Typological tendencies in verse and their cognitive grounding

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Part I

How verse templates are built

2 Numeric control in verse constituent structure

2.1 Introduction

This chapter investigates verse constituent structure from a typological perspective. Songs and poems typically follow some abstract template like a stanza form composed of two couplets, where each line within the couplet is divided into four musical beats. Regularities such as the repetition of a melody, the placement of beats, stressed syllables and pauses, or the rhyming patterns make this kind of segmentation transparent. Here, I provide an overview of segmentation cues used in verse templates from different traditions, and discuss how they can inform the problem of numeric control during the creation of verse. By numeric control I refer to the fact that verse constituents often require a discrete number of sub-sections, such as four-line stanzas or seven-syllable lines. This case study illustrates the kind of research questions which can benefit from thorough typological data on verse traditions. Besides, numeric control relates more generally to aspects of human cognition such as working memory constraints, which can be helpful in explaining the observed typological data. Conversely, limits in the variation of verse forms can be informative for theories of numeric cognition.

2.1.1 Segmentation in music analysis and cognition

The study of segmentation plays a prominent role in the fields of music analysis and cognition. Most studies focus on instrumental music, and on how *listeners* make sense of the acoustic input, i.e. which cues they use to chunk continuous event sequences into discrete, meaningful sections. This chapter, instead, addresses the issue of segmentation from the perspective of the creator of verse. Although not identical, the cues used in perception are likely to overlap with those meaningful during production.

In their influential book on the analysis of Western tonal music, Lerdahl & Jackendoff (1983:13) hold that "grouping can be viewed as the most basic component of musical understanding." By analysing a range of pieces of tonal music and their own intuitions on how these are parsed, the authors put forward a collection of well-formedness and preference rules for the segmentation and grouping of music stimuli. For instance, part of the second Grouping Preference Rule states that, in "a sequence of four notes $n_1 n_2 n_3 n_4$ (...) the transition $n_2 n_3$ may be heard as a group boundary if the interval of time between the attack points of n_2 and n_3 is greater than that between the attack points of n_1 and n_2 and that between the attack points of n_3 and n_4" (Lerdahl & Jackendoff 1983:45). Some rules are music-specific, while others resemble more generally Gestalt-type principles of perception, such as the cited rule on the proximity of adjacent events. The *implication-realization model* by Narmour (1990) offers a similar kind of approach to an ideal listener's grouping of musical inputs, but concentrating specifically on the pitch-structure.

In *The cognition of basic musical structures*, Temperley (2001) develops a comparable formalisation of grouping based on preference rules, and he implements and tests them computationally. After this kind of bridge work between theoretical and computational approaches, a wealth of studies have emerged within the field of music information retrieval (Burgoyne, Fujinaga & Downie 2015). These have offered the possibility of grounding empirically introspection-based proposals, and further refining them. Brown, Gifford & Davidson (2012), for instance, implement the principles of melodic closure proposed by Narmour (1990) and test the algorithms against a corpus of more than 3000 folk tunes. Nieto & Bello (2016) evaluate the performance of eight previously-published computational algorithms designed to analyse the constituent structure of music audio recordings. A lengthier overview of how the music information retrieval community tackles the problem of segmentation is provided by Rodríguez López (2016), with a thorough taxonomy of the main segmentation cues treated in the literature.

Besides computation, the main empirical grounding for segmentation cues comes from music psychology studies. Deutsch (2013, and other contributions within the volume) discusses state-of-the-art experiments on music segmentation, and how they relate to theoretical proposals such as those by Lerdahl & Jackendoff (1983) and Narmour (1990). Besides providing experimental evidence for well-established grouping cues such as pitch proximity, perception studies have also enabled the demonstration of otherwise difficult to proof principles, e.g. that listeners heavily rely on transition probabilities between adjacent notes to abstract motifs which are readily identifiable in future input (Saffran et al. 1999).

The study of verse constituent structure can draw important insights from this kind of research on music segmentation, particularly because most verse traditions are sung. Nevertheless, a study of verse segmentation needs to take into account its linguistic features as well. As a matter of fact, the main available source of evidence for grouping and segmentation in verse are structural analyses of the verbal material in poetic corpora, from which researchers infer a set of abstract templates (also known as *poetic metres*). These are meant to capture the regularities found in the texts, and reflect the emic structures employed in a productive way by the original creators. Studies on the verse of European languages tend to focus on a genre (e.g. the French alexandrine, Dominicy 1992), but other studies may deal with individual songs (e.g. a Havasupai *Origin Song*, Hinton 1990), or with the (virtually) complete verse repertoire of a language (e.g. the songs of the Pintupi, Moyle 1979).

Besides language-specific studies, there have been a number of attempts at summarising the range of possible principles used in verse traditions across the world (Lotz 1960; Fabb 1997; Aroui 2009). These provide insightful taxonomies to understand the basis on which verse constituents *can* be defined. That is comparable to the traditional goal of linguistic typology, i.e. "to determine the limits of possible human languages" (Bickel 2007:239). More recently, however, "instead of asking 'what's possible?', more and more typologists ask 'what's where why?'" (Bickel 2007:239). A comprehensive typology of verse constituent structure, thus, needs to examine balanced samples of verse traditions, and address issues of geographical and genealogical skewing both from a synchronic and a diachronic perspective. Within this context, the present study focuses exclusively on synchronic explanations to patterns which appear to follow a global skew.

2.1.2 Typological approaches to verse

Compared to other aspects of language, such as the syntax or phonology of everyday speech, versification systems have not received as much worldwide typological investigation. There are several reasonable explanations for this. First, verse arguably plays a marginal role in all societies compared to speech. Second, verse productions are more prone to particular kinds of creativity which reflect the inventiveness and idiosyncrasies of an individual singer, composer or poet, rather than a core set of conventional structures shared across the community. Compare, for instance, the phonological inventory or number system of a language, with its inventory of melodies or metrical patterns; the latter tend to be open-ended and more unstable. Third, partly due to the previous two issues, there has been less theorization in the field of metrics, which may have hindered the development of comparative concepts necessary in a typological enterprise (Haspelmath 2010).

Nonetheless, some attempts have been made to capture patterns of stability and variation across verse traditions. The ethnomusicologist Alan Lomax led a seminal enterprise in the 1960s to study song systems from a comparative perspective. The ambitious Cantometrics project (Lomax & Grauer 1968; Lomax 1976) surveyed a sample of more than 4000 songs from ca. 400 cultures. Each song was analysed by completing a questionnaire covering 37 features, related to aspects such as the performers (e.g. presence of soloists, chorus, instruments), rhythm (e.g. simple, complex, irregular metre), melodic shape and range (e.g. arched, terraced), or phonation features (e.g. falsetto, nasalized).

Although this kind of comparative studies had been largely abandoned (Patel & Demorest 2013), the original Cantometrics approach has received renewed attention in the twenty-first century. The CantoCore project (Savage et al. 2012; 2015b) builds upon the same questionnaire-based methodology, improves the inter-rater reliability, and omits performance and instrument-related features to focus on 26 aspects related to the structure of vocal songs. Some of these features are potentially useful for a typological study of constituent structure, e.g. feature #2 (number of beats in a bar), or feature #21 (phrase repetition). However, their usefulness for the purposes of this chapter is limited by two methodological issues. First, for each question, only the maximal value found in the song is chosen. Second, the responses are expected to fall within a discrete number of categories: e.g. feature #2 (number of beats in a bar) takes three possible values: duple, triple, and complex (i.e. "the number of beats can only be divided by prime numbers greater than 3" Savage et al. 2012:95). On the one hand, there is a general granularity issue, i.e. by accepting a single, maximal value per song, we are capturing the upper limits and ignoring within-song heterogeneity. On the other hand, employing pre-defined, closed sets of feature values interferes with typological aims:

> Traditional typological databases first define a set of crosslinguistic types in a functionally defined domain (...) and then assign each language in the sample to a type. One problem of this procedure is that the initial definitions make it unlikely that hitherto unknown types can ever be discovered: if a type does not fit the original scheme, it is usually treated as a transitional phenomenon, although outside the a priori typology it may as well be a primitive type of its own. (Bickel & Nichols 2002)

