 2023).[10]

Table 3.10: Extension suffixes in Tira

| Form | Affix | Class | IPFV.ITV | IPFV.VEN |
|---|---|---|---|---|
| No extension suffix | | *aɔ* | lá v�́lɛ̀ð-à | lá vɘ̀lɛ̀ð-ɔ́ |
| | | *ɔɔ* | lá vɍ́ð-ɔ̀ | lá vɍ̀ð-ɔ́ |
| Causative | *-ij* | *ɔi* | lá vɍ́lɛ̀ð-ìj-ɔ̀ | lá vɘ̀lɛ̀ð-ìj-í |
| | | | lá vɍ́ð-ìj-ɔ̀ | lá vɍ̀ð-ìj-í |
| Benefactive | *-iṯ* | *ɔɔ* | lá vɍ́lɛ̀ð-ìṯ-ɔ̀ | lá vɘ̀lɛ̀ð-ìṯ-ɔ́ |
| | | | lá vɍ́ð-ìṯ-ɔ̀ | lá vɍ̀ð-ìṯ-ɔ́ |
| Passive; reflexive | *-in* | *ɔɔ* | lá vɍ́lɛ̀ð-ìn-ɔ̀ | lá vɘ̀lɛ̀ð-ìn-ɔ́ |
| | | | lá vɍ́ð-ìn-ɔ̀ | lá vɍ̀ð-ìn-ɔ́ |
| Antipassive; reciprocal | *-ið* | *au* | lá vɍ́lɛ̀ð-ìð-à | lá vɘ̀lɛ̀ð-ìð-ú |
| | | *ɔu* | lá vɍ́ð-ìð-ɔ̀ | lá vɍ̀ð-ìð-ú |
| Pluractional | *-aC* | *aɔ* | lá vɘ́<r>lɛ̀ð-àð-à | lá vɘ̀<r>lɛ̀ð-àð-ɔ́ |
| | *-ɔC* | *ɔɔ* | lá vɍ́ð-ɔ̀ð-ɔ̀ | lá vɍ̀ð-ɔ̀ð-ɔ́ |
| Applicative; locative | *-aṯ* | *aɔ* | lá vɍ́lɛ̀ð-àṯ-à | lá vɘ̀lɛ̀ð-àṯ-ɔ́ |
| | *-ɔṯ* | *ɔɔ* | lá vɍ́ð-ɔ̀ṯ-ɔ̀ | lá vɍ̀ð-ɔ̀ṯ-ɔ́ |

There may be multiple extension suffixes within the same verb form. This is illustrated by the examples in (87)–(88). Again, we see that the extension suffixes do not alter the tone patterns, but are included in the same domain as the verb root with respect to tone assignment. Here, the verb is in the imperfective itive form, which has a HL stem tone pattern after the auxiliary, with the L tone extending over the entire verb stem, resulting in a string of Low-toned extension suffixes. In verb forms with multiple extension suffixes, the final suffix determines the inflectional class (here *aɔ*-class). For more on the extension suffixes and their ordering, see Simmons (2022a).

(87) kúkù     k-á     káɾtʃ-ìð-àṯ-à           nɘ̀-lɘ̀vɛ́r
     (CLk)Kuku CLk-AUX search-ANTIP-LOC-FV LOC-(CLl)field
     'Kuku will search in the field.' (IPFV.ITV)

---

[10]The consonant of the pluractional marker *-aC/-ɔC* is a copy of the final vowel of the verb root, and some pluractional forms also have an infix <r>; see Hassen and Rose (2024) for details.

(88)  kúkù      k-á      kàɾtʃ-ìð-àt̪-ɔ́              nɘ̀-lɘ̀vér
      (CLk)Kuku CLk-AUX search-ANTIP-LOC-FV LOC-(CLl)field
      'Kuku will search in the field (far).' (IPFV.VEN)

### 3.2.6  Section summary

The present section has laid out the syntagmatic generalizations of the verb forms in Tira, and explained their internal structure. We have seen that the inflected verb forms are distinguished by tonal and non-tonal formatives. We have focused on under-ived (root) lexemes, but briefly discussed derived forms as well, i.e. verbs with extension suffixes. We now turn to a more detailed analysis of the tone patterns of the different verb forms.

## 3.3  Tonal analysis

What we have seen so far is that different verb forms are distinguished by a combination of tonal exponents, final vowels, prefixes, and auxiliaries. This is exemplified by the paradigm of verb forms for 'pull', repeated here in Table 3.11, which also contains schematized representation of the tone patterns associated with each paradigm cell.

**Table 3.11**: Paradigm for the verb *vɘlɛð* 'pull' with schematized tone patterns

| *vɘlɛð* 'pull' | Itive (away) | Ventive (towards) | | |
|---|---|---|---|---|
| IMP | vɘ́lɛ́ð-ɔ́ | vɘ̀lɛ̀ð-á | HH-H | LL-H |
| IPFV | l-á vɘ́lɛ̀ð-à | l-á vɘ̀lɛ̀ð-ɔ́ | H HL-L | H LL-H |
| PFV | l-à vɘ́lɛ̀ð-ɛ̀ | lɘ̀-vɘ̀lɛ̀ð-ɔ́ | L HL-L | L-LL-H |
| DEP | ŋɘ̀-vɘ́lɛ̀ð-ɛ̀ | ŋɘ̀-vɘ́lɛ̀ð-à | L-HL-L | L-HL-L |
| | lɘ̀-vɘ̀lɛ̀ð-ɛ̀ | lɘ̀-vɘ̀lɛ̀ð-ɛ̀ | L-LL-L | L-LL-L |
| INF | ðɘ́-vɘ́lɛ́ð-á | | H-HH-H | |

123

In this section, we present a tonal analysis of the verb forms, and discuss the interplay between phonology and morphology. We will show that some stem tone alternations are morphological in nature, while some are phonologically motivated. The section is organized as follows. First, we will show how some phonological processes affect the surface verb stem tones. Specifically, the verb stems in the periphrastic forms can be analyzed as Low-toned underlyingly, though sometimes surfacing as HL after High tone spreading or docking of floating tones. This illustrates the need for incorporating the syntagmatic dimension in the analysis of the system. Furthermore, there are stem tone alternations that are truly morphological in nature in the sense that they cannot be motivated by phonological factors. This illustrates the need to incorporate the paradigmatic dimension as well.

Next, we will discuss the outcomes of the above-mentioned phonological processes on verb forms where the root is asyllabic (e.g. *p* 'beat'), and show how such forms provide evidence for a domain boundary between the verb stem (defined as the verb root plus any and all extension suffixes) and the final vowels. Based on this proposed domain boundary, we will discuss the tone of the final vowels separately. We will show that although there are some tendencies for ventive forms to have a High-toned final vowel, and the itive forms to have a Low-toned final vowel, these generalizations do not hold up across all forms. While we could have imagined that it would be possible to segment the tone patterns into one tone or tonal melody per morphosyntactic property, this does not seem to be possible, and instead, the tone patterns are arguably associated with the inflected verb forms in each paradigm cell in a holistic manner.

### 3.3.1 Stem tone alternations in periphrastic expressions

As explained in Section 3.2.2, the auxiliaries of the periphrastic verb forms can be separated from the verb stem by intervening words, such as subject nouns. The

examples in (89)–(91) illustrate this with the subject noun *lárò* 'chickens', which itself has a HL tone pattern. The word order is thus (O)AuxSV, and the verb stem begins in a Low tone in all three examples.[11]

(89) ð-à      lárò        vòlèð-ὲ
CLð-AUX (CLl)chickens pull-FV
'The chickens pulled it (ð-class) away.'         PFV.ITV

(90) ð-á      lárò        vòlèð-à
CLð-AUX (CLl)chickens pull-FV
'The chickens will pull it (ð-class) away.'         IPFV.ITV

(91) ð-á      lárò        vòlèð-ɔ́
CLð-AUX (CLl)chickens pull-FV
'The chickens will pull it (ð-class) towards.'         IPFV.VEN

The examples in (92)–(94) illustrate the periphrastic verb forms with the same (O)AuxSV word order, but where the intervening subject noun ends in a High tone. Here, the verb stem begins with a High tone in all three examples.

(92) ð-à      émàɾðén     vɘ́lèð-ὲ
CLð-AUX (CLk)woman pull-FV
'The woman pulled it (ð-class) away.'         PFV.ITV

(93) ð-á      émàɾðén     vɘ́lèð-à
CLð-AUX (CLk)woman pull-FV
'The woman will pull it (ð-class) away.'         IPFV.ITV

(94) ð-á      émàɾðén     vɘ́lèð-ɔ́
CLð-AUX (CLk)woman pull-FV
'The woman will pull it (ð-class) towards.'         IPFV.VEN

High tone spreading is a lexically general process in Tira (see Chapter 2), and the stem tone alternations in (89)–(94) can be straightforwardly analyzed as an instance of this, with High tone spreading to a Low-toned verb stem in (92)–(94). These examples

---

[11]For more details about what may intervene between the auxiliary and the verb stem, see Jenks, Hassen, and Rose (2022) as well as Chapter 4. In short, it can be a subject or object pronominal, or a subject which is a full nominal. The intervening subject noun phrase may also include modifiers and relative clauses.

further illustrate that subject nouns begin in a High tone when intervening between the auxiliary and the verb stem; since the lexical (nominative) tone pattern of *èmàɽðén* 'woman' is in fact LLH, as illustrated in (95)–(97) (see also Chapter 2 for lexical tone patterns in Tira and the carrier phrases used to determine them). The initial High tone on *émàɽðén* 'woman' in the imperfective forms in (93)–(94) above can be analyzed as High tone spreading from the preceding auxiliary. In the perfective itive form in (92), however, this is not a possible analysis, as the auxiliary itself has a Low tone. The perfective itive auxiliary can be analyzed as contributing a floating High tone which docks onto the following word, which in the case of (92) is *èmàɽðén* (realized as *émàɽðén*). In (89)–(91) above, there is no observable outcome of this High tone docking, as the noun *lárò* 'chickens' already begins in a High tone. But when the auxiliary is directly followed by the verb stem, it is instead the verb stem which begins in a High tone; the periphrastic verb forms with the word order SAuxVO are illustrated in (95)–(97).[12]

(95)  èmàɽðén    k-à     və́lèð-ɛ̀ ðèdɔ̀ɽɔ̀
      (CLk)woman CLk-AUX pull-FV (CLð)root
      'The woman pulled the root away.'                                    PFV.ITV

(96)  èmàɽðén    k-á     və́lèð-à ðèdɔ̀ɽɔ̀
      (CLk)woman CLk-AUX pull-FV (CLð)root
      'The woman will pull the root away.'                                 IPFV.ITV

(97)  èmàɽðén    k-á     və̀lèð-ɔ́ ðɛ́dɔ̀ɽɔ̀
      (CLk)woman CLk-AUX pull-FV (CLð)root
      'The woman will pull the root towards.'                              IPFV.VEN

The example in (95) is consistent with an analysis in terms of High tone docking on the verb stem, and we can therefore analyze the perfective itive auxiliary as in (98). The example in (96) is consistent with an analysis in terms of High tone spreading from

---

[12]Note that the floating High tone of the perfective itive does not 'self-dock' on the auxiliary in (89) above. Because tautomorphemic docking is attested elsewhere in the language (see Section 3.3.3), one could assume that in (89), the High tone does associate to the following noun, but there is no observable change because the noun already begins in a High tone.

the auxiliary, as indicated in (99). If the two imperfective auxiliaries were instances of the same marker, this would predict High tone spreading in (97) above as well, yet what we see is that the stem is Low-toned in this case.

(98)  Floating High tone docking (PFV.ITV)

k-à⟨H⟩ vòlèð-ɛ̀ → [kà vɘ́lèðɛ̀]

(99)  High tone spreading (IPFV.ITV)

k-á vòlèð-à → [ká vɘ́lèðà]

(100)  No High tone spreading (IPFV.VEN)

k-á vòlèð-ɔ́ → [ká vòlèðɔ́]

The lack of High tone spreading indicated in (100) seems to be construction-specific. The explanation for the difference in tonal behavior of the two imperfective auxiliaries in (96)–(97) cannot be located in properties of the auxiliaries themselves (e.g. the contribution of a floating Low tone from the imperfective ventive auxiliary), nor in properties of the verb stem in the itive versus the ventive (e.g. a grammatical Low tone on the imperfective ventive stem, blocking the High tone spreading). The reason for this is that as illustrated in (92)–(94) above, subjects receive a High tone after *both* imperfective auxiliaries, and the verb stems of *both* imperfective auxiliaries receive a High tone after a subject ending in a High tone.[13]

---

[13]Kaldhol (ms.) proposes a tentative phonological analysis of the lack of High tone spreading in (100) by treating the auxiliaries as clitics, with their High tones being subject to the OCP when the auxiliaries are bound to the verb root. However, independent evidence is needed to test this hypothesis, and the language does not function in a way that allows us to do that. Even if we do find independent evidence (such as other High-toned clitics that behave the same way; as of now, this is unattested), the tonal difference in (99)–(100) is still morphologically informative; what distinguishes the two surface realizations of the imperfective forms is not just the quality and tone of the final vowel, but also the stem tone patterns. The details are left out of the present chapter because even if we are able to find independent evidence to motivate a phonological analysis of the difference between the two imperfective auxiliaries, the point relevant for the present chapter still remains: a complete understanding of the nature of the system needs to incorporate the syntagmatic dimension as well, and address High tone spreading and floating tone docking.

Based on what we have seen in the present section, we may turn the schematized tone patterns in Table 3.11 above into a set of proposed underlying tone patterns, as illustrated in Table 3.12. Here, the verb stem is analyzed as underlyingly Low-toned in all periphrastic constructions. Its surface tone depends on the tonal properties of the preceding auxiliary, as indicated in (98)–(100) above; the two imperfective tones are indicated here as H versus H′ (where the latter marks the construction-specific lack of High tone spreading). If the auxiliary and the verb stem is separated by an intervening element (a subject nominal, as in (89)–(94) above, or a subject or object pronominal), the verb stem can receive a High tone based on the regular properties of cross-word High tone spreading in Tira (discussed in more detail in Chapter 2).

**Table 3.12**: Hypothesized underlying tone patterns

|      | Itive (away) | Ventive (towards) |
|------|--------------|-------------------|
| IMP  | HH-H         | LL-H              |
| IPFV | H LL-L       | H′ LL-H           |
| PFV  | L(H) LL-L    | L-LL-H            |
| DEP  | L-HL-L/L-LL-L | L-HL-L/L-LL-L    |
| INF  | H-HH-H       |                   |

Under this analysis, we were able to motivate some of the stem tone patterns phonologically, but this did not leave us with a set of isomorphic markers. For example, the perfective itive auxiliary /à(H)/ is informative for both TAM and deixis, but cannot be decomposed into one perfective marker and one itive marker; an arbitrary segmentation, such as calling *a* a perfective marker and its tones an itive marker, would not make any predictions beyond this paradigm cell as the other perfective form does not have any auxiliary at all, and other itive forms have other tone patterns. Therefore, it exhibits cumulative exponence.

There are two ways of analyzing the imperfective auxiliaries: either as one marker *á* (which expones the imperfective) or as two separate markers (given their

difference in tonal behavior), each of which cumulatively expone both TAM and deixis (one imperfective itive auxiliary, and one imperfective ventive auxiliary). We will treat the two imperfective auxiliaries as different markers here, but this choice is not crucial for the present purposes: what matters is that a phonological analysis is necessary to fully describe the stem tone alternations in Tira, but the phonological analysis is not the full story.[14]

In sum, there is good evidence that some of the stem tone alternations in Tira verbs are phonologically motivated and can be analyzed in terms of High tone spreading or docking. These phonological processes are necessary to understand the structure of the word forms, and the syntagmatic relationship between the different markers. This does not mean that we are left with a set of isomorphic markers after accounting for the phonologically conditioned tonal alternations. We could have seen that the phonological analysis left us with a set of underlying forms, each one having a dedicated function (e.g. perfective, ventive, and so forth), and that these forms combine in a compositional way. Instead, what we see is that even when accounting for the phonologically conditioned alternations, the system still exhibits complexity of exponence. Different verb forms are distinguished by multiple different markers which are involved in contrasts of both TAM and deixis, i.e. there is verbose and overlapping exponence (as defined in Chapter 1).

---

[14]The alternative analysis of the TAMD auxiliaries is that there is a single marker *a* which is assigned different tone patterns based on TAMD. The distinction is not crucial for the abstractive approach taken here, where we are concerned with the internal organization of word forms and paradigms. If one instead were to propose a constructive analysis, where each word form is built incrementally, one is left with an analytical problem: on the one hand, when analyzing the *a* auxiliaries as different markers, their shared vowel quality is unexplained and accidental. On the other hand, if one posits that there is a single *a* auxiliary whose tones are assigned based on TAMD ("Grammatical Tone" in the traditional constructive understanding of the term, e.g. Rolle 2018)—and then spreads or docks as explained above—one would make those grammatical tone assignment rules specific to the TAMD auxiliary, as no other words in Tira show tonal TAMD marking in the same way. In the end, both options seem to be *ad hoc* solutions; we will not attempt to argue for either one here.

### 3.3.2 Morphological stem tone alternations

We will now move on to discuss stem tone alternations that cannot be accounted for as phonologically conditioned. Recall that the verb stem (i.e. the *derivational stem*) here includes the verb root and any and all extension suffixes, but excludes the final vowel. As was already mentioned in Section 3.2.1, the stem tone of the dependent verb forms are conditioned by the person and number of the subject, but in a morphomic way: The verb stem is all Low in the 1PL.EXCL and 3PL forms, but HL in all of the other forms. Examples of a HL form and a LL form are repeated here in (101). There is, to our knowledge, nothing that will unify the two values 1PL.EXCL and 3PL to the exclusion of all of the other forms, such that we can capture the verb stem tone distribution in terms of natural classes. In the dependent forms, the LL and HL stem tone patterns are thus morphologically conditioned and morphomic in nature. This is different from the stem tone alternations discussed in the previous section, which showed that in periphrastic forms, the alternation between HL and LL is phonologically conditioned (with HL being due to High tone spreading or docking of a floating tone, as argued above).[15]

(101)  HL vs. LL stems in dependent forms
     a.  ŋə̀- vɘ́lɛ̀ð -ɛ̀ (3SG of DEP.ITV)
     b.  lə̀- vɘ̀lɛ̀ð -ɛ̀ (3PL of DEP.ITV)

In addition, there is a HH stem tone pattern, which arguably is morphological in nature. First, the HH stem tone pattern is found in two paradigm cells—the imperative itive and the infinitive, repeated in (102)—so we can either consider it to be a single polyfunctional tone pattern, or two tone patterns that happen to be homophonous.

---

[15]As discussed briefly above, it could be possible to analyze a subset of the subject markers of dependent forms as contributing a floating tone (either /ŋə̀$^{(H)}$-/ or /lə̀$^{(L)}$-/ in (101)). This hypothesis predicts that if something intervenes between the subject marker and the verb, the floating tone will dock on the intervening element instead. However, unlike what is the case for the perfective itive auxiliary à$^{(H)}$, we have been unable to test this hypothesis as no other elements can intervene besides object markers, which seem to impose their own tone patterns.

There are no clear arguments for either, but given that the imperative itive HH tone has to do with TAM and deixis, while the infinitive is non-finite and unmarked for deixis, we will treat them as two unrelated tone patterns here.

(102)   HH stems
        a.   $\boxed{\text{vǝléð}}$ -ɔ́ (IMP.ITV)
        b.   ðɔ́- $\boxed{\text{vǝléð}}$ -á (INF)

Let us first consider the imperative itive HH tone (as in *vǝléð-ɔ́* 'pull (away)!'). The HH tone on the stem makes this form different from the imperative ventive (whose stem tone is LL), but we cannot simply call it an itive tone pattern, because other itive forms have other stem tone patterns—see Table 3.12 above. Therefore, the HH tone pattern is informative for both TAM and deixis at the same time (i.e. there is cumulative exponence). However, the final vowel suffix and its tone are also informative for both TAM and deixis. There are at least two options for how to treat the relationship between the stem tone pattern and the final vowel, which we will discuss in turn.

First, one could propose that the imperative itive is marked by a final vowel suffix -ɔ́ whose tone spreads regressively across the verb stem, thus allowing for a single marker which cumulatively expones the imperative and itive. There are a few problems with this approach. One is that there does not seem to be any way of testing it, unless we can identify a suffix that can intervene between the derivational stem and the final vowel suffix and block the hypothesized spreading (recall from Section 3.2.5 that extension suffixes such as the passive *-in* are included in the derivational stem, so they cannot be used to test this hypothesis). Another issue is that regressive High tone spreading is not attested elsewhere in Tira, so this would in any case be an instance of morphologically specific phonology and not something that follows from independently motivated facts in the language.

Second, one could treat the tone pattern and the final vowel as two separate formatives varying independently of each other. This is the approach we will take here, because the quality and distribution of the final vowels differ across inflectional classes, while the tone patterns do not. The final vowels are therefore not only informative for the TAM and deixis inflectional values, but also for inflectional class membership. Under this approach, the tone pattern cumulatively expones the imperative and the itive. The final vowel is also informative for TAM and deixis, but the final vowels (*-ɔ, -u* and *-i*) are morphomic in nature and cannot be assigned a consistent function in the same way (see also Section 3.4.2). Thus there is verbose exponence (multiple exponents sensitive to the same kind of information) and tone is a co-exponent of morphosyntactic properties, but the relationship between the tonal and non-tonal formative is quite opaque in nature. Figure 3.1 is an autosegmental representation of this word form. Note that autosegmental representations are used purely as descriptive tools for the present purposes.

$$
\begin{array}{c}
\text{H} \\
\nearrow\,\uparrow\,\searrow \\
\text{vəlɛð} \quad \text{-ɔ}
\end{array}
$$
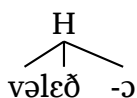
**Figure 3.1**: The imperative ventive

We now turn to the infinitive (or gerund) tone pattern; this verb form is all High (e.g. *ðə́-və́lɛ́ð-á* 'to pull'). The High tone pattern is one of three elements that differentiate the infinitive form from the other verb forms; the other two elements are the prefix *ðə-* and the final vowel (*-ɔ* or *-a*). In order to understand the nature of the tone pattern of this form, it is helpful to compare it to deverbal nouns in Tira. The examples in (103) show different nominal and verbal forms of the root *iritʃətʃ-*, whose meaning is related to studying or teaching. The examples in (104) show different nominal and verbal forms of the root *tʃəl-* 'be good'. Here, the noun class prefixes arguably are used in a derivational way; for example, the *ŋ*-class prefix creates abstract nouns.

| (103) | | Form | Tone | Controls agreement | | |
|-------|----|-----------|------|---------|---|---|
| | a. | ìrìtʃətʃɔ̀ | LLLL | k- | | 'student' |
| | b. | lìrìtʃətʃɔ̀ | LLLL | l- | | 'students' |
| | c. | ŋìrìtʃətʃɔ̀ | LLLL | ŋ- | | 'notes, study, learning' |
| | d. | ðírítʃə́tʃɔ́ | HHHH | ð- | | 'teaching' |
| | e. | írítʃə́tʃí | HHHH | no | | 'teach!' (IMP.ITV) |
| | f. | ìrìtʃətʃɔ́ | LLLH | no | | 'teach (far)!' (IMP.VEN) |

| (104) | | Form | Tone | Controls agreement | | |
|-------|----|---------|------|---------|---|---|
| | a. | ìtʃə̀là | LLL | k- | | 'good person' |
| | b. | làtʃə̀là | LLL | l- | | 'good people' |
| | c. | ŋàtʃə̀là | LLL | ŋ- | | 'goodness' |
| | d. | ðə́tʃə́lá | HHH | ð- | | 'being good' |
| | e. | tʃə́ló | HH | no | | 'be good!' (IMP.ITV) |
| | f. | tʃə̀lá | LH | no | | 'be good (far)!' (IMP.VEN) |

While nouns may have any tone pattern regardless of noun class (e.g. ðɔ̀mɔ̀tʃɔ̀ 'man', ðéŋén 'sound', ðɪ̀t̠rɔ́ 'Tira language'), the infinitive/gerund forms are all High, while the other nominal forms in (103)–(104) are all Low. Thus deverbal nouns and the infinitive forms are associated with distinct tone patterns. Noun class prefixes on agreement targets are Low-toned in Tira, and there is, to our knowledge, no other construction in which a noun class prefix consistently contributes a High tone. We therefore analyze the High tone of the infinitives as morphological tone, understood here as a property of the infinitive construction. We will assume this High tone pattern is associated with the whole verb form holistically. The alternative analysis is that there is a special prefix ðə́- which is different from the other noun class prefix ðə̀- and has a High tone which spreads across the entire word form. However, there is typically no High tone spreading from prefixes in Tira (e.g. the otherwise identical progressive prefix ðə́-; see Section 3.2.2), and when High tones do spread, they only spread once, so this would be an instance of morphologically specific phonology and not something that follows from independently motivated facts in the language. Given the *ad hoc* nature of this alternative analysis, we instead maintain that the prefix ðə- and the tone of the verb form are co-exponents as opposed to a single exponent. Figure 3.2 is an

autosegmental representation of this verb form (the left-alignment of the High tone is not intended to be meaningful here).



**Figure 3.2**: The infinitive

The LL stem tone pattern is also morphological in nature, and in different ways across paradigm cells. One the one hand, there are reasons to analyze the LL stem tone pattern as being the unmarked or "underlying" one; for example, of all the main clause forms, it seems to be the basic form which the verb has when it is not affected by High tone spreading or docking (as discussed in the previous section). By extension, one could consider an analysis of the imperative ventive form (e.g. *vòlèð-á* 'pull (towards)!') as having the "underlying" stem tone pattern and no tonal marking of TAM and deixis; while the final vowel cumulatively expones the imperative and the ventive, the verb stem is unmarked.

There are at least two reasons why this analysis is inadequate: First, the two imperative forms always differ tonally this way, regardless of the quality of the final vowels, which in one inflectional class is the same (e.g. *vŕð-ɔ́* 'throw (away)!' vs. *vɾ̀ð-ɔ́* 'throw (towards)!'). Based on paradigmatic constrasts, the Low stem tone therefore is morphologically informative and a part of the TAM and deixis marking. Second, with asyllabic roots (discussed further below), the Low stem tone is realized on the final vowel where it combines with the High tone, creating a rising contour (compare *p-ɔ́* and *p-ɔ̌* 'beat!'). This further suggests that the Low tone is active in creating paradigmatic contrasts; the Low-toned stem of the imperative ventive is not just an unmarked or "underlying" verb stem tone; it finds a way of being realized even in phonologically adverse environments. The representations in Figures 3.3–3.4 capture the imperfective ventive forms of *vɾð* 'throw' and *p* 'beat', respectively.

134

```
L   H
|   |
vrð  -ɔ      (IMP.VEN)
```
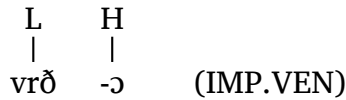
Figure 3.3: The imperative ventive of *vrð* 'throw'

```
L    H
 \   |
p   -ɔ      (IMP.VEN)
```
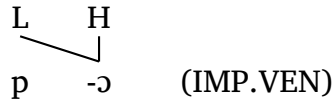
Figure 3.4: The imperative ventive of *p* 'beat'

To summarize, we need to appeal to the morphology as well as the phonology in order to analyze the stem tone patterns in Tira. The HH stem tone pattern is always morphological in nature and informative for morphosyntactic properties. The HL stem tone pattern is sometimes due to phonological processes such as High tone spreading or docking, and sometimes morphomic in nature. While there are reasons to consider the Low tone pattern to be the basic verb stem tone pattern, it is also morphological in nature, either morphomic (in the case of the dependent forms) or morphological (cumulatively exponing the imperative and ventive, as a co-exponent with the final vowel).

### 3.3.3  Asyllabic stems

We now turn to verb forms where the root is asyllabic (e.g. *p* 'beat'), and discuss how such forms provide evidence for a domain boundary between the verb stem (defined as the verb root plus any extension suffixes) and the final vowels. Because these roots consist of a single consonant and always are followed by a vowel-initial suffix, they always syllabify as onsets and do not contribute Tone-Bearing Units. In some cases, these consonants are even voiceless, so they do not provide any voiced segmental material at all during which tones may be realized. In other words, they create a *phonologically adverse environment* for tones (Roettger 2017): one question that arises is how

this affects the realization of the stem tone patterns and the outcomes of the processes of High tone spreading and docking. As a starting point, consider the paradigm for the verb *p* 'beat' in Table 3.13. The tone patterns of a CVC root is included in Table 3.14 for comparison; there are several differences here which will be discussed in more detail below.

