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Topics in Wappo Phonology

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DISSERTATION

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To the ʔonaʔcáṭis

And to my sister Desirae, who made all of this possible

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TOPICS IN WAPPO PHONOLOGY

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ABSTRACT

This work examines various topics in the phonology and phonetics of the Wappo language (*ʔonaʔcáṭis*), an Indigenous American language spoken in Northern California. Utilizing both published written sources and the large audio corpus of spoken Wappo compiled by linguist Jesse Sawyer and housed at the California Language Archive at UC Berkeley, this work addresses several fundamental questions in Wappo phonology, including phoneme inventory structure, phonotactics, phoneme frequency, phonetics and allophony, word-level prosody, morphophonemics, and a detailed discussion of the context of Wappo phonology within the California Linguistic Area, including the question of a localized linguistic sub-area around the region of Clear Lake, north of the Wappo homeland. The work also includes a discussion of the sociolinguistic history of the Wappo speech community and the ongoing community-driven language revitalization program.

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0. INTRODUCTION

0.1 The Geographical Setting of the Wappo Language

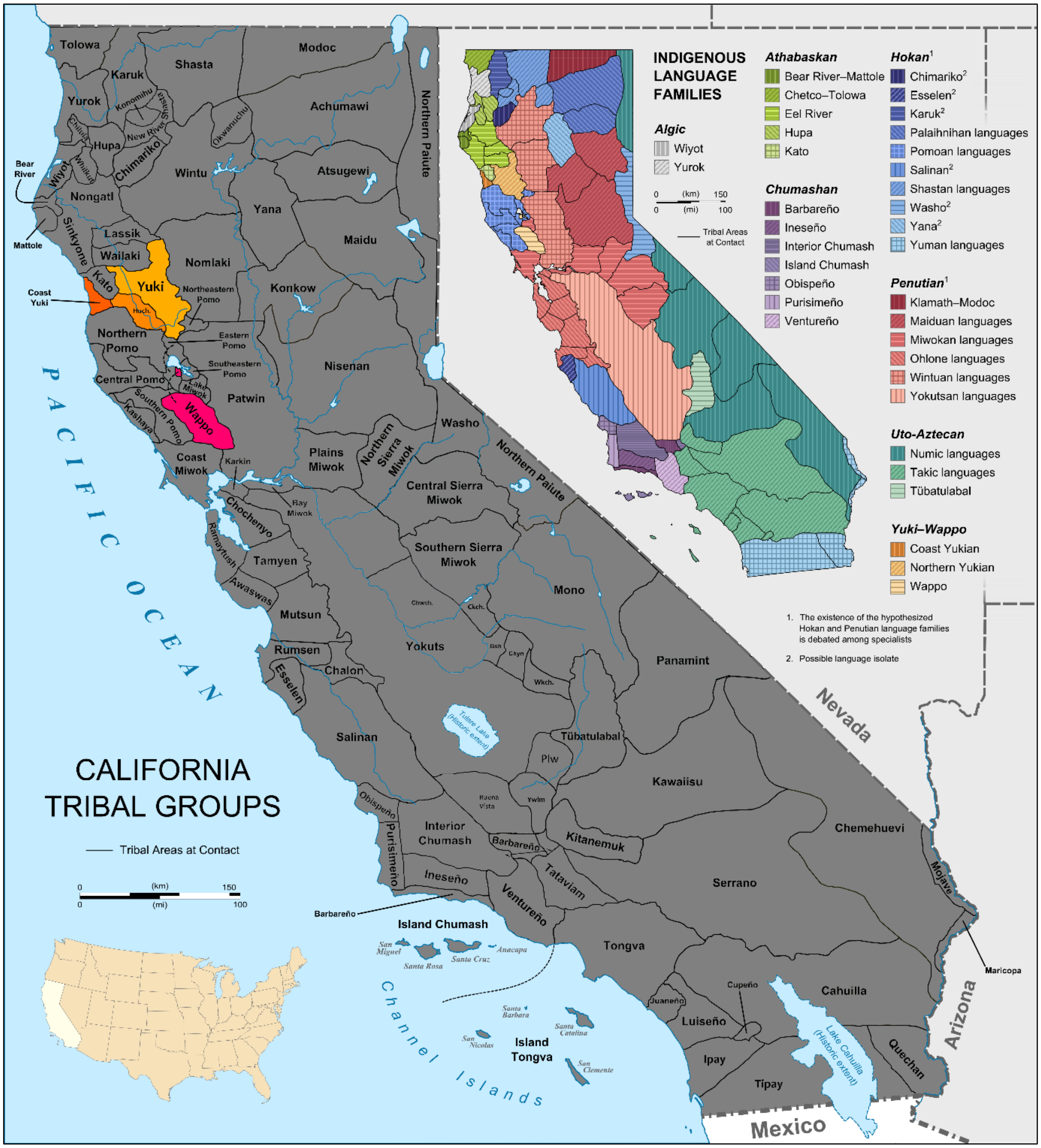
The Wappo people – in their own language *ʔonaʔcáṭis*, ‘the outspoken people – are one of the more than one hundred Indigenous ethnic groups of California. They historically inhabited the region between Clear Lake and San Francisco Bay, in the northwestern part of the state. Their homeland is centered on the Napa Valley, which today houses the major towns of (from south to north) Napa, Yountville, St. Helena, and Calistoga. This valley lies at the southern end of the Northern Coast Range, a range of relatively high, forested mountains which extends from San Francisco Bay up the California coast into southwestern Oregon, and which still today houses an astonishing variety and diversity of Indigenous languages - not only Wappo and its larger Yuki-Wappo family, which are endemic to this region, but also the Pomoan languages, the western Miwokan languages, the Pacific Coast Athabaskan languages, the Coast Algic languages Wiyot and Yurok, and the Shastan languages, as well as the Karuk and Chimariko language isolates. Additionally, the Wintuan languages occupy the eastern slopes of the Coast Range as well as the adjacent Sacramento Valley floor. The geographical setting of Wappo and its Yukian relatives in relation to the other Indigenous groups of California is given in Map 0.1.

Within this region is found the Pleistocene-era lake known as Clear Lake, in precontact times a center of Indigenous population and economic and social activity, and an area that may be implicated archaeologically with the origins of the Wappo people and their linguistic relatives (Frederickson 1984:475; Jones & Klar 2007:310). Clear Lake represents the northernmost limit of the historic Wappo homeland, with a small band of Wappo known as the Lile’ek historically present in the vicinity of Mt. Konocti on the southern shore of Clear Lake itself, in direct contact with the Eastern and Southeastern Pomo, yet isolated from the rest of the Wappo-speaking bands further to the south by Pomoan speakers (Golla 2011:106). The region centered on the northern Mayacamas range of today’s Napa County and the southern shore of Clear Lake in Lake County is where the Wappo were in closest contact with the three language groups that, together with Wappo, form what has been termed the “Clear Lake Linguistic Area” – Pomoan, Lake Miwok, and Patwin (Mithun 1999:317; Berman 1973:260).

Map 0.1

The Geographical Setting Of Wappo And The Yukian Languages[1]

Wappo
Northern Yukian: Yuki • Huchnom • Coast Yuki



[1] Map adapted from https://commons.wikimedia.org/wiki/File:California_tribes_%26_languages_at_contact.png, original work by Wikipedia user 'Concerto'

The eastern boundary of the Wappo homeland is the ridge of the Mayacamas Mountains, separating the Napa Valley on the west from the broad valley now occupied by Middletown and the Lake Berryessa Reservoir on the east. To the north-northeast of the Wappo homeland, in the region of Middletown and Hidden Valley, is the homeland of the Lake Miwok, one division of the western Miwokan peoples. The Lake Miwok language has received a great deal of phonological influence from the neighboring Patwin language to its east, as well as from Pomoan and Wappo, making it more similar to these languages in terms of phonology than to its Miwokan relatives (Golla 2011:158, 250; see also Chapter 7).

To the east of the Wappo homeland, occupying the eastern slopes of the Mayacamas Mountains and the entirety of the Vaca Mountains of the inner Coast Range, and extending across the Sacramento Valley floor east to the Sacramento River, lay the homelands of the Patwin, a Wintuan-speaking people. The Patwin, divided into the Hill Patwin (in the eastern Coast Ranges), the River Patwin (along the Sacramento), and the Southern Patwin (from the lower Sacramento to Suisun Bay), occupied a vast region, extending from the Sutter buttes in the Central Valley, down the right bank of the Sacramento River, to the marshy shores of the Sacramento Delta in what is now Solano County, and wrapping around the southeastern edge of the Wappo homeland. The Hill Patwin were the Patwin bands that were in closest contact with the Wappo, and even more intensively with the Lake Miwok (Golla 2011:158, 250).

To the west, the Wappo homeland reached the ridge of the Sonoma Range, and in the northwest, occupied part of the Russian River valley around the present-day town of Geyserville. West of the Wappo, occupying most of what is today Sonoma County, southern Mendocino County, and the adjoining Pacific coast, lay the homelands of the Pomo, the cultures with which the Wappo have historically shared the most cultural features (Driver

1936:218-9). The Pomo linguistic groups found in the region to the immediate west of the Wappo homeland included the Southern Pomo, the Central Pomo, and the Kashaya (Southwestern) Pomo.

To the south of the Wappo homeland, where the Napa valley gives way to the marshy wetlands and low hills north of San Pablo Bay just south of the present-day town of Napa, the eastern bands of the Coast Miwok were in contact with the southwesternmost bands of the Southern Patwin (Golla 2011:145), who had only recently begun to occupy these regions at the time of European contact; their presence meant that the Wappo homelands did not extend south to the shores of San Francisco Bay.[2]

The current Wappo population is concentrated in urban and suburban areas around the city of Santa Rosa, in Sonoma County, California, in what was historically Southern Pomo territory. The original Wappo homeland in the Napa Valley and surrounding areas was gradually lost to Spanish, Mexican, and Euro-American colonization between the late 18th century and late 19th century (Heidenreich 2007; Cook 1976:174, 204-6, 262; Barrett 1908:41-2), and is now largely owned by the wineries and associated tourist industries that constitute the California Wine Country. The modern-day Mishewal Wappo Tribe of the Alexander Valley, a state-recognized tribe and the current political incarnation of the Wappo community, is at present engaged in a legal battle to regain federal recognition in order to re-acquire a landbase for their nation within their original territories (Ebberling 2018).

The current linguistic consensus is that Wappo belongs to a small “Yuki-Wappo” or “Yukian” family, endemic to northwestern California, consisting of two coordinate branches: Wappo itself (with its historically-attested internal dialects), and Yuki or Northern Yuki(an),

[2] The ancestors of the Patwin and their close linguistic relatives the Nomlaki and Wintu appear to have originated in southwestern Oregon, and migrated south into California sometime during the 1st millennium CE (Golla 2011:250; Whistler 1977).

historically spoken in the upper drainages of the Eel River and the adjacent coast, in the Northern Coast Range in what is today northern Mendocino County and southern Humboldt County, California. Yuki, or Northern Yuki(an), consists of three attested varieties: Yuki proper, Huchnom, and Coast Yuki. The available evidence seems to indicate that by the early 20th-century documentation of Yuki speech, the three varieties had the status of (roughly) mutually-intelligible dialects, with small differences in phonology, lexicon, and grammar that were noted by speakers (Balodis 2011:10-12). Though the current consensus is that Wappo and Yuki form a genetic unit, Jesse O. Sawyer, the primary researcher of Wappo in the mid- to late-20th century, was a dissenting voice: he considered Wappo and Yuki to be genetically unrelated, their similarities instead being due to a period of intense language contact around the Northern Yukian homelands prior to a supposed Wappo migration south to its historic homeland in Napa (see Sawyer 1980). However, Sawyer is alone in this assessment, as all other researchers who have examined the question are in agreement that the evidence points to a Wappo-Yuki genetic relationship.[3]

The external genetic connections of the Yuki-Wappo family remain uncertain, despite more than a century of investigation. The vast majority of researchers have not found a genetic connection between Yuki-Wappo and any of the other language families of the California Culture Area, or indeed with any other Indigenous language family of North America. This has led most to conclude that Yuki-Wappo may be a linguistic relict from a group of peoples that predate all other known groups in California (with the exception of the Chumashan languages of Southern California, which likewise have not yielded to any outside connections (Golla 2011:194)). However, the theory of Yuki-Wappo being a remnant of an early Californian population has been challenged by some researchers, most notably Joseph

[3] Elmendorf & Shepherd (1999) is an article rebutting Sawyer's (1980) assessment.

Greenberg, who asserted that there are striking resemblances in vocabulary between Yuki-Wappo and the so-called "Gulf" assemblage of the lower Mississippi River valley and the Gulf of Mexico – viz. the Muskogean family and the isolates Natchez, Tunica, Atakapa, and Chitimacha (Greenberg 1987). Greenberg posits that the Yuki-Wappo peoples represent a migration of a Gulf-connected culture and language across several thousand kilometers from the Mississippi basin to northwestern California, reminiscent of other long-distance migrations in North America, such as that of the Apachean languages of the US Southwest from an original homeland in western Canada. This theory has met with some interest,[4] but is still considered far from demonstrated. Aside from these possible connections, lexical resemblances have also been noted between Yuki-Wappo and the Siouan languages of central North America (Elmendorf 1963, 1964), and between Yuki-Wappo and members of the proposed Penutian phylum of languages (Shipley 1957), which constitute a network of families stretching from British Columbia to central California, possibly also including members in the US Southwest and in Mesoamerica.[5]

0.2 The Present Study

In working through the extant documentation of the Wappo language, beginning in 2012 when I first started working with the Wappo community on a language revitalization project, I noticed a strong focus in the literature on the documentation of Wappo vocabulary,

[4] Munro (1994) is an assessment of the hypothesis from the point of view of a specialist in Muskogean.
[5] Two Mesoamerican groups that have frequently been included in the Penutian hypothesis are the Mixe-Zoquean languages of the Isthmus of Tehuantepec and the Totonacan languages of the Gulf Coast of Veracruz state, Mexico; Brown et al. (2011) have recently demonstrated that these two groups form a clade they call Totozoquean, and subsequently, this family has been compared with the Chitimacha isolate of coastal Louisiana and Texas, a language historically connected to the Gulf group described above (Brown et al. 2014). If the Totozoquean-Chitimacha connection is valid, it would suggest the possibility of a single phylum encompassing both the Penutian and Gulf languages, and thus potentially also Yuki-Wappo, since this family has historically been connected with both assemblages (e.g. in Greenberg 1987).

morphology, and to some extent syntax, but next to no coverage of Wappo phonetics or phonology. In my opinion, the reason for this is twofold. Part of it is due to the endangered nature of the Wappo speech community, and to the focus on salvage linguistics during much of the 20th century. During the period 1917-1922, when the first major documentation of the language was carried out, the number of fluent, native speakers of Wappo totaled no more than twenty (Radin 1929:7), and by World War II, likely no more than half that. By the time the most important and thorough documentation work was carried out, by the UC Berkeley linguist Jesse O. Sawyer during the 1960s and 1970s, there were only three fluent speakers that regularly contributed material to the documentation work, with occasional elicitation from about four others. One of the three main fluent speakers, Jesse Sawyer's principal consultant Mrs. Laura Fish Somersal, passed away in 1990 (Thompson et al. 2006:xiii), and since then, the Wappo language has been essentially dormant; the speech community post-1990 consists exclusively of a small number of partial speakers, those born in the mid-20th century and who heard the language as children and young adults from the last remaining native speakers, but whose first language is English and who have used Wappo only sporadically if at all. In the context of the small and dwindling number of fluent speakers of Wappo during the early to mid 20th century, as well as the particular theoretical focuses in the field of linguistics at that time, many researchers likely chose to prioritize recording as much vocabulary and grammatical structure as possible, rather than trying to carry out a detailed analysis of the language's phonology and phonetics beyond just determining its phoneme inventory. This decision was likely also shaped by the fact that the first phase of documentation of Wappo, in the early 20th century, took place before the maturation of phonology as a subfield of linguistics.

The other major reason for the relative lack of phonetic and phonological studies of Wappo is because Jesse Sawyer was, before the 2010s, the only researcher to make audio recordings of Wappo speech.[6] Between approximately 1959 and 1975, Sawyer collected some 41 hours of audio recordings on reel-to-reel tape of Mrs. Laura Somersal and two of her Wappo-speaking relations, Irene Alturas Amante and Clara Leger, with occasional input from some four other speakers. While these audio recordings are extensive and of high quality, a fact for which both I and the Wappo community are extremely grateful, Sawyer seems to have utilized them primarily as a record of Wappo words, phrases, songs, and stories as such, and did not appear to utilize them to study the language's phonetic and phonological characteristics (outside of a few articles on some specific topics; see Sawyer 1964a, 1964b, 1981, 1991). Nevertheless, Sawyer's recordings were eventually deposited in the archives of UC Berkeley's Survey of California and Other Indian Languages (SCOIL),[7] and are now available to the Wappo community as well as to linguistic researchers.

My aim, then, in this study, is to try to provide an in-depth picture of the phonetics and phonology of the Wappo language, based on the sound recordings of Mrs. Laura Somersal and the other Wappo speakers who worked with Jesse Sawyer, and based on the written documentation of the language collected by Paul Radin, Jesse Sawyer, and others. Because the audio recordings in particular are based on the speech of, at the very most, seven distinct consultants, the actual audio documentation of the language is necessarily limited to these individuals' speech patterns, and thus may not reflect all the characteristics that were present in the larger Wappo speech community of their generation. Additionally, the data on which this study is based were collected at a time when the Wappo speech community had

[6] A more recent series of recordings was made in the mid-2010s by Alex Walker and Jessica Kirchner, working with a speaker named Harry Brown. See http://wieldoc.org/?page_id=27
[7] now part of the California Language Archive, CLA (https://cla.berkeley.edu/)

already experienced some 60 to 100 years of language attrition, and when the language was in the moribund stage of language decline;[8] therefore, the data may also not reflect all of the characteristics that were present in pre-contact Wappo, when all speakers were either Wappo monolinguals or multilingual in Wappo and neighboring California Indigenous languages.

Though prior research on Wappo phonetics and phonology was largely lacking, it was not completely absent, and this study begins with a review of earlier research on this topic, particularly that undertaken and published by the linguist Paul Radin between 1917 and 1929. It then progresses through later documentation of the language (chiefly by Jesse Sawyer, but also by a handful of other Californianists), and then opens into my own body of research, which forms the bulk of the dissertation. In my research chapters, I will first be discussing the phonological inventory of the Wappo language; following this will be a discussion of two further aspects of Wappo phonology, namely phonotactics and phoneme frequency. Next is a chapter analyzing the phonetic characteristics of Wappo, a chapter which utilizes data from and analysis of the invaluable Jesse O. Sawyer Collection of Wappo Sound Recordings for the first time in the linguistic literature. After this, there is a brief discussion of Wappo word-level prosody, including stress and its acoustic correlates in the language. Following this is a chapter on the moderately large number of distinct morphophonemic processes in Wappo. There then follows an extensive discussion of Wappo phonology in typological and areal context, compared both to the patterns characteristic of the California Linguistic Area as a whole (including specific features of a "Coast Ranges" linguistic area), and to the unique patterns of a putative "Clear Lake Linguistic Area" in northwestern California that includes Wappo and members of the Pomoan, Miwokan, and Wintuan language families. Finally, the

[8] Even in the early 20th century, Radin notes that certain sound distinctions were starting to merge as Wappo suffered language attrition (Radin 1929:9).

study concludes with a discussion of the historic and current state of the Wappo speech community and the ongoing language revitalization efforts.

CHAPTER 1: PRIOR RESEARCH

1.0 Introduction

The linguistic documentation of the Wappo language has a relatively short history. As far as is known, the Wappo language does not appear to have been noted or written down in any capacity during the Spanish colonial period; while communities such as the Ohlone to the south did see materials like catechisms created in their language by mission priests, not enough of the Wappo were missionized before the region's independence from Spain to warrant that kind of effort for the Wappo language. While Mission San Francisco Solano (Mission Sonoma) was constructed at the edge of Wappo territory in 1823 during the early period of Mexican rule, there are no records from this mission either of the Wappo language being written or described.

Contact between Euro-American society and the Wappo nation only began with the arrival of American and European pioneer-settlers in the 1840s, culminating in the Bear Flag insurrection by these communities against Mexican rule in 1846 and the subsequent annexation of California to the United States in 1848 after US victory in the Mexican-American War. The Wappo people are not even mentioned in English-language scholarship until Stephen Powers and John Wesley Powell's 1877 survey *Tribes of California* (which, however, is notable for containing the first published example of the Wappo language, a vocabulary collected in the 1850s by John Russell Bartlett (Golla 2011:29, 191)[9]). Samuel A. Barrett and Alfred L. Kroeber's 1908 work *The Geography and Dialects of the Miwok*

[9] A similar vocabulary was collected in the same decade by the Swiss philologist Francis Berton: "Vocabulaire des Indiens de la Vallée de Napa et du Clear Lake, Californie: rédicé en 1851" published in 1880. Note that while the 1880 publication lists the collection date as 1851 (Sawyer 1991:113), the Smithsonian archives lists the collection date as 1857 (Manuscript 861, National Anthropological Archives, Smithsonian Institution).

Indians, Barrett's solo work of the same year *The Ethnogeography of the Pomo and Neighboring Indians*, and Henriette Rothschild Kroeber's "Wappo Myths", again of the same year, began the anthropological examination of Wappo culture, but had very little mention of language. Alfred Kroeber's *The Languages of the Coast of California North of San Francisco* (1911) and *Handbook of the Indians of California* (1925) both have sections on the Wappo people with some discussion of their language, but these are encyclopedic works meant as general surveys of many languages, not in-depth studies of particular ones. Harold E. Driver's 1936 *Wappo Ethnography*, while being perhaps the most comprehensive text yet published on Wappo culture (as it was practiced in the early 20th century), likewise does not devote much space to the analysis of the Wappo language beyond the (very valuable) documentation of Wappo cultural terms. Indeed, the whole of 20th- to 21st-century scholarship on the Wappo language can in large part then be attributed to just five researchers: Paul Radin, Jesse O. Sawyer, and the team of Sandra Thompson, Joseph Sung-yul Park, and Charles N. Li.

1.1 Paul Radin

Paul Radin's *A Grammar of the Wappo Language* of 1929, the first of only two published grammars of Wappo, includes a small section on phonetics and phonology (Radin 1929:9-18), which, considering it is something of a sidenote to Radin's larger study of Wappo morphology and syntax in that volume, ironically constitutes the largest phonetic and phonological study of Wappo heretofore published. It is also the first analysis of the phonetics of Wappo present in the linguistic literature, so any analysis of Wappo phonetics and phonology must begin here.

Radin perceived the outlines of the Wappo phonetic inventory, but in many of the details, his assessment does not match that of later researchers, nor does it correspond well to the audio corpus of the language compiled by Jesse O. Sawyer. In particular, Radin's perception of glottalization and aspiration is unreliable compared to later assessments; there are many examples in his grammar of his failing to record a glottalization or aspiration feature for some consonants in particular words which later documentation showed was indeed present. Though Radin notes that language attrition may have already affected certain aspects of his speakers' phonology at the time of his fieldwork in the late 1910s (Radin 1929:9-10), the validity or extent of this as an explanation for the discrepancies between Radin's analysis and that of later researchers is impossible to assess now, a century after Radin's work and half a century after Sawyer's.

A difficulty with Radin's analysis is that he does not give any example words for his posited phonetic segments, examples that could be checked against the attestations in Sawyer's 1965 *English-Wappo Vocabulary*, or in the audio corpus. Occasionally he cites a few words to demonstrate phonological processes, but these processes are themselves simply claimed by Radin without supporting evidence or further analysis.[10]

The phonetic segments of Wappo as posited by Radin (1929:9-11) are reproduced in Table 1.1. It should be noted that, when it comes to Radin's work, I am using the term 'phonetic' and 'phonetic segments', rather than 'phonemic' or 'phonemic inventory'. This is because Radin's analysis predates by several decades the incorporation of modern phoneme theory into Americanist linguistics (Maddieson, p.c.); he posits a series of sounds for the language, but comparison of this series to the audio data and, to a lesser extent, the

[10] Some of the evidence for his assertions can be seen in examples given in the morphological sections of his grammar, but Radin's prose description does not connect these back to his phonetics section; the examples are presented for morphological consideration only.

morphological data that we have, shows that his posited sound inventory is purely at the phonetic or surface level, rather than the phonemic. Therefore, Radin's analysis ends up positing a larger number of phones – especially vowels, but also consonants – than later research justifies. While somewhat useful for subsequent analysis of the positional phonetics of Wappo segments, to the extent that Radin perceived these accurately, Radin's overall analysis of Wappo phonology is largely superseded by that of later researchers.

Table 1.1

Wappo Segment Inventory According to Radin (1929:9-11)

Vowels	ɛ ɪ ɔ ʊ e i o u a
Diphthongs	ao ai ɛo ɛi ɛu ei ɔa ɔi iɛ ui
Consonants	
labial	p p’
dental	t t· t’ ṭ ṭ’
palatal	k k· k’
affricative	tc[11] tc’ ts ts’
spirant	c s
nasal	n m
lateral	l
glottal catch	’

1.1.1 Consonants

On the question of phonation types in the stop series of Wappo, Radin clearly had some doubts:

> “Whether three series of stops occur (sonant, surd, glottalized surd[12]) is an open question. Kroeber heard them whereas Barrett did not, while I am uncertain although inclined to agree with Kroeber. To my ear, however, the series seems to be unaspirated stop, long stop, glottalized stop.” (Radin 1929:9)

Later researchers – chiefly Sawyer (1965, 1991), and Thompson et al. (2006) – were quite certain about two series at least, a voiceless unaspirated (plain) series and a glottalized series,

[11] <c> in this period of Americanist transcription represented [ʃ], thus <tc> represented [tʃ].
[12] ‘sonant’ would now be termed ‘voiced’, and ‘surd’ would now be termed ‘voiceless’.

while Thompson et al. (2006) gave phonemic status to a third, a voiceless aspirated series, which Sawyer had accurately transcribed but had apparently considered merely a synchronic sequence of plain stop plus /h/ and thus not phonemic as such (Sawyer 1965:vii). Since Radin apparently perceived a simple ‘unaspirated’ (short) series in opposition to a ‘long’ series, it seems likely that his ‘unaspirated’ series corresponds to Sawyer’s voiceless unaspirated (plain) series and his ‘long’ series corresponds to the voiceless aspirated series recorded by Sawyer and later judged phonemic by Thompson et al. This would fit well with the fact that aspirated stops are, in general, temporally longer than unaspirated ones, but it still seems odd that Radin, aware of the existence of aspiration as a feature, would not hear it. It is possible that the generation represented by Radin’s consultants did pronounce this series as a geminate stop, while the generation that worked with Sawyer had come to pronounce it as singulate and aspirated, though in my opinion this is not likely.

Radin does posit four series of stops by place of articulation, as does Sawyer, but he has some interesting remarks about two of them. These are worth quoting in full. First is his assessment of the post-dental coronal series:

> “... ṭ and ṭ’ represent a true series quite distinct from [dental] t. In addition to being *palatalized*[,] ṭ gives the impression acoustically of a *lateral* consonant and was indeed often written as t^{r}. These sounds, we know, have a fairly extensive distribution. I personally am inclined to regard them as transformations of the lateral l.” (Radin 1929:10; emphasis and bracketed material added)

The fact that Radin describes this series as being both palatalized, and having a lateral phonetic character, is quite different from the unremarkable alveolar series described by Sawyer or Thompson et al. (Sawyer 1965:vii; Thompson et al. 2006:1-3). The transcription that suggests itself for Radin's description is either [t̠ʲ] or [t̠ˡ], or a combination of the two, [t̠ʎ].[13] In the California region, a phonemic palatalized coronal stop is somewhat rare, attested only in the Ohlonean and Yuman languages (Golla 2011:204-7). A phonemic coronal stop with lateral release, or a coronal lateral affricate, is only slightly more common, and it is only attested with glottalization, i.e. [ƛ']; a phoneme of this type occurs for example in the Oregon and California Athabaskan languages, and in the Wintuan languages Wintu and Hill Patwin (Golla 2011:204-7). If Radin's description is accurate, it would suggest that the Wappo of the early 20th century possessed a palato-lateralized stop or lateral affricate series like the ones attested sporadically for other parts of California, and which was subsequently lost (i.e. converted to a simple alveolar stop) by later generations of speakers. However, a major problem with this hypothesis is that the later-attested system, an opposition between a dental stop series and an alveolar stop series, is one of the defining phonological characteristics of California as a linguistic area, being attested in nearly half the stocks of the region; it is present in the Northern Yukian, Pomoan, Miwokan, Ohlonean, Yokutsan, and Yuman families, as well as in Chimariko, Wappo, Esselen, and Salinan. Mutsun Ohlone and the Yuman language Quechan display this opposition in addition to the palatalized coronal stop noted above (for sources on language data in this work, see Appendix A). Thus, the balance of the evidence indicates that the dental-alveolar phonemic opposition noted by Sawyer and

[13] Complicating matters is Radin's use of <tʳ> to transcribe the sound, which suggests a retroflex rather than lateral character, e.g. [ʈ͡ʂ] or [ʈ͡ɻ].

Thompson et al. is more likely to be the correct assessment, and that Radin may simply have noticed an unusual phonetic realization of an essentially alveolar stop.[14]

Next is Radin's assessment of the dorsal series:

> "Palatals.—k is medial. It was never heard as a sonant. k· was heard in two positions, as a back-palatal and as an intermediate between k· and weak velar q. The velar tinge was so inconsistently given that it seemed best to regard it as of no importance. My final feeling was that two distinct k's were involved here, a back-palatal and a velar which have today practically fallen together both in Wappo and Yuki proper." (Radin 1929:10)

It seems here that Radin is using "palatal" in the broader sense of 'dorsal,' rather than 'palatal' in the narrow sense. That being the case, he describes two close parallel series of dorsal stops - a "back palatal," presumably [k^j] or [k], and something approaching a more back-velar or uvular pronunciation, presumably [k̲] if not [q]. However, as Radin notes, this difference was inconsistently given, appearing to be only a vestige of a former phonemic distinction in the generation of Radin's consultants. If there was indeed at one time a phonemic distinction between a velar stop series and a uvular series, then it would place Wappo among a subset of California languages that includes its close areal neighbors Eastern Pomo and Southeastern Pomo, among others.[15] However, there is no evidence for such an opposition in Sawyer's later audio attestations of Wappo.

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[14] Perhaps as an idiosyncratic feature of a particular speaker or group of speakers with whom Radin worked.
[15] Other languages of California that have a phonemic contrast between a velar and uvular stop include the Chumashan family, the Palaihnihan family, most of the Cochimí-Yuman family, Central, Kashaya, Eastern, and Southeastern Pomo, the Uto-Aztecan languages Cahuilla, Cupeño, Luiseño-Juaneño, Serrano, and Western

Radin describes Wappo as having a set of affricates and fricatives in the front-palatal region, transcribing them as *tc, ts*, *c,* and *s*. The <c> here follows an early Americanist usage (that based on Powell 1880, Boas 1911, and the American Anthropological Association standard of 1916) of using that letter to represent the post-alveolar fricative [ʃ], and thus *tc* represents the post-alveolar affricate [t̠͡ʃ]. *ts* is the expected alveolar affricate [t͡s] and *s* is the expected alveolar fricative [s].

One major difference between Radin's assessment and that of Sawyer is that Radin claims a third phonation series only for the dental stop series /t/ ([t̪]) and the 'palatal' (i.e. dorsal) stop series /k/. That is, for each of the four stop/affricate series /p/, /ṭ/, /ts/, /tc/, Radin claims there is only a twofold opposition between unaspirated and glottalized, i.e. /p ~ p'/, /ṭ ~ ṭ'/, etc., while for the remaining /t/ and /k/ series he claims a threefold opposition between unaspirated, 'long', and glottalized, i.e. /t ~ t· ~ t'/ and /k ~ k· ~ k'/. Assuming the two 'long' series correspond to Sawyer and Thompson et al.'s later aspirated series, one must ask why Radin failed to perceive a 'long' series for /p/, /ṭ/, /ts/, /tc/, since such series manifestly exist in Sawyer's data. Radin asserts that in the speech of his consultants, many of the previously separate consonant phonemes were beginning to coalesce due to language attrition. In fact, even for the palatal/dorsal series, Radin admits that "k' shows a marked tendency to merge with k·" (Radin 1929:10). Later he summarizes:

> "As pointed out above, a frequent phonetic phenomenon in Wappo is the merging of unaspirated and of glottalized stops with long stops. The most obvious interpretation seems to be, that owing to the small number of people

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Mono, the Wintuan languages Wintu and Nomlaki, the California Athabaskan languages Hupa and Kato, the Plateau language Klamath-Modoc, and the isolate Chimariko (Appendix A).

> still speaking Wappo fluently, the various consonantal series have developed a tendency to assimilate.” (Radin 1929:10)

Regarding the nasals of Wappo, Radin observes merely that “they are pronounced as in English” (Radin 1929:10). Radin gives two nasal phonemes, /m/ and /n/. There is little indication that he adequately perceived the separate glottalized nasal series /m’/ and /n’/ that are well-attested in Sawyer’s data; for example, *tom’* ‘fawn, baby deer’ appears in Radin (1929) as *t·ɔm’*, with the glottalization mark on the final consonant, but *p’in’* ‘mustard greens’ appears in the same work as *p’ın*, without the glottalization mark on the final consonant (Radin 1929:188, 189).

For laterals, Radin states that “l has the continental value” – i.e. presumably a ‘light’, non-velarized dental or alveolar articulation, like that of French or Spanish. But he also notes: “Occasionally it was heard as dorsal (ɫ). But this is quite secondary and due to a preceding aspirated vowel.” Radin’s ‘aspirated vowels’ will be discussed further below, but for now this observation is interesting because there is some indication in the Sawyer audio corpus that the lateral approximant phoneme /l/ can indeed occur in a velarized form [ɫ] in certain contexts (particularly in syllable codas – though there is no indication that preceding aspiration has an effect). As with the nasals, there is little indication that Radin consistently perceived the separate glottalized lateral /l’/ that Sawyer later recorded; *p*^{h}*il’* ‘snow’ appears in Radin (1929) as *pil·* , *mul’* ‘many, all’ appears as *mul·*, *pol’* ‘dirt, dust’ appears as *p·ɔl*, and *wil’* ‘body’ appears as *wil* (Radin 1929:188, 191, 193). However a number of words with <*l*> in Radin (1929) (including ‘snow’ and ‘many, all’, above) are transcribed with a lengthening mark (the middle dot <·>), suggesting that Radin may have perceived glottalized /l’/ as simply a lengthened /l/ (which does indeed occur phonetically in Wappo; see discussion in Chapter 4 on word-internal coda lengthening of plain sonorants, inclulding /l/).

