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Emergence and evolution of free variation in Central Pame prefixes: Sound change vs. paradigmatic structure

Borja Herce
University of Zurich

Abstract: Many word forms from different classes in Central Pame (cent2145, Otomanguean) allow two synonymous forms, one containing a prefix with the vowel /a/ and another one with /u/ (e.g. *wa-ttsáuʔ*∼*wu-ttsáuʔ* '(s)he feels'). I conduct historical corpus research and elicitation to throw light on the diachronic origin and contemporary profile of this unusual phenomenon. Evidence suggests that it started as a sound change /a/>/u/ between bilabial consonants. However, paradigmatic pressures have largely dismantled the original distribution of allomorphy synchronically, generalizing free variation (aka. overabundance). In addition, other phonological and morphosyntactic cues have emerged for the probabilistic prediction of these allomorphies. The case provides an extraordinary window into the cognitive underpinnings of sound change, allomorphy, and the paradigm in a highly-inflecting understudied language.

Keywords: Paradigm, sound change, overabundance, analogy, Otomanguean

1 Introduction

Central Pame (Glottocode: cent2145) is an Oto-Pamean (Otomanguean) language spoken by around 3000 people in and around Santa María Acapulco (21.47, -99.44, San Luis Potosí, Mexico). It is classified as threatened according to Glottolog (Hammarström et al. 2021), but the language is still acquired robustly as an L1 by children in many communities. Maybe as expected from a largely unstandardized language, variation is widespread in Central Pame, both in phonological processes and in morphological forms. Among the former, for example, variation has been observed regarding the application of anticipatory vowel quality assimilation in /ahɛ/ and /aʔɛ/ sequences (e.g. maʔɛ̀i∼mɛʔɛ̀i 'chilli pepper.SG', láʔɛʔɛt∼lɛ́ʔɛʔɛt 'dig.1SG.PRS'). Among the latter, the 1DU and 1PL present forms of many verbs have been observed to fluctuate between a prefix ta- and a prefix la- (e.g. láʔɛʔɛik∼táʔɛʔɛik 'dig.1DU.PRS', latsônʔ∼tatsônʔ 'fall.1PL.INC.PRS'). Some of these forms may be preferred in different geographical areas (dialectal variation), or by different speakers (idiolectal variation). In other cases, different forms might be in free variation, used by one and the same speaker with no detectable difference in meaning (cf. Spanish *amara*∼*amase* 'love.1/3SG.IPF.SBJV'). In this paper I focus on one of these cases; one which is extraordinarily prominent in the lexicon and grammar of Central Pame. Many words and word forms from different classes have two acceptable forms, one containing a prefix with a vowel phoneme /a/ and the other one containing the same prefix with the vowel /u/: mbavài ∼mbuvài 'cry.1SG.SUB', wammù∼wummù 'plate.PL', nambù∼numbù 'black', etc. Here I explore the phenomenon in depth.

The language was documented initially 70+ years ago by SIL missionaries Lorna Gibson and Donald Olson, who compiled a number of texts, and descriptions of the language's phonology, and nominal and verbal morphology. As will be shown in coming sections, /a/

forms predominated in the earliest descriptions, and /u/ forms become progressively more common through time until today, when they are found in similar proportions. This, and the phonological environments where /u/-containing allomorphs occurred initially (before bilabials, as will be shown later) makes sound change the prime suspect. Exploring this variation, thus, promises to contribute importantly both to our understanding of overabundance (i.e. the use of synonymous inflected forms in parts of the paradigm, see Thornton 2012), and its links to sound change (actuation) in an unstandardized, under-researched, and highly morphologically complex language.

Section 2 presents the basic facts about Central Pame phonology, Section 3 provides an introduction to the language's morphology and the areas of the grammar (most) subject to this free variation of /a/∼/u/. Section 4 tracks the proportion of /a/ vs /u/ prefixes in relevant word forms in the oldest documented periods. Section 5 presents the results of the synchronic elicitation of 200+ of these overabundant forms from two speakers of different ages. Section 6 pulls apart the different types of /a/∼/u/ variation as they emerge from the synchronic and diachronic profile of different prefixes. Section 7 discusses the results' implications for our understanding of sound change and actuation in different environments. Section 8 discusses their implications for our understanding of paradigm structure. Section 9 summarises the paper, reiterates its main conclusions, and suggests avenues for future research.

2 Phonology of Central Pame

As this paper deals with a putative sound change, a short introduction to the language's sounds is in order. The phonological inventory I assume (see Figure 1) includes five vowel phonemes, in an asymmetric arrangement with more front than back vowels,[1] and 20 consonantal phonemes. This agrees in most respects[2] with the earliest descriptions of the language from 70 years ago (Gibson 1956).

	Bilabial	Alveolar	Palatal	Velar	Glottal
Voiceless stops	p	t		k	ʔ
Voiced stops	b	d		g	
Africates		ts	tʃ		
Fricatives		s	ʃ		h
Nasals	m	n		ŋ	
Laterals		l	ʎ		
Vibrant		r			
Glides	w		j		

	Front	Back
High	i	u
Mid-close	e	
Mid-open	ɛ	
Low	a	

Figure 1: Phonological inventory of Central Pame

[1] Whether /a/ is regarded as [+front] or [+back], and whether it forms a natural class with /u/ is unknown but does not matter for the validity of this nor other claims in this paper.

[2] Gibson (1956) identifies a phoneme /f/, which I only found in Spanish loanwords, and a marginal phonemic contrast between /k/ and a stop articulated further back that I have not found.

A source of uncertainty (largely irrelevant to the present paper) is whether one should consider certain combinations complex segments or segment sequences (see Round 2023). Stops and affricates, most notably, frequently precede /j/, /w/, /ʔ/, and /h/. It is hence unclear whether these might be analysed as complex palatalized, labialized, aspirated, and/or glottalized phonemes (i.e. pʲ, pʷ, pʰ, pˀ, etc.). The same applies to combinations of a nasal and a homorganic voiced stop (i.e. mb, nd, ŋg), which could be analysed as prenasalized stops given their behaviour in the language's phonotaxis and syllabification. Finally, all consonants, with the possible exception of /r/ whose word-medial occurrence is extremely rare, can be phonologically long (aka 'geminate' or 'fortis') or short/lenis. Syllable structure can be quite complex, with up to three consonants allowed in both onset and coda positions.

All vowels may be oral or nasal, with nasality continuing to the end of the word once it occurs. Many diphthongs are also possible (i.e. /au/, /ɛu/, /eu/, /iu/, /ai/, /ɛi/, /ei/, /ui/, etc.) and have the same duration as single vowels. Tautomorphemic sequences of vowels intervened by short glottals (i.e. aha, eʔe, aʔu, ehu, aʔi, uhi, etc.) behave in many respects as single vowels or diphthongs (for example in relation to tone-stress), and could hence be seen as rearticulated vowels (Avelino 2010). The sequences are sometimes realised as creakiness or breathiness towards the middle part of the vowel or diphthong.

The present brief introduction cannot possibly present all the allophonic and phonetic processes in the language. Most pervasive is the neutralisation of the contrast between the alveolar and the palatal or velar series in the environment after /i/, in which context both become palatal.[3] Also important is the fact that consonant clusters, and particularly single short/lenis consonants, and above all short glottals, appear to be often "transparent" to the quality of the previous vowel, particularly /i/ and /u/ (i.e. ike～ikje, aʔi～aʔai, uhi～uhui, etc.). Although the exact articulation of vowels depends, as is generally the case, on neighbouring segments, the distinction between /a/ and /u/[4] is very clear acoustically, with hardly any overlap of their allophonic realizations (see Figure 2), and without neutralization of the phonological opposition in any environment (i.e. both occur in unstressed and stressed syllables, with any tone, and in any consonantal context.).

[3] Here I write these as velar or palatal, in agreement with established convention in the language. This automatic process of palatalization is discussed in more detail in Herce (2024). Essentially, it means that while the two points of articulation (i.e. alveolar vs palatal or velar) are kept distinct in all other environments (e.g. la**tt**òŋ 'I protect' vs la**kk**ò 'I belittle'), they are merged after /i/ (e.g. ki**kk**yòŋ 'you protect' vs ki**kk**yò 'you belittle').

[4] The single back vowel phoneme will be transcribed here as /u/ or 'u' everywhere for consistency, but it should be kept in mind that, because the language lacks a phonemic opposition between back vowels, a transcription with /o/ could have been equally felicitous. The latter solution is adopted, for example, by Gibson in the earliest descriptions. Speakers, by contrast, usually transcribe this phoneme with 'u'. Phonetically, the vowel varies between [u], [ʉ], [ʊ], and [o]. See Becker-Kristal (2010) for a general treatment of this widespread ambiguity.

