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'Phoneme fluctuation': Empirical and theoretical limitations

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Abstract
The persistent notion of 'phoneme fluctuation', primarily used in the SIL tradition of language documentation, presents a number of empirical and theoretical problems. In this article we examine some of the perils of the concept and look into reasons that have kept it in place. We ultimately argue that the alleged 'unconditioned alternations' we find in the languages where the term is used can be accounted for by more parsimonious means, compatible with descriptions of better-understood languages. We conclude that *phoneme fluctuation* is epiphenomenal and problematic insofar as it creates a veneer of 'exoticism' or 'simplicity' around the languages so described.

In the description of a number of under-studied languages, there is a tradition of observing patterns of so-called 'phonemic fluctuation'. These are cases where an otherwise unremarkable phonemic contrast appears to be lost in particular lexical items, such that two or more contrasting segments are permitted in the same position, in the same word, with no clear evidence of social or phonological conditioning. An example of this type of alternation can be found in Arabela (ARL; arab1268), as described in Rich (1963) and reproduced in (1). Here we see that, although minimal pairs contrasting /n/ and /r/ are common (1a-b), there are also lexical items where the phonemes alternate in what appears to be a free manner (1c-d).

(1) Arabella
   a. /ˈ**n**inju/ 'to come'
   b. /ˈ**r**inju/ 'to breathe'
   c. /ˈ**n**jurjuku/ 'egg'
   d. /ˈ**r**jurjuku/ 'egg'

A preliminary survey of fifty languages where 'phoneme fluctuation' is used in this sense (see Figure 1), shows the term to be geographically and genetically widespread.[1] It also shows a preponderance of mid-to-late-20th-century documentary work associated with the *Summer Institute of Linguistics* (known today as SIL, see sil.org). This is a US-based evangelical organisation tasked with documenting ethnolinguistically minoritised languages, developing practical orthographies, and promoting literacy through their usage. While SIL's end goal is tied to the spread of their Christian faith[2], the materials they produce often represent the sole available pedagogical and descriptive resources for particular languages, making them invaluable to communities and linguists (see Dobrin 2009 for a critical overview).[3] As we will show, *fluctuation* may have been a reasonable descriptive shorthand for the SIL's stated purposes, but is likely to be empirically and theoretically inaccurate beyond these narrow goals.

Figure 1. *Languages with descriptions that allude to 'phoneme fluctuation'. Blue markers represent descriptions in the SIL tradition. See interactive map at https://benmolineaux.github.io/PhonemeFluct/.*

While the purported phenomenon is primarily adduced for descriptive purposes, the concept was taken up as a valid theoretical category, particularly in the late-20th-century French functionalist tradition (Key 1968b, 1979, 1976, Martinet 1969, 1983, Clairis 1991, Walter 1992). While its theoretical impetus has subsided, the concept remains a part of a number of language-specific and regional traditions today. In this light, it is worth asking whether these traditions further our understanding of the phenomena or simply obscure other key

[1]These represent the first 50 languages described using the term (in English, Spanish and French) on Google Scholar. Full references available online.
[2]SIL has a close connections to the *Wycliffe Bible Translators* https://www.wycliffe.net/, both founded by missionary-linguist William Cameron Townsend.
[3]SIL also produces a range of digital resources for linguistic description such as *Ethnologue* (Eberhard et al. 2024) and *Fieldworks Language Explorer* (FLEx: https://software.sil.org/fieldworks/).

patterns. In what follows, we survey the history of the concept (§1), its theoretical and empirical (dis)advantages (§2), and propose potential alternative analyses based on a case study (§3).

1. 'Phoneme fluctuation': from descriptive shorthand to theoretical construct

The tendency to describe certain sound systems — particularly those of indigenous languages — as somehow anarchic or lacking consistency, has a long and unsavoury history. Most famously, early North American anthropologists explicitly linked perceived phonic variability with cultural inferiority. Powell (1880), for instance, claims that "the sounds of a savage or barbaric language… are constantly changing … from that which is represented by one, two or more letters to another of the same group… the Indian is equally satisfied whichever of the sounds is employed"(1), while Brinton (1890) specifically refers to *fluctuation*: "the phonetic elements… are, in many American languages, singularly vague and *fluctuating*… consonants are 'alternating' … vowels 'permutable'" (397–98, emphasis added).