Table **3.13**: The verb *p* 'beat'

|  | Itive | Ventive |  |  |
|---|---|---|---|---|
| IMP | p-ɔ́ | p-ɔ̌ | H | L͡H |
| IPFV | l-á p-ɔ̀ | l-á p-ɔ́ | H L | H H |
| PFV | l-á p-ɛ̀ | lɜ̀-p-ɔ́ | H L | L-H |
| DEP | ŋɜ́-p-ɛ̀ | ŋɜ́-p-ɔ̀ | H-L | H-L |
|  | lɜ̀-p-ɛ̀ | lɜ̀-p-ɔ̀ | L-L | L-L |
| INF | ðɜ́-p-ɔ́ | | H-H | |

Table **3.14**: The verb *var* 'escape'

|  | Itive | Ventive |  |  |
|---|---|---|---|---|
| IMP | váɾ-ú | vàɾ-á | H-H | L-H |
| IPFV | l-á váɾ-à | l-á vàɾ-ú | H H-L | H L-H |
| PFV | l-à váɾ-ì | lɜ̀-vàɾ-ú | L H-L | L-L-H |
| DEP | ŋɜ̀-váɾ-ì | ŋɜ̀-váɾ-à | L-H-L | L-H-L |
|  | lɜ̀-vàɾ-ì | lɜ̀-vàɾ-à | L-L-L | L-L-L |
| INF | ðɜ́-váɾ-á | | H-H-H | |

In what follows, we will discuss these forms further, and show how the tone system accommodates to forms that lack a TBU in the root. In Section 3.3.1, we established that there is High tone spreading from the imperfective itive auxiliary based on examples such as the ones in (105)–(106). What follows the auxiliary begins in a High tone, illustrated with the verb stem in (105) and the subject noun *làrò* 'brothers' in (106). As a reminder, the auxiliary indexes the noun class of the topic of the sentence, which in this case is the subject in (105), and the object in (106).

(105)  làɾò      l-á      vɛ́lɛ̀ð-à ðɛ̀dɔ̀ɾɔ̀
       (CLl)brothers CLl-AUX pull-FV (CLð)root
       'The brothers will pull the root away.'                        IPFV.ITV

(106)  ð-á      láɾò      vɛ̀lɛ̀ð-à
       CLð-AUX (CLl)brothers pull-FV
       'The brothers will pull it (ð-class) away.'                    IPFV.ITV

The examples in (107)–(108) illustrate a similar pair with the verb *p* 'beat', which itself is asyllabic and does not contribute a TBU. We could have expected that the High tone would spread to the final vowel in (107), yet it does not. In (108), however, the High tone of the auxiliary spreads to the otherwise Low-toned subject noun *lùrnɔ̀* 'grandchildren'.

(107)  lùrnɔ̀      **l-á**    **p-ɔ̀**    ðùɾì     nd̥ɔ̀bà
       (CLl)grandchildren CLl-AUX beat-FV (CLð)wood tomorrow
       'The grandchildren will beat the wood tomorrow.'               IPFV.ITV

(108)  **ð-á**    lúrnɔ̀                p-ɔ̀     nd̥ɔ̀bà
       CLð-AUX (CLl)grandchildren beat-FV tomorrow
       'The grandchildren will beat it (the wood) tomorrow.'          IPFV.ITV

It is not simply the case that High tone spreading to *pɔ* in (107) is blocked by a constraint against spreading to CV words or word-final vowels; the examples in (109)–(110) illustrate High tone spreading to the otherwise Low-toned CV noun *ðù* 'heart'.[16]

(109)  **ðù**      ð-á      léɲìt̥-à   ðìɲú      ð-ámìɲ-ì-ŋ
       (CLð)heart CLð-AUX know-FV (CLð)thing CLð-want-FV-3SG.SBJ
       'The heart will know what it wants.'                           IPFV.ITV

(110)  ð-á      **ðú**      lɛ̀ɲìt̥-à
       CLð-AUX (CLð)heart know-FV
       'The heart will know it.'                                      IPFV.ITV

The example in (111) illustrates that when the root *p* 'beat' is suffixed by the passive marker *-in*, the High tone spreads to this suffix. It is not the case that the

---

[16]Note that *ðù* 'heart' is the only Low-toned CV noun in our database; it is not an animate noun and cannot be the agent of the transitive verb *pɔ* 'beat (st.)', hence the choice of a different verb in (109)–(110).

137

passive suffix itself has a High tone; this is shown by the perfective ventive form of the passive, which is provided in (112). Here, the passive suffix is Low-toned (see also Section 3.2.5).

(111)  l-á      p-ín-ɔ̀
       CL1-AUX beat-PASS-FV
       'They will be beaten.'                                          IPFV.ITV

(112)  là-p-ìn-ɔ́
       CL1-beat-PASS-FV
       'They were beaten.'                                             PFV.VEN

The conclusion we can draw from these data is that the final vowel cannot host a High tone from spreading. One way of capturing these data, is by positing a domain boundary before the final vowel, with High tone spreading taking place within this domain, which includes the verb root and any extension suffixes, but not the final vowel, i.e. the *derivational verb stem*. The autosegmental representations below illustrate this; Figure 3.5 shows a verb stem which simply consists of a consonant (*p*) and does not contribute a TBU, so the High tone does not spread. Figure 3.6 shows that the extension suffix creates a TBU within the verb stem, and the High tone spreads. For comparison, High tone spreading to a monosyllabic root (*kɔt̪* 'braid') is illustrated in Figure 3.7.
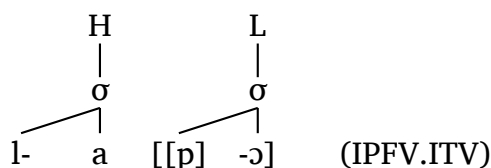


**Figure 3.5**: No High tone spreading to an asyllabic stem
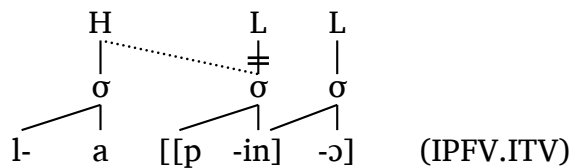


**Figure 3.6**: High tone spreading to the extension suffix

138

H    L    L

    |     ‡    |

    σ    σ    σ

l- a  [[k ɔ t̪] -a]   (IPFV.ITV)
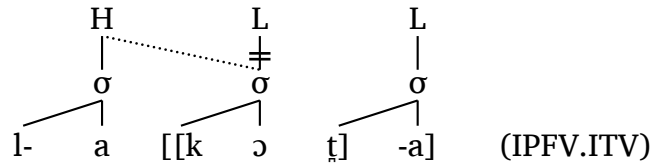
**Figure 3.7**: High tone spreading to a monosyllabic stem

We see a similar effect with the perfective itive auxiliary. Above, we established that while this auxiliary is Low-toned itself, it contributes a floating High tone which docks onto the following word; this was illustrated with examples such as the ones in (113)–(114). What follows the auxiliary begins in a High tone, illustrated with the verb stem in (113) and the subject noun *làɾò* 'brothers' in (114).

(113) làɾò   l-à   və́lèð-ɛ̀ ðèdɔ̀ɾɔ̀
   (CLl)brothers CLl-AUX pull-FV (CLð)root
   'The brothers pulled the root away.'        PFV.ITV

(114) ð-à   láɾò   vàlèð-ɛ̀
   CLð-AUX (CLl)brothers pull-FV
   'The brothers pulled it (ð-class) away.'      PFV.ITV

The examples in (115)–(116) illustrate a similar pair with the verb *p* 'beat', which itself is asyllabic and does not contribute a TBU. We could have expected that the High tone would dock onto the final vowel in (115), yet it does not. Instead, the High tone docks onto the auxiliary itself, a case of *tautomorphemic docking* (see e.g. McPherson and Heath 2016). It is not simply the case that the auxiliary has a High-toned allomorph used with asyllabic verbs; the example in (116) shows that if the auxiliary is followed by the subject, the auxiliary is Low-toned, and its floating High tone docks onto the subject.

(115) lùrnɔ̀   l-à<sup>(H)</sup> p-ɛ̀  ðùɾì   → [lùrnɔ̀ lá pɛ̀ ðùɾì]
   (CLl)grandchildren CLl-AUX beat-FV (CLð)wood
   'The grandchildren beat the wood (and left)' (PFV.ITV)

(116) ðùɽ̀ì    ð-à⒣    lùrnɔ̀              p-ɛ̀    → [ðùɽ̀ì ðà lúrnɔ̀ pɛ̀]
      (CLð)wood CLð-AUX (CLl)grandchildren beat-FV
      'As for the wood, the grandchildren beat it (and left)' (PFV.ITV)

Note that if there are any extension suffixes intervening between an asyllabic root and the final vowel, the floating High tone docks onto the TBU created by this suffix, as in (117), which illustrates a passive form.

(117)  High tone docking on extension suffix

       l-à⒣    p-ìn-ɛ̀    → [là pínɛ̀]
       CLl-AUX beat-PASS-FV
       'They were beaten (and left).' (PFV.ITV)

These data are consistent with the domain boundary hypothesized above, with High tone spreading and docking taking place within the derivational stem, i.e. a domain which includes the verb root and any extension suffixes, but excludes the final vowel. The autosegmental representations below illustrate this; Figure 3.8 shows a verb stem which simply consists of a consonant (*p*) and does not contribute a TBU for the floating High tone to dock onto, and instead, the floating High tone contributed by the auxiliary exhibits "self-docking". Figure 3.9 shows that the extension suffix creates a TBU within the verb stem, and the floating High tone docks onto this TBU. For comparison, floating High tone docking to a monosyllabic root (*kɔṯ* 'braid') is illustrated in Figure 3.10.
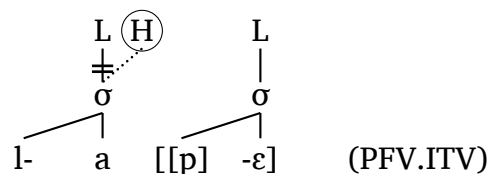


**Figure 3.8**: Tautomorphemic docking

As a result of these facts, the imperfective itive and perfective itive forms are tonally neutralized if the verb root is asyllabic; in such cases, the two verb forms are
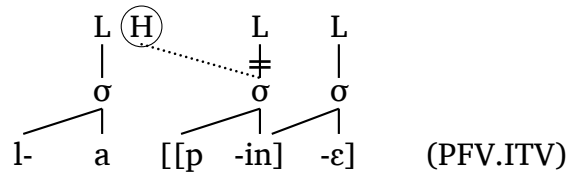
**Figure 3.9**: Floating High tone docking on the extension suffix
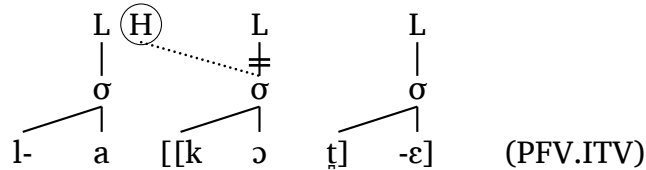


**Figure 3.10**: Floating High tone docking on a monosyllabic stem

distinguished by the quality of the final vowels only, and both forms have a High-Low tone pattern. This is illustrated in (118). Notice also that the imperfective ventive is tonally distinguished from these two forms and has a High-High tone pattern when the stem is asyllabic. As these examples show, the outcome is three uniquely discriminable forms.

(118)   a.   PFV.ITV: *lá pὲ*
        b.   IPFV.ITV: *lá pɔ̀*
        c.   IPFV.VEN: *lá pɔ́*

So far, we have explored what happens when the verb stem is expected to receive a phonologically conditioned High tone, but does not have the TBUs to support it, because the verb is asyllabic. We now move on to explore what happens when the verb stem is expected to receive a *morphologically* conditioned High tone. As shown in Section 3.2.1.3, the verb stem of the dependent form is either HL or LL depending on the person/number of the subject. For example, the 3SG forms are HL, as in (119), while the 3PL forms are LL, as in (120).

(119)   3SG dependent forms of 'pull'
        a.   Itive: ŋə̀-vɔ́lὲð-ὲ
        b.   Ventive: ŋə̀-vɔ́lὲð-à

(120)   3PL dependent forms of 'pull'
    a.  Itive: lə̀-və̀lὲð-ὲ
    b.  Ventive: lə̀-və̀lὲð-à

The examples in (121)–(122) show the 3SG and 3PL dependent forms of the asyllabic root *p* 'beat'. In these cases, we could have seen that the tonal distinction was neutralized, or that the H tone assigned to the stem would be realized on the final vowel. Instead, what we see, is that the preceding subject marker receives the High tone. There is thus a shift in tonal target, such that the otherwise Low-toned TBU *preceding* the verb stem receives the stem tone.

(121)   3SG dependent forms of 'beat'
    a.  Itive: ŋə́-p-ὲ
    b.  Ventive: ŋə́-p-ɔ̀
(122)   3PL dependent forms of 'beat'
    a.  Itive: lə̀-p-ὲ
    b.  Ventive: lə̀-p-ɔ̀

We will compare this to a case where there is no preceding TBU to which the High tone may associate. This is found with the imperative forms. Recall that the two imperative forms are distinguished by their stem tone pattern and/or the quality of the final vowel, as illustrated in (123). The examples in (123c) illustrate that extension suffixes (here the passive) are included in this verb stem domain and thus receive a High tone in the imperative itive and a Low tone in the imperative ventive. The examples in (123d) illustrate the two imperative forms of *p* 'beat'. Here, we could have seen that the two forms were neutralized, but instead, they are distinguished tonally. This suggests that there is a principle of discriminability between forms at play. In the imperative ventive form of 'beat', the Low tone otherwise assigned to the stem combines with the High tone of the final vowel to form a Rising tone. In Figure 3.11, an autosegmental representation is provided to illustrate this.

(123)

| | ITV | VEN | |
|---|---|---|---|
| a. | váléð-ɔ́ | vɜ̀lɛ̀ð-á | 'pull!' |
| b. | dɔ́ŋð-ɔ́ | dɔ̀ŋð-á | 'push!' |
| c. | p-ín-ɔ́ | p-ìn-ɔ́ | 'be beaten!' |
| d. | p-ɔ́ | p-ɔ̌ | 'beat!' |
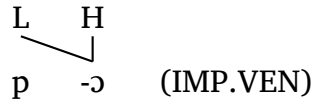
Figure 3.11: The imperative ventive form of an asyllabic verb

This is the only attested type of case where a tone which is expected to be realized on the verb stem instead is realized on the final vowel. This seems to happen only when there is no other sonorant material in the form during which the tone may be realized. Notice that if the Low stem tone had not been allowed to surface in (123d), the two forms would have neutralized to *pɔ́*, but by realizing the stem tone over the final vowel, the contrast is maintained. One might have expected the Low tone to override the High tone, yielding *pɔ̀* in the imperative ventive, yet this is not what happens. It seems that while High tones may override Low tones in Tira (e.g. in the self-docking cases), Low tones do not override High tones, but may combine with them to form contours. Although the realization of a Low stem tone over the final vowel in *p-ɔ̌* seemingly contradicts the hypothesis proposed above—i.e. there is a domain boundary between the derivational stem and final vowels over which tones may not spread or dock—this domain was based on the behavior of High tones (High tone spreading and docking of floating High tones) and may still be maintained.

We now turn to the imperfective ventive form. Recall that there is no High tone spreading from the auxiliary to the verb stem here, thus this form surfaces with a Low-toned verb stem. This is illustrated in (124)–(125): the verb stem is Low-toned after the auxiliary in (124), although the High tone spreads onto a following subject noun, as

in (125). As explained in Section 3.3.1, the lack of High tone spreading in (124) seems to be construction-specific.

(124)  làɾò        l-á      vəlὲð-ɔ́ ðέdɔ̀ɾɔ̀
       (CLl)brothers CLl-AUX pull-FV (CLð)root
       'The brothers will pull the root towards.'                    IPFV.VEN

(125)  ð-á         láɾò         vəlὲð-ɔ́
       CLð-AUX (CLl)brothers pull-FV
       'The brothers will pull it (ð-class) towards.'                IPFV.VEN

The example in (126) illustrates the imperfective ventive form of *p* 'beat'. Based on what we saw with the imperative form in Figure 3.11, one could have expected the Low tone of the stem to combine with the High tone of the final vowel, creating a rising contour, yet this does not happen. Based on what we saw with the perfective itive in Figure 3.10, one could have expected the Low tone to shift to the auxiliary, combining with its High tone or overriding it, yet this does not happen either. Instead, the auxiliary as well as the final vowel are simply High-toned.

(126)  lùrnɔ̀             l-á      p-ɔ́      ðúɾì
       (CLl)grandchildren CLl-AUX beat-FV (CLð)wood
       'The grandchildren will beat the wood (far).'                IPFV.VEN

In the form *lá pɔ́,* there is no evidence of the Low tone, and the entire word form is High-toned. We speculate that the shift of tonal target which we saw in the imperative (*p-ɔ̌* with the Low stem tone realized over the final vowel) does not take place in this context because it does not need to for paradigmatic contrasts to be maintained; unlike what we saw with the imperatives, there are no other verb forms with which the imperfective ventive form would neutralize to tonally, because it is the only periphrastic verb form with a surface [HH] tone pattern (see also (118) above). In this case, the Low stem tone may just be left floating, as the autosegmental representation in Figure 3.12 indicates.
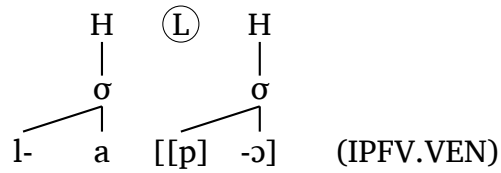
**Figure 3.12**: The imperfective ventive form of an asyllabic verb

To summarize, the inflected forms of asyllabic verbs demonstrate evidence for a domain boundary between the (derivational) verb stem (consisting of the verb root and any extension suffixes) and the final vowel. If the verb stem is expected to receive a phonologically conditioned tone, but is asyllabic and does not contribute a TBU, High tone spreading is blocked, and High tone docking is instead realized as tautomorphemic docking. If the verb stem instead is expected to receive a morphologically conditioned tone, but is asyllabic and does not contribute a TBU, the tonal target may shift to the preceding TBU if one is present (as in the dependent forms), or to the following one if not (as in the imperative forms). No such shifting is found in the imperfective ventive forms, where the surface realization of a HLH melody is HH when the stem is asyllabic (*lá pɔ́*), with no evidence of the Low stem tone. The material discussed in the present section shows that in phonologically adverse environments for tones, the forms find a way of accommodating the tone patterns associated with each verb form, in a manner that ensures discriminability of forms.

### 3.3.4   Suffix tones

So far, we have seen evidence that there is a verb stem domain which includes the verb root and any extension suffixes, but excludes the final vowel. We will therefore discuss the final vowels separately here. That is, rather than analyzing the tone of the stem and the tone on the final vowel as the implementation of a single tonal melody, we assume that the High tone on the final vowel is independent of the stem tone pattern.

One major analytical question that arises is what determines the tone of the final vowels. There are at least two possibilities: (i) the final vowel suffixes have either a Low or a High tone inherently; or (ii) the tone is independent from the final vowel but realized on it. Here, we will argue for option (ii), based on the fact that the final vowels vary across inflectional classes independently of tone. Although realized simultanously, the vowels and the tones serve different functions in the system; the quality of the final vowel suffixes provide different information from their tones because they are informative for inflection class, while tones are not. As a starting point, consider the data in (127)–(128), illustrating the final vowel suffixes of the *aɔ*-class (e.g. *dɔŋð* 'push') and *ɔɔ*-class (e.g. *vrð* 'throw'), respectively.

| (127) | aɔ-class | Itive | Ventive | | (128) | ɔɔ-class | Itive | Ventive |
|---|---|---|---|---|---|---|---|---|
| | IMP | -ɔ́ | -á | | | IMP | -ɔ́ | -ɔ́ |
| | IPFV | -à | -ɔ́ | | | IPFV | -ɔ̀ | -ɔ́ |
| | PFV | -ɛ̀ | -ɔ́ | | | PFV | -ɛ̀ | -ɔ́ |
| | DEP | -ɛ̀ | -à | | | DEP | -ɛ̀ | -ɔ̀ |
| | INF | | -á | | | INF | | -ɔ́ |

These examples reiterate what we saw in Section 3.2.5, namely that while the quality of the final vowel suffixes may differ across verbs, their tones are always the same. The quality of the final vowels is informative for morphosyntactic properties as well as for inflectional class membership, but the tones are only informative for morphosyntactic properties, and in a different way from the final vowels themselves, given the difference in distribution. Because the tones provide different information from their hosts, we treat them as individual exponents here.

Another analytical question that arises is what the tones of the final vowels express; that is, they are informative for morphosyntactic properties, but can we identify e.g. a ventive tone or a perfective tone? The schematized tone patterns provided above are repeated here in Table 3.15. These data show that one cannot segment the tone

patterns into one tone or tonal melody per function. There are some corners of the paradigm that looks promising with respect to generalizations, but these do not hold up across all forms: for example, while most ventive forms have a High-toned final vowel, not all of them do: the dependent ventive has a Low-toned final vowel. Further, it is not the case that *all* verb forms that end in a High-toned final vowel are ventive: the imperative itive also has a High-toned final vowel. The tone patterns cannot be segmented into one tone per function, but instead, each tone pattern is associated with the morphosyntactic property set of its paradigm cell (e.g. LL-H for imperative ventive).

**Table 3.15**: Schematized verb tone patterns

|  | Itive | Ventive |
| --- | --- | --- |
| IMP | HH-H | LL-H |
| IPFV | H HL-L | H LL-H |
| PFV | L HL-L | L-LL-H |
| DEP | L-HL-L/L-LL-L | L-HL-L/L-LL-L |
| INF | H-HH-H | |

To summarize, the tones of the final vowel suffixes provide different information from the quality of the final vowels, and can therefore be treated separately as opposed to being analyzed as an inherent property of the suffixes. Although ventive forms tend to have High-toned final vowels and itive forms tend to have Low-toned final vowels, there are exceptions to the tendencies, and no consistent tone-function mapping emerges from the data. Instead, the tonal exponent realized on the final vowel is morphological in nature: it contributes to the creation of paradigmatic contrasts, but not as the result of a consistent mapping between form and function.

### 3.3.5 Section summary

In this section, we discussed various approaches to analyzing the tone patterns of inflected verb forms. We have distinguished between stem tone alternations that are phonologically conditioned and those that are morphologically conditioned. Furthermore, we have argued that the tones of the final vowels are not an inherent part of these suffixes, but vary independently of them and provide different information from them. We have analyzed the TAMD auxiliaries as three different markers with different tonal properties. In the next section, we will go deeper into the interplay between tonal and non-tonal formatives in the organization of the paradigms.

## 3.4 Paradigmatic generalizations

So far, we have focused on the structure and organization of the inflected word forms individually. In the present section, we will move on to discuss how each inflected word form is embedded into a larger, relational system, and discuss the organization of the paradigms. Section 3.4.1 lays out the structure of each inflectional class. Section 3.4.2 discusses the distribution of the final vowels and argues that they are morphemes. Section 3.4.3 discusses how the organization of the paradigms allow for implicative relations between the verb forms, and propose a set of interpredictibility zones and principal parts. Section 3.4.4 discusses the functional load of the different exponents. Section 3.4.5 concludes.

### 3.4.1 Inflectional classes and paradigmatic layers

There are six inflectional classes in Tira which differ based on the quality and distribution of the final vowels. Other exponents (tones, auxiliaries, prefixes) remain

the same across classes. The final vowels thus form an independent *paradigmatic layer* (see e.g. Ackerman and Malouf 2013; Brown and Hippisley 2012; Parker and Sims 2020) and is discussed separately here. The paradigms in (129)–(134) illustrate the final vowels of the different inflectional classes, labeled here based on the principal parts (as analyzed below). Paradigms with fully inflected verb forms were illustrated in Section 3.2.3. The shading of cells indicate distributions within paradigms.[17]

(129)

| *aɔ*-class | Itive (away) | Ventive (towards) |
|---|---|---|
| IMP | -ɔ | -a |
| IPFV | -a | -ɔ |
| PFV | -ɛ | -ɔ |
| DEP | -ɛ | -a |
| INF | -a | |

(130)

| *au*-class | Itive (away) | Ventive (towards) |
|---|---|---|
| IMP | -u | -a |
| IPFV | -a | -u |
| PFV | -i | -u |
| DEP | -i | -a |
| INF | -a | |

(131)

| *ɔu*-class | Itive (away) | Ventive (towards) |
|---|---|---|
| IMP | -u | -ɔ |
| IPFV | -ɔ | -u |
| PFV | -i | -u |
| DEP | -i | -ɔ |
| INF | -ɔ | |

(132)

| *ɔi*-class | Itive (away) | Ventive (towards) |
|---|---|---|
| IMP | -i | -ɔ |
| IPFV | -ɔ | -i |
| PFV | -i | -i |
| DEP | -i | -ɔ |
| INF | -ɔ | |

---

[17]A potential seventh inflectional class is identical to the 'escape'-class in (130), except that there is *-o* instead of *-u*; the relationship between these two vowels in Tira are still under investigation, and the two classes are merged here to err on the side of caution with respect to avoiding proliferation of inflectional classes.

(133)

| *ai*-class | Itive (away) | Ventive (towards) |
|---|---|---|
| IMP | -i | -a |
| IPFV | -a | -i |
| PFV | -i | -i |
| DEP | -i | -a |
| INF | -a | |

(134)

| *ɔɔ*-class | Itive (away) | Ventive (towards) |
|---|---|---|
| IMP | -ɔ | -ɔ |
| IPFV | -ɔ | -ɔ |
| PFV | -ɛ | -ɔ |
| DEP | -ɛ | -ɔ |
| INF | -ɔ | |

In terms of the quality of the final vowels, there are six inflectional classes, but in terms of paradigmatic contrasts, there are three distributional classes: First, the classes in (129)–(131) all have three different final vowels, and although the quality of the vowels differ, the paradigms share the same distribution of contrasts (indicated by the shading of cells). The classes in (132)–(133) have two different final vowels, and although there is a difference in vowel quality— *-i* and *-ɔ* in (132), and *-i* and *-a* in (133)—the distribution of contrasts are shared between these two classes. The class illustrated in (134) also has two different final vowels, but the distribution is different from the other classes.

There are some patterns of organization that emerge; for example, the two imperative vowels always form the mirror image of the two imperfective vowels (this generalization holds vacuously in (134), where the two vowels are the same), and the perfective itive and the dependent itive vowels are always the same within any given paradigm (either *-i* or *-ɛ*). A phonological generalization that emerges is that if the perfective itive and dependent itive vowel is *-ɛ,* none of the other final vowels are high vowels. We will return to the organizational patterns below.

The type frequencies of the different inflectional classes are provided in Table 3.16. Note that these numbers are based on our database of 100 verb roots. Because ex-

tension suffixes determine the inflectional class (see Section 3.2.5 and Simmons 2022a), the numbers will look different when taking derived forms into account. For example, all verbs suffixed with the causative marker *-ij* fall into the 'return'-class with the final vowels *-ɔ* and *-i,* and all verbs suffixed with the passive/reflexive marker *-in* fall into the 'throw'-class with the final vowels *-ɔ* and *-ɛ,* regardless of the inflectional class of the verb root.

**Table 3.16**: Type frequencies of attested inflectional classes

| Class | Final vowel set | Type frequency | Exemplary verb |
|---|---|---|---|
| a/ɔ | -a -ɔ -ɛ | 36 | 'push' |
| a/u | -a -u -i | 15 | 'escape' |
| ɔ/u | -ɔ -u -i | 4 | 'climb down' |
| ɔ/i | -ɔ -i | 11 | 'return' |
| a/i | -a -i | 15 | 'spread' |
| ɔ/ɔ | -ɔ -ɛ | 19 | 'throw' |
| Total | | 100 | |

## 3.4.2 Morphomic distributions

We have seen that all of the final vowels are found in more than one paradigm cell, i.e. they are *polyfunctional*. Moreover, the distribution of the final vowels across cells cannot be captured as a natural class, meaning that they are *morphomic*. To see this, consider the distribution of the three final vowels *-ɔ, -a,* and *-ɛ* in the *aɔ*-class, illustrated in Table 3.17. There is, to our knowledge, nothing to unify the morphosyntactic property sets associated with the paradigm cells where e.g. *-ɔ* is found to the exclusion of the others.

Both stems and inflectional exponents can show morphomic distributions (see Herce 2020 for examples from 74 languages); Round (2015) proposes the term *meromorphome* for morphomic exponents. The final vowels in Tira are meromorphomes, but

**Table 3.17**: The morphomic distributions of the final vowels in the *aɔ*-class

| -ɔ | -a | -ɛ |
|---|---|---|
| imperative itive | imperative ventive | perfective itive |
| imperfective ventive | imperfective itive | dependent itive |
| perfective ventive | dependent ventive | |
| | infinitive | |

they are morphomic also in a second sense: as explained above, we can abstract away from the actual vowels and identify three patterns of distribution. These are illustrated in (135)–(137), which follow the shading of cells in (129)–(134) above, with the actual final vowels substituted by letters A, B, and/or C.

(135)

| | Itive (away) | Ventive (towards) | |
|---|---|---|---|
| IMP | A | B | *aɔ*-class |
| IPFV | B | A | *au*-class |
| PFV | C | A | *ɔu*-class |
| DEP | C | B | |
| INF | | B | |

(136)

| | Itive (away) | Ventive (towards) | |
|---|---|---|---|
| IMP | A | B | *ɔi*-class |
| IPFV | B | A | *ai*-class |
| PFV | A | A | |
| DEP | A | B | |
| INF | | B | |

(137)

| | Itive (away) | Ventive (towards) | |
|---|---|---|---|
| IMP | A | A | *ɔɔ*-class |
| IPFV | A | A | |
| PFV | B | A | |
| DEP | B | A | |
| INF | | A | |

These patterns of distribution cannot be reduced to either *form* (each pattern except (137) are instantiated by different final vowel sets) or *function* (the distributions cannot be captured in terms of natural classes). Therefore, the final vowels in Tira constitute an example of morphology by itself (in the sense of Aronoff 1994). Round (2015)

proposes the term *metamorphome* for such distributions. While the term *meromorphome* is used about the exponents themselves, *metamorphomes* are abstractions over actual markers, and form a layer between form and function.

