Buriat dorsal epenthesis is not reproduced with novel morphemes

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Abstract
In Buriat, the consonant realized contextually as dorsal or uvular alternates with zero at stem-suffix boundaries. This alternation has been analyzed as phonological epenthesis and has been known as a challenge to the existing theories of phonological markedness. The analysis of this alternation has also been debated. This paper presents new fieldwork and experimental evidence addressing the ways in which the reported epenthesis pattern is generalized to new environments. The results do not fully support the phonological insertion account of the alternation. An alternative analysis of Buriat dorsal-zero alternation in terms of floating features is proposed.

Note: some examples in this draft contain references to the author's example database. These can be ignored for most purposes.

1 Introduction

The analysis of alternations between a consonant and zero is associated with a long-standing problem – the deletion-insertion ambiguity (Hale 1973; McCarthy 1991; Baković 1999; Morley 2015). Both kinds of analyses have been proposed for many known cases such as English dialectal r-zero alternations (McCarthy 1991; 1993; Harris 1994; Baković 1999; Gick 1999 a.o.), French liaison (Klausenburger 1974; 1977; Churma 1977; Tranel 1981; 1996; Wetzels 2002 a.o.) or Maori passive (Hale 1973; de Lacy 2003 a.o.). The typology of consonant-zero alternations is accordingly debated (Lombardi 2002; de Lacy 2002; 2006; Rice 2008; Blevins 2008; Hall 2013; Staroverov 2014), and Morely (2015) argues that it may not be possible to come up with general criteria that would differentiate between deletion and insertion cross-linguistically.

Buriat presents a famous and controversial case of consonant-zero alternations where the consonant realized contextually as dorsal [g, ɣ] or uvular [ɢ, ʁ] alternates with zero at stem-suffix boundaries (Poppe 1938; 1960; Sanžeev 1941; Sanžeev, Bertagaev & Tsidendambaev 1962; Čeremisov 1973). This alternation has been analyzed as phonological epenthesis and has been known as a challenge to the existing theories of phonological markedness (Rice 2008; Morley 2015; Vaux & Samuels 2015). This analysis has also been debated (de Lacy 2006; de Lacy & Kingston 2013).

This paper presents new elicitation and experimental evidence in order to test whether the reported epenthesis pattern is generalized to new environments. The results of an experiment using wug test methodology do not fully align with the hypothesis of a general insertion process, since only one speaker out of nine consistently generalized the reported dorsal/uvular insertion pattern. However, a more extensive experimental study may be needed to fully establish these results. New elicitation data on numerals also do not show consistent generalization of /g/-insertion.

Motivated by these new results, I propose an alternative account of the Buriat facts where the dorsal/uvular consonant alternating with zero corresponds to an underlying floating feature

(e.g. Zoll 1996), similar to a featural affix (Akinlabi 1996; 2011). The paper explores the theoretical implications of this new account, and the ways of testing its predictions.

After introducing some background on Buriat (section 2), the potential accounts of the dorsal-zero alternation are introduced in section 3. Section 4 considers new elicitation evidence that bears on the possibility of dorsal epenthesis and section 5 presents the experiment. The proposed alternative analysis is laid out in section 6, and section 7 concludes.

2 Buriat basics

This section briefly surveys the aspects of Buriat phonology relevant to dorsal-zero alternations. The data in this article come from the author's field investigation of the Barguzin dialect of Buriat, as spoken in the village of Baragkhan. More details on the consultants can be found in section 5.1.3. The transcription used here adheres to IPA.

The segment inventory of the studied dialect presents few substantial differences from that of Standard Buriat (Poppe 1938; 1960; Sanžeev 1941; Sanžeev, Bertagaev & Tsidendambaev 1962; Radnaeva 2003a; 2003b; 2006; 2008). The first syllable exhibits all vocalic contrasts in Buriat, and the relevant inventory is given in (1). [1]

In addition to long and short vowels, Buriat has diphthongs, shown on the right-hand side in (1). The vowel harmony behavior of diphthongs is regulated by their underlying composition, but on the surface at least some of the diphthongs appear as long monophthongs, e.g. /ai/ → [ɛː]; /ei/ → [eː]. The realization of underlying /oi/ is variable and may require further investigation in the studied dialect. Most commonly /oi/ is pronounced as [œɛ], although in some words it undergoes consistent raising to the close-mid region.

(1) Buriat vowel inventory: first syllable

Underlying monophthongs			Underlying diphthongs
i iː	ʉ ʉː	u uː	/ai/ ɛː /oi/ œɛ /ui/ ui /ʉi/ yi /ei/ eː
ə əː	ɵː	o oː	
	a aː		

The vowel system in (1) is documented here based on the preliminary formant measurements of minimal and near-minimal pairs of words contrasting for the relevant vowels in the first syllable. In the studied dialect, orthographic "ɣ, ɣɣ" are high central rounded vowels [ʉ ʉː] while the corresponding vowels in Standard Buriat have previously been transcribed as IPA [ʊ ʊː] (Radnaeva 2003a; 2003b; 2006; 2008). The orthographic "ə, əə" are centralized in the Barguzin dialect to [ə əː]. The corresponding sounds in Standard Buriat have been transcribed as [e eː] (Radnaeva 2003a; 2003b; 2006; 2008).

The non-first syllables present a reduced vocalic inventory lacking the short high rounded vowels [u ʉ]. The vowels in non-first syllables are also subject to reduction and harmony restrictions. The duration of long vowels is reduced in non-initial syllables. The short /o ə a/ tend to be reduced to a schwa-like quality in this environment. Furhter investigation is needed to find out whether vowel reduction leads to complete neutralization of /o ə a/ → [ə], as

[1] The vowels transcribed here as [o a] may be more accurately represented by [ɔ ɑ] in Standard Buriat (Radnaeva 2003a,b; 2006; 2008). My data are not sufficient to firmly establish this for the Barguzin dialect. Nothing in what follows hinges on the exact realization of these vowels.

suggested by Svantesson et al. (2005) for Mongolian. For now, I will distinguish [o] vs. [ɘ] vs. [a] in non-first syllables. The rules of Buriat vowel harmony will be described in detail in section 2.1 below.

The Buriat consonant inventory is presented in (2). The segments in parentheses occur only in loanwords.

(2) Buriat consonants

p b	pʲ bʲ	t d	tʲ dʲ	(k) g/ɢ	gʲ	
(f v)	(fʲ vʲ)	s z	ʃ ʒ	x/χ	xʲ/χʲ	h
		(ts)	(tʃ)			
m	mʲ	n	nʲ			
		l	lʲ			
		r	rʲ			
(w)			j			

The voicing contrast may be more accurately described as a difference in aspiration (Poppe (1960); see also Svantesson et al. (2005) on Mongolian), although a detailed phonetic investigation remains to be undertaken. All voiced stops undergo at least partial devoicing word-finally. Preconsonantal devoicing is also reported (Poppe 1960), although it is more variable, judging from my recordings. The phonetic realization of voiced dorsal /g/ (both underlying and 'epenthetic') varies with the vowel harmony class of the word. In front-vowel words this segment appears as [g], and sometimes undergoes lenition to [ɣ] intervocalically. In back-vowel words it appears as uvular [ɢ] and frequently lenites to [ʁ] between vowels. In what follows, this segment will be loosely referred to as 'dorsal'. The dorsal fricative /x/ varies according to similar principles, although the details of its positional allophones were not extensively studied here.

The non-palatalized consonants do not occur before short /i/, although both palatalized and non-patalalized consonants appear before long /iː/. Palatalized consonants trigger allophonic fronting of the following vowels.

Buriat allows syllables to begin with a vowel only word-initially. Native Buriat words disallow onset clusters and only allow [ŋg] as a complex coda. The syllable structure for native words is thus CVCC word-medially and (C)VCC word-initially. Loanwords (mainly from Russian) allow larger consonant clusters in both onset and coda. A description of stress in the studied dialect is left for future research. See Poppe (1960) and Walker (1994) for a description of stress in Standard Buriat.

2.1 Vowel harmony

Buriat vowels are subject to a pervasive set of vowel harmony alternations, targeting two kinds of features. All vowels within a word must agree in frontness (see also Poppe 1960: 21), hence every word may contain either the vowels from a relatively back set /a aː ai o oː oi u uː ui/ or the vowels from a relatively front set /ɘ ɘː ei ɵː ʉ ʉː ʉi/. The frontness value of the word is controlled by the first syllable vowel. The vowels /i iː/ act as neutral occurring in both kinds of words.

Buriat also has rounding harmony affecting non-high vowels and operating according to a rather complicated set of rules. The descriptions of Buriat rounding harmony vary in the

amount of detail they provide, and the description below is largely based on the fairly detailed report of Poppe (1960: 21-24), which is also consistent with the data from studied dialect.

The rounding of suffix vowels is determined by the nearest long vowel or diphthong in the stem, or else by the vowel in the first syllable of the stem. Rounding harmony thus manifests itself in the suffix alternations, and Sanžeev et al. (1962: 41-42) also note similar distributional restrictions on vowels in non-first syllables of stems.

Harmony alternations and other restrictions described above effectively limit the set of vowels in non-first syllables to only seven underlying options, which will be symbolized as follows: /A/, /Ai/, /Aː/, /Uː/, /Ui/, /i/, /iː/. The alternations seen in suffix vowels are summarized in (3), based on the quality of the triggering vowel. The trigger vowel is the last long vowel or diphthong of the stem, or else the first vowel of the stem. The frontness of the trigger vowel is controlled by the first syllable.