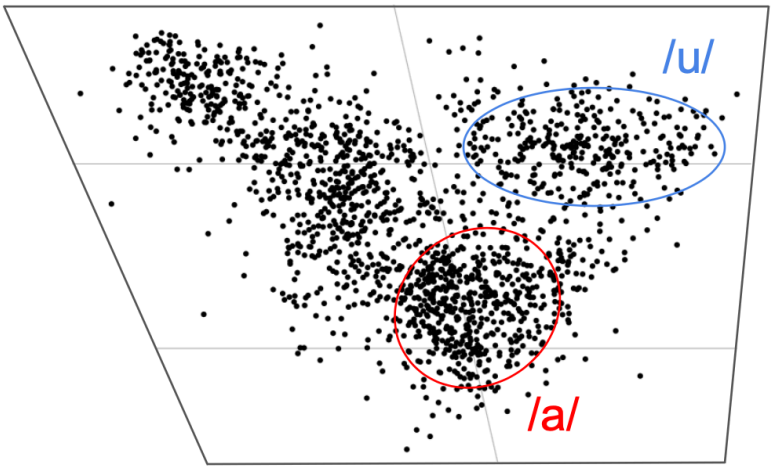

Figure 2: Scatterplot of vowel-token formants of a man in his 50s

Although a detailed analysis would be very welcome, stress and tone appear to be distinctive in Central Pame. They seem to be inextricably linked to each other, however, in that only stressed syllables bear contrastive tone. When the stress falls in the last syllable (which corresponds to the root), this can take any one of three tones: high, falling, and low. When stress falls onto an earlier syllable (which corresponds to the prefix), only the high tone is generally allowed, i.e. tone has not been observed to be distinctive when stress is on the penultimate or antepenultimate syllables. Within these aforementioned limits and implications, stress and tone are unpredictable in Central Pame, i.e. morphologically and lexically contrastive.

Regarding phonotactics, verbal and nominal roots in Central Pame are always monosyllabic (provided, as explained before, that VglottalV sequences do not "count" as VCV). This is invariably so in the native vocabulary, but loan nouns (no loaned verbs have been found) are also often adapted to this structure phonologically, by either shortening them to get rid of a second syllable (e.g. Sp. taza > CP. tás, Sp. yute > CP. yút), by reanalyzing them as morphologically complex, i.e. decomposable into a prefix and a root (e.g. Sp. botón > CP. wa-tű̱ŋ, Sp. brujo > CP. wa-rúh), or by both at the same time (e.g. Sp. guangoche > CP. wa-ŋgútʃ). No constraints have been noted (e.g. regarding same or different point of articulation) regarding which consonants that can coexist within roots.

3 Morphology of Central Pame and loci of /a/∼/u/ free variation

Morphology in Central Pame is quite complex, as in other languages in the Otomanguean stock more generally (Baermann et al. 2019), and in the Oto-Pamean family more specifically (Feist & Palancar 2021, Herce 2022). Verbal inflection is most complex. It is based on multiple morphological layers which are relatively independent from each other: prefixes, tone alternations, stem alternations, and suffixes, all of which show lexically-determined behaviour (i.e. inflection classes) in one way or another. Prefixes (segmented in Table 1) are the most interesting subsystem for the phenomenon under investigation, as it is here that /a/∼/u/ overabundance has been observed (see the /u/ prefixes in bold in Table 1, for which an allomorph with /a/ is also possible). Apart from lexically, verbal prefixes vary depending on the person (1.EX, 1.INC, 2, 3) and number (SG,

DU, PL) of the A or S arguments, as well as according to 6 different TAM categories (PRS, PST, FUT, POT, SUB, IMP).

TAM	Person	'feel'	'die'	'deceive'	'erect'
PRS	1SG	la-ttsáuʔ	la-tù̱	tu-nhù̱n	tú-mmãʔãi
	1PL.EX	ta-ttsáunʔ	ta-tù̱nʔ	tu-nhù̱nʔ	tú-mmãʔãiŋʔ
	2SG	ki-ttʃáuʔ	ki-kjù̱	tu-nhù̱n	tú-mmãʔãi
	2PL	ki-ttʃáunʔ	ki-kjù̱n	tu-nhù̱n	tú-mmãʔãiŋ
	3SG	**wu**-ttsáuʔ	∅-ttù̱	lu-nhù̱n	lú-mmãʔãi
	3PL	∅-ttsháuʔ	∅-ttù̱t	**wu**-nhù̱n	**wú**-mmhãʔãi
SUB	1SG	nda-ttsáuʔ	**mbu**-ttù̱	ndu-nhù̱n	ndú-mmãʔãi
	1PL.EX	nda-ttsáunʔ	**mbu**-ttù̱nʔ	ndu-nhù̱nʔ	ndú-mmãʔãiŋʔ
	2SG	ŋgi-tʃâuʔ	ŋku-ttù̱	ŋgi-ŋhjù̱n	ŋgí-mmjãʔãi
	2PL	ŋgi-tʃâuinʔ	**mbu**-ttù̱n	ŋgi-ŋhjù̱n	ŋgí-mmjãʔãiŋ
	3SG	nda-tsáuʔ	**mbu**-ttù̱	nda-nhù̱n	ndá-mmãʔãi
	3PL	nda-tsháuʔ	**mbu**-ttù̱t	nda-nhù̱n	ndá-mmhãʔãi
FUT	1SG	**mu**nu-ttsáuʔ	ma-ttù̱	**mu**nu-nhù̱n	**mu**nú-mmãʔãi
	1PL.EX	**mu**nu-ttsáunʔ	ma-ttù̱nʔ	**mu**nu-nhù̱nʔ	**mu**nú-mmãʔãiŋʔ
	2SG	mana-ttsáuʔ	maku-tù̱	mana-nhù̱n	maná-mmãʔãi
	2PL	mana-ttsáunʔ	maku-tù̱n	mana-nhù̱n	maná-mmãʔãiŋ
	3SG	mana-tsáuʔ	ma-ttù̱	mana-nhù̱n	maná-mãʔãi
	3PL	mana-tsháuʔ	ma-ttù̱t	mana-nhù̱n	maná-mhãʔãi
IMP	2SG	∅-tʃâuʔt	ku-tù̱t	wi-ŋhjù̱n	wí-mmjãʔãi
	2PL	∅-tʃâunʔ	ku-tù̱n	wi-ŋhjù̱n	wí-mmjãʔãiŋ

Table 1: Partial paradigms of four Central Pame verbs

Given the large number of morphologically quite heterogeneous conjugations (8 large classes, plus many irregulars), and the large number of person-number cells, the complete system is too large and complex to describe here in a comprehensive way (see Olson 1955). I show in Table 1 the partial paradigms[5] of four representative verbs, to show lexical differences in prefixes (compare 3SG.PRS wu-, ∅-, and lu-), in stem alternations (notice how the stem onset becomes aspirated [i.e. -tts- > -ttsh-] in the 3PL in 'feel', but not in 'die'), and in inflectional tone (notice how 'die', and 'deceive' have a constant tone-stress throughout the paradigm [low tone indicated with a grave accent ù], while 'feel' alternates between a high [á] and falling [â] tones).

[5] For compactness, the PST and POT tenses have been omitted as these don't show /a/∼/u/ overabundant prefixes. Dual and inclusive forms have also been left out because these are, in the conjugations in Table 1, predictable from SG and exclusive forms respectively.

Various prefixes in the Central Pame verbal paradigm show fluctuation between /a/ and /u/ vowels. These are mainly the ones highlighted in bold in the shaded cells in Table 1. In Table 1, their /u/ variant has been chosen for consistency, but /a/ is also possible. That is, the PRS.3SG form *wuttsáu?*, for example, alternates freely with *wattsáu?*, the FUT.1SG form *munuttsáu?* alternates with *manuttsáu?* (also *mununhǜn* with *manunhǜn,* and *munúmmã?ãi* with *manúmmã?ãi*), the SUB.1SG form *mbuttǜ* alternates with *mbattǜ*, and the PRS.3PL *wunhǜn* alternates with *wanhǜn* (also *wúmmhã?ãi* with *wámmhã?ãi*).

Nominal inflection in Central Pame is also complex (see Gibson & Bartholomew 1979). Nouns inflect for their own number (SG, DU, PL), and for the person (1.INC, 1EX, 2, 3) and number (SG, DU, PL) of a possessor. Some nouns inflect for the possessor only via suffixes (see 'jug' in Table 2), but others, among which are most body parts and kin terms, but also numerous objects (e.g. 'plate' in Table 2) and even abstract notions, do so via prefixes, stem alternations, and tone as well, much like verbs do. Also like verbs, these nouns are arranged into multiple inflectional classes and contain many irregulars.