The existence of morphomes is debated (see e.g. Luís and Bermúdez-Otero 2016), and in frameworks without a morphomic layer, one would have to capture the data in terms of accidental homophony. For example, the final vowel of the imperative itive (e.g. *vɔ̂lέð-ɔ́* 'pull away!') and the imperfective ventive (*lá vɔ̀lὲð-ɔ́* 'they will pull towards') would be two different markers with different functions, which just happen to be identical, and there would be no utility attributed to the patterns of homophony. A stricter demarcation of morphomes would only include cases in which two homophonous markers with different functions participate in lexically idiosyncratic allomorphy (see e.g. Herce 2020). This does indeed apply to the final vowels in Tira: Simmons (2023) shows that the *-ɔ* triggers rounding harmony of the vowels /a/ and /ɛ/ on the verb stem in the *ɔɔ-*, *ɔu-*, and *ɔi-*classes, but not the *aɔ-*class. This is an instance of morphologically constrained rounding harmony, and it bolsters the argument that the final vowels indeed are morphomes: when homophonous affixes (i.e. the *-ɔ* suffixes in a subset of inflectional classes) participate in idiosyncratic allomorphy (in this case, they trigger morphologically constrained rounding harmony), this is independent evidence that they are indeed instances of the same marker as opposed to different markers that are accidental homophones.

From an abstractive perspective, exponents are emergent properties of paradigms (see Chapter 1), and we do not have to worry about whether there is a single *-ɔ́* or two markers with different functions (*-ɔ́* 'imperative itive' and *-ɔ́* 'imperfective ventive'). What matters is that their formal identity allows us to investigate the paradigmatic organization in more detail, and this can be turned into predictions for learning and processing.

### 3.4.3 Paradigmatic organization

In languages with inflectional classes, we may ask how speakers can form new inflectional forms they have not heard before. For example, imagine a child acquiring Tira, who wants to produce the imperative itive form of *anṯ-* 'enter', but has never heard this form before. How would the child know what it is? Assuming our hypothetical child has acquired all of the inflectional classes we have discussed here, the child will know that the imperative itive forms always are High-toned, but the final vowel can be either *-ɔ, -u,* or *-i*. There are thus three options, and one question that arises is what information may guide the child in choosing between the possible forms. This is not merely a practical problem for a speaker of Tira, but a major question in morphological theory and learning, which has been formulated as follows:

- **Paradigm Cell Filling Problem**: What licenses reliable inferences about the in-flected (and derived) surface forms of a lexical item?
(Ackerman, Blevins, and Malouf 2009, p. 54)

First, we might hypothesize that type frequency plays a role, and if our estimates are correct, the *aɔ*-class has the highest type frequency. Without any other information, the child might produce *ánṯ-ɔ́* 'enter (away)!' on analogy with verbs in the *aɔ*-class, e.g. *dɔ́ŋð-ɔ́* 'push (away)!' However, speakers are exposed to inflected word forms and not isolated roots (and verb roots in Tira are always bound; even imperatives have a suffix), and thus, if the child knows that the root meaning 'enter' is *anṯ-*, it is because they have already learned at least one other form of 'enter', and this verb form will have some information that may be useful in predicting novel forms. For example, if the child already has learned that the imperfective ventive form is *lá ànṯ-ɔ́*, they will immediately know that the imperative itive form is *ánṯ-ɔ́* because of how the inflectional paradigms in general are organized (recall that across inflectional classes, the quality of the final vowel of the imperative itive and the imperfective ventive are the same). In addition,

the child also immediately knows that the perfective ventive form is *l-ànṯ-ɔ́*; across inflectional classes, this set of paradigm cells always share the same final vowel. When two or more paradigm cells are such that you can predict the form of one based on the other without any uncertainty, this set of cells form a *zone of full interpredictability* (see e.g. Pellegrini 2023, pp. 94–99). There are three such zones in Tira verbs, illustrated by the shading of cells in Table 3.18. If one knows the final vowel of one of the paradigm cells within a Zone (e.g. the imperative itive for Zone 2), one immediately knows the final vowel of all of the other paradigm cells within that Zone as well.

Table 3.18: Zones of interpredictability

|  | Itive (away) | Ventive (towards) |
|---|---|---|
| IMP | Zone 2 | Zone 1 |
| IPFV | Zone 1 | Zone 2 |
| PFV | Zone 3 | Zone 2 |
| DEP | Zone 3 | Zone 1 |
| INF | Zone 1 | |

Notice that although the shading of cells here is the same as what is found for the *aɔ*-class, *au*-class, and *ɔu*-class and their corresponding metamorphome in (135) above, these zones apply across inflectional classes, such that knowing one form within e.g. Zone 1 means that you immediately know the other forms within Zone 1. The classes differ in how the zones overlap: in (136), Zone 2 and Zone 3 have the same final vowels, while in (137), Zone 1 and Zone 2 have the same final vowels. The zones of interpredictability in Table 3.18 apply to the system as a whole.

If our hypothetical child has established that *anṯ-* 'enter' has the final vowel *-ɔ* in Zone 2, we may now ask whether this is helpful in predicting any forms outside of the Zone, e.g. the imperative ventive (Zone 1). The answer is 'no'. On the one hand,

because only two of the six inflectional classes in Tira have the final vowel -ɔ in Zone 2—the aɔ-class and the ɔɔ-class, repeated here in (138)–(139)—we know that *anṯ-* 'enter' belongs to one of those two. However, this information does not narrow down the possibilities for predicting the final vowel of the imperative ventive: if 'enter' belongs to the aɔ-class, the imperative ventive has *-a*, and if 'enter' belongs to the ɔɔ-class, it has *-ɔ*. Without any further information, there is still uncertainty in predicting the final vowel of this form.

(138)

| *aɔ*-class | Itive (away) | Ventive (towards) |
|------------|--------------|-------------------|
| IMP | -ɔ | -a |
| IPFV | -a | -ɔ |
| PFV | -ɛ | -ɔ |
| DEP | -ɛ | -a |
| INF | -a | |

(139)

| *ɔɔ*-class | Itive (away) | Ventive (towards) |
|------------|--------------|-------------------|
| IMP | -ɔ | -ɔ |
| IPFV | -ɔ | -ɔ |
| PFV | -ɛ | -ɔ |
| DEP | -ɛ | -ɔ |
| INF | -ɔ | |

Now imagine that the child learns that the imperfective itive form is *lá ánṯ-ɔ̀*. Because this form belongs to Zone 1, we know for sure that all of the other forms in Zone 1 end in *-ɔ* as well, including the imperative ventive. But what is more is that because we know at least one form from Zone 1 *and* one from Zone 2 (both Zones have the final vowel *-ɔ* in the case of *anṯ-* 'enter'), we have enough information to place the verb in an inflectional class—in this case, the 'throw'-class—and thus know the Zone 3 vowel as well (in this case, *-ɛ*). That is, by knowing the right subset of forms, we can place the verb in the right inflectional class and predict the entire rest of the paradigm. A paradigm cell or set of cells with this property is known as a *principal part*, a concept known from the Graeco-Roman grammar tradition, and formalized by e.g. Stump and Finkel (2013). Their definition is as follows:

- The **principal parts** of a lexeme L are a set of cells in L's realized paradigm from which one can reliably deduce the remaining cells in L's realized paradigm. (Stump and Finkel 2013, p. 11)

In Tira, any combination of forms in Zone 1 and Zone 2 (e.g. the two imperative forms) functions as a principal part, in that final vowel pairs associated with the principle part is unique to the inflectional class in question. The principal parts are given in Table 3.19.[18]

**Table 3.19**: Principal parts

| Zone 1 | Zone 2 | |
|--------|--------|---|
| -a | -ɔ | *aɔ*-class (e.g. *dɔŋð* 'push') |
| -a | -u | *au*-class (e.g. *var* 'escape') |
| -ɔ | -u | *ɔu*-class (e.g. *ur* 'climb down') |
| -ɔ | -i | *ɔi*-class (e.g. *vɜɽ* 'return st.') |
| -a | -i | *ai*-class (e.g. *kəltʃ* 'spread') |
| -ɔ | -ɔ | *ɔɔ*-class (e.g. *vrð* 'throw') |

In order to appreciate the usefulness of the principal parts, let us contrast it with a set of cells which does not have this property. First, knowing just a single form is never enough in Tira (for example, knowing the final vowel of Zone 1 for a given verb narrows down the possible inflectional classes for the given verb from six to three, but not all the way to one). Second, while any combination of forms in Zone 1 and Zone 2 (e.g. the two imperative forms) functions as a principal part, Zone 3 (the perfective itive and dependent itive) is not as informative; to see this, consider Table 3.20, which illustrates the final vowel sets of all inflectional classes and all three zones. This shows that knowing the Zone 3 vowel and either the Zone 1 or Zone 2 vowel does not uniquely identify the inflectional class: for example, if the Zone 3 final vowel is *-i* and the Zone

---

[18]As mentioned in Section 3.2.3, there is a seventh pattern which was excluded from the present discussion pending more research on the relationship between [u] and [o] in Tira. If it is included here, its Zone 1 and Zone 2 vowels would be *-a* and *-o*, a seventh pattern. The Zone 3 vowel is [i]. The three vowels follow the distribution of the metamorphome in (135), so excluding this pattern from the discussion here does not have any bearing on the identification of principal parts.

2 vowel is *-u,* there are two options (the *au*-class or the *ɔu*-class). If the Zone 3 final

vowel is *-i* and the Zone 1 vowel is *-a,* there are also two options (the *au*-class and the

*ai*-class).

Table 3.20: Final vowel sets

| Zone 1 | Zone 2 | Zone 3 | |
|--------|--------|--------|---|
| -a | -ɔ | -ɛ | *aɔ*-class (e.g. *dɔŋð* 'push') |
| -a | -u | -i | *au*-class (e.g. *var* 'escape') |
| -ɔ | -u | -i | *ɔu*-class (e.g. *ur* 'climb down') |
| -ɔ | -i | -i | *ɔi*-class (e.g. *vɜɾ* 'return st.') |
| -a | -i | -i | *ai*-class (e.g. *kəltʃ* 'spread') |
| -ɔ | -ɔ | -ɛ | *ɔɔ*-class (e.g. *vrð* 'throw') |

Because the final vowels in Tira are morphomic and verbs fall into different

inflectional classes, the shapes of the inflected verb forms are not predictable from

compositional principles (i.e. with verb roots combining with dedicated markers for

the relevant morphosyntactic properties). But as we have seen in this section, the

distributions of forms across inflectional classes reveal patterns of organization that

allow for inferences about inflected forms and inflectional class membership. Thus the

organization of the Tira verb morphology illustrates the following:

"[T]he importance of internal structure for morphology is not in the identification of
exponents for meaningful bits, but in ways that the organization of exponents
facilitate patterns of discriminability that help to distinguish and relate (classes of)
words." (Ackerman and Malouf 2016, p. 298)

The present section has discussed how the organization of paradigms in Tira help

in reducing the uncertainty of predicting the form of inflected words. There is by now a

long-standing tradition in measuring this uncertainty by calculating Shannon's Entropy

(Shannon 1948); for example, the uncertainty of predicting one inflected form given

another (set of) form(s) can be measured by calculating the Conditional Entropy (see

e.g. Ackerman and Malouf 2013). Calculations of this kind would serve as a quantitative version of the paradigmatic analysis laid out here, but would necessitate a larger dataset; typically, such analyses are conducted on databases of several hundred or even thousands of lexemes. For example, the analysis of Asama verb paradigms by Lévêque and Pellard (2023) consists of a database of 999 verb lexemes, and the analysis of Pitjantjatjara verb paradigms by Wilmoth and Mansfield (2021) is based on a database of 1072. Careful description and documentation takes time, and our current Tira verb database (based on data collection between 2020–2024) consists of about 250 verb lexemes, of which paradigms of nine cells have been elicited for about 100 verbs. We do not know to what extent these verbs are representative of the Tira verb lexicon in general, and will therefore have to leave a quantitative analysis for future research. For now, the main goal was to show that by treating the final vowels as morphomic and as forming an independent paradigmatic layer, we were able to reveal a set of organizational properties and identify the principal parts of the system.

### 3.4.4   Functional load and discriminability

We have seen that Tira exhibits *complexity of exponence*, i.e. various deviations from one-to-one mappings between forms and functions. Morphosyntactic property sets are realized on lexemes through a combination of tonal exponents, morphomic final vowels, prefixes and auxiliaries, and there are inflectional classes, distinguished by the quality and distribution of the final vowels. We could have imagined a system in which one could identify a "main exponent" (Matthews 1974/1991, p. 181),[19] with the other ones being subsidiary, but this opens up the question of what criteria to use. While

---

[19]Matthews (1974/1991) does not define "main exponent", but this would refer to cases where one exponent can be analyzed as triggering another; e.g. where a stem tone change can be analyzed as being triggered by an affix, e.g. by "stem readjustment rules" (see Halle and Marantz 1993). In such cases, one could propose that the affix is the main exponent and the tone is secondary (*auxiliary prosodic exponence* in Rolle's (2018) terminology).

it is the case that in the periphrastic constructions, the stem tone alternations can be attributed to the auxiliaries, the other stem tone patterns are arguably morphologically conditioned and not triggered by any segmental marker (see Section 3.3). Moreover, the final vowels vary across the inflectional classes while their tones do not; thus they are independent of each other and informative for different properties. Therefore, there is no main exponent among the possible elements, but many moving parts varying independently of each other and playing different roles in the organization of each verb form as well as the organization of the paradigms.

Instead of aiming to distinguish between main and subsidiary exponents, one might investigate functional load, measured by the number and type of verb forms that are distinguished by a single formative (e.g. tone or the final vowel). This is illustrated by the examples in (140)–(142), which shows exemplary paradigms of three verbs (one for each distributional class). Boxing is used to indicate pairs of verb forms that are distinguished by one formative only; either the final vowel or the tone pattern. If there is more than one such pair within a paradigm, shading is used to distinguish the different pairs. Tone patterns are treated holistically here; that is, pairs of verb forms that are distinguished tonally are marked, regardless of how many tones differ between them. These examples show that even in this aspect, no single type of exponent emerges as more important than the others, as there is usually more than one formative which distinguishes one inflected form from another, and thus the functional load of each exponent taken individually is relatively low.

(140)

| *dɔŋð* 'push' | Itive (away) | Ventive (towards) | Distinguished by |
|---|---|---|---|
| IMP | dɔ́ŋð-ɔ́ | dɔ̀ŋð-á | |
| IPFV | l-á dɔ́ŋð-à | l-á dɔ̀ŋð-ɔ́ | |
| PFV | l-à dɔ́ŋð-ɛ̀ | lɛ̀-dɔ̀ŋð-ɔ́ | |
| DEP | ŋɛ̀-dɔ́ŋð-ɛ̀ | ŋɛ̀-dɔ́ŋð-à | FV |
| INF | | ðɛ́-dɔ́ŋð-á | |

160

(141)      *kə́ltʃ* 'spread'    Itive (away)    Ventive (towards)    Distinguished by

| | Itive (away) | Ventive (towards) | Distinguished by |
|---|---|---|---|
| IMP | kə́ltʃ-í | kə̀ltʃ-á | |
| IPFV | l-á kə́ltʃ-à | l-á kə̀ltʃ-í | Tone |
| PFV | l-à kə́ltʃ-ì | lə̀-kə̀ltʃ-í | |
| DEP | ŋə̀-kə́ltʃ-ì | ŋə̀-kə́ltʃ-à | FV |
| INF | ðə́-kə́ltʃ-á | | |

(142)      *vrð* 'throw'    Itive (away)    Ventive (towards)    Distinguished by

| | Itive (away) | Ventive (towards) | Distinguished by |
|---|---|---|---|
| IMP | vŕð-ɔ́ | vr̀ð-ɔ́ | Tone |
| IPFV | l-á vŕð-ɔ̀ | l-á vr̀ð-ɔ́ | Tone |
| PFV | l-à vŕð-ɛ̀ | lə̀-vr̀ð-ɔ́ | |
| DEP | ŋə̀-vŕð-ɛ̀ | ŋə̀-vŕð-ɔ̀ | FV |
| INF | ðə́-vŕð-ɔ́ | | |

The first thing to notice is that across all classes, the two dependent forms are always distinguished by their final vowels and this alone. That is, the functional load of the final vowels is higher here than elsewhere in the paradigm, as the other forms that have different final vowels also have some other difference (e.g. different tone patterns). In (140), there are no verb forms which are distinguished by tone alone, but there are in (141) and (142). Thus the functional load of tone is higher in (141), where it is the only cue to distinguishing the imperfective ventive and the perfective itive, and even higher in (142), where there are two pairs of verb forms distinguished by tone, namely the two imperative forms and the two imperfective forms. But because the tone patterns are the same across classes, they are always there, reinforcing the differences between the inflected verb forms, even when they also differ in e.g. the final vowels. In fact, one could argue that tone is a more reliable indicator of morphosyntactic properties than the final vowels, given that the final vowels also differ across classes, and thus tone cannot be dismissed as secondary to the segmental exponents even in paradigms such as (140).

Another striking aspect of the system is that in spite of the extensive polyfunctionality resulting from the distribution of the final vowels across the paradigms, there

is no syncretism, i.e. no cases in which two forms of the same lexeme are identical. As the examples in (140)–(142) above show, two inflected verb forms always differ in at least one aspect, e.g. the final vowel or the tone. As we saw in Section 3.3.3, this holds true even when the verb stem is asyllabic and the tonal distinctions between the forms were maintained in alternative ways. The system is therefore organized in a maximally discriminable way, with unambiguous paradigmatic contrasts among the verb forms. Although there is a lack of form-function isomorphy at the level of exponents, this yields form-function isomorphy at the level of fully inflected verb forms, in the sense that there is a one-to-one relationship between inflected verb forms taken holistically and the meanings that they mark (i.e. the lexical meaning of the verb combined with a morphosyntactic property set).

Another way for a morphological system to be organized in a maximally discriminable way, is by conforming to an "agglutinative ideal", with dedicated markers combining in a compositional way. But as Tira exemplifies, this is not the only way; discriminability among inflected forms may also be achieved through extensive complexity of exponence.

### 3.4.5 Section summary

In this section, we have presented a set of paradigmatic generalizations of the TAM and deixis marking in Tira, and discussed the difference between the inflectional classes, the morphomic distributions of the final vowels, the organization of the paradigms and their partitioning into different zones of interpredictability and principal parts, the functional load of the different exponents, and the discriminability of inflected verb forms.

## 3.5 Concluding remarks

The present chapter has shown that verbs in Tira are marked for TAM and deixis by a combination of tonal exponents, morphomic final vowels, prefixes and auxiliaries. The system exhibits complexity of exponence in the sense that there is non-isomorphy between form and function; the meaning of the verb forms are distributed across different markers. It does not seem to be possible to identify "main" and "subsidiary" exponents, rather, there are different pieces varying independently of each other, and each exponent taken individually has low functional value. However, the distributions of forms across inflectional classes reveal patterns of organization that allow for inferences about inflectional class membership. Furthermore, the system is organized in a maximally discriminable way, without the need to identify classic morphemes to achieve unambiguous paradigmatic contrasts among the verb forms.

We have seen that in order to understand the nature of the system, we need to take both the syntagmatic and the paradigmatic dimension into account. The syntagmatic dimension is important not just to analyze the structure of each form, but because it matters for understanding the tone patterns and for distinguishing between stem tone alternations which can be motivated by the phonology versus those which cannot. As we saw in Section 3.3, the HH stem tone pattern is always morphological, while the HL stem pattern can be morphological or phonological (due to either High tone spreading or floating High tone docking to a LL stem). However, even though a phonological analysis is necessary to describe the surface forms, taking the phonological effects into account does not fully reduce the complexity of exponence. For example, while the HL stem tone pattern of the perfective itive forms can be analyzed as being due to a floating High tone contributed by the auxiliary, it is still the case that the resulting perfective itive auxiliary /à$^{(H)}$/ cumulatively expones both the perfective and the itive, and that

the perfective itive is further distinguished from the other forms by its morphomic final vowel, which is *-ɛ* or *-i* depending on inflectional class. That is, we cannot identify a dedicated perfective marker, nor a dedicated itive marker, and similar points can be made for the other verb forms as well.

A paradigmatic perspective provides a principled way of addressing various types of complexity of exponence and lack of compositionality. Tira provides one particularly instructive and intriguing type among many (e.g. Ackerman and Malouf 2013; Lévêque and Pellard 2023; Pellegrini 2023; Wilmoth and Mansfield 2021). The paradigmatic analysis provided here involved identifying a set of implicative relations, zones of inter-predictability, and principal parts. This is based on the observation that each inflected word form provides some information about the other word forms, and that from the perspective of the speaker, the uncertainty of predicting a novel word form is reduced given some information about known forms. A paradigmatic analysis can be construed as a set of implications for speakers and learners, accessible in the data distributions. They can form the basis for probabilistic learning of this complex morphological system. Whether or not they do (and whether they do it in a way that is in line with the analysis discussed here) is of course an empirical question, and one we will have to leave for future research on language acquisition, productivity, and diachronic developments.

# Chapter 4

## Tonally conditioned constructional change in West Heiban

This chapter presents a comparative morphological analysis of the two West Heiban languages Tira and Moro, specifically the Thetogovela dialect of Moro. Jenks and Rose (2015) show that Moro exhibits tonally conditioned morpheme ordering, where object markers are prefixes in a set of verb constructions associated with a distinct tone pattern, and suffixes elsewhere. The present study presents primary data from the related language Tira, and shows that in Tira, the location of object markers does not correlate with a tonal distinction between verb forms, but rather depends on whether the verb is in a subordinate form or not, and whether the verb forms are synthetic or periphrastic. When comparing cognate verb forms in Tira and Moro, the location of object markers are generally the same. This is exemplified in (143), where the object markers are postverbal (suffixes), and in (144), where they are preverbal in the sense that they occur before the verb root (in Moro, the object markers are prefixes, while in Tira, the object markers are bound to the TAMD auxiliary preceding the verb root).[12]

(143)  Postverbal object markers

    a.  g-a-vəleð-ə́-**ɲé**                                        Moro
        CLg-RTC-vəleð-FV-**1SG.OBJ**
        'S/he pulled me.' (PFV)

    b.  jə̀-və̀lɛ̀ð-ɛ́-**ŋì**                                        Tira
        CLj-pull-FV-**1SG.OBJ**
        'S/he pulled me.' (PFV)

(144)  Preverbal object markers

    a.  g-a-**ɲə́**-vəleð-a                                     Moro
        CLg-RTC-**1SG.OBJ**-pull-FV
        'S/he is about to pull me.' (IPFV)

    b.  j-á-**ŋì**             və̀lɛ̀ð-à                          Tira
        CLj-AUX-**1SG.OBJ** pull-FV
        'S/he will pull me.' (IPFV)

---

[1]RTC = Root Clause marker, FV = Final Vowel. Note that Low tones are unmarked in Moro, but marked in Tira.

[2]The vowel of the 1SG object marker *ɲé* in Moro is reduced to the [ə] in (144).

There is, however, one verb form which deviates from this general observation, namely the imperfective ventive. As illustrated in (145), this form has postverbal object markers in Moro, but the cognate construction in Tira instead has preverbal object markers.[3]

(145)   The puzzle of the imperfective ventive

    a.  g-á-vəleð-ə́-**ɲé**                                          Moro
        CLg-RTC-pull-FV-1SG.OBJ
        'S/he is about to pull me and come' (IPFV.VEN)

    b.  j-á-**ŋì**               vɜ̀lɛ̀ð-ɔ́                          Tira
        CLj-AUX-**1SG.OBJ** pull-FV
        'S/he will pull me (towards)' (IPFV.VEN)

In this chapter, Tira and Moro are compared to the Central Heiban languages, and it is argued that Moro constitutes the innovative system. Further, I sketch a series of hypothesized diachronic developments that account for the synchronic system in Moro, including the univerbation of periphrastic constructions into synthetic ones, and the reanalysis of the preverbal *a* marker from a TAMD auxiliary to a clause type marker. Finally, I will propose that Moro has undergone a process of *tonally conditioned constructional change*, whereby the object markers have gone from preverbal to postverbal in the imperfective ventive in Moro, by analogy with other verb forms which have the same tone pattern and object suffixes, thus making the distribution of object markers synchronically aligned with the verb tone. The present study shows that tone may play an active role in language change and contribute to the reorganization of constructions. As such, it makes a significant contribution to the study of the Heiban languages while also advancing our understanding of the role of tone in morphotactic change, a previously understudied topic in historical linguistics.

---

[3]Note that the Moro verb form in (145) was referred to as the distal imperfective by Jenks and Rose (2015), but 'distal' was later change to 'venitive' (here: ventive); see e.g. Jenks et al. (Forthcoming).

The chapter is organized as follows. Section 4.1 discusses previous literature on tone in diachrony, and contextualizes the current study within current efforts in historical linguistics to advance our field's understanding of how tones and their function may change over time. Section 4.2 provides background on the Heiban languages and the classification of Tira and Moro. Section 4.3 provides an overview of the verb morphology in Tira and Moro. Section 4.4 lays out the order of subject and object markers within each verb form in the two languages. Section 4.5 provides a comparison to the Central Heiban languages, illustrating that they share some key properties with Tira which are not found in Moro. Based on this, we will hypothesize that Moro is the innovative language, and in Section 4.6, we propose a series of diachronic developments that would account for the synchronic system in Moro, culminating in the tonally conditioned constructional change that has led to the difference in (145).

## 4.1   Tone change: beyond tonogenesis

This chapter contributes to a growing literature on the study of the role of tone in language change, a topic that has received little attention compared to segmental change (see e.g. Campbell 2021). As a field, we know less about how tones change than we know about how tone contrasts may arise, a phenomenon known as *tonogenesis* (e.g. Hyslop 2022; Kingston 2011). A growing number of scholars attempt to move beyond the study of tonogenesis, and advance our understanding of tone in diachrony by investigating tonal sound change, how tone systems may gain or lose tones over time, the role of tone change within the comparative method, and how tone systems may inform dialectology or the subclassifications of language families (Auderset 2022; Campbell 2021; Dockum 2019; Hyman 2018; Kubozono and Giriko 2018; Yang and Xu 2019).

Additionally, a few recent works have aimed to answer broader questions about how the *function* of tone may change diachronically. For example, Grimm (2023) discusses variation in Northwestern Bantu, and shows that in some languages, High tones are co-exponents of TAM alongside segmental ones, while in other languages, the tone carries a heavier functional load due to the erosion of the segmental co-exponents. This is not a type of morphological tonogenesis (where tonal exponents develop as tonal stability after deletion of segments), but is instead an example of how the function associated with existing morphological tones may be affected by changes elsewhere in the system.

Kaldhol and Stausland Johnsen (2021) show how grammaticalization has affected the tone system in Somali (Cushitic). Somali words previously had a maximum of one High tone, but after periphrastic constructions with multiple High tones became synthetic through univerbation, single words may now have multiple High tones. Furthermore, evidence from loanword adaptations suggests that the 'one High tone per word' rule in Somali is not synchronically productive (Kaldhol and Stausland Johnsen Forthcoming). In this case, univerbation affected the distributional restrictions on tone.

Tone has also been shown to condition segmental changes. DiCanio (2022) shows that in Itunyoso Triqui (Oto-Manguean), there is tonally conditioned allomorphy, where segmental markers (specifically clitic pronouns) are more likely to be deleted if tone redundantly marks the same morphological function as that marker on the preceding stem. Clitic pronouns are variably realized based on whether or not there are adjacent tonal cues. In this case, tone is active in the phonology of the language, influencing the rate of deletion, an ongoing change.

A morphological example of tone playing an active part in diachronic change comes from Scandinavian dialectology. Many Scandinavian dialects have a tone contrast on syllables with primary stress; the exact tones differ across dialects, and this

169

difference is abstracted over by giving the cognate categories the same labels across dialects: *Accent 1* and *Accent 2*. These form an inherent part of inflectional paradigms; for example, Scandinavian languages have a distinction between "weak" and "strong" verbs known from other Germanic languages (where strong verbs lack a suffix in the past tense), and as illustrated by the Grenland Norwegian data in Table 4.1, weak verbs typically have Accent 2 in the present tense while strong verbs have Accent 1.[4]

**Table 4.1**: Verb paradigms in Grenland Norwegian (Enger 2019, pp. 171–172; color coding added)

|           | Infinitive | Present   | Past    | PST.PTCP  |          |
|-----------|------------|-----------|---------|-----------|----------|
| 'throw'   | 2kaste     | 2kastær   | 2kasta  | 2kasta    | Weak I   |
| 'think'   | 2teŋke     | 2teŋker   | 2teŋte  | teŋt      | Weak IIa |
| 'know'    | 2çene      | 2çener    | 2çente  | çent      | Weak IIa |
| 'build'   | 2byge      | 2byger    | 2bygde  | bygd      | Weak IIb |
| 'scream'  | 2skri:ke   | 1skri:ker | skreik  | 2skri:ki  | Strong   |

Enger (2019) discusses the role of tone in verbal paradigms across Scandinavian dialects, and how it relates to the suffixes: In dialects of the type illustrated in Table 4.1, the present tense can be marked by the suffix *-er* and have either Accent 1 or Accent 2; that is, there is no correlation between the suffix *-er* and the stem tone, and one cannot simply analyze the stem tone as being sponsored by the suffix. Rather, the stem tone in the present tense correlates with the distinction between weak verbs (Accent 2) and strong verbs (Accent 1). In some dialects, a correlation between the stem tone and the suffix has been introduced, but the path to that correlation differs across dialects: In Table 4.2, the tone has changed in the Weak IIa and Weak IIb classes, such that Accent 1 is aligned with the suffix *-er*. In Table 4.3, the suffix of the Weak II class has changed to -ær, creating a better alignment between the suffix -ær and Accent 2.[5]

---

[4]Accent is not specified on monosyllabic forms in Tables 4.1–4.3 because there is no tone contrast on monosyllabic words in these varieties.