It was Franz Boas who, based on his vast fieldwork experience and appreciation of the complexity and systematicity of North American languages, famously rejected this approach: "I maintain that there is no such phenomenon as synthetic or alternating sounds, and that their occurrence is in no way a sign of primitiveness of the speech in which they are said to occur; that alternating sounds are in reality alternating apperceptions of one and the same sound"(1889: 52). In other words, alternations result from non-native observer's inability to assign predictably varying sounds to the single category perceived by native speakers, in a sense that strongly foreshadows the structuralist notion of *allophony*.

Indeed, early structuralist work (e.g. Laziczius 1932, Trubetzkoy 1939) acknowledged the question of phonologically unconditioned phonemic alternations, yet saw them mostly as the instances of expressive or conative (appeal) speech. Such phenomena were placed within the realm of what Trubetzkoy (1939: 14–25) called *phonostylistics*, and were deemed to be outwith the representational remit of the phonological enterprise. It was only with the advent of theories of orthographic phonemics — aimed at producing systematic writing in languages without a spelling tradition — that full phoneme fluctuation was embraced as a possible feature of phonological grammars. The work of Kenneth Pike (1947), in particular, saw the need for such free fluctuation in phonemes as a result of fully unconditioned alternations between two otherwise contrastive elements. In his view, fluctuation was restricted to particular lexical items, however it was conditioned neither phonologically, nor stylistically, nor by speech rate. Indeed, he claimed that 'In ordinary free fluctuation between full phonemes, the substitution of the one phoneme for the other occurs sporadically, and arbitrarily, within a single style of speaking or a uniform speed" (Pike 1947: 125).

Such an approach would have a profound effect on the documentation of indigenous languages, particularly in the Americas and New Guinea, through the work of the *Summer Institute of Linguistics*. Crucially, Pike served as the first president for the organisation, a post he held for nearly four decades (1942–1979), overseeing its expansion into more than 50 countries (see https://www.sil.org/about/history). It is no surprise, therefore, that we find Pike's approach to phonemics — including phoneme fluctuation — heavily engrained in the materials produced by the institution he headed.

In the Americas, one of the most prolific of the SIL-influenced researchers, and an important source for much early data and analysis involving phonemic fluctuation, was Mary Ritchie Key.[4] Following a decade working on Nahuatl, in Puebla, Mexico, Key moved to Bolivia in 1954, where she did pioneering work on Pano-Tacanan languages (Key 1968b,a). Her interest in phoneme fluctuation was only to take centre-stage around 1975, when she spent a Fullbright-Hays sabbatical in Chile. Here she applied this notion to data from Mapudungun (ARN; mapu1245; Key 1978a,b) and the Fuegian languages (Key and Clairis 1976). In this work, the phonological fluctuation between elsewhere fully contrastive phonemes was seen to be far more common in unwritten American languages than what is found in written languages. In other words, a language like English displays sporadic — and presumably stylistic — alternations such as [iðɹ̩]~[aɪðɹ̩] 'either' or [wɪð]~[wɪθ] 'with', however in languages like Mapudungun or Kawésqar (ALC; qawa1238) it was claimed that such fluctuations are integral to the phonological system (cf. Key 1976, 1979). While Key conceded that paralinguistic phenomena — speech style or expression of emotion — may explain some part of the alternations, she also noted that they often correspond to known sound changes in related varieties. This led her to a series of proposals about different Native American languages' broader genetic affiliations (see also Key 1981).

Indeed, one of Key's main observations about fluctuation is that it can be used as a springboard to diachrony. Thus, one way of explaining phoneme fluctuation would be as instances of dialect borrowing in the context of highly multidialectal and multilingual societies (Key 1976: 141), as exemplified in Table 1 for Chama (known today as Ese Ejja, ESE; esee1248) and related Pano-Tacanan varieties.