Although not ideal for the research question at hand, datasets using the CantoCore methodology prove to capture an adequate amount of inter-population variation. This has enabled the use of verse data to address questions of population migration (Brown et al. 2014; Savage et al. 2015a). Further along this method-

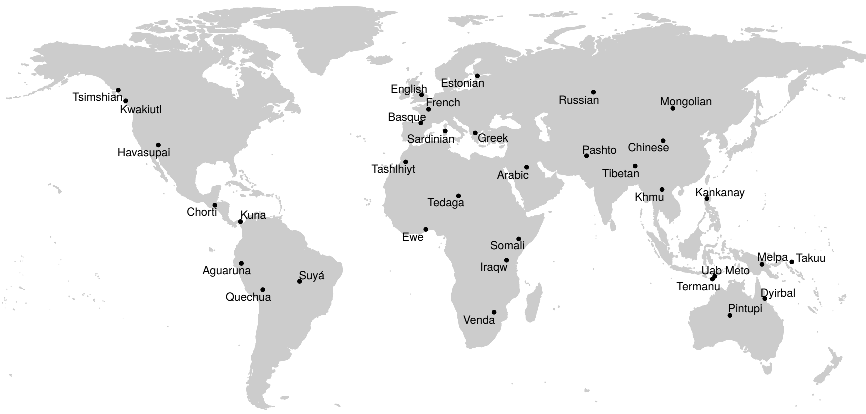


Figure 2.1: Languages discussed in the chapter.

ological line, Le Bomin, Lecointre & Heyer (2016) exploit 322 features (mostly binary, encoding presence or absence) to demonstrate the vertical transmission of musical features among 58 populations from Gabon.

In addition to musicological surveys, linguists and literary scholars have long compiled repertoires of metrical templates, focusing on European traditions. These typically overlook musical aspects, but, unsurprisingly, offer more rigorous analyses of phonological features such as stress and vowel length. Recently, efforts are being made to integrate datasets from different languages, opening the possibility for comparative work (González-Blanco García, Manailescu & Ros 2016). A promising pilot database within the linguistic approach to verse is Versetyp (Versace & Fabb 2011). It follows a typological-questionnaire methodology comparable to the Cantometrics, although the fields are less restricted, hence being more prone to capturing variation.

The data I discuss in this chapter, combined with the lessons from these typological projects, may prove useful for a future collection of constituent structure data. Such an enterprise can be minimally divided into two modules. First, a prerequisite would be to compile a database of available published resources on the verse traditions of the world's languages (this can be modelled e.g. after the Glottolog repository of linguistic references, Nordhoff & Hammarström 2011). Second, a coherent way of representing verse templates is needed, in order to capture the complete constituent structure and the feature specifications associated to each constituent (e.g. Humphrey et al. 2014 for a convenient JSON-based approach).

The remainder of the chapter is divided into two sections, closed by a general discussion. In Section 2.2 I provide a catalogue of cues or strategies used in different traditions to demarcate verse constituents. The data is based on sources about the versification system of several languages from all major landmasses of the world. The approximate location of the main languages discussed in the text are shown in Figure 2.1, and a complete list with additional details is available in Table 2.1 of the Supplementary Information.

The sampling of languages is not by any means comprehensive, yet it attempts to maximise the genealogical coverage given the available bibliographical sources. In the process of selecting languages, I check whether verse templates are reported, or, in the lack of templates, whether analyses of individual songs are provided. The description of templates is usually preferred because, arguably, it reflects more accurately the cognitive structure and principles used to create the songs. In Section 2.3, I discuss the range of numeric control requirements observed in the analysed templates. Finally (Section 2.4), I propose that the way in which verse constituents are segmented, and their numeric demands, reflect limits on working memory, and how chunking strategies can alleviate them.

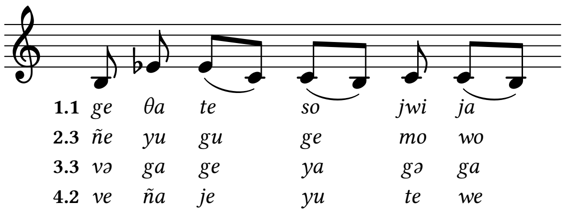
2.2 Segmentation cues in verse

The segmentation cues observed in the data can be grouped into three categories: (1) parallelism, (2) contrast, (3) boundary marking. Probably the most widespread example of parallelism is melodic parallelism, that is, the repeated use of a melodic contour with different words attached to it. Boundary marking can overlap with parallelism, as in the case of line-final rhyme, where some degree of phonological parallelism is required for the rhyming segments to fulfil their bounding function. The use of contrast can also be used in a parallel fashion, e.g. when each stanza alternates a solo line and a group line. Nonetheless, these two kinds of cues can also work independently of parallelism, by relying on locally detectable features, such as the lengthening of the line-final syllable.

2.2.1 Parallelism

Parallelism establishes an identity relation between two or more sections of text. As such, parallelism is inherent to the notion of verse template, as it always relies on the reiteration of some structural pattern. Jakobson (1966a:399) opens a major article on poetic parallelism with the following quote by the nineteenth-century poet Gerard Manley Hopkins: “The artificial part of poetry, perhaps we shall be right to say all artifice, reduces itself to the principle of parallelism.” This cen-

Example 2.1: Melodic parallelism in a Havasupai *Sweathouse Origin Song* (Hinton 1984:236). All four lines have different texts but are set to the same tune. Numbers correspond to the line identifiers in the original publication.



trality of parallelism as a defining feature of verse is also highlighted by Anthony Seeger (2004:45) when he places seven categories of Suyá [Nuclear-Macro-Je; Je][1] verbal production on a continuum according to their level of fixity or parallelism, starting with free, everyday speech, and ending with entirely fixed songs based on extensive repetition and parallelism.

2.2.1.1 Melodic parallelism

Melodic parallelism is extremely common. Whenever a tune is used repeatedly with different words attached to it we can talk of melodic parallelism. As with all kinds of parallelism, we can be more easily aware of it if the parallel sections are adjacent. Strophic songs are a widespread example, and it is straightforward to locate in song collections because most often the musical notation is given only for one of the strophes, and for the remainder just the words are provided. This kind of presentation of strophic songs with melodic parallelism can be observed in the Havasupai [Cochimi-Yuman; Yuman] *Sweathouse Origin Song* (Hinton 1984; 1990), in the Northern Kankanay [Austronesian; Nuclear Austronesian] songs transcribed by Maceda (1958), or in the study of Tashlhiyt [Afro-Asiatic; Berber] versification by Dell & Elmedlaoui (2008). Example 2.1 shows four sample lines from the Havasupai *Sweathouse Origin Song*, all set to the same tune.

Another context where melodic parallelism is very clearly manifest is improvised verse. In Basque [Isolate] (and in many other languages, e.g. Yaqub 2007 for Palestinian Arabic [Afro-Asiatic; Semitic], Zedda 2009 for Sardinian [Indo-European; Italic]), a singer chooses a melody from a conventional repertoire and uses it as a placeholder to produce new strophes (Egaña 2007). This can also be done in the form of a duel, where the melody is used in alternation by two differ-

[1] In the first mention of a language, I include its genealogical information between brackets, extracted from Glottolog (Nordhoff & Hammarström 2011).

ent singers. The complete text can be easily divided tracking each repetition of the tune.

Melodic parallelism can also mark the internal structure of a strophe by establishing identity relations between lines. Verse scholars often make explicit these kinds of parallel structure by describing the formal composition of a song using codes such as *aabb*, where each of the letters corresponds to the melodic contour of a line. Some of the many languages for which lines with parallel melodies have been reported are Melpa [Nuclear Trans New Guinea; Central East New Guinea Highlands] (Niles 2011), Suyá (Seeger 2004), or Venda [Atlantic-Congo; Volta-Congo] (Blacking 1969). From a production perspective, creating a stanza with the melodic structure *aabb* can be conceived as creating two groups of two lines with parallel melodies instead of four disconnected lines.

An important issue concerning parallelism in general and melodic one in particular is the fact that the link between the terms is one of similarity; that is, identity with some difference. In the Melpa *amb kenan* courting song, the central section of each stanza is divided into two halves, where "the first half of the melody is partially tonally transposed a step lower in the second part" (Niles 2011:281). The melodic parallelism between the two sections provides a cue to group them together and differentiate them from the preceding or following material; however, the fact that they are similar but not *identical* makes it possible to set apart the two sections as different objects (a_1a_2), and not as a reiteration of the same object ($a \times 2$).