Another observation that Radin makes about glottalization, in addition to that about the glottalized stop and affricate series discussed above, is an opposition between ‘aspirated vowels’ and ‘glottalized vowels’. The way these are described, they appear to be sequences of a vowel plus either a glottal fricative /h/ or a glottal stop /ʔ/. In this light, Radin’s statement about the prevalence of word-final glottalized vowels is one of the main points of agreement between his analysis and Sawyer’s: “All terminal vowels that are not aspirated, i.e., in other words, the overwhelming majority, are weakly glottalized” (Radin 1929:9). A large percentage of the Wappo lexicon recorded in Sawyer’s *Vocabulary* does indeed terminate in a vowel-glottal stop sequence /Vʔ/, and a few forms also terminate in a vowel-glottal fricative sequence /Vh/ (Sawyer 1965); and Sawyer later notes that post-vocalic /h/ often serves to signal morphological contrasts, in the form CVh vs. CVØ (Sawyer 1991:23)

1.1.2 Vowels

Radin divides the Wappo vowel system into several phonation types, in some ways paralleling those of the stop/affricate series:

> “On superficial study all vowels, particularly terminal ones, seem to occur in three forms: simple, aspirated, and glottalized. The glottalized is, however, purely secondary and of no historical importance, terminal vowels being always either glottalized or aspirated. Similarly aspiration simply indicates a

syncopated syllable, h+vowel, that has been reduced to ‘[16] owing to loss of following vowel.” (Radin 1929:11)

Radin’s comments here seem to indicate that he felt the aspiration and glottalization features to be of recent origin, and perhaps even a synchronic process in the contemporary language. Since he does not go into further detail, it is difficult to ascertain whether he felt aspiration and glottalization of vowels was a contrastive phonological feature, or merely a phonetic detail that occurs in certain positions.

Table 1.2 gives the vowel inventory of Wappo as described in Radin (1929). I have organized the vowel segments he presents in terms of their vocalic features.

Table 1.2

Wappo Vowel Inventory According to Radin (1929:11)

closed and medium in length	i	e	a	o	u
open and short[17]	ɪ	ɛ		ɔ	ʊ
semi-vowels	j				w

It is not clear from Radin’s brief description of the vowel inventory whether he believed the ‘closed and medium’ series and the ‘open and short’ series occurred in different phonological contexts, or were simply two convenient feature labels for the collection of vowels that he posited for the language. Unlike later authors, Radin also considers the sounds [w] and [j] to be part of the vowel system rather than the consonant system. It is unclear whether he felt

[16] The turned apostrophe <‘> represents aspiration, [ʰ].
[17] Radin’s symbols for [ɪ ɛ ʊ] are < ι ϵ υ >, forms of the Greek lower-case iota, epsilon, and upsilon, respectively.

them to be distinct from [u] and [i], or [ʊ] and [ɪ], or were just varieties of one or both of those series, presumably at syllable boundaries. As with the phonemes /m/, /n/, and /l/, there is little indication that Radin consistently noticed the glottalized semi-vowels /w'/ and /j'/ that Sawyer later described (unless his descriptor "glottalized vowels" also applies to the semi-vowels); for example, *hiy'* 'louse' appears in Radin (1929:183)[18] as *hi*, *yaw'* 'younger brother' appears as *yáo* (1929:191), and *k'áy'el* 'white' appears as *k'ayέl·* (1929:193), all without the glottalization recorded by Sawyer, yet *ciy'* 'grasshopper' is recorded in Radin (1929:190) as *tsi'*, and *nuy'* 'sand' is recorded as *núi'* (1929:187), both with glottalization.

Radin also describes a series of diphthongs for Wappo. Some of these he considers 'original', and some he considers 'secondary'; based on the examples he provides, he appears to consider the former group as being a sort of 'stable' diphthong that has an indivisible, unitary existence, and appears to consider the latter group as arising from phonetic or morphophonemic effects such as the loss of intervocalic segments and resulting hiatus (Radin 1929:11).

Table 1.3 gives the diphthongs that Radin describes as 'original'; unlike Tables 1.1 and 1.2, I have modified the presentation in Table 1.3 to better display the phonological features of the diphthongs that Radin proposed.

[18] Though note that Radin records the nominative form, *híy'=i*, as *hí'i* (Radin 1929:131).

Table 1.3

Wappo Diphthong Inventory According to Radin (1929:11)

	rising	level	lowering
non-rounded diphthongs	ai ɛi ei		iɛ
rounding diphthongs	ao ɛu	ɛo	
unrounding diphthongs	ɔi	ui	ɔa

Many of these diphthongs are also attested in Sawyer (1965) and in the Wappo audio corpus, so Radin's assessment here is largely correct. However, from an examination of some of his transcriptions, a few of the words he transcribed with a diphthong actually consist of two vowels separated by a glottal stop: for example, Radin (1929) has *pátɛnáok* 'six' (Radin 1929:194), while a transcription that more closely matches the audio data is *paténaʔukʰ* (see WSR 62, 86, 111).[19]

1.2 Jesse O. Sawyer

After Paul Radin's 1929 analysis, the next researcher to describe the phonological structure of Wappo in any detail was UC Berkeley linguist Jesse O. Sawyer. Though Sawyer did not devote any specific articles or books to describing Wappo phonology as a whole, he does introduce a proposed phonemic inventory in his *English-Wappo Vocabulary* (1965), which he uses as the basis for all of his transcriptions of Wappo in that and subsequent works. He also wrote three articles addressing specific aspects of Wappo phonology: Sawyer (1964a) "Wappo words from Spanish," which looks at the adaptations of Spanish loanwords to Wappo phonology; Sawyer (1964b) "The implications of Spanish r and rr in Wappo history,"

[19] Throughout this work, items from the Jesse O. Sawyer Collection of Wappo Sound Recordings will be marked with 'WSR' followed by the file number in which the item is found. For example, an item marked 'WSR 65' can be found in File 65 of the collection.

which focuses particularly on those two loan phonemes as well as the sociolinguistic context of Spanish loans in Wappo in general; and Sawyer (1981) “The Wappo glottal stop,” a study of the morphophonemic role of the glottal stop in Wappo. In addition, *Wappo Studies,* Sawyer’s 1991 review of various topics in Wappo structure, contains a section outlining some aspects of Wappo phonology as Sawyer analyzed them – for example, aspirated stops are analyzed as being sequences of plain stops plus /h/, and a length distinction in vowels is asserted. There is also some mention of Wappo sentence-level prosody and secondary-stress assignment, and a discussion of some trace examples of vowel harmony[20] (Sawyer 1991:22-24).

Table 1.4 lays out the consonant inventory of Wappo as given in Sawyer (1965).

Table 1.4

Wappo Phoneme Inventory as Presented in Sawyer (1965:vii)

p	t	ṭ	c	č	k	ʔ	i	i·			u	u·
p̓	t̓	ṭ̓	c̓	č̓	k̓		e	e·			o	o·
m	n	l	w	y					a	a·		
m̓	n̓	l̓	w̓	y̓			Stress: ` and ´					
			s	š		h	Juncture: | ↓ and space					
and from Spanish influence:												
f	d	đ	g	r	r̓							

The major new analysis that Sawyer adds is positing a series of glottalized sonorants, namely /m’/, /n’/, /l’/, /w’/, /y’/, which went previously unproposed and inconsistently

[20] See Chapters 5 and 6 for my analysis of word-level prosody and morphophonology, respectively.

transcribed by Radin. Sawyer also abolishes Radin’s ‘long’ stops t· and k· – indeed, phonemic consonant length contrasts are not acknowledged by Sawyer or by any subsequent author, myself included.

Sawyer gives a few brief remarks about this system. First, regarding the /t/ series, he notes that “the ‘t’ is most similar to English /θ/, except that it is a stop” (Sawyer 1965:vii). This clearly implies that the place of articulation of the /t/ series is dental, thus [t̪ , t̪’]. Second, regarding the parallel /ṭ/ series, he states: “the ‘ṭ’ [is most similar] to English /t/ except that varieties in the environment of back vowels are backed” (Sawyer 1965:vii-viii). This implies that the unmarked place of articulation of the /ṭ/ series is alveolar, like the English /t/ phoneme. What Sawyer means by “backed” is not entirely clear, but it most likely means either a post-alveolar or retroflex realization, i.e. [t̠] or [ʈ], and this general assessment is borne out by analysis of the audio corpus. Unlike Radin’s assessment of this phoneme (Radin 1929:10), Sawyer mentions no trace of a lateral release or other lateralization feature, so if such a feature did characterize the speech of Radin’s generation of consultants, that feature had disappeared by the generation of Mrs. Laura Fish Somersal, Sawyer’s principal consultant (though it should be noted that Mrs. Laura, born around 1890, would have already been in her 20s when Radin was working with his group of consultants).

One final relevant observation here is Sawyer’s description of the Spanish loan-phoneme /đ/. Sawyer describes it as “a voiced variety of the stop ‘t’” (Sawyer 1965:viii), implying that it is a voiced dental stop /d̪/. But if that is the case, what is the value of the phoneme Sawyer gives as simple /d/? It is possible that the latter is an alveolar stop compared to the dental, but why this should be the case phonologically is not clear, considering that the loan-language Spanish lacks any sort of place opposition in its coronal stops that Wappo could map onto. More likely, /d/ is meant to represent a dental stop and /đ/ is meant to represent a dental fricative, /ð/. This distinction is again borne out by analysis of the audio corpus.

1.3 Sandra A. Thompson, Joseph Sung-yul Park, and Charles N. Li

The final study to address Wappo phonology before the present study is Sandra Thompson, Joseph Sung-yul Park, and Charles N. Li's *A Reference Grammar of Wappo* (2006). This work is of great importance to Wappo documentation in that it is the only modern and accurate study of Wappo morphology and syntax; as the authors themselves point out, Radin's earlier 1929 grammar is, unfortunately, not wholly reliable (Thompson et al. 2006:xii). Their comments on this issue are given in full below:

> "First, Radin's transcription is problematic; in particular, he does not seem to have recognized the distinction between glottalized and non-glottalized consonants, between aspirated and unaspirated stops, or between syllable-final /h/ and /ʔ/; second, Radin's analysis suffers from methodological inadequacies, failing to distinguish synchronic morphological phenomena from suspected diachronic relics in morphology; and third, it was produced in a context of a much more shallow understanding of grammatical typology and universals than is available today." (Thompson et al. 2006:xii)

While Radin's 1929 grammar is an important contribution to the documentation of Wappo and to the documentation of California Indigenous languages as a whole,[21] in its treatment of Wappo morphosyntax it is largely superseded by Thompson et al. (2006). Furthermore, Thompson et al.'s study notes that their focus on morphology and syntax is important because Sawyer had not devoted much analytical attention to the topic. From the introduction to Thompson et al. (2006):

> "Here we reproduce Sawyer's (1965:vii) sounds of Wappo. Since Sawyer's phonemic analysis was based on Mrs. Laura [Somersal]'s speech, we have taken it as the basis for the transcription we will use in this book. Further discussion of the phonetics and phonology of Wappo can be found in Sawyer (1981, 1991). We do not attempt to improve on his analysis here; from the beginning of our fieldwork, we concentrated on morpho-syntactic analysis, both because Sawyer had dealt almost not at all with morphological and syntactic patterns, and because both we and Mrs. Laura felt more competent in that area." (Thompson et al. 2006:1; bracketed material added)

Though not the focus of their study, Thompson et al. make several crucial observations about Wappo phonetics and phonology in the introduction to their grammar. Because these authors worked with Mrs. Laura Somersal, the same consultant whom Jesse Sawyer worked with most extensively, they are able to cross-check several claims about Wappo phonetics and phonology that had been put forth by Sawyer. Thompson et al.'s comments in this regard are reproduced below, with my own commentary following each.

[21] In particular, it contains documentation of Wappo lexical items that appear in no other published work.

1. Sawyer's lexical entries are marked for stress, which we do not mark. Word stress is essentially predictable, falling on the first 'core' syllable, that is, the first syllable which is not synchronically (or transparently diachronically) a prefix. (Thompson et al. 2006:1)

This is confirmed by a study of the Wappo audio corpus. Stress does indeed occur on the lexical word root, regardless of lexical category. However, this is not the whole story – there is a more complex relationship between word stress and vowel length that is described in more detail in Chapters 2, 4, and 5, and there are a small number of morphemes that add secondary stress to the prosodic words in which they occur, discussed in Chapter 5.

2. Sawyer transcribes a glottal stop at the beginning of words whose initial phoneme is a vowel. We omit this glottal stop, as it appears to us to be predictable. (Thompson et al. 2006:1)

There are two theoretical approaches to ostensibly "vowel initial" words that appear with an initial glottal stop, in Wappo as in many other languages. The first approach is to assume that the underlying, phonemic form is onsetless, but that a later rule in the phonetic derivation inserts a glottal stop, so that no surface form is without an onset. The second is to assume that the underlying phonemic form itself possesses a glottal onset, which is then present at all levels of phonetic derivation. In my own analysis of Wappo, I have found that there are no phonetic contexts in which a syllable surfaces without an onset, whether this onset be a glottal stop or any other consonant. Glottal-stop initial syllables occur in all positions within the word (initially, intervocalically, post-consonantally), and words or morphemes with an initial glottal stop never lose that stop no matter what material does or does not precede them.[22] However, word-internally, there are some vowel-initial suffixes that do trigger glottal-stop epenthesis when added to a vowel-final root. Thus, I have concluded that most instances of glottal stop in Wappo represent an inherent consonant that is lexically specified in the same way as the other consonants of the language, but that a separate, epenthetic glottal stop occurs in some morphological contexts. More discussion on the status of the glottal stop can be found in Chapters 2, 3, and 4.

3. Sawyer's lexicon contains a number of words with long vowels. We were not able to hear this distinction, and Mrs. Laura could not confirm that it existed. We have kept the length marking when citing examples from Sawyer (1965). (Thompson et al. 2006:1)

Whether long vowels are present in Wappo (either phonemically or phonetically) is a question that previous studies have not adequately addressed, and so it was one of the main goals of the present study to address and settle it. Based on the evidence present in the Wappo audio corpus, I argue that long vowels are indeed a component of the language as a phonetic phenomenon, being primarily triggered by certain syllabic and metrical rules, but that they can be marginally phonemic in a handful of anomalous word-forms; this discussion can be found in Chapters 2 and 4.

[22] Though in rapid speech contexts, the glottal stop, as with other segments, may be subject to loss; see Chapter 4, Section 4.3.7.

4. Sawyer postulates two series of stops, plain and glottalized,[23] *but does not allow for aspirated stops. We would analyze what he transcribes as /ph/, /th/, and /kh/ as aspirated stops, and consider Wappo to have three series of stops, plain, aspirated, and glottalized*. (Thompson et al. 2006:2)

As discussed earlier, Radin had posited three sets of stops for Wappo, namely plain, long, and glottalized, and Sawyer had posited two sets, plain and glottalized, with the plain stops occurring secondarily aspirated as a result of phonetic combination with the phoneme /h/ (and for that matter, Sawyer asserts in Sawyer (1981:22) that the glottalized stops are themselves a secondary outcome of a plain stop followed by the glottal stop /ʔ/). Whether the aspirated and glottalized stop series arose diachronically from earlier series of plain stop plus glottal phoneme is a question for further research, but I would argue that such a description cannot be applied to the synchronic situation. Instead, I side here with Thompson et al. (2006) in asserting that there are three fully independent phonemic series of Wappo stops: plain, aspirated, and glottalized. Radin's 'long' series, then, must be assumed to be, if not a relict of a fourth series, then spurious. Evidence for the independent phonemic status of an aspirated stop/affricate series is given in Chapter 2.

1.4 Summary

As with many of the Indigenous languages of California, the formal scientific documentation of Wappo's phonetics and phonology began only relatively recently and has a long way yet to go to be considered complete. Radin, despite the caveats with regard to the accuracy of some elements of his transcription, as well as his operating in a pre-phoneme

[23] This is a widespread areal feature of California and western North America in general (Mithun 1999:19).

paradigm, was still able to make a valuable contribution to the documentation of the overall lexicon of Wappo, many of its morphophonemic alternations, and some aspects of its phonetic vowel qualities. Sawyer brought Wappo scholarship further forward by providing phonemic transcriptions that were reliably accurate, especially for glottalized and aspirated segments, and most importantly, made audio recordings that provide largely our only evidence for the phonetics and phonology of the Wappo language independent of transcription. Finally, Thompson, Park, and Li further refined Sawyer's phonological analysis, and, more importantly, provided the most accurate and comprehensive analysis of Wappo morphosyntax to date. It is my hope that the present study will likewise be able to build on its predecessors and provide new analyses and insights into Wappo phonetics and phonology, especially in a much-needed typological light.

CHAPTER 2: PHONOLOGY

2.0 The Wappo Phoneme Inventory

Based on analysis of both the written and audio documentation of Wappo, I posit that the Wappo phoneme inventory consists of 32 primary consonant phonemes and five vowel phonemes. In addition, there are 17 marginal consonant phonemes: ten that appear in only a handful of lexical roots (five marginal consonants and five marginal vowels) and seven that are clearly loan phonemes from Spanish. This analysis of the Wappo phoneme inventory is based on the combined evidence and argumentation of Radin (1929), Sawyer (1964a, 1964b, 1965, 1981, 1991), and Thompson et al. (2006), as well as my analysis of the Jesse O. Sawyer Collection of Wappo Sound Recordings (collection LA90, California Language Archive, University of California at Berkeley).

2.1 Consonant Phonemes

Table 2.1 lays out my proposal for the consonant phonemes of Wappo. The segments given in parentheses (X) are marginal phonemes within the native vocabulary, while the segments given in curly brackets {X} are found only in words of Spanish origin.

Table 2.1

Phonemic Consonant Inventory of Wappo[24]

		Bilabial	Dental	Alveolar	Palato-Alveolar	Palatal	Velar	Glottal
Stop	Plain	p	t	ṭ			k	ʔ
	Glottalized	p’	t’	ṭ’			k’	
	Aspirated	p^h	t^h	ṭ^h			k^h	
	Voiced	{b}	{d}				{g}	
Affricate	Plain			c	č			
	Glottalized			c’	č’			
	Aspirated			c^h	č^h			
Fricative		{f}	{ð}	s	š			h
Nasal	Plain	m		n				
	Glottalized	m’		n’				
	Aspirated	(m^h)		(n^h)				
Lateral	Plain			l				
	Glottalized			l’				
	Aspirated			(l^h)				
Glide	Plain	w				y		
	Glottalized	w’				y’		
	Aspirated	(w^h)				(y^h)		
Rhotic	Plain			{r}				
	Glottalized			{r’}				

Notes:

1. {f} is labiodental
2. /w/, /w’/, and /w^h/ are labiovelar glides
3. {r} usually represents an alveolar or post-alveolar approximant, like the English [ɹ]

[24] Throughout this work, I will be using the Americanist symbols <c č š y ṭ r> in preference to their IPA counterparts <t͡s t͡ʃ ʃ j t̪ ɹ> respectively.

2.1.1 Consonantal Phonemes: Manner

2.1.1.1 Stop and Affricate Series

Like many of the languages of California (Golla 2011:204), Wappo stops and affricates exhibit a three-way contrast in phonation type between plain, glottalized, and aspirated forms.

There is no phonemic voicing among the Wappo stops and affricates; the plain series sounds impressionistically voiced to Anglophone ears in some positions, particularly word-initially, but spectrogram analysis proves that these segments are not voiced – see Chapter 4.

The stop series is spread across four places of articulation: bilabial /p/, front coronal /t/, back coronal /ṭ/, and velar /k/. The front coronal position is generally dental, based on auditory impression and spectrogram evidence, while the back coronal position is generally alveolar or post-alveolar, based on the same evidence. There is a definite phonemic distinction between these two places of articulation, as evidenced by numerous minimal pairs – see section 2.1.2.2.1. Unlike some of the languages of California, Wappo lacks a uvular stop series */q/.

The affricate series is distributed across two places of articulation, front coronal /c/ and back coronal /č/; however, these do not strictly align with the front and back coronal stops. The front coronal affricates are alveolar, thus aligning with the back coronal stops, while the back coronal affricates are palato-alveolar, falling somewhat behind the back coronal stops.

There is a single stop in the glottal place of articulation, the glottal stop /ʔ/. Unsurprisingly, this phoneme does not participate in the plain/glottalized/aspirated phonation division.

Wappo has acquired three voiced stops from Spanish loans, bilabial /b/, dental /d/, and velar /ɡ/. However, these are infrequent and not well-integrated into the phonological system, appearing only in a small number of loanwords, including some proper names. While /d/ occurs in six words, /ɡ/ is only attested in two words, and /b/ in only a single word.

2.1.1.2 Fricative Series

In contrast to the rich stop and affricate series, the Wappo fricatives are few in number; they consist solely of an alveolar /s/ and a palato-alveolar /š/. There is also a glottal fricative /h/, but this phoneme patterns more closely, in both its morphophonemic function and its relative frequency, with the glottal stop /ʔ/ than with the two coronal fricatives, and thus from a phonological standpoint is better considered a glottal segment rather than a fricative segment. The two coronal fricatives align in place of articulation with the affricates; front-coronal /s/ aligns with the front-coronal/alveolar affricate /c/, and back-coronal /š/ aligns with the back-coronal/palato-alveolar affricate /č/. Unlike most of the languages of California, Wappo lacks any type of dorsal fricative, e.g. velar /x/ or uvular /x̣/.[25]

[25] Among the genetic units of California, only Klamath-Modoc, Maiduan, Miwokan, Palaihnihan, Tübatulabal, Washo, and Yuki-Wappo entirely lack dorsal fricatives (see Appendix A).

Wappo has acquired two fricatives from Spanish loans: a voiceless labiodental fricative /f/, and a voiced interdental fricative /ð/. The latter is more frequent than the former, with fourteen attestations of /ð/ compared to seven for /f/.

There is no phonemic voicing distinction for any of the native stops, affricates, or fricatives in Wappo; the unmarked state of all of these is voiceless, as determined from spectrographic analysis (see Chapter 4). This is in fact the unmarked form of obstruents worldwide, with voiceless stops, affricates, and fricatives being both independent of and more frequent than their voiced counterparts cross-linguistically (Maddieson 1984:35, 38, 45).

2.1.1.3 Sonorant Series

The Wappo sonorant series consists of two nasal series and three approximant series; the approximants are divided into two glides and a lateral approximant. The two nasals are bilabial /m/ and coronal /n/ (the coronal appears impressionistically to be alveolar), while the three approximants are a labiovelar glide /w/, a palatal glide /y/, and a coronal lateral /l/ (as with /n/, the place of articulation of /l/ appears to be alveolar).

Unlike four of the neighboring languages to Wappo, namely Eastern Pomo, Southeastern Pomo, Northeastern Pomo, and Patwin (McLendon 1973:11, 1975:9; Moshinsky 1974:5; Chang 2007:605, 615-7; Lawyer 2015:225), Wappo lacks a native rhotic phoneme, typically realized in California as a rhotic semivowel, a postalveolar trill, or a flap (Golla 2011:207).[26] Wappo has however acquired a rhotic loan-phoneme through borrowings

[26] Languages of California that have a rhotic phoneme include the Ohlonean languages, the California Algic languages, many of the Yuman-Cochimí languages, many of the Uto-Aztecan languages, the Wintuan languages Patwin and Wintu, the Pomoan languages Eastern, Southeastern, and Northeastern Pomo, the Palaihnihan language Atsugewi, the Shasta language, and the isolates Chimariko, Esselen, Karuk, Salinan, and

from Spanish, as have many other languages of California. The Spanish loans in Wappo include mostly words for Eurasian material-culture items (primarily for agriculture), and Spanish names. The /r/ loan-phoneme in Wappo is realized as an alveolar or post-alveolar approximant [ɹ], similar to the rhotic phoneme of English; this may be a recent development due to Wappo-English bilingualism. It is the most frequent Spanish loan-phoneme, occurring in more than 60 words in Sawyer (1965).

The five series of Wappo sonorants pattern together by exhibiting a two-way phonation distinction between a plain form – a typical voiced sonorant – and a glottalized form, which is realized phonetically as a sequence of a voiced sonorant and a glottal stop, often with a strongly audible glottal release word-finally; for example, the glottalized bilabial nasal /m'/ is phonetically [m͡ʔ]. Additionally, for all of the native sonorant series, there are some lexical items that exhibit a phonemically 'aspirated' sonorant form, e.g. /lʰ/, which is realized as a voiced sonorant that transitions into a glottal fricative – /lʰ/ is phonetically [l͡h] (see Section 2.1.4 for discussion of these 'aspirated' sonorants of Wappo). In parallel with the native sonorants, the Spanish loan-phoneme /r/ has developed a glottalized counterpart, /r'/, attested in word-final position in a single Spanish loanword, *wápor'* 'ship' (from Spanish *vapor* 'steam', i.e. 'steamship, steamer').

Yana. Other than Ohlonean, Algic, Uto-Aztecan, and Wintuan, all of these languages are included in the Hokan hypothesis (Appendix A).

2.1.2 Consonantal Phonemes: Place

2.1.2.1 Labials

As outlined above, Wappo has a set of labial stops, nasals, and approximants. These consist of a bilabial stop series /p/, /p'/, /p^h/, a bilabial nasal series /m/, /m'/, and a labiovelar glide series /w/, /w'/; in addition there are the marginal aspirated sonorants /m^h/ and /w^h/. Some (near-)minimal pairs to illustrate the phonemic distinctions among these segments are given below;[27] relevant segments are highlighted in magenta.

2.1.2.1.1 Labial Stops

Laryngeal states: plain vs. glottalized vs. aspirated

(1)	*pec'*	'bird species'	(WSR 92, 114)
	p'eh	'shell'	(WSR 99, 102)
(2)	*pec'*	'bird sp.'	(WSR 92, 114)
	p^h*eʔ*	'foot'	(WSR 8, 64, 80, 114)
(3)	*p'ip*^{h}	'acorn of the white oak'	(WSR 3, 96)
	p^h*il'*	'snow'	(WSR 8, 66, 86, 114)

[27] The glottalized sonorants /m'/, /n'/, /l'/, /w'/, /y'/ occur only in coda position; see Chapter 3.

2.1.2.1.2 Labial Sonorants

Laryngeal states: /m/ vs. /m'/

(4)	*c'um*	'cloud'	(WSR 4, 101)
	num'	'pine nut, piñón'	(WSR 90)

Laryngeal states: /w/ vs. /w'/

(5)	*ʔew*	'fish'	(WSR 67, 70, 86)
	tehéw'	'small animal, baby animal, pet'	(WSR 101)

2.1.2.2 Coronals

As outlined above, Wappo has two parallel and contrasting series of coronals, distributed across the language's stops, affricates, and fricatives. This contrast is one of the chief characteristics of the Wappo phoneme inventory, and is also a common phonological feature of the California linguistic region as a whole; two or even three contrasting affricate and/or fricative places are found in virtually all of the families and isolates of the California region, and an equivalent stop-place contrast is an areal characteristic of the California Coast Ranges in particular (see Chapter 7).

The coronal stops of Wappo are divided into a dental series /t/, /t'/, /t^h/ – referred to as 'front' in this work – and an alveolar series /ṭ/, /ṭ'/, /ṭ^h/, referred to as 'back'. Affricates and fricatives are divided into an alveolar series and a palato-alveolar series; for these, the alveolar series is ‘front’ and the palato-alveolar series is ‘back’, thus these terms are intended as relative phonemic labels rather than phonetic descriptions. The front (alveolar) affricate/fricative series is /c/, /c’/, /cʰ/, /s/; the back (palato-alveolar) series is /č/, /č’/, /čʰ/, /š/.

The coronal nasal series and coronal lateral approximant series appear to be solely alveolar in articulation, and thus do not participate in the front/back distinction found among the obstruents. The coronal nasal series is /n/, /n’/, while the coronal lateral approximant series is /l/, /l’/. To these may be added the two marginally-occurring aspirated sonorant phonemes /nʰ/ and /lʰ/.

Some coronal (near-)minimal pairs are given below.

2.1.2.2.1 Coronal Stops

Dental /t/ series vs. alveolar /ṭ/ series

(6)	*tuy’*	‘truth’	(WSR 61.2, 74)
	ṭúʔmiʔ	‘to grind dry things, like pinole’	(Sawyer 1965:46)
(7)	*tí:yaʔ*	‘hawk sp.’	(Sawyer 1965:49)
	ṭíy’iš	‘straight’	(Sawyer 1965:99)
(8)	*matʰ*	‘long ago, years ago’	(Sawyer 1965:60)
	meṭʰ	‘above, up’	(WSR 66, 100)

(9)	*c'otʰ*	'mosquito'	(WSR 61.2, 75, 78, 81, 86)
	c'eṭʰ	'locust; cicada'	(WSR 9, 91)
(10)	*t'ol*	'hair'	(WSR 8, 64, 92, 114)
	ṭ'okʰ	'iris (flower)'	(Sawyer 1965:55)
(11)	*t'áʔmiʔ*	'to lick'	(WSR 86)
	ṭ'aʔ	'leg'	(WSR 8, 64, 79, 91, 114)

Laryngeal states: plain vs. glottalized vs. aspirated for dental /t/ series

(12)	*tel*	'nest, bird nest'	(Sawyer 1965:69)
	t'en	'knot, on a tree or in a board'	(WSR 93)
(13)	*taw'*	'tradition, custom, way'	(Sawyer 1965:107)
	tʰal	'what?; something'	(WSR 97, 112)
(14)	*t'ul*	'field, meadow, valley'	(WSR 66, 72, 86)
	tʰuʔ	'there, there nearby'	(WSR 95, 103)

Laryngeal states: plain vs. glottalized vs. aspirated for alveolar /ṭ/ series

(15)	*ṭóhe·ma*	'hanger (tool for hanging things)'	(Sawyer 1965:48)
	ṭ'óhma	'poison'	(WSR 85, 108)
(16)	*ṭúpu·luʔ*	'bead, clam shell bead'	(Sawyer 1965:21)
	ṭʰúṭu·wis	'bird sp.'	(WSR 92)
(17)	*ṭ'íškʰiʔ*	'tied tight'	(Sawyer 1965:105)
	ṭʰíṭi·yaʔ	'to shake with cold; to tremble'	(WSR 73)

2.1.2.2.2 Coronal Affricates

Alveolar /c/ series vs. palato-alveolar /č/ series

(18)	*caw*	'top, point'	(WSR 78)
	čaʔ	'tea' (< Russian *čaj*)	(Sawyer 1965:102)
(19)	*c'ey'*	'a few days ago, a while ago'	(Sawyer 1965:38)
	č'ey	'mushroom'	(WSR 86)
(20)	*cʰow*	'earth, land, ground, soil, country'	(WSR 8, 66, 78, 101)
	čʰóhma	'type of basket'	(WSR 3, 76)

Laryngeal states: plain vs. glottalized vs. aspirated for alveolar /c/ series

(21)	*cíc^{h}a*	‘blanket’	(WSR 80)
	c’íc’a	‘bird; white meat’	(WSR 80, 91, 98)
(22)	*cípe*	‘onion’	(WSR 8, 65, 80, 86)
	c^{h}ípe	‘red’	(WSR 65, 80)
(23)	*c’íc’a*	‘bird; white meat’	(WSR 80, 91, 98)
	c^{h}íca	‘bear’	(WSR 67, 80, 86, 91, 98, 113)

Laryngeal states: plain vs. glottalized vs. aspirated for palato-alveolar /č/ series

(24)	*čéke*	‘oriole’	(WSR 88, 92)
	č’éna	‘stick hooked for catching limbs’	(Sawyer 1965:98)
(25)	*čálaʔ*	‘core’	(WSR 88)
	č^{h}ál’is	‘girl (pre-adolescence)’	(WSR 63, 91, 100, 112)
(26)	*č’úhe*	‘dew’	(Sawyer 1965:29)
	č^{h}úya	‘house’	(WSR 76, 78)

2.1.2.2.3 Fricatives

(27)	*síne*	‘a sprout’	(WSR 93)
	šín	‘mole (skin mark)’	(WSR 97, 99)

(28)	*sóṭ'o·ko*	'elk'	(WSR 9, 113)
	šóṭʰe·ma	'comb'	(WSR 88)

2.1.2.2.4 Coronal Sonorants

Laryngeal states: /n/ vs. /n'/

(29)	*ʔon*	'people, family, clan, tribe'	(WSR 97, 98)
	kʰon'	*evidential marker for hearsay information*	(WSR 74)

Laryngeal states: /l/ vs. /l'/

(30)	*tel*	'nest, bird nest'	(Sawyer 1965:69)
	cel'	'then, at that time'	(WSR 74, 109)

2.1.2.3 Palatals

There is a single palatal series, the glide approximants /y/, /y'/, and the marginal /yʰ/. A palatal (near-minimal) pair is given below.

Laryngeal states: /y/ vs. /y'/

(31)	*puy*	'net, fish net'	(WSR 3, 109)
	nuy'	'sand'	(WSR 66)

2.1.2.4 Dorsals

In contrast to the coronal obstruent set in Wappo, the dorsal obstruent set is sparse. It consists of a single velar stop series, /k/, /k'/, /kʰ/.

Some dorsal (near-)minimal pairs are given below.