Recourse to fluctuation allows Key to propose a greater number of sound correspondences and genetic links across languages of the Americas. So, if /b/ and /d/ fluctuate in Language A then both are legitimate correspondences to a single phoneme, in Language B, such as /p/, thus doubling the pool of potential cognate segments. However, often the alternations are heavily lexically restricted and there is scarce evidence for one of the assumed sound changes (e.g. /p/>/d/) within the proposed language family. Key's reconstructed genetic groupings are, unsurprisingly, extremely long-distance, including languages from Uto-Aztecan in the north, to Fuegian languages in

[4]Technically, Key was employed by the Wycliffe Bible Translators and not by SIL. Nevertheless, both institutions operated under Pike's linguistic approach.

Table 1. *Chama phoneme fluctuation and cognates across Pano-Tacanan languages (Key 1968b).*

Alternation	Chama	Tacana	Caviña	Chacobo	Gloss
t ~ k	etakʷa ~ ekakʷa	etakʷa	etakʷa	—	'liver'
i ~ e	pia ~ pea	pia	pea	—	'another'
b ~ d	bawit͡ʃo ~ dawit͡ʃo	—	—	—	'mouse'
b ~ d	—	di	—	bi	'mosquito'

the far south (Key 1979, 1981). They are also overwhelmingly rejected by more recent accounts of Meso and South American language families (see Campbell 2024).[5]

Such deeper diachronic implications of fluctuation, Key tells us, were suggested to her by André Martinet (1981: 3). Indeed, the 'Father of Functionalism' was profoundly interested in the broader implications of the phenomenon, as presented in both Key's data for Tacanan and Mapudungun and in Clairis' data for Kawésqar (Clairis 1977, 1985). Martinet considers the status of phoneme fluctuation within a theory of phonology in a 1983 article entitled *Ce que n'est pas la phonologie [what phonology is not]*. Here, he identifies the phenomenon as belonging to 'certain exotic languages' (13) and concludes that, despite occurring in 'more than half the cases for which the question can be asked' (13), fluctuation cannot be said to affect the phonological status of the phonemes. This is because the fluctuations are not the result of phonological conditioning or of stylistic, geographical or social variation. Ultimately, in Martinet's view, fluctuations are lexically restricted and therefore should not fall within the remit of the phonologist who identifies them, but within that of the lexicographer or the grammarian who can pinpoint the units where the alternations are to be found.[6] Thus, much like the early structuralists, the functionalist approach exiles fluctuation from phonology. However, while the former do so in light of a purported expressive alternation, the latter do so in light of their lexical idiosyncrasies.

2. Limitations

Despite being fairly well-established as a heuristic in the SIL documental tradition, we may ask if recourse to phonemic fluctuation is descriptively adequate for the languages so being analysed, and, furthermore, whether the approach is theoretically coherent to begin with. On the one hand, it is possible that the theoretical availability of such free variation — passed down

[5] A reviewer points out that, on a smaller scale, some of Key's claims have been vindicated, particularly for Ese Ejja (Chama) where /t/-/k/ doublets (as in the 'liver' forms in Table 1) can be attributed to dialect borrowing, as noted by Vuillermet (2012: 66), who establishes a *t* : *k* isogloss separating (some) Ese Ejja dialects.

[6] In part, the appeal of fluctuation among French functionalism lies in the idea that lexical contrast must place a functional limit on phoneme fluctuation. This is because languages would be functionally sub-optimal if fluctuation created a proliferation of homophones.

from Pike to a plethora of SIL missionary-linguists and beyond — produced some confirmation bias, precluding further investigation into the potential conditioning factors of the alternation, or into other theoretical frameworks that would account for them. On the other hand, if fluctuating phonemes are the result of overlapping dialectal forms, then perhaps an analysis under a single phonological module is less theoretically sound than one where overlapping multi-dialectal modules interact, or, indeed, where homonym-rich lexical strata result from close dialect interaction.

Empirically, a first attempt to explain such fluctuations may be simply as a case of allophony where the phonological context has not yet been uncovered. An example of this comes from Yahgan (YAG; yama1264), where Guerra (1990) observed ‘fluctuation’ between high and mid vowels, such that /u/ alternated with /o/ and /i/ with /e/. Careful work by Poblete and Salas (1997), however, came to show these alternations were not only restricted to final position (2a-b), but also that they were absent from lexical items which consistently surface with a mid vowel (2c-d). In a traditional phonemic analysis, then, the alternating forms have contextually predictable allophones. The lowering rules /u/→[o] and /i/→[e] occur variably in final position, while final /o/ and /e/ remain unchanged. The Yahgan pattern, therefore, is better analysed as a ‘garden variety’ neutralisation process.