(3) Summary of Buriat rounding harmony

Trigger vowel	Suffix vowel						
	A	Ai	Aː	Uː	Ui	i	iː
/a, aː, ai, u, uː, ui/	a	ai	aː	uː	ui	i	iː
/o oː oi/	o	oi	oː	uː	ui	i	iː
/ə, əː, ei, ʉː, ʉi, i, iː/	ə	ei	əː	ʉː	ʉi	i	iː
/өː/	ə	ei	өː	ʉː	ʉi	i	iː
/ʉ/	ə	ei	өː/əː	ʉː	ʉi	i	iː

High suffix vowels only alternate in frontness. Further, the underlying /A Ai/ do not have a front rounded counterpart in the Buriat inventory (no short *[ə], no *[əi]), and thus they appear round only if the trigger is one of /o, oː, oi/. The long non-high vowel /Aː/ shows up with four different qualities on the surface: [aː, oː, əː, өː]. Generally, this vowel always agrees in frontness with the trigger and always takes on rounding from non-high rounded trigger vowels. Even though /Aː/ never appears rounded if the trigger is one of /u uː ui/, it sometimes is rounded if the trigger is the short vowel /ʉ/. Thus in stems where the first syllable vowel is [ʉ], and there are no long vowels or diphthongs in the stem, the suffixes with underlying /Aː/ may appear either with [өː] or with [əː], depending on the stem. As reported by Poppe (1960: 23) all stems where first-syllable [ʉ] fails to trigger rounding have the last syllable beginning with a palatalized consonant.

The phonetic basis of vowel harmony is obscured by the realization of diphthongs, e.g. /ai/ patterns as a back vowel even though it's realized as a front vowel [ɛː]. Several classes of morphemes systematically escape vowel harmony. The so-called particles, such as the negation /gʉi/ [gyi], escape harmony both in Standard Buriat (Poppe 1960) and in the studied dialect. The studied dialect also has a number of non-harmonizing suffixes which are absent Standard Buriat. The non-harmonizing dialectal suffixes will be written here with an underlying lower case vowel symbol. These morphemes behave just as Standard Buriat suffixes with respect to hiatus alternations they trigger (see section 3).

3 Buriat dorsal-zero alternation

This section describes the patterns of hiatus resolution in Buriat and presents the possible alternative analyses of the /g/-zero alternations, many of which have been explored in the literature. The alternations are introduced in 3.1. A deletion account is presented in 3.2 where I present multiple counterexamples from non-alternating /g/-final stems, /g/-initial suffixes, and medial /Cg/ and /gC/ clusters. Sections 3.3-3.4 discuss the insertion account and the morphological accounts, respectively, followed by a summary in section 3.5.

3.1 Hiatus resolution: the data

Buriat allows no word-medial vowel-initial syllables. This generalization is known from the descriptions of Standard Buriat (Sanžeev 1941; Poppe 1960), and it is confirmed by the elicitation data from the studied dialect. Note that the diphthongs, that is sequences of vowels within a syllable, are allowed, witness the surface [œɛ], [ui], and [yi]. In what follows, I will illustrate Buriat hiatus resolution at morpheme boundaries. Buriat has no prefixes, so only suffixal boundaries are discussed. Unless otherwise noted, all data are from the studied dialect, and these data match existing descriptions of Standard Buriat (Sanžeev 1941; Poppe 1960; Sanžeev, Bertagaev & Tsidendambaev 1962). Although the underlying representations for some of the examples are debated, unambiguous surface morpheme boundaries are shown for ease of reference. The symbol '(g)' will be used to refer to the dorsal alternating with zero, where its underlying status is left unspecified.

To set the scene, the behavior of *consonant-final stems* is illustrated in (4).[2] These stems end in a consonant in isolation, or before consonant-initial suffixes such as /xA/ 'infinitive' (4a). In (4b) these stems are followed by the *vowel-initial suffixes*. All vowel-initial suffixes uncovered so far begin with a long vowel after consonant-final stems (and have a long vowel elsewhere). The lack of vowel-initial suffixes with a short vowel may not be fully representative of the studied dialect, but robust data on a couple suffixes starting with a short vowel is yet to be collected.

(4) Buriat consonant-final stems and vowel-initial affixes

a. [xatar-xa] 'dance-INF'
   [bʊ̶rgəd] 'eagle'
   [hʊ̶ːl] 'tail'

b. [xatar-aː] 'dance-IPF' 140809_EO_elct_21_62
   [bʊ̶rgəd-əːr] 'eagle-INSTR' 140820_KB_elct_01_1240
   [hʊ̶ːl-əːr] 'tail-INSTR' 140820_KB_elct_02_1241
   [bʊ̶rgəd-aːn] 'eagle-ABL.DIAL' 140820_KB_elct_09_1248

The examples in (5) illustrate the stems that I'll refer to as *short vowel stems*. These end in a short vowel in isolation (5a). When short-vowel stems are followed by vowel-initial suffixes, hiatus is resolved by vowel deletion, as shown in (5b).

[2] The following abbreviations are used in glosses: ABL.DIAL – dialectal ablative; CAUS(ative); COMIT(ative); DAT(ive); FREQ(uentative); INF(initive); INSTR(umental); IPF – imperfective; PASS(ive); PL.IMP – plural imperative; PST – past.

(5) Buriat short vowel stems and vowel deletion

a. [nabʃa] ‘leaves’
   [ʃono] ‘wolf’
b. [nabʃ-aːr] 'leaves-INSTR' 140819_OB_elct_09_1070
   [ʃon-aːn] 'wolf-ABL.DIAL' 140820_B_elct_12_1157

The /g/-zero alternations happen after *long vowel stems* (6). These stems end in a long vowel or a diphthong in isolation or before a consonant-initial suffix (6a). When long vowel stems are followed by (long) vowel-initial suffixes, a dorsal/uvular sound appears between the two vowels. The surface [g,ɣ,ɢ,ʁ] allomorphs are distributed according to the general pattern of /g/-realization (see section 2). The dorsal also appears between the comitative suffix [tɛː] which is shown word-final in (6c), and the instrumental which was illustrated in (4). The comitative + instrumental combination is shown in (6d).[3]

(6) Buriat long vowel stems and the /g/-zero alternation

a. [xʉlʲəː-dəg] ‘wait-FREQ’ 140811_NB_elct_39_207
   [buː] ‘gun, rifle’
   [taxʲaː] ‘hen’
b. [buːʁaːr] ‘rifle-INSTR’ 140820_B_elct_01_1146
   [xʉlʲəːgəː] ‘wait-IPF’ 140809_EO_elct_23_66
   [taxʲaːʁaːn] ‘hen-ABL.DIAL’ 140820_B_elct_10_1155
c. [hurgaːl-tɛː] ‘education-COMIT’ 140809_EO_elct_09_38
d. [bajartɛːʁaːr] ‘pleasure-COMIT-INSTR’ 140822_OB_elct_14_1581

To summarize, while a potential sequence of a short + long vowel triggers vowel deletion in Buriat (5), the potential sequences of bimoraic vowels show up with a surface dorsal (6b,d). This dorsal segment is absent on the relevant stems and suffixes in other contexts (4),(6a,c). The stem classes in (4-6) are quite pervasive in Buriat (i.e. they all include a large number of stems). The following suffixes trigger the /g/-zero alternation in the studied dialect: /(g)Aːr/ 'instrumental'; /(g)aːn/ 'ablative (dialectal)'; /(g)Aːd/ 'approximative'; /(g)Aː/ 'imperfective, imperfective participle'; /(g)aːn/ 'perfective, perfective participle (dialectal)'; /(g)AːʃA/ 'habitual participle'; /(g)Aːd/ 'perfective gerund'; /(g)AːrAi/ 'future imperative'; /(g)iː/ 'non-future 2nd person imperative'; /(g)UːʒAn/ 'non-future 3rd person imperative'.[4] Finally, the suffix-suffix combinations are rather restricted but the comitative + instrumental sequences illustrated in (6c-d) also show /g/-zero alternations.

[3] The combination of comitative and instrumental affixes also has a fast speech dialectal variant /tʲAAr/ showing apparent vowel deletion, e.g. /noxoi-tAi-Aːr/ [noxœɛtʲoːr] ‘dog-COMIT-INSTR’.

[4] This list is similar to that compiled by Morley (2015) for Standard Buriat, but it includes a few dialectal morphemes and excludes the morphemes which are not used in the studied dialect. In addition to these, Poppe (1960) also lists a number of derivational suffixes which start with a long vowel but which are not recorded after stems ending in long vowels (see also Morley 2015: fn 10). These derivational affixes are of limited productivity: they do not attach to the relevant stems, and some are absent in the studied dialect altogether.

3.2 Deletion account and the non-alternators

This section discusses whether it is possible to analyze the /g/-zero alternation as deletion (Uffmann 2014), and brings some new elicitation data to bear on the issue. The deletion account has two varieties exemplified in (7) with stems and suffixes from (4-6). On the one hand, long vowel stems could underlyingly end in /g/, coupled with word-final and pre-consonantal /g/-deletion (7a). On the other hand, vowel-initial suffixes could start underlyingly in /g/, and in this case /g/ would be deleted after consonants (7b).