Laryngeal states: plain vs. glottalized vs. aspirated

(32)	*kélšiʔ*	'to blush, to feel ashamed'	(WSR 73)
	k'éna	'long, tall'	(WSR 77, 113)

(33)	*kápi*	'tied'	(WSR 100)
	kʰápe	'feather'	(WSR 8, 64, 93, 114)

(34)	*k'óy'iʔ*	'to knead'	(WSR 79, 81)
	kʰóy'kʰiʔ	'to sit, of empty containers'	(Sawyer 1965:92)

2.1.2.5 Glottals

The Wappo glottal phoneme set consists of the glottal stop /ʔ/ and the glottal fricative /h/, a group of phonemes that is pervasive in the California linguistic area; even across the varied genetic units of the region, the glottal stop /ʔ/ and the glottal fricative /h/ are nearly ubiquitous[28] (Golla 2011:207). Unusually, these two phonemes account for a

[28] Among the languages described in Golla (2011), only Achumawi, a Palaihnihan language of northeastern California, does not have an entirely phonemic glottal stop, though it is still present phonetically (Good et al. 2003; Nevin 1998:54). In the same sample, only some members of the Yuman family and the isolate Seri, both of the upper Gulf of California region, lack a phonemic /h/ (Golla 2011:99, 124, 127).

disproportionately large share of the overall segmental makeup of the Wappo lexicon, measured by type frequency. This is partly attributable to their common occurrence in inflectional morphemes, particularly in verbs, but other factors may also be responsible for the high type frequency of these segments – see discussion in Chapter 3. Furthermore, there is a strong morphophonemic interaction among the glottal phonemes /ʔ/ and /h/ and some instances of phonemic long vowels; a similar morphophonemic interaction is seen between the plain, glottalized, and aspirated sonorants. This topic is taken up in more detail in Chapter 6.

Below are some (near-)minimal pairs involving the two glottal phonemes /ʔ/ and /h/.

(35)	*táka*	'soft'	(WSR 96)
	tákaʔ	'basket'	(WSR 61.2, 91)
(36)	*k'a*	'person'	(Sawyer 1965:77)
	šah	'tooth'	(WSR 8, 64, 73, 75, 80, 114)
(37)	*ʔah*	'I (1st sg. nom. pronoun)'	(WSR 79, 97, 112)
	háhšiʔ	'to say'	(WSR 106)
(38)	*kaʔ*	'crow'	(WSR 61.2, 67, 88, 114)
	šah	'tooth'	(WSR 8, 64, 73, 75, 80, 114)

(39) -*líʔiʔ* 'traditional ball game' (WSR 88, 116)

-*líhiʔ* 'to raise, lift' (WSR 73, 99)

(40) *ʔopáʔmiʔ* 'to eat' (WSR 70)

ʔosáhmiʔ 'to cover with a cloth' (WSR 117)

2.1.3 Loan Phonemes

In addition to its native set of consonant phonemes, the Wappo data also include some attestations of loan phonemes. The evidence indicates that all of these were acquired through the assimilation of Spanish loanwords, as they are only attested in what are transparently Spanish loans[29] (although in many cases, these loans were not transmitted directly from Spanish to Wappo, but rather through one or more Pomoan languages or other local languages first (Sawyer 1964a:164, 169)). The loan phonemes are:

1. A voiced dental stop /d/, attested in six items in Jesse Sawyer's 1965 *English-Wappo Vocabulary*:

(41)	a.	*déðal'*	'thimble'	< Sp. *dedal*
	b.	*déne:ðoʔ*	'fork, table fork'[30]	< Sp. *tenedor*
	c.	*déwel'-saʔ*	'owe, be in debt'	< Sp. *deber*
	d.	*dóloris*	'Dolores'	< Sp. *Dolores*

[29] The Wappo audio corpus contains a few examples of Southern Pomo words, but they are being recited by the speaker-consultant Mrs. Laura Fish Somersal explicitly as words from Southern Pomo, not as Wappo words. See e.g. *kárwen* 'Mrs. Laura (Somersal)'s father's name in Southern Pomo' (WSR 106).

[30] This word is transcribed with a medial <d> in Sawyer 1964a (165), 1964b (173), and Sawyer 1965 (42), but its audio attestation suggests the medial consonant should be the fricative [ð] (WSR 107).

e.	*dúlseʔ*	'sweet, candy'	< Sp. *dulce*	
f.	*ʔispʰáwdaʔ*	'baking powder'	< Sp. *esponjado*	

The articulation of this stop is (inter)dental, as confirmed by attestations of 'fork' in the audio corpus (WSR 80, 107).[31] Note that in Spanish, word-initial /d̪~ð/ is realized as a stop [d̪] when at the beginning of an intonational phrase. This opposition was carried over into Wappo, in which /d̪/ in Spanish loans remains [d̪] word-initially, but is usually realized as [ð] word-internally[32] (see number 3 below).

2. A voiceless labiodental fricative /f/, attested in seven items in Sawyer (1965):

(42)	a.	*číri:faʔ*	'sheriff, policeman'	< Sp. *cherife*	<E. *sheriff*
	b.	*fére:nuʔ*	'rein'	< Sp. *freno*	
	c.	*férmi:naʔ*	'Hermina' [sic.]	< Sp. *Fermina*	
	d.	*hoséfi:naʔ*	'Josephine'	< Sp. *Josefina*	
	e.	*rífleʔ*	'rifle'	< Sp. *rifle*	<E. *rifle*
	f.	*ʔaðelfí:naʔ*	'Adelfina'	< Sp. *Adelfina*	
	g.	*ʔestúfaʔ*	'stove'	< Sp. *estufa*	

3. A voiced (inter-)dental fricative /ð/, attested in 14 items in Sawyer (1965). Note that in Spanish, non-utterance-initial post-vocalic /d̪~ð/ is generally realized as a fricative [ð] or an

[31] My preferred transcription for 'fork' based on the audio corpus tokens is /d̪ene·ðó(r)ʔ/.
[32] The sole exception being *ʔispʰáwdaʔ* 'baking powder', possibly because the /d/ here is following a consonant /w/.

approximant [ð̞], and all attested /ð/ in Wappo occur either intervocalically or between a vowel and a following /r/.

(43)	a.	*déðal’*	‘thimble’	< Sp. *dedal*
	b.	*kumá:ðreʔ*	‘mother of one’s godchild’	< Sp. *comadre*
	c.	*kumpá:ðreʔ*	‘father of one’s godchild’	< Sp. *compadre*
	d.	*máðri:naʔ*	‘godmother’	< Sp. *madrina*
	e.	*pá:ðreʔ*	‘preacher, priest’	< Sp. *padre*
	f.	*páðri:nuʔ*	‘godfather’	< Sp. *padrino*
	g.	*sé:ðaʔ*	‘silk’	< Sp. *seda*
	h.	*siwaðé:raʔ*	‘saddle blanket’	< Sp. *sudadera (?)*
	i.	*sólta:ðoʔ*	‘soldier’	< Sp. *soldado*
	j.	*ʔáðe:laʔ*	‘Adelle’	< Sp. *Adela*
	k.	*ʔaðelfí:naʔ*	‘Adelfina’	< Sp. *Adelfina*
	l.	*ʔáspa:ðaʔ*	‘spades, a suit in the card deck’	< Sp. *espada (?)*
	m.	*ʔíha:ðaʔ*	‘female godchild’	< Sp. *ahijada*
	n.	*ʔíha:ðoʔ*	‘male godchild’	< Sp. *ahijado*

4. A rhotic segment /r/.[33] Based on the audio corpus, this is generally realized as an alveolar or post-alveolar approximant, [ɹ], similar to the rhotic phoneme of English. The /r/ segment is attested in 62 items in Sawyer (1965), making it the most common loan phoneme in Wappo.

[33] The phoneme inventory that Sawyer provides in the introduction to his dictionary includes the glottalized rhotic phoneme /r’/ (Sawyer 1965:vii), as does the inventory provided in Sawyer 1964b (172), but there are no examples containing this phoneme in the actual dictionary or in either of the 1964 articles. However, Sawyer 1964b (172) states that /r’/ “has been found in one word” (though the word is not given), and indeed, one item

Additionally, there is a single attestation of a glottalized counterpart, /r'/. Wappo appears to add a glottalization feature to the right edge of most Spanish loans – a glottal stop /ʔ/ if the loan is vowel-final, or a glottalization of the sonorant if the loan is sonorant-final (Sawyer 1964a:164). One particular loan ending in /r/ thus receives glottalization, transforming the /r/ into /r'/, namely *wápor'* 'ship', from Spanish *vapór* 'steam' (WSR 2).

There are also a small number of attestations of two other loan phonemes from Spanish:

1. A voiced bilabial stop /b/, in the Spanish loan *pà:loʔ blánkuʔ,* 'pimp' (Sawyer 1965:78), from Spanish *palo blanco,* 'white stick, white staff' – this was probably a local euphemistic expression in 19th-century California Spanish.[34] This item is present in the audio corpus (WSR 103), where it appears as the relatively unassimilated [pálo bláŋko].

2. A voiced velar stop /g/ in the Spanish loan *ʔí:gus*, 'fig' (from the Spanish plural *higos* 'figs'). This item is present in the audio corpus; in recording WSR 107, it appears as /ʔí:gos/, and in recording WSR 2, it appears as /ʔí:gus hòl/ ('fig tree'), with a different vowel in the second syllable. In both recordings, the /g/ is a voiced velar stop of the kind found in English, not a voiced velar fricative/approximant as in the original Spanish word (i.e. [ˈiɣos]).

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with a final /r'/ does subsequently appear in the audio corpus: *wápor'* 'ship', from Spanish *vapór* 'steam' (WSR 2). Additionally, there is a hint of a (glottalized) rhotic in the attestations of the word 'fork' in the audio corpus: two of the four tokens sound like [deneðóə̯ʔ] or [deneðóɚ̯ʔ] (WSR 80, 107). The non-syllabic and sometimes r-colored schwa near the end of the tokens could be a trace of a coronal approximant gesture like [ɹ]. This item had been transcribed as *déne·doʔ* in Sawyer 1964a (165), Sawyer 1964b (173), and Sawyer 1965 (42). The source of the loan is Spanish *tenedor* 'fork'. The voicing of initial *t-* to *d-* in the Wappo form is unusual; it may be due to assimilation to the following *ð*.

[34] "[Mrs. Laura Somersal] believes this [the term *pà:loʔ blánkuʔ*] may be from her father's language, Southern Pomo." (Sawyer 1965:78).

An orthographic <g> is also recorded in the word *tarougoun*, cited by Sawyer (1965:48) from the Swiss philologist Francis Berton's 1851 vocabulary of the languages of Napa and Clear Lake (see reference in Sawyer 1991:113). Sawyer glosses this as 'hanger, clothes hanger, a wood peg driven into a wall as a hanger', and cites its etymology as Spanish *tarugo* ('peg, dowel'). He likewise surmises that a more accurate and modernized transcription of the word recorded in Berton's vocabulary would be **táru:gon'* (Sawyer 1965:48). Sawyer states that this word was unknown to Mrs. Laura Somersal (Sawyer 1965:48), and the word does not appear to be present in the audio corpus.

2.1.4. Aspirated Sonorants

In addition to the series of plain sonorants /m n l w y/ and glottalized sonorants /m' n' l' w' y'/, a small number of Wappo words appear to show a third 'aspirated' sonorant series /m^h n^h l^h w^h y^h/. Though they are marginal by type frequency, they do appear to genuinely be a distinct phonemic series within the language. There are seven lines of evidence that support this assertion:

1. In parallel to the glottalized sonorants, which phonetically represent a sequence of a sonorant plus a glottal stop, the aspirated sonorants represent a sequence of a sonorant plus a glottal fricative. For example, /l^h/ is phonetically [lh], just as /l'/ is phonetically [lʔ].

2. These segments also share with the glottalized approximant series the phonotactic restriction of being prohibited from occurring word-initially or post-consonantally; see Chapter 3.

3. The only alternative to considering these segments to be single phonemes would be that they are a sequence of two separate phonemes, e.g. /n^h/ is actually /n/ + /h/. However, because these sequences often occur in the coda of a root syllable, either at the end of a word or before another consonant, such an analysis would mean that they would be the only licensed tautosyllabic consonant clusters in the language, an analysis that is undesirable from the point of view of phonemic parsimony. A similar argument was advanced by Eugene Buckley to support the phonemic status of aspirated sonorants in Kashaya Pomo (Buckley 1990:81-2).

4. When the words that contain aspirated sonorants are parsed morphologically, it is clear that the aspirated sonorant segments are wholly within a single morpheme, rather than the sonorant and aspiration components representing the connected boundaries of adjacent morphemes. For example, *k^{h}en^{h}iʔ* ‘to peel’ exhibits the common verbal suffix *-iʔ*, which means that the verb root must be *k^{h}en^h-*; the correct morphological parse is thus *k^{h}en^h-iʔ*, not **k^{h}en-hiʔ*; **-hiʔ* is not an identifiable verbal morpheme in Wappo.

5. In one elicited case, a word with an aspirated labiovelar glide /w^h/ contrasts with a nearly identical word with a clear sequence of /w/ + /h/ at a morpheme boundary: *cíw^{h}el’* ‘angelica herb’ vs. *c^{h}iw hel* ‘fly’s backside’ (*c^{h}iw* ‘fly’, *hel* ‘anus’) (WSR 103).

6. There is a phonetic rule in Wappo that lengthens sonorants in the coda of stressed syllables before another consonant, e.g. /héwseʔ/ ‘to grow’ → [héw:seʔ]. If the *-wh-* sequence in words like *cíw^{h}el’*, ‘angelica, or *híw^{h}ol’*, ‘beans’, were two separate phonemes, the /w/ would

occupy the coda of the tonic syllable, while the /h/ would occupy the onset of the following syllable, and the rule would be triggered, i.e. /cíwhel'/ → [cíw:hel']. However, when we examine an audio recording of *cíwʰel'*, we find that the [w] segment is not lengthened, suggesting that it and the following [h] segment are being viewed by the phonology as a single unit.

7. There are three loanwords of Spanish origin in which the aspirated labiovelar glide /wʰ/ appears to be mapping from the Spanish velar fricative [x]. This suggests that, to Wappo speakers, /wʰ/ is or was psychologically a single phoneme.[35]

As stated above, this set of phonemes is marginal in comparison to the other phonemes of Wappo in terms of type frequency. They occur in about twenty native word roots, and in three loanwords from Spanish. Representative examples of the aspirated sonorants are given below.

(44) *kómʰlu tákaʔ* 'a dish-shaped basket about six to eight inches high' (WSR 100)

(45) *kʰénʰ-iʔ* 'to peel, to peel with a knife' (WSR 99; Sawyer 1965:77, 115)

(46) *na-pi-šólʰ-i·yaʔ* 'to whisper' (WSR 49, 74)

[35] Cf. the sequence /ju/ in English, which in many ways behaves as a single phoneme; for instance, it represents the preferred adaptation of the (Middle- and Modern-) French phoneme /y/ in loans such as *bureau* (Eng. [ˈbjʊɹoʊ̯] < Fr. [byʁo]) and *debut* (Eng. [deɪˈbju] < Fr. [deby]).

(47) *híwʰ-miʔ* ‘to shake as a crib to quiet the baby; to rock’ (Sawyer 1965:86, 90)

(48) *čáyʰ-seʔ* ‘to roll’ (Sawyer 1965:51)

Though not described in any depth, Jesse Sawyer did apparently note the existence of aspirated (or ‘voiceless’) sonorants in his 1981 article on the morphological functions of the glottal stop in Wappo:

> “Looked at in another way the Wappo sound system consists of a group of sounds – p t ṭ c č k m n l y w – all of which may occur either glottalized or aspirated – that is, with an accompanying ʔ or h. ʔ and h function like free agents which triple the phonemic distinctions made by the language. There are few restrictions on the stop series except for some gaps in syllable final aspiration, but the combinations of glottalization and voicelessness with m, n, l, w, and y are limited to syllable final position.” (Sawyer 1981:146-7)

2.2 Vowel Phonemes

The Wappo vowel system consists of the five basic vowels /i/ /e/ /a/ /o/ /u/. This system is typical on a global typological level and is the most common system in the California linguistic region (Gordon 2016:58-9; Golla 2011:207-8).

Table 2.2 lays out the Wappo phonemic vowel inventory.[36]

Table 2.2

Phonemic Vowel Inventory of Wappo

	Front	Central	Back
High	i (i:)		u (u:)
Mid	e (e:)		o (o:)
Low		a (a:)	

Short vowels are the default phonemic vowel segments in Wappo. A small number of lexical items appear to display phonemically long stressed vowels; otherwise, long vowels are a purely phonetic phenomenon, and only occur in unstressed syllables under certain metrical conditions. The subject of phonemic vowel length is discussed in Section 2.2.5 below, and in Chapter 4. Phonetic vowel lengthening is discussed in Chapter 4.

2.2.1 Vowel Phonemes: Height

The Wappo vowel set follows the cross-linguistically typical height pattern of languages with five distinct vowels, namely two high vowels /i/ /u/, two mid vowels /e/ /o/, and one low vowel /a/ (Maddieson 1984:136; Gordon 2016:51).

2.2.2 Vowel Phonemes: Backness

There are two overall backness qualities in the vowel set, namely front and back. The vowels /i/ /e/ are front, while the vowels /u/ /o/ are back.

[36] Throughout this work, I will be using the normal colon (V:*)* to indicate phonemic vowel length, in preference to the IPA paired-triangle colon (Vː) . To indicate vowel length that is not inherently phonemic but rather the result of a metrical vowel lengthening rule, the Americanist middle-dot symbol V· will be used.

The backness quality for the phonemic vowel /a/ varies depending on adjacent consonants, but tends to be fairly central.

2.2.3 Vowel Phonemes: Rounding

As is typical cross-linguistically, the two phonemic back vowels /u/ /o/ are rounded, while the remaining vowels /i/ /e/ /a/ are unrounded.

2.2.4 Vowel Phonemes: Minimal Pairs

Some (near-)minimal pairs by vowel quality are given below.

(49)	*ciw*	'type of skin rash'	(WSR 80, 103)
	cew	'there, there far off'	(WSR 103)
(50)	*mey*	'water'	(WSR 8, 66, 77, 112)
	may	'who?; someone'	(WSR 97, 112)
(51)	*cuc*^{h}	'bird sp.'	(WSR 101)
	coc^h	'foam'	(WSR 8, 66, 78, 81, 86)
(52)	*nok*^{h}	'friend'	(WSR 98, 106)
	mak^h	'rain (n.)'	(Sawyer 1965:84)

(53)	*p^{h}il'*	'snow'	(WSR 8, 66, 86, 114)
	c^{h}ul'	'urine (female)'	(WSR 64, 78, 92)
(54)	*hel*	'fire'	(WSR 8, 66)
	hol	'tree, stick, wood'	(WSR 66)
(55)	*mic^h*	'road'	(WSR 81, 96, 99)
	mat^h	'long ago, years ago'	(Sawyer 1965:60)
(56)	*mun*	'parsley berry'	(Sawyer 1965:76)
	nan	'mouth'	(WSR 8, 64, 114)
(57)	*šin*	'mink'	(WSR 99)
	ʔon	'people, family, clan, tribe'	(WSR 97, 98)
(58)	*huʔ*	'head'	(WSR 8, 64, 72, 114)
	p^{h}eʔ	'foot'	(WSR 8, 64, 80, 114)

2.2.5 Vowel Length

The question of a phonemic difference in vowel length in Wappo has been addressed variously by different authors. Radin (1929) marked long vowels where he felt he heard them, but since his overall analysis was pre-phonemic, the long vowels marked in his grammar could have been either phonetic or phonemic in any given lexical item. Sawyer (1965) also consistently marked vowel length (to a highly accurate degree, based on my comparison with his audio corpus), but likewise does not appear to have distinguished between phonemically long vowels and phonetically long ones. Thompson et al. (2006) took up the question of whether vowel length in Wappo was phonemic, and concluded that, based on their own field experience with Wappo speakers, there was no detectable distinction between short and long vowels, and the speaker-consultant with whom they worked, Mrs. Laura Fish Somersal, could not confirm whether such a distinction existed (Thompson et al. 2006:1).[37]

In the present case, after an extensive analysis of the Wappo audio corpus, my conclusion is that vowel length does play a role in Wappo phonology, but that it is primarily a phonetic phenomenon, rather than a phonemic one – lengthened vowels undoubtedly exist, but, outside of about twenty lexical items with ambiguous structure, their presence is largely predictable from syllabic and metrical features.

Some attested words with a stressed phonemic long vowel are given below.

(59) Stressed /í:/

ʔí:ʔi	'yes'	(WSR 74, 105)
sí:kaʔ	'feather man (mythological figure)'	(WSR 108)
	(cf. *sík'iskʰiʔ* 'pregnant')	
ší:šawo	'black acorn bread'	(WSR 61.2, 72)
ʔohlí:taʔ	'choked on food'	(WSR 73, 82)
	(cf. *mehlítaʔ* 'felt with the hands')	

[37] Additionally, Victor Golla named Yukian as a stock that "definitely lacked" a phonemic vowel length contrast (Golla 2011:209).

tí:yaʔ	'hawk sp.'[38]	(Sawyer 1965:49)

(60) <u>Stressed /é:/</u>

té:kʰiʔ	'to melt, to flow (perf.)'	(WSR 4, 77)
	(cf. *téktekʰ* 'hawk sp.')	

(61) <u>Stressed /á:/</u>

há:ʔe	'isn't it?'	(WSR 110)
pá:ta	'now, just now'[39]	(WSR 101)
	(cf. *pát'o* 'cottonwood')	
ʔá:kal'	'chaff, husk, grain'	(WSR 103, 108)
cá:ṭ'eʔ	'type of headdress'	(WSR 3, 92, 100, 105)
	(cf. *hincáṭel'* 'wake up!')	
čá:ni	'type of dance'	(WSR 92)
	(cf. *čáno* 'manzanita')	

(62) <u>Stressed /ó:/</u>

čó:-		'to go'	
a.	*čó:-kʰiʔ*	'go (perfective)'	(WSR 3, 70, 115)
b.	*čó:-siʔ*	'go (future 1)'	(WSR 108, 114, 115)
c.	*čó:-yàw·miʔ*	'go (future 2)'	(WSR 3, 79, 103)
		(cf. *čóy·kʰiʔ* '(water) be stagnant')	

[38] I was unable to find this item in the Wappo audio corpus, and so its long vowel is unconfirmed.
[39] The long vowel in this item varies; see discussion in Chapter 4.

d.	*čó:-làhkʰiʔ*	‘don’t go!’	(WSR 93, 106)
	cʰó: nóma· c’ín	‘weasel sp.’	(WSR 113)
	hancʰó:ya	‘alone; orphan; sorry’[17]	(WSR 100, 103)
		(cf. *cʰóy’miʔ* ‘to write’)	

(63) <u>Stressed /ú:/</u>

tú:leʔ	a guess in the grass game	(WSR 88, 110, 114)
	(cf. *c’éma túltuʔ* ‘salamander sp.’)	
méy pú:suʔ	‘whale’	(WSR 79)
	(cf. *napús* ‘not tell the truth’)	
kú:ṭeʔ	‘Washington clam’[17]	(WSR 3, 8, 61.2, 67, 85, 86, 98)
	(cf. *kúṭe* ‘rib’)	

The items *méy pú:suʔ*, ‘whale’, and *kú:ṭeʔ*, ‘Washington clam’, appear to be borrowings from Western Miwokan, most likely Coast Miwok; cf. Bodega (Coast) Miwok *púuṣu* ‘whale’, *kúuṭa* ‘Washington clam’ (Callaghan 1970:132, 109). Indeed, many of the Wappo items that feature a stressed long vowel may ultimately be borrowings from neighboring languages of the Miwokan, Pomoan, and Wintuan families, all of which have phonemic vowel length contrasts.

Because the number of lexical items with a genuinely phonemically-stressed long vowel is relatively few, and because other incidences of vowel length can be ascribed to predictable metrical patterns, it is my conclusion that vowel length alternation in Wappo is only marginally phonemic at best, and perhaps may turn out to be entirely phonetic in nature once the internal structures and etymologies of the exceptional items are better understood.

2.2.6 Nasal Vowels

Wappo lacks a category of phonemically distinct nasal vowels, and indeed, outside of the Athabaskan language Tolowa-Chetco and the Yuki language, neither phonemic nor phonetic nasal vowels are common in the California linguistic region (Golla 2011:209; Balodis 2011:85, 111). There is one Wappo lexical item, however, that does exhibit distinctive nasal vowels:

(64) *hį́ʔį* ‘no’ (WSR 74, 75, 105)

Jesse Sawyer speculated that the nasalization in this word may be due to influence from the English interjection *huh-uh*, phonetically [ʔə̃ʔə̃] ~ [ʔɑ̃ʔɑ̃] ~ [ʔm̩ʔm̩] (Sawyer 1965:69).

2.2.7 Diphthongs

Wappo has many examples of words that display a phonetic diphthong, i.e. a sequence of a vowel and a glide within the same syllable. All such diphthongs are falling (the stressed vocalic nucleus comes first, followed by the glide element, rather than the reverse), and most are also closing (the glide element is closer/higher in articulatory height than the nucleic element); the two non-closing diphthongs are /iw/ and /uy/, which are height-harmonic (the articulatory height of the nucleus and glide elements is equal). Representative examples are given below.[40]

(65)	a.	*may*	'who?; someone'	(WSR 97, 112)
	b.	*caw*	'top, point'	(WSR 78)
	c.	*wey*	'obsidian'	(WSR 76, 86, 109)
	d.	*k'ew*	'man'	(WSR 63, 82, 112)
	e.	*k'óy-*	'to move'	(WSR 66, 95)
	f.	*c^how*	'earth, land, ground'	(WSR 8, 66, 78, 101)
	g.	*puy*	'net, fish net'	(WSR 3, 109)
	h.	*c^hiw*	'fly (insect)'	(WSR 67, 77, 80, 103, 114)

These are undoubtedly diphthongs phonetically, but there are several reasons to believe that Wappo does not possess true phonemic diphthongs, of the kind found in English for example. Firstly, there are no examples in which a diphthong occurs solely as the nucleus of a word, followed by a separate consonant as the coda; for all attested diphthongs, the offglide element (universally a labiovelar or palatal glide) forms the coda for the overall syllable.[41] With no contrast with a nucleic diphthong available, the syllabic structure of a word like *may* in (65) has to be CVC, rather than CVV.

[40] In addition to these, there are a few items in Sawyer (1965) transcribed with /iy/ and /iy'/ (no examples of the equivalent */uw/ or */uw'/ are attested in that work, but may be present in the audio corpus, depending on analysis). Since an examination of the audio corpus shows that sequences of a high vowel plus a homorganic glide are phonetically indistinguishable from an equivalent high vowel lengthened (i.e. /iy/ vs. /i:/), their status as diphthongs is doubtful, and thus they will not be discussed further here.

[41] There are two exceptional cases to this statement. The first is *huʔáyc^h* 'neck' (WSR 64, 96, 114), in which the sequence [ay] appears to be a true nucleic diphthong, because the overall tonic syllable is closed by /c^h/ – alternatively, this word would likewise be exceptional in having a complex coda, /yc^h/. The second is *maʔháys* 'ten' (WSR 62, 111), which has the same difficulty: a nucleic diphthong [ay] followed by a separate coda

Secondly, all attested Wappo diphthongs may also occur with the second element glottalized – i.e. closed by /y'/ or /w'/. Examples are given below.

(66)	a.	*nay'*	'pine nut sp.'	(Sawyer 1965:72)
	b.	*taw'*	'tradition, custom, way'	(Sawyer 1965:107)
	c.	*c'ey'*	'a few days ago, a while ago'	(Sawyer 1965:38)
	d.	*tehéw'*	'small animal, baby animal, pet'	(WSR 101)
	e.	*hòl c'óy'*	'scrub oak'	(WSR 90)
	f.	*č'ów'-*	'to remove, take off'	(WSR 93)
	g.	*nuy'*	'sand'	(WSR 66)
	h.	*piw'-*	'to crush'	(Sawyer 1965:86)

To these may also be added a handful of examples where the glide members of the marginal 'aspirated sonorant' series occur as the offglide:

(67)	a.	*láy^h-te*	'white people'	(WSR 75)
	b.	*na-héy^{h}le*	'steam from the breath'	(WSR 90)

Since /y'/ and /w'/ (as well as /y^h/ and /w^h/) are a separate phonemic series from /y/ and /w/, these examples suggest that, on the phonemic level, these diphthongs are simply collocations of a pure vowel /i e a o u/ with one of the two glottalized/aspirated glides /y', y^h/ and /w', w^h/.

consonant /s/, or a complex coda /ys/. However, one of the contemporary Wappo community members volunteered the form *maʔháyis* for 'ten', with a vowel between the glide and final /s/. This suggests that *maʔháys* is simply a reduced variant of *maʔháyis*, with no nucleic diphthong or complex coda, suggesting that the other exceptional form, *huʔáyc^h*, may likewise be a reduced form of an unattested **huʔáyic^h*.

This then implies that the non-glottalized/aspirated diphthongs are likewise simple collocations of a pure vowel plus a normal glide.

The phonetic surface form of these collocations is unquestionably a diphthong, but their deeper phonemic representation appears to be that of two adjacent phonemes – a vowel followed by a glide sonorant – rather than a single diphthongal phoneme series phonemically separate from both the vowel phoneme series and glide sonorant phoneme series.

2.3 Stress

Wappo has a simple system of stress assignment. In every lexical word, the stressed syllable is the sole or initial syllable of the morphological root. For monosyllabic words, the entire word is a root, and thus bears stress (see Chapter 5). For monomorphemic root words of more than one syllable, the first syllable of the root (i.e. the initial syllable of the word) universally bears stress. For polymorphemic words, again the sole or first syllable of the root universally bears stress. The addition of affixes does not alter stress assignment; whether a polymorphemic word is two syllables or six syllables, the sole or initial syllable of the morphological root is the syllable that bears primary stress, just as with monomorphemic words.

2.3.1 Primary Stress

Every morphological root bears stress. There are two types of morphological roots: monosyllabic and polysyllabic. Monosyllabic morphological roots bear primary stress on their sole root syllable. Polysyllabic morphological roots bear primary stress on their first root syllable; the other syllables of polysyllabic morphological roots are never stressed.

Table 2.3 gives examples of primary stress assignment in words with both monosyllabic and polysyllabic roots, both with and without affixes, and in words consisting of one to five syllables. In the column marked 'morph. structure', the morphological root is underlined.

Table 2.3

Primary Stress Assignment Across Word Types

word	gloss	morphological structure	stress assignment
hól	'tree'	hól	σ́
mét'e	'woman'	mét'e	σ́ σ
cámtiʔ	'do!'	cám-tiʔ	σ́ σ
t'áka·la	'bat (animal)'	t'ákala	σ́ σ σ
kút'i·ya	'small'	kút'-iya	σ́ σ σ
naʔk'áši?	'to bite'	naʔ-k'á-ši-ʔ	σ σ́ σ
hotéhelkʰiʔ	'melted (perf.)'	ho-téhel-kʰi-ʔ	σ σ́ σ σ
č'amehc'ím'iʔ	'to wring out'	č'a-meh-c'í-m'i-ʔ	σ σ σ́ σ
naʔsótiya·kʰiʔ	'to be soft (food)'	naʔ-sót-iya-kʰi-ʔ	σ σ́ σ σ σ
napišólʰi·yaʔ	'to whisper'	na-pi-šólʰ-iya-ʔ	σ σ σ́ σ σ

2.3.2 Secondary Stress

There are two types of words that bear a secondary stress, which requires a minimum word length of two syllables. The first type is words containing the negative morpheme *-làh*. This morpheme bears a secondary stress after the primary stress of the morphological root; this is manifested as a second pitch peak in the prosodic word, lower than that of the morphological root syllable, but higher than that of the syllables between the two peaks (for detailed discussion, see Chapter 5). Examples of words with the negative morpheme *làh* are given in (68); the maximum number of intervening syllables between the two stressed syllables in these forms that has been found in the audio corpus is two, as in (68f).

(68)	a.	*šáhlàh*	‘dull (lit. tooth-NEG)’	šáh-làh
	b.	*c’ítilàh*	‘lazy (lit. bone-NEG)’	c’íti-làh
	c.	*šáhlàhkʰiʔ*	‘to be dull’	šáh-làh-kʰi-ʔ
	d.	*hák’šelàhkʰiʔ*	‘not like, not want’	hák’-še-làh-kʰi-ʔ
	e.	*napéʔilàhkʰiʔ*	‘don’t repeat!’	na-péʔi-làh-kʰi-ʔ
	f.	*ʔohméstistalàhkʰiʔ*	‘failed to do’	ʔoh-més-tis-ta-làh-kʰi-ʔ

The second type of word that bears secondary stress is that containing the intentional future suffix *-yàwmiʔ*.[42] Like the morpheme *-làh*, the morpheme *-yàwmiʔ* carries a secondary stress that is the next-highest-pitched syllable in the prosodic word after that of the morphological root. Examples of words with the intentional future suffix *yàwmiʔ* are given in (69).

(69)	a.	*čó:yàwmiʔ*	‘going to go’	čó:-yàwmiʔ
	b.	*ʔúk’iyàwmiʔ*	‘going to drink’	ʔúk’i-yàwmiʔ
	c.	*nahúʔelyàwmiʔ*	‘going to teach’	na-húʔel-yàwmiʔ
	d.	*ʔísal’isyàwmiʔ*	‘going to fry’	ʔísal’is-yàwmiʔ

[42] Sawyer (1965) transcribes this morpheme as *yá:miʔ*; however, in the audio corpus, there is consistently a noticeable labial glide between the /a/ and the /m/. In some tokens it is slight, and could be transcribed as [yaʷmiʔ], but in others it is fully present and even lengthened, i.e. [yáw·miʔ], according to the lengthening rule for internal-coda glides (see Chapter 4). It is possible that the morpheme had an older form *-yámiʔ, and that the /w/ glide is an excrescent sound under the influence of the following labial /m/.

2.4 Summary

The Wappo phoneme inventory consists of a relatively large number of stops and affricates. The stops consist of labial /p/, dental /t/, alveolar /ṭ/, and velar /k/, while the affricates consist of alveolar /c/ and palato-alveolar /č/. Each stop and affricate appears in three parallel series of plain, glottalized, and aspirated forms. Wappo has two glottal segments /ʔ/ and /h/, and two voiceless fricatives, alveolar /s/ and palato-alveolar /š/. It also has a series of five sonorants, consisting of two nasals /m/ and /n/, a lateral /l/, and two glides /w/ and /y/. These sonorants occur in two parallel series, plain and glottalized, with a marginal third series, aspirated, also attested. Wappo has also adopted a small number of consonants from Spanish, which appear exclusively in Spanish loans – these are /b/, /d̪/, /ɡ/ /f/, /ð/, /r/, /r'/. Wappo also has five vowel phonemes, /i/, /e/, /a/, /o/, /u/ which are short in their unmarked form, but which may appear long in a few exceptional words, or by metrical phonetic processes. There are no true phonemic diphthongs, but sequences of a vowel and a glide phoneme produce phonetic diphthongs. Stress is universally assigned to the sole or initial syllable of the morphological root of the word; if the suffixes *-làh* (NEG) or *-yàwmiʔ* (FUT.intentional) are present, they bring a secondary stress into the prosodic word characterized by a pitch that is lower than that of the morphological root, but higher than that of intervening syllables.

