Research Article

Grace Wivell, Veronica Miatto, Ayla Karakaş, Kalina Kostyszyn and Lori Repetti*

All about ablaut: a typology of ablaut reduplicative structures

https://doi.org/10.1515/lingty-2023-0018
Received February 25, 2023; accepted February 17, 2024; published online May 23, 2024

Abstract: In this typological study, we identify 31 languages that have reduplication with a changed vowel, as in English *tick-tock*, referred to as ablaut reduplication. Cross-linguistically, this type of reduplication typically manifests as total reduplication with a changed vowel whose quality may or may not be fixed, and when it is not fixed the vowel differs maximally from the corresponding vowel in the base. The order of the copy relative to the base can be fixed or variable, and when it is variable the order enforces a language-specific vowel contour across the two components, such as a low vowel in the first constituent and a high vowel in the second, regardless of which constituent is the base. Furthermore, all cases of ablaut have strikingly similar semantics (playfulness, onomatopoeia, movement, etc.). We review previous treatments of the topic and outline the necessary components of a unified analysis that accommodates the typological patterns.

Keywords: ablaut; reduplication; fixed segmentism

1 Introduction

Reduplication is a morphological process "in which the phonological form of an affix is determined in whole or in part by the phonological form of the base to which it attaches" (Wiltshire and Marantz 2000: 557), and which carries "some inflectional or derivational meaning" (Wiltshire and Marantz 2000: 558). Total (or full)

***Corresponding author: Lori Repetti [lɔɹi ɹəpɛɾi]**, Department of Linguistics, Stony Brook University, Stony Brook, NY 11794-4376, USA, E-mail: lori.repetti@stonybrook.edu
Grace Wivell [gɹeɪs wɑɪvəl], Veronica Miatto [verɔnika mjatto] and Kalina Kostyszyn [kalina kɔstɪʃɪn], Department of Linguistics, Stony Brook University, Stony Brook, NY, USA
Ayla Karakaş [ajla karakaʃ], Department of Linguistics, Yale University, New Haven, NY, USA

reduplication involves the repetition of the entire base (1a), and partial reduplication refers to the repetition of a portion of the base (1b).[1]

(1) Types of reduplication (data from Wiltshire and Marantz 2000)
  (a) total reduplication: Warlpiri (warl1254): *kurdu* 'child', *kurdu-kurdu* 'children'
  (b) partial reduplication: Agta (dupa1235): *takki* 'leg', *tak-takki* 'legs'

Other types of reduplication involve a copy of the entire base or a portion of it, with a segmental change (consonant or vowel). Cases in which the quality of the changed segment is fixed (called "fixed segmentism") have been studied in detail by Alderete et al. (1999), who subcategorize this type of reduplication into two types: phonological fixed segmentism (2a) in which the quality of the fixed segment is phonologically unmarked (Alderete et al. 1999: 334), and morphological fixed segmentism (2b) in which the fixed segment is an affix which "can contain marked structures" (Alderete et al. 1999: 355). (The changed segment is bolded in (2).)

(2) Types of reduplication with fixed segmentism (data from Alderete et al. 1999)
  (a) phonological fixed segmentism:
    – changed consonant: Tübatulabal (tuba1278): *pitita, **ʔ**i-pitita* 'to turn over'
    – changed vowel: Yoruba (yoru1245): *gbóná* 'be warm', *gb**í**-gbóná* 'warmth'
  (b) morphological fixed segmentism:
    – changed consonant: Kamrupi (assa1263): *gharā* 'horse', *gharā-**s**arā* 'horse and the like'
    – changed vowel: Marathi (mara1378): *saman* 'luggage', *saman-s**u**man* 'luggage, etc.'

The goal of this paper is to examine a subset of the types of reduplication in (2), in particular those cases involving a changed vowel, and to question the claim made by Alderete et al. (1999: 355) that when there is more than one fixed segment, there is "no phonological conditioning of the choice" among them. To achieve this goal, we constructed a database of languages with reduplication with a changed vowel, and separated out the cases of "phonological fixed segmentism" based on criteria discussed in Section 2. Within the remaining group, we identified the languages in which the order of the copy relative to the base is fixed (Section 3) and those in which the order of the copy and base varies (Section 4). We show that variation in

1 See Urbanczyk (2017) for a recent overview of the phonological and morphological aspects of reduplication, and Dolatian and Heinz (2020) and Lambert (2022) for mathematical accounts of reduplication.

constituent order results in a language-specific vowel contour across the two components: low-high pattern (illustrated by Austronesian languages and Turkic languages of the Altaic family) (Section 4.1), high-low pattern (illustrated by Indo-European languages) (Section 4.2), and back-front pattern (illustrated by the Tai-Kadai family) (Section 4.3). We outline the implications for previous treatments of the topic and the components necessary for a unified analysis (Section 5), and we conclude the paper in Section 6.

2 Background and methodology

In our search for typological patterns involving reduplication with a changed vowel, we constructed a database consisting of 228 languages from 42 families, with family affiliation based on WALS (Dryer and Haspelmath 2013) and Ethnologue (Eberhard et al. 2020) (see Appendix A). We used a convenience sample, as we looked for descriptions of "reduplication", "word doubling", etc. in grammars that were available to us. This bibliographical bias has inevitably resulted in something of a genetic and areal bias, though we strove to avoid these biases as much as possible by considering languages from many families, as well as several language isolates: Arawak (araw1281), Basque (basq1248), Hadza (hadz1240), and Sandawe (sand1273). Of the 228 languages investigated, 64 exhibited reduplication with a vowel change in one of the constituents, and it is this set which we further investigated.

We were inspired by Alderete et al.'s (1999) distinction between phonological and morphological fixed segmentism, but we found their criteria for differentiating the two types of reduplication unsatisfactory. They report that in phonological fixed segmentism, the quality of the fixed segment is unmarked, its quality can vary in different contexts in a phonologically predictable manner, and its quality might be only partially specified. In morphological fixed segmentism, the quality of the fixed segment does not need to be unmarked quality since it is an affix (Alderete et al. 1999: 355–357) which they analyze as "an analogue to infixation" (Alderete et al. 1999: 356). Furthermore, there can be more than one fixed segment "with no phonological conditioning of the choice" among them (Alderete et al. 1999: 355). Their focus on the marked/unmarked quality of the changed segment was not sufficient to differentiate the two types of reduplication in a meaningful way.

Instead, we identified cases of phonological fixed segmentism from among the 64 languages with reduplication with a vowel change, using Alderete et al.'s (1999) criteria and adding a morphological component and a generalization about the order of constituents that emerged from the data: (i) The quality of the fixed segment is unmarked and unchanged, although its quality might be only partially specified, as in Igbo (nucl1417) which always has a high vowel in the reduplicant, but its backness

and rounding are determined by various phonological factors (Alderete et al. 1999: 342). (ii) The process of reduplication plays a productive role in the inflectional or derivational morphology (Wiltshire and Marantz 2000). (iii) The order of the copy relative to the base is fixed. The cases of reduplication that share all three characteristics are not the object of study and were removed from the inventory.

The remaining data are from 31 languages (10 language families),[2] and they share the traits in (3) (see Appendix B and Appendix C).

(3) (a) the quality of the changed vowel might vary from word to word
(b) the position of the copy relative to the base may or may not be fixed
(c) the meaning expressed includes playfulness, onomatopoeia, diminution, repetition, humor, etc.
(d) we only find total reduplication[3]

We propose that "morphological fixed segmentism" (2b) is a misnomer for this type of reduplication since the changed segment is not necessarily "fixed". Instead, the traditional terms "rhyme reduplication" and "echo reduplication" referring to this type of reduplication involving a changed consonant, and "ablaut reduplication" ("ablaut" for short) referring to cases with a changed vowel, seem more appropriate. We use the term "ablaut reduplication" for the languages in (3).

We adopt the following terminology and notation in this article. We utilize the terms 'base' and 'copy'/'reduplicant' when a base is clearly identifiable, and we use the term 'constituent' when there is no identifiable base. For example, in English *chit-chat*, *chat* is the base, and *chit* is the copy, which we underline, while in English *riff-raff* there is no identifiable base. We indicate in boldface the alternating vowels in the two constituents: ***ch**it-ch**a**t, r**i**ff-r**a**ff*. Examples are presented in IPA, unless we use the language's orthography or the source's transcription, in which cases the word is presented in italics.

In the next two sections we discuss languages in which the order of the copy relative to the base is fixed (Section 3) or varies (Section 4), and we will see that the variability in order is driven by a particular target contour of vowels across the two constituents.[4]

2 In order to limit the scope of this investigation, we did not include cases where there is a changed consonant along with a vowel change.