(7) Deletion analyses of the Buriat data

	Stem URs: examples	Suffix URs: examples	Deletion examples
a.	/xʉlʲəːg/ 'wait';	/Aː/ 'IPF'; /dAg/ 'FREQ'	/xʉlʲəːg-dAg/ →
	/xatar/ 'dance'		[xʉlʲəːdəg] 'wait-FREQ'
b.	/xʉlʲəː/ 'wait'	/gAː/ 'IPF'; /dAg/ 'FREQ'	/xatar-gAː/ →
	/xatar/ 'dance'		[xataraː] 'dance-IPF'

Although an analysis along these lines has been considered by Uffmann (2014) and Morley (2015), some additional predictions have not been fully explored. If Buriat phonology included one of the deletion processes in (7), then we would expect that g+C or C+g clusters would be absent, or at least restricted in Buriat. The examples of non-deletion of /g/ next to a consonant are thus potential counterexamples to the deletion accounts. Hall (2013) argues for a similar criterion applied to rhotic-zero alternations.

Both my elicitations and the existing descriptions of Standard Buriat present multiple examples of C+g and g+C sequences across a variety of morphological environments. Some examples are given in (8a) for gC sequences and in (8b) for Cg sequences.

(8) Preservation of /g/ next to a consonant

a.	[bəsəg-tə] 'letter-DAT'	140822_OB_elct_36_1603
	[zuraʁ-ta] 'drawing-DAT'	140822_OB_elct_40_1607
	[tanʲi-gda-ba] 'recognize-PASS-PST'	140821_OB_elct_05_1394
	[jaba-gtiː] 'walk-PL.IMP'	140809_EO_elct_34_89
b.	[ɛː-lgaː] 'fear-CAUS.IPF'	140820_B_elct_03_1148
	[malgɛː] '(winter) cap'	
	[xargiː] 'road'	
	[baːbgɛː] 'bear'	

These examples represent a general pattern. Buriat has a good deal of stems which end in a non-alternating /g/, illustrated by the first two examples in (8a). Buriat also has a number of suffixes beginning in a non-alternating /g/, illustrated by the suffixes /-gda/ 'passive' and /-gtiː/ 'plural imperative' in (8a). (8b) shows consonant + g sequences stem-internally and suffix-initially. The suffixes which would begin in /g/ followed by a vowel seem hard to come by, but given that both g+C and C+g sequences are abundant it is not clear how this gap could be incorporated in a possible deletion analysis.

To summarize, the potential accounts where /g/ is deleted before or after a consonant face multiple counterexamples from g+C and C+g clusters. The abundance of counterexamples to /g/-deletion can be taken as evidence against the deletion accounts, and it will be shown that

other accounts do not face this problem. The only potential argument for deletion accounts could come from the absence of suffixes starting in a g+V sequence but since suffixes are a closed class, this gap could be accidental. I will not be considering the deletion analysis in what follows, while acknowledging that further work may be needed to show that the lack of g+V-initial suffixes is a non-productive generalization.

This section has argued that the presence and generality of a consonant deletion process can be falsified by considering potential counterexamples, i.e. instances where /g/ does not alternate with zero in appropriate environments. Hall (2013) applies a very similar criterion in a typological study of rhotic-zero alternations. These results go against the idea that deletion is not distinguishable from insertion cross-linguistically (Morley 2015).

3.3 Insertion account

The insertion account of the /g/-zero alternation is schematized in (9), based on the examples in (4-6) (see also Rice 2008; Morley 2015).

(9) Deletion analyses of the Buriat data

Stem URs: examples	Suffix URs: examples	Insertion examples
/xʉlʲəː/ 'wait';	/Aː/ 'IPF'	/xʉlʲəː-Aː/ →
/xatar/ 'dance'		[xʉlʲəːgəː] 'wait-IPF'

On this analysis, the long vowel stems underlyingly end in a vowel, and vowel-initial suffixes have no initial underlying consonant. A voiced dorsal consonant is inserted between any two bimoraic nuclei. The potential counterexamples to this analysis would be cases of unresolved hiatus, but these do not occur either in the elicitation results or in the existing descriptions. The insertion process described above also seems to be fairly general morphologically, i.e. it applies with a large number of suffixes and in all recorded cases of relevant suffix-suffix boundaries. De Lacy and colleagues cite two affixes which involve suppletive alternations instead of /g/-insertion in a similar context (de Lacy 2006; de Lacy & Kingston 2013), these will be discussed in more detail in section 3.4 below. However, the number of suppletive suffixes is small, compared to the number of suffixes which trigger the /g/-zero alternation (see also Morley 2015).

The main arguments against a general process of dorsal insertion in Buriat are theoretical. In some of the existing OT theories of insertion (de Lacy 2002; 2006; Lombardi 2002; de Lacy & Kingston 2013), epenthetic segments must have the relatively unmarked place feature, unless epenthetic consonant place is influenced by the context. In Buriat the quality of a (reportedly) inserted segment is the same regardless of the surrounding vowels, and therefore we would expect that one of the less marked coronal consonants would be inserted, based on this theory.

In a related set of approaches to markedness, it is assumed that certain phonological patterns are harder to learn than others because of a learning bias which may have a phonetic or a structural source. For example, a growing body of literature argues that phonetically natural alternations are easier to learn than the unnatural ones (Wilson 2006; Zuraw 2007; Becker, Ketrez & Nevins 2011; Baer-Henney & van de Vijver 2012; White 2014), although some studies fail to show such a bias (Hayes et al. 2009; Moreton & Pater 2012a). A pattern inserting a dorsal consonant between any two long vowels is arguably not phonetically natural (as in fact most patterns of default consonant insertion). VV sequences are most phonetically similar to V-glide-V out of all potential VCV sequences (Delattre, Liberman & Cooper 1955; Liberman et al. 1956; O'Connor et al. 1957; Wright 2004). Thus dorsal insertion involves a relatively large perceptual change, and it is therefore expected to be disfavored by a learning bias for perceptually minimal changes (Steriade 2008; Hayes & White 2015).

To summarize, an insertion account seems to capture the Buriat data relatively well. However both the place markedness theory of epenthesis and the existing evidence for a naturalness bias in learning lead us to expect that dorsal insertion may not be internalized as a general pattern, even in the presence of relatively robust evidence.

3.4 Morphological accounts

This section describes a possible approach to the Buriat /g/-zero alternations where the alternation is not handled by the productive phonology of the language. This idea can be implemented in a number of ways. For example de Lacy and colleagues argue that the data in (6) could stem from a pattern of phonologically-conditioned suppletion (de Lacy 2006; de Lacy & Kingston 2013). On the suppletion account, the vowel-initial affixes have a lexically stored /g/-initial variant, thus the instrumental affix would have allomorphs /gA:r/ and /A:r/. Some motivation for the suppletion story comes from the patterning of accusative, reflexive accusative, and genitive in the nominal paradigms. These three affixes have clearly suppletive allomorphs in Standard Buriat (Poppe, 1960), and their patterning is largely confirmed for the studied dialect. An important assumption behind the suppletion analysis is that g-zero alternation is limited to only a few suffixes, and it is a mere accident that these affixes have a very similar pattern of suppletive allomorphy (de Lacy & Kingston 2013: 304). However, the number of affixes triggering the alternation is quite large (see section 3.1 and Morley (2015)), and therefore it seems unlikely that all of these affixes, accidentally as it was, have the same suppletive allomorphs.

Another possible morphological account would assume that all relevant affixes start with a floating feature DORSAL (Zoll 1996; Akinlabi 1996), or possibly a bundle of features, which I will write as /^{g}/. This account is summarized in (10). The floating /^{g}/ is realized only between two bimoraic nuclei, and otherwise it is left unrealized.

(10) Floating /g/ analysis of the Buriat data

Stem URs: examples	Suffix URs: examples	Floater realization examples
/xʉlʲəː/ ‘wait’;	/^{g}Aː/ ‘IPF’	[xʉlʲəːgəː] ‘wait-IPF’;
/xatar/ ‘dance’		[xataraː] ‘dance-IPF’

On this account, Buriat phonology handles the realization and non-realization of the floating features, but the quality of a consonant alternating with zero is specified underlyingly for each affix. A parallel account could assume that the floating features are part of the stem, but this possibility is not entertained further here because the stems are an open class, and because many of the relevant stems show a morphologically governed /n/-zero alternation in other environments (see section 4).

It is interesting to compare the floating /^{g}/ analysis to the suppletion account. The realization of floating features is always governed by phonology whereas suppletive allomorphy doesn’t have to be. In this way, the floating /^{g}/ account seems to better capture the syllabic motivation for the realization of a dorsal. However on both accounts it is a mere coincidence that so many suffixes trigger dorsal-zero alternations according to the same set of rules. The different affixes could as well have different floating features associated with them.

To summarize, this section has presented some possible morphological accounts incorporating the assumption that the dorsal-zero alternation is encoded in the lexicon, at least partially. While these accounts capture the data, they seem to face an issue in explaining the fact that dorsals alternate with zero according to the same set of rules with a large number of suffixes.

3.5 Summary and predictions

This section has considered the possible treatments of the dorsal-zero alternation in Buriat. The deletion analysis faces multiple counterexamples from unresolved C+g and g+C clusters. According to the insertion account, Buriat has a general phonological alternation inserting a dorsal between two bimoraic nuclei (Morley 2015; Vaux & Samuels 2015). On the other hand, according to the morphological accounts, the dorsal alternating with zero is part of the underlying specification of the relevant suffixes (de Lacy 2002; de Lacy 2006; de Lacy & Kingston 2013; Uffmann 2014). The morphological accounts have to assume that a large number of suffixes accidentally match in their morphophonological behavior. The implications of morphological accounts for novel environments will be discussed in detail in section 6.