CHAPTER 3: PHONOTACTICS AND PHONEME FREQUENCY

3.0 Introduction

In the first section of this chapter, we will examine phonotactic constraints in the Wappo lexicon. The phonotactic constraints present in Wappo can be divided into three basic types:

1. Syllable structure constraints
2. Positional constraints on individual phonemes
3. Co-occurrence tendencies between phonemes

3.1 Syllable Structure Constraints

Wappo exhibits a 'moderately complex' syllable structure according to the definitions delineated in the World Atlas of Language Structures (Maddieson 2013). The canonical syllable structure of Wappo is CV(C); that is, all syllables of the language consist of either a simple open CV syllable or a simple closed CVC syllable. The first major constraint on syllable structure in Wappo is that no syllable in the language admits any type of consonant cluster, i.e. Wappo does not allow more than one consonant to occupy any syllable onset or coda. This constraint is stated below:

Constraint 1: Onsets and codas are always simple; no more than a single consonant phoneme is admitted in the onset or coda of any syllable

Wappo affixes are equally likely to have CV or CVC shapes; neither syllable type predominates among the prefixes and suffixes of the language, nor among the language's clitics. However, among the language's lexical roots, including independent monomorphemic words, there is a very marked preference for CVC syllables over CV syllables. The vast majority of bound roots in Wappo are at least CVC,[43] with fewer than 40 out of the nearly 1,000 roots attested in the written and audio corpus consisting of only a CV syllable, a rate of about 4%. The occurrence of CV structure in independent monomorphemic words is even more highly restricted, with just a single example of a CV monomorphemic word: *k'á* 'person'.[44] This pattern appears to represent a type of minimality effect (Gordon 2016:262-9), in which the language requires that a certain lexical class consist of a minimum level of syllabic structural complexity (often corresponding to syllable weight) along a typological hierarchy, with the lower bound moving 'up' through increasing levels of syllable complexity or weight the more 'restrictive' a language is with regards to minimality. In the case of Wappo, CVC appears to be the preferred minimal structure for both bound lexical roots and independent monomorphemic words; CV structure is below the cutoff for the language's preferred minimum syllable structure, hence the relative rarity of that structure in both bound roots and independent words. In the typological hierarchy constructed for minimality effects in Gordon (2016), a cutoff between CV and CVC is in fact one of the most common cutoff points (Gordon 2016:264).

While codas are optional in Wappo syllables, onsets are not. This leads to a formulation of a second constraint:

[43] either with or without additional material, e.g. CVC, CVCV, CVCVC, or CVCCV

[44] And even this word has an allomorphic form *k'áni*, with CVCV structure (Sawyer 1965:77; WSR 103, 106).

Constraint 2: All syllables must have an onset

This means that while the structures CV and CVC are licensed, the structures *V and *VC are not.

There are two apparent exceptions to this constraint; however, both are only present at the surface phonetic level, not at the phonological level. The first is the set of words of the shape CV́C_g.σ, a closed non-final stressed syllable where the coda consonant C_g is one of the plain glide approximants /w/, /y/. There is a phonological process in Wappo wherein, if the coda consonant of a stressed non-final syllable has a [+continuant] feature, that consonant undergoes phonetic lengthening, and if this consonant is /w/ or /y/, the lengthening process converts the segment to an equivalent long vowel: /w/ → [u·] and /y/ → [i·]. This then results in an apparent vowel-vowel sequence, where the first vowel is the actual syllabic nucleus, and the second vowel is the converted glide phoneme. An example is given in (1) below.

(1) /héw.seʔ/
[héu·.seʔ] ‘grow (of humans) (IPFV)’ (WSR 3, 92)

Nevertheless, this is not an exception to Constraint 2, as the lengthened vowel segment is underlyingly a consonant. Compare the form in (1), where the root element /w/ is a coda, to the related form in (2), where the root element /w/ is an onset:

(2) /hé.wah.k^hiʔ/ ‘grown (of humans) (PRF)’ (WSR 3, 5, 92)
[hé.wah.k^hiʔ]

See Chapter 4 for more discussion of this phonological process.

The second apparent exception to the obligatory-onset constraint involves a handful of attested words with a unique structure. These are given in (3).

(3)	a.	*ʔúču·aʔ*	'night'	(WSR 66)
	b.	*súmu·aʔ*	'twilight, evening'	(WSR 99)
	c.	*ṭʰúṭu·is*	bird sp.	(WSR 92)
	d.	*c'ítu·is*	fish sp.	(WSR 2)
	e.	*ʔépu·is*	'sister-in-law: brother's wife'	(WSR 63)

These words are examples of another widespread phonological rule, namely that, in words of the shape (σ).CV́.C<u>V</u>.σ, that is, words of at least three syllables with antepenultimate stress where the tonic and post-tonic syllables are both open, the vowel of the post-tonic syllable undergoes phonetic lengthening (this vowel is underlined above). Thus, at first glance, the underlying forms for these words would appear to be as in (4):

(4)	a.	/ʔú.ču.aʔ/
	b.	/sú.mu.aʔ/
	c.	/ṭʰú.ṭu.is/
	d.	/c'í.tu.is/
	e.	/ʔé.pu.is/

Since these would represent the only exceptions in the language to Constraint 2 (i.e. they would be words that contain an onsetless syllable, here the final syllable), and since the medial vowel which undergoes lengthening in all of these words is /u/, it perhaps makes sense to posit an alternative underlying form with a glide phoneme /w/ as the onset of the third syllable. At the surface phonetic level, this underlying /w/ is subsumed into the preceding lengthened /u/. Their actual underlying forms, and resulting surface forms, would then be as in (5):

(5)	a.	/ʔú.ču.waʔ/	→	/ʔú.ču·.waʔ/	→	[ʔú.ču·.aʔ]
	b.	/sú.mu.waʔ/	→	/sú.mu·.waʔ/	→	[sú.mu·.aʔ]
	c.	/ṭʰú.ṭu.wis/	→	/ṭʰú.ṭu·.wis/	→	[ṭʰú.ṭu·.is]
	d.	/c’í.tu.wis/	→	/c’í.tu·.wis/	→	[c’í.tu·.is]
	e.	/ʔé.pu.wis/	→	/ʔé.pu·.wis/	→	[ʔé.pu·.is]

Though there is no independent synchronic evidence for this analysis (such as an alternation between zero and /w/ in other paradigmatic forms of these words), one possible piece of diachronic supporting evidence is that the word in (3-5e), *ʔépu·wis* ‘brother’s wife’, may represent an old compound of *ʔépa* ‘older brother’ and *mísi* ‘wife’; if this is the case, an original form like **ʔépamis(i)* could have seen a leniting of the medial /m/ to /w/ over time,[45] with accompanying assimilation of the preceding vowel /a/ to /u/. However, this is only speculation.

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[45] Cf. the historical lenition of /m/ to /w/ in certain contexts in Irish, which is now a part of the language’s synchronic morphophonology, i.e. the lenited form of ||m|| <m> is ||w|| <mh>.

3.2 Positional Constraints

There are only three absolute restrictions on the positional occurrence of individual phonemes or phoneme classes in Wappo. These are stated in Constraints 3, 4, and 5 below.

Constraint 3: Glottalized sonorants (R') and aspirated sonorants (R^h) may not occur word-initially, or after a consonant

Glottalized and aspirated sonorants may occur only in three phonotactic positions:

1. Word-final position:

(6)	*tóm'*	'fawn'	*láy*^{h}	'great; foreign'
	(WSR 61, 85)		(WSR 77)	

2. Intervocalically after a stressed vowel (as stressed syllables are always roots, the glottalized/aspirated sonorants may also not occur root-initially, even if a vowel-final prefix precedes):

(7)	*k'áy'el*	'white'	*k*^{h}*én*^{h}*iʔ*	'to peel (with a knife)'
	(WSR 65, 69)		(WSR 99)	

3. Coda position before another consonant:

(8) *naʔc'óḻ'siʔ* 'to gnaw' *làyʰmée* 'ocean'[46]

(WSR 82) (WSR 77)

But they are prohibited from occurring in word-initial (or root-initial) position:

(9) *#R'/h

And they are also prohibited from occurring in word-internal onset position after a consonant:

(10) *CR'/hV

The fact that the glottalized and aspirated sonorants cannot occur in onset position except intervocalically implies, conversely, that they must always be preceded by a vowel.

The next constraint describes a phenomenon that occurs as a phonetic feature not only in Wappo but in several other of those languages of California and Oregon that have a phonemically aspirated stop/affricate series.

Constraint 4: Plain stops (P) are neutralized to a phonetically aspirated form [Pʰ] in word-final position.[47]

[46] morphologically *láyʰ+méy*, 'great'+'water'.

[47] Neutralization of plain and aspirated stops/affricates in word-final or syllable-final positions occurs, e.g., in the Palaihnihan languages Achumawi and Atsugewi (Nevin 1998:111-3, 123; Good et al. 2003:3; Good 2004:8), in Yana (Jacobsen 1976:217-9), in Klamath-Modoc (Blevins 1993:246-7), in Molala (Berman 1996:3), and

Root-final phonemically-aspirated stops are aspirated whether in word-final or word-internal positions:

(11) a. *p'íp*^{h} 'white oak/valley oak acorn' (WSR 3, 96)

b. *p'íp*^{h}*o* 'white oak/valley oak tree' (WSR 3, 69, 76, 86, 96)

(12) a. *míc*^{h} 'road' (WSR 81, 96, 99)

b. *míc*^{h}*u* 'on the road' (road=LOC) (WSR 96)

But root-final phonemically-plain stops are only plain word-internally; they become phonetically aspirated when in word-final position:

(13) a. *mákšiʔ* 'to rain' (WSR 66)

b. *mákiš* 'rain (n.)' (WSR 8)[48]

c. *mák*^{h} 'rain (n.)' (Sawyer 1965:84)

d. *téktek*^{h} 'hawk sp.' (reduplicated /tek-tek/) (WSR 72, 80, 92)

Because of this tendency, it is not possible to securely identify which roots end in phonemically plain stops or phonemically aspirated stops unless they can be found with suffixes or other material added to them to disambiguate the root-final phoneme.

possibly in Northern Kalapuya [Tualatin-Yamhill] (Berman 1990:39). Crucially, this feature also occurs in Eastern Pomo, spoken directly north of the Wappo area, and whose speakers were in contact with northern speakers of Wappo (Golla 2011:105-6).

[48] The speaker in this file is Mrs. Clara Leger.

Constraint 5: Plain affricates may not occur in any coda position, whether word-internally or word-finally

Unlike plain stops, which can occur in word-internal codas, plain affricates cannot occur in any coda position, whether word-internal or word-final. Even aspirated affricates are quite rare in word-internal coda position; the only documented examples are given below, two of which are the result of affixation to an aspirated-affricate-final root. Only one, *ʔéč^{h}t'i* 'brother-in-law', appears to be monomorphemic.

(14)	a. *c^{h}ác^h*	'cold'	(WSR 81)
	b. *c^{h}ác^h-k^{h}iʔ*	'to be cold' (*-k^{h}iʔ* 'stative')	(WSR 66, 77)
(15)	*č'óč^h-miʔ*	'to rip' (*-miʔ* 'durative'[49])	(WSR 99)
(16)	*ʔéč^{h}t'i*	'brother-in-law: sister's husband'	(WSR 63)

By contrast, glottalized affricates appear to be unrestricted with regard to coda position.

3.3 Co-Occurrence Constraints

This set of constraints has to do with restriction on the co-occurrence of various similar types of consonants within the same root.

[49] 'Durative' (hereafter DUR) is Thompson et al. (2006)'s term for the habitual/progressive verbal aspect in Wappo (Thompson et al. 2006:32). This is the language's general present tense form for non-stative verbs.

Constraint 6: The front and back coronal stops may never co-occur in the same root

Root shapes of the type *tVṭ or *ṭVt simply do not occur in Wappo, regardless of phonation type (plain, glottalized, aspirated) and regardless of which series is in onset or coda position. There are no attested exceptions to this constraint. It would be a fruitful avenue of investigation in phonological typology to explore whether this constraint holds for the other languages of the California region that have a coronal stop place contrast, and to compare these findings with those of the other two world regions where a coronal stop place contrast is common, the Indian Subcontinent and Australia.

Constraint 7: The front and back coronal affricates may never co-occur in the same root

In exactly the same manner as the coronal stops in Constraint 6, the front and back coronal affricates cannot co-occur in the same root. Root shapes of the type *cVč or *čVc do not occur in Wappo regardless of phonation type, and regardless of which series is in onset or coda position. There are no attested exceptions to this constraint. As with the constraint on the coronal stops, it would be fruitful to investigate whether the constraint on co-occurrence of different coronal affricates within the same root holds for the other languages of the California region, or indeed any language, with the relevant phonemic distinction.

Constraint 8: The front and back coronal fricatives may never co-occur in the same root

As with the prior constraints, the two coronal fricatives may not occur together; root shapes of the type *sVš and *šVs do not occur in Wappo, no matter which phoneme is in onset or coda position. There are no attested exceptions to this constraint. Again, it would be fruitful to investigate whether this constraint holds for the other languages of California with the relevant phonemic distinction, or with any such language worldwide.

Since Constraints 6, 7, and 8 describe the same phenomenon, differing merely in manner of articulation, they could be combined into a single constraint, stated as Constraint 9:

Constraint 9: The front and back coronal phonemes of the same manner of articulation may never co-occur in the same root

3.4 Phonotactic Tendencies

The next set of phonotactic restrictions have a good number of exceptions each; these are far less rigid than those described in sections 3.2 and 3.3. Thus, I will be referring to these restrictions as ‘tendencies’ rather than ‘constraints’.

Tendency 1: Roots should not contain more than one aspirated segment

The first tendency appears to be one that discourages morphological roots from containing more than one aspirated segment.[50] There are eight attested roots that go against this tendency, two of which, given in (17) and (18), represent the sole examples of roots with two identical aspirated segments, i.e. aspirated segments of the same place and manner.

(17)	*cʰácʰ*	‘cold’	(WSR 77, 81)
(18)	*čʰíčʰo*	‘Douglas fir, spruce’	(WSR 69, 72)
(19)	*pʰótʰ-*	‘rotten and crumbly (tree)’	(WSR 93)
(20)	*kʰótʰ-*	‘black oak’	(WSR 3, 76, 100)
(21)	*kʰátʰ-*	‘to cover (?)’[51]	(WSR 90, 114)
(22)	*kʰénʰ-*	‘to peel with a knife’	(WSR 99)
(23)	*ṭʰólʰ-*	‘bitter, salty’	(WSR 72)

[50] Note the similarity in motivation to Grassmann’s Law, the process in Sanskrit and Greek which eliminated the first of two consecutive aspirated segments within a root.

[51] Attested in *(may’)šukʰátʰe·ma* ‘breechcloth’, morphologically (may’=)šu-kʰátʰ-ema, REFL=bottom.LEX-‘cover’-PURP, and *may’mekʰátʰe·ma* ‘suspenders’, morphologically may’=me-kʰátʰ-ema, REFL=hand?-‘cover’-PURP (WSR 90, 114).

(24) *k*^{h}*íl*^{h}- ‘to get loose’ (WSR 99)

(25) *k*^{h}*éy*^{h}- ‘to slide’ (Sawyer 1965:12, 23, 93)

Interestingly, four of these eight contain the rare aspirated sonorant in their codas. The roots *c*^{h}*ác*^{h} ‘cold’ and *č*^{h}*íč*^{h}*o* ‘Douglas fir, spruce’ are the only attested roots with two identical aspirated segments. It is possible that *c*^{h}*ác*^{h} is onomatopoeic in origin, and *č*^{h}*íč*^{h}*o* is a flora term, which cross-linguistically often derive from substrate languages. Alternatively, both roots may have originally been reduplicated forms, i.e. *c*^{h}*a>c*^{h}*a, č*^{h}*i>č*^{h}*i(-o)*.

Tendency 2: Roots should not contain two identical glottalized segments

Of equal strength to Tendency 1 is a dispreference for a morphological root to contain two of the same glottalized segment, i.e. glottalized segments of the same place and manner of articulation. As the glottalized sonorants may not occupy the initial position of a root, this tendency only applies to glottalized stops and affricates. There are eight attested exceptions.

(26) *c’íc’a* ‘bird; white meat’ (WSR 80)

(27) *č’áč’*- ‘to peck, as a chicken’ (WSR 92)

(28) *č’óč’*- ‘sugar pine’ (WSR 69, 90)

(29)	*ṭ’éṭ’*-	‘flatulence’	(Sawyer 1965:14, 113)
(30)	*ṭ’óṭ’*-	‘to fit; to be even’	(WSR 101, 114)
(31)	*ṭ’úṭ’*-	‘woven willow sticks used to drive fish toward a dam-trap’	(Sawyer 1965:39)
(32)	*k’ék’*	‘crane; egret’	(WSR 67, 86, 92, 114)
(33)	*k’ók’*-	fish sp.	(WSR 67)

It is perhaps significant that the back-apical segments /ṭ/ and /č/ predominate among this set. Three of the items, namely ‘bird’, ‘to peck’, and ‘flatulence’, may be onomatopoeic in origin. Three others, ‘sugar pine’, ‘crane/egret’, and ‘fish sp.’, are flora and fauna terms.

Tendency 3: A root should not contain identical segments with opposite marked phonation type

A morphological root should not contain segments of the same place and manner of articulation but with a mixture of the two marked phonation types, namely glottalized and aspirated. That is, roots of the shape *p’Vp^h or *p^{h}Vp’, *c’Vc^h or *c^{h}Vc’, are discouraged. This tendency only applies to the marked phonation types, so identical segments with the unmarked phonation type, ‘plain’ (voiceless unaspirated), may occur without restriction, either in combination with the two marked phonation types, e.g. pVp’, p^{h}Vp, or with each other, e.g. pVp. Likewise, this tendency only applies to segments of the same place and manner of articulation; if the segments have different place/manner features, then they are allowed to occur with a mixture of the marked phonation types (or any other combination), e.g. t’Vp^h, k^{h}Vč’, ṭ’Vp, cVk’, etc.

Though somewhat complex, this tendency is stricter than the previous two: there are only five attested roots that deviate from it:

1. Identical place/manner, glottalization followed by aspiration:

(34) *p’íp*^{h} ‘white oak, valley oak’ (WSR 3, 96)

(35) *ṭ’éṭ*^{h} ‘wild rose’ (WSR 3, 91)

(36) *č’óč*^{h}- ‘to rip, to rip up, to tear out’ (WSR 99)

2. Identical place/manner, aspiration followed by glottalization:

(37) *c*^{h}*úc’*- ‘to sneeze’ (WSR 77)

(38) *č*^{h}*éč’*- ‘tan oak, maul oak’ (WSR 3, 96)

It is possible that the final aspirate in *ṭ'éṭʰ* 'wild rose' is phonetic rather than phonemic; no examples of this word with suffixes have been found, which would determine the status of the aspiration on the final phoneme. If it is not phonemic, the number of marked-phonation mixed roots would be reduced from five to four.

Note also that three of these five exceptions – 'white oak', 'wild rose', 'tan oak' – are flora terms, which may derive from a substrate language, and the other two – 'rip, tear' and 'sneeze' – may be onomatopoeic in origin. These two factors could explain their exceptional phonological shape in Wappo.

The final tendency I will describe relates to the relative infrequency of two particular vowels in word-final position. Among those words ending in vowels, it is uncommon for the vowel to be either of the two back rounded vowels /o/ or /u/.

Tendency 4: Vowel-final words should not end in /o/ or /u/

Sawyer (1991) had already noted the fact that relatively few Wappo words end in the vowels /o/ or /u/, and he listed and discussed those forms that do (Sawyer 1991:29-37). Among the words that end in /o/, nearly all are names of trees or other plants. Sawyer speculated that the final /o/ segment in these words was a grammaticized form of *hól* 'tree' (Sawyer 1991:32). Ignoring the words that end in /o/ in the Wappo corpus that refer to trees or other plants, we are left with only the handful of final-/o/ items given below.

(39)	*cími·ṭo*	'hummingbird'	(WSR 88, 92)
(40)	*wíci·lo*	'meadowlark'	(WSR 92)
(41)	*sólko*	'mouse'	(WSR 67, 85, 113)
(42)	*sóṭ'o·ko*	'elk'	(WSR 9, 113)
(43)	*šáwo*	'bread'	(WSR 47, 79, 80)
(44)	*šóyo*	'basket (Napa dialect)'	(WSR 77)
(45)	*kóto*[52]	'but'	(Thompson et al. 2006:107)
(46)	*téymo*[53]	'over, above'	(WSR 95)

(47) a. *hék(')o·to* 'they, them' (WSR 112)
(3PL unmarked pronoun, proximal)

b. *cék(')o·to* 'they, them' (WSR 93, 97, 98, 112)
(3PL unmarked pronoun, distal/neutral)

[52] This form appears a single time in Thompson et al. (2006:107). Elsewhere in the same work, it appears as *kota* (2006:29), *k'ota* (2006:111, 112), and *kot'a* (2006:161). An analysis of the Wappo audio corpus shows that *k'ota* is most likely the correct transcription (WSR 75, 81), barring inter-speaker, dialectal, or speech-context variation.

[53] This form appears once in the Wappo audio corpus with a clear final /o/ (WSR 95), but in other tokens in the corpus (WSR 72), the final vowel is very reduced and ambiguous between /o/ and /u/. The word appears as *téymu* in Sawyer (1965:1, 18, 54, 74, 88, 107), while in Thompson et al. (2006), the same word appears as both *teymu* (2006:42) and *temu* (2006:16).

(48) *ʔók'o·to* 'children' (SG *ʔék'a*) (WSR 92, 97, 100)

Note that the noun *ʔók'o·to* 'children', and probably the pronouns *hék(')o·to*, *cék(')o·to* 'they, them', end in a plural morpheme -*to*, which is a vowel-harmonic variation of the general nominal plural -*te*.

Words ending in /u/ are somewhat more common than those ending in /o/, but are still far less numerous than those ending in /i/, /e/, and /a/. The following is a fairly complete list:

(49) *k'éšu* 'deer; meat' (WSR 5, 64, 67, 85, 113)

(50) *háyu* 'dog'[54] (WSR 67, 77, 97, 113)

(51) *hútu* 'snail' (WSR 103)

(52) *hu(h)túku·lu* 'owl; moth'[55] (WSR 67, 86, 91, 107, 114)

(53) *ʔokéyu* 'dragonfly; male partner' (WSR 91)

(54) *ʔéču* 'creek, stream' (WSR 66, 77, 88, 90, 95, 110)

[54] This word is shared with some of the Pomoan languages (e.g. Southern Pomo *hay·u*), and may be a Pomoan loan in Wappo (cf. WSR 113). It may ultimately be Miwokan in origin, whence it passed to Pomoan and Wappo; Callaghan proposed Proto-Miwokan *háju (Callaghan 1970:16) and gives Bodega (Coast) Miwok *hajúuṣa* (Callaghan 1970:16).
[55] This word appears to be an example of a very widespread *Wanderwort* for 'owl' distributed across western North America; see Gursky (1967).

(55)	*c'úl'u*	'rapids, swift rapids, riffle'	(WSR 61, 70, 77, 101)
(56)	*čúlu(h)*	'ridge'	(WSR 78)
(57)	*ʔík'u*	'vomit (n.)'	(WSR 85, 100)
(58)	*čʰéy'u*	'feces'	(WSR 91, 97)
(59)	*=tʰu*	dative case enclitic	(Thompson et al. 2006:12)
(60)	*=u, =mu*	locative case enclitic	(Sawyer 1965:126-7; Thompson et al. 2006:16-7)
(61)	*=lakʰu*	*focus marker* (?)[56]	(Thompson et al. 2006:37, 147)
(62)	*=kʰu*	*discourse marker*[57]	(WSR 18, 93)

Note that five of these items are faunal terms, three are landscape terms, and two more are body-related terms. The remainder are grammatical morphemes.

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[56] Thompson et al. (2006) refers to this item as a "morpheme for clarification after a misunderstanding" (2006:xvii), and gives a few examples of its use (2006:37, 147). Syntactically, it appears to be a phrase-level enclitic.

[57] This form does not appear in either Sawyer (1965) or Thompson et al. (2006). It appears in at least two phrases in the Wappo audio corpus: *cé=kʰu ʔah č'uṭéhtaʔ* 'I forgot about that' (lit. that=*kʰu* I forgot) (WSR 93) and *hín=kʰu ʔah tókʰiʔ* 'I think I was asleep' (lit. sleep=*kʰu* I went-to) (WSR 18.1). It appears to be a type of discourse marker with a hedging or perspectival function, and cliticizes to the first element of the phrase in each case (and may in fact be involved in fronting that element syntactically). It is possible that the clitics in examples (61) and (62) are related.

Tendency 5: The onset and nucleus of a root should not have the same height/backness features

This tendency effectively excludes roots of the shape *wúC and *yíC, where the initial glide consonant and the following nucleus vowel are essentially the same articulatory gesture. A root *wúC would involve an initial glide phoneme with the features [+high, +back] and a nucleic vowel with the same features, [+high, +back]. A root *yíC would involve an initial glide phoneme with the features [+high, -back] and a nucleic vowel with the same features, [+high, -back]. The articulatory gesture for the initial glide and the nucleic vowel in either example would thus be essentially identical. The motivation for the constraint likely derives from the acoustic similarity between the two phonemes of these sequences, and thus appears to be avoided because of its potential adverse effect on listener comprehension.

There are only three attested Wappo roots that go against this tendency:

(63)	*wúl'*-		'rocking, to rock back and forth'	(Sawyer 1965:86)
(64)	a.	*yíw*-$_1$	'racing, footrace'	(WSR 72, 100)
	b.	*yíw*-$_2$	'fighting, struggling'[58]	(WSR 72, 73)
(65)	*yíʔ*-		'to cut meat into strips'	(WSR 109)

[58] The two *yíw*- roots may ultimately be the same root.

3.5 The Phonemic Status of Initial Glottal Stop /ʔ/

In Section 3.1, it was stated that all Wappo syllables must have an onset, formulated as Constraint 2; the structures CV and CVC are allowed, but not the structures *V or *VC. However, we can only be confident in this constraint if we understand the distribution and phonemic status of the laryngeal consonant /ʔ/, or glottal stop.

The reason for singling out this consonant is that there are a large number of languages attested worldwide in which otherwise onsetless syllables are 'repaired' with an epenthetic consonant, and that consonant is frequently a glottal stop.[59] Wappo has a very large number of roots, as well as several prefixes and proclitics, that begin with a glottal stop, and so it seems necessary to determine whether the initial glottal stop in Wappo is an epenthetic consonant whose function is to avoid onsetless initial syllables, or whether it is a fully phonemic consonant in its own right.

In his 2017 study of initial glottal stop in Amarasi, an Austronesian language of Timor, Owen Edwards laid out three logical possibilities regarding the phonemic status of the segment:

1. All initial glottal stops before vowels are distinctive (i.e. phonemic)
2. All initial glottal stops before vowels are automatic (i.e. epenthetic)
3. There is a difference between distinctive and automatic glottal stops word-initially before vowels, and the difference emerges in certain environments

(Edwards 2017:417)

[59] Word-initial epenthetic glottal stop has been attested for such major languages as Tagalog, Hausa, and German (with varying conditioning environments), and indeed for English – a glottal stop may be optionally inserted before vowel-initial words in the pragmatic context of emphasis, e.g. 'my [ʔ]*other* friend'.

A phonemic glottal stop should remain present in a particular morpheme no matter what morphophonological context the morpheme occurs in; conversely, an epenthetic glottal stop will only appear in contexts in which epenthesis is phonologically necessary. Thus, a diagnostic test for determining the phonological status of an initial glottal stop is to look for evidence of the presence of a glottal stop varying in different morphophonological contexts.

My conclusion, based on the evidence found in both the written and audio corpus of Wappo, is that Edwards' third logical possibility applies: that the initial glottal stop in Wappo, as indeed Edwards found for Amarasi, can be either phonemically distinct or epenthetic, depending on different underlying forms.

Firstly, there are no examples of any morpheme in Wappo that is vowel-initial when word-internal, but receives a glottal stop onset when word-initial; that is, there is no variation between VC and #ʔVC in any morpheme of the language. This can be observed throughout the Wappo audio corpus: morphemes with an initial glottal stop always retain that glottal stop, whether in isolation, following a word with a final vowel, following a word with a final consonant, or with an attached prefix or proclitic, whether vowel-final or consonant final. Representative examples are given below.

(66)	isolation	*ʔ̲áwe*	'kidney; potato' (WSR 64, 79, 114)
(67)	word-initial, after a V-final word	*ʔóma ʔ̲ón'iʔ*	'digging deep or in a trench' (WSR 99)

(68)	word-initial, after a C-final word	*wítʰahan ʔ̲èču*	'Westside Creek (placename)' (WSR 99)
(69)	root-initial, after a V-final prefix	*ʔiʔ̲éše·pi*	'my daughter-in-law' (WSR 63)
(70)	root-initial, after a C-final prefix	*masʔ̲ólalewin'*	'fourteen' (WSR 62)

The phonemic glottal stop /ʔ/, then, has a distribution just like any other consonant phoneme, such as /p/ or /n/. In the areal context of Wappo, similar observations regarding the phonemic status of the glottal stop /ʔ/ were made by Alex Walker for Southern Pomo, the language spoken immediately to the west of the Wappo speech area (Walker 2013:76-82).[60]

On the other hand, there is a particular context in which a glottal stop is clearly being epenthesized, making this manifestation of the glottal stop an allophonic segment, rather than a phonemic one. I will distinguish this glottal stop by setting it in curly brackets, {ʔ},[61] to distinguish it from the phonemic glottal stop /ʔ/.

The epenthetic glottal stop occurs in relation to verbal roots of the shape CV; as mentioned in Section 3.1, roots of this shape represent only about 4% of all verbal roots in the language, suggesting they fall below a syllable-structure minimality threshold in the language (see Gordon 2016:262-9).

[60] The primary Wappo speaker in the audio corpus, Mrs. Laura Fish Somersal, also spoke Southern Pomo, her father's language (Sawyer 1965:vii).
[61] From here forward, I will indicate epenthetic consonants in curly brackets, {X}.

When a consonant-initial suffix is attached to a CV root, the two combine without modification:

(71)	a.	*kú-*	'to bend'	
	b.	*kú-m'iʔ*	'bend' (DUR)	(WSR 96)
	c.	*kú-taʔ*	'bend' (PST)	(WSR 96)

But when a vowel-initial suffix is attached to such a root, a glottal stop is epenthesized between the two morphemes, preventing hiatus of the vowels and ensuring that the vowel-initial suffix does not surface in an onsetless syllable:

(72)	a.	*kú-*	'to bend'	
	b.	*kú-{ʔ}-eʔ*	'bend' (IMP)	(WSR 96)

The epenthetic glottal stop here is indeed epenthetic; it is not a part of the root, as example (71) shows, and it is also not a part of the suffix, as vowel-initial suffixes do not have a glottal onset when attaching to consonant-final roots:

(73)	a.	*wíl-*	'to tell'	
	b.	*wíl-šiʔ*	'tell' (DUR)	(WSR 75, 106)
	c.	*wíl-taʔ*	'tell' (PST)	(WSR 90, 93)
	d.	*wíl-eʔ*	'tell' (IMP)	(WSR 75, 106)

Thus, the glottal stop has a dual status in Wappo. For most morphemes in which it occurs initially, it is an inherent phonemic consonant, one that does not vary across morphophonological contexts. But it may also occur as an epenthetic segment in the context in which there is risk of vowel hiatus, between a vowel-final root and a vowel-initial suffix. In this context, the glottal stop is epenthesized in order to prevent hiatus and to supply an onset to the first syllable of the underlyingly vowel-initial suffix. This latter function incidentally provides additional support for positing CV(C) as the canonical syllable structure in Wappo, as there are truly no surface syllables in the language without an onset, epenthetic repair being deployed in those situations in which there is otherwise risk of such.

Further discussion of the morphophonological distribution of the epenthetic glottal stop can be found in Chapter 6.

3.6. Distribution of Glottalized and Aspirated Sonorants

Wappo is typologically unusual for employing series of glottalized sonorants and aspirated sonorants in parallel to its series of plain sonorants.[62] Here, we examine the phonotactic patterns and distribution of these unusual sounds in the Wappo lexicon.

3.6.1 Glottalized Sonorants

Wappo has a series of phonemic glottalized sonorants, that is, sonorant phonemes that are accompanied by glottalization. Wappo employs five glottalized sonorant phonemes, namely /m’ n’ l’ w’ y’/. In the typology of glottalized segments, the glottalized sonorants of Wappo are *post-glottalized*; that is, the glottalization occurs after the articulation of the

[62] Although glottalized sonorants are rare on a global scale, they are relatively common in the California linguistic area and other parts of western North America. See Chapter 7 for detailed discussion.

sonorant, e.g. /m'/ is phonetically [mʔ], a plain bilabial nasal followed by a glottal closure. Almost all of the instances of these phonemes occur as the final consonants of lexical roots; as noted in Constraint 3 in Section 3.2, they are absolutely prohibited from occurring in word-initial, root-initial, or post-consonantal position. However, there are a small number of affixes and one clitic that contain a glottalized sonorant as well.

There is only one attested pre-root element in Wappo that contains a glottalized sonorant, namely the reflexive proclitic *may'=*. This item occurs preposed to a variety of verbs and verbal derivatives to indicate reflexivity.

(74) *may'=* reflexive proclitic, 'self'

Additionally, there are three attested suffixes that contain a glottalized sonorant:

(75) *-m'iʔ* verbal suffix, DUR

(76) *-el'₁* verbal suffix, IMP

(77) *-el'₂* a type of derivational suffix, with indeterminate semantics

The first of these suffixes, *-m'iʔ*, is one of a large number of what Thompson et al. have termed "durative" suffixes (Thompson et al. 2006:32), typically encompassing present tense and either an imperfect, habitual, or progressive aspect, depending on discourse context. Like all tense/aspect/mood marking in Wappo, this suffix always occurs as the final suffix in the verbs in which it occurs (though it may be followed by the polar interrogative enclitic *=hVʔ*). Because glottalized sonorants may not occur in onset position after a consonant, the suffix *-m'iʔ* may only attach to CV́- and CV́CV- roots, that is, to those roots whose final segment is a vowel.