(2)	a.	/puˈʃak**i**/	→	[puˈʃak**i**]~[puˈʃak**e**]	‘embers’
	b.	/ˈuʃk**u**/	→	[ˈuʃk**u**]~[ˈuʃk**o**]	‘smoke’
	c.	/oˈkol**e**/	→	[oˈkol**e**]	‘one’
	d.	/ˈim**o**/	→	[ˈim**o**]	‘father’

The percept of ‘fluctuation’ may also emerge due the phonetic boundary of ‘the same’ segment being opaque to those documenting the languages (i.e. Boas’ critique set out in §1). We know, for instance, that non-native observers often conflate categories that are unavailable in their own L1, leading to inadequate inventory descriptions. For instance, early European descriptions of Australian languages often failed to distinguish laminal and apical contrasts typical of Pama-Nyungan consonants (Koch 2008). We also see these misapperceptions (to borrow Boas’ term) in phenomena such as stress deafness (Dupoux et al. 2010) or stress ghosting (Tabain et al. 2014), where non-native observers miscategorise phonetically variable phenomena, which may share cues with other structural properties (e.g. stress and intonation). Particularly relevant to our purposes is the early characterisation of laryngeal features of Northern Pame (PMQ; nort2984) consonants (aspirated, voiced, voiceless and glottalised) as ‘fluctuating’ (Gibson 1956), where more careful native speaker consultation shows the features to be contrastive and morpho-phonologically conditioned (Berthiaume 2003).

Another explanatory possibility is that some instances of fluctuation may be evidence for reduced competency in the final stages of community-level language shift (i.e. language/dialect ‘death’ cf. Dressler 1972). A clear example of this has been suggested by Viegas Barros (2015), who observes a number of cases of 'phoneme fluctuation' for items found in Chaná (QSI; chan1296), a language documented through a single language rememberer. Crucially his reports contrast with the invariability of the same phonemes in written 19th century sources.

Looking beyond cases of mis-perception or mis-transmission, it is not inconceivable that the descriptions of some of the languages characterised as containing 'fluctuating' phonemes do indeed entail some degree of lexically-specific free variation between two segments which otherwise contrast in the language. It would be surprising if much of such free variation in any language remained truly free variation over time rather than becoming structured variation, coming under control of the grammar or acquiring social or register-bound indexation.[7] It may well be that this is also the case for many of these languages, yet the resulting social, geographic or register-bound variants are perceived by non-native observers as part of a single discrete system. This possibility already suggests itself in Key's reading of fluctuation and dialect borrowing (cf. Table 1). However, in her interpretation, the alternating forms – which may derive from separate routes of inheritance and contact – are strictly synonymous, leaving out the possibility that some of these variants may be socially indexed or have distinct, predictable connotations.

In what follows, we take a closer look at the possibility that much of the 'fluctuation' that has been reported for Mapudungun, a language isolate of the Southern Cone of the Americas, can be explained through better-understood mechanisms. In doing so, we believe that we may provide a more empirically nuanced picture of the language, while also avoiding the portrayal of the language's phonological system as somehow 'anarchic' or 'fickle'.

3. Case study: 'phoneme fluctuation' in Mapudungun

One of the descriptive traditions where the term 'phoneme fluctuation' has gained an important foothold is that for Mapudungun, the endangered, ancestral language of the Mapuche people, spoken in what is today southern Chile and Argentina. The term appears to have been first introduced by Mary Ritchie Key (see §1, 1976, 1978a) and elaborated upon with Christos Clairis, (see Key and Clairis 1976). 'Phoneme fluctuation' eventually shows up in a number of SIL and non-SIL works on Mapudungun, including Croese (1980), Catrileo (1986) and Zúñiga 2006. Adalberto Salas' 1992 grammar is most comprehensive in its diagnosis of the phenomenon, identifying the pairs in (3) as 'the most prominent cases of phoneme fluctuation' (88–89).[8]

[7] See, for instance, the politically-indexed alternation of /ɪræk/ v. /ɪrɑ:k/ for 'Iraq' in US-English (Hall-Lew et al. 2010), or the difference between the general meaning of *lord* v. the specific meaning of *laird*, as Scottish member of the landed gentry (both from Old English *hlaford*, via distinct diachronic pathways in English and Scots).