Based on the data considered so far, it seems that Buriat data favor a phonological insertion account. However, a number of phonological patterns discussed in the literature have proven to be non-productive, sometimes surprisingly so (see Kawahara 2011 for a review). The Buriat dorsal-zero alternation has been subject to a number of alternative analyses, and it has important theoretical implications. For those reasons it is important to test the generalization of the insertion rule to novel environments. The rest of this paper presents new evidence of how Buriat speakers treat new or unfamiliar suffixes. Section 4 presents new elicitation results on the suffix /-AːdAːr/ which attaches to numerals and carries an adverbial distributive meaning (e.g. 'in pairs', 'in bundles of three' etc). Section 5 reports on the results of an experiment with a made-up augmentative suffix /-AːbA/.

4 The numeral distributive

The numeral distributive /-AːdAːr/ presents a suitable test ground for the treatment of dorsal-zero alternations. The affix starts with a bimoraic vowel, and it can in principle be combined with any numeral, some of which also end in bimoraic vowels. However due to its meaning, the numeral distributive is expected to commonly occur with the numeral /xojor/ 'two' (in contexts of people working, walking etc. in pairs), and perhaps with the stem /zuːⁿ/ 'hundred' (in contexts of exchanging a larger bill in bills of a hundred). It is likely that the consultants never produced (and perhaps never heard) this affix with a variety of other numerals. This affix thus serves as a potential novel environment for /g/-zero alternations. On the phonological insertion account, the amount of exposure to this particular suffix should not matter, since Buriat dorsal insertion is a general phonological alternation affecting all sequences of bimoraic vowels.

The examples in (11) illustrate the shape of numeral distributive, and of some numeral stems. The distributive surfaces with a long vowel after numeral stems ending in a short vowel or in a consonant (11a). On the other hand, there are numeral stems which end in a bimoraic vowel and trigger dorsal-zero alternations – these are illustrated in (11b).

(11) Numeral distributive and numeral stems contain a long vowel

a. Numeral distributive with consonant-final stems

/xojor-AːdAːr/	[xojoroːdoːr] 'in bundles of two'
/tabaⁿ-AːdAːr/	[tabaːdaːr] 'in bundles of five'

b. Numeral stems with other suffixes

/zurgaː-Aːr/	[zurʁaːʁaːr] 'six-INSTR'	140820_LD_elct_05_1325
/doloːⁿ-Aːr/	[doloːʁoːr] 'seven-INSTR'	140820_LD_elct_06_1326
/zuːⁿ-Aːr/	[zuːʁaːr] 'hundred-INSTR'	140820_LD_elct_07_1327

Some of the stems in (11b) end in a /Vː^{n}/ sequence containing a floating /^{n}/. Floating /^{n}/ is used here to symbolize a morphologically-governed n-zero alternation. Thus /^{n}/ is always realized in the nominative but never in the instrumental. When the floating /^{n}/ is not realized, the /Vː^{n}/ stems pattern exactly as long vowel stems. Whenever possible, I use the stems clearly ending in a bimoraic vowel to illustrate dorsal-zero alternations. However, since numeral stems are a small class and many numerals end in /Vː^{n}/, such stems are also cited here as relevant.

The insertion account makes a prediction about the combination of the numeral distributive with the stems in (11b): dorsal epenthesis is expected to occur in this case. This prediction is not fully confirmed, as illustrated by the data in (12). All forms here come from two consultants. The same forms elicited from one additional consultant exhibited some variation: on one session the pattern in (12) was produced whereas on a later session, the numeral distributive triggered g-zero alternations with the words for *six* and *seven*.

(12) Numeral distributive with stems ending in a bimoraic nucleus

/zurgaː-AːdAːr/	[zurʁaːdaːr] ‘in bundles of six’
/doloː^{n}-AːdAːr/	[doloːdoːr] ‘in bundles of seven’
/zuː^{n}-AːdAːr/	[zuːʁaːdaːr] ‘in bundles of a hundred’

Overall, the numeral distributive consistently shows up with a dorsal only when attached to the numeral /zuː^{n}/ ‘hundred’. The other numeral stems ending in a bimoraic nucleus exhibit some variation, most commonly showing vowel deletion with the distributive. The resistance of this suffix to dorsal epenthesis is unexpected on the phonological insertion account.

5 Experimental evidence: the new augmentative

The experimental part of this study combines the wug test methodology (Berko 1958) with novel affixes acquisition (Tessier 2012) which has previously been used within the artificial grammar learning paradigm (see Moreton & Pater 2012a; 2012b for a review). Since the morphological accounts postulate that the alternating dorsal is part of an affix, novel stems with native affixes do not provide a suitable test ground for distinguishing the two accounts. For that reason native stems were tested with a novel affix. The participants were taught a new affix /AːbA/ with an augmentative meaning. Native augmentatives are absent in Buriat. The phonological insertion account predicts that the new affix would trigger dorsal/uvular epenthesis when attached to native stems ending in a bimoraic nucleus. This section details the experimental methods (5.1) and results (5.2), and ends with some summarizing discussion (5.3).

5.1 Method

5.1.1 Stimuli

Prior to the experiment, about 50 nominal stems ending in either a consonant or a bimoraic nucleus were identified using the Buriat-Russian dictionary (Čeremisov 1973). These stems were paired with appropriate pictures (obtained from Google picture search) and presented to the participants in a picture naming task, as slides on the screen of a 15-inch notebook computer.[5] The participants were instructed to name the object they see in Buriat using the

[5] Due to power outages, an Ipad 2 was used for picture naming with two participants. All participants did the main experiment with the same notebook computer.

phrase [ənə __] ‘This is ___’. The main experiment used the same pictures as those in the picture naming task. The stimulus set for each participant was designed to include only the words that he or she volunteered as a first reaction to the relevant picture. Although an effort was made to keep the stimulus set constant across participants, there were some inevitable differences. First, some of the participants occasionally failed to provide the intended Buriat word (usually replacing it with a Russian analog, or providing only a more general term such as *bird* for picture of an *eagle*). Second, some of the relevant words were found to have both a dialectal and a literary variant, e.g. *saw* /xʲʉrəː/ [xʲʉrəː] (literary); /xʉrei/ [xʉreː] (dialectal). In these cases, the form that the given consultant volunteered first was used in the experiment, provided that it was of the relevant phonological shape.

All stems used in the main experiment were between one and three syllables long. All stimuli were embedded in a carrier sentence [ənə __] ‘This is ___’. The stimuli for the training phase were presented both auditorily and orthographically. The training set consisted of eight consonant-final stimuli for most participants. Due to occasional failure to produce the relevant words in the picture naming task, one participant (B) received seven training items, one received six (VV), and one – five (NV). The number of training items did not seem to affect the performance in the experiment.

All of the training stimuli were recorded from the same consultant, who did not participate in the main experiment, under the recording conditions described below in 5.1.2. The unmodified training stimuli were recorded in a picture naming task, and the modified stimuli bearing the novel affix were recorded from their orthographic representation. The vowels of the novel affix in modified stimuli varied according to the rules of vowel harmony (Poppe 1960). Each stimulus was recorded in the carrier phrase and repeated three times. The resulting sound files were segmented using Praat (Boersma & Weenink 2012), and the most suitable instance was embedded in the Powerpoint presentation for the experiment. All training stimuli were embedded with the maximal loudness setting of Powerpoint. The training stimuli always included stems of different frontness harmony classes, which means that the novel affix was always changing its shape according to the rules of vowel harmony.

In addition to the training stimuli, there were twelve test stems for each participant: five stems ending in a long vowel or a diphthong, and seven stems ending in a consonant. In total 108 test responses were obtained (12 responses from 9 participants), out of which 45 responses were potential cases of hiatus. The relatively small number of items per participant was motivated by the fact that pilot subjects exhibited visible signs of tiredness and started to modify the shape of the novel affix more and more when additional items were added. The vowel-final test stimuli always included items of different harmony classes as well as items ending in both long vowels and diphthongs.

The consonant-final stimuli in the experiment never ended in /g/ since including these stems could independently explain possible /g/-insertion answers. The Buriat nominal stems very often end in liquids /r l/, and this tendency was inevitably present in the data. However, the training stimuli always included items ending in non-liquids, such as /bʉrgəd/ ‘eagle’, /ʒəməs/ ‘berry’, and /nom/ ‘book’. Whenever possible, consonant-final stems with a non-liquid ending were also included in the test set.

5.1.2 Procedure

At the time of the picture naming task, all participants were unaware of its goal. In the main experiment, the participants were instructed to remember the way in which the words are changed, and to guess the meaning associated with the change from pictures they were presented. The participants were also encouraged to give feedback on whether they thought the

experiment was game-like enough to be appropriate for children, since an extension to children was planned in the future.

At the training phase, the participants were presented eight pairs of pictures where the first picture (normal object) corresponded to a training item in unmodified form while the second picture (big object) corresponded to a training item with the novel affix. The training items were presented both orthographically (on a computer screen) and auditorily (through Sennheiser HD 202 headphones), and the participants were asked to repeat what they heard three times for each slide.