The second suffix, *-el'*, occurs as the imperative form of a small number of verbs. Table 3.1 gives a selection from both the Wappo audio corpus and Sawyer (1965).

Table 3.1

Imperative Forms in -el'

Wappo	gloss	root	source
č'a-me·-ṭéh-el'	'untie! turn loose!'	ṭéh-	(WSR 116)
šík'a ʔo-k'óy-l-el'	'get up close!'	k'óy-l-	(WSR 66)
hin-cáṭ-el'	'wake up!'	cáṭ-	(WSR 18; Sawyer 1965:93, 112, 117)
mo-čít-el'	'turn away from me!'	čít-	(Thompson et al. 2006:72)
to-čít-el'	'turn towards me!'	čít-	(Thompson et al. 2006:72)
č'o-čít-el'	'turn around!'	čít-	(Sawyer 1965:108)
šúʔwela ho-čòh-el'	'walk backward!'	čóh-	(Sawyer 1965:6)
meh-šík'-el'	'breathe!'	šík'-	(WSR 70)
te-lép-el'	'stop!'	lép-	(WSR 109)
te-wél-el'	'come back!'	wél-	(WSR 75)
šuh-wél-el'	'back up!'	wél-	(WSR 95)
ma-wél-el'	'go home!'	wél-	(Sawyer 1965:45)
šúʔwela me-šuh-wél-el'	'back up backwards!'	wél-	(Sawyer 1965:6)

The status and function of the third affix, by contrast, is not at all clear; even its independence as a separate affix is only clear for 'teaching/teacher' in example (78). If the *-el'* element in the words for 'mortar' and 'dancehall' are in fact the same as that in 'teaching/teacher', and if the same root is present in 'poke, nudge' as in 'mortar', and in 'dance hall' as in 'resting, relaxing', then it would suggest that this *-el'* element is (or was) some type of nominalizing suffix. Whatever its reality or function at one time, it did not appear to be productive by the time of the documentation of the language.

(78) *te-na-hú-{ʔ}-el’* ‘teaching, teacher’ (WSR 9)

cf. *na-hú-m’iʔ* ‘to teach’ (WSR 9)

root: *hú-*

(79) *lél+tók-el’* ‘mortar (tool for grinding with a pestle)’ (lit. stone+?mortar) (Sawyer 1965:65)

?cf. *tóko·-miʔ* ‘poke, nudge’ (Sawyer 1965:72, 81, 115)

(80) *púk-el’* ‘dance hall, an enclosure of brush in a circle in a temporary camp where there was no sweathouse’ (Sawyer 1965:26)

?cf. *púke·-kʰiʔ* ‘resting, relaxing’ (Sawyer 1965:85)

More marginally, the word *cél’*, ‘then, at that time’, appears to consist of the distal demonstrative element *ce-* plus an unidentified morpheme *-l’*. This morpheme may represent an old suffix, or the remains of a noun with a meaning like ‘time’, thus *cel’* may potentially be derived from a compound with the meaning ‘(at) that time’.

(81) *cel’* ‘then, at that time’ < *ce-* (distal demonstrative) + *-l’* ? (Sawyer 1965:103)

There are an additional five lexical items in which a glottalized sonorant occurs in the second, unstressed syllable of the root. While these syllables are now an inseparable part of the overall word, having no independent morphological status, it is possible that diachronically they represent old suffixes. It is also entirely possible that one or more of these words are loans from an outside language, and thus exhibit an atypical phonological structure (certainly the phonemic long vowel in the item in (82) is also atypical).

(82)	*ʔá:kal̲’*	‘husk or chaff’	(WSR 103, 108)
(83)	*méw’oy̲’* [63]	name of a mythological figure	(WSR 100)
(84)	*čékel̲’*	‘group’	(Sawyer 1965:47)
(85)	*cíwʰel̲’*	‘angelica’ (a perennial and medicinal herb)	(Sawyer 1965:3, 79)
(86)	*ho-témel̲’-saʔ*	‘noticing things’	(WSR 106)

Finally, there are a small number of lexical items in which a glottalized sonorant occurs as the medial consonant in a monomorphemic CVCV(C) word. These are given below.

(87)	*pól̲’eʔ*	‘boy’	(WSR 61.1, 63, 86, 112)
(88)	*čʰál̲’is*	‘girl (pre-pubescent)’	(WSR 63, 91, 100, 112)
(89)	*c’úl̲’u*	‘rapids, riffle, ripple’	(WSR 61.1, 70, 77, 101)

[63] This is the only attested Wappo root that contains two glottalized sonorants; however, it is morphologically opaque.

(90) *méw'oy'* name of a mythological figure (WSR 100)

(91) *líy'e·-kʰiʔ* 'heavy like a cloth'[64] (WSR 77)

(92) *nomašóy'i* 'caterpillar' (WSR 91, 114)

(93) *čʰéy'u* 'feces' (WSR 91)

3.6.2. Aspirated Sonorants

As stated in Chapter 2, Wappo has a series of "aspirated" sonorants that consist phonetically of a sonorant followed by a glottal fricative, i.e. /mʰ/ is phonetically [mh]. This set of phonemes is extremely marginal in comparison to the other phonemes of Wappo in terms of frequency. They occur in fewer than a dozen native words, as well as three loanwords from Spanish. As such, more investigation is needed into their history and into their role in the Wappo lexicon and phonological system.[65]

As with the glottalized sonorants, the aspirated sonorants are phonotactically prohibited from two positions: word-initial onset position, and word-internally after a consonant. They occur therefore in word-internal onset position after a vowel (i.e., intervocalically), and in coda position, both word-internally and word-finally. The two aspirated nasals and the aspirated lateral are the most marginal of the group in their

[64] In practice, it is impossible to distinguish cases of the sequence -iy'- from cases of the sequence -iʔ- in Wappo (likewise -uw' and -uʔ-), unless sufficient examples of morphological variation are present to allow for a selection between the two alternatives. Where such examples are lacking, and thus a clear selection isn't possible, I use the alternative chosen by the original researcher, e.g. Sawyer.

[65] There may be a historical connection between the aspirated sonorant series in Wappo and the voiceless sonorant series in neighboring Eastern Pomo, a feature unique among coastal California languages; see McLendon (1975:26-8). I plan on addressing areal connections of various kinds among Wappo, Yukian, Pomoan, Miwokan, and Wintuan in future work.

distribution. The aspirated nasals /mʰ/ and /nʰ/ are only attested in a single item each – *kómʰlu tákaʔ* 'type of basket', *kʰénʰiʔ* 'to peel' – and the aspirated lateral approximant /lʰ/ is only attested in four roots: *ṭʰólʰ-* 'bitter', *túlʰ-*, 'hole', *kʰílʰ-* 'loose', and *šólʰ-* 'whisper'. It is perhaps significant that three of these six attestations occur with an aspirated stop in the onset of the root. As these three segments only occur in roots with additional affixal material, it is not clear whether the aspirated nasal and lateral can even occur word-finally, or if they are completely restricted to word-internal codas and onsets.

Attestations of aspirated nasals /mʰ/ /nʰ/ and lateral /lʰ/:

(94)	/mʰ/	*kómʰlu tákaʔ*		a type of basket	(WSR 100)
(95)	/nʰ/	*kʰénʰ-iʔ*		'to peel'	(WSR 99)
(96)	/lʰ/	a.	*no-ṭʰólʰ-iya·-kʰiʔ*	'it is bitter'	(WSR 72)
		b.	*ʔòma na-túlʰ-ukʰ*	'round hole in the wall/ground'	(WSR 100)
		c.	*č'a-kʰílʰih-kʰiʔ*	'(it) got loose'	(WSR 99)
		d.	*na-pi-šólʰ-i·yaʔ*	'whisper'	(WSR 49, 74)

In contrast to the aspirated nasals and lateral, the aspirated glide phonemes /wʰ/ and /yʰ/ have a somewhat greater distribution, occurring in several verb roots and also a few nouns and adjectives. Additionally, the aspirated labiovelar glide /wʰ/ appears in three

Spanish loanwords, apparently mapping from the Spanish velar fricative /x/, which Wappo lacks.

Attestations of aspirated labial glide /w^h/ and aspirated palatal glide /y^h/ are given below.

(97)	/w^h/	a.	*cí*w^h*el'*	'angelica'	(WSR 91, 103)
		b.	*sí*w^h*el*	'tassle, fringe'	(WSR 97)
		c.	*hí*w^h*-miʔ*	'rock, shake as a crib to quiet the baby'	(Sawyer 1965:86)
		d.	*hu-sí*w^h_1*-is*	'messy-haired'	(WSR 97)
		e.	*sí*w^h_2*-*	'whistle, wind blowing'	(WSR 117)
		f.	*hu-šú*w^h*e*	'steam'	(WSR 81)
		g.	*wé*w^h*-el-*k^h*iʔ*	'rigid, being rigid'	(WSR 96)
		h.	*hí*w^h*ol'*	'beans' (< Sp. *frijol*)	(WSR 79)
		i.	*ká*w^h*on'*	'box' (< Sp. *cajón*)	(WSR 80)
		j.	*tá*w^h*al'*	'work' (< Sp. *trabajar*)	(Sawyer 1965:122)

(98)	/y^h/	a.	*la*y^h	'great, big; foreign'	(WSR 77)
		b.	*ʔá*y^h*iʔ*	'white willow'	(Sawyer 1965:8, 98, 120)
		c.	*hé*y^h_1*-*	'steam from the breath'	(WSR 90)
		d.	*hé*y^h_2*-*	'to saw (cut wood); to drag, scour'	(WSR 114)

e.	*čá*$\underline{y}^{h}$-	‘to roll’	(Sawyer 1965:51, 86; Thompson et al. 2006:70)
f.	k^{h}*é*$\underline{y}^{h}$-	‘to slide’	(Sawyer 1965:12, 23, 93)
g.	*tá*$\underline{y}^{h}$-	‘to throw sticks’	(Sawyer 1965:105)
h.	*wé*$\underline{y}^{h}_{1}$	‘let’s! ready!’	(WSR 103, 110)
i.	*wé*$\underline{y}^{h}_{2}$	‘spear’	(WSR 70, 99, 100, 105)

As phonemically aspirated sonorants are rather rare on a global level, their phonotactic and lexical distribution in Wappo and other languages should be a subject of further research.[66]

3.7 Phoneme Frequency

3.7.1 Phoneme Frequency in Wappo

Gordon (2016) is an excellent recent overview of the field of phonological typology, and interestingly, one of the topics it explores is the relatively neglected one of intra-language phoneme frequency, that is, the type- or token-frequency of individual phonemes in any given sample of speech or text from a given language. Using a genetically- and areally-balanced 32-language sample, Gordon plots the ratio of expected intra-language phoneme frequency (using a null hypothesis that each segment of a particular language’s phoneme inventory will occur with equal frequency in a given linguistic sample) to observed intra-language phoneme frequency, against the percentage of languages in his sample that possess

[66] See also argumentation in Botma (2012) for the reinterpretation of what many researches have labeled ‘voiceless’ sonorants as ‘aspirated’ sonorants instead.

each of the 25 cross-linguistically most-common segments given in Maddieson (1984). Gordon's original figure giving the results is reproduced below (Gordon 2016:73):

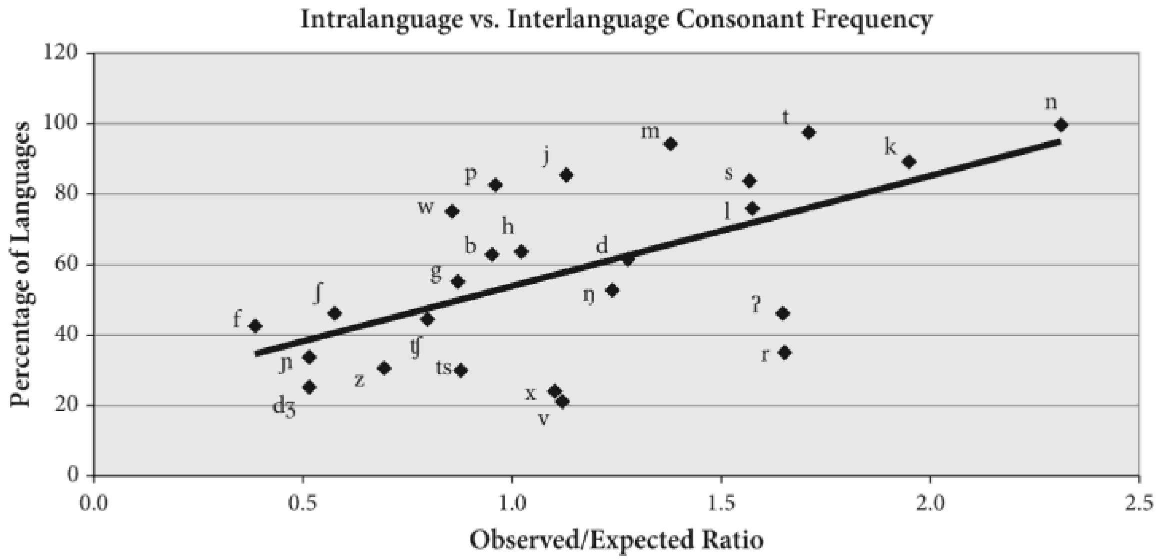


FIGURE 3.13. Language-internal frequency in a sample of 32 languages (reflected on the x-axis as the observed-to-expected ratio) vs. cross-linguistic frequency (reflected on the y-axis as the percentage of languages possessing the sound) of the 25 cross-linguistically most common consonants according to Maddieson (1984)

As this figure shows, there is a positive correlation between the observed frequency of individual consonant phonemes within languages, on the one hand, and their cross-linguistic frequency of occurrence in phoneme inventories, on the other. Put another way, consonants that occur in a larger proportion of the world's languages are the same ones that occur at a higher type- or token-frequency within the languages that have them.

My analysis of Wappo posits 32 common consonants and an additional 5 marginal consonants,[67] these latter being the aspirated sonorant series /mʰ nʰ lʰ wʰ yʰ/. Taking 32 as a

[67] not counting the phonemes imported from Spanish

conservative estimate of the language's consonant inventory size, we can then say that in any given sample of Wappo lexemes, the type frequency of each consonant, if each occurred at equal frequency, would be 100/32, or about 3.13%. This constitutes the expected type frequency of each consonant phoneme within any given sample of the Wappo language.

In order to test how the intra-language frequency of Wappo consonants compares to the intra-language frequencies of the languages in Gordon (2016)'s sample, I assembled a sample of 126 monomorphemic CVC root words, taken from both the Sawyer (1965) dictionary and the Wappo audio corpus. Because each word in the sample is CVC, there are two 'slots' per word in which a consonant may occur, giving a total of 252 slots across the 126 words. Table 3.2 gives the token frequency of each Wappo consonant by its occurrence in onset and coda positions in the 126-member sample of monomorphemic CVC root words.

Table 3.2

Frequency of Wappo Phonemes in Onset and Coda Position for Monosyllabic CVC Root Words[68] (n_{items} = 126) ($n_{consonants}$ = 252)

red text: segments among the 20 most-common cross-linguistically in Maddieson (1984)

green text: segments among the 21st-25th most common cross-linguistically in Maddieson (1984)

rank	segment	tokens	% of C slots in sample	observed/ expected ratio
1	**n**	20	7.94	2.54
2	**w h**	17	6.75	2.16
3	**m**	16	6.35	2.03
4	**l**	14	5.56	1.78
5	**y**	12	4.76	1.52
6	**c’**	11	4.37	1.40
7	**cʰ ʔ š**	10	3.97	1.27
8	**kʰ**	9	3.57	1.14
-	**t+ṭ**[69]	8	3.17	1.01
9	**pʰ m’**	8	3.17	1.01
10	**p t ṭʰ l’**	7	2.78	0.89
11	**k’ c y’**	6	2.38	0.76
12	**tʰ ṭ’**	5	1.98	0.63
13	**p’ k č’**	4	1.59	0.51
14	**t’ w’**	3	1.19	0.38
15	**s n’ (yʰ)**	2	0.79	0.25
16	**ṭ č čʰ**	1	0.40	0.13

[68] Because the sequences /iy’/ and /uw’/ are phonetically indistinguishable from the sequences /iʔ/ and /uʔ/ respectively, I chose to code the five items in the sample transcribed with /iy’/ as /iʔ/, and the two items transcribed with /uw’/ as /uʔ/, due to the typological rarity of the glottalized sonorant segments vis-à-vis the glottal stop.

[69] This is the combined frequency of the plain dental stop /t/ and the plain alveolar stop /ṭ/ in the Wappo sample, given for comparison with the general coronal *t (i.e. not specified for place) that is present in UPSID (UCLA Phonological Segment Inventory Database) and which forms the basis for Maddieson (1984)’s values.

One thing to keep in mind when interpreting the results in Table 3.2 is that the plain stops and affricates /p t ṭ k c č/ do not occur in word-final position, while glottalized sonorants /m’ n’ l’ w’ y’/ do not occur in word-initial position, and thus their overall frequency may not be as high in this sample as it may be more generally in the language. All other segments, however, are phonotactically unrestricted in monosyllabic words.

This tabulation gives us the intra-language observed/expected frequency for each of the 32 consonant phonemes of Wappo. We can now compare those values to the intra-language observed/expected frequency for the languages in Gordon (2016)’s sample, to see in which ways the individual consonants of Wappo align with or deviate from the mean values cross-linguistically. This comparison is given in Table 3.3. Note that, because Gordon’s phoneme sample consists of only the 25 most common phonemes cross-linguistically as presented in Maddieson (1984), the Wappo consonants that are not part of this group of 25 are excluded from the comparison.

Table 3.3

Comparison of Intra-Language Frequency of Wappo Consonants to That of Gordon (2016)'s Global Typological Sample

Values in parentheses are inverted (1/x) to facilitate comparison

rank	segment	Wappo frequency	global frequency	Wappo/global ratio
1	s	0.25	1.60	(6.40)
2	č	0.13	0.80	(6.15)
3	k	0.51	1.95	(3.82)
4	w	2.16	0.90	2.40
5	š	1.27	0.60	2.12
6	h	2.16	1.05	2.06
7	t+ṭ	1.01	1.70	(1.68)
8	m	2.03	1.45	1.40
9	ʔ	1.27	1.65	(1.30)
10	y	1.52	1.20	1.27
11	c	0.76	0.90	(1.18)
12	l	1.78	1.60	1.11
13	p	0.89	0.95	(1.07)
14	n	2.54	2.40	1.06

Two phonemes of Wappo in particular show a striking deviation in frequency from the global average represented in Gordon's sample: the front-coronal fricative /s/ and the back-coronal plain affricate /č/. Both segments are more than six times less frequent in the Wappo sample than their global average intra-language frequency would predict. While /č/ is less frequent globally than random chance predicts, /s/ is more frequent globally, and so the relative rarity of /s/ in the Wappo sample is especially surprising.

After these two segments, the other main outlier is the Wappo /k/; it is nearly four times less frequent in the sample than its global average intra-language frequency would predict. The segment /k/ is even more frequent globally than /s/, occurring in the Gordon sample at nearly twice the predicted frequency; yet in Wappo, it is around twice as uncommon as predicted.

Behind these outliers, there is a moderate difference in frequency of occurrence in Wappo compared to the global average for the segments /w/, /š/, and /h/, except in this case, they are more common in the Wappo sample than their global intra-language frequency would predict; each of these three segments is about twice as common in the Wappo sample as globally.

Although the sample analyzed in Gordon (2016) consisted only of the 25 most common consonants cross-linguistically as determined in Maddieson (1984), and thus did not include examples of glottalized or aspirated segments and their attested intra-language frequencies, some remarks on the relative frequencies within the Wappo sample of the three phonation types – plain, glottalized, aspirated – of the language's stops, affricates, and sonorants could be useful.

Consonants with secondary articulations or unusual phonations – termed 'elaborated' by Lindblom & Maddieson 1988 (67) – are cross-linguistically less common than their 'plain' counterparts (Maddieson 1984:38). Most phonemic inventories worldwide consist of only plain segments, some consist of plain and elaborated segments, but none (or very few) consist only of elaborated segments, at least for a given place of articulation. For example, the plain segment /k/ occurs in more languages than either its glottalized counterpart /k'/ or its labialized counterpart /k^w/ (Maddieson 1984:38). With that stated, it is interesting that for

Wappo, which has two additional ‘elaborated’ phonation types for each of its stops, affricates, and sonorants, several of the elaborated forms are actually more common in the sample than the plain forms. Looking back at Table 3.2, we see that, for the front-coronal affricate series //c//, the glottalized form /c’/ and the aspirated form /c^{h}/ are both more common than their plain counterpart /c/ (observed frequencies of 1.4 and 1.27 compared to 0.76, respectively); likewise, for the velar stop series //k//, the aspirated form /k^{h}/ and the glottalized form /k’/ are both more common than their plain counterpart /k/ (1.14 and 0.76 compared to 0.51, respectively); and also for the back-coronal stop series //ṭ//, where the aspirated form /ṭ^{h}/ and the glottalized form /ṭ’/ are both more common than their plain counterpart /ṭ/ (0.89 and 0.63 compared to 0.13, respectively).

Similarly, for the bilabial stop series //p//, aspirated /p^{h}/ is more common than plain /p/ (1.01 compared to 0.89), though glottalized /p’/ is the least common of the three (0.51); and for the back-coronal affricate series //č//, glottalized /č’/ is more common than either plain /č/ or aspirated /č^{h}/ (0.51 compared to 0.13 for both of the latter two). Out of the six stop and affricate series of Wappo, only one has an observed frequency pattern wherein the plain member is the most common: the dental series, where plain /t/ is more common than either aspirated /t^{h}/ or glottalized /t’/ (0.89 compared to 0.63 and 0.38, respectively).

By contrast, the sonorants, though they can occur in plain, glottalized, and aspirated forms, overwhelmingly prefer the plain form. Plain /m/ occurs at an observed frequency of 2.03, compared to 1.01 for glottalized /m’/. Likewise, plain /n/ is more frequent than glottalized /n’/ (2.54 compared to 0.25); plain /l/ is more frequent than glottalized /l’/ (1.78 compared to 0.89); plain /w/ is more frequent than glottalized /w’/ (2.16 compared to 0.38); and plain /y/ is more frequent than glottalized /y’/ (1.52 compared to 0.76) (the aspirated sonorant series are even more infrequent: four of the five aspirated sonorants do not show up in the sample at all, and the one that does, the aspirated palatal glide /y^h/, occurs at an observed frequency of 0.25, the second-lowest value in the sample). The largest disparity between any of the pairs of plain versus glottalized sonorants is that of the alveolar nasal series, where glottalized /n'/ is roughly 10 times less frequent than plain /n/. The fact that the glottalized sonorants in Wappo may only occur in coda position and not word-initial onset position is likely partly responsible for these low observed frequency rates, but it may also be the case that, given how rare glottalized sonorants are cross-linguistically, their presence in a sample of the lexicon of any given language that uses them may be likewise low.

3.7.2 Motivating Factors for Unusual Phoneme Frequencies

Presented with these patterns, both in Wappo and in the global sample used by Gordon (2016), we must find mechanisms that could account for this variance in intra-language frequency of a given segment across languages. For example, what mechanism would lead glottalized stops and affricates, which are cross-linguistically less frequent than their plain counterparts, to be more frequent than those counterparts in Wappo specifically? Similarly, what mechanism would lead the Wappo segments /s/, /č/, /k/ to be far less frequent, and /w/, /š/, /h/ to be more frequent, than their global intra-language occurrence would suggest?

I propose two broad explanations for the anomalous phoneme frequencies seen in the Wappo sample. First, Wappo has a larger consonant inventory than is the norm worldwide, and in many such languages with inventory sizes above the mean, including Wappo, the additional consonants past a certain point are generally created through 'elaborations' of the basic set of consonants using secondary articulations or changes in phonation, as described above (cf. Lindblom & Maddieson 1988:67-73; Gordon 2016:63). The effect of these elaborations on intra-language phoneme frequency is currently an under-studied phenomenon, but I believe that it will prove to be the case that certain combinations of a ‘simple’ base consonant and a secondary feature may be preferred or dispreferred from an articulatory or perceptual standpoint, leading to their type frequency in a given language’s lexicon being greater or lesser than expected. This hypothesis would need to be tested, taking into account various lines of phonological theory and articulatory and perceptual phonetics, and utilizing a large amount of data taken from languages worldwide.

Second, phoneme frequency may have a diachronic dimension that is likewise under-studied. A recent merger of two phonemes in a particular language may result in the merged phoneme taking on the frequencies of the two prior phonemes, making the new phoneme more frequent than what would be expected. In Wappo in particular, I suspect this may be the cause behind the unusually high type frequency of /h/, and to a lesser extent, /ʔ/. These two consonants in particular are often cross-linguistically the ‘end point’ of the debuccalization of a range of other consonants, as attested in languages worldwide.[70] Similarly, a recent sound shift of a typologically common phoneme to a more uncommon form may result in the new phoneme inheriting the higher-than-expected type frequency of its predecessor. Both of these possibilities were acknowledged by Gordon (2016:74) in his interpretation of the global sample discussed above. It may also be possible that diachronic shift could result in a phoneme with lower type frequency than its ancestor, although the mechanism for how this

[70] Cf. for example the diachronic shift of */s/ to /h/ in Brythonic, Hellenic, and Iranian within Indo-European; */p/ to /h/ in Japanese; /k/ to /ʔ/ in many Austronesian languages; /t/ to /ʔ/ in some varieties of English; /f/ to /h/ (to zero) in Spanish; */k/ to */h/ in pre-Proto-Germanic; and many other examples.

would come about is unclear.[71] Nevertheless, such a process may account for e.g. the unusual intra-language rarity of /s/ and /k/ in Wappo, which are otherwise highly frequent phonemes cross-linguistically and at the intra-language level. In either case, progress on the internal reconstruction of Wappo as well as the reconstruction of Proto-Yuki-Wappo will help shed light on whether historic phonemic mergers and shifts could be responsible for the higher- or lower-than-expected type frequencies of various Wappo phonemes.

3.8 Summary

Wappo has a large inventory of consonants, with multiple phonation types, and, perhaps as a consequence of this phonemic complexity, also has a decently complex set of phonotactic rules that guide their placement in words.

Wappo syllables may be either of the CV or CVC shape; there are no tautosyllabic consonant clusters. A very small number of stressed CV: syllables occur as well. Both bound and independent roots appear to have a minimality constraint wherein the preferred minimal structure is CVC. The class of glottalized and aspirated sonorants may not occur in word-initial position or post-consonantal position. The plain stop series is neutralized to an aspirated form word-finally, and plain affricates do not occur in codas at all. Each member within the three pairs of coronal obstruents – stops /t/ /ṭ/, affricates /c/ /č/, and fricatives /s/ /š/ – may not co-occur within the same lexical root, and similarly, roots should not contain more than one aspirated segment of any kind, nor two idential glottalized segments. Roots should also not contain idential segments with opposite marked phonation type. In contrast to consonants, vowels in the language are phonotactically unrestricted, except that word-final

[71] One possibility could be a very recent diachronic shift from a typologically unusual sound to a typologically common one, e.g. a shift from */ɬ/ to /ʃ/; the new /ʃ/ could continue to have a low type frequency for a while after the shift.

/o/ and /u/ are much less frequent than word final /i/, /e/, or /a/. Finally, onset and nucleus of a given lexical root should not share the same height/backness features.

The glottal stop /ʔ/ is a fully phonemic consonant in most cases, but may also be used epenthetically in some verb forms to prevent vowel hiatus.

The typologically rare glottalized and aspirated sonorant series primarily occur as the final consonant of lexical roots, but they also occur in a small number of affixes and one clitic.

The language-internal phoneme frequency of Wappo has some congruence with, but also some interesting deviations from, the cross-linguistic frequency of the same phonemes globally. While some unmarked phonemes are as common as expected from global data, many marked phonemes are much more common than expected, and in many cases are more common than their unmarked counterparts. Conversely, a few unmarked phonemes that are common cross-linguistically are unexpectedly rare in Wappo. Two explanations are proposed for these discrepancies: altered segment frequencies that are the fallout of the ‘elaboration’ of basic consonants using secondary articulations; and diachronic coalescence or shift of phonemes, resulting in increased or reduced phoneme frequencies for the resulting segment.

CHAPTER 4: PHONETICS

The data for this chapter are drawn from the extensive Jesse O. Sawyer Collection of Wappo Sound Recordings archived at the California Language Archive at the University of California Berkeley.[72] The chapter provides acoustic documentation of some of the notable phonetic characteristics of Wappo, in particular the distinctions between the plain, glottalized, and aspirated stops and affricates, the phonetic features of the typologically-rare glottalized and aspirated sonorant series, and the phonetic variations in vowel and consonant length in different syllabic positions. All tokens used in this chapter come from the speech of Mrs. Laura Fish Somersal, the primary speaker in the Jesse O. Sawyer Collection of Wappo Sound Recordings (WSR) and the principal consultant for Jesse O. Sawyer as well as for the team of Sandra A. Thompson, Joseph Sung-yul Park, and Charles N. Li (Thompson et al. 2006:xiii). Only one other consultant in the recordings, Clara Leger, provides listed elicited forms (WSR 8). The other speakers that do appear are only found in the context of joint elicitation sessions or in conversations, many of which feature a high degree of conversational overlap and background noise. Hence, I have decided to focus solely on Mrs. Somersal's speech in order to establish a baseline on Wappo phonetics *per se*, without having to (yet) address questions of inter-speaker or dialectic variation.

4.0. Methods

The programs Praat and Audacity were used for analysis and editing, respectively. All measurements for this chapter were made in Praat (Boersma and Weenink 2021, version 6.2.01), using the following parameters for spectrographic and F0 analysis:

[72] https://cla.berkeley.edu/

1. Window length was set to 0.005
2. Pitch range was set to 50-250 Hz
3. Maximum formant value was set to 5300, in partial compensation for the speaker's lower than average voice pitch

Formant values were obtained using the "Get formant" commands in the SoundEditor window. For vowel quality, the formant values were taken in roughly the central third of the given vowel.

For segment duration, the boundaries of segments were identified by eye on the spectrogram and/or waveform, typically at the initiation or cessation of voicing or frication, at formant transitions, at release bursts for stop consonants, or at other abrupt changes in acoustic energy. Duration was then taken as the interval between relevant boundaries.

4.1 Overview

In order to contextualize the discussion of Wappo phonetics, the Wappo phoneme inventory is repeated from Chapter 2, as Table 4.1 below.

Table 4.1

Phonemic Consonant Inventory of Wappo

		Bilabial	Dental	Alveolar	Palato-Alveolar	Palatal	Velar	Glottal
Stop	Plain	p	t	ṭ			k	ʔ
	Glottalized	p’	t’	ṭ’			k’	
	Aspirated	p^{h}	t^{h}	ṭ^{h}			k^{h}	
	Voiced	{b}	{d}				{g}	
Affricate	Plain			c	č			
	Glottalized			c’	č’			
	Aspirated			c^{h}	č^{h}			
Fricative		{f}	{ð}	s	š			h
Nasal	Plain	m		n				
	Glottalized	m’		n’				
	Aspirated	(m^{h})		(n^{h})				
Lateral	Plain			l				
	Glottalized			l’				
	Aspirated			(l^{h})				
Glide	Plain	w				y		
	Glottalized	w’				y’		
	Aspirated	(w^{h})				(y^{h})		
Rhotic	Plain			{r}				
	Glottalized			{r’}				

Phonemes in parentheses (X) are marginal; phonemes in curly brackets {X} occur only in Spanish loanwords. See Chapter 2.

4.1.1 Consonantal Phonetics

The consonants of Wappo can be divided into several groups, based on their articulation features. The following sections describe each of these groups in turn.

4.1.1.1 Plain Stop Series – [p t ṭ k]

The plain stop consonants consist of two sequential components: the stop occlusion itself and a following interval of voice onset time, defined as the period between the release of the articulators and the initiation of the following segment. For plain stops, the voice onset time is about 37 milliseconds on average (n=130), making it reasonable to classify these as unaspirated. (Occlusion duration varies widely and systematically by position for all stops and affricates in Wappo – see section 4.3.8).

The front-coronal stop [t] is dental (indeed often interdental) in articulation, comparable to the [t̪] of Spanish *tapa, lata*, while the back-coronal stop [ṭ] is alveolar or post-alveolar in articulation, comparable to the [t] of English *stop, post* (althought somewhat more apical in articulation than is the norm for English /t/).

4.1.1.2 Plain Affricate Series – [c č]

The two plain affricate phonemes, [c] and [č], consist of three components: the stop occlusion, a period of frication, and a (very short) period of voice onset time, typically about 6 milliseconds in duration (and frequently zero milliseconds) (n=56).

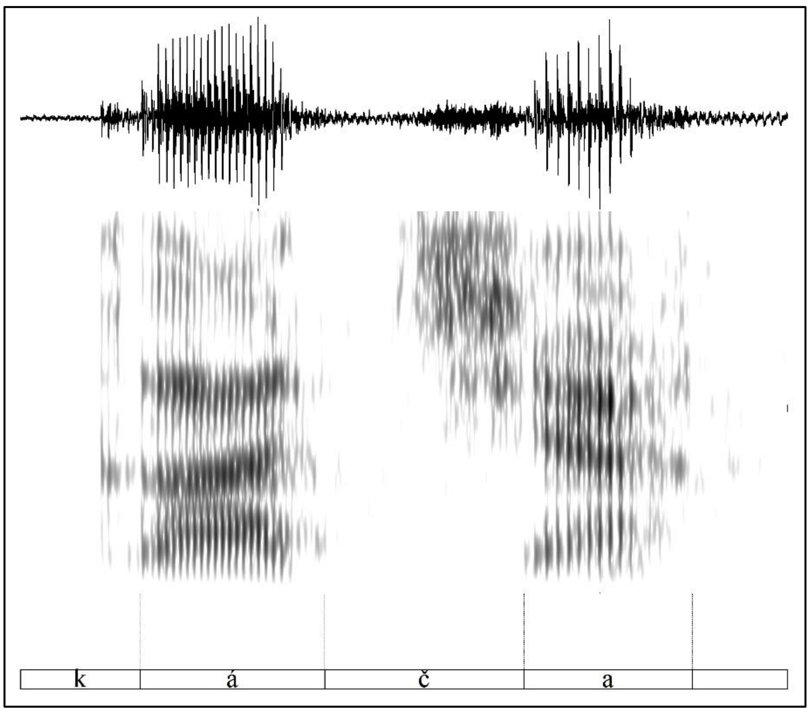
The front-coronal affricate [c] is generally alveolar in articulation, comparable to the [ts] in English *nuts, Betsy*, while the back-coronal affricate [č] is palato-alveolar in articulation, comparable in place to the [tʃ] of Spanish *leche* or English *chop*. Figure 4.1

gives a spectrogram and waveform for a medial (intervocalic) occurrence of the back-coronal affricate /č/, showing the occlusion, frication, and (very short) VOT.