Number	Possessor	'sheep'	'plate'	'father'	'jug'
SG	none	**tsu-**tʔèʔ	ma-mmù	-	ma-tsèi
SG	1SG	**tsu-**tʔèʔ	nu-mmàhaŋ	∅-tátk	ma-tsèik
SG	1PL.EX	**tsu-**tʔèʔ	nu-mmàhamʔ	∅-tátk	ma-tsèikʔŋ
SG	2SG	**tsu-**tʔèʔ	ni-mmáhaŋ	∅-tát	ma-tsèikʔ
SG	2PL	**tsu-**tʔèʔ	ni-mmáhan	∅-tát	ma-tsèikʔŋ
SG	3SG	**tsu-**tʔèʔ	ni-mmàhaŋ	**wú-**mmɛuʔ	ma-tsèp
SG	3PL	**tsu-**tʔèʔ	ni-mmàhant	**wú-**mmɛuʔt	ma-tsèpt
PL	none	**su-**tʔèʔt	**wu-**mmù	-	**wu-**tsèi
PL	1SG	**su-**tʔèʔt	ru-mmàhaŋ	-	**wu-**tsèik
PL	1PL.EX	**su-**tʔèʔt	ru-mmàhaŋ	-	**wu-**tsèikʔŋ
PL	2SG	**su-**tʔèʔt	ri-mmáhaŋ	-	**wu-**tsèikʔ
PL	2PL	**su-**tʔèʔt	ri-mmáhaŋ	-	**wu-**tsèikʔŋ
PL	3SG	**su-**tʔèʔt	ri-mmàhaŋ	-	**wu-**tsèp
PL	3PL	**su-**tʔèʔt[6]	ri-mmàhaŋ	-	**wu-**tsèpt

Table 2: Possessor and number inflection in six Central Pame nouns

[6] There are ways to express possession in Pame beside synthetic inflection of the possessed noun, for example through pronouns in possessive function, or through possessive classifiers. The latter is the case of 'sheep', which remains uninflected for possessor because in possessive constructions it occurs together with an possessor-inflectable classifier/noun (i.e. lit. my-animal sheep).

Various prefixes and word forms are attested in both an /a/ and a /u/ form. Most frequent among these, as in verbs, is wa-/wu-, which often expresses the plural number of the noun (see 'jug' in Table 2). This can be unpossessed plural exclusively when dedicated prefixes exist for expressing plurality of the possessor (see 'plate' in Table 2). In a few highly irregular kin terms (see 'father' in Table 2), wa-/wu- indicates a third person possessor, and, very exceptionally, also a second person possessor.

Besides wa-/wu-, various other prefixes have been observed to fluctuate, albeit much less frequently (i.e. only in a minority of the words that have them) between an /a/ and an /u/ form. These include: tsa-/tsu- and sa-/su- (see 'sheep' in Table 2), na-/nu- and la-/lu- (e.g. *nambù/numbù* 'black.SG' and *lambù/lumbù* 'black.PL', and ska-/sku- (e.g. *skasuá?/skusuá?* 'blue'). Note that adjectives (last two examples provided) and adverbs are morphologically similar to (unpossessed) nominal forms, and hence will not be presented separately here.

Without further analysis, identifying the environment, phonological or morphosyntactic, where free variation is found appears to be impossible synchronically. The /a/∼/u/ free variation occurs in both unstressed and stressed contexts. In the prefixes in Table 1 it seems to occur exclusively after a bilabial consonant (note that the realisation of /w/ is usually closer to [β]). However, this does not seem to be a deterministic factor, as this phonological environment (i.e. after bilabial) does not hold, as I showed in Table 2, in all cases of /a/∼/u/ free variation in other grammatical categories.

4 Diachronic emergence of the /a/∼/u/ variability

Because the synchronic situation appears puzzling at first sight, a reasonable thing to do is to inspect earlier descriptions of the language to assess whether the situation was different at some point in the past. We are fortunate enough that the first substantial descriptions of Central Pame are from around 1950, and hence over 70 years old today. Gibson (1956) presented a first but quite thorough and accurate description of the language's phonology and morphophonology. It is very revealing that this (long) paper does not mention fluctuation between /a/ and /u/. This is telling, I believe, because Gibson does mention various others, like between /i/, /e/, /ɛ/, and /a/ in a few words, and, more prominently, between /i/ and /ei/. It is unlikely, thus, that Gibson would have missed the /a/∼/u/ variability if it had been nearly as pervasive as it is today.

To confirm this, and to assess in a quantitative objective way the situation 70 years ago, I consulted all of the earliest descriptions and materials in the language (Gibson 1950a, 1950b, 1950c, Gibson et al. 2016[7]). From these, all word forms were mined which had been found to be /a/∼/u/-variable in the present-day language. I focus on wa-/wu- and mba-/mbu- (N=275), because, as mentioned before, they constitute the majority of overabundant forms and because, and, as will become clear later (Section 6), their observed behaviour is internally cohesive but very different from what happens in other prefixes (hence we need to conclude they represent a separate phenomenon).

[7] Note that despite its publication date the texts were recorded and transcribed around 1950.

Forms with /a/ predominate very significantly in the texts from 1950 (233 vs 42 in number of tokens, 119 vs 33 in number of distinct words). I ran a binary logistic regression linear model in R (function glm), with the a-vs-u vowel of the prefix as the predicted binary variable and morphosyntactic value, identity of the following consonant, stem vowel, stress, and syllable structure as categorical predictors. Only the following consonant and stress were found to be significant (Table 3).

	Chisq	Df	Pr(>Chi)
Morphosyntactic value	7.598	6	0.49
Following consonant	65.268	12	<.001 ***
Syllable structure[8]	0.942	2	0.58
Stem vowel	1.525	4	0.69
Stress	6.822	1	<0.01 **

Table 3: Results of glm model assessing the predictability of the /a/〜/u/ allomorphy from different grammatical and phonological factors. 1950 data.

Looking in detail at the grammatical (Table 4) and phonological environment (Table 5) where each is found I find that, whereas no statistically significant differences can be detected between different grammatical values, the phonological environment was very significantly associated with the use of one allomorph or the other. Before bilabials, particularly non-nasal ones, /u/-containing allomorphs predominated, whereas /a/-containing ones occurred elsewhere, almost without exception. There might also have been a preference for /u/ to occur in stressed prefixes. Focusing on environments before a bilabial (which is where there is variation, and hence where the following consonant is not a sufficient predictor), 15 out of 18 types have /u/ in stressed contexts but only 14 out of 27 in unstressed contexts. This difference, the same as the one between bilabials and other consonants, is statistically significant (Chi-square = 4.6713, p = .031).

	1950				**1975**			
	Tokens		**Types**		**Tokens**		**Types**	
Grammatical value	**/a/**	**/u/**	**/a/**	**/u/**	**/a/**	**/u/**	**/a/**	**/u/**
3SG.PRS	**138**	27	**68**	21	**138**	**167**	**48**	**30**
3PL.PRS	**30**	7	**16**	5	**105**	32	**19**	**9**
SUB	**12**	1	**9**	1	**44**	12	**32**	9
1PL.PRS	**6**	**3**	**5**	**3**	**14**	8	**2**	**3**

[8] With levels 'lenis' (e.g. 'n'), 'fortis' (e.g. 'nn'), and 'consonant cluster' (e.g. 'nt') depending on the phonotatic structure of the following stem onset.

N.SG	**16**	3	**7**	2	**37**	11	**7**	1
N.PL	**16**	1	**10**	1	**9**	**10**	**3**	**3**
ADJ.PL	**15**	0	**4**	0	**28**	0	**5**	0

Table 4: Grammatical value of /a/ vs /u/-containing allomorphs

	1950				**1975**			
	Tokens		**Types**		**Tokens**		**Types**	
Following segment	**/a/**	**/u/**	**/a/**	**/u/**	**/a/**	**/u/**	**/a/**	**/u/**
/b/	0	**1**	0	**1**	0	**4**	0	**2**
/p/	**8**	**21**	5	**16**	0	**58**	0	**20**
/m/	**21**	**16**	**11**	**12**	7	**75**	5	**18**
/l/	**13**	0	**2**	0	**26**	0	**6**	0
/n/	**24**	0	**15**	0	**89**	2	**24**	1
/r/	**5**	0	**1**	0	**1**	0	**1**	0
/s/	**7**	0	**3**	0	**15**	0	**9**	0
/d/	**13**	1	**5**	1	1	**32**	**1**	**3**
/t/	**54**	0	**34**	0	**127**	0	**29**	0
/k/	**18**	1	**15**	1	**37**	**30**	**19**	4
/ŋ/	**4**	1	**3**	1	**15**	3	**5**	1
/ʔ/	**58**	1	**19**	1	**52**	**36**	**15**	**6**
/h/	**8**	0	**6**	0	**5**	0	**2**	0
stressed	**48**	**21**	**33**	**18**	**123**	**86**	**28**	**20**
unstressed	**185**	21	**86**	15	**252**	**154**	**88**	**35**

Table 5: Presence of /a/ vs /u/-containing allomorphs by following segment[9]

A parallel gathering of data (N=622) was conducted in texts from the 1970's (in a translation[10] of Saint John's Gospel). This revealed similar broad tendencies to the earliest texts, but showed a broader distribution of /u/-containing allomorphs. These are now exceptionless before /b/ and /p/ and predominant before /m/. They have also spread to occurring before /d/ and, less regularly, before /ʔ/ and /k/. Overall, thus, the /u/-containing

[9] Some of the phonemes of the language introduced in Figure 1 have not been found in this position. These (e.g. /w/, /j/, /g/) are not shown in the table. Cells have been shaded to indicate visually when the number they contain is a substantial proportion (operationalized as at least one quarter) of their category. Thus, 8/21 (/u/ before /b/ in 1950 tokens) is shaded, but 5/16 (1950 types) is not.