The Melpa kind of parallelism-with-a-difference can be considered to be encoded in the template, since it remains constant throughout the song. In other cases, though, differences in melodic detail of otherwise parallel sections can be attributed to the instantiation of the template; hence, these differences cannot play a structural role in the planning of a new text. For instance, every line of the Venda *domba* female initiation song uses the same basic melody, but with variations: "the melody of the last five syllables of each word-phrase remains the same throughout, but that of the first four (or three, five or six) syllables varies according to changing patterns in the speech-tones of the words" (Blacking 1969:256). The lack of complete sameness between the lines, thus, is not employed as a grouping or segmentation cue, but rather derives from the process of setting new words to the same melody.

2.2.1.2 Rhythmic parallelism

In many cases, the melodic structure of songs and poems is either unspecified or unreported. Verse classified as spoken poetry (of the kind well-known in European languages), for instance, does not employ melodic parallelism. Chanted verse such as that present in nursery rhymes often do not require fixed pitch sequences either, but follow intonational contours similar to those used in speech. The length of a melody very frequently determines the length of verse lines; in the absence of melodies, rhythmic parallelism can serve this purpose. By rhythmic parallelism I refer to the formal identity in the number of temporal units, be it syllables, linguistic accents, or musical beats, among others.

Syllabic poetry constitutes a simple case of this kind of parallelism. Each line of French [Indo-European; Italic] classical alexandrine contains twelve full syllables, plus an optional schwa (Dominicy 1992:161). This equal number of placeholders per section provides parallel templates where the words can be attached to. In Classical Tibetan [Sino-Tibetan; Bodic], one of the most common forms is the heptasyllabic quatrain, where each line consists of seven syllabic placeholders (Poucha 1950:196). The rhythmic parallelism in classical Tibetan is more detailed; beyond mere placeholders, there is evidence that lines tend to share the placement of stress. Tibetan shows fixed word-initial stress, and most lines are made up of two bisyllabic words followed by a trisyllabic one, giving the general structure (σ́σ)(σ́σ)(σ́σσ) (Vekerdi 1952:223). Besides the syllabic parallelism, there is evidence of stress parallelism too.

This brings us to a generalisation about rhythmic parallelism. The rhythmic identity between sections relies on an equal number of placeholders; these, however, can be defined in several ways. A placeholder can correspond to a simple phonological constituent like the syllable, it can be further specified as a stressed or heavy syllable, or it can correspond to a non-phonological category such as the musical beat. The key principle is that the size of the parallel sections is controlled by a template where a number of placeholders are required. A melody can also control the size of the constituents; nonetheless, we categorise melodies differently (i.e. as melodic parallelism) for two reasons. First, the identity of a melody can be recognized and used as template in spite of variations in the number of notes or placeholders, as long as certain interval and contour properties are preserved (Deutsch 2013b). Second, each placeholder in a melodic template can take many more values (i.e. notes of a scale) than rhythmic placeholders, where mostly unary (syllabic placeholder) or binary (heavy or light syllable) features are employed.

Example 2.2: First three stanzas of the song *Fast car* by Tracy Chapman, with number of syllables per line. Each line is set to two four-beat musical bars, but the number of syllables per line varies throughout.

5 *You got a fast car*
9 *I want a ticket to anywhere*
6 *Maybe we make a deal*
10 *Maybe together we can get somewhere*
6 *Anyplace is better*
10 *Starting from zero got nothing to lose*
6 *Maybe we'll make something*
9 *Me, myself I got nothing to prove*

5 *You got a fast car*
10 *I got a plan to get us out of here*
10 *I been working at the convenience store*
12 *Managed to save just a little bit of money*
6 *Won't have to drive too far*
11 *Just 'cross the border and into the city*
7 *You and I can both get jobs*
12 *And finally see what it means to be living*

9 *You see my old man's got a problem*
11 *He live with the bottle that's the way it is*
10 *He says his body's too old for working*
9 *His body's too young to look like his*
8 *My mama went off and left him*
10 *She wanted more from life than he could give*
11 *I said somebody's got to take care of him*
9 *So I quit school and that's what I did*

Controlling the length of sections with an equal number of beats is a very common type of rhythmic parallelism. Take, for instance, the song *Fast car* by Tracy Chapman. The first three stanzas are shown in Example 2.2, each line preceded by the number of syllables it contains. All three stanzas follow the same template, defined, among other things, by being composed of eight lines of the same duration: one musical bar with four beats. This temporal placeholder is used to set new lines of text, which can be composed of a varying number of syllables. Lines contain between 5 and 12 syllables, and no single line shows the same number of syllables across the three stanzas.

Nursery rhymes in many languages employ beat-number parallelism without syllable-number parallelism (Burling 1966). Very frequently, lines have a length of four beats but an unequal number of syllables, such as *Hickory dickory dock*, with lines of 6, 7 or 8 syllables set to the constant four-beat structure. Still, it is also common to employ both beat-number and syllable-number parallelism, such as in *Eeny meeny miny moe*. The tunes used in the traditions of Basque improvised verse (Egaña 2007) and Tashlhiyt singing (Dell & Elmedlaoui 2008) also follow both types of parallelism.

Finally, there are verse traditions where evidence for a musical beat is lacking, where the number of syllables per line is not constant, but where we can infer the use of rhythmic parallelism. Medieval poetry in Germanic languages such as Dutch, English or German, the number of stressed syllables per line is kept constant, with freedom with respect to the occurrence of unstressed syllables (Gasparov 1996). To be sure, this is very similar to beat-parallelism (cf. Example 2.2 by Tracy Chapman), but with no evidence of isochrony between stresses, due to shortage of documentation on how these texts were performed.

2.2.1.3 Semantic and syntactic parallelism

In the field of metrics, the term *parallelism* usually refers to the juxtaposition of semantically paired constituents: "perhaps the most familiar and recognized variety of parallelism is semantic parallelism, especially at the level of the metrical line in relation to adjacent verses" (Frog 2014:12). We can track this association between *parallelism* and *semantic identity* back to the 18th century, when Robert Lowth presented an analysis of ancient Hebrew poetry as based primarily on semantically linked pairs of lines (Jakobson 1966b:399). This work initiated a line of research which has since analysed a wide variety of verse traditions in terms of semantic parallelism (see Fox 2014a for a thorough discussion, on which I rely for this section).

Geographic areas where this kind of verse composition seems most pervasive (or, at least, has attracted more scholarly attention) include Central America (e.g. Mayan), central Eurasia (e.g. Turkic, Mongolic), and Melanesia (e.g. Austronesian). Still, "the extent of the literature and the frequency with which canonical parallelism has been cited in different oral traditions suggest it is a phenomenon of near universal significance" (Fox 2014a:29).

Even if this kind of parallelism is reported for many languages, its spread is not as extensive as other putative universals such as the use of isochronous metres or melodic phrases (Brown & Jordania 2011). For instance, regarding Indo-European, one of the largest language families of the world, Jakobson (1966b:405) argues that Russian [Indo-European; Balto-Slavic] folk poetry is the "only living oral tradition (...) which uses grammatical parallelism as its basic mode of concatenating successive verses." It is worth noting that Jakobson refers here to *canonical* parallelism: "poetic patterns where certain similarities between successive verbal sequences are compulsory or enjoy a high preference" (Jakobson 1966b:399). As with other structuring strategies, semantic parallelism can also be used in a less strict way "as a device for creating cohesion within sequences" (Frog 2014:15).

A well-researched verse tradition where this kind of parallelism represents

Example 2.3: Parallel couplets in Termanu (Rotinese, Austronesian), taken from a funeral chant by Stefanus Adulanu (Fox 2014b:104).