[5]To be clear, it is not the case that Swedish or TAS Norwegian developed from Grenland Norwegian; rather, Grenland Norwegian is an illustration of a variety that has kept the same type of system as the one from which standard Swedish and TAS Norwegian changed (Enger 2019, pp. 171–172).

**Table 4.2**: Verb paradigms in "standard" Swedish (Enger 2019, p. 171; color coding added)

|  | Infinitive | Present | Past | PST.PTCP |  |
|---|---|---|---|---|---|
| 'throw' | 2kasta | 2kast**ar** | 2kastade | 2kastat | Weak I |
| 'think' | 2täŋka | **1**täŋk**er** | 2täŋkte | täŋkt | Weak IIa |
| 'build' | 2byga | **1**byg**er** | 2bygde | bygd | Weak IIb |
| 'scream' | 2skri:ka | 1skri:k**er** | skrek | 2skri:kit | Strong |

**Table 4.3**: Verb paradigms in Trøgstad, Askim, Spydeberg (TAS) Norwegian (Enger 2019, p. 172; color coding added)

|  | Infinitive | Present | Past | PST.PTCP |  |
|---|---|---|---|---|---|
| 'throw' | 2kaste | 2kast**ær** | 2kasta | 2kasta | Weak I |
| 'know' | 2çene | 2çen**ær** | 2çente | çent | Weak II |
| 'scream' | 2skri:ka | 1skri:k**er** | skrek | 2skri:kit | Strong |

As Enger (2019, p. 172) points out, the two changes in Tables 4.2 and 4.3 are interesting for different reasons: the tone change which led to the system in Table 4.2 (where verbs in the Weak II class now receive Accent 1 in the present tense) cannot be accounted for in a phonological way. Instead, this is a purely morphological change, and an empirical argument for the role of autonomous morphology (in the sense of Aronoff 1994). The suffix change which led to the system in Table 4.3 (where verbs in the Weak II class now receive the suffix -ær) shows that tone in fact has the potential to condition a suffixal change; Accent 2 conditioned -ær instead of the other way around. Enger (2019, pp. 172–174) argues that this poses a problem for any theory that analyzes tonal morphology as "epiphenomenal", where all non-concatenative morphology is reduced to syntactic affixes underlyingly, e.g. Bye and Svenonius (2012). If diachronic change provides a window into the type of generalizations that speakers make—which it has been argued to do (e.g. Blevins 2004; Bybee 1994, 2003)—then the evidence suggests that tonal generalizations are a vital part of speakers' grammars, with the potential to condition suffixal change.

The present chapter contributes to the study of tone in language change in the following ways: First, the study presents a novel case study, and brings the Heiban languages to the table by presenting primary data from Tira and comparing it to published sources on Moro as well as the Central Heiban languages. Second, the study moves beyond the focus on surface tone contrasts to investigating the function of tone in the broader system in which it participates. Specifically, we argue that the synchronic system of tonally conditioned affix ordering in Moro (documented and analyzed by Jenks and Rose 2015) is due to an analogical change where the location of object markers has shifted and now correlates with the tone patterns of different verb forms. The present chapter therefore contributes to comparative Heiban studies as well as historical linguistics in general, by showing that tone may play an active role in diachrony and condition morphotactic change.

## 4.2   The Heiban languages

Heiban is a family of languages spoken in the Nuba Mountains in Sudan. Their internal classification as proposed by Schadeberg (1981a, p. 189) is illustrated in Figure 4.1 (note that Cwaya, a.k.a. Shwaia and Shwai, is left unclassified within the West-Central branch). Cognate lexemes and noun class pairings are related by regular sound correspondences (Schadeberg 1981a), and the branch has been shown to be related above 40 % lexicostatistically (Hammarström 2013). Schadeberg (1981a) transcribes tone for all the Heiban languages, but as the datasets in his comparative study mostly consists of word lists and simple phrases, tonal reconstruction is left for later work pending more in-depth research on the tone systems in each language. To my knowledge, this has yet to come to fruition, and tonal analysis has so far only been documented in depth for Tira, Rere/Koalib, and Moro.

Proto Heiban

West-Central Heiban          East Heiban

West Heiban    (Cwaya)    Central Heiban       Warnang    Ko

Moro    Tira                              Koalib/Rere

Otoro    Logol

Ebang/Abul Laru
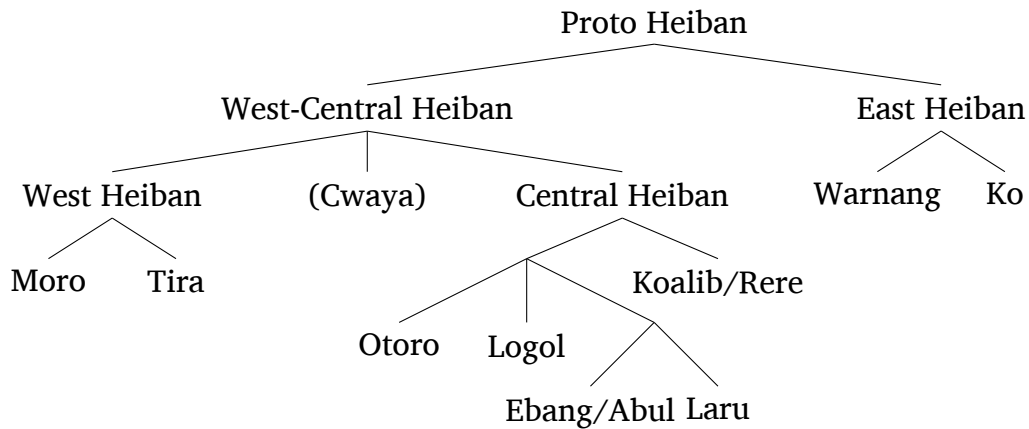
**Figure 4.1**: Classification of the Heiban languages, adapted from Schadeberg (1981a, p. 189).

While there is good evidence that the Heiban languages are related, their external classification is debated. Greenberg (1950, 1963) considered Heiban to belong to the Kordofanian language family (along with Talodi, Rashad, Katloid and Kadugli), which he further proposed to constitute a branch of the larger Niger-Congo phylum. However, the evidence for Kordofanian as a branch of Niger-Congo has been debated (see e.g. Hammarström 2013), and so has the evidence for Kordofanian as a family at all. Schadeberg (1981b) argues for the exclusion of the Kadugli languages, and further that Kordofanian consists of four subgroups: Heiban, Talodi, Rashad, and Katloid. However, Quint (2006) is skeptical about the inclusion of the Katloid languages due to the lack of a convincing set of lexical cognates. Blench (2013) goes a step further and asks whether Kordofanian should be split up, and Dimmendaal (2018) argues for deconstructing Kordofanian overall. The reason for this is that while there is evidence that Katla (or Katloid) and Rashad are related, and further, that all four groups share grammatical and lexical properties that may point to a shared Niger-Congo origin, these shared properties do not, in Dimmendaal's view, constitute "shared innovations relevant for subgrouping" (Dimmendaal 2018, p. 20). For example, similarities in the noun class systems across

languages might instead be due to shared retention from an earlier Niger-Congo origin (Dimmendaal 2018, p. 20). Regardless of their external classification, what is relatively uncontroversial is that the Heiban languages form a genetic grouping.

The present chapter focuses on the two languages of the West Heiban branch, Tira and Moro, but references to other Heiban languages is made when necessary and possible. Specifically, this chapter aims to lay out the variation in how Tira and Moro organize their verb systems. The Tira data presented here is based on work with the native speaker Himidan Hassen. The Moro data presented here illustrates the Thetogovela dialect, and is a combination of published material (e.g. Jenks and Rose 2015; Jenks et al. Forthcoming; Rose 2013) and unpublished material; unless otherwise indicated, the source of the Moro data is field notes provided by Sharon Rose.

As we will see, Moro and Tira share several properties, as expected from their close genetic relationship, but they also differ in certain key areas. In cases where Tira behaves more like languages in the other Heiban branches, we will hypothesize that this is due to retention from West-Central Heiban or earlier and that Moro is the innovative language. Further, we will make proposals for the kinds of developments that may have taken place in Moro. These proposed developments include univerbation, reanalysis, and analogy, i.e. structural changes in Moro, affecting constructions and paradigms. As we will see, this reorganization has led to a situation where tone plays different roles in the respective verb systems. The present chapter thus contributes to our understanding of variation across the Heiban languages, but also makes a broader contribution by analyzing a case study of tone change at its functional level, which is, as mentioned, an emerging topic in historical linguistics.

## 4.3   Verb morphology

The present section provides an overview of the verb morphology in Tira and Moro, focusing on the marking of TAM and verbal deixis, as well as the distinction between main and subordinate forms. Table 4.4 illustrates different forms of the Moro verb *vəleð* 'pull' (see also Jenks et al. Forthcoming; Rose 2013), and Table 4.5 illustrates different forms of the cognate Tira verb *vəlɛð* 'pull' (see also Chapter 3). As these paradigms show, tonal and non-tonal exponents interact in distinguishing verb forms in both languages; for example, the two imperative forms differ in their tone pattern as well as the quality of their final vowel.[6]

**Table 4.4**: Partial paradigm of Moro verb forms

| *vəleð* 'pull' | Regular | | Ventive |
|---|---|---|---|
| IMP | *və́léð-ó* <br> pull-FV | | *vəleð-a* <br> pull-FV |
| IPFV | *C-a-və́léð-a* <br> CL-RTC-pull-FV | | *C-á-vəleð-ó* <br> CL-RTC-pull-FV |
| PFV | | *C-a-vəleð-ó* <br> CL-RTC-pull-FV | |
| INF | *X-və́léð-e / X-vəleð-e* <br> SBJ-pull-FV | | *X-və́léð-a / X-vəleð-a* <br> SBJ-pull-FV |
| Gerund | | *ðə́-və́léð-áŋ* <br> CLð-pull-NMLZ | |

There are some key differences in how the two languages organize their morphology: as shown in Tables 4.4–4.5, Moro does not have a deixis contrast in the perfective, while Tira does. Further, while both languages have preverbal *a* markers in a subset of forms (the two imperfectives and the perfective itive in Tira, and the two imperfectives and the single perfective form in Moro), their distributions differ, and they are therefore

---

[6]The C indicates a noun class marker, the X indicates a subject marker; this notation is used to indicate that these are variables.

**Table 4.5**: Partial paradigm of Tira verb forms (from Chapter 3)

| *vəlɛð* 'pull' | Itive | | Ventive |
|---|---|---|---|
| IMP | *və́lɛ́ð-ɔ́* <br> pull-FV | | *və̀lɛ̀ð-á* <br> pull-FV |
| IPFV | *C-á və́lɛ̀ð-à* <br> CL-AUX pull-FV | | *C-á və̀lɛ̀ð-ɔ́* <br> CL-AUX pull-FV |
| PFV | *C-à və́lɛ̀ð-ɛ̀* <br> CL-AUX pull-FV | | *Cə̀-və̀lɛ̀ð-ɔ́* <br> CL-pull-FV |
| DEP | *X-və́lɛ̀ð-ɛ̀ /X-və̀lɛ̀ð-ɛ̀* <br> SBJ-pull-FV | | *X-və́lɛ̀ð-à /X-və̀lɛ̀ð-à* <br> SBJ-pull-FV |
| INF | | *ðə́-və́lɛ́ð-á* <br> INF-pull-FV | |

analyzed as having different functions. The Tira *a* is a TAMD auxiliary (see Chapter 3), and the Moro *a* marker indicates clause type (see Jenks et al. Forthcoming).

Furthermore, the Tira *a* auxiliary is syntactically independent, while the Moro *a* is a prefix. As we saw in Chapter 3, there are two possible word orders in Tira: SAuxVO and OAuxSV. The order depends on information structure; in a topic-comment construction, the initial constituent is the topic, shown in (146). As exemplified here, the subject occurs between the auxiliary and the verb root unless it is topicalized. If the verb form is synthetic, the corresponding word orders are SVO and OVS, illustrated in (147). The verb indexes the noun class of the topic, regardless of its syntactic function. Similar facts are found in focus constructions, which we will return to below (see also Jenks, Hassen, and Rose 2022; Kaldhol, Rose, and Simmons Accepted).[7]

(146)   Topic-comment constructions in Tira (periphrasis)

---

[7]The noun class agreement in (146)–(147) is not simply a case of topic agreement, as similar facts are found in relative clauses and focus constructions as well (see Section 4.6). Further, the noun phrase which controls the agreement does not need to be an argument of the main verb, but can be an adjunct or a noun phrase extracted from embedded clauses; see Jenks, Hassen, and Rose (2022) and Kaldhol, Rose, and Simmons (Accepted).

a. S Aux V O

láɾò       **l-á**     **r̀lànḍ-ɔ́** ðɔ́ɾà
(CLl)chickens CLl-AUX close-FV (CLð)fence
'The chickens will close the fence' (IPFV.VEN)

b. O Aux S V

ðɔ́ɾà       **ð-á**     láɾò       **r̀lànḍ-ɔ́**
(CLð)fence CLð-AUX (CLl)chickens close-FV
'As for the fence, the chickens will close it' (IPFV.VEN)

(147) Topic-comment constructions in Tira (synthesis)

a. S V O

láɾò       **là-r̀lànḍ-ɔ́**    ðɔ́ɾà
(CLl)chickens CLl-close-FV (CLð)fence
'The chickens closed the fence' (PFV.VEN)

b. O V S

ðɔ́ɾà       **ðè-r̀lànḍ-ɔ́**    láɾò
(CLð)fence CLð-close-FV (CLl)chickens
'As for the fence, the chickens closed it' (PFV.VEN)

In Moro, on the other hand, it is not the case that a noun phrase can intervene between the clause marker *a* and the verb root. In declarative sentences where the subject is the topic, the word order is SVO, as illustrated in (148a). It is possible to topicalize other arguments, as in (148b). Here, the word order is OSV; the subject is preverbal and the clause marker *a-* is still prefixed to the verb root. Other aspects of this construction that makes Moro different from Tira is that the verb agrees with the subject even when the object is topicalized in (148b), and further, there is a 3SG object marker on the verb if the object is a human. If the object is non-human, there is no object marker on the verb; see (148c)–(148d). Tira lacks a 3SG object marker (see also Kaldhol and Rose 2024).

(148) Topic-comment constructions in Moro

a. SVO

ŋeɾá        ŋ-a-wəndaṭ-ó    kúk:ù-ŋ
(CLŋ)girl CLŋ-RTC-see-FV (CLg)Kuku-ACC
'The girl saw Kuku'

b. OSV

kúk:u        ŋeɾá        ŋ-a-wəndaṭ-ó-ŋó
(CLg)Kuku (CLŋ)girl CLŋ-RTC-see-FV-3SG.OBJ
'As for Kuku, the girl saw him'

c. SVO

ŋeɾá        ŋ-a-sː-ó          átʃəvá-ŋ
(CLŋ)girl CLŋ-RTC-eat-FV (CLg)food-ACC
'The girl ate food.'

d. OSV

átʃəvá        ŋeɾá        ŋ-a-sː-ó
(CLg)food (CLŋ)girl CLŋ-RTC-eat-FV
'As for the food, the girl ate it.'

To summarize, Tira has both synthetic and periphrastic verb forms, where the preverbal *a* marker is a syntactically independent TAMD marker. In Moro, the cognate verb forms are all synthetic, and the *a* marker is a prefix which indicates clause type. While the subject in Tira is postverbal in object topic constructions (OVS or OAuxSV), the subject in Moro is always preverbal (SVO), even in object topic constructions (OSV). As we will see in Section 4.4, there are similar differences in the patterns of subject/object marking.

Another difference between the two languages is that while Tira has a set of six verbal inflectional classes distinguished by the quality and distribution of the final vowels (laid out in Chapter 3), Moro does not. Instead, most alternations in the final vowels of verbs are phonologically conditioned, and due to the vowel height harmony in the language (Ritchart and Rose 2017; Rose 2013). There is a correspondence between the inflectional classes in Tira and the harmony classes in Moro (Simmons 2023); this

is indicated in Table 4.6, which show that the verbs that fall into the Tira inflectional classes that have the final vowel -*a* in the (itive) imperfective are cognate to verbs with low vowels in Moro. The verbs that fall into the Tira inflectional classes that have the final vowel -*ɔ* in the (itive) imperfective are cognate to verbs with high vowels in Moro.

**Table 4.6**: Inflectional classes in Tira and harmony classes in Moro

| Tira | | | Moro (low vowels) | | | Tira | | | Moro (high vowels) | | |
| IPFV | IMP | DEP | IPFV | IMP | DEP | IPFV | IMP | DEP | IPFV | IMP | DEP |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| a | ɔ | ɛ | a | o | e | ɔ | ɔ | ɛ | ɜ | u | i |
| a | u/o | i | a | o | e | ɔ | u | i | ɜ | u | i |
| a | i | i | a | o | e | ɔ | i | i | ɜ | u | i |

As for tone, there is no evidence of lexical tone or inflectional classes made by tone in Tira verbs (see Chapter 3), but Moro verbs fall into different groups based on the realization of default tone pattern, found in a subset of verb forms. The list of verb forms that have this tone pattern is discussed in more detail in Section 4.4.5. The realization of the default tone pattern is influenced by a number of factors, including syllable weight and whether the root is vowel- or consonant-initial. In addition, some verbs seem to have a tone pattern which is lexically marked. The exact details of the conditioning will not be recapitulated here (see Jenks et al. Forthcoming, pp. 296–303; Jenks and Rose 2011, 2012), but a few examples of the surface realizations are provided in Table 4.7; these examples show different verbs in their imperfective forms, with the g-class prefix.

As we have seen in this section, tonal and non-tonal exponents interact in distinguishing verb forms in both languages, but there are some differences in how the verb morphology is organized. For the present purposes, the most crucial differences include the status and function of the preverbal *a* marker, the word order differences, and the fact that periphrastic verb forms in Tira have cognate forms in Moro which instead are

**Table 4.7**: Examples of the realizations of the default tone pattern in Moro (Jenks et al. Forthcoming, pp. 296–303)

|    | Tone | Example | |
|----|------|---------|---|
| a. | no H tone | g-a-ð:-a | 'slice, cut' |
| b. | root-initial H | g-a-kér-a | 'break' |
|    | | g-a-vә́dað-a | 'clean, sweep' |
| c. | root-initial H with binary spreading | g-a-wáð-á | 'poke' |
|    | | g-a-vә́léð-a | 'pull' |
|    | | g-a-kә́rә́ɲat̪-a | 'tell off, rebuke' |

synthetic. With all of this in mind, we now turn to subject/object marking in the two languages, and show how tone plays different roles in the two systems.

## 4.4   Subject/object marking

As we saw in the previous section, the word order facts differ in the two languages: in Moro, subjects are always preverbal (SVO or OSV), while in Tira, the subject may be postverbal if the object is topicalized (OVS in synthetic forms, OAuxSV in periphrastic forms). There is a similar difference in the pronominal subject and object marking in the two systems. In Moro, the location of subject markers is fixed as preverbal, exemplified in (149a-b). If the subject is third person, there is no overt 3SG.SBJ marker, but the verb indexes the noun class of the subject, as in (149c) (see also Jenks et al. Forthcoming).[8]

(149)   SM-V-OM in Moro

  a. **é-**g-a-tʃombәð-á-**ŋá**
   **1SG.SBJ-**CLg-RTC-tickle-FV-**2SG.OBJ**
   'I tickled you' (PFV)

---

[8]As indicated in (149), the final vowel *-ó* of the perfective in Moro may be reduced to [ə] before an object marker, and/or colored by the following vowel.

b. **ŋá-**g-a-tʃombəð-ɔ́-**ɲé**
   **2SG.SBJ-**CLg-RTC-tickle-FV-**1SG.OBJ**
   'You tickled me' (PFV)

c. **g**-a-tʃombəð-ɔ́-**ɲé**
   **CLg**-RTC-tickle-FV=**1SG.OBJ**
   'S/he tickled me' (PFV)

In Tira, the order of the subject and object markers depends on a range of factors (Hassen, Kaldhol, and Rose 2021), including the person hierarchy; consider first the examples in (150), which illustrate that when both arguments are Speech Act Participants, the subject marker precedes the verb, and the object marker follows the verb.[9]

(150) SM-V-OM in Tira (SAP > SAP)

a. **á-**vəlɛ̀ð-ɔ́-**íŋì**      → [ávəlɛ̀ðɛ́ŋì]
   **2SG.SBJ-**pull-FV-**1SG.OBJ**
   'You pulled me.' (PFV.VEN)

b. **jɛ́-**vəlɛ̀ð-ɔ́-**áŋà**      → [jɛ́vəlɛ̀ðáŋà]
   **1SG.SBJ-**pull-FV-**2SG.OBJ**
   'I pulled you.' (PFV.VEN)

In contrast, if one argument is third person (and not realized by a full nominal), the verb indexes the noun class of that argument, and the other argument is postverbal; this is illustrated in (151). Here, there is a tonal distinction on the postverbal pronominal marker, indicating whether it is the subject or the object.

(151) CL-V-SM/OM in Tira (SAP and 3)

a. kə̀-vəlɛ̀ð-ɔ́-**íŋì**      → [kə̀vəlɛ̀ðɛ́ŋì]
   CLk-pull-FV-**1SG.OBJ**
   'S/he pulled me (towards)' (PFV.VEN)

b. kə̀-vəlɛ̀ð-ɔ́-**íŋí**      → [kə̀vəlɛ̀ðɛ́ŋí]
   CLk-pull-FV-**1SG.SBJ**
   'I pulled him/her (towards)' (PFV.VEN)

---

[9]There is hiatus between the final vowel and the object markers in (150); in (150a), there is fusion between the -ɔ and the -i to -ɛ, and in (150b), the -ɔ deletes before the -a. See also Chapter 2 on hiatus.

If both arguments are third person (and not realized by full nominals), the verb indexes the noun class of the object, and the subject is indicated by a 3SG.SBJ marker -ŋ, which is invariant for noun class; this is illustrated in (152). Note that (unlike Moro) there is no overt 3SG.OBJ marker in Tira; instead, the noun class of the object is indexed on the verb.

(152) CL_{OBJ}-V-SM in Tira (3 > 3)

    a. **jə̀-**vəlɛ̀ð-ɔ́-**ŋ**
       CLj-pull-FV-**3SG.SBJ**
       'He/she/it pulled him/her/it (j-class)' (PFV.VEN)

    b. **ðə̀-**vəlɛ̀ð-ɔ́-**ŋ**
       CLð-pull-FV-**3SG.SBJ**
       'He/she/it pulled him/her/it (ð-class)' (PFV.VEN)

As the examples in (153) show, pronominal arguments intervene between the auxiliary and the verb root in periphrastic constructions in Tira. This is illustrated here with a mixed scenario (third person and SAP), where the noun class of the third person argument is indexed, and the other argument (the object in a., and the subject in b.) follows the auxiliary. Note that while there was a purely tonal difference between the two forms in (151) above, there is a tonal and segmental difference in (153).

(153) Periphrasis in Tira: CL-Aux-SM/OM V

    a. **j-**á-**ŋê**        vəlɛ̀ð-à → [jáŋê vəlɛ̀ðà]
       CLj-AUX-**1SG.OBJ** pull-FV
       '(S)he/it (j-class) will pull me'

    b. **j-**á-**ɛ́**         vəlɛ̀ð-à → [jɛ́ vɛ́lɛ̀ðà]
       CLj-AUX-**1SG.SBJ** pull-FV
       'I will pull him/her/it (j-class)'

We analyze the subject/object markers in Tira as being phonologically bound to the TAMD auxiliary, but not phonologically bound to the verb root. This choice is based on our analysis of hiatus. In the following, we will add more details about what happens

in hiatus contexts in different constructions (see also Chapter 2 for an introduction to hiatus and High tone stability in Tira). The example in (154) shows that hiatus resolution typically does not occur across word boundaries (here: between the auxiliary and the subject noun, and between the subject noun and the verb root). The example in (155) shows that when there is hiatus between the TAMD auxiliary *a* and a vowel-initial root, there may be vowel coalescence or deletion of the first vowel (here /á ɔ̀/ → [ɔ́], with High tone stability). This shows that while the TAMD auxiliary is syntactically independent (as shown by the (O)AuxSV example in (154)), it is phonologically bound to the verb stem when the two are adjacent. As illustrated in (156), there is vowel deletion also if there is hiatus between the TAMD auxiliary and a subject/object marker. In contrast, vowel deletion does not apply between the subject/object marker and the verb root, as illustrated in (157).

(154)  No deletion: CL-**Aux S V**

ŋg-**á**      ɔ̀ðə̀ŋìnà      ɔ̀ɾdʒɛ̀tʃ-ɔ̀n-ɔ́ ánó  →  [ŋg**á ɔ́**ðə̀ŋìnà ɔ̀ɾdʒɛ̀tʃɔ̀nɔ́ ánó]  Tira
CLk-AUX (CLk)hippo help-EXT-FV PART
'The hippo will help him/her (far)' (IPFV.VEN)

(155)  Deletion: CL-**Aux V** O

ŋg-**á**      ɔ̀ɾdʒɛ̀tʃ-ɔ̀n-ɔ́ kúkù-ŋú   ánó  →  [ŋg**ɔ́**ɾdʒɛ̀tʃɔ̀nɔ́ kúkùŋú ánò]     Tira
CLk-AUX help-EXT-FV Kuku-ACC PART
'S/he will help Kuku (far)' (IPFV.VEN)

(156)  Deletion: CL-**Aux-OM** V

ŋg-**á-é**ɲár              və̀lɛ̀ð-ɔ́ →  [ŋg**é**ɲár və́lɛ̀ðɔ́]                    Tira
CLk-AUX-1PL.EXCL.OBJ pull-FV
'S/he will pull us (towards).' (IPFV.VEN)

(157)  No deletion: CL-Aux-**OM V**

ŋg-á-ŋ**à**          ɔ̀ɾdʒɛ̀tʃ-í ánó   →  [ŋgáŋ**à** ɔ̀ɾdʒɛ̀tʃí ánó]              Tira
CLk-AUX-2SG.OBJ help-FV  PART
'S/he will help you (far).' (IPFV.VEN)

We will now return to Moro. While the location of subject markers in Moro is fixed, there is variable ordering of object markers: in a subset of verb forms, object markers are postverbal, as in (158a), and in another set of verb forms, they are preverbal, as in (158b). As shown by Jenks and Rose (2015), their location is conditioned by tone; we will get back to this below. The Moro facts can be schematized as in (159), a simplified version of the Moro verb template (see Rose 2013).

(158) Variable object markers in Moro

    a. (SM-)CL-V-**OM**

        g-a-t͡ʃombəð-ə́-**ɲé**
        CLg-RTC-tickle-FV-**1SG.OBJ**
        'S/he tickled me.' (PFV)

    b. (SM-)CL-**OM**-V

        g-a-**ɲə́**-t͡ʃombəð-a
        CLg-RTC-**1SG.OBJ**-tickle-FV
        'S/he is about to tickle me.' (IPFV)

(159) Moro verb template

    (SM-)CL-{OM}-V-{OM}

In what follows, we will compare cognate constructions in the two languages in more detail, and lay out the similarities and differences in the order of pronominal argument markers.

## 4.4.1 Imperatives

Both Tira and Moro have two imperative forms, marked for verbal deixis. These are distinguished by their tone patterns as well as their final vowel, as was illustrated in

184

Tables 4.4–4.5. As illustrated in (160)–(161), object markers are suffixes in imperatives in both languages.[10][11]

(160)   Object markers in imperative forms (Moro)

    a.  vɔ́léð-ɔ́-lo
         pull-FV-**3PL.OBJ**
         'Pull them!' (IMP)

    b.  vəleð-á-lo
         pull-FV-**3PL.OBJ**
         'Pull them from there to here!' (IMP.VEN)

(161)   Object markers in imperative forms (Tira)

    a.  vɔ́lέð-ɔ́-l̀
         pull-FV-**3PL.OBJ**
         'Pull them away!' (IMP.ITV)

    b.  vɔ̀lὲð-á-l̀
         pull-FV-**3PL.OBJ**
         'Pull them towards!' (IMP.VEN)

While Moro has an overt 3SG object marker *ŋó* used with human objects, as illustrated in (162a-b). It is not used with non-human objects, and the forms in (162c-d) are thus identical to the bare imperatives. As the examples in (163) show, Tira does not have a 3SG object marker at all.