[8] It is worth noting that variability of this kind was observed by many of the early missionary materials, all the way back to Valdivia's 1606 grammar. Of particular note is the work of Bavarian Capuchin Félix de Augusta, who in his 1903 'Gramática Araucana' identifies "sonidos que suelen sustituirse" [sounds that tend to substitute each other] (p.2), amongst which we find <o>∼<u>; <ə>∼<ü>; <d>∼<sh>∼<r>; and <t>∼<ch>∼<tr>, all of which are taken up by Salas, and which we deny are cases of 'fluctuation' in the technical sense presented in this paper.

(3) a. /o∼u/; /i∼ɨ/; /e∼ɨ/
b. /t̪∼t; /t∼ʈʂ; /t∼tʃ/; /ʈʂ∼tʃ/; /n̪∼n/; /n̪∼ɲ/; /l∼ʎ/; /l̪∼ʎ/; /s∼ʃ/; /s∼θ/; /ʐ∼ʃ/
c. /ŋ∼m/; /ŋ∼ɲ/

In what follows, we examine these patterns, attempting to establish alternatives to the now-entrenched fluctuation account. Our analyses draws upon the existing language-specific literature, as well as novel fieldwork data.

3.1. Vocalic 'fluctuation'

For the vowels in (3a), we suggest neutralisation, contact, observational shortcomings and loss of vitality are most likely to explain the alternations.

Neutralisation:
The regular /o/-/u/ contrast in Mapudungun, as evidenced in [k**o**ʐɨ] 'soup' v. [k**u**ʐɨ] 'black', disappears in word-final position, giving alternations like [wenʈ͡ʂ**o**]∼[wenʈ͡ʂ**u**] 'man'. The phonological regularity of this pattern is confirmed by Spanish loanwords such as [paβ**o**] > [paf**u**]∼[paf**o**] 'turkey'. As with the Yahgan data in (2), the alternations in the Mapudungun back vowels are restricted to particular morpho-phonological environments (i.e. root finally, see Bickel and Zúñiga 2017:174) and are thus better accounted for by neutralisation of height features, where back mid vowels raise variably.

Contact, attrition and observational shortcomings:
A number of 'fluctuations' of the type described above are likely the result of contact-based mergers or descriptive misperceptions. As pointed out by Henríquez and Salamanca (2015) and Berríos and Salamanca (2024) the phoneme /ɨ/ (phonetically [ə] or [ɯ] as well) is the only vowel phoneme absent from the main contact language, Spanish. As such, Salas' cases of 'fluctuation' between /ɨ/ and /e/ ([wenɨj]∼[wenej] 'friend') or /i/ ([korɨ]∼[kori] 'soup') are probably best treated as instances of phonological transfer, often related to varying degrees of bilingualism in the speaker community or to the 'apperceptions' of the researchers eliciting the material.

In Huilliche, the severely endangered southernmost dialect of Mapudungun, the /ɨ/-/u/ contrast is also reported to disappear in many lexical items, with the phonetic target fluctuating between the two (Alvarez-Santullano 2016).[9] Especially in this case, 'fluctuation' is better conceptualised as a phonological consequence of loss of linguistic vitality (cf. Dressler 1972). Thus, the traditional /ɨ/ vowel found in other Mapudungun dialects and in historical descriptions of Huilliche, often merges with /u/, reflecting a more Spanish-like inventory in this dialect (with /u/, but no /ɨ/) and the dominance of a Spanish phonological module among the few remaining Huilliche-Spanish bilinguals.

[9] A similar pattern is the sporadic loss of dental-alveolar contrast, in cases where there is no affective alternation (see §3.2).