3 Madurese is included in our study, although it appears to have partial reduplication (*dak-mardik*); however, Musaffak (2011) describes these forms as derived from a fully reduplicated ablaut form *mardak-mardik*. Hence, we do not consider this to be an exception to criterion (3d).

4 Several examples included in our database have no identifiable base or two identifiable bases; however, the languages all included forms that allowed us to classify them as having either a fixed or variable order. We remain relatively agnostic as to which types of reduplicative structures to include in our corpus, mirroring Mattiola and Masini (2022) which includes morphological and syntactic

3 Fixed order of copy relative to base, and fixed/ variable vowel contour across constituents

In several languages with reduplication with a changed vowel, the order of the copy and the base is fixed, including languages from at least six different language families: Uralic (Hungarian), Dogon (Toro Tegu), Kartvelian (Georgian), Turkic (Tuvan), Indo-European (Panjabi, Farsi) and Austro-Asiatic (Semai). In some of these languages there is one fixed vowel resulting in a fixed contour of vowels across constituents (Section 3.1), while in others there are two fixed vowels resulting in a variable vowel contour (Section 3.2).

3.1 Fixed order of copy relative to base, and fixed contour of vowels across constituents

In Hungarian (Brdar and Brdar-Szabó 2014; Patay 2017; Piechnik 2015; Thun 1963), the base is always on the right, the fixed vowel in the copy is /i/ (but see footnote 10), and the resulting structure expresses playfulness and diminution (4a). In Toro Tegu (Heath 2015), the fixed vowel is /a/, the base is on the left, and reduplication of this type results in iterative adverbials (4b). In Georgian, the base is also on the left, the fixed segment is /u/, and the unit expresses onomatopoeia and other types of sound symbolism (4c). (We did not find data with a base vowel that is identical to the fixed vowel in these three languages).

(4) fixed order of copy relative to base and fixed vowel:
   (a) Hungarian: *gy**i**m-gy**o**m* ‘scum, dregs’ (base: *gyom* ‘weed’), *r**i**ssz-r**o**ssz* ‘very bad’ (base: *rossz* ‘bad’)
   (b) Toro Tegu: /g**ú**r**ù**ŋ-g**á**r̲**à**n̲/ ‘with roots spreading out’, /z**è**l**è**w-z**á**l̲**á**w/ ‘glimmering’
   (c) Georgian: /k’n**a**c’-a-k’n**u**c’-i/ ‘snapping sound’ (/k’nac’/ ‘snapping sound’), /sx**a**p’-a-sx**u**p’-i/ ‘do something quickly’ (/sxap’/ ‘indicator to do something quickly’), /b**a**tk-a-b**u**tk-i/ ‘(guns) banging’ (the linking vowel can be either /a/, as in the above examples, or /i/, as in /b**a**tk-i-b**u**tk-i/ ‘(guns) banging’; Kikvidze et al. 2018)

structures, and reduplicative and repetition structures in their analysis of discontinuous reduplication.

3.2 Fixed order of copy relative to base, and fixed or variable changed vowel

In Tuvan (Harrison 2000), a language with reduplication signaling vagueness and informality, /a/ is the fixed segment, and the base is always on the left (5). Note that with a bisyllabic base, the first vowel of the copy is the fixed /a/, and the second vowel harmonizes in backness and roundedness with the first vowel and has the same height as the vowel in the base. (In (5) and all subsequent data charts, the base form is included after the gloss in parentheses).

(5) Tuvan (Dialect A)

Pattern	Word	Gloss (reduplicated unit expresses vagueness or informality)
u-a	/**u**lu-**a**lu**u**/	'dragon' (/ulu/ 'dragon')
	/**u**du:r-**a**du:r/	'sleep-FUT' (/udu:r/ 'sleep')
y-a	/s**y**t-s**a**t/	'milk' (/syt/ 'milk')
i-a	/**i**s-**a**s/	'footprint' (/is/ 'trace')
	/**i**dik-**a**duk/	'boot(s)' (/idik/ 'boot, shoe')
ɯ-a	/q**ɯ**s-q**a**s/	'girl' (/qɯs/ 'girl')
e-a	/**e**r-**a**r/	'male' (/er/ 'man')
ø-a	/**ø**g-**a**g/	'yurt' (/øg/ 'yurt')
o-a	/x**o**l-x**a**l/	'hand' (/xol/ 'hand')
	/n**o**m-n**a**m/	'book' (/nom/ 'book')

However, if the base vowel is /a/, the vowel in the copy is not /a/, but is instead /u/ (6).

(6) Tuvan (Dialect A)

Pattern	Word	Gloss (reduplicated unit expresses vagueness and informality)
*a-a; a-u	*/**a**t-**a**t/; /**a**t-**u**t/	'name' (/at/ 'name')
	*/**a**:r-**a**:r/; /**a**:r-**u**:r/	'heavy' (/a:r/ 'heavy')

This is consistent with other languages in which the usual fixed segment is not used if the base has the same vowel. In Panjabi (Trivedi 1990: 72–73), a language native to Pakistan and India, the base is always on the left, and /u/ is the fixed segment (*k**á**r-k**ú**r* 'house, etc.', *kh**e**t-kh**u**t* 'field, etc.'); in bisyllabic words, the first vowel alternates (*pīna-p**ū**nā* 'to drink, etc.'). If the initial base vowel is /u/, then /a/ is used in the copy (*s**u**kka-s**a**kka* 'dry, etc.'). Similarly, in the related language Farsi, the base is on the left, and the fixed segment is /u/: /p**ɑ**re p**u**re/ 'torn (away)', /dædær-d**u**d**u**r/ 'go outside in a fun way'. However, /u/ is avoided if the base vowel is high, and instead /ɑ/

is used: /t**i**k-o-t**ɑ**k/ ‘signal interest in a person’. Semai, a language of Malaysia (Diffloth 1976a, 1976b; Hendricks 2001; Phillips 2013) requires the base to be on the right, and the fixed segment is /ɛ/: /prad**ɛ**k-prad**a**:k/ ‘noise of scattered large drops of rain falling on leaves of roof’, /mŋ**ɛ:**y-mŋ**u:**y/ ‘people in a crowd raising their heads here and there’; however, if the base contains /ɛ/, the copy contains /u/: /prad**u**k-prad**ɛ**k/ ‘noises of small drops of rain falling’, /klcw**ũ**c-klcw**ɛ̃**c/ ‘irregular flapping circular movements’. Significantly, in all of these cases the order of the base relative to the copy is fixed, and the usual fixed segment is not used if the base has the same vowel, thereby avoiding identity. This is consistent with Alderete et al. (1999: 356) who note that in morphological fixed segmentism “suppletive alternation … is often caused by dissimilatory constraints”.

4 Variable order of copy relative to base, and fixed contour of vowels across constituents

We have found that when the relative order of the base and copy varies in a language, the order always accommodates a particular vowel contour across the two constituents. For example, the vowels in the two constituents might differ in that the first is low and the second is high, or the first is high and the second is low, etc.; crucially, the order of the base and copy changes to accommodate these contours. We found this pattern in six different language families (Altaic, Austronesian, Basque, Indo-European, Tai-Kadai, Trans-New Guinea).

While the vowel in the copy differs in a particular feature from the corresponding vowel in the base, its exact quality can vary. For example, in English, if the base contains a high vowel (*tick*), the copy contains a low(er) vowel (*t**i**ck-t**o**ck*), or if the base contains a low vowel (*chat*), the copy contains a high vowel (*ch**i**t-ch**a**t*). While the high vowel in the copy can be tense or lax (*t**ee**ny-t**i**ny, ch**i**t-chat*), and the low(er) vowel in the copy can be front or back (*j**i**ngle-j**a**ngle, t**i**ck-t**o**ck*), the contour of the vowels across the two constituents is fixed: it is high-low. Notice that the order of the base and copy varies to accommodate the high-low vowel contour across the two constituents; the vowel contour is fixed, at the expense of the order of the base relative to the copy. Marchand (1969) suggests that the polarity of the vowels is symbolic of the movement, confusion, etc. expressed by some of the words, such as *fl**i**p-fl**o**p, m**i**sh-m**a**sh*, etc.

Cross-linguistically, the vowel differentiation involves different features resulting in the vowel contours summarized in (7): the vowel in the first constituent may be low and in the second high (what we refer to as the low-high pattern) (7a),

a high-low pattern (7b), and a back rounded – front unrounded pattern (7c). The last pattern is the rarest, and we did not find any languages with a purely front-back pattern, nor did we find any languages that use any other features to differentiate the vowels in the two constituents (for example, tenseness).