	Termanu text	English translation
1	*Besak-ka ana lino ba'e*	Now she rests on a branch
	Ma sa'e ndanak.	And perches on a limb.
2	*De ana kukuta Dela Kolik*	She continues to munch Dela Kolik
	Ma mumumu Seko Bunak.	And continues to suck Seko Bunak.
3	*De na,a na-mada man*	She eats to dry her tongue
	Ma ninu na-meti apen-na.	And drinks to slake her thirst.
4	*De henu tein-na boe*	To fill her stomach
	Ma sofe nutun-na boe.	And to satisfy her gizzard.

the main composition strategy is that of Rote Island, Indonesia (Fox 2014b). In Example 2.3 I reproduce eight lines from a funeral chant in the language of Termanu [Austronesian; Nuclear Austronesian], organised into parallel couplets (Fox 2014b:104). The couplets are not only parallel semantically, but they also follow equivalent syntactic structures; this is evident, for instance, in the translation of the third couplet, where the structure of each line can be represented schematically as: [verb phrase] *to* [verb] *her* [noun]. Indeed, both kinds of parallelism appear to overlap very frequently, and, particularly, verse traditions for which syntactic parallelism is described, semantic parallelism is also always mentioned (e.g. Sherzer 1982 for Kuna [Chibchan; Core Chibchan], Lundström 1984 for Khmu [Austroasiatic; Khmuic], and Hull 2003 for Chorti [Mayan; Core Mayan]). According to Fox (2014a:30): "syntactic and semantic parallelism are often distinguished although they are just as often intimately related. In his use of the term *grammatical parallelism*, Jakobson attempts to encompass both."

Rotenese parallel couplets are based on dyads, i.e. pairs of semantically-related words which tend to be used together, such as 'branch'–'limb', 'munch'–'suck', or 'stomach'–'gizzard' (Example 2.3). Words may have more than one potential pair, effectively creating a semantic network from which to choose from to compose couplets. For instance, the word for 'stomach' is linked to 'gizzard', but also to 'breast', which can pair with 'womb'. These semantic networks are highly constrained, and using a non-conventional pairing is "immediately detectable and—among Rotenese—quickly challenged" (Fox 2014a:39). Yet more restrictedly, in the neighbouring island of Timor, Uab Meto [Austronesian; Nuclear Austronesian] speakers use a similar kind of parallelism, where "not only are the words which can form doublets fixed, but the order in which each member of a doublet occurs is also fixed" (Edwards 2016:329).

2.2.1.4 Repetition

All examples of parallelism reviewed so far involve an identity link between some, but not all, features of the parallel sections. Melodic and rhythmic parallelism may keep an invariant pitch or temporal structure while introducing new statements; grammatical parallelism may reiterate a single statement with a variation in wording. In this sense, the ultimate degree of parallelism is attained via exact repetition of both form and content.

The use of systematic repetition as a productive device appears infrequently compared to the other strategies. It is reported, for instance, in Coast Tsimshian [Tsimshian] verse, such as the *Great blue heron* children's song, where the first half (four musical bars) consists of an exact repetition of a two-bar line, and the second half introduces a different line (Mulder 1994:106). The relative scarcity of allusions to exact repetition may derive from the fact that repetitions are often considered an aspect of performance, and not inherent to the template underlying the text. Hence, some transcriptions omit the repetitions altogether to focus on the variable aspects of the performance (Hymes 1981), which makes it particularly challenging to evaluate systematic patterns of exact repetition and their geographic distribution.

Rhyme also creates parallel identity relations where a set of sounds are repeated among two or more sections of verse. Nevertheless, rhyme differs from the repetition of words in that (at least some of) the parallel sounds involved in rhyme typically belong to different morphemes (Aroui 2005:180). Besides being a parallel strategy, rhyming also typifies boundary marking strategies, and will be further discussed in Section 2.2.3.

2.2.2 Contrast

Parallelism often involves repetition with a difference, which implies an overlap with the principle of contrast. In Northern Ewe [Atlantic-Congo; Volta-Congo], for instance, some songs systematically alternate lines sung by a solo and by a group: "a leader 'calls' a line at a time, and the rest of the chorus responds by repeating it" (Agawu 1995:14). This kind of verse structuring with a systematic contrast between solo and group (also known as *call-and-response*) has worldwide presence (Lomax 1976), and is noted as being particularly pervasive across Africa (Stone 2010:307).

Nevertheless, it is not always the case that contrastive sections are also linked by an identity relation like in the Northern Ewe example. In several types of Iraqw [Afro-Asiatic; Cushitic] singing, such as the song *bumbunáy*, solo lines

Example 2.4: First stanza of a song performed by Pacyaya (Maceda 1958:46). The right edge of each line is marked by rhyme.

Northern Kankanay text	**English translation**
ay ínnáo ínnáo ínnáo	"Oh! goodness gracious me!"
kankaná? en nan dóng? ao	Says the little frog,
makétse nan ipogáo	"Cruel are the people;
uméyak isnan máttáo	I go to the grassy place
ay dada? ét manóngyao	And they burn me out.
ay ínnáo ínnáo ínnáo	Oh! goodness gracious me!"

also alternate with a group response, but the response consists of a fixed text while the words produced by the solo singer vary (own fieldwork).

The structure of the *bumbunáy* into pairs of lines, hence, relies on two contrasting principles: the solo vs group contrast, and the fixed vs changing text contrast. This second kind of contrastive cue is common in many traditions where the role of the group is to produce a refrain. In some cases, the refrain provides the solo singer with some time to think about the following improvised words, e.g. in Aguaruna [Jivaroan] drinking songs (Overall 2007:15). In other cases, the solo text may be pre-composed, so that the refrain works as an organizational device, or, perhaps, provides time to *recall* the following words from memory. The Tashlhiyt *Ndalb irbbi* song, for instance, alternates long sections of solo singing with a fixed group refrain (Dell & Elmedlaoui 2008:7).

Given the impossibility of having a whole group sing a just-improvised text in synchrony, it makes sense that groups produce the fixed section of a song. Nevertheless, an individual singer can also use the fixed-changing contrast without the need of a chorus. In the Melpa *Amb kenan* song described by Niles (2011), each line can be divided into three sections where the central one introduces new words while the other two are kept fixed throughout. Similarly, in the Sardinian *Anninnia di Bosa* lullaby, stanzas are composed of three lines, the last of which shows an invariant text.

A third contrastive principle often correlates with the preceding ones: the contrast between semantically meaningful and meaningless material. In songs such as the Tashlhiyt *Ndalb irbbi*, the refrain does contain a meaningful text; in other cases, such as in Aguaruna drinking songs or the Melpa *Amb kenan*, however, the sections with invariable text are made up of vocables (i.e. words with no semantic content). Suyá *akia* shout songs also provide a clear illustration, where each line of meaningful lyrics is followed by a sequence containing exclusively repetitions of the syllable *te* (Seeger 2004:41).

Example 2.5: First two stanzas of a lyrical song performed by Pajai (Kara 1970:197). The left edge of each line is marked by alliteration.

Mongolian text	**English translation**
čigig ilči-ni tengčeged	if there is enough humidity and warmth,
čečeg quwar-ni delgerejü bayin-a	flowers blossom.
čing sedkilten nököd qorsiyad	if loyal partners get together,
čenggel jirgal orgiju bayin-a	joy and happiness flourish.
usu naran-ni tengčeged	if there is enough water and sunlight,
urgumal bükü soyogalaju bayin-a	every plant grows.
uqagan sanay-a saragulsigad	if the intelligence and determination become clear,
urugsi dabsin gilayiju bayin-a	they shine as they move forward.

2.2.3 Boundary marking

The best known example of a boundary cue is probably rhyme. Consider the Northern Kankanay song under Example 2.4 about a little frog (Maceda 1958:46). This is the first of 22 stanzas, all following the same template. Each of the six lines in the stanza ends with the same sequence of phonemes: *ao*. The division of stanzas into lines is noticeable through several pieces of converging evidence, e.g. all lines are rhythmically parallel since they contain seven syllables and four musical beats. On top of that, the right edge of every line is marked by a rhyming sequence. It is important to note that this kind of boundary marking only works when repeated, so as to create an identity relation between lines. Rhyme, hence, belongs to the boundary marking category as well as to the parallelism category.

The mirror image of rhyme is alliteration, i.e. a sound identity at the left edge of constituents. Alliteration, like rhyme, does not *necessarily* correlate with a line boundary. In Somali [Afro-Asiatic; Cushitic] *geeraar* stanzas, for instance, each line includes a word alliterating in a specified phoneme, but these words do not need to be line-initial (Banti & Giannattasio 1996:99). Nevertheless, some traditions do use alliteration as a line-boundary cue. Example 2.5 reproduces the first two stanzas of a Jarut Mongolian [Mongolic; Eastern Mongolic] lyrical song performed by Pajai (Kara 1970:197).[2] Every line in the first stanza starts with *č*-, while the second stanza marks lines with an alliterating *u*-. Even if rhyme and alliteration correspond to two symmetric cases of boundary-marking parallelism, typological data suggest that rhyme is more frequent than alliteration (Fabb 1999).