[10] The text can be found here: http://live.bible.is/bible/PBSTBL/JHN/1 I have not been able to find an exact date for when this translation work was done (it probably took several years), but my older informants, some of which were involved in the project, estimate it happened in the mid 1970's.

allomorph can be seen to have become more common over time, while preserving a strong degree of association to concrete phonological environments. This, of course, points very strongly to sound change as the origin of the /a/∼/u/ variability found in Central Pame.

The articulatory motivation of a change BaB > BuB[11] is quite clear. In the typology of sound changes outlined by Garrett & Johnson (2013:19), it would classify as an assimilation motivated by gestural dynamics. It is known (e.g. Hillenbrand et al. 2001) that bilabial consonants have the effect of producing more back and rounded articulations of neighbouring vowels phonetically. If/when the labiality and closedness of the surrounding bilabials spreads to an intervening open vowel, this simplifies/minimizes the movement of articulators. The change in Central Pame appears to have applied quite regularly across heterogeneous grammatical environments, hence largely discarding the possibility of it being (or having started as) a morphological phenomenon. Even though the overlap in phonological environment between the /a/ and /u/-containing allomorphs was not large, a number of words are attested with both wa- and wu- in 1950. These are 8 in total: *wambấʔãn/wumbấʔãn* 'be.fresh.3SG', *wammáŋ/wummáŋ* 'want.3SG', *wámmɛu/wúmmɛu* 'father.3SG', *wappái/wuppái* 'send.off.3SG', *wadùa/wudùa* 'come.3SG', *wáppahuʔ/wúppahuʔ* 'borrow.3SG', *wáppɛhɛ/wúppɛhɛ* 'carry.3SG' and *wáʔuʔ/wúʔuʔ* 'hear.3SG'. Most of these are found later (i.e. in 1975) only with /u/), which suggests that, in all likelihood, the split/inconsistent behaviour of these words and phonological environments in 1950 was the result of the sound change not being yet complete at this early stage.

Something worth mentioning with regard to Central Pame phonotactics (which also explains why the raw counts from Table 4 capture the situation so nicely) is that the language, by all appearances, must have (almost) completely[12] lacked the sequence /wu/ before this sound change created it. Various sources of evidence suggest this. First, although /u/ and /o/ in Spanish borrowings are usually adapted with /u/ (e.g. kumbál < *compadre* 'friend', tambùl < *tambor* 'drum', kustàl < *costal* 'bag', Spanish /βo/ and /βu/ in borrowed words appear as /wa/ (e.g. watún < *botón* 'button') or as /u/ (e.g. sentàu < *centavo* 'cent'). Second, many nominal and verbal stems add /u/ after their consonantal onset following an /u/-containing prefix (e.g. la-ŋkàuʔ 'I greet' > ndu-ŋk**u**àuʔ 'he greeted', more on this in Table 9). This rule, however, never applies after a stem onset /w/ (e.g. la-wwèheʔp 'I hate' > ndu-wèheʔp 'he hated', *ndu-w**u**èheʔp) nor after other bilabials. Third and last, there is cross-linguistic evidence that /wu/ and /ji/ sequences are difficult to pronounce and hear due to the similarity of the two segments (see the OCP principle, Leben 1973, Yip 1988). They are avoided in many languages (e.g. /wu/ is not allowed in Jarawara [Dixon 2004:20], or /ji/ in Spanish: *constr**uy-o*** 'I build', *constr**uy-e**s* 'you.SG build', *constr**uy-e*** '(s)he builds', *constr**u-i**mos* 'we build', *constr**u-ís*** 'you.PL build', *constr**uy-e**n* 'they build') and they are often lost to sound change (e.g. */wu/ > /u/ in the prehistory of Old Norse, as *wulfaz 'wolf', *wullō 'wool', and *wurmiz 'worm' became *ulfr*, *ull*, and *ormr*).

[11] I use the symbol B here to represent any bilabial: /p/, /b/, /w/, or /m/ in Central Pame.

[12] The few cases which have it, like for example nu-wû 'I gave', result from the intersection of a stem vowel /u/ that is stable across the paradigm (e.g. lá-ppu 'I give', kí-ppyu 'you give', etc.), as is generally the case in Central Pame inflection excluding cases of suppletion, plus a very widespread pattern of stem-initial consonant alternation /pp/-/w/-/m/.

5 Synchronic in-depth study of speaker preferences

Central Pame documentation dwindled from the early missionary work and hence no large contemporary corpus exists for the language that can be freely consulted (but see Hurch 2022). In its stead, I conducted a targeted elicitation of words that were identified beforehand (from previous sources and during fieldwork with native speakers) as potentially allowing both prefixes. To detect overabundance, all words were elicited three times,[13] in separate sessions in order to avoid self-priming and to ensure independence. With the same goal, the order of words was randomized before each session, and distractors (i.e. non-overabundant words) were also introduced. In total, 254 target words were elicited from 2 different speakers: a 45 year old female (F45), and a 29 year old male (M29). Among these words, 188 are of the wa-/wu- and mba-/mbu- type that constitutes the focus of this paper. Results for these are shown in Tables 6 and 7.

	F45		**M29**	
Grammatical value	**/a/**	**/u/**	**/a/**	**/u/**
3SG.PRS	**124**	**107**	**135**	**96**
3PL.PRS	**51**	**66**	**40**	**77**
SUB	**24**	**51**	12	**63**
1PL.PRS	**3**	**3**	**2**	**4**
N.SG	**31**	**26**	**39**	**18**
N.PL	**21**	**15**	**25**	**11**
ADJ.PL	**21**	**21**	**30**	**12**

Table 6: Grammatical value of /a/ vs /u/-containing allomorphs

	F45		**M29**	
Following segment	**/a/**	**/u/**	**/a/**	**/u/**
/b/	0	**6**	**2**	**4**
/p/	1	**68**	**29**	**40**
/m/	1	**59**	**20**	**40**
/l/	**6**	3	**7**	2
/n/	**49**	**32**	**38**	**43**
/r/	**3**	0	**3**	0

[13] This number tries to strike a balance between detecting as many cases of overabundance as possible, while at the same time minimizing the number of separate elicitation sessions required. Under the assumption that in a canonically overabundant form each token has a 50% chance of using either form, 3 trials reduce by-chance invariance to 25%.

/s/	**24**	3	**22**	5
/d/	3	**18**	1	**20**
/t/	**81**	**48**	**65**	**64**
/k/	**38**	**22**	**30**	**30**
/ŋ/	**6**	**6**	**3**	**9**
/ʔ/	**38**	**13**	**34**	**17**
/h/	**25**	5	**27**	3
stressed	**54**	**54**	**53**	**55**
unstressed	**221**	**235**	**230**	**226**

Table 7: Presence of /a/ vs /u/-containing allomorphs by following segment

They show that some of the tendencies that were observed diachronically in Section 4 have continued into the modern language. The proportion of /u/-containing forms has continued to increase until representing half of the tokens in present-day language. The trends with respect to phonological environment remain largely in place, but have blurred further. Following 'apparent time' studies in sociolinguistics (see e.g. Bailey et al. 1991), I take the 45 year old speaker to represent here a more conservative *état de langue* than the 29 year old. The younger speaker shows an increased proclivity to allow the /a/-containing prefixes wa- and mba- before bilabial consonants, the environment where the original sound change started and where it appeared to have reached completion 50 years ago. This, I believe, suggests that the original sound change BaB>BuB is no longer active and that morphological analogy is currently in the process of undoing some of its results (more on this in Section 8)

As with the 1950 data in Section 4, I ran a generalized linear model with the same dependent and independent variables. The results (Table 8) show that the importance of the different predictors has changed quite dramatically. The nature of the following consonant continues to play a significant (although less important) probabilistic role in predicting the use of an /a/ or an /u/ form of the prefix. Syllable structure continues to play no role. Everything else, however, has changed. Thus, it appears that stress no longer plays a role regarding the likelihood of wa-/mba- vs wu-/mbu-. Instead, I find a significant statistical effect of the stem vowel.