(7) Summary of patterns with varying order of base and copy

Pattern Sample Language (Family)	Word	Gloss (base, if identifiable)
(a) low – high Indonesian (Austronesian)	/d͡ʒuŋk**a**t-d͡ʒuŋk**i**t/	‘see-saw’ (/d͡ʒuŋkit/ ‘slant, tilt’)
	/kut**a**ʔ-kut**i**ʔ/	‘tinkering with’ (/kutaʔ/ ‘to be actively thinking about something’)
	/lek**a**ʔ-lek**u**ʔ/	‘bumpy’ (/lekuʔ/ ‘curved inwards’)
(b) high – low German (Indo-European)	*gɪgəl-g**a**gəl*	‘giggling’ (*gɪgəl* ‘to giggle’)
	*m**ɪ**ps-mɔps*	‘cute kid’ (*mɔps* ‘pug’)
	*v**i**bkə-v**a**bkə*	‘nickname for Wiebke’ (*vibkə* ‘proper noun’)
(c) back rounded – front unrounded Thai (Tai-Kadai)	/s**u**p-s**i**p/	‘gossip’ (/sip/ ‘to whisper’)
	/r**o:**ŋ-r**e:**ŋ/	‘scanty’ (as the foliage of trees) (/ro:ŋ/ ‘light, weightless’)
	/ŋ**ɔ:**-ŋ**ɛ:**/	‘to be fussy, pout like a child’ (/ŋɛ:/ ‘baby crying sound’)

While the quality of the vowel in the copy is not fixed, it is also not completely random: in all cases the corresponding vowels in the two constituents differ in a language-specific feature or features, and the contrast tends to “maintain maximal perceptual distance,” as noted in Minkova’s work on English ablaut reduplication (2002: 151). Others have made similar observations about ablaut reduplicatives cross-linguistically, noting that the vowels in the two constituents exhibit “strong or maximal contrast” (Arleo 2009: 307) and are “opposite” (Strik Lievers 2013: 187–188). For example, a high vowel ([+hi, –lo]) in the base will tend to alternate with a low vowel ([–hi, +lo]) in the copy, and the order of the base and copy changes to

accommodate the particular vowel contour. In the following sections we discuss in detail each of the ablaut patterns identified in (7).

4.1 Low-high pattern

The vast majority of the languages that we found with the low-high pattern belong to the Austronesian family, and we will use Indonesian, the national language of Indonesia, as our main example to illustrate this pattern. What we call "ablaut" in this paper is considered a subset of what in Indonesian is referred to as *kata ulang berubah bunyi* 'reduplication with a changed sound', which can include changes of either a consonant or vowel within a reduplicative unit. Across the Austronesian languages, this kind of reduplication is used in onomatopoeia, repetitive movements, intensification, and sometimes in the formation of new words.[5]

The Indonesian vowel inventory includes the following monophthongal vowel phonemes: /i, u, e, ə, o, a/ (Soderberg and Olson 2008). Most of the words which demonstrate the ablaut pattern are made up of bisyllabic constituents, and the ablaut vowel is almost always found in the rightmost syllable of each. (There are some examples in which there are multiple vocalic changes which we do not investigate in this paper). Of the 130 Indonesian examples of ablaut in our database, only 32 have an identifiable base. Though this is a small subset of the data, these examples demonstrate a clear and consistent pattern, illustrated in (8).

(8) Indonesian

Pattern	Word	Gloss
a-u	/lek**a**ʔ-lek**u**ʔ/	'bumpy' (/lekuʔ/ 'curved inwards')
	/t͡ʃəla**s**-t͡ʃə**l**u**s**/	'to go in and out' (/t͡ʃəlus/ 'can be entered, as into a hole')
	/lik**a**-lik**u**/	'details, inner workings' (/liku/ 'twist, turn')
	/d͡ʒeb**a**r-d͡ʒeb**u**r/	'repeatedly splash water while bathing' (/d͡ʒebur/ 'splash water while bathing')
a-i	/pern**a**ʔ-pern**i**ʔ/	'silly complications' (/perniʔ/ 'beads')
	/d͡ʒuŋk**a**t-d͡ʒuŋk**i**t/	'see-saw' (/d͡ʒuŋkit/ 'slant, tilt')
	/kem**a**ʔ-kem**i**ʔ/	'chew or mumble' (/kemiʔ/ 'mumble')
	/kəmp**a**s-kəmp**i**s/	'panting for breath' (/kəmpis/ 'blow all the air out')

5 Our Indonesian dataset includes 152 examples of reduplicative structures with a changed sound, of which 130 contain ablaut reduplicative structures. Data are from Echols and Shadily (1975), and each entry was then confirmed using the Kamus Besar Bahasa Indonesia (KBBI) (2008) 'Big Dictionary of Indonesian' and with the help of two native speakers of Indonesian.

a-i	/kut**a**ʔ-kut**i**ʔ/	‘tinkering with’ (/kutaʔ/ ‘to be actively thinking about something’)
	/bas**a**-bas**i**/	‘polite language’ (/basa/ ‘language’)
	/səl**a**ŋ-səl**i**ŋ/	‘alternatingly’ (/səlaŋ/ ‘in between’)
	/warn**a**-warn**i**/	‘colorful’ (/warna/ ‘color’)

When the base includes a high vowel (/u/ or /i/), it is the second constituent, and the copy has /a/, the only available low vowel in Indonesian. However, when the base has /a/ in the ablaut position, the base is the first constituent, and the copy has the high vowel /i/.[6] Thus, the obligatory low-high ablaut pattern affects the position of the base relative to the copy. Regardless of which available high vowel is present in the base, /i/ or /u/, the maximally contrastive /a/ is selected for the copy, and the low-high order is maintained.

This ordering and contrast look somewhat different when a mid vowel is present in the base (9). If the base contains a mid vowel, it is the second constituent, and the low vowel /a/ is in the first constituent. Though the contrast is not low-high, the rising contour is maintained.

(9) Indonesian

Pattern	Word	Gloss
a-e	/t͡ʃor**a**t-t͡ʃor**e**t/	‘scribble’ (/t͡ʃoret/ ‘to strikethrough’)
	/pol**a**s-pol**e**s/	‘paint or smear something’ (/poles/ ‘material used to smear or paint something’)
a-o	/ber**a**ʔ-ber**o**ʔ/	‘scream and shriek’ (/beroʔ/ ‘lower abdomen’)
	/leŋg**a**ʔ-leŋg**o**ʔ/	‘sway hips’ (/leŋgoʔ/ ‘a swaying of the hips while one strides’)
	/t͡ʃəpl**a**s-t͡ʃəpl**o**s/	‘to speak frankly, uninhibitedly’ (/t͡ʃəplos/ ‘to speak frankly’)

These same generalizations can be found in several other Austronesian languages spoken in modern-day Indonesia (10), including Javanese (data from Wivell 2023a) and Balinese (data from Darsana 2016) which contain the same monophthongs as Indonesian (Brown and Ogilvie 2008; Spitzing 2002).[7]

6 This does raise the question of why Indonesian selects /i/ consistently, rather than /u/. There is some evidence to suggest that /i/ in Indonesian is somewhat higher than /u/ (Soderberg and Olson 2008), but it has also been suggested that substrate languages can heavily influence a speaker’s Indonesian phonology (van Zanten 1986).

7 Malaysian (Nadarajan 2006; Siah 2023) and Minangkabau (Sutawijaya et al. 1984) also appear to have similar patterns. It is worth noting that disyllabic roots in Austronesian languages may have a general preference for nonhigh-high patterns, as described in Alderete and Finley (2016); whether

(10) Other Austronesian languages

Language	Pattern	Word	Gloss
Balinese	a-i	/kəjəŋ**a**t-kəjəŋ**i**t/	‘to show off, repeatedly’ (/kəjəŋit/ ‘showing one’s teeth as in a smile’)
	a-e	/sləd**a**t-sləd**e**t/	‘to glance at something’ (/sladet/ ‘a glance like lightning’)
	a-o	/leŋg**a**h-leŋg**o**h/	‘sway’
	a-ə	/s**a**ab-s**əə**b/	‘look around’
Javanese	a-i	/sep**a**-sep**i**/	‘very quiet’ (/sepi/ ‘quiet’)
		/kel**a**h-kel**i**h/	‘nothing special, ordinary’ (/kelah/ ‘not special’)
	a-u	/bek**a**h-bek**u**h/	‘to keep complaining and moaning’ (/bekuh/ ‘to complain by moaning’)
	a-e	/bleb**a**r-bleb**e**r/	‘to jump or fly back and forth’ (/bleber/ ‘taking a flying leap’)
	a-o	/gemb**a**r-gemb**o**r/	‘to do a lot of loud talking or shouting’ (/gembor/ ‘to cry noisily’)

A more specific type of low-high pattern involves an additional difference in the round feature, so that the first (low) vowel is unrounded and the second (high) vowel is rounded. This pattern is illustrated by Turkish in which the /a/-/u/ alternation is the most prevalent, but /e/-/y/ is also found (Marchand 1952; Rossi 1964), including dialect variants such as ***e**bil-**ü**bül yümürek* ‘learn to walk’, *rüzgâr **e**fil **ü**fül esiyor* ‘the wind blows cool’ (Marchand 1952: 63). We also find cases with /a/-/ɯ/ and /a/-/i/ with an unrounded high vowel in the second constituent: [**a**ŋgɯr-ʃ**ɯ**ŋgɯr] ‘jingle-jangle’, [**a**lan-**i**lan] ‘whatchamacallit’. Turkish reduplicated forms are typically used onomatopoeically or to intentionally provide a sense of vagueness or playfulness. Alongside Turkish and Tuvan, several other Turkic languages have been explored for this study; however, the patterns found in the other Turkic languages are more inconsistent, which may be due to limitations of our data.