(162)   The 3SG object marker in Moro

    a.  vɔ́léð-ó-ŋó
         pull-FV-**3SG.OBJ**
         'Pull him/her!' (IMP)

    b.  vəleð-á-ŋó
         pull-FV-**3SG.OBJ**
         'Pull him/her from there to here!' (IMP.VEN)

---

[10]As already mentioned, the final vowels may be subject to vowel reduction when an object marker is added; this is illustrated by the example in (160a) as well, where the final vowel *-o* has reduced to [ə].

[11]The imperative ventive in Moro has a Low-toned final vowel except when there is an element following it, as in (160), where it is High-toned.

    c.  vɘ́léð-ó
        pull-FV
        'Pull (it)!' (IMP)

    d.  vəleð-a
        pull-FV
        'Pull (it) from there to here!' (IMP.VEN)

(163)   No 3SG object marker in Tira

    a.  vɘ́léð-ɔ́
        pull-FV
        'Pull (him/her/it) away!' (IMP.ITV)

    b.  vɘ̀lɛ̀ð-á
        pull-FV
        'Pull (him/her/it) towards!' (IMP.VEN)

## 4.4.2 Perfective

As we saw in Tables 4.4–4.5, Tira has two perfective forms distinguished by verbal deixis, while Moro only has one. In the Moro perfective form, any object markers occur after the final vowel as suffixes. Verb forms with different object markers are illustrated in Table 4.8.

**Table 4.8**: Moro perfective of *tʃombəð* 'tickle' with objects (Rose 2013, p. 26)

| no OM | g-a-tʃombəð-ó | 's/he (g-class) tickled' |
|---|---|---|
| 1SG | g-a-tʃombəð-ɔ́-**ɲé** | |
| 2SG | g-a-tʃombəð-á-**ŋá** | |
| 3SG | g-a-tʃombəð-ó-**ŋó** | |
| 1DU.INCL | g-a-tʃombəð-ɔ́-**ńda** | |
| 1PL.INCL | g-a-tʃombəð-ɔ́-**ńd-r** | |
| 1PL.EXCL | g-a-tʃombəð-**álánda** | |
| 2PL | g-a-tʃombəð-ɔ́-**ńda** | |
| 3PL | g-a-tʃombəð-ó-**lo** | |

Unlike Moro, Tira has two perfective forms. The perfective ventive, a synthetic form, is illustrated with different subjects in Table 4.9 and different objects in Table

4.10. Here, we focus on mixed scenarios, where one argument is third person and the other is a Speech Act Participant. As these examples show, the verb indexes the noun class of the third person argument regardless of its syntactic function, and the other subject/object marker follows the verb (as previously explained, there is hiatus between the final vowel and the object markers which may be solved by fusion or deletion).[12]

Table 4.9: Tira perfective ventive with SAP subjects

| no SM | jə̀-və̀lɛ̀ð-ɔ́ | 's/he (j-class) pulled (towards)' |
|---|---|---|
| 1SG | jə̀-və̀lɛ̀ð-ɛ́ŋ(í) | 'I pulled him/her (j-class) (towards)' |
| 2SG | jə̀-və̀lɛ̀ð-áɲá | 'You pulled him/her (j-class) (towards)' |
| 1DU.INCL | jə̀-və̀lɛ̀ð-ɔ́l:í | 'We two pulled him/her (j-class) (towards)' |
| 1PL.INCL | jə̀-və̀lɛ̀ð-ɔ́l:í-ŕ | 'We all pulled him/her (j-class) (towards)' |
| 1DU.EXCL | jə̀-və̀lɛ̀ð-áɲà | 'We (not you) pulled him/her (j-class) (towards)' |
| 2PL | jə̀-və̀lɛ̀ð-áɲá | 'You all pulled him/her (j-class) (towards)' |

Table 4.10: Tira perfective ventive with SAP objects

| no OM | jə̀-və̀lɛ̀ð-ɔ́ | 's/he (j-class) pulled (towards)' |
|---|---|---|
| 1SG | jə̀-və̀lɛ̀ð-ɛ́ŋì | 's/he (j-class) pulled me (towards)' |
| 2SG | jə̀-və̀lɛ̀ð-áŋà | 's/he (j-class) pulled you (towards)' |
| 1DU.INCL | jə̀-və̀lɛ̀ð-áʈɛ́ | 's/he (j-class) pulled us two (towards)' |
| 1PL.INCL | jə̀-və̀lɛ̀ð-áʈɛ́-ŕ | 's/he (j-class) pulled us all (towards)' |
| 1DU.EXCL | jə̀-və̀lɛ̀ð-ɛ́ɲárɛ́ | 's/he (j-class) pulled us (not you) (towards)' |
| 2PL | jə̀-və̀lɛ̀ð-áʈɛ́ | 's/he (j-class) pulled you all (towards)' |

In contrast, the perfective itive in Tira is a periphrastic form which has a preverbal TAMD auxiliary *a* (see also Chapter 3). As Tables 4.11–4.12 show, subject/object markers follow the auxiliary in the perfective itive (in some cases, the auxiliary itself is deleted due to hiatus). Note that there are some differences in the shape of the subject/object markers suffixed to the verb, as in Tables 4.9–4.10, and the ones suffixed

---
[12]In the 1SG and 2SG forms in Tables 4.9–4.10, there is a tonal distinction between the the subject and object markers (e.g. *-ɛ́ŋí* and *-ɛ́ŋì*). In the other forms, there is a segmental distinction instead (or in addition), as in the 1DU.INCL forms *-ɔ́l:í* and *-áʈɛ́*. Note also that among the subject markers in Table 4.9, there is a tonal distinction between 1DU.EXCL *-áɲà* and 2PL *-áɲá*, while among the object markers in Table 4.9, the 2PL is instead syncretic with the 1DU.INCL form *-áʈɛ́*.

to the auxiliary, as in Tables 4.11–4.12. Note also that the 1PL.INCL forms are distinguished from the 1DU.INCL forms by the marker -ŕ, suffixed to the verb even in the periphrastic forms, where other subject/object markers are suffixed to the auxiliary.

**Table 4.11**: Tira perfective itive with SAP subjects

| no SM | j-à válèð-ɛ̀ | 's/he (j-class) pulled (away)' |
|---|---|---|
| 1SG | j-ɛ̀ válèð-ɛ̀ | 'I pulled him/her (j-class)' (away) |
| 2SG | j-à válèð-ɛ̀ | 'You pulled him/her (j-class)' (away) |
| 1DU.INCL | j-ál válèð-ɛ̀ | 'We two pulled him/her (j-class)' (away) |
| 1PL.INCL | j-ál válèð-ɛ̀-ŕ | 'We all pulled him/her (j-class)' (away) |
| 1DU.EXCL | j-éɲâ vàlèð-ɛ̀ | 'We (not you) pulled him/her (j-class)' (away) |
| 2PL | j-éɲá válèð-ɛ̀ | 'You all pulled him/her (j-class)' (away) |

**Table 4.12**: Tira perfective itive with SAP objects

| no OM | j-à válèð-ɛ̀ | 's/he (j-class) pulled (away)' |
|---|---|---|
| 1SG | j-àŋê vàlèð-ɛ̀ | 's/he (j-class) pulled me (away)' |
| 2SG | j-àŋâ vàlèð-ɛ̀ | 's/he (j-class) pulled you (away)' |
| 1DU.INCL | j-àʈɛ́ válèð-ɛ̀ | 's/he (j-class) pulled us two (away)' |
| 1PL.INCL | j-àʈɛ́ válèð-ɛ̀-ŕ | 's/he (j-class) pulled us all (away)' |
| 1DU.EXCL | j-éɲár válèð-ɛ̀ | 's/he (j-class) pulled us (not you) (away)' |
| 2PL | j-àʈɛ́ válèð-ɛ̀ | 's/he (j-class) pulled you all (away)' |

What we have seen in this section is that the perfective form in Moro has subject markers preceding the noun class marker, and object markers suffixed to the verb form. This is similar to the perfective ventive in Tira, except that in Tira, the suffixed marker can be either a subject or object marker. The Tira perfective itive is different in that the subject/object markers instead are suffixed to the TAMD auxiliary. In Table 4.13, a summary chart is provided with abstractions over the constructions we have seen so far.

**Table 4.13**: Perfectives in Moro and Tira: a summary

| Moro perfective | Tira perfective ventive | Tira perfective itive |
|---|---|---|
| (SM)-CL-RTC-root-FV-**OM** | CL-root-**SM/OM** | CL-AUX-**SM/OM** root-FV |
| g-a-vəleð-ə́-**ɲé** | jə̀-vəlɛ̀ð-**íŋì** | j-à-**ŋî** vəlɛ̀ð-ɛ̀ |
| 'S/he pulled me' | 'S/he pulled me (towards)' | 'S/he pulled me (away)' |

## 4.4.3  Imperfective

In Moro, subject markers are always preverbal and have their fixed slot in the verb template (Rose 2013). This is illustrated in Table 4.14 by the regular imperfective of *tʃombəð* 'tickle'. Note that in Thetogovela Moro, the class marker is fixed as *g-* when the subject is a Speech Act Participant; for third person subjects, it varies by noun class (here illustrated by *g-* for 3SG and *l-* for 3PL).

**Table 4.14**: Moro imperfective of *tʃombəð* 'tickle' with subjects

| Person/number | Subject marker | | |
|---|---|---|---|
| 1SG | é- | é-g-a-tʃómbəð-a | 'I am about to tickle' |
| 2SG | á- | á-g-a-tʃómbəð-a | |
| 3SG | CL- | g-a-tʃómbəð-a | |
| 1DU.INCL | ál(ə́)- | ál(ə́)-g-a-tʃómbəð-a | |
| 1PL.INCL | ál(ə́)- -r | ál(ə́)-g-a-tʃómbəð-a-r | |
| 1PL.EXCL | ɲá- | ɲá-g-a-tʃómbəð-a | |
| 2PL | ɲá- | ɲá-g-a-tʃómbəð-a | |
| 3PL | CL- | l-a-tʃómbəð-a | |

In Moro, the location of object markers are different in the two imperfective forms. The regular imperfective is illustrated in Table 4.15; in most person/number combinations, the object markers are prefixed to the verb root following the root clause marker *a-*. In the 1PL.INCL and 1PL.EXCL forms there are what Jenks and Rose (2015, p. 292) call *split OMs*, where there is a prefix as well as well as a suffix (cf. the 1PL.INCL form in Tira in Table 4.12 as well as below). The 3PL form has a suffix only.

**Table 4.15**: Moro regular/proximal imperfective of *tʃombəð* 'tickle' with objects (Rose 2013, p. 14)

| | | |
|---|---|---|
| no OM | g-a-tʃómbəð-a | 's/he is about to tickle' |
| 1SG | g-a-**ɲə́**-tʃombəð-a | |
| 2SG | g-a-**ŋá**-tʃombəð-a | |
| 3SG | g-a-**ŋó**-tʃombəð-a | |
| 1DU.INCL | g-á-**ńdə**-tʃombəð-a | |
| 1PL.INCL | g-á-**ńdə**-tʃombəð-a-**r** | |
| 1PL.EXCL | g-a-**ɲə́**-tʃombəð-**álánda** | |
| 2PL | g-á-**ńdə**-tʃombəð-a | |
| 3PL | g-a-tʃómbəð-a-**lo** | |

The regular imperfective has the so-called default tone pattern in Moro, which in the case of *tʃómbəð* 'tickle' is realized by a High tone on the initial vowel of the verb root when there are no object markers, as shown in Table 4.15. Jenks and Rose (2015) propose that the object markers are included within the domain of tone assignment (the macrostem). When a High-toned object marker is prefixed to the verb, this functions as the default tone pattern; note that the verb root itself is Low-toned in such forms. In contrast, the verb root has its regular default tone realization in the 3PL form, where the object marker is suffixed. Jenks and Rose (2015) further argue that the 3PL is a suffix rather than a prefix due to it being Low-toned and therefore not being able to satisfy the default tone realization requirement. Verb forms with the default tone pattern (see also Section 4.4.5) are the only ones that have any prefixed object markers.

In contrast, the Moro ventive imperfective has suffixed object markers, as illustrated in Table 4.16. The ventive imperfective has a Low-toned verb root, and there is a High tone on the preverbal *a*-marker.[13]

In Tira, subject/object markers follow the TAMD auxiliary *a* in periphrastic forms, and both imperfective forms are periphrastic. Examples are provided in (164)–

---

[13]The imperfective ventive can be analyzed as having a root clause marker *a-*, being deleted due to hiatus with the initial element of a circumfix *á- -ó* (Jenks et al. Forthcoming, p. 306); see also Section 4.6.

**Table 4.16**: Moro ventive imperfective of *vəleð* 'pull' with objects

| | | |
|---|---|---|
| no OM | g-á-vəleð-ó | 's/he (g-class) is about to pull and come' |
| 1SG | g-á-vəleð-ɔ́-**ɲé** | |
| 2SG | g-á-vəleð-á-**ŋá** | |
| 3SG | g-á-vəleð-ó-**ŋó** | |
| 1DU.INCL | g-á-vəleð-ɔ́-**nda** | |
| 1PL.INCL | g-á-vəleð-ɔ́-**nd-r** | |
| 1PL.EXCL | g-á-vəleð-**álánda** | |
| 2PL | g-á-vəleð-ɔ́-**nda** | |
| 3PL | g-á-vəleð-ɔ́-**lo** | |

(165). The imperfective forms thus behave like the periphrastic perfective itive form in Tira discussed above.

(164)   The imperfective itive in Tira

   a. CL_S-Aux-**OM** V

   j-á-**ŋî**              vəlèð-à
   CLj-AUX-**1SG.OBJ** pull-FV
   'He (j-class) will pull me (away)' (IPFV.ITV)

   b. CL_O-Aux-**SM** V

   j-á-**ɛ́**              vəlèð-à  →  [jɛ́ válèðà]
   CLj-AUX-**1SG.SBJ** pull-FV
   'I will pull him (j-class) (away)' (IPFV.ITV)

(165)   The imperfective ventive in Tira

   a. CL_S-Aux-**OM** V

   j-á-**ŋî**              vəlèð-ɔ́
   CLj-AUX-**1SG.OBJ** pull-FV
   'He (j-class) will pull me (towards)' (IPFV.VEN)

   b. CL_O-Aux-**SM** V

   j-á-**ɛ́**              vəlèð-ɔ́  →  [jɛ́ válèðɔ́]
   CLj-AUX-**1SG.SBJ** pull-FV
   'I will pull him (j-class) (towards)' (IPFV.VEN)

Full paradigms of the imperfective itive with mixed scenarios (where one argument is a Speech Act Participant and the other is third person) where neither argument is realized as a full nominal are provided in Tables 4.17–4.18.

**Table 4.17**: Tira imperfective itive with SAP subjects

| no SM | j-á vɔ́lɛ̀ð-à | 's/he (j-class) will pull (away)' |
|---|---|---|
| 1SG | j-ɛ́ vɔ́lɛ̀ð-à | 'I will pull him/her (j-class)' (away) |
| 2SG | j-á vɔ́lɛ̀ð-à | 'You will pull him/her (j-class)' (away) |
| 1DU.INCL | j-ál vɔ́lɛ̀ð-à | 'We two will pull him/her (j-class)' (away) |
| 1PL.INCL | j-ál vɔ́lɛ̀ð-à-ŕ | 'We all will pull him/her (j-class)' (away) |
| 1DU.EXCL | j-ɛ́ɲâ vɔ̀lɛ̀ð-à | 'We (not you) will pull him/her (j-class)' (away) |
| 2PL | j-ɛ́ɲá vɔ́lɛ̀ð-à | 'You all will pull him/her (j-class)' (away) |

**Table 4.18**: Tira imperfective itive with SAP objects

| no OM | j-á vɔ́lɛ̀ð-à | 's/he (j-class) will pull (away)' |
|---|---|---|
| 1SG | j-áŋê vɔ̀lɛ̀ð-à | 's/he (j-class) will pull me (away)' |
| 2SG | j-áɲâ vɔ̀lɛ̀ð-à | 's/he (j-class) will pull you (away)' |
| 1DU.INCL | j-áʈɛ́ vɔ́lɛ̀ð-à | 's/he (j-class) will pull us two (away)' |
| 1PL.INCL | j-áʈɛ́ vɔ́lɛ̀ð-à-ŕ | 's/he (j-class) will pull us all (away)' |
| 1DU.EXCL | j-ɛ́ɲár vɔ́lɛ̀ð-à | 's/he (j-class) will pull us (not you) (away)' |
| 2PL | j-áʈɛ́ vɔ́lɛ̀ð-à | 's/he (j-class) will pull you all (away)' |

Full paradigms of the imperfective ventive with mixed scenarios (where one argument is a Speech Act Participant and the other is third person) where neither argument is realized as a full nominal are provided in Tables 4.19–4.20.

**Table 4.19**: Tira imperfective ventive with SAP subjects

| no SM | j-á vɔ̀lɛ̀ð-ɔ́ | 's/he (j-class) will pull (towards)' |
|---|---|---|
| 1SG | j-ɛ́ vɔ̀lɛ̀ð-ɔ́ | 'I will pull him/her (j-class)' (towards) |
| 2SG | j-á vɔ̀lɛ̀ð-ɔ́ | 'You will pull him/her (j-class)' (towards) |
| 1DU.INCL | j-ál vɔ́lɛ̀ð-ɔ́ | 'We two will pull him/her (j-class)' (towards) |
| 1PL.INCL | j-ál vɔ́lɛ̀ð-ɔ́-ŕ | 'We all will pull him/her (j-class)' (towards) |
| 1DU.EXCL | j-ɛ́ɲâ-vɔ̀lɛ̀ð-ɔ́ | 'We (not you) will pull him/her (j-class)' (towards) |
| 2PL | j-ɛ́ɲá vɔ́lɛ̀ð-ɔ́ | 'You all will pull him/her (j-class)' (towards) |

**Table 4.20**: Tira imperfective ventive with SAP objects

| | | |
|---|---|---|
| no OM | j-á vàlèð-ɔ́ | 's/he (j-class) will pull (towards)' |
| 1SG | j-áŋê vàlèð-ɔ́ | 's/he (j-class) will pull me (towards)' |
| 2SG | j-áŋâ vàlèð-ɔ́ | 's/he (j-class) will pull you (towards)' |
| 1DU.INCL | j-áʈɛ́ vɔ́lèð-ɔ́ | 's/he (j-class) will pull us two (towards)' |
| 1PL.INCL | j-áʈɛ́ vɔ́lèð-ɔ́-ŕ | 's/he (j-class) will pull us all (towards)' |
| 1DU.EXCL | j-éɲár vɔ́lèð-ɔ́ | 's/he (j-class) will pull us (not you) (towards)' |
| 2PL | j-áʈɛ́ vɔ́lèð-ɔ́ | 's/he (j-class) will pull you all (towards)' |

What we have seen in this section is that while the two imperfective forms in Moro differ with respect to the location of object markers, the two imperfective forms in Tira are similar in that subject/object markers are suffixed to the preverbal TAMD auxiliary. In Tables 4.21–4.22, summary charts are provided with abstractions over the constructions we have seen in this section. Note that while the two imperfectives in Moro are different, the imperfective ventive is like the perfective in Moro (discussed above) in having suffixed object markers.

**Table 4.21**: Imperfectives in Moro: a summary

| Moro imperfective | Moro imperfective ventive |
|---|---|
| (SM)-CL-RTC-**OM**-root-FV | (SM)-CL-RTC-root-FV-**OM** |
| g-a-**ɲé**-vəleð-a | g-á-vəleð-ɔ́-**ɲé** |
| 'S/he is about to pull me' | 'S/he is about to pull me and come' |

**Table 4.22**: Imperfectives in Tira: a summary

| Tira imperfective itive | Tira imperfective ventive |
|---|---|
| CL-AUX-**SM/OM** root-FV | CL-AUX-**SM/OM** root-FV |
| j-á-**ŋî** vàlèð-à | j-á-**ŋî** vàlèð-ɔ́ |
| 'S/he will pull me (away)' | 'S/he will pull me (towards)' |

As mentioned at the beginning of the chapter, the location of object markers in Tira and Moro tend to be the same in cognate constructions, but the imperfective ventive is an exception to this. As illustrated in Tables 4.21–4.22, the object markers

are suffixed to the verb in the Moro imperfective ventive, but suffixed to the auxiliary in the Tira imperfective ventive. This suggests that one or both languages have changed in some meaningful way from their common origin; we will return to this point in Section 4.6.

### 4.4.4  Subordinate forms

In the dependent forms in Tira and the infinitive 1 forms in Moro—which we hypothesize to be cognate based on form and function—both arguments occur before the verb stem if pronominal. This is illustrated for Moro in (166), where the two infinitive 1 forms are provided with both subject and object markers, and the order is SM-OM-V.

(166)   The infinitive 1 in Moro

    a.  SM-OM-V

       (n-)áŋ-ŋó-tʃombəð-e
       COMP-**3SG.SBJ-3SG.OBJ-**tickle-FV
       '...her to tickle her/him' (INF1)

       (Jenks et al. Forthcoming, p. 209, glossing added)

    b.  SM-OM-V

       (n-)áŋ-ŋó-tʃombəð-a
       COMP-**3SG.SBJ-3SG.OBJ-**tickle-FV
       '...her to tickle her/him and come' (VEN.INF1)

       (Jenks et al. Forthcoming, p. 209, glossing added)

The examples in (167) illustrate similar facts in Tira: in the dependent forms, the order is SM-OM-V.

(167)   The dependent forms in Tira

      a.   SM-OM-V

        ŋ-é-vəlèð-ɛ̀
        **3SG.SBJ-1SG.OBJ-**pull-FV
        '...him/her to pull me away' (DEP.ITV)

      b.   SM-OM-V

        ŋ-é-vəlèð-à
        **3SG.SBJ-1SG.OBJ-**pull-FV
        '...him/her to pull me towards' (DEP.VEN)

As the examples in (168)–(169) show, the 3SG.SBJ marker *ŋ(ə)-* in the dependent forms is invariant for noun class; in (168), it is co-referential with the noun *ùrnɔ̀* 'grandfather' (k-class), and in (169), it is coreferential with the noun *ðàŋàl* 'sheep' (ð-class), but it does not co-vary in form based on these nouns' classes.

(168)   l-àr̤ṭ-ɔ́      úrnɔ̀         **ŋə̀-**vɔ́lèð-à      èdɔ̀ɽɔ̀                Tira
        CLl-tell-FV (CLk)grandfather 3SG.SBJ-pull-FV (CLj)roots
        'They told grandfather to pull the roots (towards).' (DEP.VEN)

(169)   l-àr̤ṭ-ɔ́      ðáŋàl-à        **ŋə̀-**vɔ́lèð-à      èdɔ̀ɽɔ̀                Tira
        CLl-tell-FV (CLð)sheep-ACC 3SG.SBJ-pull-FV (CLj)roots
        'They told the sheep to pull the roots (towards).' (DEP.VEN)

Finally, the examples in (170)–(171) show again that there is no overt 3SG.OBJ marker in Tira; here, the surface word order is simply SM-V (a zero marker is added for the purpose of glossing and is not intended to be a claim about the presence of a silent object). Moro has an overt 3SG.OBJ marker used for human objects, illustrated in (166) above, but when the object is non-human, Moro is like Tira and does not have an overt object marker here.

(170)   l-àr̤ṭ-ɔ́      úrnɔ̀         ŋə̀-Ø-vɔ́lèð-à                      Tira
        CLl-tell-FV (CLk)grandfather 3SG.SBJ-3SG.OBJ-pull-FV
        'They told grandfather to pull him/her/it (towards).' (DEP.VEN)

(171) k-àrṭ-ɔ́    lúrnɔ̀         lɜ̀-Ø-vɜ̀lɛ̀ð-à                                    Tira
CLk-tell-FV (CLl)grandchildren 3PL.SBJ-3SG.OBJ-pull-FV
'He told the grandchildren to pull him/her/it towards.'

## 4.4.5 The default tone pattern in Moro

All and only the verb forms with the default tone pattern allow for prefixed object markers in Moro (Jenks and Rose 2015). In addition to the forms we have already seen (the regular imperfective and the infinitive 1 forms), there are more verb forms in Moro that exhibit the default tone pattern, listed in Table 4.23, where they are illustrated with the verb *ʧombəð* 'tickle', for which the default tone is realized as HL. To our knowledge, these verb forms do not have cognate verb forms in Tira, and so they are only briefly discussed here.[14]

**Table 4.23**: Verb forms with the default tone pattern in Moro (Rose 2013, p. 9)

|                              | 'tickle'                    |
| ---------------------------- | --------------------------- |
| infinitive 2                 | (n)-áŋ-↓ʧómbəð-a            |
| consecutive imperfective     | ṭ-áŋ-↓ʧómbəð-ó             |
| consecutive perfective       | n-áŋɔ́-↓ʧómbəð-e           |
| consecutive ventive perfective | n-áŋɔ́-↓ʧómbəð-a          |
| negative                     | g-anːá áŋ-↓ʧómbəð-a        |
| negative imperative          | ánːá á-↓ʧómbəð-a           |

As the examples in Table 4.23 show, the default tone pattern can co-occur with a suffix with different vowel qualities and tonal properties: *-e, -a, -ó*. These forms do not have a noun class marker or a clause type marker, and instead, there is a conjunction *nɔ́-*, a complementizer *ṭɔ́-*, or a negation verb, *g-anːá* or *ánːá*. The forms given here are 3SG forms, with a 3SG subject marker *áŋ-* or *ɔ́ŋɔ́-*, which is invariant for noun class.

---

[14]The arrow ↓ in Table 4.23 indicates downstep; downstep is noted in some works on Moro, but not all (cf. Table 4.24). In the present chapter, we keep the variability in the transcriptions to stay true to the sources.

For more on the morphological properties and syntactic distribution of these forms, see Jenks et al. (Forthcoming) and Rose (2013).

We now turn to object marking. Forms with the default tone pattern have prefixed object markers, as illustrated in Table 4.24 with the verb *vǝleð* 'pull', for which the default tone pattern is realized as HH. When these forms have a High-toned object marker, the object marker occurs as a prefix, and the verb root is Low-toned. Under the analysis proposed by Jenks and Rose (2015), object markers are underlyingly postverbal in Moro, but prosodically deficient (i.e. they are not phonological words on their own and need to attach to a host). High-toned object markers move to prefix position in these verb forms to realize the default tone pattern (which minimally consists of a High tone at the left of the macrostem, which includes the verb root and any object markers); elsewhere, object markers become prosodically incorporated as suffixes.

**Table 4.24**: Verb forms with default tone and prefixed object markers in Moro (Jenks and Rose 2015, p. 274)

|    |               | No OM             | with 3sg OM       |                                        |
| -- | ------------- | ----------------- | ----------------- | -------------------------------------- |
| a. | IPFV          | g-a-vǝ́léð-a       | g-a-**ŋó**-vǝleð-a | 's/he is about to pull (him/her)'      |
| b. | INF 1         | (n)-áŋ-vǝ́léð-e    | (n)-áŋ-**ŋó**-vǝleð-e | 'that s/he pull (him/her)'          |
| c. | INF 1 VEN/INF 2 | (n)-áŋ-vǝ́léð-a  | (n)-áŋ-**ŋó**-vǝleð-a | 'that s/he pull (him/her)'          |
| d. | CONS.IPFV     | ṭ-áŋǝ́-vǝ́léð-ó     | ṭ-áŋ-**ŋó**-vǝleð-ó | '...s/he is pulling (him/her)'        |
| e. | CONS.PFV      | n-ǝ́ŋǝ́-vǝ́léð-e    | n-ǝ́ŋ-**ŋó**-vǝleð-e | '...s/he pulled (him/her)'           |
| f. | CONS.PFV.VEN  | n-ǝ́ŋǝ́-vǝ́léð-a    | n-ǝ́ŋ-**ŋó**-vǝleð-a | '...s/he pulled (him/her) from there to here' |
| g. | NEG           | g-anːá áŋ-vǝ́léð-a | g-anːá áŋ-**ŋó**-vǝleð-a | 's/he doesn't/didn't pull (him/her)' |
| h. | NEG.IMP       | ánːá á-vǝ́léð-a    | ánːá á-**ŋó**-vǝleð-a | 'don't pull (him/her)!'             |

### 4.4.6  Double object constructions

So far, we have focused on argument marking in the case of monotransitive verbs. The present section moves on to briefly discuss ditransitive verbs and double object marking, to further illustrate the point that only verb forms with the default tone pattern in Moro may have prefixed object markers, and only a single one. In Moro, the set of verb forms that take suffixed object markers only, such as the perfective (discussed in Section 4.4.2), have two suffixed object markers if the verb is ditransitive. This is illustrated in (172).[15]

(172)  g-a-natʃ-ə́-**ɲə́-ŋo**                                        Moro
       CLg-RTC-give-FV-**1SG.OBJ-3SG.OBJ**
       'S/he gave me to her/him' or 'S/he gave her/him to me.' (PFV)

The set of verb forms in Moro that allow for prefixed object markers (the verb forms with the default tone pattern, such as the regular imperfective, discussed in Section 4.4.3) allow for only one prefixed object marker; if there are two, the other one occurs as a suffix. This is illustrated in (173) with the regular imperfective. This shows that even in verb forms that allow for prefixed object markers, there are sometimes suffixed object markers as well.