	Chisq	Df	Pr(>Chi)
Morphosyntactic value	48.086	6	<.001 ***
Following consonant	49.470	13	<.001 ***
Syllable structure	0.198	2	0.91
Stem vowel	153.647	4	<.001 ***

Stress	0.642	1	0.42

Table 8: Results of statistical model assessing the predictiveness of /a/∼/u/ allomorphy from different grammatical and phonological factors. Contemporary younger speaker.

Looking deeper into this, /u/-vowel stems turn out to be much more likely to select wu-/mbu- (156 out of 180), while all other stem vowels prefer wa-/mba- (e.g. 129 out of 186 in the case of /a/). It needs to be kept in mind that, as discussed in Section 2, there are various morphophonological rules in Central Pame that involve vowels apparently "hopping over" consonants or consonant clusters, or generating off-glides in the stem. This usually proceeds from left to right when (semi-)productive rules are involved. Thus, /i/-containing prefixes regularly trigger palatalization of the stem onset and/or an /i/-offglide in the stem nucleus. Similarly, in many lexemes, /u/-containing prefixes trigger an /u/ off-glide in the stem. As a result of these morphophological operations, /u/-containing prefixes tend to co-occur with stems whose (first) vowel is /u/.

gloss	**la- (1SG.PRS)**	**nu- (1SG.PST)**	**ni- (2SG.PST)**
'feel'	la-ttsáuʔ	nu-tsáuʔ	ni-tʃáuʔ
'borrow'	la-sáʔ	nu-sâʔ	ni-ʃâʔ
'wash'	la-séiʌʔ	nu-s**u**éiʌʔ	ni-ʃéiʌʔ
'use'	la-kkéʔ	nu-kk**u**éʔ	ni-kkiéʔ
'belittle'	la-kkù	nu-kù	ni-kiù
'skin'	la-suâ	nu-suâ	ni-ʃuâ
'give'	la-mmɛ̀ũŋ	nu-mɛ̀ũŋ	ni-miɛ̀ũŋ
'visit'	la-ppɑ̀	nu-pɑ̀	ni-piɑ̀

Table 9: Morpho-phonological effects of /a/, /u/, and /i/-containing prefixes on stems

Table 9 illustrates the morphological effects in the language of /u/-containing prefixes (illustrated in this case with nu-). In the first two lexemes (i.e. 'feel' and 'borrow'), this triggers no changes in the stem. In the next two (i.e. 'wash' and 'use'), so called 'labializing' verbs (Olson 1955), a prefix with the vowel /u/ triggers an /u/ off-glide in the stem (in bold). In the next two (i.e. 'belittle' and 'skin'), the stem already has an /u/ vowel and so further labialization is impossible. In the last two, containing bilabial stem onsets, further labialization is also phonotactically impossible.[14]

There could be considerable system-internal pressure for word forms to conform to these syntagmatic "vowel harmonies" of sorts. Thus, whereas a prefix of the form wa- would be expected to occur with the default or underlying form of the stem (and this would have been

[14] The language does not allow sequences of a bilabial consonant followed by /w/. This can be thought of as an OCP-type phonotactic constraint parallel to the one in many languages against sequences of a palatal followed by /j/. In Spanish, for example, /mja/, /nja/, and /kja/ are possible (e.g. *rumia, Estonia, azequia*) but /tʃja/, /ɲja/, and /ʌja/ are impossible.

historically the case), a prefix of the form wu- would be expected to trigger, or co-occur with, the same stem changes as other /u/-vowel prefixes like nu-.[15]

gloss	la- (1SG.PRS)	nu- (1SG.PST)	wa-/wu- (3SG.PRS)	Stem type
'borrow'	la-sáʔ	nu-sâʔ	wa-sáʔ ∼ wu-sáʔ	no-change
'skin'	la-s**u**â	nu-s**u**â	wa-s**u**â ∼ wu-s**u**â	no-change
'use'	la-kkéʔ	nu-kk**u**éʔ	wa-kkéʔ ∼ ʔwu-kkéʔ ∼ *wu-kk**u**éʔ	labializing

Table 10: Paradigm-level morphophonology of wa- and wu- prefixes

These associations are presented in Table 10. While both *wa-sáʔ* and *wu-sáʔ*, or *wa-suâ* and *wu-suâ* would be morphophonologically unexceptional as the 3SG.PRS forms of 'borrow' and 'skin' respectively, only a 3SG.PRS wa- would preserve the extant morphophonological system in labializing verbs, by which labialization is triggered by all and only those prefixes that contain the vowel /u/. This pressure for system-internal conformity (aka system-dependent naturalness, see Dressler 2017) must be the reason that stem vowel has emerged as a probabilistic predictor of the wa-/wu- allomorphy in Central Pame. This finding also agrees with those in other languages (e.g. Kiranti, see Herce 2021) by which maintaining syntagmatic relations of phonological conditioning is highly valued and can determine the evolution of affixal morphology, in this case, a preference for *wa-kkéʔ* over *wu-kkéʔ*. While the inherited morphophonological system could also have been preserved, in theory, by innovating a form *wu-kkuéʔ*, this is never found in Central Pame. As in Western Kiranti, whereas affix choice seems quite flexible, the paradigmatic domain of stem alternation appears to be comparatively inelastic. The fact that stem labialization is not found in the 3SG.PRS, thus, appears to decisively play against this potential form *wu-kkuéʔ*.

What happens with morphosyntactic values might be equally as, or even more interesting. Although in the data from 70 years ago, morphosyntactic values did not seem to impact the chosen form at all, they appear to have become an important predictor nowadays. Thus, although no statistically significant differences were found between different morphosyntactic values initially (see Tables 3 and 4), in the language of contemporary speakers (particularly the younger one), the 3SG.PRS tends to significantly prefer wa- to wu- (135 vs 90), while 3PL.PRS tends to prefer wu- to wa- (74 vs 40), and the SUB form tends to prefer mbu- to mba- (60 vs 12). Nominal and adjectival forms, in turn, all prefer wa- forms over wu- (39 vs 15, 25 vs 8, and 27 vs 7). These differences, unlike those in 1950, are statistically highly significant (e.g. for 3SG.PRS vs 3PL.PRS, Chi-squared = 18.8032, p=.000014). They also appear to have emerged gradually (see Table 11), which might be indicative of an evolutionary preference towards certain allomorphs for particular morphosyntactic values. This will be discussed in detail in Section 8.

[15] Note that this applies only to stem labialization. Other stem alternation processes occur in the language (e.g. the consonant length alternations observed in many of the forms in Table 9 between PRS and PST) which are completely orthogonal to the presence or absence of an /u/ prefix.

	1950		1975		F45		M29	
Grammatical value	**/a/**	**/u/**	**/a/**	**/u/**	**/a/**	**/u/**	**/a/**	**/u/**
3SG.PRS	0.976 (N=68)	1.087 (N=21)	0.907 (N=48)	1.196 (N=30)	1.101 (N=124)	0.904 (N=107)	1.165 (N=135)	0.834 (N=96)
3PL.PRS	0.973 (N=16)	1.097 (N=5)	1.000 (N=19)	0.999 (N=9)	0.894 (N=51)	1.101 (N=66)	0.681 (N=40)	1.321 (N=77)
SUB	1.150 (N=9)	0.461 (N=1)	1.151 (N=32)	0.682 (N=9)	0.656 (N=24)	1.327 (N=51)	0.319 (N=12)	1.686 (N=63)
1PL.PRS	0.793 (N=5)	1.727 (N=3)	0.590 (N=2)	1.865 (N=3)	1.025 (N=3)	0.976 (N=3)	0.664 (N=2)	1.338 (N=4)
N.SG	0.993 (N=7)	1.024 (N=2)	1.290 (N=7)	0.389 (N=1)	1.115 (N=31)	0.890 (N=26)	1.364 (N=39)	0.634 (N=18)
N.PL	1.161 (N=10)	0.419 (N=1)	0.737 (N=3)	1.555 (N=3)	1.196 (N=21)	0.813 (N=15)	1.384 (N=25)	0.613 (N=11)
ADJ.PL	1.277 (N=4)	0.000 (N=0)	1.474 (N=5)	0.000 (N=0)	1.025 (N=21)	0.976 (N=21)	1.424 (N=30)	0.573 (N=12)
sum	119	33	116	55	275	289	283	281

Table 11: Index of over/underrepresentation[16] of /a/ and /u/ forms with different values

6 Different types of /a/～/u/ variation

Note that, although a sound change BaB > BuB fits the phonological environments of wa- vs wu- and mba- vs mbu- prefix allomorphy very well, particularly in the earliest periods, it does not fit other less prominent cases of /a/～/u/ variation that had been detected in the language. Because of their different synchronic and diachronic profile, I consider there are two comparatively independent phenomena.