The Turkish vowel inventory includes /i, y, ɯ, u, e, œ, a, o/ with vowels patterning either as high or low (van der Hulst and van de Weijer 1991). The phonological status of vowel height in Turkic languages varies. In Turkish, Kyrgyz, and Tuvan, mid vowels generally pattern with low vowels (Johnson and Csato 1998) while Azerbaijani exhibits a three-way height distinction (Householder and Lotfi 1965). In some languages, like Tatar, there is controversy in the literature regarding vowel height:

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this is the same preference observed in the patterns we describe, but over two constituents, we leave to future research.

Makhmutova (1969) claims that it has a three-way height distinction, while Baskakov (1988) argues for two.

The alternating vowel is in the first syllable of polysyllabic constituents, and it is low and unrounded in the first constituent, and high and (usually) rounded in the second. The second vowel in disyllabic constituents harmonizes with the backness of the first.[8]

(11) Turkish

Pattern	Word	Gloss
a-u	/t͡ʃ**a**tur-t͡ʃ**u**tur/	'crunching sound' (*çatır çatır* 'crunching sound')
	/s**a**lak-s**u**lak/	'stupidly' (*salak* 'fool')
	/j**a**muk-j**u**muk/	'lopsided' (*yamuk* 'uneven, crooked')
	/h**a**pur-h**u**pur/	'guzzling food'
a-ɯ	/ʃ**a**ŋgɯr-ʃ**ɯ**ŋgɯr/	'jingle-jangle' (/ʃɯŋgɯr ʃɯŋgur/ 'jingle-jangle')
a-i	/f**a**lan-f**i**lan/	'whatchamacallit' (/filan/ 'whatchamacallit')
e-y	/t**e**k-t**y**k/	'few and far between' (*tek* 'single, only one')
	/t**e**rs-t**y**rs/	'crooked' (*ters* 'backward')
	/k**e**m-k**y**m/	'hem and haw'
	/**e**bil-**y**byl (jymyrek) /	'learn to walk' (dialect variant)

If the base contains a low vowel, it is the left constituent, and the copy contains a high vowel, reflecting the low unrounded-high rounded contour: /t͡ʃ**a**tur-t͡ʃ**u**tur/ 'crunching sound', /t**e**k-t**y**k/ 'few and far between'. If the base contains a high vowel, it is on the right, and the copy contains a low vowel. We have found some cases of a base with a high unrounded vowel, and it is, as predicted, the rightmost constituent, with a low unrounded vowel (in particular, /a/) in the left copy constituent: /ʃ**a**ŋgɯr-ʃ**ɯ**ŋgɯr/ 'jingle-jangle' (/ʃɯŋgur ʃɯŋgur/ 'jingle-jangle', Castagneto 2004: 142), /f**a**lan-f**i**lan/ 'whatchamacallit' (/filan/'whatchamacallit', Marchand 1952: 63).[9] Note

8 Several compounds that resemble ablaut reduplicated forms with an additional consonant change also exhibit this vowel pattern: /**a**llak-b**u**llak/ 'jumble up', /**e**ften-p**y**ften/ 'flimsy'. We have omitted them from discussion since they involve changes that are beyond the scope of this paper.

9 The first comprehensive dictionary of Turkic languages (*Dīwān Lughāt al-Turk,* compiled some time between 1072 and 1074) reveals that ablaut has been prevalent in Turkic languages even since Proto-Turkic (Kāshgarī 1985-1986). In Karakhanid Turkic, the literary language of the compendium, the roundness of the vowel in the right constituent is not necessarily contrastive to that of the left constituent. Karakhanid examples showing the /a/-/ɯ/ pattern include /qat͡ʃ qɯrt͡ʃ/ 'panic' and /s**a**rt s**ɯ**rt/ 'talking nonsense' (Ido 2008).

that the low-high contour is maintained, although the roundedness difference is necessarily sacrificed.

It is often not clear which constituent is the base since both constituents may be nonce or onomatopoeic words. However, the contour across the two constituents is consistently low-high. This contour is also reflected in Turkic languages for which we do not have information on the base, as in Azerbaijani (Bakı dialect): /a-u/ (***ş**a**p**-ş**u**p* 'shoes worn at home'), /e-y/ (*c**e**ne-c**ü**ne* 'unable, incapable').

4.2 High-low pattern

The high-low pattern is represented in at least four different language families: Austronesian (marginally), Trans-New Guinean, Basque, and Indo-European.[10] Two Austronesian languages, Lio (Sawardo et al. 1987; Wivell 2023b) and Keo (Baird 2002), appear to demonstrate a high-low pattern in their ablaut reduplicative structures, different from other languages in the Austronesian family: Lio /s**i**ko-s**a**ko/ 'cut up'; Keo /f**i**ngo-f**a**ngo/ 'dirty, red-faced from crying'. It also appears as though Bargam, a Trans-New Guinea language, may have a high-low pattern, in words such as *kwas**i**n-kwas**a**n* 'various edible greens' (Hepner 2006). Both Keo and Lio are Central Malayo-Polynesian languages spoken in Central Flores, a region geographically somewhat distant from the other Austronesian languages in which ablaut is observed, and they have a different ablaut pattern from other Austronesian languages. These languages are known to have been affected by contact with Trans-New Guinea languages,[11] which may explain why the ablaut patterns of Lio and Keo are more similar to Bargam than to other Austronesian languages. For these three languages there is limited data, and more work is needed to understand the relationship among the

10 We saw in Section 3 above that Hungarian has a fixed position for the base (it is on the right), and a fixed vowel (/i/). However, if the base is polysyllabic, the vowels in the reduplicant follow a high-low /i-ɛ/ pattern (n.b. in Hungarian, /ɛ/ patterns as a low vowel; Siptár and Törkenczy 2007.). With bisyllabic bases, we usually find /i … ɛ/ in the copy (a), although we also find /i … i/ ***kivi**r-**kava**r* 'to mix, jumble together' (base: *kavar* 'stirring') and /ɛ … ɛ/ ***tepe**-**tupa*** 'dabbler, bad workman' (base: *tupa* 'dumbass'). With trisyllabic bases, we find /i … i … ɛ/ (b), and with quadrisyllabic bases, we find /i…i…i…ɛ/ (c).

(a) /i…ɛ/: ***dimbe**s-**dombos*** 'hilly' (*domb* 'hill'), ***girbe**-**görbe*** 'full of curves, crooked' (*görbe* 'curve') (Brdar and Brdar-Szabó 2014)

(b) /i…i…ɛ/: ***dirimbel-dorombol*** 'purr' (***dorombol*** 'purr') (Patay 2017)

(c) /i…i…i…ɛ/: ***csivirítem**-**csa**v**arítom*** 'twist' (*csavarítom* 'twist') (Thun 1963)

11 For example, it has been suggested that Lio's numeral system was influenced by Papuan languages (Salhotra et al. 2023).

languages and the role of areal contact (as opposed to genealogical relationships) in the ablaut patterns observed.

In Basque we also find the high-low pattern, with *i-a* systematically realized across constituents: ***d*in*bi*-*d*a*n*b*a*** ‘shot, thrash, sound of small drum’ (*danba* ‘bang’), ***kli*s-*kl*a*s*** ‘to crack, crackle’ (*klis* ‘click’). This pattern is robustly attested in the surrounding Indo-European languages, which we discuss in detail, beginning with German. In German, the meaning conveyed is the usual one of playfulness, onomatopoeia, etc. German includes a fairly large vowel inventory: high vowels /ɪ, iː, ʏ, yː, ʊ, uː/, mid vowels /ɛ, eː, œ, øː, ɔ, oː/, and low vowels /a, ɑː/ (Kohler 1990), and the relevant vowel in the first constituent is most often lax /ɪ/, although tense high front vowels /y/ and /i/ are also attested. The ablaut vowel in the second constituent is most often /a/, and occasionally /ɔ/ or /o/ are found. Kentner (2017: 16) claims ablaut is productive in German if the vowel of the base has an ablaut counterpart, i. e., if it is /i, ɪ/ or /a, o, ɔ/. Freywald (2015: 5–6) also claims that proper names can productively undergo ablaut to express intimacy or mild depreciation. A clear generalization emerges: the first constituent must contain a high vowel, while the second constituent contains a low(er) vowel.