(173)  g-a-**ɲə́**-natʃ-a-**ŋó**                                     Moro
       CLg-RTC-**1SG.OM**-give-FV-**3SG.OBJ**
       'S/he is about to give me to her/him' or 's/he is about to give her/him to me.'

       (IPFV)

We now turn to Tira. The examples in (174)–(175) illustrate the perfective ventive—a synthetic form—of the ditransitive verb *aŋtʃ* 'show'. In (174), both objects are full nominals and they follow the verb, with the indirect object preceding the direct

---

[15]The order of the object markers in Moro is determined by the person hierarchy (1 > 2 > 3), resulting in ambiguity; see Ackerman, Malouf, and Moore (2017), Jenks and Rose (2015), and Rose (2013) for details.

object. In (175), both objects are pronominal, and the direct object is bound to the verb while the indirect object occurs as a free pronoun.

(174)  jɛ́-àŋtʃ-í  **àpɾí-ɲá**  ŋɛ́n-ɛ́→ [jáŋtʃí ápɾíɲá ŋɛ́nɛ̀]  Tira
1SG.SBJ-show-FV (CLj)boy-ACC (CLŋ)dog-ACC
'I showed the dog to the boy.' (PFV.VEN)

(175)  kúkù  k-àŋtʃ-í-**íŋì**  **ŋâŋ**→ [kúkù kàŋtʃíŋì ŋâŋ]  Tira
CLk.Kuku CLk-show-FV-**1SG.OBJ 2SG.OBJ**
'Kuku showed me to you.' (PFV.VEN)

The examples in (176)–(177) illustrate a periphrastic form—the imperfective itive—of the same verb. In (176), both objects are full nominals and they follow the verb, with the indirect object preceding the direct object. In (177), both objects are pronominal, and the direct object is bound to the auxiliary while the indirect object occurs as a free pronoun following the verb.

(176)  íŋ-g-á  àŋtʃ-ɔ̀  **àpɾí-ɲá**  ŋɛ́n-ɛ́→ [íŋgáŋìtʃɔ̀ àpɾíɲá ŋɛ́nɛ̀]  Tira
1SG.SBJ-CLg-AUX show-FV (CLj)boy-ACC (CLŋ)dog-ACC
'I will show the dog to the boy.' (IPFV.ITV)

(177)  kúkù  ŋg-á-**ŋî**  àŋtʃ-ɔ̀  **ŋâŋ**→ [kúkù ŋgáŋî àŋtʃɔ̀ ŋâŋ]  Tira
CLk.Kuku CLk-AUX-1SG.OBJ show-FV 2SG.OBJ
'Kuku will show me to you.' (IPFV.ITV)

While Tira only allows a single pronominal marker on verb forms, with a second one occurring as a free pronoun, Moro allows two bound ones. In both languages, only one marker can occur before the verb root (prefixed to the verb root in Moro, and suffixed to the auxiliary in Tira). One hypothesis is that the second one in Moro became prosodically incorporated into the verb complex, but maintained its position post-verbally.

### 4.4.7  Summary of patterns

A summary of the patterns of subject/object marking seen in the present section is provided in Table 4.25. Note that *stem* here means the root and any extension suffixes. The examples in the two languages are lined up based on hypothesized cognacy between constructions (note that Moro only has one perfective form, while Tira has two).

**Table 4.25**: Subject/object marking in Tira and Moro: a summary

|  | Moro |  | Tira |
| --- | --- | --- | --- |
| IMP | stem-FV-**OM** | IMP.ITV | stem-FV-**OM** |
| IMP.VEN | stem-FV-**OM** | IMP.VEN | stem-FV-**OM** |
| PFV | (SM)-CL-RTC-stem-FV-**OM** | PFV.VEN | CL-stem-FV-**SM/OM** |
|  |  | PFV.ITV | CL-AUX-**SM/OM** stem-FV |
| IPFV.VEN | (SM)-CL-RTC-stem-FV-**OM** | IPFV.VEN | CL-AUX-**SM/OM** stem-FV |
| IPFV | (SM)-CL-RTC-**OM**-stem-FV-**OM** | IPFV.ITV | CL-AUX-**SM/OM** stem-FV |
| INF1 | (COMP)-SM-**OM**-stem-FV-**OM** | DEP.ITV | (COMP)-SM-**OM**-stem-FV |
| INF1.VEN | (COMP)-SM-**OM**-stem-FV-**OM** | DEP.VEN | (COMP)-SM-**OM**-stem-FV |

In Tira, the location of subject and object markers is predictable from the syntactic properties of the construction, specifically whether the form is a main clause or subordinate form, and whether the form is synthetic or has a preverbal TAMD auxiliary. Unlike Moro, it is not the case that Tira has a fixed location for subject markers; rather, there is a single slot which may be filled by either a subject marker or an object marker.

In Moro, the location of the object markers is instead predictable from the tonal properties of the verb form in question (Jenks and Rose 2015). There are three patterns attested: either the verb stem has no tone, or it is High toned, or it has the default tone pattern (realized in different ways based on a number of phonological factors, but minimally involving a High tone at the left edge of the stem); the three types are illustrated in Table 4.26.[16]

---

[16]Note that Table 4.26 lists some verb forms that have not been illustrated in the present work because they do not have any clear cognates in Tira; for example, Tira has a clause-final negation marker, and no special negative verb form, unlike Moro.

**Table 4.26**: Location of object markers by tone and construction type in Moro (adapted from Jenks and Rose 2015, pp. 284–285)

|     | Example    | Tone         | OM type       | Constructions |
|-----|------------|--------------|---------------|---------------|
| a.  | -tʃómbə́ð-  | All High     | suffix        | IMP           |
| b.  | -tʃombəð-  | No High      | suffix        | IMP.VEN       |
|     |            |              |               | PFV           |
|     |            |              |               | IPFV.VEN      |
| c.  | -tʃómbəð-  | Default tone | prefix/suffix | IPFV          |
|     |            |              |               | INF1          |
|     |            |              |               | INF1.VEN      |
|     |            |              |               | INF2          |
|     |            |              |               | INF2.VEN      |
|     |            |              |               | NEG           |

As these examples show, verb forms in Moro fall into three groups based on their stem tone pattern, and the morphosyntactic property sets associated with these groups do not form natural classes (i.e. the distribution of the stem tone patterns is morphomic; see Chapter 1 for more on morphomic tone). Further, the verb forms fall into two groups based on the distribution of the object markers, such that in one group, all object markers are suffixes, while in the other group, a subset of object markers are prefixes. The morphosyntactic property sets associated with these two groups do not form natural classes (i.e. the morphotactic split is morphomic). Finally, there is a correlation between tone and the morphotactics such that prefixed object markers are only found on verb forms associated with the default tone pattern, and the other forms have object suffixes. Note that the default tone pattern in Moro does not correspond to a specific tone pattern in Tira (the stem tone alternations in Tira were discussed in Chapter 3).

To summarize, the object markers in Moro are prefixes occuring before the verb root in verb forms that have the default High pattern. Elsewhere, the object markers are suffixes.[17]

While in Tira, the location of the object markers are predictable from the syntactic properties of each construction involved, it is predictable from the verb tone in Moro, and one question that arises is how this difference came about. So far, we have attempted to lay out the patterns while staying neutral to the question about how the differences between the two languages developed. Evidence that Moro might be the innovative system comes from the fact that argument ordering similar to what we see in Tira is attested outside of West Heiban as well, in the Central Heiban languages Rere/Koalib, Otoro, and Ebang, as well as Cwaya. We turn to these languages next.

## 4.5   A comparison to Central Heiban

The Central Heiban language Rere/Koalib share the following properties with Tira: First, it has both synthetic and periphrastic verb forms, with a subset of verb forms having a preverbal TAMD marker which is syntactically independent, as evidenced from the fact that subject nouns may intervene between the TAMD auxiliary and the verb root. This distinction is illustrated in (178).

(178)   Synthesis vs. periphrasis in Rere

    a.   SVO

        kwór        **kwì-bùbl-è̀**    ʈɔ̀ŋɔ́r-à
        (CLkw)man CLkw-wrestle-FV (CLʈ)boy-ACC
        'The man wrestled the boy.' (PFV)

---

[17]One complication is that in the infinitive 1 forms, as well as consecutive and infinitive 2 forms, the default tone pattern may be overridden by a No High tone pattern imposed by 1PL.EXCL and 3PL subjects—see Jenks and Rose (2015, pp. 296–297) for discussion. As discussed in Chapter 3, the stem tone alternations in Tira show the same distribution, such that the 1PL.EXCL and 3PL forms are Low-toned (the other forms are High-Low; there is no direct correspondence to the default tone pattern).

b. SAuxVO

kwór **kwì-m** **bùbl-è** ʈɔ̀ŋɔ́r-à
(CLkw)man CLkw-**PRF** wrestle-FV (CLʈ)boy-ACC
'The man had wrestled the boy.' (REM.PRF)

c. CL$_O$-V S

**ʈì-bùbl-é** kwór
CLʈ-wrestle-FV (CLkw)man
'The man wrestled him (ʈ-class)' (PFV)

d. CL-$_O$-Aux S V

**ʈì-mí** kwór **bùbl-è**
CLʈ-PRF (CLkw)man wrestle-FV
'The man had wrestled him (ʈ-class)' (REM.PRF)

(Personal field notes; Titus Kunda, native speaker, p.c.)

Second, the location of subject/object markers is predictable from this distinction, such that they are suffixed to the verb in synthetic constructions, as in (179a-b), and to the auxiliary in periphrastic constructions, as in (179c-d). Notice that tone disambiguates who did what to whom in (179); this is similar to the Tira facts discussed above. Rere verb morphology and subject/object marking is documented and analyzed in more detail by Kim, Kaldhol, and Rose (in prep.) and Rose (2024).[18]

(179)   Subject/object markers in Rere

a. kwì-bùbl-é-**ɲí**
CLkw-wrestle-FV-**1SG.OBJ**
'S/he (kw-class) wrestled me.'

b. kwì-bùbl-è-**ɲì**
CLkw-wrestle-FV-**1SG.SBJ**
'I wrestled him/her (kw-class).'

c. kwì-m-**íɲ** búbl-è
CLkw-AUX-**1SG.OBJ** wrestle-FV
'S/he (kw-class) had wrestled me.'

---

[18]For an analysis of the vowel alternations (e.g. *mi* vs. *m*; *ɲi* vs. *iɲ*) and the tonal alternations in (178)–(179), see Kim, Kaldhol, and Rose (in prep.) and Rose (2023).

d.  kwì-m-**ìɲ**           bùbl-è
    CLkw-AUX-**1SG.SBJ** wrestle-FV
    'I had wrestled him/her (kw-class).'

    (Personal field notes; Titus Kunda, native speaker, p.c.)

The Cwaya language (which is unclassified within the West-Central Heiban branch; see Section 4.2) is not as well documented, but based on an unpublished manuscript by Guest (1998), the language seems to function the same way as Tira and Rere/Koalib in these key respects: Cwaya has both synthetic and periphrastic verb forms, with a subset of verb forms having a preverbal TAMD marker, as illustrated in (180). The preverbal TAMD marker is syntactically independent, as evidenced by the fact that a subject noun may intervene, as in (180d).

(180)  Synthesis vs. periphrasis in Cwaya

    a.  SVO

        alangár **la-we-r**      xahreza
        we       CLl-wash-PL (CLx)cloth
        'We wash the cloth.' (PRS)

    b.  SAuxVO

        alangár **la-ma   wé-r**    xahreza
        we       CLl-PST wash-PL (CLx)cloth
        'We washed the cloth.' (PST)

        (Guest 1998, glossing added)

    c.  CL$_O$-V S

        **nga-nga** yaxrá
        CLng-see hens
        'The hens see it (ng-class).' (PRS)

d. CL<sub>O</sub>-Aux S V

**nga-má**   yaxrá **ngá**
CLng-PST hens   see
'The hens saw it (ng-class).' (PST)

(Guest 1998, glossing added)

In Cwaya, too, he location of subject/object markers is predictable from the distinction between synthesis and periphrasis, such that they are suffixed to the verb in synthetic constructions, and to the auxiliary in periphrastic constructions; this is illustrated with an object marker in (181a-b), and a subject marker in (181c-d) (the verb indexes the noun class of the third person subject in (181a-b) and the third person object in (181c-d)).[19]

(181)   Subject/object markers in Cwaya

a. CL<sub>S</sub>-V-OM

xa-ké-**nga**
CLx-destroy-**2SG.OBJ**
'It (x-class) destroys you' (PRS)

b. CL<sub>S</sub>-Aux-OM V

xa-má-**ngá**       ké
CLx-PST-**2SG.OBJ** wash
'It (x-class) destroyed you' (PST)

c. CL<sub>O</sub>-V-SM

za-we-**nga**
CLz-wash-**2SG.SBJ**
'You wash it (z-class)' (PRS)

---

[19]Note that the tone system in Cwaya has not been worked out, and it is unclear from the data in Guest (1998) what the significance is to the tonal alternations on the 2SG marker in (181).

d. CL$_O$-Aux-SM V

za-ma-**nga**     wé
CLz-PST-**2SG.SBJ** wash
'You washed it (z-class)' (PST)

(Guest 1998, glossing added)

An example of a phenomenon which is found in Rere/Koalib and Cwaya, but is unattested in Tira (and Moro), is a TAMD auxiliary which is simply a High tone. As the examples in (182)–(183) show, it is possible for a subject noun to intervene between the class marker (indicating the noun class of the object) and the verb. The class marker is High-toned in this case, and we analyze this High tone as a syntactically independent TAMD marker along with the segmental ones already discussed above (for more details on Rere, see Kim, Kaldhol, and Rose in prep.).

(182)   CL$_O$-Aux S V order in Rere (where Aux = H tone)

ṯì-H      kámlá     ɛ̀ːj-ɛ́  → [ṯí kámlá ɛ̀ːjɛ́]
CLṯ-AUX (CLk)camel see-FV
'The camel will see it (ṯ-class)' (IPFV)

(Personal field notes; Titus Kunda, native speaker, p.c.)

(183)   CL$_O$-Aux S V order in Cwaya (where Aux = H tone)

nga-H     yaxrá ngá → [ngá yaxrá ngá]
CLng-FUT hens   see
'The hens will see it (ng-class).' (FUT)

(Guest 1998, glossing added)

Similar constructions are documented for Ebang, but without tone transcriptions (Schadeberg 2020; Schadeberg and Kossmann 2010). Similar ordering facts with respect to the subject/object markers are attested, and again, the location of these markers depend on whether or not the verb form has a preverbal TAMD marker. A few key examples are presented in (184)–(187): in (184), there is a subject marker occurring between a preverbal future marker and the verb stem; in (185), there is an object marker

occurring between a preverbal perfective marker and the verb stem. The sentences in (186)–(187) show subject noun phrases occurring between a preverbal TAM marker and the verb (the noun class marker *gw-* instead indexes the noun class of the object). Note that the published materials are based on Bible translations and therefore contain examples from naturalistic texts rather than elicited sentences that are designed to form minimal pairs, and the transcriptions lack indications of tone.

(184)  CL<sub>O</sub>-TAM-SM V order in Ebang (Future)

al-ari **gw**-a-**l**-rinya
PL-want **CL**-FUT-**PL.SBJ-**kill
'they wanted that they might destroy him' (Mar 3:6)

(Schadeberg and Kossmann 2010, p. 93)

(185)  CL<sub>S</sub>-TAM-OM V order in Ebang (Perfective)

Ninena Diimaas **gwi**-m-**inyi**=gathani..., a    gwi-m=ela Tasaaluuniika
as        Demas   **CL**-PFV-**1SG.OBJ**=leave and CL-PFV=go Thessalonica
'For Demas has left me... and went to Tessalonica (...)' (2Ti 4:10)

(Schadeberg 2020, p. 85)

(186)  CL<sub>O</sub>-TAM S V order in Ebang (Future)

a    gw-**a** l.iji  **urlani**  ganu
and CL-FUT people be.hostile in
'and people will persecute him' (Mar 10:30)

(Schadeberg 2020, p. 91)

(187)  CL<sub>O</sub>-TAM S V order in Ebang (Perfective)

abi gwi-**ma** K.alo **ina**
but CL-PFV God  have.mercy
'but God had mercy on him' (Phi 2:27)

(Schadeberg 2020, p. 91)

It is possible in Ebang to have the order CL S V without a TAM marker, as illustrated in (188). Tone is not marked in these examples, and what we know from Rere

and Cwaya is that TAMD auxiliaries may in fact be single High tones, docking onto the class marker, was was illustrated in (182)–(183). Something similar might be going on in Ebang; there may be a tonal TAM marker in (188) which accounts for the seemingly stranded noun class marker.

(188)   CL<sub>O</sub> S V order in Ebang

> A   **gwi** ejigur   ko   **ake.juma**
> and CL   soldiers also laugh
> 'The soldiers also mocked him' (Luk 23:36) (Schadeberg 2020, p. 97)

Similar facts seem to hold in Otoro: First, some verb forms have a preverbal TAM marker, while others do not, as illustrated in (189). In these examples, we maintained the location of word boundaries (spaces) in the original source, which suggest that even the verb form in (189b) is synthetic (i.e. a single word); unfortunately, there is no data in Stevenson's (1943/2009) grammar that allows us to determine whether Otoro is like Moro, or like Tira and Rere in that the auxiliaries are syntactically independent and may be separated from the verb root by a subject noun phrase. Second, it is possible for subject/object markers to occur between the TAM marker and the verb root. Examples are provided in (190) (note that Otoro has an overt subject pronoun in initial position, which may be coreferential with the bound subject marker on the verb, unlike what we have seen in Tira).

(189)   Presence vs. absence of a preverbal TAMD marker in Otoro

> a.   ŋi   gwu-dhirɔ
>      1SG CL-sleep
>      'I sleep, slept, was sleeping.' (Stevenson 1943/2009, p. 239, glossing added)

> b.   ŋi   gwu-**ma**-dhirɛ
>      1SG CL-**PRF**-sleep
>      'I have slept.' (Stevenson 1943/2009, p. 256, glossing added)

(190)  Subject/object markers in Otoro

      a.  ŋu  gwu-piδ-**iŋi**
         3SG CL-hit-1SG.OBJ
         'He hit(s) me.' (Stevenson 1943/2009, p. 183, glossing added)

      b.  ŋi  gwu-piδ-**i(ŋi)**
         1SG CL-hit-1SG.SBJ
         'I hit him.' (Stevenson 1943/2009, p. 183, glossing added)

      c.  ŋu  gwu-m-**iŋi**-pi
         3SG CL-PRF-1SG.OBJ-hit
         'He has hit me.' (Stevenson 1943/2009, p. 184, glossing added)

      d.  ŋi  gwu-m-**i**-pi
         1SG CL-PRF-1SG.SBJ-hit
         'I have hit him.' (Stevenson 1943/2009, p. 185, glossing added)

To summarize, the presence of a preverbal TAMD marker and its correlation with the location of subject/object markers is attested in Tira (West Heiban) as well as Rere, Cwaya, Ebang and Otoro (Central Heiban). In all of these languages except Otoro (for which we do not have evidence for or against), the preverbal TAMD marker is syntactically independent from the verb as evidenced by the fact that subject noun phrases may intervene between the two. We hypothesize that Tira and the Central Heiban languages retain these properties from Proto-West-Central-Heiban. Under this hypothesis, Moro is the innovative language in that it has lost constructions of this kind, and the word order (O) TAM S V is unattested in Moro. The next section sketches a series of potential developments that we propose have taken place in Moro, and we will outline how it has affected the role of tone in the organization of the verb system.

## 4.6   Diachronic proposals

As shown in the previous sections, Tira and Moro share some properties in the organization of their verb systems; for example, both tonal and non-tonal exponents

interact in the marking of TAM and deixis, and the location of pronominal argument markers varies across different verb forms. We also saw substantial differences in how the two systems are organized, and for the present purposes, we will focus on the following:

- Moro does not have a deixis contrast in the perfective, while Tira does
- there is a preverbal *a* marker whose function differs across the two languages: in Tira, it is a part of the TAMD marking in the main clause, and in Moro, it marks the main root clause (see below)
- in Moro, the preverbal *a* marker is bound to the verb, while in Tira, it is syntactically independent
- the location of subject/object markers differ in the two languages; in Moro, it correlates with the tone patterns of different verb forms, while in Tira, it correlates with the presence of the auxiliary *a* no matter its tone, and the distinction between main and subordinate clauses

One question that arises is how these differences came about. While more research on tone in related Heiban languages is necessary for comparative analysis and reconstruction, we will sketch some proposals in the next sections for West Heiban, focusing on changes to the word order, the status of the preverbal *a* markers, and the location of object markers. Finally, we will propose that tone itself conditioned a constructional change, affecting the order of object markers in Moro.

## 4.6.1 Subjects becoming fixed as preverbal

In Tira and Moro, word order is variable and depends on information structure. As discussed in Section 4.3, the word order in Tira is SVO or SAuxVO with subject topics and OVS or OAuxSV with object topics, and the verb indexes the noun class of the topic, regardless of its syntactic function. In Moro, the subject is always preverbal, and the verb always indexes the noun class of the subject. The word order is SVO with subject topics and OSV with object topics.

In addition, Tira relies on case marking to disambiguate who did what to whom in a more extensive way than Moro: from a sample of 500 common nouns in Moro, only 8% have a distinct accusative case marker (Jenks and Rose 2018), but from our sample of 212 common nouns in Tira, 47% have a distinct accusative case marker. Based on these facts as well as comparisons to Central Heiban, Kaldhol and Rose (2024) propose that Moro is innovative, and that two changes have taken place concomitantly in Moro: the loss of accusative case marking, and a change to the word order, such that subjects are consistently preverbal (SVO or OSV).

It is not only subject noun phrases that have become fixed as preverbal in Moro, but also the bound subject markers, which were illustrated in Section 4.4.3. Moro is unlike Tira and the Central Heiban languages in this respect, and again, we hypothesize that Moro is the innovative language. While tone may be used to distinguish who did what to whom in other Heiban languages, as in the Tira example in (151) and the Rere example in (179) above, this is not possible in Moro; rather, subject markers have their fixed slot in the verb template (Rose 2013).

## 4.6.2 Univerbation of periphrastic constructions

The periphrastic constructions in Tira which have the preverbal marker *a* include the perfective itive and the two imperfective forms. As we saw in Section 4.3, there are two possible word orders in Tira: SAuxVO and OAuxSV (and in synthetic forms, the corresponding orders are SVO and OVS). This was exemplified with topic-comment constructions in (146) and contrasted with the Moro facts, for which the possible orders are SVO and OSV (148). As discussed in Section 4.5, constructions similar to the Tira OAuxSV construction, where a constituent may intervene between two parts of the verb form, are attested in Central Heiban languages as well. A summary chart is provided in Table 4.27.

**Table 4.27**: Word order variation across Heiban

|  | Synthetic | Periphrastic |
|---|---|---|
| Tira and Central Heiban | SVO | SAuxVO |
|  | OVS | OAuxSV |
| Moro | SVO | – |
|  | OSV | – |

We therefore hypothesize that Moro is the innovative language, and propose that what has taken place in Moro is *univerbation*, i.e. "the union of two syntagmatically adjacent word forms into one" (Lehmann 2020, p. 206). Univerbation is one of the aspects of *grammaticalization*, which can be defined as "a diachronic change by which the parts of a constructional schema come to have stronger internal dependencies" (Haspelmath 2004, p. 26). Grammaticalization is typically conceptualized as happening along a cline:

(191) **The cline of wordhood** (Hopper and Traugott 2003, p. 7)

content item > grammatical word > clitic > affix

There is, to our knowledge, no evidence that the *a* marker in Tira or Moro correspond to a content item (such as a lexical verb) synchronically. In Tira, the *a* markers are syntactically independent and may be considered to be grammatical words, but there is also evidence in favor of an analysis of these markers as clitics, being bound to the verb stem when adjacent to it, but independent words elsewhere (see the discussion of hiatus in Section 4.4.3). Moro lacks the possibility of syntactic constituents intervening between the *a* markers and the verb root, and it is synchronically best analyzed as a prefix (Jenks et al. Forthcoming). Synchronically, the morphological verb in Moro can be divided into different domains, including a preverb and a macrostem (Jenks et al. Forthcoming; Rose 2013), and while the clause type markers belong to the domain referred to as the preverb and are excluded from the macrostem (the domain for

tone assignment), they are included in the morphological verb, the domain for vowel harmony, suggesting they are indeed phonologically bound.

To summarize, we propose that due to the word order changes in Moro—with subjects becoming fixed as preverbal—noun phrases cannot intervene between the preverbal *a* marker and the verb root anymore, and the two have gradually univerbated into a single tight construction, where the preverbal *a* has become a prefix.

### 4.6.3   Reanalysis of the function of *a*

It seems likely that the vocalic prefix *a-* in Moro is cognate with the Tira *a* auxiliaries; however, they have different functions in the two languages. As we saw above, the preverbal *a* markers are found in a subset of paradigm cells in Tira, and are therefore informative for TAM and deixis, and analyzable as a part of the TAMD marking system. The examples in (192) illustrate this, focusing on declarative main clause forms. The examples in (193) show that in Moro, the *a-* marker occurs across all declarative main clause forms, and is therefore not informative for TAM and deixis.

(192)   The distribution of *a* by TAMD in Tira (from Chapter 3)

| | Itive | Ventive |
|---|---|---|
| IPFV | C-**á** vɘ́lɛ̀ð-à | C-**á** vɘ̀lɛ̀ð-ɔ́ |
| PFV | C-**à** vɘ́lɛ̀ð-ɛ̀ | C-vɘ̀lɛ̀ð-ɔ́ |

(193)   The distribution of *a* by TAMD in Moro: (Jenks et al. Forthcoming, p. 307)

| | Regular | Ventive |
|---|---|---|
| IPFV | C-**a**-vɘ́léð-a | C-**á**-vɘleð-ó |
| PFV | | C-**a**-vɘleð-ó |

As we have seen, there is only one perfective form in Moro. This form (*C-a-vɘleð-ó*) looks superficially similar to the Tira perfective ventive (*C-vɘ̀lɛ̀ð-ɔ́*) based on the tone pattern and the back rounded final vowel. We therefore hypothesize that the two forms

are cognate. Tira has a perfective itive form as well, while Moro does not, and there are two possible reasons for this: either Tira has gained a perfective form, or Moro has lost one. Evidence in support of Tira being innovative in this respect is the fact that the lack of a deixis contrast in the perfective is attested outside of West Heiban as well: the Central Heiban language Rere (Koalib) has a single, synthetic perfective verb form (see e.g. Rose 2024). Further, the Moro perfective has a preverbal marker *a-* which is not found in the Tira perfective ventive form, but instead looks cognate to the Tira TAMD auxiliary *a*, which is found in a subset of forms, including the perfective itive. We hypothesize that the origin of the Moro perfective was a synthetic verb form (like the Rere perfective and the Tira perfective ventive) and that it later gained a prefix *a-*.

The distribution of the *a-* in Moro is such that it is not informative for aspect or deixis (as it is found in all three paradigm cells). Instead, the distribution of the *a-* in Moro is such that it is informative for clause type: it occurs in indicative root (main) clauses and indicative embedded clauses, and contrasts with two other clause type markers, illustrated in Table 4.28: *é-* (which occurs in finite clauses with displaced subjects, including subject relative clauses and secondary predicates) and *ə́-* (which occurs in subjunctive clauses and clauses with displaced non-subjects) (Jenks and Rose 2017). Note that these clause markers are subject to vowel harmony: /a/ may be raised to [ɜ], /e/ to [i], and /ə/ to [ɘ]. The corresponding forms in Tira will be illustrated below.