The first concerns the first person future forms manu- vs munu- in verbs. All sources from 1950 and from 1975 report the form manu- exclusively (N=76), whereas the form munu- is the only one that appeared in the contemporary elicited data (N=120) from both speakers. Even though forms with manu- were not categorically rejected as ungrammatical, this variation/change has a completely different profile than the one of wa-/wu- and mba-/mbu-. Diachronically, it appears to have been a much faster change from one allomorph to the other. Phonologically, the /a/ that underwent change would not have ever been before a

[16] This index is calculated as follows: (total.datapoints*tokens.of.a.or.u.allomorph.with.value.X/tokens.with.value.X/)/tokens.of.a.or.u.allomorph. For example: [(119+33)*68/(68+21)]/119 = 0.976. As this is slightly <1, this means /a/-forms are slightly underrepresented in the 3SG.PRS in 1950, given the incidence of /a/ and /u/ forms in this period.

bilabial, as it is consistently before /n/,[17] so the sound change would not have applied in this environment. The change has, hence, the appearance of a morphological analogical one. Many tenses (including the FUT in the nu/na syllable) are characterized by an /u/ in the first person opposed to /a/ in the third person. The change from manu-/mana- to munu-/mana- may thus constitute an extension of a general morphological pattern, facilitated maybe by the increased univerbation of what was formerly a syntactically independent word/clitic *ma* into prefixal TAM and agreement-marking morphology.

The second source of /a/〜/u/ fluctuation concerns tsa-/tsu-, sa-/su-, na-/nu-, la-/lu-, and ska-/sku- prefixes in nouns and adjectives. The motivation and evolution of this variation is less clear to me because it involves comparatively few items. It appears to be associated with a flux of members between similar (small) inflectional classes. As discussed by Gibson & Bartholomew (1979), and as briefly advanced around Table 2, nouns and adjectives fall into various different declensions by their SG/PL prefixes. Two of these classes (namely tsa-/sa-, and tsu-/su-) might be similar enough that members fluctuate quite frequently between them. 'Ash', for example, is first attested as *sandué* (in Gibson 1950b), but is now consistently *sundué* in the elicited data from my consultants. 'Sheep' is attested as *sat?ɛ?* in the earliest texts but is now consistently *sut?ɛ?*. The choice of form varies, thus, across periods. Sometimes, however, variation is observed across speakers. The word for 'soldier' (borrowed from Sp. *soldado*) was produced consistently as *sandàl* by one speaker (M29), and *sundàl* by the other (F45); 'black' was *nambù* for one (M29) (*lambù* in the plural), and *numbù/lumbù* for the other (F45), 'blue' is consistently *skusuá?* for one (F45), and *skasuá?* for the other (M29), and 'wool' is *sadù* for one (F45) and *sudù* for the other (M29).

Of course, the fact that these prefixes also involve /a/ vs /u/ may have played some role. The variation caused by the BaB > BuB sound change might have fuelled the spread of /a/〜/u/ confusions in other domains. However, these other prefixes/forms (i.e. manu-/munu-, sa-/su-, na-/nu-, ska-/sku-, etc.) tend not to partake in overabundance, variation between them being structured diachronically, or dialectally or idiolectally instead. This fundamental difference (i.e. that they are clearly "something else" compared to the variation between wa-/wu- and mba-/mbu-) is the reason why they have not been the focus of the present research, even though distinguishing different types of /a/-/u/ variation was fundamental initially to narrow down the object of analysis to explore a coherent phenomenon.

7 Relevance to sound change and actuation

The findings from previous sections bear on both the limits of sound change and the importance of paradigmatic structure. With regards to the former, they provide evidence, in a severely underdocumented and non-WEIRD (Henrich et al. 2010) language, of a sound change and its rough temporal progression, spanning around 7 decades. They suggest that the BaB>BuB sound change in Central Pame did not have a single immutable domain of

[17] In those verbs that have ma- rather than manu-/mana- as their FUT morpheme (see e.g. 'die' in Table 1), the /a/ is compulsory and /u/ is never found, not even before bilabial stems like in *ma-ppú?* 'descend.1SG.FUT'. This could suggest that a preceding /m/, unlike /b/ and /w/ (we cannot know about /p/, unfortunately, due to its absence from inflectional prefixes), might not have provided the required phonological environment for the change (see also the mixed status of following /m/ in Table 4). Alternatively, morphological analogy could have reintroduced or preserved ma- in these few verbs.

application from beginning to end. Rather, this domain appears to have progressively expanded diachronically to include a wider range of phonological environments.

Thus, in 1950 (the earliest documented period) it appears that (non-nasal?)[18] bilabials were the ones that preferably triggered the change (see Table 12), particularly in stressed syllables. In later periods, it is observed that the change becomes more categorical in its original environment while also extending to new and more idiosyncratic phonological environments: /m/ (the remaining bilabial), short /d/ and /ʔ/ followed by /u/ in 1975, /k/ and /ŋ/ in the older present-day speaker consulted, and /t/ and /n/ in the younger speaker. These new environments are progressively less conducive to the sound change at hand and more at odds with its assumed initial phonetic characteristics (involving labiality, raising, and backing). The phonologically unnatural environment (in the sense of Mielke 2008) where the /u/-containing allomorphs occurred at this stage could be interpreted as the first sign of dephonologization. Only at the last stage, however, do we observe a return of wa- and mba- prefixes to those environments (i.e. before bilabials) that they had been expelled from initially by the sound change. This, in my view, marks the point when the sound change has certainly ceased to operate productively.

	1950		**1975**		**F45**		**M29**	
Following segment	**/a/**	**/u/**	**/a/**	**/u/**	**/a/**	**/u/**	**/a/**	**/u/**
/b/	0	**1**	0	**2**	0	**6**	**2**	**4**
/p/	5	**16**	0	**20**	1	**68**	**29**	**40**
/m/	**11**	**12**	5	**18**	1	**59**	**20**	**40**
/l/	**2**	0	**6**	0	**6**	3	**7**	2
/n/	**15**	0	**24**	1	**49**	**32**	**38**	**43**
/r/	**1**	0	**1**	0	**3**	0	**3**	0
/s/	**3**	0	**9**	0	**24**	3	**22**	5
/d/	**5**	1	**1**	**3**	3	**18**	1	**20**
/t/	**34**	0	**29**	0	**81**	**48**	**65**	**64**
/k/	**15**	1	**19**	4	**38**	**22**	**30**	**30**
/ŋ/	**3**	1	**5**	1	**6**	**6**	**3**	**9**
/ʔ/	**19**	1	**15**	**6**	**38**	**13**	**34**	**17**
/h/	**6**	0	**2**	0	**25**	5	**27**	3
stressed	**33**	**18**	**28**	**20**	**54**	**54**	**53**	**55**

[18] The differences between /p/ and /m/ border on statistical significance. Phonetically, voicing and nasality are known to modify the articulation of vowels, particularly with vowel height. Voicing of neighbouring consonants appears to be phonetically associated with more closed articulations of open vowels (see Hillenbrand et al. 2001), so it is surprising that this should slow down a change /a/>/u/. Given the known association between nasality and vowel height (Abramson et al. 1981, Beddor 1983, Chen 1997) (it makes low vowels higher and high vowels lower) it also seems unusual for nasality to do so.

unstressed	**86**	15	**88**	**35**	**221**	**235**	**230**	**226**

Table 12: Phonological contexts associated to /a/ and /u/ allomorphy in different periods

It might be interesting to inspect, in addition, the proportion of forms which are found, for different periods and speakers, to be attested in its two forms (and are hence indisputably overabundant). The numbers in Table 13 draw on words that are documented or elicited at least two times.[19] They show that the proportion of wa-/wu- and mba-/mbu- words that appear with both forms (e.g. *wáppahuʔ* and *wúppahuʔ* 'borrow.3SG' are both attested in 1950) has varied across time. In the earliest sources, most of the words that are attested with wu-/mbu- are also attested with wa-/mba-. This, as well as the low proportion of /u/ forms and their sensible initial phonetic environment, indicates that these early cases of overabundance must have been due to sound change actuation. The speech community cannot fall asleep one day saying *wáppahuʔ* and wake up the next day saying *wúppahuʔ*, so the coexistence of the old and the new pronunciation is not surprising. Later periods witness the completion of the sound change in its (ever expanding) phonetic environment, and hence overabundance practically disappears. After the sound change ceases to apply productively, however, overabundance makes a swift comeback. As (some) speakers fail to identify the context/niche where each allomorph is found, morphological analogy begins to modify the regular (i.e. phonologically-derivable) distribution of the allomorphy to follow morphological structural reasons instead. These are outlined in Section 8.