Next, consider the case of the Iraqw *slufay* genre, where every line sung by

[2] I have based the English translation on the French version published by Kara (1970).

the solo singer is closed by a collective *haya* 'okay' (Beck & Mous 2014:361). Likewise, in Khmu *hrlɨɨ* solo singing, the end of each strophe is marked by the word *sáh* 'I say' (Lundström 1984:34). This too constitutes a line-boundary cue involving sound parallelism. Unlike rhyme and alliteration, however, the Iraqw and Khmu markers involve an exact repetition of a complete word. If we compare it to rhyming pairs such as *good-neighbourhood* or *high-sky* (from *Kaya* by Bob Marley), we observe that rhyme does not rely on repeating a morpheme, but rather draws an identity relation between phonemes from different morphemes.

In the Iraqw example, the boundary-marking word is kept constant (i.e. parallel) across the whole song; in Kuna singing, on the contrary, a number of different words can play this structural role: "lines are marked grammatically by means of an elaborate set of initial and final words, particles, and affixes" (Sherzer 1982:373). Similarly, in some Ku Waru and Melpa sung tales, lines are closed by a vowel taken from a restricted set: *e*, *o*, or *a* (Rumsey 2010; Niles 2011). In contrast to the Kuna and Iraqw examples, though, these vowels are vocables, i.e. they lack semantic content. This way of defining verse constituents is common also in American traditions, such as Coast Tsimshian (Mulder 1994), or Kwakiutl [Wakashan; Northern Wakashan]: "what have often been called *nonsense syllables* are shown in Kwakiutl to be structural abstracts, covarying with the form of stanzas" (Hymes 1981:10).

Finally, probably the most extensively used boundary-marking cue is the pause; that is, driving adjacent sections apart by introducing some amount of emptiness in between. This is realised in a variety of ways, such as lengthening the final syllable, inserting a silent gap, breathing, or leaving an empty musical beat. This cue can be readily related to the Gestalt principle of proximity, as argued in several cognitive and computational approaches to music segmentation (e.g. Cambouropoulos 1997 and other papers in that volume). Besides, it also bears a close resemblance to final lengthening and pausing as constituency cues in everyday speech (Beckman & Edwards 1990; Fletcher 2010).

In most of the examples cited where a musical transcription is available, we can observe that the notes with the longest duration are systematically placed at the end of constituents, e.g. the Sardinian *Anninnia* lullaby (Sassu & Sole 1972), where line-final notes are at least twice as long as the longest non-final note. In other cases, the authors explicitly mention that singers pause at the end of constituents, e.g. Takū [Austronesian; Nuclear Austronesian] (Moyle 2007:197), Khmu (Lundström 1984:34), Tedaga [Saharan; Western Saharan] (Brandily 1976:171), or Kuna: "there is a notable pause between lines" (Sherzer 1982:377).

Besides variable or non-categorical pauses (often related to breathing), many songs show a categorical pause in the form of an empty musical position. Consider the English [Indo-European; Germanic] nursery rhyme *Eeny meeny miny moe* (Example 3.1 on page 55), where each beat contains two syllables except for the last one in each line, with a single syllable. The gap becomes even longer in cases such as *Hickory dickory dock*, where all lines except the third have a completely empty final beat. Hayes & MacEachern (1998) discusses further English data, and Burling (1966) shows that this kind of gaps at the edges of lines is a common feature of nursery rhymes in several unrelated languages. In this context, whether the last syllable in a line is sustained (i.e. as a long note) or not does not change the fact that the total time span between the last syllabic onset of a line and the first onset of the following line is larger than the neighbouring ones (Temperley 2001:68).

2.3 Numeric control in verse templates

A Shakespearean sonnet contains fourteen lines, and a typical blues verse twelve bars. The poet or musician needs to keep track of those quantities somehow (not necessarily consciously), or else the resulting composition may not adhere to the conventional form. This kind of numeric control can be inferred from regularities in verse productions: after reading, say, fifty fourteen-line sonnets by Shakespeare, we can expect the fifty-first to contain fourteen lines too.

In some of the reviewed traditions, certain styles of singing consist in improvising new verse by following a specified template (e.g. Basque, Tashlhiyt, Northern Kankanay). In these cases, we assume that the performer must take care of the regularities imposed by the template, including numeric ones. In many other styles, though, the texts are fixed and performers do not need to keep track of these numeric regularities (e.g. Pintupi, Coast Tsimshian). In any case, when discussing numeric control, we assume that these fixed texts had to be created at some point, and that the templatic regularities we observe had to be taken care of at the time of composition.

In this section I provide an overview of the requirements of numeric control imposed by different verse templates. In the case of the sonnet, for instance, one has to be aware that the fourteenth and final line has been reached. Nevertheless, Shakespearean sonnets show further structure beyond a concatenation of lines. Rhyming evidence, for instance, shows that the last two lines form an independent section, while the preceding twelve lines are grouped into three quatrains. Hence, the numeric control can be carried out at more than one level: one can

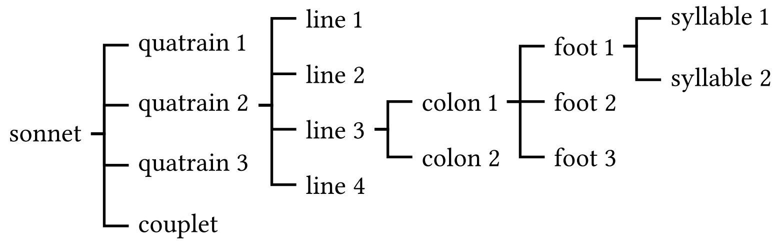


Figure 2.2: Schematic constituent structure of a Shakespearean sonnet. All lines have the same internal structure; the couplet has two instead of four lines.

track a series of three quatrains followed by a couplet, so that reaching the final line does not require keeping track of fourteen constituents, but concludes by reaching the second line of the fourth stanza (i.e. the couplet).

In order to evaluate the numeric requirements imposed by a template, I examine the number of children constituents contained within a given verse constituent, from the bigger ones, such as complete song series or stanzas, to the smallest, such as syllabic feet. In this way, I describe the *minimal* numeric control required to realise a template. In the case of the Shakespearean sonnet, the constituent structure of the template may be characterised using the diagram in Figure 2.2 (Kiparsky 1977; Hanson 2006).

Focusing on the lowest-level constituents (i.e. the syllables) and without considering the hierarchical structure, we would derive the *maximal* numeric control: that is, the number of syllables needs to be tracked up to 140 (i.e. 14 lines $\times$ 10 syllables each).[3] The opposite analysis makes full use of the chunking we have evidence for and provides the *minimal* numeric control, which would be 2, 3, or 4 depending on the constituent level. For instance, in order to create a well-formed quatrain, a quantity of four lines needs to be tracked, while a foot only requires a quantity of two syllables.

In Section 2.2, I have reviewed a number of segmentation cues in verse. Arguably, these constitute structural evidence for putative mental chunks used during the creation of verse. Poets and singers may group constituents based on such cues, and hence alleviate the numeric control imposed by verse templates, e.g. bringing it down from 140 to 4 in the case of the sonnet. Provided that a verse constituent contains a regular number of children constituents, the are at least two possible proxies for the numeric requirements imposed by the template.

[3] Lines can also contain 11 syllables if ending in a feminine rhyme; I overlook this variation for argumentation purposes.

First, the total ***n**umber of **c**hildren **c**onstituents* (*ncc* score) amounts to the highest possible numeric requirement within a constituent. Second, considering that adjacent constituents can be both set apart via contrasting cues or connected through parallelism, a reduced numeric requirement is embodied by the ***m**aximum number of **i**dentical **a**djacent **c**onstituents* (*miac* score). If we describe the stanza structure of a sonnet as *aaab* (i.e. three quatrains and a couplet), the ncc score equals four, and the miac score is given by the series of three quatrains.