Though Kentner (2017) does not discuss bases in this context, he notes that the order of the vowel contrast is rigid, with high vowels appearing in the first constituent, and low(er) vowels in the second constituent; consequently, the base can be either the first or second constituent to accommodate this contour (12). Except for the particular contour of the vowels (high-low) in these reduplicative pairs, German ablaut is very similar to the other languages discussed above: whether the base is the first or second constituent is dictated by the strict ordering of vowels, the entire base is copied with the exception of the ablaut vowel, and the meaning expressed is cross-linguistically similar.

(12) German

Pattern	Word	Gloss
ɪ-a	***Hi*ckh*a*ck**	‘bickering’ (*hacken* ‘to chop’)
	***fli*tterfl*a*tter**	‘flittering’ (*flattern* ‘to flutter’)
	***schwi*bbelschw*a*bbel**	‘wobbling’ (*schwabbeln* ‘to waddle’)
	***Mi*x*ma*x**	‘app’
	***gi*ggelg*a*ggel**	‘giggling’ (*giggeln* ‘to giggle’)
	***kri*tzelkr*a*tzel**	‘scribbling’ (*kritzeln* ‘to scribble’)
ɪ-ɔ	***Sti*pst*o*p**	‘game’ (*Stopp* ‘stop’)
	***ti*ppt*o*pp**	‘in top form’ (*Topp* ‘masthead’)
	***Mi*psm*o*ps**	‘cute kid’ (*Mops* ‘pug dog’)
	***Sti*nkst*o*nk**	‘tantrum’ (*stinken* ‘to stink’)

i-a	***ni*gel*na*gel(neu)**	'brand new' (*Nagel* 'nail')
	***Wie*bke*wa*bke**	'nickname' (*Wiebke* 'proper name')
i-o	***pi*pel*po*pel**	'snot' (*Popel* 'booger')
y-a	***Flü*gel*fla*gel**	'(poetic neologism by Christian Morgenstern)' (*Flügel* 'wing')

Another Indo-European language that illustrates the high-low pattern is English, which has a long history of ablaut reduplicative structures: ***py**tyr-**pa**tyr* (i. e., 'pitter-patter') meaning 'rapid repetition of words' is the first attested example from 1450 (see Thun 1963 for the origin of reduplicatives in English.). The English vowel inventory includes /i, ɪ, u, ʊ, e, ɛ, ʌ, ə, o, ɔ, æ, ɑ/, and the data in (13) show that most of the English examples have a high vowel /ɪ/ (or /i/) in the first constituent and a low vowel /æ/ (or /ɑ/) in the second constituent. There are a few cases with /ɔ/[12] in the second constituent, and many of these are likely due to a historic shift in vowels in English (Minkova 2002). While the high vowel is always a front vowel, the low vowel can vary along the backness continuum. The data primarily come from Schiffman (1999), whose corpus is made up of over 600 examples of various types of English reduplication, including many examples of what we have identified as ablaut. It is unclear what dialects of English the corpus refers to, but most of the data are consistent with American English.

(13) English

Pattern	Word	Orthography
ɪ-æ	/t͡ʃɪt-t͡ʃæt/	*chit chat*
	/dɪli-dæli/	*dilly dally*
	/snɪp-snæp/	*snip snap*
	/d͡ʒɪŋgəl-d͡ʒæŋgəl/	*jingle jangle*
	/klɪk-klæk/	*click clack*
	/fɪɾəl-fæɾəl/	*fiddle faddle*
ɪ-ɑ	/tɪp-tɑp/	*tip top*
	/flɪp-flɑp/	*flip flop*
	/tɪk-tɑk/	*tick tock*
i-ɑ	/tiɾə-tɑɾə/	*teeter totter*
ɪ-ɔ	/sɪŋ-sɔŋ/	*sing song*
	/kɪŋ-kɔŋ/	*King Kong*
	/kɹɪs-kɹɔs/	*criss cross*
i-ɔ	/si-sɔ/	*see saw*

12 The vowel /ɔ/ corresponds to many pronunciations in different varieties of English, including [ɔ ɑ ɒ oˑ].

Crucially, the order of base and copy varies to accommodate the obligatory contour of the vowels (high-low): in *chit chat* the base (on the right, which is the most common position) contains the low vowel /æ/, therefore the copy contains a high vowel, while in *jingle jangle* the base (on the left) contains the high vowel /ɪ/ so the copy contains a low vowel. In some cases the base is not identifiable (*teeter totter*), or both constituents are independent words (*tip top*). As in all other languages discussed thus far, the ordering of the vowel contour is strict, but the ordering of the base and copy is not.

Ablaut reduplicative structures are also present in Romance languages, though not as prevalently as in the Germanic languages discussed above. Barnes Wales (2016) provides Spanish examples of ablaut, many of which are loan words from English (*tik tak* 'sound', *zig zag* 'zig zag'). Italian has the same loans, but also exhibits native examples: *ninna nanna* 'lullaby' (*nanna* 'sleep'), *così così* 'so-so' (*così* 'so'). Other Romance languages follow the same high-low pattern: French (Grammont 1933: 380 quoted in Strik Lievers 2013: 186; Pharies 2020), Provençal (Pharies 2020), Catalan (Pharies 2020), Portuguese (Pharies 2020), Milanese (Brugnatelli 1996-1997), etc. as shown in (14).

(14) Romance languages

Language	Pattern	Word	Gloss
Spanish	i-a	*tik tak*	'sound'
		zig zag	'zig zag'
Italian	i-a	*ninna nanna*	'lullaby' (*nanna* 'sleep')
		così così	'so-so' (*così* 'so')
		Pim Pam	'proper noun' (in the song 'Le scarpe Pim Pam')
		Pinco Panco	'Tweedledee' (cf. *Panco Pinco* 'Tweedledum')
		tric trac	'onomatopoeia; game'
		di riffa o di raffa	'by hook or by crook' (*riffa* 'raffle')
French	i-a	*bric-à-brac*	'bric-a-brac'
		ric-rac	'very precise'
		flic-flac	'splish splash'
		bredi-breda	'hasty and hazy way'
		patati-patata	'and so on'
		comme ci comme ça	'so-so'
Provençal	i-a	*barrabin-barraban*	'hastily'
		flisco-flasco	'sound of whiplashes'

Catalan	i-a	*bal**i**ga-bal**a**ga*	'fool'
		*roman**ì**-roman**à***	'children's game'
		*x**i**no-x**a**no*	'without worries'
Portuguese	i-a	*tr**i**que-tr**a**que*	'firework'
Milanese	i-a	*c**i**ff-ci**a**ff*	
		*bargn**i**ff-bargn**a**ff*	(from a children's riddle)

A few Romance cases of high vowel – mid vowel alternations are also found: Milanese: ***bi**sa-bo**s**a* 'hodgepodge', Piedmontese *Cr**i**ch e Cr**o**ch* 'characters in a folk tale' (Brugnatelli 1996-1997: 188), Venetian: *Pet**i**n e Pet**ɛ**e*, or *Bet**i**n e Bet**ɛ**e* 'proper nouns from nursery rhyme'.

4.3 Back rounded – front unrounded pattern

Standard Thai (hereafter, Thai), the national language of modern-day Thailand and part of the Tai-Kadai family, has nine monophthongal vowel phonemes (both short and long) /ɯ, u, ɤ, o, ɔ, i, e, ɛ, a/ (Abramson 1962; Narang and Misra 2010; Tingsabadh and Abramson 1993) and ablaut reduplicative structures with the same semantic connotation as the other languages discussed above, but with a different pattern: Thai imposes a back rounded – front unrounded pattern, rather than a difference in height (and rounding), as seen in the other languages we investigated. In Thai ablaut reduplicative forms, the vowel in the first constituent is a back rounded vowel, and the vowel in the second constituent is a front unrounded vowel of the same height (Haas 1942, 1946). Haas (1942: 2) notes that, among the many types of reduplicative patterns in Thai, "the favorite is the alternation of a rounded back vowel with its corresponding unrounded front vowel".[13]

Ablaut reduplicative structures are found in words with both monosyllabic and polysyllabic bases, and, in the latter, the vowel that alternates is in the rightmost syllable. The base can be either the left or right constituent as long as the resulting forms "fit the pattern of rounded back vowel alternating with its corresponding unrounded front vowel" (Haas 1942: 5) as seen in (15) (tone is not included).