	1950	**1975**	**F45**	**M29**
/a/-only	78% (N=46)	64.8% (N=46)	47.3% (N=89)	26.6% (N=50)
overabundant	13.6% (N=8)	1.4% (N=1)	3.2% (N=6)	44.7% (N=84)
/u/-only	8.5% (N=5)	33.8% (N=24)	49.5% (N=93)	28.7% (N=54)

Table 13: Proportion of attested overabundant forms in different periods/speakers

Before concluding the discussion on the interface between sound change and morphology, it must be pointed out that a regular change BaB>BuB should have introduced /u/ not only in many /a/-containing prefixes, but also in a few /a/-containing stems. Some bilabial suffixes exist (mostly -mʔ, which occurs as a mark of 1.DU.EX A/S and possessor, and -p, which occurs as a marker of 3 IO in verbs, and of 3 possessor in nouns) which would have provided the right phonological environment for the sound change to apply in stems of the form Ba. Thus, the sound change would have been expected to apply to forms like *ta-wà-mʔ* 'go.1DU.EX.PRS', *na-mbâ-mʔ* 'waist.1DU.EX', *tu-ppǎ-mʔ* 'complete.1DU.EX.PRS', tá-ppahamʔ 'imitate.1PL.EX.PRS', *ŋgu-bà-pt* 'tissue.3PL', etc., but not to most other forms in the same paradigms that had either non-labial or zero suffixes (e.g. *la-wà-∅* 'go.1SG.PRS',

[19] The data from 1950 and 1975 on the one hand, and that of F45 and M29 on the other can be compared without further provisos. Comparisons between the former (corpus data from multiple speakers) and the latter (elicited data from single speakers), however, have to be taken with a grain of salt. The frequencies of corpus data are Zipfially distributed (e.g. in the 1950 data, words vary between being attested 2 times only [26 words] and being attested 19 times [the word *waʔě̀heʔ* 'say.3SG']), while in the elicited data each word appears three times exactly. This, of course, impacts the random chance for overabundance to be attested in these two types of data. However, given that 3 is close to the mean number of occurrences in the corpus data of words attested at least twice, this is unlikely to represent a very significant distortion.

ta-wà-n 'go.1PL.INC.PRS'). Forms like **ta-wù-mʔ*, however, are never found, and these lexemes have stable /a/ vowels throughout their paradigms. Whereas prefixal vowels are, obviously, highly variable, stem vowels are for the most part invariant across the paradigm in Central Pame. Because /u/ would have been introduced in only a very few cells of very few lexemes, and with an unparalleled paradigmatic distribution, the sound change could have been resisted here from the beginning (consider as a parallel example the resistance to palatalization in the first conjugation of Romance verbs, see e.g. Maiden 2004:165).

8 Relevance to paradigm structure

Central Pame is, in the typical Otomanguean fashion, a very complex language morphologically. Thus, and in contradistinction to languages like English, the overwhelming majority of word forms in the language are paradigmatically related to many other word forms. Paradigm structure becomes, in this context, of the utmost importance to understand the actuation of sound changes and the final distribution of their outcomes.

I showed in Tables 3, 8, and 11, that, although morphosyntactic values appeared not to have played any role initially (as expected, probably, from an ongoing productive sound change), they started to play an ever-increasing role later on. Had it applied regularly (as it largely did in the intermediate periods), the sound change BaB>BuB should have produced the paradigmatic results illustrated in Table 14.

Class		Conjugation I		Conjugation IV		Conjugation II	
TAM	Person	'feel'	'want'	'die'	'be scared'	'deceive'	'erect'
PRS	1SG	la-ttsáuʔ	la-mmə̀ŋ	la-tŭ	la-pûi	tu-nhŭn	tú-mmãʔãi
	1PL.EX	ta-ttsáunʔ	ta-mmə̀nʔ	ta-tŭnʔ	ta-pûiŋʔ	tu-nhŭnʔ	tú-mmãʔãiŋʔ
	2SG	ki-ttʃáuʔ	ki-mmjə̀ŋ	ki-kjŭ	ki-pjûi	tu-nhŭn	tú-mmãʔãi
	2PL	ki-ttʃáunʔ	ki-mmjə̀n	ki-kjŭn	ki-pjûiŋ	tu-nhŭn	tú-mmãʔãiŋ
	3SG	**wa**-ttsáuʔ	**wu-**mmə̀ŋ	∅-ttŭ	∅-pûi	lu-nhŭn	lú-mmãʔãi
	3PL	∅-ttsháuʔ	∅-mmhə̀ŋ	∅-ttŭt	∅-pûik	**wa**-nhŭn	**wú**-mmhãʔãi
SUB	1SG	nda-ttsáuʔ	nda-mmə̀ŋ	**mba**-ttŭ	**mbu-**ppûi	ndu-nhŭn	ndú-mmãʔãi
	1PL.EX	nda-ttsáunʔ	nda-mmə̀nʔ	**mba**-ttŭnʔ	**mbu-**ppûiŋʔ	ndu-nhŭnʔ	ndú-mmãʔãiŋʔ
	2SG	ŋgi-tʃâuʔ	ŋgi-mjə̀ŋ	ŋku-ttŭ	ŋku-ppûi	ŋgi-ŋhjŭn	ŋgí-mmjãʔãi
	2PL	ŋgi-tʃâuinʔ	ŋgi-mjə̀n	**mba**-ttŭn	**mbu-**ppûiŋ	ŋgi-ŋhjŭn	ŋgí-mmjãʔãiŋ
	3SG	nda-tsáuʔ	nda-mə̀ŋ	**mba**-ttŭ	**mbu-**ppûi	nda-nhŭn	ndá-mmãʔãi
	3PL	nda-tsháuʔ	nda-mhə̀n	**mba**-ttŭt	**mbu-**ppûik	nda-nhŭn	ndá-mmhãʔãi

Table 14: Partial paradigms of six Central Pame verbs (regularly expected outcomes)

If/when wa- and mba- regularly changed to wu- and mbu- respectively before a bilabial, many inflection classes in the language would have split into two (see Herce 2024, Forthcoming for an overview of prefixal inflection classes in the language). As long as the sound change was productive and BaB sequences in the language were automatically

turned into BuB, the allomorphy was phonologically conditioned and remained predictable. However, after the sound change ceased to operate, speakers must have had to face a very complex morphological configuration.

Inflection classes in Central Pame are generally quite different morphologically from each other. Many values and prefixes (see e.g. 3SG.PRS wa-, ∅-, lu-, or 1SG.SUB nda- mba- ndu- in Table 11) are diagnostic of inflection class membership, and thus, concerning prefixes, solving the Paradigm Cell Filling Problem (PCFP, see Ackerman et al. 2009) would not have represented an exceedingly complex task initially. The change BaB>BuB, however, introduced a great degree of additional complexity into the system, as it generated various minimally different classes, identical everywhere except in one cell/prefix. This complicated the PCFP very significantly. For example, whereas a single principal part (e.g. 3SG.PRS) would have sufficed to identify the prefixal inflection class before the change in the forms in Table 11, three principal parts (e.g. 3.SG.PRS, 3PL.PRS, and 1SG.SUB) became suddenly necessary after the change. The number of distillations (i.e. sets of cells which are not mutually predictable) also doubled (from 3 to 6), the average predictability of inflection classes was severely reduced (from 0.810 to 0.554), etc.[20]

As the data from Section 8 show, speakers' reaction appears to have been twofold:

a) The two competing forms became allowed in many/most verbs (see Table 13). Systematic overabundance, thus, "came to the rescue" of the older system by merging again the conjugations that had split in a single cell/prefix via sound change. Although the former phonological conditioning environment is still detectable synchronically as a probabilistic preference towards /a/ or /u/-containing forms before certain segments (see Tables 12 and 13), the competence[21] and performance of younger speakers show that most verbs allow both forms quite freely nowadays.

b) At the same time, unconditioned free choice is exceedingly uncommon in language, as it constitutes a superfluous complication to grammar compared to the absence of variation. As the predictive role of some phonological cues (i.e. following consonant) dwindled, other phonological cues (i.e. stem vowel) and morphosyntactic values started to be co-opted as predictors for the /a/ vs /u/-containing allomorph that should be used in different environments. Concerning the latter, as Table 11 shows, 3SG.PRS forms tend to favour wa-, 3PL.PRS forms favour wu-, SUB forms favour mbu-, and nominal and adjectival declension favour wa-. Were these trends to continue and become categorical requirements, of course, overabundance would disappear from the system once again.

It appears, furthermore, (see Table 11) that these preferences did not arise by chance from the accidental overrepresentation of one or the other allomorph in particular conjugations in the earliest period. Rather, they seem to often run against early proportions and gradually take the upper hand. This could suggest that they are due to some sort of selective preference (Newberry et al. 2017) for one of the forms. Selective advantages might not be

[20] These and other measures can be calculated in Finkel & Stump's Principal Parts Analyzer (https://www.cs.uky.edu/~raphael/linguistics/analyze.html). For explanations of these and related metrics of morphological complexity see Stump & Finkel (2013, 2015).