**Table 4.28**: Perfectives by clause type in Moro (Jenks et al. Forthcoming, p. 289)

| Root clause (RTC) | Displaced subject (DPC1) | Subjunctive (DPC2) | |
|---|---|---|---|
| g-a-wəndaṯ-ó | g-é-wəndaṯ-ó | g-ə́-wəndaṯ-ó | 's/he watched' |
| g-ɜ-dɜdəð-ú | g-í-dɜdəð-ú | g-ə́-dɜdəð-ú | 's/he hiccuped' |

The usage of the two other clause type markers is exemplified by focus clefts in (194)–(195); the example in (194) has a displaced subject and the DPC1 marker é; the example in (195) has a displaced object and the DPC2 marker ə́- (Rose et al. 2014).[20]

(194)   Focus cleft constructions in Moro: SVO

ŋwə́-matʃə́-kːi        g-**é**-mː-ó                  ówːá         g-óal-á
CLT-(CLg)man-CLg.DEM SM.CLg-**DPC1**-take-PFV (CLg)woman SM.CLg-tall-ADJ
'This is the man who married the tall woman.' (Rose et al. 2014, p. 104)

(195)   Focus cleft constructions in Moro: OSV

ŋw-ógovél-kːi         (n-)úʤí            (nə́-)g-**ə́**-wəndaṯ-ó
CLT-(CLg)monkey-CLg.DEM COMP-(CLg)person COMP-SM.CLg-**DPC2**-see-PFV
'This is the monkey that the person saw.' (Rose et al. 2014, p. 105)

The examples in Table 4.29 illustrate the perfective, imperfective and imperfective ventive forms in root and dependent clauses. The fact that the preverbal marker of the imperfective ventive is á- in main as well as dependent clauses suggests that in Moro, the imperfective ventive is marked by a circumfix á- -ó which is in hiatus with the clause marker, causing it to delete due to the regular process of hiatus resolution in the language (Jenks et al. Forthcoming, p. 306). There is no evidence for a similar circumfix in Tira.[21]

**Table 4.29**: The distribution of *a* in Moro by clause type

|                     | Perfective      | Imperfective    | Imperfective ventive |
| ------------------- | --------------- | --------------- | -------------------- |
| root clause a-      | g-**a**-vəleð-ó | g-**a**-vɘ́léð-a | g-**á**-vəleð-ó       |
| dependent clause é- | g-**é**-vəleð-ó | g-**é**-vɘ́léð-a | g-**á**-vəleð-ó       |
| dependent clause ə́- | g-**ə́**-vəleð-ó | g-**ə́**-vɘ́léð-a | g-**á**-vəleð-ó       |

In Tira, what distinguishes corresponding clause types is simply a High tone. This is illustrated by the focus constructions in (196), which exhibit similar word order

---

[20]CLT = cleft, SM = subject marker, DPC = dependent clause marker.
[21]The analysis of the imperfective ventive forms in Table 4.28 are therefore: /g-a-á-vəleð-ó/ → [gávəleðóó] and /g-é-á-vəleð-ó/ → [gávəleðóó] (Jenks et al. Forthcoming, pp. 306–307).

as we saw with topic constructions above: SAuxVO is found when the subject is focused, as in (196a), and OAuxSV is found when the object is focused, as in (196b). For comparison, the corresponding topic constructions are provided in (197); these show that the perfective itive has a Low-toned auxiliary *à* here (see also Chapter 3). The High tone found in focus constructions is also found in relative clauses and content questions where the interrogative pronoun is fronted/ex situ; see Hassen et al. (2021), Jenks, Hassen, and Rose (2022), and Kaldhol, Rose, and Simmons (Accepted) for details.

(196)   Focus constructions in Tira

    a.  S Aux V O

        àn  láɾò      **l-á**     r̃lànd̪-ɛ̀ ð́ɔ́ɾà
        FOC (CLl)chickens CLl-AUX close-FV (CLð)fence
        'It was the *chickens* who closed the fence (and left).' (PFV.ITV)

    b.  O Aux S V

        àn  ð́ɔ́ɾà    **ð-á**    láɾò       r̃lànd̪-ɛ̀
        FOC (CLð)fence CLð-AUX (CLl)chickens close-FV
        'It was the *fence* that the chickens closed (and left).' (PFV.ITV)

(197)   Topic constructions in Tira

    a.  S Aux V O

        láɾò      **l-à**    r̃lànd̪-ɛ̀ ð́ɔ́ɾà
        (CLl)chickens CLl-AUX close-FV (CLð)fence
        'The chickens closed the fence (and left).' (PFV.ITV)

    b.  O Aux S V

        ð́ɔ́ɾà    **ð-à**    láɾò       r̃lànd̪-ɛ̀
        (CLð)fence CLð-AUX (CLl)chickens close-FV
        'As for the fence, the chickens closed it (and left).' (PFV.ITV)

If the High tone found in focus constructions in Tira is cognate to the two clause markers *é-* and *ɔ́-* in Moro, this is likely a case of morphological tonogenesis, where the vowels have been deleted, but the tone remains. Under this hypothesis, Tira is

innovative in this respect, and lost the vowels originally associated with the High tone of these markers.

Synchronically, the *a* markers themselves are not informative for clause types in Tira, as illustrated in Table 4.30: these data show that the *a* markers are found in both clause types, and only in the relevant TAMD forms (that is, not in the perfective ventive). It is a High tone that marks these clause type distinctions, but instead of the three-way distinction found in Moro, there is a two-way distinction (see also Jenks, Hassen, and Rose 2022). Furthermore, the two imperfective forms in Tira begin in a High-toned auxiliary, and there is no distinction between verb forms used in topic and focus constructions; this is illustrated in (198)–(199) (see also Kaldhol, Rose, and Simmons Accepted); instead, the difference is in the presence or absence of the Focus marker *àn*.

**Table 4.30**: The distribution of *a* and High tone in Tira by TAMD and clause type

|  | Perfective itive | Perfective ventive | Imperfective itive | Imperfective ventive |
|---|---|---|---|---|
| Topic | C-à vɘ́lɛ̀ð-ɛ̀ | C ɘ-vɘ̀lɛ̀ð-ɔ́ | C-á vɘ́lɛ̀ð-à | C-á vɘ̀lɛ̀ð-ɔ́ |
| Focus | C-á vɘ́lɛ̀ð-ɛ̀ | C ɔ́-vɘ̀lɛ̀ð-ɔ́ | C-á vɘ́lɛ̀ð-à | C-á vɘ̀lɛ̀ð-ɔ́ |

(198)   Focus constructions in Tira

    a.  S Aux V O

        àn   láɾò        **l-á**       **ŕlànḏ-à**  ðɔ́ɾà
        FOC (CLl)chickens CLl-AUX close-FV (CLð)fence
        'It is the *chickens* who will close the fence.' (IPFV.ITV)

    b.  O Aux S V

        àn   ðɔ́ɾà      **ð-á**      láɾò        **ŕlànḏ-à**
        FOC (CLð)fence CLð-AUX (CLl).chickens close-FV
        'It is the *fence* which the chickens will close.' (IPFV.ITV)

(199)   Topic constructions in Tira

    a.  S Aux V O

       láɾò        **l-á**       **ŕlànd̠-à** ðɔ́ɾà
       (CLl)chickens CLl-AUX close-FV (CLð)fence
       'The chickens will close the fence.' (IPFV.ITV)

    b.  O Aux S V

       ðɔ́ɾà        **ð-á**     láɾò       **r̀lànd̠-à**
       (CLð)fence CLð-AUX (CLl).chickens close-FV
       'As for the fence, the chickens will close it.' (IPFV.ITV)

To summarize, the distribution of the *a* markers by TAMD and by clause type differ across the two languages such that they are best analyzed as TAMD markers in Tira and clause type markers in Moro.

We hypothesize that Proto-West-Heiban had vocalic TAMD auxiliaries as well as vocalic clause markers with inherent tone, but no root clause markers. Under this analysis, the High tone found in focus constructions in Tira arose through tonal stability after vowel deletion (e.g. *é-* → H: morphological tonogenesis), but the TAMD auxiliaries were retained. Thetogovela Moro retained *é-* and *ɔ́-*, but also reanalyzed *a* as root clause marker, creating the three-way distinction (note that in standard Moro, the *ɔ́-* is not used).

While it is possible that the Tira TAMD auxiliaries developed from a clause type marker, it seems more likely that the Moro root clause marker developed through the reanalysis of the TAMD auxiliaries. One reason for this is that preverbal TAMD auxiliaries are attested outside of West Heiban in Central Heiban languages (e.g. the future marker *a* in Ebang (Schadeberg 2020, pp. 90–92) and the future marker *a* in Otoro; Stevenson 1943/2009, pp. 251–256). Specifically, we propose that the hypothesized changes in the system (univerbation as well as a merging of the two perfective forms)

has led to a change in the paradigmatic contrasts in which the *a* participates, leading to a reanalysis of the function of *a* in Moro from a TAMD marker to a clause type marker.

### 4.6.4   Changes in the location of subject/object markers

As we saw in Section 4.4, the location of subject/object markers differ in Moro and Tira. In Tira, the location is predictable from syntactic properties of the verb form; whether it is in a dependent (subordinate) form or not, and whether it is synthetic or periphrastic. In Moro, the subject markers have a specific slot in the verb template. Their location is therefore fixed as preverbal, similar to the syntactic facts, as subject NPs in Moro always are preverbal. The location of object markers, on the other hand, is variable, but predictable from whether the verb form has the default tone pattern or any of the other tone patterns. In the present section, we will hypothesize that the Tira facts reflect the Proto-West-Heiban facts, i.e. that it reflects where the subject/object markers were located prior to the hypothesized univerbation and reanalysis of the preverbal *a* markers, which we propose have taken place in Moro. We will therefore focus on similarities and differences in the verb forms in Table 4.31, i.e. main clause declarative forms in the perfective and imperfective.

**Table 4.31**: Subject/object markers in Moro and Tira

|  | Moro |  | Tira |
|---|---|---|---|
| PFV | C-a-vələð-ó-X<br>(SM)-CL-RTC-stem-FV-**OM** | PFV.VEN | C-vəlèð-ɔ́-X<br>CL-stem-FV-**SM/OM** |
|  |  | PFV.ITV | C-à-X vəlèð-ɛ̀<br>CL-AUX-**SM/OM** stem-FV |
| IPFV | C-a-X-vələð-a(-X)<br>(SM)-CL-RTC-**OM**-stem-FV(-OM) | IPFV.ITV | C-á-X vəlèð-à<br>CL-AUX-**SM/OM** stem-FV |
| IPFV.VEN | C-á-vələð-ó-X<br>(SM)-CL-RTC-stem-FV-**OM** | IPFV.VEN | C-á-X vəlèð-ɔ́<br>CL-AUX-**SM/OM** stem-FV |

If Moro is the innovative language with respect to the status and function of the *a*, it is reasonable to hypothesize that it is innovative with respect to the location of object markers as well. We do not know whether Proto-West-Heiban had two perfective forms (like Tira) or one (like Moro), but based on the tone pattern and the quality of the final vowel, we hypothesize that the Moro perfective is cognate to the Tira perfective ventive, and that the source construction in Proto-West-Heiban had suffixed object markers. Under this hypothesis, the single perfective form in Moro has postverbal objects simply because it has retained this property from the origin construction in Proto-West-Heiban.

The regular imperfective in Moro has prefixed objects, and this is similar in structure to the itive imperfective in Tira, where object markers are suffixed to the auxiliary, and thus occur between the *a* and the verb root. This similarity is predicted by the univerbation analysis; we propose that the regular imperfective form in Moro has preverbal objects simply because it has retained this property from the origin construction in Proto-West-Heiban. Under this analysis, the object markers have become "trapped" inside the word after univerbation.

This leaves us with one final puzzle: If the imperfective ventive in Moro is cognate to the imperfective ventive in Tira, and the origin of both of these forms was a periphrastic construction—one with a preverbal TAMD auxiliary—in Proto-West-Heiban, then why does the ventive imperfective in Moro have *postverbal* object markers? This difference between the two languages, illustrated in (200)–(202), does not seem to follow from the developments we have proposed so far, and we will explore this more in the next section.

(200)   IPFV.VEN attested for Tira:

CL-AUX-**SM/OM** stem-FV

(201)   IPFV.VEN predicted for Moro:

(SM)-CL-RTC-**OM-**stem-FV

(202) IPFV.VEN attested for Moro:

(SM)-CL-RTC-stem-FV-**OM**

## 4.6.5 Tonally conditioned constructional change

What we have seen so far is that with one exception, the location of object markers in Moro is predictable from the location of subject/object markers in the cognate constructions in Tira, which we have hypothesized to constitute the Proto-West-Heiban pattern. There are at least two possible explanations for the exceptional case: either there has been yet another constructional change in Moro, or our assumption that Moro is the innovative language is wrong, and the imperfective ventive in Proto-West-Heiban had *postverbal* object markers, like Moro.

Given that subject/object markers follow TAMD auxiliaries (including imperfectives) not just in Tira, but in Central Heiban languages as well (see Section 4.5), we maintain the hypothesis that Moro in fact is the innovative language, which means that a morphotactic change must have taken place in the imperfective ventive in Moro. Crucially, we saw in Section 4.4.7 that in Moro—but not Tira—the location of object markers is predictable from the tone patterns of the verb forms. A synchronic analysis of these facts, couched within the framework of Optimality Theory, was proposed by Jenks and Rose (2015). In the present chapter, we would like to complement this analysis with a diachronic one.

We propose that the location of object markers in the imperfective ventive changed from preverbal to postverbal in Moro as a type of analogical change; the location of object markers of the imperfective ventive—which has an all Low stem tone pattern—has shifted to postverbal position in Moro by analogy with all the other verb forms that have the all Low stem tone pattern and suffixed object markers. Because of

221

the change to the attested pattern in (202) above, object markers in Moro are prefixes *only if* the verb stem has the default tone pattern.

A possible alternative analysis is that the change from preverbal to postverbal object markers in the imperfective ventive was based on analogy with other instances in which postverbal object markers occur with *-ó* final verbs; other forms with a final vowel *-ó* include the perfective and the regular imperative, both of which have postverbal object markers. However, this generalization does not fully hold, as the consecutive imperfective form (discussed in Section 4.4.5) has the final vowel *-ó* as well, and *preverbal* object markers. Table 4.32 illustrates the lack of a correlation between the suffix *-ó* and the location of object markers.

**Table 4.32**: Object markers on verb forms ending in *-ó* in Moro

| Form | No OM | with 3sg OM |
|---|---|---|
| IMP | və́léð-ó | və́léð-ə́-**ŋó** |
| PFV | g-a-vəleð-ó | g-a-vəleð-ə́-**ŋó** |
| IPFV.VEN | g-á-vəleð-ó | g-á-vəleð-ə́-**ŋó** |
| Consecutive IPFV | ṭ-áŋə́-və́léð-ó | ṭ-áŋ-**ŋó**-vəleð-ó |

Under our analysis, the function of the tone patterns in the overall system has been adapted to serve a new purpose: to condition the location of the object markers. While this previously was conditioned by the syntactic properties of the constructions (which is what we see synchronically in Tira), the relevant properties have been lost in Moro due to changes in the distribution and function of the *a* marker. The tone patterns in Moro form a part of the constructional make-up of each verb form, and presumably, their original function was to create paradigmatic contrasts and thus be informative for TAMD. This is still true, but synchronically, they now serve a second purpose as well.

To summarize, we have an example of a case where *tone* was the driver of constructional change. As pointed out by Jenks and Rose (2015), the verb forms which have postverbal object markers in Moro—see Table 4.26 above—do not form a natu-

ral class to the exclusion of the other verb forms semantically or morphosyntactically speaking; tone is the only unifying factor. If this was true also of a former stage in the development of Moro, before the shift in the location of the object markers, then tone seems to be the only possible conditioning factor of this change. We may thus hypothesize an intermediate stage at which point all of the proposed changes here had taken place except the shift in the location of object markers; this would look roughly as in Table 4.33, what we may call *Pre-Moro*. A question for future research on Moro is whether there are dialects that still function this way synchronically; this would support our analysis.

**Table 4.33**: Hypothesized intermediate stage in Moro

|  | Pre-Moro |  | Moro |
|---|---|---|---|
| PFV | (SM)-CL-RTC-stem-FV-**OM**(-OM) |  | (SM)-CL-RTC-stem-FV-**OM**(-OM) |
| IPFV | (SM)-CL-RTC-**OM-**stem-FV(-OM) |  | (SM)-CL-RTC-**OM-**stem-FV(-OM) |
| IPFV.VEN | *(SM)-CL-RTC-**OM-**stem-FV(-OM) | > | (SM)-CL-RTC-stem-FV-**OM**(-OM) |

The case of *tone-driven constructional change* in Moro can be added to the growing list of cases where tone has been the active driver of language change, influencing the overall organization of the grammar of a language.

## 4.6.6 Synchrony versus diachrony

The present study has aimed to develop a diachronic account of the Moro verb system, by comparing Moro, Tira, and the Central Heiban languages, and propose a set of diachronic developments that may account for the observed differences. While the present study has built on previous work by Jenks and Rose (2015), who showed that there is a correlation between the verb tone patterns in Moro and the location of object markers, there is a key difference between the diachronic and synchronic analysis. The proposed development in (203) indicates that object prefixes became

suffixes in the imperfective ventive in Moro, while the regular imperfective has prefixed object markers simply due to retention of this property from the proto-language. The synchronic analysis by Jenks and Rose (2015) is that object markers are underlyingly postverbal, but prosodically deficient, and become bound to the verb as either prefixes or suffixes, depending on the construction. The difference between the two imperfective forms under this account is given in (204) (Jenks and Rose 2015, p. 289).

(203)  Diachronic analysis of OMs in Moro

    a.  IPFV.VEN

        *g-á-**ɲé**-vəleð-ó → g-á-vəleð-ə́-**ɲé**

    b.  IPFV

        *g-a-**ɲé**-vəleð-a → g-a-**ɲé**-vəleð-a

(204)  Synchronic analysis of OMs in Moro (Jenks and Rose 2015)

    a.  IPFV.VEN

        /g-á-vəleð-ó **ɲé**/ → [g-á-vəleð-ə́-**ɲé**]

    b.  IPFV

        /g-a-vəleð-a **ɲé**/ → [g-a-**ɲé**-vəleð-a]

In a sense, the two analyses say the exact opposite: while the diachronic proposal is that object markers used to be *preverbal* in both constructions, the synchronic analysis is that object markers are underlyingly *postverbal* in both constructions. Jenks and Rose (2015) further develop an OT account in which the High-toned object markers move to the prefix position in verb forms with the default tone pattern because they are phonologically optimizing when occurring there, by providing the macrostem with a High tone. We will not recapitulate the details of this analysis here, but it is worth noting the difference in directionality embedded in the two perspectives in (203)–(204).

The diachronic account can be interpreted as cognitively realistic, in the sense that diachrony reveals speakers' intuitions about their system at the time of the change. Thus the proposed tonally conditioned change to the object markers in the imperfective ventive in Moro—if on the right track—reveals that the connection between tone and morphotactics was cognitively real to the speakers at the time of the change. Whether this connection is synchronically real today—and whether speakers' mental grammars function in the way captured by Jenks and Rose (2015), allowing for the OT analysis to be cognitively grounded—is a question for psycholinguistics and productivity studies. One fruitful avenue for future research would thus be to explore speakers' intuitions of the Moro system experimentally.

### 4.6.7 Section summary

This section has summarized key similarities and differences in the organization of the verb systems in Moro and Tira, and proposed hypotheses for diachronic developments that may have led to the synchronic systems. More work on related Heiban languages is necessary to argue convincingly for these changes, which rely on the hypothesis that Moro is innovative in most respects, and that Tira constitutes a system that is closer in nature to Proto-West-Heiban, and potentially Proto-West-Central-Heiban as well. However, the changes that are proposed here (univerbation, reanalysis, analogy) are well-known from the literature on historical linguistics. Whether the changes proposed here turn out to have support in a broader comparative study is a question for future research, but what is clear from the data, is that changes from Proto-West-Heiban to the synchronic systems found in Tira and Moro have led to a number of differences in the organization of verb constructions. As a result, tone plays vital, but very different roles in the two verb systems; it may distinguish who did what to whom in Tira (but not Moro), and condition the location of object markers in Moro (but not Tira).

## 4.7    Chapter summary

The present chapter has made three key contributions: First, it has contributed to the documentation and description of Tira by presenting novel data illustrating subject/object marking on verbs. Second, it has contributed to Heiban studies by comparing the organization of the verb systems in the two West Heiban languages Tira and Moro, and showing how tone plays vital, but different roles within the two languages. The aim was to provide a non-aprioristic comparison, focusing on the empirical generalizations, and making reference to the Central Heiban languages when possible and appropriate. Third, we proposed a set of diachronic developments hypothesized to have taken place in Moro that would account for the differences between Tira and Moro: univerbation of periphrastic constructions, reanalysis of a preverbal TAMD marker as a clause type marker, and tonally conditioned constructional change, affecting the location of object markers within the Moro verb template.

In this way, the present chapter contributes to current efforts within historical linguistics that aims to advance our understanding of tone in diachrony by moving beyond tonogenesis (the birth of tone contrasts) and focus on how tone may change over time. More specifically, we have shown how the *function* of tone may change by showing that in Moro, the function of the verb tone patterns has been adapted to serve a new purpose: to condition the location of the object markers. While tone is often treated as passive in diachrony (arising due to other changes, such as changes to consonants or the loss of segmental material), the present study shows that tone can be an active force and cause changes to the organization of grammatical systems.

# Chapter 5

# Concluding remarks

The overarching goal of the studies presented in this dissertation is to advance our understanding of the role of tone in the organization of morphological systems. The findings have implications for morphological theory and typology, language documentation, comparative studies and historical linguistics.

In Chapter 1, I presented a typological study and discussed cross-linguistic diversity in tonal exponence. I showed that tone may be involved in considerable complexity of exponence, i.e. deviations from form-function isomorphism. In this study, I aimed to move beyond previous morpheme-based approaches to the study of tone in morphology by addressing a broader set of phenomena than what a morpheme-based theory would predict, e.g. polyfunctionality, morphomic distributions, paradigmatic layers, and inflectional classes. The broader claim made in this chapter is that the attested diversity of form-function mappings constitutes an empirical argument for a paradigm-based view of morphology, where the attested diversity is taken at face value and the range of encoding strategies are treated as equivalent, as opposed to choosing form-function isomorphism as the theoretical 'ideal'.

In Chapters 2 and 3, I presented novel data illustrating the role of tone in the morphology of Tira, a previously understudied Heiban language spoken in the Nuba Mountains in Sudan. I showed that there is complexity of exponence in the verb system, and that Tira verb forms are distinguished by a combination of tonal exponents, morphomic final vowels, prefixes, and auxiliaries. It does not seem to be possible to identify "main" and "subsidiary" exponents; rather, there are different pieces varying independently of each other, and each exponent taken individually has low functional value. However, the distributions of forms across inflectional classes reveal patterns of organization that allow for inferences about inflectional class membership. It was shown that in order to understand the nature of the system, we need to take both the syntagmatic and the paradigmatic dimension into account. The broader claim made in

this chapter is consequently that morphological theory needs to integrate both dimensions.

In Chapter 4, I provided a comparative morphological study of the Heiban languages, focusing in particular on the West Heiban languages Tira and Moro. Based on the similarities and differences between these two languages as well as comparisons to the Central Heiban languages, I argued that a diachronic development of tonally conditioned constructional change has taken place in Moro, demonstrating that tone can be the active driver of morphotactic change. This study thus contributes to our understanding of tone in diachrony by moving beyond tonogenesis and tone change to the study of changes to the *function* of tone in the overall system in which it participates.

Together, these studies show that tone can play a multitude of roles in the organization of morphological systems in the world's languages. In order to analyze the morphological role of tone in any given language, several aspects need to be considered: whether tone is the sole exponent of a morphosyntactic property or one of multiple exponents; whether the tonal exponent is a single tone or a tonal melody; and how each tonal and/or non-tonal exponent map onto grammatical meaning, based on their distribution across the paradigms. The dissertation provides a novel approach to the study of tone and morphology by embedding the study of tone within a broader study of morphological organization. While many previous studies of tone have focused on phonological or syntactic aspects of tone, and implicitly or explicitly adopted a morpheme-based view of morphology, this dissertation has aimed to refine our understanding of the purely morphological aspects of tone, by incorporating phenomena such as complexity of exponence, morphomic tone, paradigmatic organization, paradigmatic layers, and inflectional classes made by tone.

Based on these studies, there are a number of topics that emerge as promising for future research: First, we need careful description and analysis of tone and morphology

in more languages, and ideally, this would be based on full paradigms of a large number of lexemes. It is my hope that this endeavor will benefit from the analytical tools discussed and synthesized in this dissertation, including e.g. verbose exponence, morphomes, and paradigmatic layers. While the present dissertation has focused on the interplay between tonal and segmental exponents, a comprehensive typology would need to incorporate other types of suprasegmental exponence as well, and lay out the interplay between e.g. morphological tone and morphological length, phonation, and nasality.

Second, the study of Tira would benefit from continued documentation and the construction of a larger database, data from more speakers to investigate between-speaker variation, the development of speech corpora to get more reliable estimates of frequency effects, and eventually, productivity studies that may help elucidate whether the generalizations proposed here are cognitively real, or whether some of them constitute fossilized patterns.

Third, the Heiban languages are all in need of more in-depth documentation and description, and due to the attested complexity uncovered so far for these languages, we may be decades away from a proper understanding of the diversity found within this language family. As shown in this dissertation, what we already know about the Heiban languages pushes the boundaries of our understanding of what is possible in human language, and it is my hope that dedicated work on these languages and related ones will continue to inform—or break—linguistic theory in novel ways.

# References

Ackerman, Farrell, James P. Blevins, and Robert Malouf (2009). "Parts and wholes: Implicative patterns in inflectional paradigms". In: *Analogy in Grammar: Form and Acquisition.* Ed. by James P. Blevins and Juliette Blevins. Oxford University Press, pp. 54–82.

Ackerman, Farrell and Robert Malouf (2013). "Morphological organization: The low conditional entropy conjecture". In: *Language* 89.3, pp. 429–464.

— (2016). "Implicative Relations in Word-Based Morphological Systems". In: *Cambridge Handbook of Morphology*. Ed. by Andrew Hippisley and Gregory Stump. Cambridge University Press, pp. 297–328.

Ackerman, Farrell, Robert Malouf, and John Moore (2017). "Symmetrical objects in Moro: Challenges and solutions". In: *Journal of Linguistics* 53, pp. 3–50.

Ackerman, Farrell and Gregory T. Stump (2004). "Paradigms and periphrastic expression: A study in realization-based lexicalism". In: *Projecting Syntax*. Ed. by Andrew Spencer and Louisa Sadler. CSLI, Stanford., pp. 111–158.

Ackerman, Farrell, Gregory T. Stump, and Gert Webelhuth (2011). "Lexicalism, periphrasis, and implicative morphology". In: *Non-Transformational Syntax: Formal and Explicit Models of Grammar*. Ed. by Robert Borsley and Kersti Börjars. John Wiley and Sons, pp. 325–358.

Akinlabi, Akinbiyi (2011). "Featural Affixes". In: *The Blackwell Companion to Phonology*. Ed. by Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume, and Keren Rice. John Wiley and Sons.

Alaki, Thomas Abdalla Kuku (2017). *Litiro of Tombore Phonology*.

Alamin, Suzan, Gertrud Schneider-Blum, and Gerrit J. Dimmendaal (2012). "Finding your way in Tima". In: *Directionality in Grammar and Discourse: Case Studies from Africa*. Ed. by Angelika Mietzner and Ulrike Claudi. Köln: Rüdiger Köppe Verlag, pp. 9–33.

Andersen, Torben (1981). *A grammar of Modo: A preliminary sketch.* Aalborg: University Centre of Aalborg.

Anderson, Stephen R. (2015). "Dimensions of morphological complexity". In: *Understanding and Measuring Morphological Complexity*. Ed. by Matthew Baerman, Dunstan Brown, and Greville G. Corbett. Oxford: Oxford University Press, pp. 11–26.

Andrzejewski, Bogumil W. (1964). *The declension of Somali nouns*. London: School of Oriental and African Studies, University of London.

Arkadiev, Peter and Francesco Gardani (2020). "Introduction: Complexities in morphology". In: *The Complexities of Morphology*. Ed. by Peter Arkadiev and Francesco Gardani. Oxford: Oxford University Press, pp. 1–20.

Aronoff (1994). *Morphology by Itself: Stems and Inflectional Classes*. Cambridge, Massachusetts/London, England: The MIT Press.

Auderset, Sandra (2022). "Confronting challenges in historical linguistics: Quantitative approaches to dialect area subgrouping and tone change in Mixtec". PhD thesis. University of California Santa Barbara.

Baerman, Matthew (2013). "Inflection class interactions". In: *Morphology in Toulouse*. Ed. by Nabil Hathout, Fabio Montermini, and Jesse Tseng. Munich: LINCOM.

— (2014). "Inflectional class interactions in Otomanguean". In: *Patterns in Mesoamerican morphology*. Ed. by Jean Léo Léonard and Alain Kihm. Michel Houdiard Éditeur, pp. 15–25.

Baerman, Matthew, Dunstan Brown, and Greville G. Corbett (2017). *Morphological complexity*. Cambridge University Press.

Baerman, Matthew, Enrique Palancar, and Timothy Feist (2019). "Inflectional class complexity in the Oto-Manguean languages". In: *Amerindia* 41, pp. 1–18.

Baerman, Matthew and Enrique L. Palancar (2014). "The organization of Chinantec tone paradigms". In: *Carnets de Grammaire 22: Proceedings of Les Décembrettes, 8th international conference on morphology*. Toulouse: CLLE-ERSS, pp. 46–59.

Baerman, Matthew, Dunstan Brown, Roger Evans, Greville G. Corbett, Lynne Cahill, and Sacha Beniamine (2023). *Surrey Morphological Complexity Database*. University of Surrey, http://dx.doi.org/10.15126/SMG.23/1.

Bateman, Janet (1990). "Iau segmental and tonal phonology". In: *Miscellaneous studies of Indonesian and other languages* 10, pp. 29–42.

Bauer, Laurie (2012). "Typology of Compounds". In: *The Oxford Handbook of Compounding*. Ed. by Rochelle Lieber and Pavol Štekauer. Oxford: Oxford University Press.

Beniamine, Sacha and Olivier Bonami (2023). "Inflection Class Systems". In: *The Wiley Blackwell Companion to Morphology*. Ed. by Peter Ackema, Sabrina Bendjaballah, Eulàlia Bonet, and Antonio Fábregas.