After the training phase, the participants took a short break and were asked what they thought was the meaning of the new item. The test stimuli were presented to the participants only orthographically. At the test phase, the participants were presented with pairs of pictures where the first picture (normal object) was paired with the corresponding unmodified stem while the second picture (big object) appeared with a gapped phrase [ənə __] 'This is ___'. The participants were instructed to fill the gap and to repeat the resulting phrase three times.

The test phase always started with five consonant-final items in order to give the participants some practice in attaching the new affix. The remaining two consonant-final test items were randomly interspersed with vowel-final test items in the final part of the test phase.

The experiment lasted between ten and twenty minutes and was performed in a quiet room. The participants' responses were recorded using an AKG C-1000S microphone (cardioid) and a Zoom H4N portable solid-state recorder. The participants were asked to repeat each response three times. In cases of occasional stutterings, self-corrections, or interruptions, further repetitions were prompted.

The results were segmented using Praat (Boersma & Weenink 2012). Each of the test responses was coded for whether it reflects frontness harmony and rounding harmony (the latter was assessed according to the rules presented in Poppe, 1960). The responses to vowel-final test items were additionally coded for the hiatus resolution strategy they employed. Additional modifications to the novel affix were also noted, although they rarely occurred.

5.1.3 Participants

Nine speakers of Barguzin Buriat from the village of Baragkhan took part in the experiment. One of the speakers (CDSh) spent their childhood in Southern Buriatia (close to Mongolian border), but was living in the area for more than forty years. Data from two additional speakers were discarded since these participants did not use the intended affix, and instead used a completely new morpheme or the Russian augmentative.

For sociolinguistic reasons eight out of nine participants were female, aged between 37 and 65. The one remaining participant (B) was a man aged 17. The consultant's job was not considered socially appropriate for older men.

5.2 Results

Each of the test responses was consistent across the three repetitions. In rare cases of self-correction, the participants clearly insisted on just one response. The participants understood the instructions and were using the novel affix (except for two additional subjects). Since the number of items and participants is relatively small, most of the results reported here are qualitative rather than quantitative. Nevertheless, the pattern is clear in many cases, as we shall see.

5.2.1 Frontness harmony

The participants correctly applied frontness harmony to the novel suffix in all cases. This was judged by the acoustics of the long vowel in the suffix /A:bA/. Short vowels in non-first syllables are subject to qualitative reduction, and the the harmony class of the reduced vowel

is much harder to judge acoustically. For that reason, all instances where the first long vowel of the suffix was deleted or shortened were excluded from assessing harmony patterns (see 5.2.4 on shortening). Across all participants, the long vowel of the novel suffix correctly appeared as [əː/өː] after front-vowel stems in 32 responses, each participant provided at least three such responses, each repeated three times. The long vowel of the suffix correctly appeared as [aː/oː] after back-vowel stems in 54 responses.

5.2.2 Rounding and other harmony

Unlike frontness harmony, the expected rounding harmony was often not found in the data. Occasionally rounding harmony was also overapplied, but only if it led to total harmony. Recall that the rules of Buriat rounding harmony are rather complex. According to Poppe (1960) mid vowels /o oː өː/ always trigger roundness of the suffix /A Aː Ai/, short high central /ʉ/ lexically varies in whether it does so, and /uː u ʉː/ never trigger suffix roundness. The trigger for suffix rounding is reported to be the last bimoraic vowel of the stem or else the first vowel of the stem.

The table in (13) summarizes rounding harmony observed in the data (based only on the responses where the long vowel of the suffix was realized and appeared as long).

(13) Rounding harmony on the novel augmentative suffix

Expected	Observed [+rnd]	Observed [–rnd]	Total	% as expected
[+rnd]	5	6	11	45%
[–rnd]	4	71	75	95%

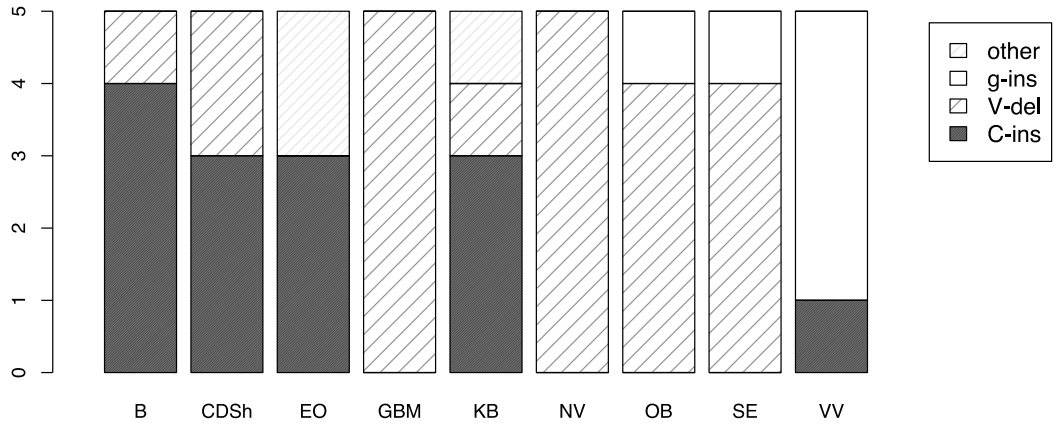
It can be observed that the participants almost never used a round vowel where an unround one is expected. In fact the four cases of 'overrounding' all come from one consultant (NV), and in all of these cases the height of the suffix vowel was also unexpectedly modified. In other words, these four responses changed the intended /Aː/ of the novel augmentative /AːbA/ to [uː/ʉː] after stems with a high rounded vowel in the first syllable. These four responses thus exhibit total harmony – a pattern not found in native Buriat data.

Importantly however, in cases where a round vowel is expected, rounding was actually produced only 45% of the time. Although the amount of data is small in this case, the observations are rather evenly distributed among consultants. This can be a preliminary indication of the fact that rounding harmony in Barguzin Buriat is either not active at all or operative according to a special set of rules.

5.2.3 Hiatus resolution

The potential hiatus between a stem-final bimoraic nucleus and a long vowel of the novel suffix was always resolved. The strategies employed for hiatus resolution are summarized in (14) for each speaker.

(14) Buriat hiatus resolution with the novel affix



It can be observed that hiatus was resolved fairly consistently within each speaker. Six out of nine speakers gave either four or five responses using the same hiatus resolution strategy. /g/-insertion was used as a consistent hiatus strategy by only one speaker (VV, four out of five responses). The remaining speakers together produced only two /g/-insertion responses (one for each OB and SE), and the overall number of /g/-responses for these remaining speakers was not significantly different from zero (Fisher's exact test, $p = 0.25$). The /g/-responses for both OB and SE were produced with the same stem /buː/ 'gun, rifle', yielding the novel augmentative [buːʁaːba].

Four speakers consistently employed vowel deletion in hiatus (GBM, NV, OB, SE). Vowel deletion was also commonly observed as an alternative response strategy for participants who overwhelmingly did insertion of a consonant other than /g/ (B, CDSh, EO, KB). This latter group of participants is in fact rather heterogeneous. For one thing, the participant responses were less consistent within this group (three out of four group members gave only three of the same response). Furthermore, the inserted consonant was different for different participants. Two participants employed insertion of /r/, one participant inserted /l/, and one participant inserted /b/. The insertion of liquids is consistent with the fact that many training and filler consonant-final stems ended in /r l/ in the experiment (see section 5.3 for further discussion). The three responses coded as 'other' in (14) constituted inserting an additional CV or CVC sequence between the stem and the suffix.

5.2.4 Shortening and other modifications

In addition to hiatus repairs and harmony, the participants occasionally also applied other modifications to the novel affix. Shortening is perhaps most notable. The first vowel of the novel augmentative /AːbA/ was shortened in /r/-insertion repairs for participants B and KB (7 responses total). The suffix was realized as /rAbA/ in these cases. Shortening did not occur in any other responses. The duration of the shortened vowel was quite substantial and hardly interpretable as an instantiation of /r/ release: mean 74,66ms, sd 21.7ms for consultant B (24 tokens); mean 61,37ms, sd 13,4ms for consultant KB (18 tokens).

Each consultant gave seven responses for consonant-final stems and occasionally the novel affix was modified with consonant-final stems. Across all participants, there were only seven responses where the suffix /AːbA/ was unexpectedly modified after consonant stems. These

responses consisted in inserting a consonant or a vowel before the suffix (consultants KB and VV) or truncating the suffix to /bA/ (one response from consultant B).

5.3 Discussion

The consultants understood the task, most of them correctly identified the meaning of the novel suffix in the feedback, and the participants used the novel augmentative (with the exception of two speakers whose data was excluded). Importantly, the participants were not simply using the same string of segments all the time: they correctly varied the form of the affix according to the frontness harmony class of the stem.

The hiatus resolution strategies applied by the participants are not fully consistent with phonological /g/-insertion. Thus only one participant (VV) was applied dorsal epenthesis while the majority of subjects either deleted one of the vowels or inserted some consonant other than /g/. The only instances of /g/-insertion in other participants are two responses occurring with the stem /buː/ 'gun, rifle'. The generalization of native hiatus resolution strategies stands in a sharp contrast with the native frontness harmony patterns which were applied consistently by all participants in all cases where harmony could be assessed.