[21] Grammaticality judgements were obtained to compile the list of words to be elicited.

too difficult to identify in some cases. The preference for 3PL.PRS wu-, for example, could be plausibly derived from the presence of the same vowel /u/ elsewhere across the present in the conjugation where this occurs (i.e. *tu-nhǜn, lu-nhǜn, wu-nhǜn* or *t-unhǜn, l-unhǜn, w-unhǜn* if you will). The same could be said of the preference towards wa- in nominal and adjectival paradigms. Prefix vowels across most Central Pame declensions tend to be shared across number (Gibson & Bartholomew [1979:310] give among others ni-/li-, ni-/ri-, na-/la-, na-/ra-, mi-/wi-, tsu-/su-, tsa-/sa-, and tʃi-/ʃi- classes). A class ma-/wa- fits into this system much better than a ma-/wu- class.

The speed with which different meanings move towards fixation (i.e. towards a categorical /a/ or /u/ prefix), however, seems to depend also very importantly on the frequency of the value/form at hand (Reali & Griffiths 2010, Ventura et al. 2022). The 3SG.PRS is the most frequent inflectional value in the verb. In addition, the inflectional class which has 3SG.PRS wa-/wu- is the most numerous one in the language. This is the cell/form for which the speakers show a more balanced distribution of allomorphs, close to 50%-50%. Next in frequency (and next more balanced) is the 3PL.PRS and its corresponding inflectional class. Least frequent and least balanced are SUB forms and their class.[22]

9 Conclusions

This paper has explored in detail a recent sound change in Central Pame, and its morphological outcomes. It contributes, thus, to the study of both sound change and paradigm structure. It does so with data from a severely underdocumented non-WEIRD language, which contributes to the diversity of data in the respective field(s). It combines data from the earliest available descriptions and texts with contemporary elicitation from two different speakers to obtain a finer-grained understanding of both recent historical change and the contemporary system. Methodologically, it shows that, given the right approach, small languages without a long written tradition can also be studied diachronically (see also Feist & Palancar 2021). Results reflect the very complex interaction of sound change and paradigm structure in the language.

It has long been known (see e.g. Malkiel 1960), that paradigmatic and morphological structure have the ability to disrupt the regular application (or the regular actuation) of sound change. This is the reason, of course, why historical linguists tend to look for regular correspondences in roots rather than in affixes (Nichols 1996). However, and especially in morphologically highly complex languages, the disruptive effects of paradigmatic structure extend everywhere and tend to be underestimated. In these languages, morphological change can be a greater obstacle than lexical replacement for the identification (and the longevity) of regular sound correspondences. Thus, the failure to identify the latter in some languages or areas (e.g. in Australia, see Miceli & Round 2022), need not imply that (regular) sound changes have not occurred, or have occurred less frequently than in other areas of the world. Rather, it might derive from the greater importance (and hence greater disrupting capacity) of paradigms in some languages than in others. This should not be

[22] I exclude from here the 1PL.PRS form, which occurs only in a couple of verbs and for which too few tokens exist to ascertain the proclivity towards /a/ or /u/ in any robust way. Comparison with the frequency of nominal and adjectival forms is also complicated, but noun PLs should be less frequent than noun singulars, which matches with the greater preference for wa- in the PL.

surprising, as morphology has been argued to be the most cross-linguistically variable linguistic component of all (Baerman & Corbett 2007:115).

In the case of the Central Pame BaB>BuB sound change that this paper investigates, we are surprised by the extent and speed (a few decades) with which paradigmatic structure has almost completely dismantled the original phonetic environment and regularity of the sound change. To begin with, this change never occurred in stems (i.e. it seems to have been resisted here from the beginning). The general paradigmatic stability of stem vowels, coupled with the paucity of suitable phonetic environments, appears to have prevented the sound change from applying in this morphological environment. In prefixes (some of them highly frequent with regards to both type and token frequency), the sound change did manage to apply almost with a Neogrammarian-like regularity (see Table 5). Although the exact phonetic domain for the application of the sound change seems to have expanded over time, its regularity within a given time period seems to have been quite considerable.

Once the sound change stopped, however, paradigmatic analogy kicked in, quickly rearranging the phonologically-expected distribution of allomorphs to match morphological principles instead. Regular sound change, as is often the case (consider Sturtevant's [1947] Paradox), introduced much additional and unnecessary complexity into Central Pame paradigmatic structure. Rather than learning (or managing to learn) the lexical distribution of the new affixes, speakers seem to have restructured the system to allow for massive overabundance, i.e. free choice of wa- and wu-, or mba- and mbu- in every one of their contexts, lexical or morphosyntactic. This effectively reversed the expected (i.e. regular) morphological effects of the sound change (i.e. the multiplication of inflection classes and principal parts, and the general complication of predictive relations). Analogical change, thus, eliminated the additional complexity introduced by sound change and allowed the old system of inflection classes to continue.

At the same time, and because completely unconditioned variation might not be particularly desirable either (see Clark & MacWhinney 1987, and Carstairs-McCarthy 1994), other phonological factors (the quality of the stem vowel) and morphosyntactic values have started to play an increasingly important role as predictors for the choice of allomorph. If the trend continues and if wa- were to become the only option in the 3SG.PRS, and wu- and mbu- became categorically required in the 3PL.PRS and SUB respectively, this case of massive and systematic overabundance will disappear from the paradigm once again and there will be no trace whatsoever left in Central Pame of a regular sound change BaB>BuB ever having occurred in the language.

Summarizing, beyond the unravelling of a fascinating historical process in Central Pame, this paper has contributed to our understanding of sound change (and how its domain of application can expand over time) and paradigm structure (whose capacity to fight off certain kinds of irregularity can hardly be overstated). As explained across this section, sound change and morphological change are, maybe to the regret of historical linguists, much more intertwined than is usually appreciated. Future research could be profitably aimed at further probing on this complex relationship, and into the mechanisms behind Sturtevant's Paradox. In the best documented families/languages, this could be done via the compilation of ordered attested historical sound changes and their automated application to inflected lexicons (Smith 1969, Sims-Williams 2018) to obtain a fine-grained understanding of which

morphological properties tend to lead to analogical readjustments and which do not. In less well documented languages, as I do here, decades-old descriptions and texts can enjoy a second life and be repurposed to explore short-term language change. This will undoubtedly yield new discoveries in languages and communities that are excitingly diverse but usually far off the radar of historical linguists.

Supplementary material
All data and scripts for statistical analysis can be found here
https://osf.io/s8246/?view_only=980228be212442649f847a08a82a02bb

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Address for correspondence

Borja Herce
borja.hercecalleja@uzh.ch
Department of Comparative Language Science
Affolternstr. 56, 8050

Zurich, Switzerland

Résumé

De nombreuses formes de mots de différentes classes du Pame central (cent2145, Otomanguean) autorisent deux formes synonymes, l'une contenant un préfixe avec la voyelle /a/ et l'autre avec /u/ (par exemple wa-ttsáuʔ～wu-ttsáuʔ 'il/elle se sent'). Je mène des recherches de corpus historiques et des élicitations pour mettre en lumière l'origine diachronique et le profil contemporain de ce phénomène inhabituel. Les preuves suggèrent que cela a commencé par une modification phonétique /a/>/u/ entre les consonnes bilabiales. Cependant, les pressions paradigmatiques ont largement démantelé la distribution originale de l'allomorphie de manière synchronique, généralisant la variation libre (connue sous le nom de «surabondance»). De plus, d'autres indices phonologiques et morphosyntaxiques sont apparus pour la prédiction probabiliste de ces allomorphies. Ce cas offre une fenêtre extraordinaire sur les fondements cognitifs de la modification phonétique, de l'allomorphie et du paradigme dans un langage peu étudié et très infléchissant.

Zusammenfassung

Viele Wortformen aus verschiedenen Klassen in ZentralPame (cent2145, Otomanguean) erlauben zwei synonyme Formen, eine mit einem Präfix mit dem Vokal /a/ und eine andere mit /u/ (z. B. wa-ttsáuʔ～wu-ttsáuʔ 'er/sie fühlt sich'). Ich führe historische Korpusforschung und Elizitierung durch, um den diachronen Ursprung und das zeitgenössische Profil dieses ungewöhnlichen Phänomens zu beleuchten. Es gibt Hinweise darauf, dass es als Lautwechsel /a/>/u/ zwischen bilabialen Konsonanten begonnen hat. Paradigmatische Zwänge haben jedoch die ursprüngliche Verteilung der Allomorphie synchron weitgehend aufgelöst und die freie Variation (auch als 'overabundance' bekannt) verallgemeinert. Darüber hinaus sind weitere phonologische und morphosyntaktische Hinweise für die probabilistische Vorhersage dieser Allomorphien entstanden. Der Fall bietet einen außergewöhnlichen Einblick in die kognitiven Grundlagen von Lautveränderungen, Allomorphie und dem Paradigma in einer stark flektierenden, wenig erforschten Sprache.