I propose that, in general, the miac better reflects the numeric requirements imposed by a template because it reduces the tracking of numerosity to a minimum. In the presence of explicit chunking or contrastive adjacent constituents, one can make use of alternative strategies to adhere to the template, such as relying on transition-based information. As a simple example, consider a call-and-response structure (such as those presented in Section 2.2.2) where each stanza is composed of two lines (*ab*), one sung by the solo singer (*a*), the other by the group (*b*). One can rely on the fact that *a* is always followed by *b*, without needing to resort to counting. In the cases where adjacent constituents are defined by exactly the same set of features (e.g. number of syllables, melody, rhyme), however, numerosity has to be controlled directly.

2.3.1 Above the line

Very often lines are grouped into higher order constituents such as couplets or stanzas. In the Havasupai *Origin song*, for instance, a melody composed of three lines is repeated 39 times (Hinton 1990). In most strophic songs like this one, there is no evidence that the actual number of stanzas is specified in the template. A corpus of songs all containing 39 stanzas would provide evidence for the non-arbitrariness of the number. Hence, we can state that the miac score in these cases is unbounded, and thus uncontrolled. This also applies to the various traditions based on parallel couplets, such as Kuna or Termanu.

Next, there are templates where supra-line constituents must come in pairs such as *ab*, where both *a* and *b* contain several lines. In these cases, the numerosity of supra-line constituents is constrained, but minimally so. For instance, the Melpa *kang rom* sung tale is based on the repetition of a melody containing eight lines, clearly grouped into two quatrains with partial melodic parallelism (Niles 2011). In this case, the number of children constituents equals two, but the miac score is reduced to one, because the melody of the first and second quatrain differs.

The numeric requirement increases in templates with a similar binary supra-line division, but with an *aa* type of structure, where the two sections have identical feature specifications. This is common in sung stanzas with an *ab–ab* couplet structure, such as the Quechua coplas from Cochabamba [Quechuan; Quechua II] (Solomon 1994:384). In a spoken verse context, the lü-shi regulated verse in Literary Chinese [Sino-Tibetan; Sinitic] uses a pentasyllabic eight-line template divided into two equal quatrains of the form *abcd–abcd* (Chen 1979:373). In this case, the numeric requirements are summarised as: ncc = 2, miac = 2.

The Shakespearean sonnet (Figure 2.2) imposes yet greater demands, with ncc = 4, miac = 3. There is a total of four stanzas, with a sequence of three quatrains of identical formal specification. Verse templates realised primarily in written form, such as the sonnet, may increase supra-line numeric requirements by relying on visual support.

2.3.2 Line level

Some traditions compose verse as a sequence of lines which are not further grouped in a systematic way, in a comparable way to the strophe or couplet sequences of arbitrary size mentioned for Havasupai or Kuna. Blacking (1967:91) describes the *Ŋwana wa Vho-Mavhungu* Venda song for girls, which contains eleven lines. An Iraqw *slufay* performance by Haawú Tarmo contains more than two hundred lines (Beck & Mous 2014). In both cases, the exact number of lines does not appear to be regulated, so we can conclude that their miac is unbounded (∞).

The Iraqw and Venda examples are cases of chanted or recited verse, where there is not a clear melodic structure with discrete notes. In verse which is *sung* (to a tune), though, it is common to use templates where different lines have different melodic specifications. The stanzas of the Havasupai *Origin song* show an *aba* tune, with three lines per stanza (ncc = 3), but no adjacent lines with the same melody within the stanza (miac = 1). Each of the sub-stanzas of the Melpa *kang rom* contains four lines (ncc = 4), all with a uniform rhythmical and vocable structure (which would indicate miac = 4), but each with a different melody (miac = 1).

Many traditions are based on couplets, i.e. two-line templates. These can create two scenarios: (1) the two lines have the same formal properties (miac = 2), and (2) the lines show some contrast (miac = 1). Aguaruna drinking song couplets offer a simple illustration of the second scenario: the first line is improvised by a soloist, while the second line is a fixed refrain sung by the group. The Tashlhiyt *Ndalb irbbi* solo stanzas show a similar case where lines follow an *ab* pattern, and thus there is no numeric requirement. Here, both lines are sung by the soloist, but they contrast in the metrical pattern, and the words in the second line are fixed.

Traditions based on semantically parallel couplets may offer an example of the *aa* pattern, where the miac equals two. This can be seen in the systematic binarism of the Termanu sample shown in Example 2.3. Nonetheless, it is unclear the extent to which the two sections of a parallel couplet conform to the criterion of identical adjacent constituents, because the second section may be partially determined by the first one, hence creating an asymmetry. This is manifest in the neighbouring Uab Meto tradition: the semantically parallel terms follow a conventional order, and they often contrast in their phonological shape, by presenting parallel verbs in the unmetathesised form, followed by the metathesised form (Edwards 2016:332). Hence, couplets with completely identical lines may be less frequent than initially apparent.

Greater numerical requirements are easy to find in written traditions, for which certain features related to pitch or intonation are usually absent. The prototypical stanza of Classical Tibetan is composed of four heptasyllabic lines, formally identical and without evidence for subgrouping (Poucha 1950; Vekerdi 1952). In this kind of quatrain, both the ncc and the miac scores equal four. The lack of recorded performance features, however, may conceal other specifications which make lines dissimilar. Consider the Basque *zortziko txikia* template, consisting of four monorhyme formally identical lines, i.e. *aaaa* (Garzia, Sarasua & Egaña 2001). Given that it is a living tradition for which performance data is available, we can observe that the template is realised using a tune such as *Haizeak bidali du*, with an *aabc* line structure (Dorronsoro 1995:339). The miac score is reduced from four to two.

This melody (Example 2.6, Supplementary Information) raises a common issue with published descriptions of verse templates using synthetic codes such as *aabc*. The letters describe identity and contrast relations between constituents, but the same code is also used in cases of similarity or identity *with a difference*. In the present example, the first two lines share their beginnings, but end differently. The beginning of the *a* lines is not shared by the following lines, so a parallelism is drawn between the first two lines, setting them apart. Hence, it may be more appropriate to analyse such cases as having a supra-line constituent: i.e. a couplet which includes the first two lines following an *ab* pattern. Hence, the incorporation of melodic structure to a stanza very easily reduces the numeric requirements of the template (as reflected by the reduction of the miac score from four to one).

The examples of longer forms, such as the sonnet with fourteen lines, usually group lines into sections, and/or differentiate adjacent lines somehow, resulting in low miac scores overall. The Russian Onegin stanza contains fourteen lines, and, although it lacks a unique canonical grouping of the lines, contrary to what we find in Shakespearean sonnets, its rhyme scheme allows at most two identical adjacent lines (i.e. miac = 2) (Scherr 2006).

2.3.3 Below the line

There are a several sub-line constituents which are prone to numeric control: e.g. hemistichs, feet, beats, syllables. In some traditions, lines do not seem to exhibit any numeric control below the line, such as the verse based on semantically parallel couplets. Syllable-count tends to be the primary regularity looked for; however, other regularities are sometimes obscured because only the linguistic structure of the lines, but not the musical one, is described or taken into account (e.g. compare the analysis of Mongolian parallel verse by Poppe 1958 vs Kara 1970).

The simplest example of sub-line structure is a binary division into half-lines of the type *ab* or *aa*. All four lines of the Basque template *Haizeak bidali du* contain two half-lines (aka *hemistichs*) of seven and six syllables respectively (Dorronsoro 1995:339). The French classical decasyllable contains two hemistichs of four and six syllables each (Gouvard 1999). In these two cases, the sub-line sections share formal similarities with the lines, e.g. in requiring their boundaries to coincide with word boundaries. In this kind of asymmetric binary division, the miac equals 1, with no real numeric demand.

The lines of the *Ŋwana wa Vho-Mavhungu* Venda song, on the other hand, are divided into two symmetric sections of three syllables each (Blacking 1967:91). The subdivision of the line is made explicit by a handclap aligned with the first of the three syllables. Formally similar to the decasyllabic line, but with a symmetric division, the French classical alexandrine line contains two hemistichs of six syllables each (Dominicy 1992:161). Regarding their length in number of syllabic positions, the last two examples display both an ncc and a miac score of two. Nevertheless, adjacent constituents which seem identical may show finer-grain differences, and have effectively asymmetric representations for the poet. For instance, the second section of the Venda lines are closed by a fixed bisyllabic word (*khithi*), whereas the first section shows no such restriction. Regarding the classical alexandrine hemistichs, an additional schwa-syllable is used optionally at the end of the second hemistich, though not at the end of the first (Dominicy 1992:162).