Figure 4.1

káča, 'wild sunflower', displaying an intervocalic /č/

(WSR 88)



4.1.1.3 Glottalized Stop Series – [p' t' ţ' k']

These consonants are prototypical ejective stops, consisting of three components: a stop occlusion ending in a high-amplitude release with an audible release burst, followed by a moderately long period of near-silence (about 100 milliseconds on average; n=163) and finally a release at the glottal folds that leads into the following segment or silence.

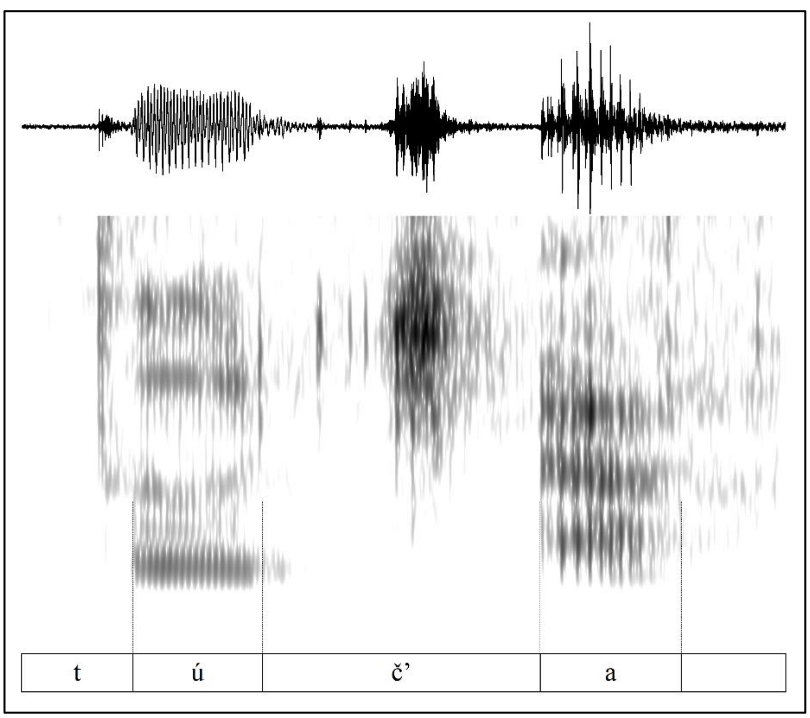
4.1.1.4 Glottalized Affricate Series – [c’ č’]

These consonants add a fourth component to those that characterize the glottalized stops, namely a frication period directly after the stop occlusion. They thus consist of a stop occlusion, a frication period that is often marked somewhere in its duration by the high-amplitude release of the oral articulators, a period of near-silence leading to the glottal release (about 51 milliseconds on average; n=80), and the final glottal release itself. Figure 4.2 gives a spectrogram and waveform for a medial (intervocalic) occurrence of the back-coronal glottalized affricate /č’/, showing the stop occlusion, frication, peak ejection energy, and near-silence period.

Figure 4.2

túč’a, ‘big, large’, displaying an intervocalic /č’/

(WSR 88)



4.1.1.5 Aspirated Stop Series – [p^{h} t^{h} ṭ^{h} k^{h}]

These consonants are distinguished from the plain stops chiefly by having a much longer voice onset time, with a characteristic period of aspiration during the gap between release of the stop occlusion and the initiation of the following segment or silence – about 151 milliseconds on average (n=175), making them the stop series with the longest VOT. The spectral characteristics of the aspiration vary substantially, depending on both the accompanying stop consonant ([p], [t], [ṭ], [k]) and the identity of the following vowel, typically with higher energy at the locations of the second, third, and fourth formants.

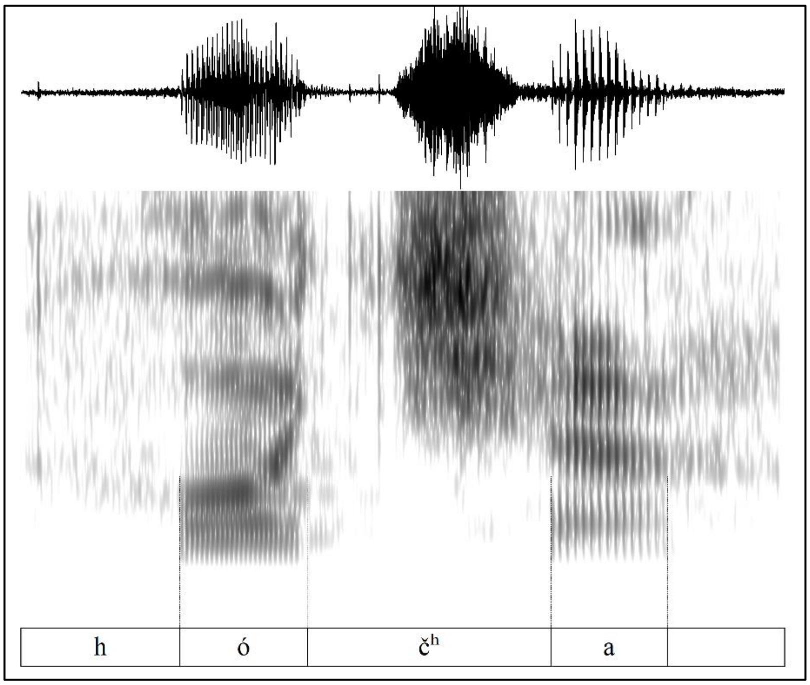
4.1.1.6 Aspirated Affricate Series – [c^{h} č^{h}]

The two aspirated affricates, [c^{h}] and [č^{h}], are distinguished from their plain counterparts [c] and [č] chiefly by a longer fricative period – about 145 milliseconds on average for the aspirated affricates (n=70) compared to about 85 milliseconds on average for the plain affricates (n=56) – as well as a substantially longer VOT; for the plain affricates, VOT averages only about 6 milliseconds (n=56), while for the aspirated affricates, it averages about 32 milliseconds (n=55). The spectral characteristic of the aspiration period for the aspirated affricates is similar to that of the aspiration period for the aspirated stops, that is, tracking the noise spectrum of the preceding frication component – either [s] for /c/ or [š] for /č/ – as well as the formant values of the following vowel. Figure 4.3 gives a spectrogram and waveform for a medial (intervocalic) occurrence of the back-coronal aspirated affricate /č^{h}/, showing the occlusion, frication, and aspiration period with its particular spectral characteristics.

Figure 4.3

hóčʰa, 'cottontail rabbit', displaying an intervocalic /čʰ/

(WSR 67)



4.1.1.7 Glottal Series – [ʔ h]

The two glottal phonemes /ʔ/ and /h/ pattern together phonologically in several ways, especially morphophonemically; see Chapter 6. Phonetically, however, they are distinct, with the glottal stop [ʔ] being a complete or near-complete glottal closure with a high-amplitude release in coda position, while the glottal fricative [h] is a voiceless continuant with a spectral frequency that varies depending on the formants of the adjacent vowels. The glottal stop [ʔ] invariably causes laryngealization in surrounding vowels, particularly the preceding vowels, characterized on a spectrogram by high-amplitude well-separated glottal pulses and a large drop in fundamental frequency. In intervocalic position, it may manifest purely as a period of laryngealization in the transition between the adjacent vowels. The duration of both the glottal stop /ʔ/ and glottal fricative /h/ vary by phonotactic position; see Sections 4.4.4 and 4.4.5.

4.1.1.8 Fricative Series – [s š]

The two fricative consonants are prototypical central coronal sibilant fricatives, with mid- and high-frequency frication. Their durations vary by phonotactic position, with durations in word-final coda position and word-internal coda position being on average longer than their durations in onset or intervocalic position – see Section 4.3.8.

The front coronal fricative [s] is laminal-alveolar in articulation, comparable to the [s] in French *ça*, while the back coronal fricative [š] is palato-alveolar in articulation, comparable to the [ʃ] in French *chat*. The highest spectral energy for [s] is found above 3,900 Hz, while that for [š] starts at around 1,700 Hz and peaks at about 2,600 Hz. The two fricatives are comparable in their average durations, with the front fricative /s/ averaging 232 milliseconds (n=33), and the back fricative /š/ averaging 243 milliseconds (n=43) in duration across all phonotactic positions.

4.1.1.9 Plain Sonorant Series – [m n l w y]

These consonants are prototypical sonorants. The plain sonorants consist of a bilabial nasal [m] and coronal nasal [n], a coronal lateral approximant [l], and two semivowels or glides, labiovelar [w] and palatal [y]. The point of articulation for the coronal nasal [n] and lateral approximant [l] is alveolar, like the equivalent consonants in English. Phonetically, all of the plain sonorants are subject to phonetic lengthening in word-internal coda position, e.g.

/m/ → [m·]; in the case of the glides [w y], this lengthening converts them into their equivalent long vowels, i.e. /w/ → [u·], /y/ → [i·].

4.1.1.10 Glottalized Sonorant Series – [m’ n’ l’ w’ y’]

This series is distinguished from its plain counterpart by a strong glottal closure at the end of the sonorant segment, cutting off the voicing and duration of the segment and then releasing again into the following segment. Thus, they are phonetically a sequence of a plain voiced sonorant and a glottal stop, e.g. /m’/ is phonetically [mʔ]. In the typology of glottalized sonorants, those of Wappo are ‘post-glottalized’ (Um 1999:474-5).

For all of the glottalized sonorants, the duration of the sonorant component itself is much shorter than that of the equivalent plain sonorant – see data in Sections 4.3.8 and 4.4.6.

4.1.1.11 Aspirated Sonorant Series – [m^h n^h l^h w^h y^h]

This final series, the most limited in occurrence, is similar in articulation to the glottalized sonorant series, but instead of terminating in a glottal stop, its members terminate in a glottal fricative. Thus, these segments are phonetically a sequence of a plain voiced sonorant and a glottal fricative, e.g. /l^h/ is phonetically [lh]. This series occurs in only about twenty distinct roots, but their identity as unitary and discrete phonemes is supported by multiple lines of evidence; see Chapter 2, Section 2.1.4.

Table 4.2 gives all attested items in both Sawyer (1965) and the Wappo audio corpus that feature an aspirated sonorant.

Table 4.2

Items Exhibiting Aspirated Sonorants

Wappo	gloss	morphological structure	source(s)
/mʰ/			
kómʰlu tàkaʔ	‘a dish-shaped basket about six to eight inches high’	?+tákaʔ	(WSR 100)
/nʰ/			
kʰenʰiʔ	‘to peel’	kʰénʰ-i-ʔ	(WSR 99) (Sawyer 1965:77, 115)
/lʰ/			
č’akʰílʰihkʰiʔ	‘it got loose’	č’a-kʰílʰih-kʰi-ʔ	(WSR 99)
napišólʰi·yaʔ	‘to whisper’	na-pi-šólʰ-iya-ʔ	(WSR 49, 74)
noṭʰ(ó/ú)lʰiya·kʰiʔ[73]	‘bitter, salty’	no-ṭʰ(ó/ú)lʰ-iya-kʰi-ʔ	(WSR 72) (Sawyer 1965:11, 66)
ʔòma natúlʰukʰ	‘hole in the wall or ground’	ʔóma+na-túlʰ-ukʰ	(WSR 100) (Sawyer 1965:52, 66)
/wʰ/			
cíwʰel’	‘angelica herb’	?	(WSR 91, 103) (Sawyer 1965:3, 79)
híwʰmiʔ *híwʰe·ma*	‘to shake, to rock’ ‘rocking chair’	híwʰ-mi-ʔ híwʰ-ema	(WSR 109) (Sawyer 1965:86, 90)
k’á husíwʰis	‘thin or shabby hair(ed)’	hu-síwʰ-is	(WSR 97)
méy hušúwʰe *hušúwʰa·yaʔ*	‘steam (from boiling water)’ ‘to steam, to be steaming’	hu-šúwʰe hu-šúwʰ-ayaʔ	(WSR 81) (WSR 81, 90, 100)
síwʰel *síwʰelkʰiʔ*	‘tassel, fringe’ ‘to hang down’	? síwʰel-kʰi-ʔ	(Sawyer 1965:102) (WSR 97)
síwʰi·yaʔ	‘the sound of wind’		(WSR 117)

[73] The root vowel in this item is ambiguous; the first token in WSR 72 has /ó/, while the second token has /ú/. This may be either a correction or an uncertainty on the part of the speaker.

síwʰiwi·saʔ	'(wind) is whistling'		(WSR 117)
wéwʰelkʰiʔ	'[to be] rigid, unbendable'	wéwʰel-kʰi-ʔ	(WSR 96) (Sawyer 1965:85)[74]
ʔówʰistaʔ	'willing to do, said alright, agreed'	ʔowʰis-taʔ	(WSR 116)
híwʰol'	'beans' (< Sp. *frijol*)	-	(WSR 79) (Sawyer 1965:8, 74, 95, 122)
káwʰon'	'box' (< Sp. *cajón*)	-	(WSR 80) (Sawyer 1965:3, 13, 20, 22, 49)
táwʰal'	'work' (< Sp. *trabajar*)	-	(WSR 9) (Sawyer 1965:9, 42, 64, 105, 108, 116, 118, 122) (Thompson et al. 2006:5, 141)
/yʰ/			
láyʰ	'great, big; foreign, White'	-	(WSR 3, 63, 75, 77, 76, 106, 112) (Sawyer 1965: many[75]) (Thompson et al. 2006:71, 104, 161)
láyʰmela	'paternal relative'		(WSR 100)
čáyʰseʔ *tečáyʰseʔ* *tečáyʰakʰiʔ*	'roll' (impf.) 'roll down' (impf.) 'roll down' (perf.)	čáyʰ-se-ʔ te-čáyʰ-se-ʔ te-čáyʰa-kʰi-ʔ	(Sawyer 1965:51) (Sawyer 1965:86) (Thompson et al. 2006:70)
héyʰiʔ *č'ahéyʰeʔ* *č'ahéyʰtaʔ*	'saw (vb.)' 'Saw it off!' 'sawed off'	héyʰ-i-ʔ č'a-héyʰ-eʔ č'a-héyʰ-ta-ʔ	(Sawyer 1965:88) (Sawyer 1965:88) (Sawyer 1965:88)

[74] Sawyer (1965:85) transcribes this item as *wélhelkhiʔ*, but the token in the audio corpus (WSR 96) sounds much more like *wéwʰelkʰiʔ*, with /wʰ/ instead of /lʰ/.

[75] Including Sawyer (1965): 18, 39, 41, 46, 50, 54, 55, 62, 72, 73, 78, 80, 84.

č'ahhéyʰtaʔ	'sawed out, as a piece from inside a larger piece'	č'ah-héyʰ-ta-ʔ	(Sawyer 1965:88)
hól č'ahéyʰukʰ	'block of wood sawed off of a log'	hól č'a-héyʰ-ukʰ	(WSR 114) (Sawyer 1965:93)
mehéyʰsiʔ	'scour'	me-héyʰ-si-ʔ	(Sawyer 1965:47, 88, 115)
may'šuhéyʰsiʔ	'drag oneself around while sitting down, as babies do on the floor'	may'=šu-héyʰ-si-ʔ	(Sawyer 1965:32)
nahéyʰle	'steam from the breath'	na-héyʰ-le	(WSR 90)
wéyʰ	'ready; now; let's'[76]	-	(WSR 103)
wéyʰ ʔísi čó:siʔ	'let's go!'	weyʰ ʔísi có:-si-ʔ	(WSR 3)
wéyʰ ʔísaʔ	'let's go!'	weyʰ ʔísaʔ	(WSR 3)
wéyʰ me(h)wíleʔ	'now tell it!'	weyʰ meh-wíl-eʔ	(WSR 106)
wéyʰ ʔisi na(h)yóṭiʔtesiʔ	'let's play a game'	weyʰ ʔísi na(h)-yóṭiʔ-te-si-ʔ	(WSR 103)
wéyʰ ʔisi pahúti·siʔ	'let's bet'	weyʰ ʔisi pa-húti-si-ʔ	(WSR 110)
wéyʰ ʔísi map'élahsiʔ	'let's get down on our knees to start the hand game'	weyʰ ʔísi ma-p'élah-si-ʔ	(WSR 110)
nahkʰéyʰiʔ	'board to slide with'	nah-kʰéyʰiʔ	(Sawyer 1965:12, 93)
nahkʰéyʰiʔseʔ	'slide (vb.)'	[nah-kʰéyʰiʔ]-se-ʔ	(Sawyer 1965:23, 93)
nahtáyʰiʔ	'throwing-stick'	nah-táyʰiʔ	(Sawyer 1965:105)
nahtáyʰiʔseʔ	'throw sticks in the game'	[nah-táyʰ-iʔ]-se-ʔ	(Sawyer 1965:105)
ʔáyʰiʔhol	'sticks of white willow prepared for making baskets'	ʔáyʰiʔ+hól	(Sawyer 1965:8, 98, 120)
nahmiláyʰ	interjection[77]	-	(WSR 2)

[76] Because *wéyʰ* is an interjection, the aspiration may be pragmatic, marking a phrase boundary, rather than phonemic.

[77] Found in the sentence "*nahmiláyʰ* | *ʔónaʔ nahwéle·laʔ*" 'let's see if you're brave enough to say it again!' (lit. *nahmiláyʰ* | again repeat.IMP) (WSR 2). Alternatively, the aspiration at the end of *nahmiláyʰ* is pragmatic and marks a phrase boundary.

4.1.2 Vocalic Phonetics

The following sections describe the phonetics of the vowels and diphthongs of Wappo, including phonetic and allophonic variations in vowel length. A raised dot <·> is used to mark phonetic vowel length, i.e. length that is allophonically (chiefly metrically) determined, while a colon <:> is used to mark the few cases of genuine phonemic vowel length, those that directly contrast with short vowels in tonic syllables.

4.1.2.1 Short Vowel Series – [i e a o u]

The short vowel series is by far the more frequent of the two vowel series, and forms the nucleus of nearly all Wappo syllables. The series constitutes a cross-linguistically prototypical five-vowel system, consisting of a high front /i/, a mid front /e/, a low central /a/, a mid back rounded /o/, and a high back rounded /u/. This series tends to be pronounced with a shorter duration and more central articulation when unstressed, i.e. /i e a o u/→[ɪ ɛ ɐ ɔ ʊ]. Additionally, the short vowels undergo lengthening in certain contexts sensitive to syllable structure and word accent; see Section 4.2.7 below.

4.1.2.2 Long Vowel Series – [i: e: a: o: u:]

This series is much more restricted in distribution than the short series, occurring only in stressed syllables, and only in a small number of lexical items, about twenty – see section 4.2.6. The phonemically-long vowels have, on average, double the duration of the short vowels, and are peripheral in articulation, not subject to being centralized.

4.1.2.3 Diphthongs

Wappo lacks a category of phonemically distinct diphthongs (see Chapter 2), but the sequence of a vowel plus any of the six glide phonemes - /w/ /y/ /w'/ /y'/ /w^h/ /y^h/ - results in a phonetic diphthong. Table 4.3 below gives all attested phonetic diphthongs. The sequences marked in gray could theoretically occur in the language, but have not been attested in the available corpus of Wappo. The sequences marked in red have an ambiguous phonemic character; for example, the phonemic sequence /iy/ is phonetically identical to a phonemic long /i:/, and the phonemic sequence /uw'/ is phonetically identical to the sequence /uʔ/. In these cases, the determination of which phonemic description is underlyingly the 'correct' one must rest on criteria of phonotactics or morphological structure, rather than on phonetics.

Table 4.3

Phonetic Diphthongs of Wappo

Gray: sequences that are theoretically licensed, but are unattested

Red: sequences with an ambiguous phonemic character

	y-offglide					w-offglide				
	i	e	a	o	u	i	e	a	o	u
plain	iy	ey	ay	oy	uy	iw	ew	aw	ow	uw
glottalized	iy'	ey'	ay'	oy'	uy'	iw'	ew'	aw'	ow'	uw'
aspirated	iy^h	ey^h	ay^h	oy^h	uy^h	iw^h	ew^h	aw^h	ow^h	uw^h

4.2. Acoustic Phonetics of Vowel Phonemes

4.2.1 Vowel Quality

A vowel formant plot giving the F1 and F2 frequency values for the nuclei of a selection of stressed monosyllabic CVC words is provided in Figure 4.4. The average frequency characteristics of the sample are provided in Table 4.4.

Figure 4.4

Formant Plot for Wappo Vowels (n=138)

Vowel qualities:	/i/	/e/	/a/	/o/	/u/

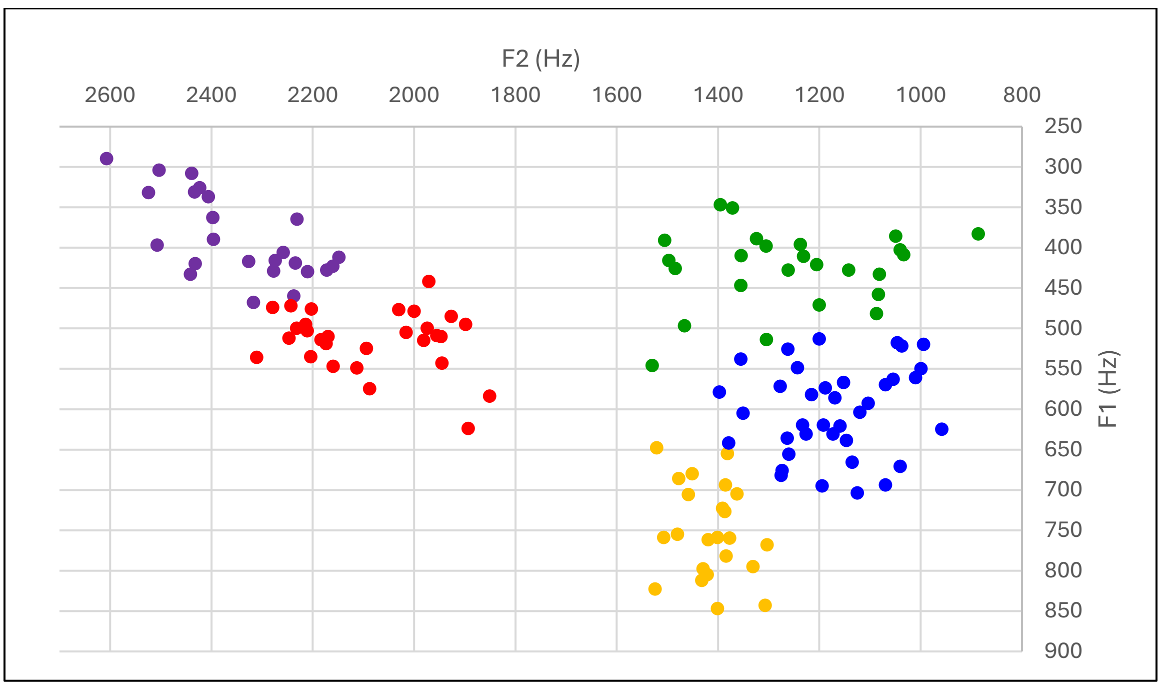


Table 4.4

Average Vowel Frequencies (n=138)

	i (n=24)	e (n=29)	a (n=23)	o (n=37)	u (n=25)
average F1	388	514	752	603	426
average F2	2348	2087	1414	1171	1257

Observations:

1. The low vowel phoneme /a/ is phonetically low-central, i.e. [ä].

2. The two front vowel phonemes, /i/ and /e/, are acoustically well-distinguished from the low and back vowels /a/ /o/ /u/; there is a substantial F2 gap between the two groups of vowels. In particular, the mid-front /e/ in Wappo is a relatively high mid vowel.

3. The two back vowels in particular, /o/ and /u/, have a large amount of F2 variation, ranging from as little as 784 Hz to as much as 1526 Hz. Several tokens trend towards being central rounded vowels, i.e. /o/ → [ɵ], /u/ → [ʉ].

4. On average, the mid-back vowel /o/ has a slightly higher F1 than the mid-front vowel /e/, meaning that /o/ tends to be a lower vowel in articulation than is /e/.

4.2.2 Effect of Stress on Vowel Quality

As described in Chapter 2, stress in Wappo is uniformly on the sole or first syllable of the morphological root of the word. The primary acoustic correlate of stress in Wappo is a pitch drop between the tonic syllable and the immediately post-tonic syllable (see Chapter 5 for detailed discussion). Examination of the Wappo audio corpus shows that there is a connection between stress and vowel features: excluding the cases of metrical lengthening, the vowels of stressed syllables are slightly longer and have a more peripheral quality than the vowels of unstressed syllables, which are conversely shorter and have a more centralized and/or open quality than their stressed counterparts. Duration of vowels is dealt with in Sections 4.2.6 and 4.2.7; here, the effect of stress on vowel articulation – more peripheral vs. more central/open – is discussed.

Paul Radin (1929) had this to say on the vowel quality, or timbre, of final vowels:

> "A marked tendency exists for most of the closed [medium-length] vowels [(a) e i o u] to become open and short [ɛ ɪ ɔ ʊ] terminally." (Radin 1929:11, bracketed information added based on discussion by Radin)

Since Wappo does not have word-final stress except in a handful of nouns and some imperative verb forms, Radin must be describing vowels that are unstressed; thus, he is noting the tendency for unstressed final vowels to become open – that is, 'lax' or centralized – relative to their stressed internal counterparts. Radin's observation is confirmed by the data from the Wappo audio corpus.

In a sample of 90 CV́CV words, that is, words with a stressed open syllable followed by an unstressed open syllable, the F1 and F2 for each of the two vowels was measured. Table 4.5 gives the numerical F1 and F2 averages per vowel phoneme per syllable, while Figure 4.5 plots the five stressed vowel averages against the five unstressed vowel averages. The vowels in this sample occurred in a variety of consonantal contexts.

Table 4.5

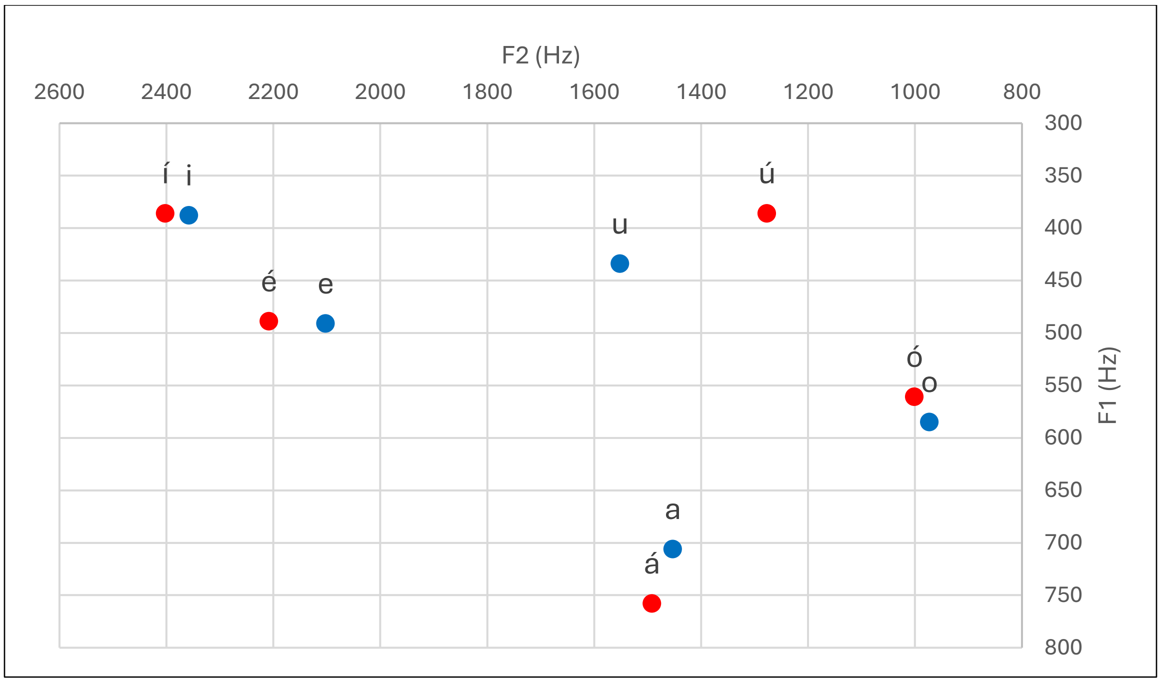
F1 and F2 Averages for Stressed and Unstressed Vowels in CV́CV Words (n=90)

	Stressed vowels: C**V́**CV					Unstressed vowels: CV́C**V**				
	/i/	/e/	/a/	/o/	/u/		/i/	/e/	/a/	/o/	/u/
F1	386	489	758	561	386	F1	388	491	706	585	434
F2	2402	2208	1492	1001	1277	F2	2358	2102	1453	973	1552
n	*26*	*12*	*22*	*15*	*15*	*n*	*10*	*33*	*22*	*16*	*8*

Figure 4.5

Average Vowel Formant Plot for Stressed vs. Unstressed Vowels in a Selection of CV́CV words (n=90)

Stressed vowels are shown in red, unstressed vowels in blue.



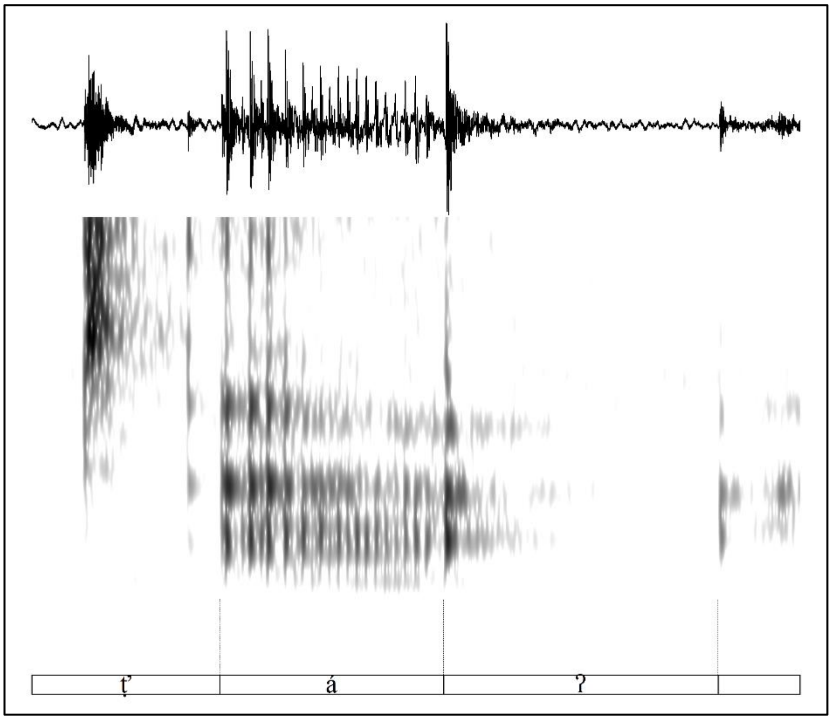
As Figure 4.5 indicates, for disyllabic words consisting of open syllables, unstressed vowels generally have a slightly more centralized articulation relative to their stressed counterparts. In the case of /u/, the unstressed form is quite sharply centralized in comparison to its stressed counterpart, causing it to be on average more fronted than even the low central vowel /a/. On the other hand, the vowel /o/ is not centralized when unstressed, but rather is slightly more open than its stressed counterpart, trending in the direction of [o̞].

4.2.3 Laryngealization of Vowels

When a vowel is found adjacent to a laryngeal consonant – whether one of the glottalized obstruents /p' t' ṭ' k' c' č'/, the glottalized sonorants /m' n' l' w' y'/, or the glottal stop /ʔ/ - the vowel becomes at least partially laryngealized. On a spectrogram, this is apparent by the longer duration of glottal closure per cycle in laryngealized vowels as compared to non-laryngealized vowels. This can be seen in Figure 4.6, a spectrogram and waveform of the word *ṭ'áʔ*, 'leg'; the vowel /a/ is showing laryngealization both in its initial period, directly after the glottalized stop /ṭ'/, and in its final period, leading into the glottal stop /ʔ/:

Figure 4.6

Laryngealization of the Vowel /a/ *in the Word* ṭ'áʔ *'leg'* (WSR 91)



4.2.4 Nasalization in Vowels

Wappo does not have phonemic vowel nasalization. However, vowels in syllables closed by a nasal consonant are sporadically phonetically nasalized, a feature also found in American English. Additionally, vowels are sometimes nasalized, in addition to being laryngealized, when preceding a glottal-stop coda, and especially in the position between a glottalized stop, affricate, or sonorant, and a glottal stop. This association between nasalization and glottalization/laryngealization is a phenomenon known as 'rhinoglottophilia', and has been documented worldwide (Matisoff 1975).

There is one lexical item, however, that does appear to have a phonemically nasalized vowel:

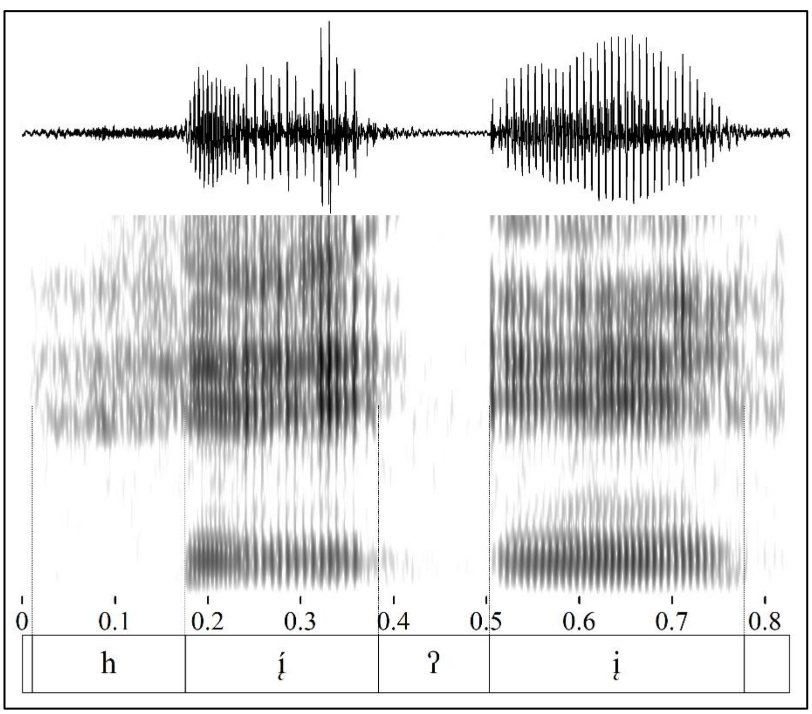
(1) *hį́ʔį* ‘no’ (Sawyer 1965:69; WSR 75, 79, 105)

The distinctive status of the nasalization of the vowels in this word can be seen when contrasted with the similar items *híc’e* ‘tree gum’ (WSR 88), or *šíʔe* ‘grass’ (WSR 78, 90), which have similar consonant segments to *hį́ʔį* but with no vowel nasalization. Figure 4.7 gives a waveform and spectrogram of the word *hį́ʔį*. The end of the first vowel shows considerable glottalization, visible as distinct striations in the spectrogram, and the broadness of F2 and F3 in the second vowel are suggestive of nasalization.