3.2. Affective alternations in Mapudungun coronals

The four-place coronal contrasts of Mapudungun (see Table 2) show a variety of *fluctuation* patterns in Salas' data (3b). However, contrary to the key tenets of phoneme fluctuation, which consider such alternations to be fully context free (Pike 1947, Clairis 1991), Salas describes at least a subset of these as having an 'affective value' (1992:89). Indeed, such emotionally-laden consonant shifts are described as far back as Febrés (1765), being treated more systematically by Catrileo (1986, 2010), as well as Molineaux (2025), where the alternants are analysed as exponents of evaluative morphology. It is observed that shifts to a palatal articulation entail diminution, with a pragmatically concomitant positive affect, (e.g. [**n**aʐki] 'cat' → [**ɲ**a**ʃ**ki] 'sweet/little cat'; [fo**t̪**ɨm] 'son of a man' → [fot**ʃ**ɨm] 'sonny'), while — more surprisingly — dentalisations entail augmentation with concomitant negative affect (e.g. [**n**aʐki] 'cat' → [**n̪**a**θ**ki] 'damned cat'; [ka**tʃ**u] 'grass' → [ka**t̪**u] 'damned grass'). Structurally, this means that, when expressing these semantico-pragmatic meanings, the place contrasts between coronals are neutralised in predictable — if subtle — ways, which are incompatible with lexically-specified 'fluctuation'.

DENTAL	ALVEOLAR	PALATAL	RETROFLEX
t̪	t	t͡ʃ	t͡ʂ
θ	s	ʃ	ʐ
n̪	n	ɲ	
l̪	l	ʎ	

Table 2. *Mapudungun coronal consonants.*

3.3. Velar nasal alternations

Finally, the tradition of 'fluctuation' in Mapudungun shows variation in nasals outside coronal place (3c), which are unlikely to be attributable to 'affect'. In the case of [ŋ∼ɲ], however, the context appears invariant. The alternation only occurs when the nasal is preceded by [i] and followed by [k], as in [wi**ŋ**ka] ∼ [wi**ɲ**ka] 'foreigner' or [wi**ŋ**kɨl]∼ [wi**ɲ**kɨl] 'hill/mountain'. Here, we suggest that a more parsimonious analysis is simply that the nasal is underspecified for place features and the realisation of place is assimilatory. For some speakers (or in some speech styles), the anticipatory assimilation to the velar gets ranked higher than the language's more typical progressive assimilation, which palatalises the nasal after a high front vowel (see Molineaux in press). In any case, the phonologically restricted context argues strongly against a lexically unpredictable account.

For the alternation between the two peripheral consonants, [ŋ∼m], a true alternation seems to exist, but it is a very rare pattern indeed. Only two examples are included across any of the surveyed materials: [**ŋ**olife] ∼ [**m**olife] 'drunkard' and [**ŋ**ulu] ∼ [**m**olu] 'eastern'. Especially considering the fact that the second term is used as a designation of one group of Mapuche people by another, it seems that what we are faced with are cases of dialect borrowing (note, furthermore, that there is a different vowel in the two forms of 'eastern'). While it is interesting to have these competing forms, this should be no more striking than alternations between English designations such as /ˈtʃɪliən/ v. /tʃəˈleɪən/ 'Chilean' for the same nationality, with the second often perceived as a 'Spanish-based' pronunciation.

4. Envoi

The availability of 'phoneme fluctuation' within our descriptive toolkit, we hope to have shown, is problematic. We suggest it should be avoided or flagged as an interim solution, rather than treating it as a definitive, reified phonological category. It seems, all things considered, that the reasons for the epiphenomenal appearance of 'fluctuation' are a constellation of descriptive, analytical and socio-historical variables which require careful disentangling. Glossing over such variables risks the assumption, on the one hand, that such languages are somehow expected to be 'simpler' than those where more nuanced work has been undertaken, or, on the other hand, it risks treating such languages as having the kind of 'vague' or 'unprincipled' sound systems that early North American anthropologists projected on to their consultants' languages.

Finally, it is worth noting that, while 'phoneme fluctuation' is problematic as a phonological concept, phenomena so described are no less worthy of attention. Indeed, we may say that 'fluctuation marks the spot' for descriptively challenging and theoretically interesting aspects of the phonological makeup of low-resource languages, as we have sketched above for Mapudungun.

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