Bickmore, Lee (2007). *Cilungu phonology*. Stanford: CSLI Publications.

— (2014). "Cilungu tone melodies: A descriptive and comparative study". In: *Africana Linguistica* 20.1, pp. 39–62.

— (2022). *Factors influencing the presence and realization of melodic tones in Bantu*. The 53rd Annual Conference on African Linguistics, University of California San Diego.

Blench, Roger (2013). "Splitting up Kordofanian". In: *Nuba Mountain Language Studies*. Ed. by Thilo N. Schadeberg and Roger M. Blench. Köln: Rüdiger Köppe Verlag, pp. 571–586.

Blevins, James P. (2006). "Word-based morphology". In: *Journal of linguistics* 42.3, pp. 531–573.

— (2016). *Word and Paradigm Morphology*. Oxford: Oxford University Press.

Blevins, Juliette (2004). *Evolutionary phonology: The emergence of sound patterns*. Cambridge: Cambridge University Press.

Bloomfield, Leonard (1933). *Language*. New York: Henry Holt and Company.

Bonami, Olivier (2015). "Periphrasis as collocation". In: *Morphology* 25, pp. 63–110.

Brown, Dunstan and Andrew Hippisley (2012). *Network morphology: A defaults-based theory of word structure*. Cambridge University Press.

Brown, Dunstan, Marina Chumakina, Greville Corbett, Gergana Popova, and Andrew Spencer (2012). "Defining 'periphrasis': key notions". In: *Morphology* 22, pp. 233–275.

Bybee, Joan (1994). "A view of phonology from a cognitive and functional perspective". In: *Cognitive Linguistics* 5 (4), pp. 285–305.

— (2003). *Phonology and language use*. Cambridge: Cambridge University Press.

Bye, Patrik and Peter Svenonius (2012). "Non-concatenative Morphology as Epiphenomenon". In: *The Morphology and Phonology of Exponence*. Ed. by Jochen Trommer. Oxford: Oxford University Press, pp. 444–512.

Caballero, Gabriela and Austin German (2021). "Grammatical Tone Patterns in Choguita Rarámuri (Tarahumara)". In: *International Journal of American Linguistics* 87.2, pp. 149–178.

Caballero, Gabriela and Alice C. Harris (2012). "A working typology of multiple exponence". In: *Current issues in morphological theory: (Ir)regularity, analogy and frequency*. Ed. by Ferenc Kiefer, Mária Ladányi, and Péter Siptár. Amsterdam/Philadelphia: John Benjamins Publishing Company, pp. 163–188.

Caballero, Gabriela and Sharon Inkelas (2013). "Word construction: Tracing an optimal path through the lexicon". In: *Morphology* 23.2, pp. 103–143.

Caballero, Gabriela and Vsevolod Kapatsinski (2015). "Perceptual functionality of morphological redundancy in Choguita Rarámuri (Tarahumara)". In: *Language, Cognition and Neuroscience* 30.9, pp. 1134–1143.

Campbell, Eric W. (2021). "Why Is Tone Change Still Poorly Understood, and How Might Documentation of Less-studied Tone Languages Help?" In: *Historical Linguistics and Endangered Languages: Exploring Diversity in Language Change*. Ed. by Patience Epps, Danny Law, and Na'ama Pat-El. New York: Routledge, pp. 15–40.

Carroll, Matthew J. (2016). "The Ngkolmpu Language, with special reference to distributed exponence". PhD thesis. Australian National University.

— (2022). "Verbose exponence: Integrating the typologies of multiple and distributed exponence". In: *Morphology* 32, pp. 1–24.

Carter, Matthew (2023). "Polyfunctional argument markers in Ket: Implicative structure within the word". In: *Morphology* 33.2, pp. 67–113.

Cheng, Chin-Chuan and Charles W. Kisseberth (1979). "Ikorovere Makua Tonology (Part 1)". In: *Studies in the Linguistic Sciences* 9.1.

Chumakina, Marina, Oliver Bond, and Greville G. Corbett (2016). "Essentials of Archi grammar". In: *Archi: Complexities of agreement in cross-theoretical perspective*. Ed. by Oliver Bond, Greville G Corbett, Marina Chumakina, and Dunstan Brown. Oxford: Oxford University Press, pp. 17–42.

Corbett, Greville G. (2009). "Canonical inflectional classes." In: *Selected proceedings of the 6th Décembrettes: Morphology in Bordeaux*. Ed. by Fabio Montermini, Gilles Boyé, and Jesse Tseng. Sommerville, MA: Cascadilla Proceedings Project, pp. 1–11.

DiCanio, Christian (2022). "The evolution of tonally conditioned allomorphy in Triqui: evidence from spontaneous speech corpora". In: *Linguistics Vanguard* 5.5, pp. 545–556.

Dimmendaal, Gerrit J. (2018). "Reconstructing Katloid and deconstructing Kordofanian". In: *Nuba Mountain language studies. New insights*. Ed. by Gertrud Schneider-Blum, Birgit Hellwig, and Gerrit J. Dimmendaal. Rüdiger Köppe Verlag, pp. 383–415.

Dockum, Rikker (2019). "The Tonal Comparative Method: Tai Tone in Historical Perspective". PhD thesis. Yale University.

Döhler, Christian (2019). *A grammar of Komnzo*. Language Science Press.

Downing, Laura J. and Al Mtenje (2017). *The Phonology of Chichewa*. Oxford: Oxford University Press.

Embick, David and Alec Marantz (2008). "Architecture and blocking". In: *Linguistic Inquiry* 39.1, pp. 1–53.

Enger, Hans-Olav (2019). "Thoughts on morphemes, on a Scandinavian background". In: *Morphological Variation. Theoretical and empirical perspectives*. Ed. by Antje Dammel and Oliver Schallert. John Benjamins Publishing Company.

Evans, Nicholas (2015). "Inflection in Nen". In: *The Oxford Handbook of Inflection*. Ed. by Matthew Baerman. Oxford: Oxford University Press, pp. 543–576.

Fedden, Sebastian (2016). "Tonal inflection in Mian". In: *Tone and Inflection: New facts and new perspectives*. Ed. by Enrique L. Palancar and Jean Léo Léonard. Berlin: De Gruyter Mouton, pp. 67–82.

Goldsmith, John A. (1976). *Autosegmental Phonology*. Cambridge, Massachusetts: Massachusetts Institute of Technology.

Green, Christopher R. and Nicola Lampitelli (2022). "Conditions on complex exponence: A case study of the Somali subject marker". In: *Phonological Data and Analysis* 4.4, pp. 1–31.

Greenberg, Joseph H. (1950). "Studies in African Linguistic Classification: VII. Smaller Families; Index of Languages". In: *Southwestern Journal of Anthropology* 6.4, pp. 388–398.

— (1963). *The Languages of Africa*. Part II of the International Journal of American Linguistics Vol. 29, No. 1. Publication Twenty-five of the Indiana University Research Center in Anthropology, folklore, and linguistics. Bloomington/The Hague, Netherlands: Indiana University/Mouton and Co.

Grimm, Nadine (2023). *A diachronic study of grammatical tone in Northwestern Bantu*. Presentation at ICHL26, Heidelberg, September 8 2023.

Guest, Elizabeth (1995). *Tira Wordlist*. Unpublished manuscript.

— (1998). *Cwaya pronouns*. Unpublished manuscript.

Guillaume, Antoine and Harold Koch, eds. (2021). *Associated Motion*. Berlin/Boston: Walter de Gruyter GmbH.

Halle, Morris and Alec Marantz (1993). "Distributed Morphology and the Pieces of Inflection". In: *The View from Building 20: Essays in linguistics in honor of Sylvain Bromberger*. Ed. by Kenneth Hale and Samuel Jay Keyser. Cambridge, MA: MIT Press, pp. 111–176.

Hammarström, Harald (2013). "Noun class parallels in Kordofanian and Niger-Congo: evidence of genealogical inheritance?" In: *Nuba Mountain Language Studies*. Ed. by Thilo N. Schadeberg and Roger M. Blench. Köln: Rüdiger Köppe Verlag, pp. 549–570.

Harris, Alice C. (2017). *Multiple Exponence*. Oxford: Oxford University Press.

Haspelmath, Martin (2004). "On directionality in language change with particular reference to grammaticalization". In: *Up and down the Cline – The Nature of Grammaticalization. Typological Studies in Language*. Ed. by Olga Fischer, Muriel Norde, and Harry Perridon. Vol. 59. Amsterdam/Philadelphia: John Benjamins Publishing Company, pp. 17–44.

Hassen, Himidan, Nina Hagen Kaldhol, and Sharon Rose (2021). *Tira participant marking: the role of tone*. Paper presented at the 51st and 52nd Annual Conference on African Languages and Linguistics.

Hassen, Himidan and Sharon Rose (2024). *Reduplication and inflection class in Tira*. Paper presented at the 11th World Congress of African Linguistics, University of Nairobi.

Hassen, Himidan, Peter Jenks, Nina Hagen Kaldhol, and Sharon Rose (2021). *Content questions in Tira*. Paper presented at the 10th World Congress of African Linguistics, Leiden University.

Heath, Jeffrey (2008). *A grammar of Jamsay*. Berlin/New York: Mouton De Gruyter.

Herce, Borja (2020). "A typological approach to the morphome". PhD thesis. University of Surrey.

Hockett, Charles F. (1947). "Problems of Morphemic Analysis". In: *Language* 23.4, pp. 321–343.

Hopper, Paul J. and Elizabeth Closs Traugott (2003). *Grammaticalization*. 2nd ed. Cambridge: Cambridge University Press.

Hyman, Larry M. (1981). "Tonal accent in Somali". In: *Studies in African linguistics* 12.2, pp. 169–203.

— (1987). "Downstep Deletion in Aghem". In: *Current Approaches to African Linguistics*. Ed. by David Odden. Dordrecht: Foris, Vol. 4.

— (2000). *Privative tone in Bantu*. Symposium on tone, ILCAA, Tokyo.

— (2009). "How (not) to do phonological typology: the case of pitch-accent". In: *Language Sciences* 31.2, pp. 213–238.

Hyman, Larry M. (2011). "Tone: Is it Different?" In: *The Handbook of Phonological Theory*. Ed. by John Goldsmith, Jason Riggle, and Alan C. L. Yu. 2nd ed. Blackwell Publishing, pp. 197–239.

— (2016). "Morphological tonal assignments in conflict: Who wins". In: *Tone and Inflection: New facts and new perspectives*. Ed. by Enrique L. Palancar and Jean Léo Léonard. Berlin: De Gruyter Mouton, pp. 15–39.

— (2018). "Towards a Typology of Tone System Changes". In: *Tonal Change and Neutralization*. Ed. by Haruo Kubozono and Mikio Giriko. Berlin: De Gruyter Mouton, pp. 203–222.

Hyman, Larry M. and Ernest Rugwa Byarushengo (1984). "A Model of Haya Tonology". In: *Autosegmental Studies in Bantu Tone*. Ed. by George Nickerson Clements and John Goldsmith. Dordrecht: Foris.

Hyman, Larry M., Sharon Inkelas, and Galen Sibanda (2009). "Morphosyntactic correspondence in Bantu reduplication". In: *The nature of the word: Essays in honor of Paul Kiparsky*. MIT Press, pp. 273–309.

Hyman, Larry M. and William R. Leben (2020). "Tone Systems". In: *The Oxford Handbook of Language Prosody*. Ed. by Carlos Gussenhoven and Aoju Chen. Oxford: Oxford University Press.

Hyman, Larry M. and Russell G. Schuh (1974). "Universals of tone rules: Evidence from West Africa". In: *Linguistic Inquiry* 5.1, pp. 81–115.

Hyslop, Gwendolyn (2022). "Toward a typology of tonogenesis: Revising the model". In: *Australian Journal of Linguistics* 42.3-4, pp. 275–299.

Inkelas, Sharon and Cheryl Zoll (2007). "Is grammar dependence real? A comparison between cophonological and indexed constraint approaches to morphologically conditioned phonology". In: *Linguistics* 45.1.

Jamieson, Carole A. (1982). "Conflated Subsystems Marking Person and Aspect in Chiquihuitlán Mazatec Verbs". In: *International Journal of American Linguistics* 48.2, pp. 139–167.

Jenks, Peter, Himidan Hassen, and Sharon Rose (2022). *A'-satisfaction with φ-interaction in Tira*. 40th West Coast Conference on Formal Linguistics.

Jenks, Peter and Sharon Rose (2011). "High Tone in Moro: Effects of Prosodic Categories and Morphological Domains". In: *Natural Language and Linguistic Theory* 29, pp. 211–250.

— (2012). "Syllable Weight and High tone in Moro". In: *Proceedings of the the 45th Chicago Linguistic Society*. Ed. by Ryan Bochnak, Nassira Nicola, Peet Klecha, Jasmin Urban, Alice Lemieux, and Christina Weaver, pp. 271–285.

Jenks, Peter and Sharon Rose (2015). "Mobile object markers in Moro: The role of tone". In: *Language* 91 (2), pp. 269–307.

— (2017). "Documenting raising and control in Moro". In: Oxford University Press, pp. 207–236.

— (2018). *The puzzle of case marking in Moro*. Paper presented at the 9th World Congress of African Linguistics, Mohamed V University, Rabat, Morocco.

Jenks, Peter, Elyasir Julima, Angelo Naser, and Sharon Rose (Forthcoming). *A Grammar of Moro with a focus on the Thetogovela dialect*. African Language Grammars and Dictionaries. Language Science Press.

Kaldhol, Nina Hagen (2023). *Dimensions of morphological complexity in the Tira verb*. SDSU Research colloquium, April 21st.

— (ms.). *High tone spreading in Tira*. Unpublished manuscript, University of California San Diego.

Kaldhol, Nina Hagen and Björn Köhnlein (2021). "North Germanic Tonal Accent is Equipollent and Metrical: Evidence from Compounding". In: *Proceedings of the 2020 Annual Meeting on Phonology*. Ed. by Ryan Bennett, Richard Bibbs, Mykel Loren Brinkerhoff, Max J. Kaplan, Stephanie Rich, Amanda Rysling, Nicholas Van Handel, and Maya Wax Cavallaro.

Kaldhol, Nina Hagen and Sharon Rose (2024). *Case marking and word order in Moro and Tira*. Annual Conference on African Linguistics 55, McGill University.

Kaldhol, Nina Hagen, Sharon Rose, and Mark Simmons (Accepted). "Prosody of topic and focus in Tira". In: *Proceedings of the Cross-disciplinary workshop on information structure in African languages*.

Kaldhol, Nina Hagen and Sverre Stausland Johnsen (2021). "Grammaticalization in Somali and the development of morphological tone". In: *Proceedings of the Linguistic Society of America*. Ed. by Patrick Farrell. Vol. 6. 1, pp. 587–599.

— (Forthcoming). "There is no 'one High tone per word' rule in Somali". In: *Synchronic and diachronic aspects of tonal accent*. Ed. by Björn Köhnlein and Pavel Iosad. Oxford: Oxford University Press.

Kim, Klaus, Nina Hagen Kaldhol, and Sharon Rose (in prep.). *Grammatical tone and person marking in the Rere (Koalib) verb*.

Kingston, John (2011). "Tonogenesis". In: *The Blackwell Companion to Phonology*. Ed. by Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume, and Keren Rice. John Wiley and Sons.

Kisseberth, Charles W. and Mohammad Imam Abasheikh (2011). "Chimwiini phonological phrasing revisited". In: *Lingua* 121.13, pp. 1987–2013.

Kristoffersen, Gjert (1992). "Tonelag i sammensatte ord i østnorsk". In: *Norsk lingvistisk tidsskrift* 10.2, pp. 39–65.

— (2000). *The Phonology of Norwegian.* Oxford: Oxford University Press.

Krott, Andrea, R. Harald Baayen, and Robert Schreuder (2001). "Analogy in morphology: modeling the choice of linking morphemes in Dutch". In: *Linguistics* 39.1, pp. 51–93.

Krott, Andrea, Robert Schreuder, R. Harald Baayen, and Wolfgang U. Dressler (2007). "Analogical effects on linking elements in German compound words". In: *Language and Cognitive Processes* 22.1, pp. 25–57.

Kubozono, Haruo and Mikio Giriko, eds. (2018). *Tonal Change and Neutralization.* Berlin/Boston: De Gruyter Mouton.

Ladd, D. Robert, Bert Remijsen, and Caguor Adong Manyang (2009). "On the distinction between regular and irregular inflectional morphology: Evidence from Dinka". In: *Language,* pp. 659–670.

Lahiri, Aditi, Allison Wetterlin, and Elisabet Jönsson-Steiner (2005). "Lexical specification of tone in North Germanic". In: *Nordic Journal of Linguistics* 28 (1), pp. 61–96.

Leemann, Adrian, Péter Jeszenszky, Carina Steiner, Melanie Studerus, and Jan Messerli (2020). "Linguistic fieldwork in a pandemic: Supervised data collection combining smartphone recordings and videoconferencing". In: *Linguistics Vanguard* 6.3.

Lehmann, Christian (2020). "Univerbation". In: *Folia Linguistica* 41.1, pp. 205–252.

Lévêque, Dimitri and Thomas Pellard (2023). "The implicative structure of Asama verb paradigms: A quantitative study of segmental and suprasegmental alternations". In: *Morphology* 33.3, pp. 261–286.

Lewis, Geoffrey (2001). *Turkish Grammar.* Oxford: Oxford University Press.

Luís, Ana and Ricardo Bermúdez-Otero (2016). *The morphome debate.* Oxford: Oxford University Press.

Marlo, Michael (2013). "Verb tone in Bantu languages: micro-typological patterns and research methods". In: *Africana Linguistica* 19.1, pp. 137–234.

Matthews, Peter H. (1972). *Inflectional Morphology: a theoretical study based on aspects of Latin verb conjugations.* Cambridge: Cambridge University Press.

— (1974/1991). *Morphology.* Cambridge: Cambridge University Press.

McPherson, Laura and Jeffrey Heath (2016). "Phrasal grammatical tone in the Dogon languages: The role of constraint interaction". In: *Natural Language and Linguistic Theory* 34, pp. 593–639.

Merrifield, W. R. and A. E. Anderson (2007). *Diccionario Chinanteco de la diáspora del pueblo antiguo de San Pedro Tlatepuzco, Oaxaca.* 2nd ed. Serie de vocabularios y diccionarios indígenas "Mariano Silva y Aceves" 39: Mexico DF: Summer Linguistic Institute.

Monich, Irina (2020). "Morphology and Tone". In: *Oxford Research Encyclopedia of Linguistics.*

Montrul, S. A. (2008). *Incomplete acquisition in bilingualism: Re-examining the age factor.* Amsterdam/Philadelphia: John Benjamins Publishing Company.

Moreno, Martino Mario (1939). *Grammatica teorico-pratica della lingua galla.* Milan: A. Mondadori.

Mous, Maarten (2012). "Cushitic". In: *The Afroasiatic Languages.* Ed. by Zygmunt Frajzyngier and Erin Shay. Cambridge: Cambridge University Press, pp. 342–422.

Naba, Jean-Claude (1994). *Le Gulmancema: Essai des systématisation.* Köln: Rüdiger Köppe Verlag.

Newman, Paul (1986). "Tone and affixation in Hausa". In: *Studies in African Linguistics* 17.3.

— (2000). *The Hausa Language : An Encyclopedic Reference Grammar.* New Haven: Yale University Press.

Nurse, Derek (2007). "Did the Proto-Bantu verb have a Synthetic or an Analytic Structure?" In: *SOAS Working Papers in Linguistics* 15, pp. 243–260.

Nüsslein, Ulrike (2020). *A Grammar of Kordofanian Julut with Particular Consideration of the Verbal Morphology.* Köln: Rüdiger Köppe Verlag.

Odden, David and Lee Bickmore (2014). "Melodic tone in Bantu: overview". In: *Africana Linguistica* 20.1, pp. 3–13.

Palancar, Enrique L. (2016). "A typology of tone and inflection: A view from the Oto-Manguean languages of Mexico". In: *Tone and Inflection: New facts and new perspectives.* Ed. by Enrique L. Palancar and Jean Léo Léonard. Berlin/Boston: De Gruyter Mouton, pp. 109–139.

Palancar, Enrique L. and Jean Léo Léonard, eds. (2016). *Tone and Inflection: New facts and new perspectives.* Berlin/Boston: De Gruyter Mouton.

Parker, Jeff and Andrea D. Sims (2020). "Irregularity, paradigmatic layers, and the complexity of inflection class systems: A study of Russian nouns". In: *The Complexities of Morphology.* Ed. by Peter Arkadiev and Francesco Gardani. Oxford: Oxford University Press, pp. 23–51.

Pellegrini, Matteo (2023). *Paradigm Structure and Predictability in Latin Inflection: An Entropy-based Approach*. Vol. 6. Studies in Morphology. Springer.

Plank, Frans (1991). "Of abundance and scantiness in inflection: A typological prelude". In: *Paradigms: The Economy of Inflection*. Ed. by Frans Plank. Empirical Approaches to Language Typology 9. Berlin/New York: Mouton de Gruyter, pp. 1–40.

Quint, Nicolas (2006). "Do you speak Kordofanian?" In: *7th International Sudan Studies Conference*. Norway: University of Bergen.

— (2010). "Benefactive and malefactive verb extensions in the Koalib verb system". In: *Benefactives and malefactives: Typological perspectives and case studies*. Ed. by Seppo Kittilä and Fernando Zúñiga. Amsterdam: John Benjamins Publishing Company, pp. 295–315.

Quint, Nicolas and Marc Allassonnière-Tang (2022). "Inferring case paradigms in Koalib with computational classifiers". In: *Corpus Linguistics and Linguistic Theory*.

Riad, Tomas (2006). "Scandinavian accent typology". In: *STUF - Sprachtypologie und Universalienforschung* 59.1, pp. 36–55.

Ritchart, Amanda and Sharon Rose (2017). "Moro vowel harmony: implications for transparency and representations". In: *Phonology* 34.1, pp. 163–200.

Roettger, Timo B. (2017). *Tonal placement in Tashlhiyt: How an intonation system accommodates to adverse phonological environments*. Vol. 3. Studies in Laboratory Phonology. Berlin: Language Science Press.

Rolle, Nicholas and Lee Bickmore (2022). "Outward-sensitive phonologically-conditioned suppletive allomorphy vs. first-last tone harmony in Cilungu". In: *Morphology* 32.2, pp. 197–247.

Rolle, Nicholas R. (2018). "Grammatical tone: Typology and theory". PhD thesis. University of California Berkeley.

Rose, Sharon (2013). "The morphological structure of the Moro verb". In: *Nuba Mountain Language Studies*. Ed. by Thilo N. Schadeberg and Roger M. Blench. Köln: Rüdiger Köppe Verlag, pp. 25–56.

— (2021). *Tone of person marking in Rere (Koalib)*. ICU LINC African Linguistics.

— (2023). *Inalienable possessives in the Heiban languages*. The 54th Annual Conference on African Linguistics, University of Connecticut.

— (2024). *Syntactic tone and tone spreading in Rere*. WCCFL42, University of California, Berkeley.

Rose, Sharon, Farrell Ackerman, George Gibbard, Peter Jenks, Laura Kertz, and Hannah Rohde (2014). "In-situ and ex-situ wh-question constructions in Moro". In: *Journal of African Languages and Linguistics* 35.1, pp. 91–125.

Round, Erich R. (2015). "Rhizomorphomes, meromorphomes, and metamorphomes". In: *Understanding and Measuring Morphological Complexity*. Ed. by Matthew Baerman, Dunstan Brown, and Greville G. Corbett. Oxford: Oxford University Press, pp. 28–52.

Sande, Hannah (2023). "Is grammatical tone item-based or process-based?" In: *Phonology* 39.3, pp. 399–442.

Saussure, Ferdinand de (1916/2013). *Course in General Linguistics. Translated and annotated by Roy Harris*. London: Bloomsbury.

Schadeberg, Thilo C. (2020). "Tmesis in Ebang (Heiban, Kordofanian)". In: *Faits de Langues* 51.1, pp. 79–98.

Schadeberg, Thilo C. and Maarten. Kossmann (2010). "Participant reference in the Ebang verbal complex (Heiban, Kordofanian)". In: *Journal of African Languages and Linguistics* 31.1, pp. 79–100.

Schadeberg, Thilo N. (1981a). *A survey of Kordofanian, volume one, the Heiban group*. Hamburg: Helmut Buske Verlag.

— (1981b). "The Classification of the Kadugli Language Group". In: *Nilo-Saharan*. Ed. by Thilo N. Schadeberg and M. Lionel Bender. Foris Publications, pp. 291–305.

Seliger, H. W. and R. M Vago (1991). *First language attrition*. Cambridge: Cambridge University Press.

Seuren, Lucas M., Joseph Wherton, Trisha Greenhalgh, and Sara E. Shaw (2021). "Whose turn is it anyway? Latency and the organization of turn-taking in video-mediated interaction". In: *Journal of Pragmatics* 172, pp. 63–78.

Shannon, Claude E. (1948). "A mathematical theory of communication". In: *Bell system technical journal* 27.3, pp. 379–423.

Simmons, Mark (2022a). *Extension suffixes in Tira*. Ms., University of California San Diego.

— (2022b). *Possessor Raising and External Possession in Tira*. Ms., University of California San Diego.

— (2023). *Diachrony of morphologically constrained rounding harmony in Tira*. Ms., University of California San Diego.

Sims, Andrea D. (2015). *Inflectional defectiveness*. Cambridge University Press.

Sims, Andrea D. (2020). "Inflectional networks: Graph-theoretic Tools for Inflectional Typology". In: *Proceedings of the Society for Computation in Linguistics* 3, pp. 88–98.

Sneller, Betsy (2022). "COVID-era sociolinguistics: introduction to the special issue". In: *Linguistics Vanguard* 8.3, pp. 303–306.

Stevenson, Roland C. (1942/2009). "A Grammar of Tira". In: *Tira and Otoro: Two Kordofanian Grammars by Roland C. Stevenson*. Ed. by Thilo C. Shadeberg. Köln: Rüdiger Köppe Verlag, pp. 1–114.

— (1943/2009). "A Grammar of Otoro". In: *Tira and Otoro: Two Kordofanian Grammars by Roland C. Stevenson*. Ed. by Thilo N. Schadeberg. Rüdiger Köppe Verlag.

— (1961). "Linguistic research in the Nuba Mountains I". In: *Sudan Notes and Records* 43, pp. 118–130.

— (1964). "Linguistic research in the Nuba Mountains II". In: *Sudan Notes and Records* 45, pp. 79–102.

Strabone, Andrew and Sharon Rose (2012). "Morphophonological Properties of Moro Causatives". In: *Selected Proceedings of the 41st Annual Conference on African Linguistics: African Languages in Contact*. Ed. by Bruce Connell and Nicholas Rolle. Somerville, MA: Cascadilla Proceedings Project, pp. 92–103.

Stump, Gregory (2014). "Polyfunctionality and inflectional economy". In: *Linguistic Issues in Language Technology* 11, pp. 73–93.

— (2017). "The nature and dimensions of complexity in morphology". In: *Annual Review of Linguistics* 3, pp. 65–83.

Stump, Gregory and Raphael A. Finkel (2013). *Morphological Typology: From Word to Paradigm*. Cambridge: Cambridge University Press.

Thornton, Anna M. (2019). "Overabundance: A Canonical Typology". In: *Competition in Inflection and Word-Formation*. Ed. by Franz Rainer, Francesco Gardani, Wolfgang U. Dressler, and Hans Christian Luschützky. Studies in Morphology 5. Springer, pp. 223–258.

Trommer, Jochen (2012). "Zero Exponence". In: *The Morphology and Phonology of Exponence*. Ed. by Jochen Trommer. Oxford: Oxford University Press, pp. 343–371.

— (2024). "The concatenative structure of tonal overwriting". In: *Linguistic Inquiry* 55.1.

Volk, Erez (2011). "Mijikenda tonology". PhD thesis. Tel-Aviv University.

Watters, Kathie S. (1993). "The Status and Function of Tone in Tira". MA thesis. University of Nairobi.

Welmers, William E. (1973). *African Language Structures*. Berkeley, Los Angeles, London: University of California Press.

Wetterlin, Allison and Aditi Lahiri (2012). "Tonal alternations in Norwegian compounds". In: *The Linguistic Review* 29, pp. 279–320.

Williams, Nicholas, W. D. L. Silva, Laura McPherson, and Jeff Good (2021). "COVID-19 and documentary linguistics: Some ways forward". In: *Language Documentation and Description* 20, pp. 359–377.

Wilmoth, Sasha and John Mansfield (2021). "Inflectional predictability and prosodic morphology in Pitjantjatjara and Yankunytjatjara". In: *Morphology* 31.4, pp. 355–381.

Woodbury, Anthony (2019). "Conjugational double-classification: The separate life cycles of prefix classes vs. tone ablaut classes in aspect/mood inflection in the Chatino languages of Oaxaca, Mexico". In: *Amerindia* 41, pp. 75–120.

Yang, Cathryn and Yi Xu (2019). "Crosslinguistic trends in tone change: A review of tone change studies in East and Southeast Asia". In: *Diachronica* 36.3, pp. 417–459.

Yip, Moira (2002). *Tone*. Cambridge: Cambridge University Press.