Figure 4.7

Phonemic Nasal Vowel

hį́ʔį ‘no’ (WSR 75)



Jesse Sawyer speculated that the nasalization in *hį́ʔį* was due to the influence of American English *uh-uh* [i.e., ʔẽʔẽ, ʔãʔã, ʔm̩ʔm̩] (Sawyer 1965:69).

4.2.5 Final Vowel Apocope

Radin mentions a tendency for final vowels in Wappo to be dropped: "...final vowels quite frequently disappear." (Radin 1929:9). In the Wappo audio corpus, the suffix *-ema*, a deverbal agentive or instrumental suffix, often exhibits apocope of its terminal vowel *-a*; at least 15 instances were found in the audio corpus.[78] What is likely occurring is that, since suffixes cannot bear stress, and because this particular suffix is disyllabic, the words in which it occurs invariably have antepenultimate stress. This distance from the locus of word-level stress, along with the fact that the *-a* is at the right edge of the word and is not followed by a consonant, creates circumstances favorable to apocope.

A few other instances of final vowel apocope that don't involve the suffix *-ema* are given below; three of these examples also involve antepenultimate stress. The vowel subject to apocope is here marked off in parentheses.

(2)	*céma hušíʔi·y(a)*	'you're welcome'	(WSR 109)
(3)	*ʔopáʔukʰ nočáy'i·y(a)*	'tasty food'	(WSR 82)
(4)	*ṭúpuluʔ méc'e·p(i)*	a personal name	(WSR 106)

[78] See e.g. 'face powder' (WSR 2), 'curry-comb' (WSR 3), 'blanket' (WSR 76), 'musical instrument' (WSR 77), 'yeast or baking powder' (WSR 79), 'belt' (WSR 85), 'toothpick' (WSR 106), etc.

(5) *k'á ʔočóčukʰ mek'án(i)* 'a good basket-maker' (WSR 106)

(6) *húc'i k'áy'el šáw(o)* 'white acorn bread' (WSR 72)

4.2.6 Vowel Duration

In prior research on Wappo, the status of vowel length – whether it is phonemic or phonetic in this language – has been ambiguous. Paul Radin did not appear to believe that vowel length was phonemic in Wappo *per se*; rather, he believed that there was a class of tense vowels that were inherently 'medium in length' contrasted with a set of lax vowels that were inherently 'short':

"The following vowels are found:
Closed and medium in length: a, e, i, o, u
Open and short: ɛ, ɪ, ɔ, ʊ
Semi-vowels: w, y." (Radin 1929:11)[79]

Jesse Sawyer reliably marked vowels that he heard as "long" with a raised dot in his published works, including both the *English-Wappo Vocabulary* (1965) and *Wappo Studies* (1991). However, Sandra Thompson and Charles N. Li in *A Reference Grammar of Wappo* (2006) claimed that they could not reliably hear any meaningful length distinctions (Thompson et al. 2006:1); therefore, throughout that work, their own transcriptions lack vowel-length marking entirely, while their quotations of material from Sawyer's work simply preserve his original markings.

[79] It is difficult to avoid the conclusion that Radin's analysis of the Wappo vowel system was being made through the lens of English phonology.

My own conclusion, after extensive analysis and measurements of the Wappo audio corpus, is that vowel length differences do play a role in Wappo, but that they are primarily a phonetic phenomenon, not a phonemic one. Phonetic vowel length is dealt with in the following section, 4.2.7; here, I address the instances of genuine phonemic vowel length in both Sawyer's *English-Wappo Vocabulary* and in the Wappo audio corpus.

The phonemic vowel length differences that occur in Wappo are found only among stressed vowels, where long and short vowels can directly contrast. The overall number of lexical items in Sawyer (1965) in which a stressed long vowel appears is relatively small; excluding Spanish loan words, there are about 40 attested in that work. However, for many of these, the item appears elsewhere in the corpus of Wappo documentation transcribed with a short vowel rather than a long one, and in others, examination of the audio corpus – both through listening and by taking measurements in Praat – reveals that the word in question actually has a short vowel, and may thus have been mistranscribed.[80] To begin the discussion of phonemically long vowels in Wappo, the instances of spurious long vowels recorded in the published literature must be eliminated. All instances of spurious long vowels recorded in Sawyer (1965) are detailed in Table 4.6.

[80] The words in question may also have been subject to dialectal variation, or pragmatic lengthening, on the occasion(s) where they were attested for the 1965 *Vocabulary*; many individual cases of vowel length variation between tokens are inexplicable with the available evidence.

Table 4.6

Words Confirmed to Lack a Long Vowel; Sawyer (1965) Transcription Judged to Be Incorrect

Angled brackets <> mark the exact spelling found in Sawyer (1965)

Sawyer (1965) transcription	Sawyer (1965) gloss	WSR transcription	WSR files
<napʰí:pa>	‘lips’	[napʰípa]	64, 69, 75, 114
<k’í:n>	‘spring worm’	[k’ín]	91
<tí:ya>	‘mother’s mother’	[tíya]	63, 107
<p’í:pʰo>	‘white/valley oak’	[p’ípʰo]	3, 69, 76, 86, 96
<ʔek’aʔé:yeʔ>	‘tiny baby’	[ʔék’a ʔéyeʔ]	91
<ʔá:we>	‘potato; kidney’	[ʔáwe]	many[81]
<ʔà:we pʰúla>	‘golden lantern’	[ʔáwe+pʰúla]	91
<meynaʔá:we>	‘beaver’	[méy+naʔáwe]	100, 113
<c’á:wopelihin>	‘(month name)’	[c’áwo+péle+hín]	22, 100
<p’á:la>	‘twins’	[p’ála]	90, 109
<cʰà:wen tekúyse>	‘fall/autumn’	[cʰáwen+tekúyse]	72
<há:laʔ>	‘center post/pole’	[hálaʔ]	100
<k’á:>	‘person’	[k’á]	many[82]
< k’àni(h) má:yaʔpi>	‘female chief/leader’	[k’áni+má(:)yaʔpi][83]	106
<ṭ’ó:ṭ’a>	‘even number’	[ṭ’óṭ’a]	101
<có:we>	‘black’	[cʰówe][84]	65, 92, 100, 108
<picó:we>	‘dirty’	[picʰówe][83]	91, 96
<č’ú:ṭʰiʔ>	‘scrape (vb.)’	[č’úṭʰiʔ]	61.2, 69, 75, 86, 102

[81] includes WSR 18, 64, 69, 76, 79, 80, 86, 91, 100, 105, 113, 114, 115
[82] includes WSR 3, 9, 63, 82, 88, 97, 98, 100, 103, 104, 106, 108, 109, 112, 114, 116, among others
[83] The vowel in this item in WSR 106 is somewhat longer than average, but not long enough to be considered phonemically long, in my opinion.
[84] The <c> consonant in these items should be aspirated (/cʰ/) according to the recordings.

<c’ú:y>	‘flicker/yellowhammer’	[c’úy]	77, 90, 92, 114
<tú:y>	‘chest’	[túy]	61.2, 64, 102, 114

These items can be reliably excluded from the set of Wappo lexical items with stressed long vowels.

Further corrections to items in Sawyer (1965) prompted by evidence in the Wappo audio corpus include the following:[85]

1. One item has been mistranscribed in Sawyer (1965) as having a pure long vowel when it actually has a diphthong, as confirmed by the Wappo audio corpus:

(7) *<pó:miʔ>* ‘to singe’ (Sawyer 1965:92)

retranscription:

/pówmiʔ/ [póu·miʔ] (WSR 61.2, 92)

2. Several items have what appear to be phonetic long vowels, but the status of the vowel appears to be dependent on morphological processes or other non-phonetic variations:

A. Three items are simply better described as having a following homorganic glide segment that produces a surface phonetic long vowel, rather than having a genuinely phonemic long vowel. Their tokens in the WSR support this retranscription.

[85] In this section, material quoted from Sawyer (1965) is given as <*item*>. My own phonemic and phonetic retranscriptions are given as /item/ and [item], respectively.

(8) <*k’ú:i:yaʔ*> ‘run’ (Sawyer 1965:87)

retranscription:

/k’úwi·yaʔ/ [k’ú·i·aʔ] (WSR 18, 101, 109)

(9) <*wí:iš*> ‘woodtick’ (Sawyer 1965:105)

retranscription:

/wíyiš/ [wí(y)ɪš] (WSR 67, 91, 101)

cf.

<*wí:ši ma:čúyelkʰiʔ*>

‘woodtick fastens its pincers, its head in the skin’ (WSR 101)

(*wíy-iš=i* → *wíyši*, with syncope of /i/ in -*iš*)

B. Two further items can be explained as having an underlying glide-final root that causes a surface long vowel when the glide ends up as a syllable coda:

(10) <*wí:šeʔ*> ‘to fight’ (Sawyer 1965:38)

cf.

<*ʔah wíye-yaw·miʔ*> ‘I’m going to fight’ (WSR 108)

verbal root: *wíy-*

retranscription:

/wíyšeʔ/ [wí:šeʔ] ‘to fight’

(11) a. <*cí:sehol*> ‘drill for making beads’ (Sawyer 1965:32)

[*cí:se* ‘piercing, drilling’ + *hól* ‘stick’]

b. <*ʔi:c’èma macì:k*^{h}*i pahmútelk*^{h}*iʔ*> (Sawyer 1965:78)

‘My pierced ears grew over’

[*ʔi:c’èma* ‘my ear’, *macì:k*^{h}*=i* ‘pierced=NOM’, *pahmútelk*^{h}*iʔ* ‘grew over’]

c. <*c’èma mací:uk*^{h}> ‘pierced ears’ (Sawyer 1965:78)

d. <*cí:uk*^{h}> ‘hole made by piercing’ (Sawyer 1965:78)

verbal root: *cíy-*

retranscriptions:

a.	/cíyse+hòl/	‘drill for making beads’
b.	/ʔic’èma macìyk^{h}i pahmútelk^{h}iʔ/	‘My pierced ears grew over’
c.	/c’èma macíyuk^{h}/	‘pierced ears’
d.	/cíyuk^{h}/	‘hole made by piercing’

C. One item varies in vowel length according to speaker:

(12) <*holwí:š*> ‘pike [fish]’ (Sawyer 1965:78)

Mrs. Laura Fish Somersal tends to pronounce it with a longer [i:], or even split into two vowels, [ii~iɪ] (WSR 61.2, 67), while Mrs. Irene Alturas Amante pronounces it with a short [ɪ] or [i] (WSR 13.1, 13.2). It is possible that this reflects a dialectal difference.

D. Another item, *páta* ‘now, recently’, appears with three variants. In Sawyer (1965), it appears with a stressed long vowel, *pá:ta* (Sawyer 1965:72). However, in the audio corpus, it appears with a stressed long vowel (WSR 3, 101), with an intervocalic /h/ (WSR 101), and with a short vowel (WSR 75, 77).

(13)	a.	<*pá:ta*>	‘now, just now’	(Sawyer 1965:72)
			‘a little while’	(WSR 101)
		<*pá:ta* | *ʔàh ʔopàʔukʰ mésiya·miʔ*>	‘right now I’m going to get the food ready’	(Sawyer 1965:72)
		<*pá:ta ʔah čó:kʰiʔ*>	‘I just went’	(WSR 3)
	b.	<*páhata*>	‘recently, a little while’	(WSR 101)
	c.	<*ʔah páta k’éma·yaʔ*>	‘I’m getting gray now’	(WSR 75)
		<*ʔah páta cʰácʰ mewíseʔ*>	‘I’m catching [a] cold now’	(WSR 77)
		<*páta ʔah cʰúc’eʔ*>	‘I’m sneezing’	(WSR 77)

E. What had been transcribed as <*c’ó·*> in Sawyer (1965) appears to actually be a unique case of vowel hiatus:

(14) <*c’ó·*> ‘redwood’ (Sawyer 1965:84)

retranscription:

/c’óo/ ‘redwood’ (WSR 78, 81, 93)

The distinction between the /óo/ sequence in this item and a long /ó:/ is primarily one of intonation; while a stressed long vowel typically has a smooth falling pitch, the vowel sequence in *c’óo* has an abrupt high-low transition between its two morae. Additionally, in several tokens there appears to be a back-velar or uvular constriction separating the two vowels, i.e. [c’óʁ̥o] (WSR 81). Sawyer himself, in a later publication (Sawyer 1991), also believed that *c’óo* was ultimately the correct transcription, and speculated that the second /o/ was once a separate, productive morpheme, appended to tree names;[86] thus this item was originally **c’ó-o* ‘redwood-tree’ (Sawyer 1991:32).

F. Two items appear to have a genuinely long vowel in isolation, but a short vowel when taking up certain positions in compounds:

(15) a. <*kú:ṭeʔ*> ‘Washington clam’ (WSR 3, 61.2, 67, 85, 86, 98)

<*lél kú:ṭeʔ*> ‘the thick Washington clam shell or the bead made from it’ (WSR 3)

[86] Nearly all tree names attested for Wappo end in -/o/; Sawyer believed that this was ultimately a grammaticized form of *hól*, ‘tree’ (Sawyer 1991:32).

b. <*kú̱ṯeʔ píʔ*> ‘Washington clam meat’ (WSR 85)

<*kú̱ṯeʔ p’éh*> ‘Washington clam shell’ (WSR 85)

(16) a. <*hancʰó̱:̱ya*>[87] ‘feeling sorry for somebody’ (WSR 100, 103)

b. <*k’á hancʰó̱ya*> ‘orphan’ (WSR 100)

<*ʔón hancʰó̱ya*> ‘orphans’ (WSR 100)

It seems likely that the metrical context is what is causing the differences in vowel length here: an original phonemic long vowel may be shortening in the context of having a stressed syllable either two syllables to the right (example 15), or two syllables to the left (example 16).

On the other hand, two items are simply the result of a typographical error, the accent marking in Sawyer (1965) being placed incorrectly:

(17) <*máyi caù̱·siʔ*> ‘Who’s saying that?’ (Sawyer 1965:88)

correction: *máyi cà̱u·siʔ*

verbal root: cáw- (phonetic form [cáu·])

(18) <*tʰik’apʰéʔi hokiù̱·kʰiʔ*> ‘The raccoon has made tracks’ (Sawyer 1965:107)

correction: *tʰik’apʰéʔi hokì̱u·kʰiʔ*

verbal root: kíw- (phonetic form [kíu·])

[87] This word appears in Sawyer (1965) with a medial <s> on pg. 95, and a medial <cʰ> on pgs. 60, 74, 78, 81, 120. An examination of the relevant WSR files (100, 103) confirms that /cʰ/ is the correct transcription.

Lastly, three items do not appear to be present in the WSR corpus, and so their status with regard to vowel length cannot be confirmed. These are:

(19)	a.	<*tí:yaʔ*>	'unidentified hawk'	(Sawyer 1965:49)
	b.	<*hučé:u:kʰiʔ*>[88]	'satisfied, feeling satisfied'	(Sawyer 1965:88)
	c.	<*mehá:pa*>[89]	'waste fibers stripped and rubbed off the roots used in basket making'	(Sawyer 1965:8)

This leaves only nine items from Sawyer (1965) that are confirmed to have a phonemically long tonic root vowel; these are listed in Table 4.7. The phonemic status of the vowel length in these items is concluded from the vowel length's unpredictability; there is no consistent phonotactic or phonological context in these items that would predict the existence of a long vowel in them, and all of them can be compared with a near-minimal twin that lacks a long vowel.

[88] The sequence <éu:> is very common in the Sawyer dictionary, while <hučé:u:kʰiʔ> is the only example containing <é:u:>; thus, it is likely that this is just a typographical error.

[89] <mehá:pa> (Sawyer 1965:8) appears as <meháp'a> elsewhere in the dictionary (Sawyer 1965:117), and so at least one form is likely a typographical error. Strangely, a form *meháp'a* appears in the audio corpus (WSR 98), but with the meaning 'spleen'.

Table 4.7

Words Attested in Sawyer (1965) Confirmed to Have a Phonemic Long Vowel

word	Sawyer 1965 pg.	gloss	transcription from the audio corpus	WSR
<sí:kaʔ>	37	‘feather man’	[sí:kaʔ]	108
<cá:ṭ’eʔ>	48	‘feather dance hat’	[cá:ṭ’eʔ]	3, 92, 100, 105
<ʔá:kal’>	54	‘husk or chaff’	[ʔá:kal’]	103, 108
<tú:leʔ>	46	‘white bone middle/ black bone outside’[90]	[tú:leʔ]	88, 110, 114
<há:ʔe>	55	‘isn’t it? aren’t you?’	[há:ʔe]	110
<ʔí:ʔih>	123	‘yes’	[ʔí:ʔi][91]	74, 81, 105
<hoté:kʰiʔ>	63	‘melted’	[hoté:kʰiʔ]	4, 77
<čó:kʰiʔ>	103	‘go (PFV)’	[čó:kʰiʔ]	3, 70, 115
<čó:siʔ>	45	‘go (FUT)’	[čó:siʔ]	3, 108, 114, 115

Among these items, two are discourse markers (*ʔí:ʔi*, ‘yes’, *há:ʔe,* ‘isn’t it?’) which can be prone to vowel length variation based on context and usage, and three are verbal allomorphs whose companion forms have a short vowel followed by coda /h/, i.e. *té:kʰiʔ* ~ *téh-*, *čó:kʰiʔ/čó:siʔ~ čóh-* (See further discussion in Chapter 6, Section 6.1.2). This leaves just four lexical items from Sawyer (1965) that have an unambiguous, non-varying long vowel: *sí:kaʔ, cá:ṭ’eʔ, ʔá:kal’, tú:leʔ.*

In addition to these, however, an examination of the audio corpus has revealed several lexical items not present in Sawyer (1965) that also appear to feature a genuine phonemically-long vowel. These new items are given in Table 4.8.

[90] This is a guess-call in the traditional Hand Game.
[91] The final <-h> in Sawyer’s transcription appears to be a boundary effect; see Section 4.2.8.

Table 4.8

Items from the Wappo Audio Corpus not Present in Sawyer (1965) that Feature a Phonemic Long Vowel

Wappo	elicitand	WSR file
c’íc’a mél lí:ta	‘acorns put in the holes in the trunk by the woodpeckers’	3
ʔohlí:taʔ, ʔopáʔukʰ ʔohlí:taʔ	‘to choke on food (past)’	82
čá:ni	‘the dance where the ladies run around like they’re going crazy’	92
pá:kaʔ pol’eʔ	‘cowboy’[92]	107
méy pú:suʔ	‘whale’[93]	79

Finally, a few items from Sawyer (1965) that feature *unstressed* long vowels are found to actually have *stressed* long vowels in the audio corpus. These are:

(20) <*ši:šáwo*> ‘black acorn bread’ (Sawyer 1965:11, 14)

retranscription: /ší:+šàwo/ (WSR 72)

(21) <*cʰo:nòma c’ín*>[94] ‘unidentified kind of weasel’ (Sawyer 1965:118)

retranscription: /cʰó:+nóma·+c’ìn/ (WSR 113)

[92] This is most likely a loan-translation of English “cowboy”; the first element *pá:kaʔ* is an adaptation of Spanish *vaca* ‘cow’, with the second element being native *pól’eʔ* ‘boy’. Note that Wappo also borrowed Spanish *vaca* as *wá:kaʔ* (see Sawyer 1965:24; WSR 67, 107).

[93] See discussion of this item in Sawyer (1991:83) (although it is incorrectly transcribed there with **pʰ* for *p*).

[94] *cʰó: nóma* may be a place name, and the possible origin of Sonoma, the name of the present-day county that lies west of Napa County and north of Marin County, north of San Francisco Bay, as well as the name of a town in Napa County (Van de Grift Sanchez 1914:241-2).

This then yields a grand total of fifteen items in the attested corpus of the Wappo language with confirmed phonemic stressed long vowels, excluding Spanish loanwords. These items are listed and described in Table 4.9.

Table 4.9

Native Wappo Words with a Phonemically Long Stressed Vowel

Wappo	gloss/elicitand	WSR file
/í:/		
/sí:kaʔ/	‘feather man’	108
/ší: šáwo/	‘black acorn bread’	72
/ʔí:ʔi/	‘yes’	74, 81, 105
/c’íc’a mél lí:ta/	‘acorns put in the holes in the trunk by the woodpeckers’	3
/ʔohlí:taʔ/	‘to choke on food (past)’	82
/é:/		
/té:k^{h}iʔ/	‘melt, flow (perf.)’	4, 77
/á:/		
/cá:ṭ’eʔ/	‘feather dance headdress’	3, 92, 100, 105
/čá:ni/	‘the dance where the ladies run around like they’re going crazy’	92
/ʔá:kal’/	‘husk or chaff; rye’	103, 108
/há:ʔe/	‘isn’t it?’	110
/ó:/		
/c^{h}ó: nóma· c’ìn/	‘unidentified kind of weasel’	113
/čó:k^{h}iʔ/	‘go (PFV)’	3, 85, 99, 101
/čó:siʔ/	‘go (FUT)’	114
/ú:/		
/méy pú:suʔ/	‘whale’	79
/tú:leʔ/	‘white bone middle/black bone outside’	88, 110, 114

It appears then that Wappo has an extremely marginal opposition between short vowels and long vowels. Unlike the neighboring Pomoan or Miwokan languages around Clear Lake, or indeed the majority of the linguistic stocks of California, where vowel length opposition is pervasive in the lexicon and in morphological processes (Golla 2011:209), Wappo does not appear to employ phonemic vowel length at all, save for a small number of idiosyncratic lexical items.

Strangely, however, Spanish loans into Wappo frequently feature phonemically long vowels, i.e. vowels that are contrastively long in duration and are not a product of the metrical effects described in Section 4.2.7. The most likely explanation for the presence of these long vowels in Spanish loans is that they are recent importations into Wappo from Pomoan or Miwokan – where phonemic vowel length is present – which in turn adopted them from Spanish. That is, the Spanish words likely passed through one or more Pomoan or Miwokan languages before arriving in Wappo, preserving the Pomoan or Miwokan long vowels along the way.

4.2.7 Allophonic Vowel Length

While Wappo largely does not have phonemic vowel length, it does have vowel length variations that are allophonic in nature. There are at least three cases in which a vowel in Wappo can be phonetically longer than other vowels within the same word:

1. Stressed vowels are usually slightly longer than unstressed vowels. In a sample of 74 CV́CV words, the first, stressed vowels averaged 117 milliseconds in length, while the second, unstressed vowels averaged 102 milliseconds; that is, the stressed vowels in CV́CV

words were on average 15% longer than the unstressed vowels in the same words. Greater vowel duration as an articulatory correlate of stress occurs in many languages around the world, including English, and thus this feature is fairly unremarkable in Wappo. Note, however, that there are many tokens in the audio corpus in which stressed and unstressed vowels within the same word have roughly equal duration.

2. Vowels in a final syllable closed by a glottal stop /ʔ/ – which are also almost always unstressed vowels – are sometimes subject to lengthening. This is always accompanied by glottalization of the vowel and sometimes nasalization; see sections 4.2.3 and 4.2.4. What is likely occurring in this case is that the articulation of the glottal stop is 'bleeding' into the preceding vowel, resulting in a laryngealized vowel with the combined duration of both the underlying vowel and (at least partially) the underlying glottal stop, i.e. /Vʔ/ → [V̰ː]

3. Vowels may be allophonically lengthened within certain metrical contexts. Both the syllable structure and placement of stress in Wappo words have an effect on vowel length, and in fact they are the principal causal or enabling mechanisms of phonetic vowel length variation in the language. The most common example of this is a context in which the vowel of a penultimate open syllable that immediately follows a tonic open syllable is lengthened phonetically. This context is so pervasive that it can even be found in many words of Spanish origin, a language which entirely lacks phonemic vowel length. Examples of this vowel lengthening rule are given in Table 4.10 below.

Table 4.10

Medial-Vowel Lengthening Rule

Syllables subject to vowel lengthening are in magenta

Phonemic		Phonetic	
/ṭʰé.ṭu.ma/	→	[ṭʰé.ṭu·.ma]	‘material for making twine or string’
/hu.ké.ce.ma/	→	[hu.ké.ce·.ma]	‘shoulder’
/pi.cʰá.ya.kʰiʔ/	→	[pi.cʰá.ya·.kʰiʔ]	‘it’s very bad, it’s terrible’
/ʔoh.ká.či.taʔ/	→	[ʔoh.ká.či·.taʔ]	‘hooked, lassoed’
/meh.má.ni.yaʔ/	→	[meh.má.ni·.yaʔ]	‘lift (vb.)’
/tú.ma.teʔ/	→	[tú.ma·.teʔ]	‘tomato’ (< Sp. *tomate*)
/wá.ra.haʔ/	→	[wá.ra·.haʔ]	‘playing-cards, card-deck’ (< Sp. *baraja*)

In a sample of 25 CV́CVCV words, that is, trisyllabic words with initial stress and consisting only of open syllables, the average length of the first, stressed vowel was 83 milliseconds, that of the medial vowel was 139 milliseconds, and that of the final vowel was 72 milliseconds; that is, in these words, the medial vowels were about 67% longer than the initial vowels, and nearly twice as long as the final vowels. As mentioned in Section 4.1.2, in order to distinguish vowels lengthened through this process from genuinely phonemic stressed long vowels, throughout this work the former are marked with a raised dot <·>, while the latter are marked with a colon <:>.[95]

There are two contexts, however, in which this rule is blocked. In the examples below, the blocking structures are marked in blue text.

[95] Phonetic *consonantal* lengthening is marked with a colon <:>; see Section 4.3.8.

1. If the vowel subject to phonetic lengthening is immediately followed by a glottal-stop-initial syllable, then the lengthening that would otherwise occur is blocked.

(22) /p’é.ṭʰa.ʔis/ → [p’é.ṭʰa.ʔis] ‘egg(s)’ (WSR 64, 80, 114)

(23) /ká.ka.ʔiš/ → [ká.ka.ʔiš][96] ‘faded, pale’ (WSR 73)

2. If the tonic syllable preceding the syllable subject to lengthening is closed (i.e. has a coda), phonetic lengthening likewise does not occur.

(24) /ṭ’ól.te.kʰiʔ/ → [ṭ’ól:.te.kʰiʔ] ‘caught’ (WSR 93)

(25) /pi.k’án.te.kʰiʔ/ → [pi.k’án:.te.kʰiʔ] ‘used to, accustomed to’ (WSR 9)

This may be partly due to a separate rule in which consonants with a [+continuant] feature are themselves lengthened when in the coda position of a stressed syllable (whether word-internal or word-final) (see Section 4.3.8); in (24) and (25) , the /l/ and /n/ codas of the tonic syllables are lengthened – [l:], [n:]. This lengthening may then prohibit lengthening of the following vowel due to moraic constraints.[97]

[96] The medial vowel in this item was slightly lengthened, but not as much as would be expected for other words of the medial-vowel-lengthening class; see WSR 73.

[97] All examples of the type found in (24) and (25) in both Sawyer (1965) and the WSR corpus occurred with a tonic coda that had a [+continuant] feature, except for two: /pič’áy’tekʰiʔ/ and /ʔokál’tesiʔ/. However, these have a glottalized sonorant as their tonic syllable coda – /y’/ and /l’/, respectively – which are phonetically [yʔ]

4.2.8 ‘Aspirated Vowels’ and Word-Final /h/

Paul Radin asserted that there was a category of ‘aspirated vowels’ in Wappo. The relevant statements from his 1929 grammar are quoted below:

> “All terminal vowels *that are not aspirated*, i.e., in other words, the overwhelming majority, are weakly glottalized.”
>
> (Radin 1929:9, emphasis added)

> “On superficial study all vowels, particularly terminal ones, seem to occur in three forms: *simple, aspirated, and glottalized*. The glottalized is, however, purely secondary and of no historical importance, *terminal vowels being always either glottalized or aspirated*. Similarly aspiration simply indicates a syncopated syllable, h+vowel, that has been reduced to <‘> owing to loss of following vowel.”
>
> (Radin 1929:11, emphasis and angled brackets added)

In the Wappo audio corpus, a large number of the words that appear to be vowel-final are closed with a long period of glottal frication. In the context in which most of these words appear, that of elicitation of single lexical items or short phrases, it is extremely difficult to tell whether this glottal frication period represents a genuine phonemic /h/ at the end of the word, or simply the release of breath at the end of the intonation phrase in which the item occurs; that is, since many of these items are single words given in response to an elicitation,

---

and [lʔ]. Thus these segments may already be taking up the same number of morae that a lengthened coda such as [n:] would.

the period of frication at the end may simply be a pragmatic side effect of uttering single-word responses to questions.

The only way to determine whether a given item with a glottal frication period genuinely does have a phonemic /h/ as a final consonant is to find other examples of the same word in which the frication is still present even with additional material following it. Such evidence, unfortunately, is sparse. Table 4.11 gives the only three items I was able to positively determine do in fact contain a word-final phonemic /h/, and the lines of evidence for each case.

Table 4.11

Words Proven to Have a Phonemic Final -/h/

Wappo	Gloss	Evidence	WSR files
ʔáh	‘I’ (1.sg.nom pronoun)	final /-h/ present even before another word within the same intonation phrase	many, including 2, 3, 4, 5, 9, 63, 66, 69, 70
ʔúh	‘already’	final /-h/ present even before another word within the same intonation phrase	9, 75, 77, 82, 96, 116
šáh	‘tooth’	*šáhlàh* ‘toothless; dull (of a knife)’ šáh=làh (tooth=NEG)	5, 96, 99
		šáhkàli ‘sharp’ šáh=kàli (tooth=LIKE)	99
		ʔišáhi č’ak’álkʰiʔ ‘(I) had my tooth pulled’ ʔi=šáh=i č’a-k’ál-kʰiʔ (1SG=tooth=NOM OFF-pull-STAT)	104

However, there are several adjectives that may have an ‘underlying’ final /h/; when they are uttered in isolation, they may or may not have a final frication period, but when suffixes are added, a phonemic /h/ is invariably present:

(26)	a.	*héwa(h)*	‘grown (up)’	(WSR 3, 5)
	b.	*héwah-kʰiʔ*	‘to be grown (up)’	(WSR 3, 5, 92)
	c.	*k’úpa(h)*	‘rotten’	(WSR 82, 93, 99)
	d.	*k’úpah-kʰiʔ*	‘to be rotten’	(WSR 82)

cf.:

(27)	a.	*táka*	‘soft, of fruit’	(WSR 96)
	b.	*táka·-kʰiʔ*	‘to be soft’	(WSR 81, 96, 108)

With this meager evidence, the most that can be said about Radin’s characterization of ‘glottalized and aspirated’ classes of vowels is that these classes don’t exist as such, but are rather just sequences of a vowel plus either a glottal stop /ʔ/ or a glottal fricative /h/. His assertion that *all* terminal vowels are either glottalized or aspirated is likewise not tenable, as there are many words that unambiguously end in a plain vowel with no following segment; evidence for this includes the fact that the final vowel in such words is eclipsed when vowel-initial affixes or clitics are added, as in (29); or that the vowel is subject to lengthening when additional syllables are added, as in (30).

(28)	a.	*k’éšu*	‘deer’	
	b.	*k’éši*	‘deer (nom. case)’	(morphologically *k’éšu=i*)

cf.:

(29)	a.	*šáh*	‘tooth’	
	b.	*šáhi*	‘tooth (nom. case)’	(morphologically *šáh=i*)

cf.:

(30) a. *táka* ‘soft, of fruit’ (WSR 96)

b. *táka·-kʰiʔ* ‘to be soft’ (WSR 81, 96, 108)

4.3. Acoustic Phonetics of Consonant Phonemes

Unlike the vowels, the consonants show relatively little phonetic variation, other than variations in duration for specific consonant classes in different positions within the word; for discussion of this, see Section 4.3.8. A few of the more prominent phonetic variations are briefly discussed here.