These results may be interpreted to imply that /g/-insertion in Buriat is not generalized to novel affixes, but only with a number of caveats. There remains a possibility that the experiment did not yield robust generalization of dorsal insertion due to lack of power and high response variability. In other words, this study has a small number of participants and items, coupled with a high degree of variation in hiatus resolution strategies, and with some unexpected changes to the novel affix after consonant-final stems. For those reasons the experiment doesn't allow us to make a statistically valid conclusion about the population of speakers as a whole. It remains to be seen how rarely the performance of /g/-inserting subject occurs in general in the studied dialect. In sum, although the results are suggestive, it may be premature to conclude that /g/ insertion is not productive from these data alone.

Finally, with respect to rounding harmony, the present results preliminarily suggest that its rules may be different from those reported by Poppe (1960), or that it may be non-productive in the studied dialect. Recall that other descriptions of Standard Buriat vowel harmony also tend to mention only a part of the patterns discussed by Poppe (Sanžeev 1941; Sanžeev, Bertagaev & Tsidendambaev 1962). Thus although there is no explicit disagreement in the sources, the existence of different descriptions suggests that there may be dialectal differences applicable to Buriat rounding harmony.

6 Analysis: the floating dorsal

Although the hypothesized dorsal insertion rule arguably provides an elegant account of the native data in (4-6), two kinds of novel environments provide preliminary evidence against the productivity of dorsal insertion. First, a rarely occurring numeral distributive suffix was frequently found to trigger vowel deletion rather than dorsal insertion with the stems with which it is not often encountered (section 4). This suffix induced dorsal insertion only in one speaker, and only variably. Second, the experiment with a novel suffix yielded no conclusive support for extension of dorsal insertion to new environments since only one speaker consistently applied this strategy. While more extensive experimental data may be needed to fully establish that dorsal insertion is non-productive, it makes sense at this point to briefly consider the possible alternative analysis of the complete Buriat dataset. This section spells out such an alternative account assuming a floating /^{g}/ and comments on the predictions of this theory. Section 6.1 discusses the ways in which the morphological accounts make predictions for novel environments and section 6.2 presents a detailed OT account of the floating dorsal.

6.1 Morphologically restricted patterns and the novel environments

This section addresses the ways in which the morphological account of the Buriat dorsal-zero alternation makes predictions for novel environments. On this account, the long vowel initial suffixes listed in section 3.1 underlyingly start with a floating /^{g}/. The number of such suffixes is relatively large, and therefore one may wonder if the alternations of floating /^{g}/ would thus be predicted to generalize on this story as well. In fact, the predictions about novel environments will depend on our theory of how Buriat speakers (and learners) come to postulate floating segments.

I propose that, unlike with phonological rules, the postulation of a latent segment or of floating features on a novel affix only occurs if the learner gets positive evidence of an alternation. For most affixes in section 3.1, such evidence is encountered in Buriat inflectional morphology. However, for the numeral distributive in section 4 and for the novel augmentative suffix in section 5 my Buriat consultants may not have received sufficient positive evidence.

As it stands, the morphological account does not yield detailed predictions for novel items. On this account, the native data present no clear evidence of a general hiatus resolution strategy between two bimoraic nuclei, and the experimental training data show no clear resemblance to the natively prevalent lexical pattern of floating /^{g}/. In fact, nothing in the morphological account excludes the theoretically possible suffixes which would start in other floating consonants. Thus if the speakers have no evidence of a floating /^{g}/ but are forced to apply some hiatus resolution strategy, they may generalize vowel deletion (the hiatus strategy observed with short vowels), or they may attempt to guess the floating features present on the given affix.

The results from two new environments are largely consistent with these two strategies being used. Thus my Buriat consultants may not have seen enough positive evidence to establish that floating /^{g}/ is part of the numeral distributive. Therefore dorsal insertion is only variably generalized to the numeral distributive, and vowel deletion often applies here.

In the experiment presented in section 5, the participants never saw the novel affix with /g/-final stems, and they did not get evidence of a /g/-zero alternation. The floating /^{g}/ account is consistent with the experimental results, since only one consultant extended the prevalent lexical property of native suffixes – the floating /^{g}/- to the novel item. The other participants (to the extent that the responses were consistent within a subject) either applied vowel deletion, or inserted a consonant other than /g/, consistent with attempting to guess the floater which is part of the suffix.

Thus the floating /^{g}/ account is potentially consistent with the results in sections 4-5 where hiatus strategies other than dorsal insertion were observed with novel items. In order to incorporate the new results, the morphological account has to adopt the assumption that positive evidence is required to postulate a floater (otherwise we might as well expect that the common floating /^{g}/ will automatically be extended to novel affixes). Furthermore, although the experimental results are consistent with the floating /^{g}/ story, they do not directly test the predictions of this morphological account. Such a test has to be left for the future, and it has to rely on an explicit theory of how morphologically restricted patterns are generalized to novel environments (Albright & Hayes 2003; Hayes et al. 2009; Gouskova & Becker 2013 a.o.)

6.2 An OT account of the floating dorsal

The aim of this section is to fully spell out a possible morphological analysis of the Buriat dorsal-zero alternation. The proposed account captures the general alternation pattern while abstracting away from a couple of affixes which are clearly suppletive (see section 3.4). The approach presented here is casted within Optimality Theory (Prince & Smolensky 2004), and it implements the floating /^{g}/ idea in line with existing work in autosegmental OT (Zoll 1996; Akinlabi 1996; 2011; Trommer 2011; Bermúdez-Otero 2012 a.o.).

I will assume that all affixes that trigger dorsal-zero alternations come with the floating features [dorsal] and [+voice] at the beginning, which is written /ᵍ/ in underlying forms. The voicing specification is necessary to ensure that the floating features are realized as a voiced segment [g/ɣ/ɢ/ʁ] rather than voiceless. The quality of a segment alternating with zero is thus encoded as part of the representation of the particular morphemes.

The exact realization of Buriat /g/ depends on the quality of the vowels in the word: dorsal in front-vowel words and uvular in back-vowel words, with a possibility of intervocalic lenition. These alternations equally apply to all dorsals, regardless of their derivational history. In what follows I will abstract away from these alternations. Although they could be analyzed by some ad-hoc constraint requiring VC feature sharing, analogous to the spreading rule proposed for Mongolian by Svantesson et al. (2005), these alternations are somewhat unique in the typology of harmony processes since they present a case of an arguably non-local vowel-consonant place feature interaction (Padgett 2011; Rose & Walker 2011; Becker 2016). Providing a theoretically-informed analysis of these alternations would lead us too far afield.

In Buriat, the floating dorsal can only be realized by inserting a root node, in violation of the constraint DEP, as defined in (15) (McCarthy & Prince 1995; 1999). Alternatively, the realization of floating dorsal could be analyzed as splitting, i.e. creation of a root node corresponding to an underlying vowel (Staroverov 2014). The difference between the two approaches to epenthesis is irrelevant here.

(15) DEP: assign a violation mark for every surface segmental root node which does not have a correspondent in the input

This analysis treats the Buriat dorsal-zero alternation as epenthesis, but epenthesis of an empty root node, rather than of a dorsal consonant.

Segmental insertion is generally disallowed in Buriat, and therefore the floating /ᵍ/ normally remains unassociated in violation of the constraint *FLOAT (Wolf 2007).

(16) *FLOAT: assign a violation mark for every feature that is not associated to a segmental root node

This is illustrated in the tableau (17) showing attachment of the instrumental suffix /ᵍAːr/ to a consonant-final stem /hʉːl/ ‘tail’ (4b). This paper combines the comparative tableau format of Prince (2002) with numbers showing violation marks.

(17) Floating dorsal is normally left unrealized

	/hʉːl-ᵍAːr/	DEP	*FLOAT
☞ a.	hʉːl(ᵍ)əːr		2
b.	hʉːlgəːr	W1	L

The winning candidate (17a) has a floating dorsal, shown in parentheses. These floating features remain unassociated, and hence not phonetically realized. The losing candidate (17b) represents an attempt to realize the floater which fatally violates DEP.

A more interesting case of floating dorsal non-realization comes from hiatus environments with a short vowel, e.g. /nabʃa-ᵍAːr/ → [nabʃaːr] 'leaves-INSTR' (5). In these cases inserting a root node could help to avoid a violation of ONSET (Prince & Smolensky 2004). Nevertheless, vowel deletion is preferred in this environment, because MAX is ranked below DEP. The relevant constraints are defined in (18-19).

(18) ONSET: assign a violation mark for every surface syllable without an onset consonant

(19) MAX: assign a violation mark for every underlying segmental root node which does not have a correspondent in the output

The analysis of Buriat short vowel deletion in hiatus is presented in (20). Here and below dots show syllabification.

(20) Hiatus resolution via vowel deletion with short vowels

	nabʃa-ᵍAːr	ONSET	DEP	MAX	*FLOAT
☞ a.	nab.ʃ(ᵍ)aːr			1	2
b.	nab.ʃa.ʁaːr		W1	L	L
c.	nab.ʃa(ᵍ).aːr	W1		L	2

Buriat does not tolerate word-medial onsetless syllables, and therefore when two vowels come together at a morpheme boundary hiatus has to be resolved, (20c) cannot win. However, it is better to delete a stem-final short vowel and leave the /ᵍ/ floating than to insert a root node (DEP >> MAX). Therefore the deletion candidate (20a) beats the insertion candidate (20b).