13 Thai also exhibits another type of reduplication with /a/ in the second constituent and quantitative differences in the alternating vowels (short vowel-long vowel), although these are less frequent.

(15) Thai

Pattern	Word	Gloss
u-i	/s**u**p-s**i**p/	‘gossip’ (/sip/ ‘to whisper’)
	/j**u**ŋ-j**i**ŋ/	‘to be complicated’ (/juŋ/ ’to be tangled, confused’)
	/khaj**u**k-khaj**i**k/	‘to move jerkily’ (/khajik/ ‘to move jerkily’)
	/t**u**ŋ-t**i**ŋ/	‘sprightly’ (/tiŋ/ ‘a dangling earring or pin’)
o-e	/j**o**:-j**e**:/	‘leaning to one side or the other’ (/jo: / and /je: / ‘slant, not straight’)
	/r**o:**ŋ-r**e:**ŋ/	‘scanty (as the foliage of trees)’ (/ro:ŋ/ ‘light, weightless’)
	/pʰl**o:**g-pʰl**e:**g/	‘limpingly’ (/pʰle:g/ ‘to walk with a limp’)
	/ʔ**o**:n-ʔ**e**:n/	‘totteringly’ (/ʔe:n/ ‘to lie down’)
ɔ-ɛ/æ	/ŋ**ɔ:**-ŋ**ɛ:**/	‘to be fussy, pout like a child’ (/ŋɛ: / ‘baby crying sound’)
	/t**ɔ**ʔ-t**ɛ**ʔ/	‘totteringly’ (/tɛʔ/ ‘to tap’)
	/mɔm-m**æ**m/	‘dirty’ (/mɔm/ ‘dirty’)
	/lɔʔ-l**ɛ**ʔ/	‘uncertain, unreliable, not serious’

Although Haas (1942) describes the ablaut pattern in Thai as a rounded back vowel alternating with an unrounded front vowel of the same height, we found two exceptions. In one case, the base contains unrounded central /a/. Unsurprisingly, it is the right constituent since it is unrounded, and the copy on the left contains, as usual, a rounded back vowel: /somt**o**m-somt**a**m/ ‘papaya salad’. In another case, the base contains unrounded back /ɯ/. It is in the left position, and an unrounded front vowel is used in the copy: /saʔd**ɯ**ŋ-saʔd**i**ŋ/ ‘flinging manner’, suggesting that the back-front contour is more important than the rounded-unrounded contour.

5 Implications for previous analyses and components of a unified analysis

There have been several attempts to explain ablaut reduplicative structures in various languages using different theoretical approaches and frameworks dating back over a century (The earliest explicit study we found is Müller 1909.). Nevertheless, it has been referred to as “extra-grammatical morphology” (Mattiello 2013; Merlini Barbaresi 2008) or “expressive morphology” (Zwicky and Pullum 1987) since

the rules for forming ablaut reduplicative structures are not completely predictable or fully productive. However, despite Alderete et al.'s claim that there is "no phonological conditioning of the choice" (1999: 355) among the vowels attested in these structures, some regularity can be found. Though providing a theoretical analysis of ablaut is beyond the scope of this paper, the cross-linguistic generalizations we have found in our typological investigation have implications for theoretical analyses, and we now suggest the necessary components of a unified analysis that can accommodate the typological patterns.

Any phonological account of ablaut must have the following three components, each of which has been suggested in the literature. The first imposes a difference on the two otherwise identical constituents (16a); the second dictates the nature of the difference between the vowels in the two constituents (16b); and the third requires a specific order of constituents dictated either by a fixed order of the copy relative to the base, or by the contour of the ablaut vowels across the two constituents (16c). We briefly discuss these components below.

(16) components of a unified analysis
- (a) imposition of a difference between two otherwise identical constituents (i.e., avoidance of identity)
- (b) identification of the nature of the difference between the vowels in the two constituents (i.e., which feature(s) define the difference, or which fixed vowel is used)
- (c) imposition of an order of constituents (i.e., the copy relative to the base is fixed, or it is determined by the contour of the ablaut vowels across the two constituents)

The first component of a unified phonological analysis of ablaut imposes a difference on two otherwise identical constituents (16a). Yip (1995) studies the Habitual-Repetitive (Hab-Rep) form in Javanese (for example, /tuk**a**-tuk**u**/ 'buy') and accounts for the different vowels in each constituent with the constraint *REPEAT(Stem) which forbids identical stems. Kenstowicz (1986) also analyzes Javanese Hab-Rep using vowel tiers and the Obligatory Contour Principle (OCP), or the avoidance of identical adjacent elements on a given tier. Patay's (2017) explanation of forms like *r**i**ssz-r**o**ssz* 'very bad' in Hungarian utilizes the DIFF constraint requiring the two constituents to be different, and Kentner (2017) explains the need to have different vowels in the constituents in German ablaut (for example, *Kr**i**mskr**a**ms* 'knick-knacks') through the constraint OCPnucleus (the avoidance of identical nuclei of adjacent feet). Minkova (2002) proposes the principle INTEREST to explain the requirement that vowels must "maintain maximal perceptual distance" in

English ablaut reduplicative structures (Minkova 2002: 151). In an analysis of Indonesian ablaut, Wivell (2021) proposes using Alderete's (2001) ANTI-FAITHFULNESS constraints to enforce difference. Other constraints introducing contrast into morphological paradigms that have been proposed in the literature, although not to account for ablaut, include Paradigm-Contrast requiring cells of a paradigm to be phonologically distinct (Ito and Mester 2004; Kenstowicz 2005). Alderete et al. (1999: 355) take a different approach and include an affixal morpheme (the ablaut vowel) in the input which overwrites a segment in the base by ranking input-output faithfulness over base-reduplicant faithfulness.

The second component identifies the nature of the difference between the vowels in the two constituents (16b). In languages in which the changed vowel has a fixed quality (perhaps with a second vowel used to avoid identity), the vowel(s) could be listed in the input. Alderete et al. (1999: 355) follow McCarthy and Prince (1986, 1990), Yip (1992), and Bruening (1997) who "argue that the identity of the fixed segmentism in overwriting is determined morphologically"; in other words, the changed vowel is present in the input. In languages in which the quality of the vowel varies in a less predictable way, the vowels could be listed, as in Kentner's (2017: 31) account for German ablaut which uses the explicit constraint ABLAUT stipulating a high front vowel (/i/, /ɪ/) in the first constituent and a non-high back vowel (/a/, /o/, /ɔ/) in the second. Neither of these approaches captures the observation that the difference between the vowels can reflect a contour in which the two vowels differ in a particular feature or features, with a tendency to maximize the difference. Minkova (2002) comes close with her proposal of a constraint penalizing base-reduplicant height identity to account for the fact that there is a height difference in English ablaut. Wivell (2021) specifies that Indonesian would need ANTI-FAITHFULNESS in height and backness in order to enforce the difference that is observed in that language.

The third component requires a specific order of constituents (16c). The order is dictated either by a fixed order of the copy relative to the base (i.e., base-copy or copy-base), or by the contour of the ablaut vowels across the two constituents (i.e., low-high, back-front, etc.). In the languages with a fixed order of the copy relative to the base (Section 3), the order of constituents is stipulated in the input or derived through alignment constraints (Alderete et al. 1999). In languages where the order is determined by the vowel contour across the reduplicated unit, various proposals have been made. Kentner's (2017) ABLAUT constraint specifies the relative ordering of vowels in German ablaut: a high front vowel is followed by a non-high back vowel. Cooper and Ross (1975) argue that the vowel in the second element must be longer and must contain a lower F2 than the vowel in the first element in English

ablaut reduplicative structures and "freezes" (or conjoined elements with a fixed order, as in *bigger and better*, *kit and caboodle*) (Cooper and Ross 1975: 71–73). Yip (1995) explains the particular ordering of vowels in the Javanese Hab-Rep form by noting that the first constituent must always have an /a/ in the final syllable. Wivell (2021) argues that in Indonesian it is the low-high order that separates ablaut from fixed segmentism, and defines her ABLAUT constraint as enforcing a particular order.