Lines with a greater number of subdivisions occur in both sung and spoken verse. Consider the popular Pashto [Indo-European; Indo-Iranian] *misrəy* template; the first line contains nine syllables, divided 1+4+4, and the second line thirteen, divided 1+4+4+4 (MacKenzie 1958:323). The Ancient Greek [Indo-European; Graeco-Phrygian] trimeter line also shows a miac of 3, with just one syllable less: 4+4+4 (Prince 1989:61). This ternary structure is similar to the long colon of an English iambic pentameter line, which contains three binary feet (Figure 2.2). In the Northern Kankanay song discussed in Example 2.4, lines contain seven syllables, divided into four musical beats of equal length (Maceda 1958:52). The first three constituents contain two syllables, but the fourth one contains a single syllable followed by a gap (cf. Section 2.2.3), yielding an *aaab* pattern, with ncc = 4 but keeping the miac = 3. Unlike the Pashto and Greek sub-line sections, the Northern Kankanay ones are also described with distinctive melodic structures. Thus, it is more accurate to represent its line substructure as *abcd*, and miac = 1.

Pintupi [Pama-Nyungan; Desert Nyungic] *tingarri* lines are also subdivided into four sections, where rhythmic parallelism is frequent (Moyle 1979:83). Among the different patterns employed, an *aaaa* structure where all subsections follow the same rhythmical configuration shows the highest frequency. *Tingarri* lines are sung, and the four sub-line constituents show different melodies, even if they are rhythmically parallel. However, there is stronger evidence for an *aaaa* pattern instead of an *abcd* one, unlike in the Norhtern Kankanay case. The words in *tingarri* lines (and lines in Pintupi verse more generally) exhibit a fixed rhythmic configuration, but each unique line of text gets aligned to a variety of melodic contours during the performance of a song. Hence, the rhythmic features of a line are probably part of the underlying template potentially used to generate new song words, which are then aligned to a melodic contour (for further details on the independence of the melody in other Central Australian traditions, see Turpin 2007). In the Northern Kankanay example, on the contrary, there is no evidence to disconnect the rhythmic and melodic features.

The sub-line constituents reviewed thus far are all subdivided into further constituents, primarily syllables. In the English and Northern Kankanay examples, sub-line constituents are divided into groups of two syllables (i.e. *feet*), comparable to spoken verse forms such as the Estonian [Uralic; Finnic] trochaic tetrameter (Lotman & Lotman 2011). This type of supra-syllabic constituents all seem to be asymmetric, with one of the syllables being somehow more prominent. In the English case, the second syllable is the prominent one (i.e. it usually allocates a stressed syllable), and the opposite is true for the Estonian tetrameter, as well as for the Northern Kankanay example (i.e. the musical beat falls on the first syllable). In both cases, the smallest sub-line constituents show an *ab* asymmetric pattern, with a miac score of one.

Larger groups of syllables show similar asymmetries. Each of the half-lines in the Venda example is composed of three syllables, with the first being prominent by being aligned with a hand-clap, suggesting an *abb* pattern. The Pashto four-syllabic sections show a 1020 prominence contour (0 indicating unstressed syllables, and 2 and 1 primary and secondary stress respectively).

In languages where the primary metrical strategy is said to be syllable counting (Fabb 2015:85–91), we find yet longer sub-line sections containing a systematic number of syllables. The first section of Dyirbal [Pama-Nyungan] *Gama* lines contain five syllables (Dixon & Koch 1996:52); each hemistich of a French alexandrine contains six syllables (Dominicy 1992:161); each line of a Classical Tibetan stanza contains seven syllables (Poucha 1950:196). Common to these three languages is the fact that they exhibit a non-contrastive, fixed word-stress. However, there is evidence that the syllables-holders within these constituents are not completely identical, thus ruling out potential miac scores of five, six, or seven.

Dyirbal has fixed initial stress, and 85% of the *Gama* lines begin with a bisyllabic word followed by a trisyllabic word, which can be analysed as an *ab* asymmetric binary division, or at least in terms of a 10100 stress pattern. This sub-line section is always followed by a bisyllabic word, then by a tetrasyllabic word. Tibetan also shows fixed initial stress (Beyer 1992:408), and its heptasyllabic constituents exhibit a subdivision similar to the Dyirbal one. Most lines are composed of three words (2+2+3), with a possible four-word variation (2+2+2+1; Vekerdi 1952:223).

In these two examples, the statistical regularities of the word make-up of the line provides evidence against a long sequence of syllable-holders with identical cognitive representation. Referring to French verse, Biggs (1996:165) argues that "the traditional account of the line as purely syllabic is incomplete", further proposing that the first hemistich of the alexandrine line is composed of three iambic feet, and the second hemistich by two anapestic feet (Biggs 1996:178). The robustness of these results may be up to discussion; nonetheless, mainstream, more conservative accounts of the data accept that, at the very least, the sixth syllable of each hemistich must have a different representation than the preceding five, because it categorically receives a stressed syllable (Dominicy 1992:164).

2.4 Discussion

Verse constituents can be set apart and grouped together on the basis of shared features, contrastive features, and boundary markers. By grouping together adjacent constituents, it is possible to posit intermediate constituency levels, such as the couplet level within an *aabb* rhyming quatrain. Most templates here reviewed show a systematic number of children constituents at some level, such as the number of lines within a stanza, or the number of syllables within a half-line. I have argued that direct control of these numeric regularities (e.g. by counting) is not needed when adjacent constituents have different templatic specifications, because the composer of verse can use these features as indication of which constituent comes next. In cases where adjacent constituents are underlyingly identical, though, the composer is obliged to keep numeric track of the constituents in order to produce the expected amount. I have proposed an index (the ***m**aximum number of **i**dentical **a**djacent **c**onstituents*, or *miac*) to capture the numerical requirements imposed by a given verse constituent.

Many constituents do not show any numeric requirement whatsoever, i.e. miac equals one, or is unbounded (∞). The prototypical case of a miac = 1 are melodic constituents, where the number of syllable holders is fixed, but they differ in pitch, duration or prominence, making it very unlikely that two adjacent holders share exactly the same feature specifications. The prototypical case of a miac = ∞ are strophic songs, where adjacent stanzas are formally identical but they are not required to come in specific numbers. Beyond these two cases, the analysed sample of templates shows robust evidence for miac scores of two, three and four, but not more. This limit lies within the subitizing range (see below), which places the numeric requirements imposed by verse templates in the broader context of human cognition.

Since Kaufman et al. (1949) coined the term, a wealth of psychological studies have discussed the difference between *subitizing*, and counting or estimating (see Mandler & Shebo 1982 and Núñez 2017 for overviews). When presented with a small set of objects, such as three stones, one is immediately aware of the exact quantity; the same accuracy is also attainable for a collection of, say, thirty-seven stones, but it will require a much slower process. In the first scenario, we are assumed to complete the task instantly by subitizing, while in the second we resort to counting. Alternatively, we often solve the second kind of scenario by estimating, which is quicker than counting, but less accurate.

Apart from the speed and accuracy advantage related to the subitizing range, its special status is also supported by developmental and linguistic data. Infants are able to discriminate (both visually and acoustically) between discrete quantities as long as these do not exceed a limit of four (Antell & Keating 1983; Bijelac, Bertoncini & Mehler 1993; Van Loosbroek & Smitsman 1990). This is remarkable, since the ability is reported for infants who have not yet acquired number-related terms or a linguistic system. With larger quantities, six-month-old infants can discriminate sets differing by a ratio such as 8 vs 16, but not by smaller ratios such as 8 vs 12 (Xu & Spelke 2000). These results have led to the proposal of two distinct core knowledge systems: an object tracking system specialised in the subitizing range, and an approximate number system used for higher numerosities (Carey & Xu 2001; Feigenson, Dehaene & Spelke 2004). These systems are considered to belong to a small set of innate, non-species-specific cognitive abilities which both enable and constrain more complex skills and cultural systems such as language or arithmetic (Spelke & Kinzler 2007).