When two bimoraic nuclei come together, deletion is not applicable in Buriat. The special behavior of long vowels in hiatus environments is well-documented cross-linguistically (Casali 1998; Staroverov 2014). In Buriat, the set of long vowels is further extended to include all bimoraic nuclei, i.e. long vowels and diphthongs. As we have seen, the diphthongs pattern together with long vowels in other respects as well (vowel harmony). Here I follow Casali (1998) and Beckman (1998) in assuming that bimoraic nuclei are protected by a special family of positional faithfulness constraints. In particular, MAX-BIMORAIC (21) protects bimoraic vowels from deletion.

(21) MAX-BIMOR(aic): assign a violation mark for every underlying bimoraic segment which does not have a correspondent in the output

The high ranked MAX-BIMORAIC protects long vowels from deletion in hiatus environments. In this case, DEP is violated instead: a consonant root node is inserted, providing a docking site for the floating /ᵍ/. This is illustrated in (22) with the analysis of the mapping /buː-ᵍAːr/ → [buːʁaːr] 'rifle-INSTR' (6b).

(22) Hiatus resolution via root node insertion between two long vowels

	[buː-ᵍAːr]	ONSET	MAX-BIMOR	DEP	MAX	*FLOAT
☞ a.	buː.ʁaːr			1		
b.	buː(ᵍ)r		W1	L	W1	W2
c.	buː(ᵍ).aːr	W1		L		W2

The winning candidate (22a) keeps both input long vowels and avoids the potential ONSET violation through floating /ᵍ/ realization. The competitors on the other hand either delete a bimoraic nucleus (22b) or have a violation of ONSET (22c).

Of course, a bare root node together with dorsal place and [+voice] does not yield a full specification of Buriat /g/. Most of the other features are left unspecified and filled in by phonological and phonetic processes of Buriat.

The proposed grammar of Buriat hiatus correctly predicts that the floating /ᵍ/ should be highly restricted in its distribution: it should only be found in a suffix-initial position before a bimoraic nucleus. According to Richness of the Base, we have to consider inputs where floating /ᵍ/ would occur in other environments, but none of these inputs would give surface evidence of a dorsal-zero alternation. Indeed, if /ᵍ/ occurred next to a short vowel or next to a consonant, it would not have a chance to be realized, since its realization is always triggered by MAX-BIMORAIC. On the other hand, if /ᵍ/ occurred morpheme-internally between two bimoraic nuclei it would always be realized, and thus equivalent to a fully specified /g/. In both of these cases, the learner would fail to postulate a floating segment because input optimization would crucially rely on the constraint prohibiting floating material, namely *FLOAT. The only environment where a floating /ᵍ/ can be reasonably postulated is at an edge of a morpheme, next to a bimoraic nucleus. Since Buriat has no prefixes and very limited compounding and reduplication, this is equivalent to the environment where /ᵍ/ actually occurs.

As I argued in section 6.1, this account is compatible with the new experimental and elicitation data in sections 4-5, on the assumption that postulating a floating /ᵍ/ requires positive evidence. On the floating /ᵍ/ account, nothing in principle excludes suffixes with other floating features, and some of the experimental responses with consonant insertion may be interpreted as an indication that Buriat grammar allows other floaters.

Interestingly, while bimoraic vowel deletion does not occur with native data, it is attested with the numeral distributive and in the experiment. These examples could be used as evidence for further refining our grammatical model of Buriat. The responses with long vowel deletion evidently do violate MAX-BIMORAIC, which we were assuming to be top ranked so far. However, in the absence of a floating /ᵍ/, consonant epenthesis would always involve insertion of place features. We can therefore assume that Buriat prohibits place insertion via a ranking DEP-PLACE >> MAX-BIMORAIC, relevant at least for the speakers who produced long vowel deletion in the absence of a floater.

To summarize, this section has provided an autosegmental OT account of the Buriat dorsal-zero alternation. This account does not postulate a general dorsal insertion process, it is compatible with the evidence in sections 4 – 5, and it correctly derives the distribution of the floating /ᵍ/. As discussed in section 6.1, the predictions of this account should be tested more directly.

7 Conclusion

This paper has provided a detailed examination of the Buriat dorsal-zero alternation, based on new elicitation and experimental data from the Barguzin dialect. While Morley (2015) argues that deletion and insertion analyses cannot be generally separated from each other, the studied dialect of Buriat exhibits robust counterexamples to the deletion analysis (section 3.2). Thus the deletion hypothesis seems falsifiable, at least in Buriat.

The insertion analysis of the dorsal-zero alternation postulates a general dorsal epenthesis process. However, this process does not appear to be generalized to novel environments in at least two kinds of situations. First, the relatively infrequent but productive numeral distributive /-A:dA:r/ does not trigger dorsal epenthesis with stems with which it was probably never seen before by the consultants. Second, when nine Buriat speakers were taught a novel augmentative suffix /-A:bA/, only one speaker systematically generalized dorsal insertion to this suffix. This is in contrast with frontness harmony which was always consistently applied by all speakers. The experimental results also suggest preliminarily that rounding harmony in Buriat may

require further investigation. Although the experimental results are suggestive, the relatively small number of items and participants coupled with high degree of response variability makes it hard to interpret the data quantitatively.

An alternative theoretical model of the Buriat dorsal-zero alternation was proposed in section 6. This model encodes the quality of the alternating segment as an underlying property of the relevant suffixes. The proposed account assumes that the relevant affixes start with a floating /ᵍ/ whose realization is governed by the general properties of Buriat phonology. The model is compatible with the results from novel environments, on the assumption that postulating a floater requires positive evidence.

To summarize, the present results suggest that the hypothesized dorsal insertion rule is not consistently generalized to new environments in Buriat. Although the data are subject to a number of caveats, they stimulated the developmenet of the floating /ᵍ/ account. The predictions of this latter morphological analysis need to be further spelled out, and tested in future experiments.

Buriat epenthesis is known as a potential counterexample to the view that dorsal consonants are relatively marked (Lombardi 2002; de Lacy 2006; de Lacy & Kingston 2013). If the results of this article are on the right track, then this counterexample may be due to a non-productive pattern. Of course, the investigation of Buriat has only indirect implications for markedness, since a detailed investigation of relatively *un*marked glottals and coronals is impossible in this langauge. The present results are also consistent with a naturalness bias for learning and generalizing phonological alternations (Wilson 2006; Zuraw 2007; Baer-Henney & van de Vijver 2012; White 2014; Hayes & White 2015): despite the relatively robust evidence, the arguably unnatural dorsal epenthesis pattern is only rarely represented as a general alternation. The link between Buriat results and naturalness is also indirect, since the phonetically natural patterns are not considered here.

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References

Akinlabi, Akinbiyi. 1996. Featural affixation. *Journal of Linguistics* 32(2). 239–289.

Akinlabi, Akinbiyi. 2011. Featural affixes. In Marc Van Oostendorp, Colin J. Ewen, Elizabeth Hume & Keren Rice (eds.), *The Blackwell Companion to Phonology*, 1945–1971. Malden, MA: Blackwell.

Albright, Adam & Bruce Hayes. 2003. Rules vs. analogy in English past tenses: a computational/experimental study. *Cognition* 90(2). 119–161. doi:10.1016/S0010-0277(03)00146-X.

Baer-Henney, Dinah & Ruben van de Vijver. 2012. On the role of substance, locality, and amount of exposure in the acquisition of morphophonemic alternations. *Laboratory*

Phonology 3(2). 221–249.
Baković, Eric. 1999. Deletion, insertion and symmetrical identity. *Harvard Working Papers in Linguistics 7*.
Becker, Laura. 2016. Vowel-consonant harmony in Uyghur. Ms, Leipzig University.
Becker, Michael, Nihan Ketrez & Andrew Nevins. 2011. The Surfeit of the Stimulus: Analytic Biases Filter Lexical Statistics in Turkish Laryngeal Alternations. *Language* 87(1). 84–125.
Beckman, Jill. 1998. *Positional Faithfulness*. PhD dissertation, Umass Amherst.
Berko, Jean. 1958. The child's learning of English morphology. *Word* 14. 150–177.
Bermúdez-Otero, Ricardo. 2012. The architecture of grammar and the division of labour in exponence. In Jochen Trommer (ed.), *The phonology and morphology of exponence*, 8–83. Oxford: OUP.
Blevins, Juliette. 2008. Consonant epenthesis: natural and unnatural histories. In Jeff Good (ed.), *Linguistic Universals and Language Change*, 79–107. Oxford: OUP.
Boersma, Paul & David Weenink. 2012. *Praat: doing phonetics by computer*. (Software). www.praat.org.
Casali, Roderic. 1998. *Resolving Hiatus*. New York: Taylor & Francis.
Čeremisov, Konstantin M. 1973. *Buriatsko-Russkii Slovar'*. Moskva: Sovetskaya Entsiklopediya.
Churma, Donald G. 1977. On choosing between linguistic analyses: A reply to Klausenburger. *Lingua* 42(2). 131–152. doi:10.1016/0024-3841(77)90023-7.
Delattre, Pierre C., Alvin M. Liberman & Franklin S. Cooper. 1955. Acoustic loci and transitional cues for consonants. *The Journal of the Acoustical Society of America* 27(4). 769–773.
Gick, Bryan. 1999. A gesture-based account of intrusive consonants in English. *Phonology* 16. 29–54.
Gouskova, Maria & Michael Becker. 2013. Nonce words show that Russian yer alternations are governed by the grammar. *Natural Language & Linguistic Theory* 31(3). 735–765. doi:10.1007/s11049-013-9197-5.
Hale, Kenneth. 1973. Deep-surface canonical disparities in relation to an analysis and change: an Australian example. In Thomas Sebeok (ed.), *Current Trends in Linguistics*. The Hague: Mouton.
Hall, Tracy Alan. 2013. How common is r-Epenthesis? *Folia Linguistica* 47(1).
Harris, John. 1994. *English Sound Structure*. Oxford: Blackwell.
Hayes, Bruce, Péter Siptár, Kie Zuraw & Zsuzsa Londe. 2009. Natural and Unnatural Constraints in Hungarian Vowel Harmony. *Language* 85(4). 822–863. doi:10.1353/lan.0.0169.
Hayes, Bruce & James White. 2015. Saltation and the P-map. *Phonology* 32(2). 1–36.
Kawahara, Shigeto. 2011. Japanese loanword devoicing revisited: a rating study. *Natural Language & Linguistic Theory* 29(3). 705–723. doi:10.1007/s11049-011-9131-7.
Klausenburger, Jurgen. 1974. Rule inversion, opacity, conspiracies: French liaison and elision. *Lingua* 34(2–3). 167–179. doi:10.1016/0024-3841(74)90015-1.
Klausenburger, Jürgen. 1977. Deletion vs. epenthesis: Intra- vs. inter-paradigmatic arguments in linguistics. *Lingua* 42(2). 153–160. doi:10.1016/0024-3841(77)90024-9.
Lacy, Paul de. 2002. *The Formal Expression of Markedness*. PhD dissertation, Umass Amherst.
Lacy, Paul de. 2003. Maximal words and the Maori passive. In John J McCarthy (ed.), *Optimality Theory in phonology: a reader*, 495–512. Oxford: Blackwell.
Lacy, Paul de. 2006. *Markedness: Reduction and Preservation in Phonology*. Cambridge: CUP.
Lacy, Paul de & John Kingston. 2013. Synchronic explanation. *NLLT* 31(2). 287–355.