Some researchers have tried to find universal explanations for a particular order. For example, Minkova (2002) introduces the FINAL-LENGTH constraint to account for the fact that in English the low (longer) vowel is in the second constituent rather than in the first. She motivates this constraint by highlighting a universal preference for longer segments in final position. Arleo (2009: 308) quotes Jespersen's (1942/1965: 176) explanation for the particular ordering of vowels in English ablaut: "you begin with what is light and indicates littleness and nearness and end with the opposite". Strik Lievers (2013: 184) notes that Jespersen (1933) claims that *i* symbolizes smallness and closeness, while *a* indicates largeness and distance. She also reports on Pinker's (1994: 167–168) suggestion that we find the high-low order because "words that connote me-here-now tend to have higher and fronter vowels … The syllogism seems to be: "me" = high front vowel; me first; therefore, high front vowel first". Strik Lievers (2013: 187) refutes these naturalistic explanations by noting the similarity between the high-low Indo-European and low-high Turkish patterns: the vowels are "at opposite poles". As suggested by Strik Lievers (2013) these constraints cannot be applied to the other attested patterns since we find low-high, as well as high-low patterns, a back-front pattern, and rounding also seems to play a role. We have not been able to find universal principles favoring these particular contours.

Van de Weijer et al. (2020) use a construction-based approach to account for English ablaut and map the order of constituents with a particular meaning; however, the constructionist framework stipulates a language-specific template or construction, and thereby misses the cross-linguistic generalizations that we identify.

One promising direction is Ryan's (2019a, 2019b) survey of prosodic end-weight effects. Ryan's assertion that languages with right-oriented phrasal prominence are generally expected to display prosodic end-weight effects, such as a lower ablaut vowel in the second constituent, is consistent with the ablaut patterns we observe in languages such as English and German, and his prediction that the opposite is also true is a possible explanation for Turkish. However, his proposal cannot be applied to a number of the languages in our study. For example, in the Western Indonesian languages, the identification of prosodic prominence is unclear (Athanasopoulou et al. 2021), and the connection between Ryan's work and some Austronesian

languages has been questioned (Siah 2023). For these reasons we refrain from making a strong claim regarding the connection between phrasal prominence and ablaut reduplication.

While each of these proposals may work for a subset of the languages investigated, they fail to fully describe the patterns we see across different languages. A unified approach would need to include the three components outlined above (16), formulated in a way that can accommodate the typological patterns. First, an ANTI-FAITHFULNESS-type constraint could impose a ban on identity between the two constituents. Minimal violations of this constraint would result in near-total identity of the two constituents, except for one segment: the ablaut vowel.

Second, the quality of one of the vowels could be fixed (along with a second vowel used to avoid identity), or an ANTI-FAITHFULNESS-type constraint could be used to mark a particular feature or features as necessarily different in the two ablaut vowels, such as ANTI-FAITHFULNESS to a particular feature. In general, the vowel contour across constituents most frequently involves the vowels /a/, /i/, and /u/. According to PHOIBLE (Moran and McCloy 2019), these are the most typologically common vowels, with /i/ represented in 92 % of languages, /u/ in 88 %, and /a/ in 86 %; note that the next most common vowel, /e/, occurs in only 61 % of languages. Furthermore, these vowels are the most perceptually distinct from each other and, within any vowel space, they are most likely to occupy the extremities (Flemming 2004; Hall 2011).

Third, the order of constituents could be determined by alignment constraints, either by aligning the reduplicant to a particular edge, or by aligning the overwriting segment or vowel feature(s) to a particular edge.

The other characteristic that we found is the strikingly similar connotation expressed in ablaut constructions cross-linguistically, including playfulness, onomatopoeia, movement, diminution, repetition, humor, vagueness, informality, etc. Regier (1998) identifies similar meanings in reduplicative structures in unrelated languages, noting "[t]here is no simple abstraction over the set of meanings expressed by reduplication. But the set of meanings is not boundless either, and in fact covers only a relatively small region of semantic space" which he attributes to iconicity and semantic extension (Regier 1998: 887). Fischer (2011) further refines Regier's (1998) categorization of meaning expressed by reduplication and discusses cases of reduplication with opaque semantics. In a recent study, Kentner et al. (2022) found that German speakers perceive the use of reduplicative structures with a changed segment (either vowel or a consonant) to have a familiar, funny, soothing, euphonic, and/or cute connotation even in nonce words, indicating that "reduplicative morphology may in and of itself […] contribute to the affective meaning and

esthetic evaluation of words" (Kentner et al. 2022: 333) (see also Cabrera 2017). A full discussion of the shared semantic themes in these reduplicative pairs is beyond the scope of this study, and we limit ourselves to noting this cross-linguistic trend.

6 Conclusions

Our two initial goals included the examination of reduplication with a changed vowel cross-linguistically, and the examination of the claim made by Alderete et al. (1999: 355) that when there is more than one fixed segment, there is "no phonological conditioning of the choice" among them. We are confident that we achieved these goals. First, by examining 64 languages with reduplication with a changed vowel, and eliminating the cases of "phonological fixed segmentism" (as defined in Section 2), we observed that the remaining 31 languages share the four characteristics in (3). We can account for these patterns within the unified analysis outlined in Section 5. Second, we show that when there is more than one fixed segment, the choice among the segments is principled: if the constituent order is fixed, the choice is based on identity avoidance (Section 3.2), and if the constituent order is variable, the choice is based on adherence to a particular vowel contour across the two constituents (Section 4).

Our typological investigation of reduplication with a changed vowel shows that, despite their differences, all languages with these types of structures share four properties: (a) the vowels in two otherwise identical constituents differ maximally for a particular feature or features, or the quality of the changed vowel is fixed (with a second vowel used to avoid identity); (b) the relative order of the base and copy is either fixed or variable, and, if variable, the order is determined by a target vowel contour (for example, low vowel – high vowel); (c) the meaning expressed by these reduplicated units is similar across languages; (d) only total reduplication is attested. On the other hand, what varies cross-linguistically is: (a) the specific vowel or vowel features that differ in the two constituents; (b) the way the order of the base and copy is determined: either the order of constituents is fixed, or the contour of the vowels in the two constituents is fixed; (c) the specific meaning expressed by the reduplicated units. With these results, we hope to have addressed the need for a systematic typological study of ablaut, highlighted by Strik Lievers (2013: 189) and others.

Ablaut reduplicative structures illustrate the opposing tendencies in language: repetition and its avoidance (Walter 2007): a constituent is repeated, but with the introduction of a difference in a vowel between the two otherwise identical units. It is perhaps for this reason that it is a common cross-linguistic, although perhaps not universal, phenomenon.

Acknowledgments: This paper would not have come about without the help of many people, including Novriska Adini, Marina Castagneto, Khanin Chaiphet, Hossep Dolatian, Jeff Heinz, Susana Huidobro, Jing Ji, Sophie Moradi, Hany Noviya, Ali Salehi, Nazila Shafiei, Nina Svanidze, and Robert Vago. An earlier version of this paper was presented as a poster at the 2020 LSA meeting in New Orleans (Wivell et al. 2020) and at Stony Brook University. We thank those audiences for their helpful comments, as well as three reviewers for *Linguistic Typology*.
Author contributions: All co-authors were involved in the conceptualization, data collection, database management, and data analysis. All approved the final version of the manuscript.

Appendix A: Languages families[a] (total: 42) and specific languages (total: 228) investigated (languages included in Appendix B are bolded and followed by an asterisk)

Family	Language
Afro-Asiatic (1)	Wolaitta
Algic (12)	Abeneki, Algonquin, Arapaho, Atikameke, Blackfoot, Cheyanne, Cree, Delaware/Lenape, Kickapoo, Ojibwe, Piscataway, Yurok
Altaic (18)	**Azerbaijani***, Bao'an, Bonan, Buryat, Dagur, Kalmyk Oirat, Kazakh, Khakas, Khalka, Kyrgyz, Mongolian, Monguor, Santa, Tatar, **Turkish***, Turkmen, **Tuvan***, Yakut
Arawakan (1)	Arawak
Atlantic-Congo (1)	Gbeya
Austro-Asiatic (5)	Bahnar, Khmer, Mon, **Semai***, Vietnamese
Austronesian (10)	**Balinese***, **Indonesian***, **Javanese***, **Keo***, **Lio***, **Madurese***, **Malaysian***, **Minangkabau***, Sundanese, Toba Batak
Aymaran (1)	Aymara
Basque (1)	**Basque***
Benue-Congo (1)	Kuteb
Bosavi (1)	Edolo
Cariban (2)	Apalai, Cariban
Dogon (6)	Bondum Dom, Dogul Dom, Jamsay, Tommo So, Nanga, **Toro Tegu***
Dravidian (3)	Kannada, Tamil, Telugu
Eastern Sudanic (2)	Bari, Dar Daju Daju
Hadza (1)	Hadza
Huitotoan (1)	Bora-Witoto
Indo-European (23)	Bengali, **Catalan***, **English***, **Farsi***, **French***, **German***, Hindi, **Italian***, Kurdish, Latgalian, Latvian, Lithuanian, Marathi, **Milanese***, **Panjabi***,