Two kind of linguistic data support the special status of the subitizing range. First, many languages (ca. 1386, Hammarström 2013) have a restricted numeral system, with words for small, exact quantities (e.g. between one and three), and approximate expressions such *several* or *many* for larger quantities (Pica et al. 2004; Epps et al. 2012). Second, languages with more extensive numeral systems often treat numeric expressions within the subitizing range in a grammatically distinct way, e.g. by using gender or case agreement, which is then neutralised for higher numerals (Greenberg 2005:42; Hurford 1987).

Given the body of behavioural, developmental and linguistic evidence, researchers have proposed that subitizing and counting involve separate cognitive processes, probably recruiting distinct neural resources (Burr, Turi & Anobile 2010; Vuokko, Niemivirta & Helenius 2013). Others, however, argue that increased effort, reaction times and neural activity are associated with higher numerosities both within and beyond the subitizing range, suggesting a gradual (rather than categorical) transition between the two tasks (Balakrishnan & Ashby 1992; Piazza et al. 2002).

An important difference between most studies on numeric cognition and the domain of verse is that the former focus on visual, static patterns, while verse involves temporal patterns which are not perceivable simultaneously. However, even if marginally, developmental studies also argue that when we perceive simple double and triple musical rhythms we are engaging in a task comparable to visual subitizing (Von Glasersfeld 1982; Steffe & Cobb 1988). Indeed, phenomenological discussions on numerical control during verse creation reject explicit counting of e.g. syllables, and describe the process in terms of *feeling* in an automatic way the right rhythm to be filled by the text (Gentili 1955 for Greek poetry, Banti & Giannattasio 1996 for Somali sung verse).

The subitizing range, hence, may prove appropriate for lower level constituents such as feet and other sub-line constituents. The fact that larger constituents, such as the number of couplets within a stanza, show similar numeric demands is unlikely to be explained by subitizing constraints; to be sure, automaticity represents an essential trait of subitizing, and it is likely to have time constraints in addition to quantity constraints.

Even beyond constituent levels prone to subitizing, a pervasive feature of verse constituents is that they get chunked. Chunking is a general cognitive strategy used spontaneously and in a wide range of contexts to deal with large quantities efficiently (Gobet et al. 2001). Similar to subitizing, it appears early in ontogeny (Rosenberg & Feigenson 2013), which argues for its basic status in cognition. Crucial to working memory, hierarchical chunking can expand its limits to allocate tens of items at a time (Ericsson, Chase & Faloon 1980).

Fabb (2014:29) argues that verse lines are "held as a whole sequence in the limited capacity of working memory." Nonetheless, other metricists have also expressed the intuition that when lines exceed a certain length limit, they undergo chunking. Regarding French verse, de Cornulier (1995:47) holds that "beyond eight, exact numbers of syllables become inaccessible to perception"[4], longer lines being divided into hemistichs as a consequence. Beltrami (1984) proposes a similar but more restricted 'law of six syllables' for Italian, and Dominicy (1992:161) hypothesises that comparable limits may hold for "many other languages."

These quantities fall within the classical, so-called magical, number of 7±2 for the number of units which can be held in working memory (Miller 1956), a remark which has been made for early Romance poetic genres too (Valenti 2009). Nevertheless, in the sample of templates, even sub-line hemistichs showed more restricted ncc and miac scores, not exceeding the subitizing limit of four. Updated versions of the magical number 7±2 seem to bridge the gap between the two limits. Miller's number is now understood as the number of *uncompressed* objects which can be held in working memory; given that we readily chunk inputs, the actual limit of *compressed* (i.e. chunked) items is set at 4±1 (Cowan 2001; Mathy & Feldman 2012). This number corresponds to the limit observed in this chapter's data; hence we conclude that numeric control demanded by verse constituents is bounded by both the subitizing range, and the working memory limit. That syllables within lines are chunked is evident in templates for which poetic feet are proposed (e.g. Greek, English). Moreover, syllables are grouped into phonological feet and words in virtually every spoken language (Hayes 1995). Hence, lines or hemistichs of up to eight syllables are easily compressable into subitizable chunks.

Finally, it is critical to note that the data here presented serve but to illustrate some problems faced by the study of constituent structure, and a case study involving numeric control. In order to develop this preliminary work, a balanced

[4] Original quotation in French: "En français, au-delà de huit, le nombre syllabique exact est inaccessible à la perception" (de Cornulier 1995:47).

sample of languages needs to be thoroughly surveyed, with detailed analyses of templates encoded into a database. This will enable discovering typological and geographical patterns which can further lead to testable hypotheses on how cognition shapes the verse templates at the core of human songs.

2.5 Conclusion

I have presented a simple taxonomy of constituency cues (parallelism, contrast, and boundary markers), and illustrated them in the verse traditions of unrelated linguistic families. Taking into account these cues we can investigate the numeric requirements imposed by a verse template. In the pilot dataset under study, there is no evidence of verse templates where the number of constituents to keep track of exceeds four. These results conform with landmarks related to numeric cognition, such as the subitizing range. Hence, verse typology can both benefit from and inform the subject of how humans deal with temporal sequences.

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Supplementary Information

Example 2.6: The tune *Haizeak bidali du* used in Basque verse to improvise new lines of text (Dorronsoro 1995:339). The beginning of the first two lines show melodic parallelism.

	Language	Family	ISO-639-3	Glottocode	Macroarea
1	Tashlhiyt	Afro-Asiatic; Berber	shi	tach1250	Africa
2	Iraqw	Afro-Asiatic; Cushitic	irk	iraq1241	Africa
3	Somali	Afro-Asiatic; Cushitic	som	soma1255	Africa
4	Ewe	Atlantic-Congo; Volta-Congo	ewe	ewee1241	Africa
5	Venda	Atlantic-Congo; Volta-Congo	ven	vend1245	Africa
6	Tedaga	Saharan; Western Saharan	tuq	teda1241	Africa
7	Dyirbal	Pama-Nyungan	dbl	dyir1250	Australia
8	Pintupi	Pama-Nyungan; Desert Nyungic	piu	pint1250	Australia
9	Arabic	Afro-Asiatic; Semitic	arb	stan1318	Eurasia
10	Khmu	Austroasiatic; Khmuic	kjg	khmu1256	Eurasia
11	Russian	Indo-European; Balto-Slavic	rus	russ1263	Eurasia
12	English	Indo-European; Germanic	eng	stan1293	Eurasia
13	Greek	Indo-European; Graeco-Phrygian	grc	anci1242	Eurasia
14	Pashto	Indo-European; Indo-Iranian	pst	cent1973	Eurasia
15	French	Indo-European; Italic	fra	stan1290	Eurasia
16	Sardinian	Indo-European; Italic	src	logu1236	Eurasia
17	Basque	Isolate	eus	basq1248	Eurasia
18	Mongolian	Mongolic; Eastern Mongolic	khk	halh1238	Eurasia
19	Tibetan	Sino-Tibetan; Bodic	bod	tibe1272	Eurasia
20	Chinese	Sino-Tibetan; Sinitic	lzh	lite1248	Eurasia
21	Estonian	Uralic; Finnic	ekk	esto1258	Eurasia
22	Havasupai	Cochimi-Yuman; Yuman	yuf	hava1248	North America
23	Chorti	Mayan; Core Mayan	caa	chor1273	North America

24	Tsimshian	Tsimshian	tsi	nucl1649	North America
25	Kwakiutl	Wakashan; Northern Wakashan	kwk	kwak1269	North America
26	Kankanay	Austronesian; Nuclear Austronesian	xnn	nort2877	Papunesia
27	Takuu	Austronesian; Nuclear Austronesian	nho	taku1257	Papunesia
28	Termanu	Austronesian; Nuclear Austronesian	twu	term1237	Papunesia
29	Uab Meto	Austronesian; Nuclear Austronesian	aoz	uabm1237	Papunesia
30	Melpa	Nuclear Trans New Guinea; Central East New Guinea Highlands	med	melp1238	Papunesia
31	Kuna	Chibchan; Core Chibchan	cuk	sanb1242	South America
32	Aguaruna	Jivaroan	agr	agua1253	South America
33	Suyá	Nuclear-Macro-Je; Je	suy	suya1243	South America
34	Quechua	Quechuan; Quechua II	qul	nort2976	South America

Table 2.1: Languages whose verse system is mentioned in the chapter.