Liberman, Alvin M., Pierre C. Delattre, Louis J. Gertsman & Franklin S. Cooper. 1956. Tempo of frequency change as a cue for distinguishing classes of speech sounds. *Journal of Experimental Psychology* 52(2). 127–137.
Lombardi, Linda. 2002. Coronal epenthesis and markedness. *Phonology* 19(2). 219–251.
McCarthy, John J. 1991. Synchronic rule inversion. *Proceedings of BLS 17*. University of California.
McCarthy, John J. 1993. A case of surface constraint violation. *Canadian Journal of Linguistics* 38. 169–195.
McCarthy, John J. & Alan Prince. 1995. Faithfulness and Reduplicative Identity. Ms, UMass Amherst and Rutgers University.
McCarthy, John J. & Alan Prince. 1999. Faithfulness and identity in Prosodic Morphology. In René Kager, Harry van der Hulst & Wim Zonneveld (eds.), *Prosody-morphology interface*. Cambridge: CUP.
Moreton, Elliott & Joe Pater. 2012a. Structure and Substance in Artificial-Phonology Learning, Part II: Substance. *Language and Linguistics Compass* 6(11). 702–718. doi:10.1002/lnc3.366.
Moreton, Elliott & Joe Pater. 2012b. Structure and Substance in Artificial-phonology Learning, Part I: Structure. *Language and Linguistics Compass* 6(11). 686–701. doi:10.1002/lnc3.363.
Morley, Rebecca. 2015. Deletion or epenthesis? On the falsifiability of phonological universals. *Lingua* 154. 1–26.
O'Connor, J.D., Louis J. Gertsman, Alvin M. Liberman, Pierre C. Delattre & Franklin S. Cooper. 1957. Acoustic cues for the perception of initial /w,j,r,l/ in English. *Word* 13. 24–43.
Padgett, Jaye. 2011. Consonant-vowel place feature interactions. In Marc Van Oostendorp, Colin J. Ewen, Elizabeth Hume & Keren Rice (eds.), *The Blackwell Companion to Phonology*, vol. 3. Malden, MA: Blackwell.
Poppe, Nicholas N. 1938. *Grammatika Buriat-Mongol'skogo iazyka*. Moskva, Leningrad: Izdatel'stvo AN SSSR.
Poppe, Nicholas N. 1960. *Buriat grammar*. Bloomington: Indiana University.
Prince, Alan. 2002. Arguing optimality. In Andries Coetzee, Angela Carpenter & Paul de Lacy (eds.), *UMOP 26. Papers in Optimality Theory II*. Amherst, Mass: GLSA.
Prince, Alan & Paul Smolensky. 2004. *Optimality Theory. Constraint Interaction in Generative Grammar*. Malden, Mass: Blackwell.
Radnaeva, Ljubov D. 2003a. The two types of transcription (the Buryat Language Database). *Proceedings of ICPhS 15*, 2737–2740. Barcelona.
Radnaeva, Ljubov D. 2003b. *Zvukovaja forma sovremennogo buriatskogo jazyka. Teoreticheskije i prakticheskije aspekty kachestvennogo i kolichestvennogo analiza*. Doctoral Dissertation, Saint Petersburg State University.
Radnaeva, Ljubov D. 2006. Phonetic research of the sound form of Modern Buryat language. *Proceedings of the XIth International Conference "Speech and Computer,"* 577–582. Saint-Petersburg.
Radnaeva, Ljubov D. 2008. Issledovanie zvukovoi formy sovremennogo buriatskogo jazyka. *Proceedings of the 36th International Conference "Problemy Izucheniya, sokhraneniya i prepodavaniya jazykov narodov Rossii."* Saint-Petersburg.
Rice, Keren. 2008. Review of de Lacy (2006). *Phonology* 25(2). 361–371.
Rose, Sharon & Rachel Walker. 2011. Harmony systems. In John Goldsmith, Jason Riggle & Alan C.L. Yu (eds.), *The Handbook of Phonological Theory, Second Edition*, 240–290. Oxford: Blackwell.
Sanžeev, Garma D. 1941. *Grammatika Buriat-Mongol'skogo iazyka*. Moskva, Leningrad:

Izdatel'stvo AN SSSR.
Sanžeev, Garma D., T. A. Bertagaev & Ts. B. Tsidendambaev (eds.). 1962. *Grammatika buriatskogo iazyka*. Moskva: Izdatel'stvo Vostochtoi Literatury.
Staroverov, Peter. 2014. *Splitting theory and consonant epenthesis*. PhD dissertation, Rutgers University.
Steriade, Donca. 2008. The Phonology of Perceptibility Effects: the P-map and its consequences for constraint organization. In K. Hanson & S. Inkelas (eds.), *The Nature of the Word: Essays in Honor of Paul Kiparsky*, 151–180. Cambridge, Mass: MIT Press.
Svantesson, Jan-Olof, Anna Tsendina, Anastasia Karlsson & Vivian Franzén. 2005. *The phonology of Mongolian*. Oxford; New York: Oxford University Press.
Tessier, Anne-Michelle. 2012. Testing for OO-Faithfulness in the Acquisition of Consonant Clusters. *Language Acquisition: A Journal of Developmental Linguistics* 19(2). 144–173.
Tranel, Bernard. 1981. *Concreteness in generative phonology: evidence from French*. Berkeley: University of California Press.
Tranel, Bernard. 1996. French liaison and elision revisited: A unified account within Optimality Theory. In C Parodi, C Quicoli, M Saltarelli & M. L Zubizarreta (eds.), *Aspects of Romance Linguistics*, 433–455. Washington, DC: Georgetown University Press.
Trommer, Jochen. 2011. *Phonological aspects of Western Nilotic mutation morphology*. Habilitation thesis, University of Leipzig.
Uffmann, Christian. 2014. Possible epenthetic segments: the role of faithfulness. Handout from a talk presented at Manchester Phonology Meeting 22.
Vaux, Bert & Bridget Samuels. 2015. Consonant epenthesis and markedness. Ms, University of Cambridge and USC.
Walker, Rachel. 1994. Buriat syllable weight and head prominence. *Phonology at Santa Cruz vol. 3*, 99–110. Santa Cruz, CA.
Wetzels, Leo W. 2002. Les adjectifs pré-nominaux du français: formes longues et formes féminines. In Haike Jacobs & Leo Wetzels (eds.), *Liber amicorum Bernard Bichakjian*. Maatsricht: Shaker Publications.
White, James. 2014. Evidence for a learning bias against saltatory phonological alternations. *Cognition* 130(1). 96–115.
Wilson, Colin. 2006. Learning phonology with substantive bias: an experimental and computational study of velar palatalization. *Cognitive Science* 30(5). 945–982.
Wolf, Matthew. 2007. For an autosegmental theory of mutation. In Leah Bateman, Michael O'Keefe, Ehren Reilly & Adam Werle (eds.), *UMOP 32: Papers in Optimality Theory III*, 315–404. Amherst, Mass: GLSA.
Wright, Richard. 2004. A review of perceptual cues and cue robustness. In Bruce Hayes, Robert Kirchner & Donca Steriade (eds.), *Phonetically based phonology*, 34–57. Cambridge: CUP.
Zoll, Cheryl. 1996. *Parsing below the segment in a constraint based framework*. PhD dissertation, UC Berkeley.
Zuraw, Kie. 2007. The role of phonetic knowledge in phonological patterning: corpus and survey evidence from Tagalog infixation. *Language* 83(2). 277–316.