(continued)

Family	Language
	Piedmontese*, Polish, **Portuguese*, Provençal*,** Russian, Serbo-Croatian, **Spanish*, Venetian***
Iroquoian (4)	Cherokee, Onadaga, Oneida, Seneca
Japonic (1)	Japanese
Kartvelian (1)	**Georgian***
Khoe-Kwadi (1)	Nama
Koreanic (1)	Korean
Kxa (1)	|Hoan
Mande (5)	Beng, Bobo, Mandinka, Vai, Worodougou
Muskogean (5)	Alabama, Choctaw, Creek, Koasati, Mikasuki
Na-Dene (20)	Cahto, Chipewyan, Chiricahua Apache, Dena-ina, Eyak, Galice Athabaskan, Halfway River Beaver, Han, Hupa, Kaska, Koyukon, Navajo, Sarcee, Slave, Tahltan, Tanacross, Tlingit, Tolowa, Ts'ets'aut, Tukudh
Niger-Congo (50)	Aghem, Ajagbe, Akan, Bafaw, Bafut, Baule, Bemba, Bena, Chichewa, Dii, Efik, Ejagham, Engenni, Eton, Ewe, Gbari, Haya, Herero, Ikalanga, Kemezung, Kikongo, Kol, Kuche, Kwanyama, Lala-bisa, Lingala, Lunda, Makonde, Mbugwe, Mfumte, Mokpwe, Mungbam, Mwani, Nchane, Noone, Nzadi, Oko, Pagibete, Pedi (Northern Sotho), Shupamem, Silozi, Siswati, Sotho, Swahili, Tonga, Tsonga, Tukì, Venda, Xhosa, Yoruba
Nilo-Saharan (3)	Dazaga, Dholuo, Gaahmg
Penutian (8)	Maidu, Molala, Mutsun, Nez Perce, Proto-Wintun, Sahaptin, Ultan, Yokuts
Sandawe (1)	Sandawe
Sepik (2)	Abau, Ambulas
Sino-Tibetan (2)	Mandarin Chinese, S'gaw Karen
Skou (1)	Barapu
Solomons East Papuan (1)	Bilua
Tai-Kadai (2)	Lao, **Thai***
Timor-Alor-Pantar (1)	Abui
Torricelli (1)	Kamasau
Trans-New Guinea (7)	**Bargam***, Bunaq, Dom, Fuyug, Golin, Hua, Kamano
Tu (2)	N|uuki, !Xoõ
Tupian (15)	Akuntsú, Cocama, Guaja, Guarani, Kaiwa, Karo, Kayabi, Mekens, Munduruku, Nheegatu, Old Tupi, Omagua, Parintintin, Tapiete, Tapirapé
Uralic (3)	Estonian, Finnish, **Hungarian***

[a]A note on classification. The Altaic family is controversial, and we adopt the WALS classification which does not include Japanese and Korean in the Altaic group. We also use the name Turkic, rather than Altaic, to refer to the languages discussed in this paper because the phenomenon under investigation is only found in the Turkic (but not the non-Turkic) Altaic languages. The families here called Bosavi, Sepik, Skou, Solomons East Papuan, Timor-Alor-Pantar, Torricelli, and Trans-New Guinea are commonly grouped together under the areal term 'Papuan', however neither WALS nor Ethnologue categorize them as such.

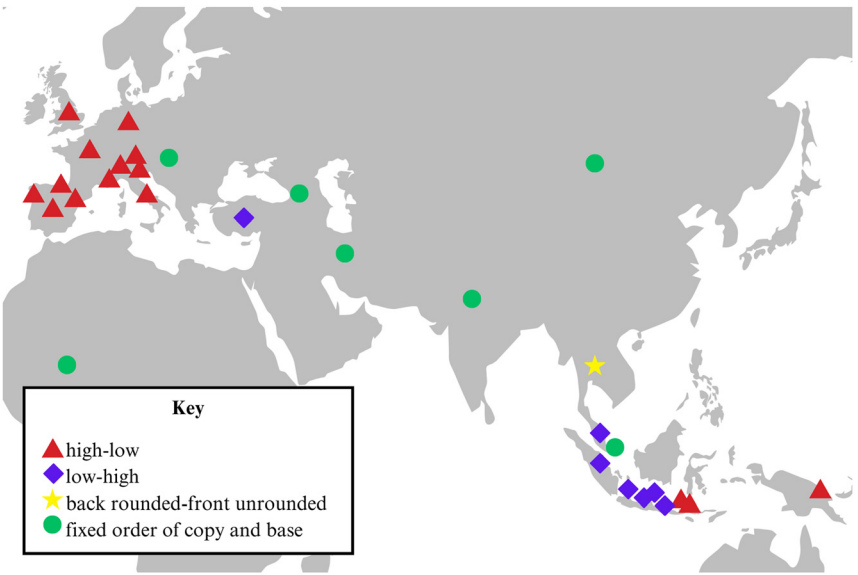
Appendix B: Languages analyzed in this study (total: 31 languages from 10 families)

Language	Family	Fixed or variable order of base/copy	Vowel contour across constituents	Sources
Azerbaijani (mode1262)	Altaic (Turkic)	No information on base	Low-high	Householder and Lotfi (1965)
Balinese (bali1279)	Austronesian	Variable order	Low-high	Spitzing 2002, Darsana 2016
Bargam (barg1252)	Trans-New Guinea	Variable order	High-low	Hepner (2006)
Basque (basq1248)	Basque	Variable order	High-low	Cabrera 2017, informants
Catalan (stan1289)	Indo-European	Variable order	High-low	Pharies (2020)
English (stan1293)	Indo-European	Variable order	High-low	Minkova 2002, Schiffman 1999, Cooper and Ross 1975, Arleo 2009, Jespersen 1942/1965
Farsi (fars1254)	Indo-European	Fixed order	(Identity avoidance)	Informants
French (stan1290)	Indo-European	Variable order	High-low	Pharies 2020, Strik Lievers 2013, Grammont 1933
Georgian (nucl1302)	Kartvelian	Fixed order	–	Kikvidze et al. 2018, informants
German (stan1295)	Indo-European	Variable order	High-low	Kohler 1990, Freywald 2015, Kentner 2017, informants
Hungarian (hung1274)	Uralic	Fixed order	–	Brdar and Brdar-Szabó 2014, Patay 2017, Piechnik 2015, Thun 1963
Indonesian (indo1316)	Austronesian	Variable order	Low-high	Echols and Shadily 1975, Kamus Besar Bahasa Indonesia (KBBI) 2008, informants
Italian (ital1282)	Indo-European	Variable order	High-low	Informants
Javanese (java1254)	Austronesian	Variable order	Low-high	Kenstowicz 1986; Wivell 2023a; Yip 1995
Keo (kakw1240)	Austronesian	Variable order	High-low	Baird (2002)
Lio (liki1241)	Austronesian	Variable order	High-low	Sawardo et al. 1987, Wivell 2023b

(continued)

Language	Family	Fixed or variable order of base/copy	Vowel contour across constituents	Sources
Madurese (nucl1460)	Austronesian	Variable order	Low-high	Musaffak (2011)
Malaysian (indo1326)	Austronesian	Variable order	Low-high	Nadarajan 2006, Siah 2023
Milanese (mila1243)	Indo-European	Variable order	High-low	Brugnatelli 1996-1997
Minangkabau (mina1268)	Austronesian	Variable order	Low-high	Sutawijaya et al. (1984)
Panjabi (lahn1241)	Indo-European	Fixed order	(Identity avoidance)	Trivedi (1990)
Piedmontese (piem1238)	Indo-European	Variable order	High-low	Brugnatelli 1996-1997
Portuguese (port1283)	Indo-European	Variable order	High-low	Pharies (2020)
Provençal (occi1239)	Indo-European	Variable order	High-low	Pharies (2020)
Semai (sema1266)	Austro-Asiatic	Fixed order	(Identity avoidance)	Diffloth 1976a, 1976b, Hendricks 2001, Phillips 2013
Spanish (stan1288)	Indo-European	Variable order	High-low	Barnes Wales (2016)
Thai (thai1261)	Tai-Kadai	Variable order	Back rounded-front unrounded	Haas 1942, 1946
Toro Tegu (toro1253)	Dogon	Fixed order	–	Heath (2015)
Turkish (nucl1301)	Altaic (Turkic)	Variable order	Low-high	Marchand 1952, Rossi 1964, Strik Lievers 2013, informants
Tuvan (tuvi1240)	Altaic (Turkic)	Fixed order	(Identity avoidance)	Harrison (2000)
Venetian (vene1258)	Indo-European	Variable order	High-mid	Informants

Appendix C: Map indicating location of languages discussed in Sections 3–4



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