4.3.1 Lenition of Stops

Some consonants, particularly the plain stops, are subject to sporadic lenition in certain contexts. In particular, the plain dental stop /t/ is often realized as an interdental fricative [θ] when the speaker’s energy seems low and articulation is less forceful:

(31) *hut̲úku·lu* [huθúku·lu] ‘owl’ (WSR 91, 114)

The glottalized dental stop /t’/ is likewise sometimes affricated, [t̪͡θ’]:

(32) *hét̲’iskʰiʔ* [hét̪͡θ’iskʰiʔ] ‘to carry’ (WSR 77)

4.3.2 Allophones of /h/

The glottal fricative /h/ can sometimes occur as a voiceless bilabial fricative [ɸ] when adjacent to a back rounded vowel and/or a labial or velar segment; as a voiceless palatal fricative [ç] when adjacent to a front unrounded vowel; and as a voiceless velar fricative /x/ when following a low central vowel and preceding a velar stop:

(33) *ʔoh̲kúkʰiʔ* [ʔoɸ̲kúkʰiʔ] ‘bent’ (WSR 96)

(34) *ʔoh̲púc’tiʔ* [ʔoɸ̲púc’tiʔ] ‘kiss! (IMP)’ (WSR 77)

(35) *pʰáʔih̲kʰiʔ* [pʰáʔiç̲kʰiʔ] ‘fired (a gun)’ (WSR 93)

(36) *č’ap’én’ah̲kʰiʔ* [č’ap’én’ax̲kʰiʔ] ‘fallen off’ (WSR 99)

/h/ can also occasionally appear voiced, [ɦ], when intervocalic or when adjacent to a glide:

(37) *k’à húṭ’* [k’àɦ̲úṭ’] ‘crazy person’ (WSR 116)

(38) *làhyáke* [làɦ̲yáke] ‘thunder’ (WSR 66)

(39) *mehwóysiʔ* [meɦ̲wó(y)i·siʔ] ‘to rub’ (WSR 116)

4.3.3 Syncope of Glides

The plain glide phonemes /w/ and /y/ may sometimes disappear when intervocalic and preceding /u/ (for /w/) or /i/ (for /y/):

(40) *meynaléwukʰ* [meynaléukʰ] ‘type of feather headdress’ (WSR 92, 100, 105)

(41) *paht’áwu* [paht’áu] ‘in the middle’ (WSR 95)

(42) *č’áyiʔ* [č’áiʔ] ‘one-stick basket’ (WSR 2, 86)

4.3.4 Height-Harmonic Diphthongs[98]

The height-harmonic diphthongs /uy/ and /uy’/ may occasionally undergo a type of feature-metathesis in which the nucleic and glide portions of the diphthong switch order; that is, the ‘falling’ nature of /uy, uy’/ is transformed into its ‘rising’ equivalent [wi, wi’]. This appears to occur when the onset consonant before the /uy(’)/ sequence is labial or velar:

(43) *híni mamúyelkʰiʔ* [hí.ni ma.mwí.yel.kʰiʔ] ‘the sun is rising’ (WSR 78)

(44) *múy’is* [mwí.ʔis] ‘wild tulip’ (WSR 91)

(45) *pʰúy’iʔ* [pʰwí.ʔiʔ] ‘to blow with the mouth’ (WSR 74)

(46) *may’kʰúy’e·ma* [may’.kʰwí.ʔe·.ma] ‘anything to wear’ (WSR 90)

(47) *may’pʰéʔ kʰúy’e·ma* [kʰwí.ʔe·ma] ‘shoe’ (WSR 101)

[98] The term ‘height-harmonic diphthong’ refers to diphthongs whose two components are both at the same articulatory height, as opposed to ‘closing’ diphthongs, where the offglide is higher (more close) than the vowel portion (e.g. ai̯), and ‘opening’ diphthongs, where the offglide is lower (more open) than the vowel portion (e.g. ia̯).

Very occasionally, the same thing happens to the other height-harmonic diphthong, /íw/, when preceded by a /k/ onset, transforming it into [yú]:

(48)	*mehkíwkʰiʔ*	[meh.kyú·.kʰiʔ]	‘connecting object sits/stands’	(WSR 2[99])

<u>4.3.5 Loss of Aspiration</u>

Loss of root-final aspiration of stops occurs when an enclitic or suffix beginning in a homorganic stop immediately follows:

(49)	a.	*kó<u>kʰ</u>*	‘liver, core’	(WSR 8, 61.1, 64, 88, 114)
	b.	*kó<u>k</u>=k’a*	‘liver, core’ (comitative case)	(Sawyer 1965:60)

(50)	a.	*nó<u>kʰ</u>*	‘friend’	(WSR 98, 106)
	b.	*nó<u>k</u>=k’a*	‘friend’ (comitative case)	(WSR 106)

(51)	a.	*c’ó<u>tʰ</u>*	‘mosquito’	(WSR 61.2, 75, 78, 81)
	b.	*c’ó<u>t</u>-te*	‘mosquitos’	(WSR 61.2)

cf.:

(52)	a.	*nó<u>kʰ</u>*	‘friend’	(WSR 98, 106)
	b.	*nó<u>kʰ</u>-ta*	‘friends’	(WSR 93)

[99] the third token only

4.3.6 Loss of Glottalization

Similarly, loss of root-final glottalization of stops may occur when a suffix beginning in a homorganic stop immediately follows:

(53) a. *ma-c'ót̲'el-*k^h*iʔ* 'to stick, adhere (perfect)' (WSR 9)

b. *ma-c'ót̲-tiʔ* 'stick (it)!' (WSR 9)

(54) a. *kút̲'-iya* 'small' (WSR 93, 95, 100)

b. *ʔoh-kút̲-tiʔ* 'make (it) smaller!' (WSR 96)

However, alternation between plain and glottalized segments is not only a phonetic phenomenon, as in examples (53) and (54), but a larger morphophonological one that occurs especially across different members of inflectional and derivational paradigms. See Chapter 6, Section 6.1 for discussion of these paradigmatic changes in glottalization.

4.3.7 Loss of /ʔ/

The glottal stop is found in a large proportion of Wappo words; it is present in many nouns and adjectives, it occurs in multiple affixes and clitics, and in verbs, it is a marker of 'non-dependency' – verbs in main clauses are uniformly 'marked' by a final glottal stop, while verbs in dependent/subordinate clauses are uniformly 'unmarked' by the lack of a final glottal stop. Phonotactically, the glottal stop may occur word-initially (no Wappo word can begin with a vowel), intervocalically, and in coda position, both before another syllable or word-finally.

Despite its ubiquity, loss of the glottal stop is a relatively common feature. In some cases, this is dependent on speech rate (it is more likely to disappear in faster speech), on phonotactics (it is more likely to disappear when adjacent to certain other consonants), on word structure, and on stress. A few examples of the more common contexts for loss of the glottal stop are given below.

Word-final glottal stops are prone to disappear when a consonant-initial suffix follows them or when another word is compounded on after them:

(55)	a.	*t'óse<u>ʔ</u>*	'friend [female-female only]'	(Sawyer 1965:42)
	b.	*t'óse<u>Ø</u>-te*	'friend (plural)'	(Sawyer 1965:42)
(56)	a.	*mé<u>ʔ</u>*	'hand'	(Sawyer 1965:48)
	b.	*mè<u>Ø</u>+hóle*	'finger (lit. hand+twig)'	(WSR 8)
(57)	a.	*pʰe<u>ʔ</u>*	'foot'	(Sawyer 1965:41)
	b.	*pʰè<u>Ø</u>+lúkuʔ*	'ankle (lit. foot+joint)'[100]	(WSR 90, 98, 114)

Note that in (55b), the medial vowel of *t'ósete* is not subject to the medial vowel lengthening rule that would be expected for a CV́CVCV word (see section 4.2.7). This implies that the medial vowel-lengthening rule operates at a level below that of the surface form [t'ósete], CV́.CV.CV, as the underlying form is /t'óseʔte/, CV́.CVC.CV

[100] Note that 'ankle' is transcribed in Sawyer (1965:4) as having a long vowel in the first syllable, i.e. <pʰe:lúkuʔ>. However, in the audio corpus, it clearly occurs with a short vowel in these syllables (WSR 90, 98, 114). Thus, this item is an example of simple coda /ʔ/ deletion, not accompanied by compensatory vowel lengthening as the Sawyer (1965) transcription would suggest.

Word-final glottal stops also often disappear in the elicitation context, especially when the speaker sounds fatigued. This does not seem to be conditioned phonologically. In such cases, they may be replaced with a glottal fricative, /h/:[101]

(58) *cʰácʰkʰiʔ* → [cʰácʰkʰih] 'to be cold' (WSR 77)

Glottal stops between two identical unstressed vowels may also occasionally disappear; when they do, the result is often a phonetic long vowel:

(59) a. *màʔa ʔíhaʔ* 'sometimes, once in a while' (WSR 101)

b. [mà: ʔíhaʔ ʔàh mí náw'i·siʔ] 'I'll see you sometime' (WSR 101)

This last process appears to also sporadically occur with the glottal fricative /h/:

(60) [páhata ~ pá:ta] 'recently, just' (WSR 3, 101)

When two laryngeal segments become adjacent (usually across a morpheme boundary), the first of the two laryngeals (the one in coda position) is prone to deletion:

(61) *maʔ̲háys* 'ten'

[maʔ̲háys] (WSR 111)

[maØ̲háys] (WSR 62)

[101] This surfacing of /h/ is more a pragmatic phenomenon rather than a phonetic one; the /h/ here could be marking a phrase boundary.

(62) *míʔ ce háṭiskʰiʔhiʔ* ‘do you know about that?’

|míʔ ce háṭis-kʰi-ʔ=hiʔ|

2SG.NOM that know-STAT-NONDEP=Q

[míʔ ce háṭiskʰiØhiʔ] (WSR 93)

(63) *ʔúh ʔah cámtaʔ* ‘I did it already’

|ʔúh ʔah cám-taʔ|

already 1.SG.NOM do-PST

[ʔúØ ʔaØ cámtaʔ] (WSR 98)

(64) *ʔúh ʔah ʔohcáy’taʔ* ‘I’ve already blocked it’

|ʔúh ʔah ʔoh-cáy’-taʔ|

already 1.SG.NOM CAUS-block-PST

[ʔúØ ʔaØ ʔohcáy’taʔ] (WSR 116)

4.3.8 Consonant Duration

Like vowels, consonants in Wappo may also vary in length, and like the vowels, this process is driven by syllable structure and position within the word.

The chief determinant of consonant length in Wappo is position within the word. Four position classes have been identified: word-initial; intervocalic; word-final; and ‘internal coda’, that is, non-final coda position. Figure 4.8 gives the average durations of the major manner classes of consonants in Wappo distributed according to these four positions. Note that the duration measure here for stops is only for the closure duration of the primary articulators, and does not include any intervals after release of the articulators (e.g. VOT, or the silence interval in ejectives); thus measurements are not available for stops in isolated word-initial position. The duration measurement for affricates measures both the stop component and the fricative component. The measurements here for glottalized sonorants only measure the duration of the sonorant portion, not the glottal portion. Note also that plain stops do not occur in word-final position, and plain affricates do not occur in codas at all; see Chapter 3.

Figure 4.8

Positional Closure Durations of Various Consonant Classes (n=524)

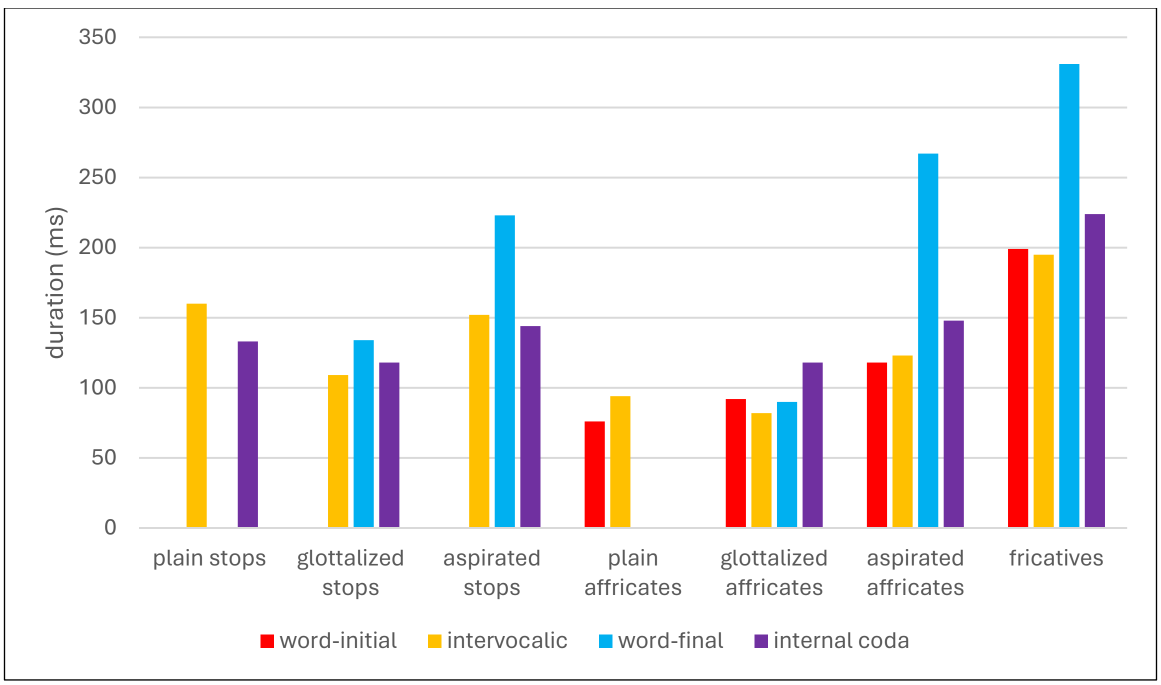
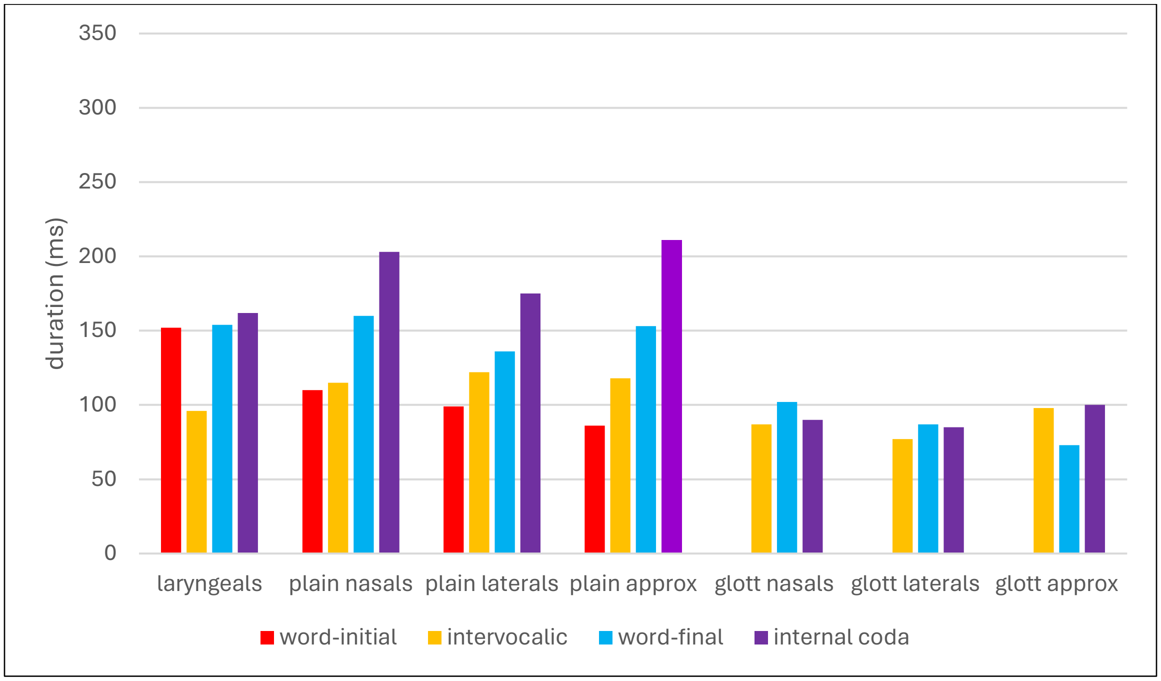


Figure 4.8 (continued)

Positional Closure Durations of Various Consonant Classes (n=524)



All consonant classes are longer on average in coda position (whether word-final or word-internal) than in onset position (whether word-initial or intervocalic). The most dramatic difference in length is seen among aspirated affricates, which occur about twice as long in word-final position as in onset position, and fricatives, which occur about 50% longer in word-final position than in onset position. Aspirated stops are likewise notably lengthened in word-final position compared to other positions. The least amount of positional variation is seen among the glottalized sonorant group, which are relatively constant in all positions (although glottalized glides are somewhat shorter intervocalically), and the laryngeals /ʔ/ and /h/, which are also relatively similar in duration in all positions, except intervocalic, where they are somewhat shorter.

Taking the observations above, we can formulate some general rules about allophonic consonant length variation (lengthened consonants are set in fuchsia text below).

1. The plain nasal sonorants /m/ /n/ and the plain lateral sonorant /l/ are phonetically longer when in the coda position of stressed, non-final syllables, than in any other position:

(65)	a.	/yóm.toʔ/	→	[yóm:.toʔ]	‘shaman, doctor’
	b.	/súm.so.ke/	→	[súm:.so.ke]	‘evening star’
	c.	/hín.ta/	→	[hín:.ta]	‘day’
	d.	/ʔón.pi/	→	[ʔón:.pi][102]	‘below, under’
	e.	/wál.ma/	→	[wál:.ma]	‘mud’
	f.	/p’íl.šeʔ/	→	[p’íl:.šeʔ]	‘to rush, move rapidly’

2. Phonetic lengthening also occurs with the plain glide series /w/ /y/ in the coda position of stressed non-final syllables, but in this case, the lengthening causes these segments to become vocalic, essentially adding a new medial syllable to the words in which they occur. In fact, the polysyllabic surface form with a lengthened medial [i·] or [u·] is how these words were consistently transcribed in Sawyer (1965). Some examples are given below.

[102] Unlike those in many other languages, the nasal phonemes /m/ and /n/ in Wappo do not appear to undergo place assimilation to a following consonant, at least within the more careful speech of the elicitiation context. For example, /ʔonpi/ ‘below, under’, is phonetically [ʔón:pi], not *[ʔóm:pi] (Note that in Sawyer (1965), this item is transcribed with <m>, but in the audio corpus it is still clearly a coronal nasal, [n] (WSR 95)). Whether this holds true for more rapid, connected speech will need to await a future study.

(66)	a.	/c’éw.saʔ/	→	[c’é.u·.saʔ]	‘to ask’
	b.	/k’áy.saʔ/	→	[k’á.i·.saʔ]	‘to wish’
	c.	/huh.móy.šeʔ/	→	[huh.mó.i·.šeʔ]	‘to think about’
	d.	/hu.k’úy.kʰiʔ/	→	[hu.k’ú.i·.kʰiʔ]	‘to be quiet, still, not move’
	e.	/ma.kʰúy.miʔ/	→	[ma.kʰú.i·.miʔ]	‘to put something on or in’

3. The fricatives /s/ and /š/ are likewise subject to phonetic lengthening in coda position, both word-internally and word-finally, and regardless of the placement of word accent. Unlike with the nasal and lateral sonorants, fricatives are longest in word-final position, with internal-coda position being only slightly longer than word-initial or intervocalic position.

(67)	a.	/yéniš/	→	[yé.niš::]	‘jackrabbit’
	b.	/hokʰácis/	→	[ho.kʰá.cis::]	‘forked, like a stick or a road’
	c.	/c’éšma/	→	[c’éš:.ma]	‘sinew, muscle, gristle’
	d.	/ʔoʔásmiʔ/	→	[ʔo.ʔás:.miʔ]	‘to leach acorns’

Phonetic lengthening of word-final fricatives, incidentally, is also a feature of Eastern Pomo, the language spoken immediately to the north of the Wappo homeland (McLendon 1969:514).

4. The plain affricates /c/ and /č/ are phonotactically prohibited from occurring in coda position, whether word-internally or word-finally; this means that (apart from the glottalized

affricates) only the aspirated affricates /c^h/ and /$\check{c}^h$/ are available to be analyzed for length variation in coda position relative to other positions. The front-coronal aspirated affricate /c^h/ is longer in its fricative component in word-final position than elsewhere; the average frication length word-finally is 267 ms (n=15), compared to word-initial position (144 ms, n=11), internal-coda position (139 ms, n=6), and intervocalic position (132 ms, n=13). The frication period for the back-coronal aspirated affricate /$\check{c}^h$/ is shorter in two of these positions than its front-coronal counterpart: in word-initial position, the frication period for /c^h/ is 91 ms (n=11) compared to 144 ms (n=11) for /$\check{c}^h$/, while in intervocalic position, the frication period for /c^h/ is 113 ms (n=11) compared to 132 ms (n=13) for /$\check{c}^h$/. In internal-coda position, conversely, the frication period for back-coronal /$\check{c}^h$/ is actually longer than that of front-coronal /c^h/, 157 ms (n=3) to 139 ms (n=6), respectively; however, this is a very small sample size and thus little can be concluded from it. There are no examples of /$\check{c}^h$/ in word-final position in the Wappo audio corpus.

4.4 Spectrograms

This section will illustrate some of the phonetic details of the Wappo consonants through waveform and spectrogram data.

4.4.1 Stops and VOT

As discussed in Chapter 2, Wappo has three series of stops/affricates: plain (unaspirated), glottalized, and aspirated. Figures 4.9, 4.10, and 4.11 give spectrograms of the labial set /p p’ p^h/ in word-initial position in order to compare the differences in VOT generally between the three stop series.

As can be seen, the VOT of the plain stop /p/ is much shorter in duration than the VOT of either the aspirated stop /pʰ/ or the glottalized stop /p'/. Between the latter two, the VOT of the aspirated stop /pʰ/ is slightly longer than that of the glottalized stop /p'/. The aspirated stop /pʰ/ is also characterized by a certain amount of turbulence between the release of the articulators and the onset of voicing, while the glottalized stop /p'/ is characterized by near-silence during the equivalent interval.

Figure 4.9

Spectrogram for Word-Initial /p/

páy'　　'alone'　　(WSR 114)

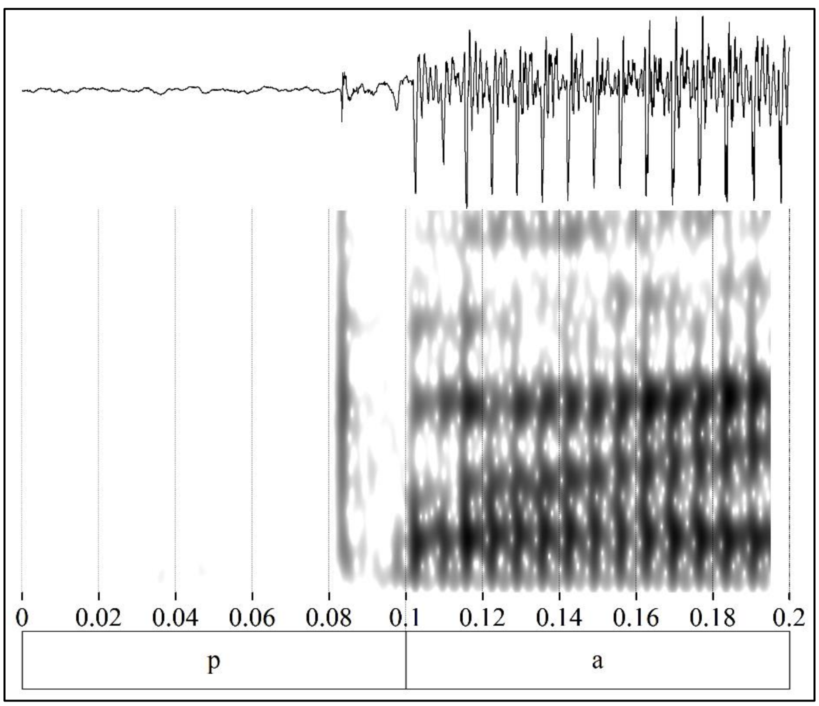


Figure 4.10

Spectrogram for Word-Initial /pʰ/

pʰáʔma ‘soaproot top(s)’ (WSR 100)

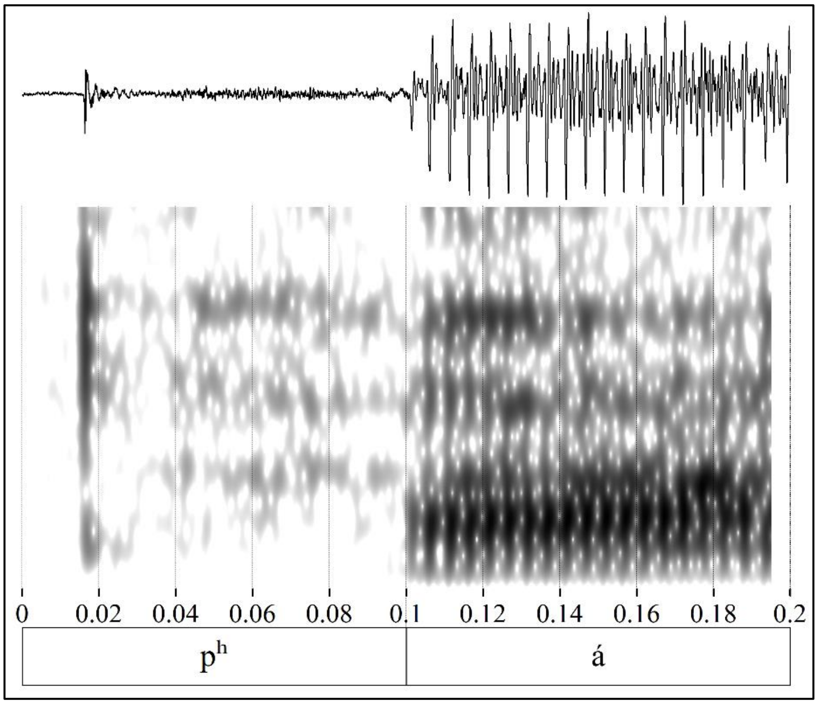
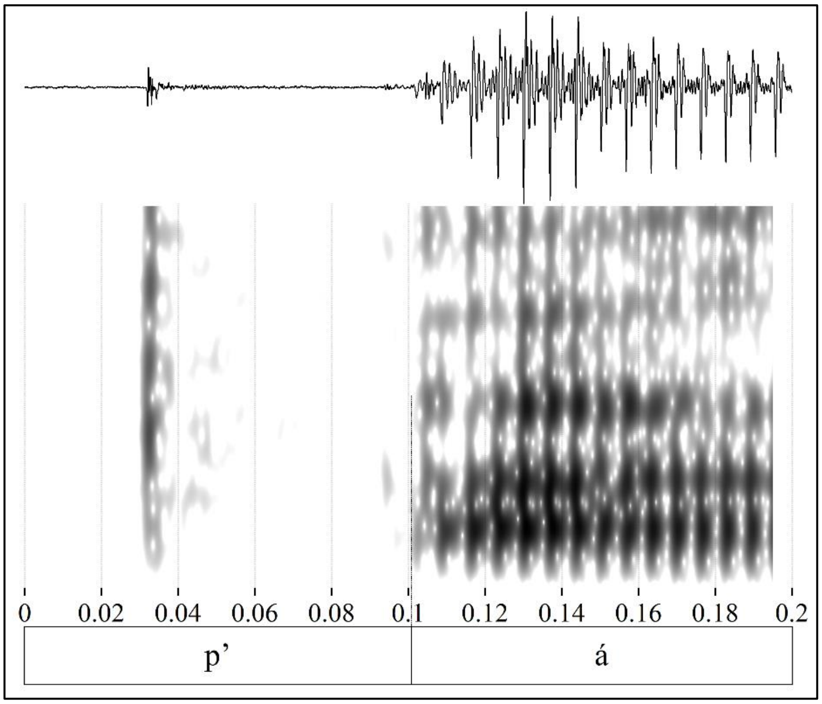


Figure 4.11

Spectrogram for Word-Initial /p’/

p’ála ‘twin’ (WSR 109)



4.4.2 Affricates and VOT

Whereas the VOT values of the three stop series differ substantially, the difference in laryngeal timing between the plain, aspirated, and glottalized affricate series is more subtle. Figures 4.12, 4.13, and 4.14 show the acoustic distinctions between these three affricate series.

Contrasting Figures 4.12 and 4.13, we can see that there is a diminution in intensity for a brief period between the fricative component of the affricates and the onset of voicing; for the plain affricate, this duration of the diminution is quite small, only a few milliseconds long, while that of the aspirated affricate is somewhat longer, on the order of 30-40 milliseconds. The noise during this period of reduced intensity in the aspirated affricate is concentrated at the frequencies of the formants in the upcoming vowel. This short, quiet period of aspiration is the feature that distinguishes the plain affricate series from the aspirated affricate series.

By contrast, for the glottalized affricate (Figure 4.14), we see instead a period of near-silence between the fricative component of the affricate and the onset of voicing, which in duration is somewhat longer than the period of intensity diminution for the aspirated affricate. This period of near-silence is what characterizes the glottalized affricate series.

Figure 4.12

Spectrogram for Word-Initial /c/

cáw 'top, point' (WSR 78)

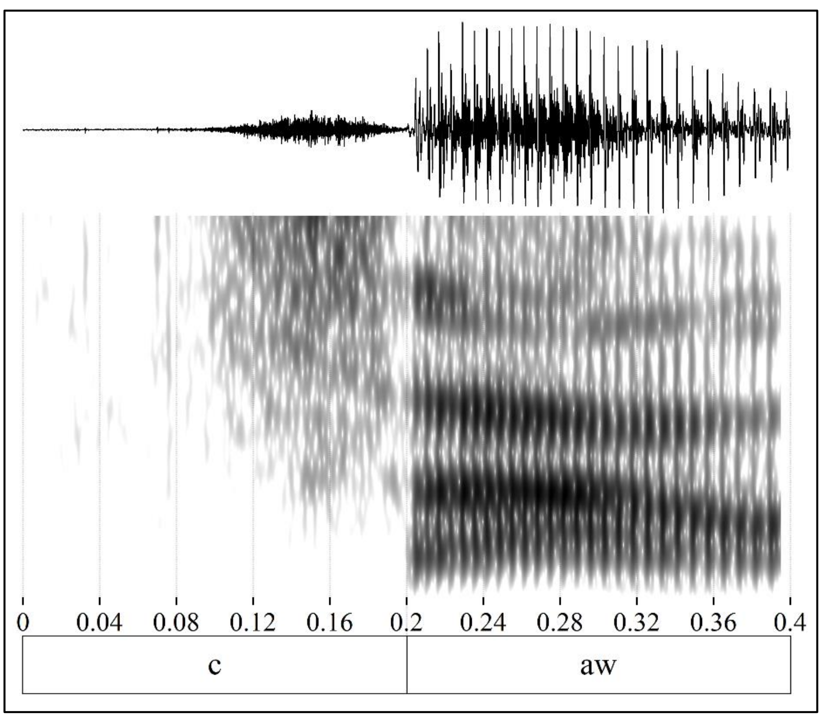


Figure 4.13

Spectrogram for Word-Initial /c^h/

c^hác^h 'cold' (WSR 81)

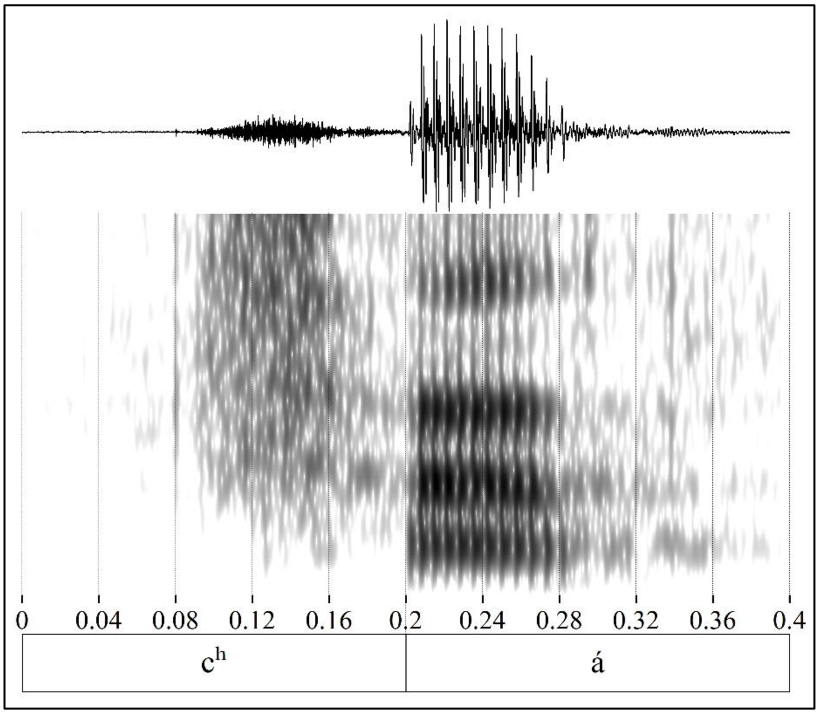
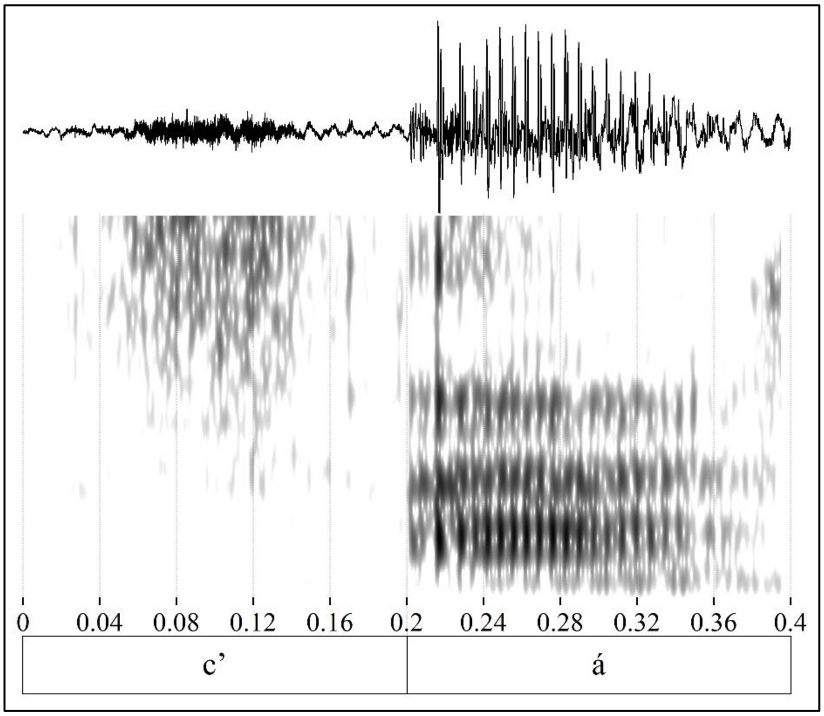


Figure 4.14

Spectrogram for Word-Initial /c'/

c'áš 'Indian sand paper [*Equisetum*]' (WSR 91)



4.4.3 Front-Coronal /t/ and Back-Coronal /ṭ/

Wappo has two phonemic coronal stop places, a front-coronal place which is dental or interdental, and a back-coronal place which is alveolar or post-alveolar (occasionally trending toward retroflex). Figures 4.15 and 4.16 give examples of each of these stop places, in the plain series.

The main spectral differences between /t/ and /ṭ/ in intervocalic position are seen in the formant shifts in the preceding vowel. For the dental /t/, there is a rise in the F2 of the preceding vowel, corresponding to an increase in vowel frontness, as the tongue tip moves into contact with the front teeth; this can be seen between timecode 0.1 and 0.15 in Figure

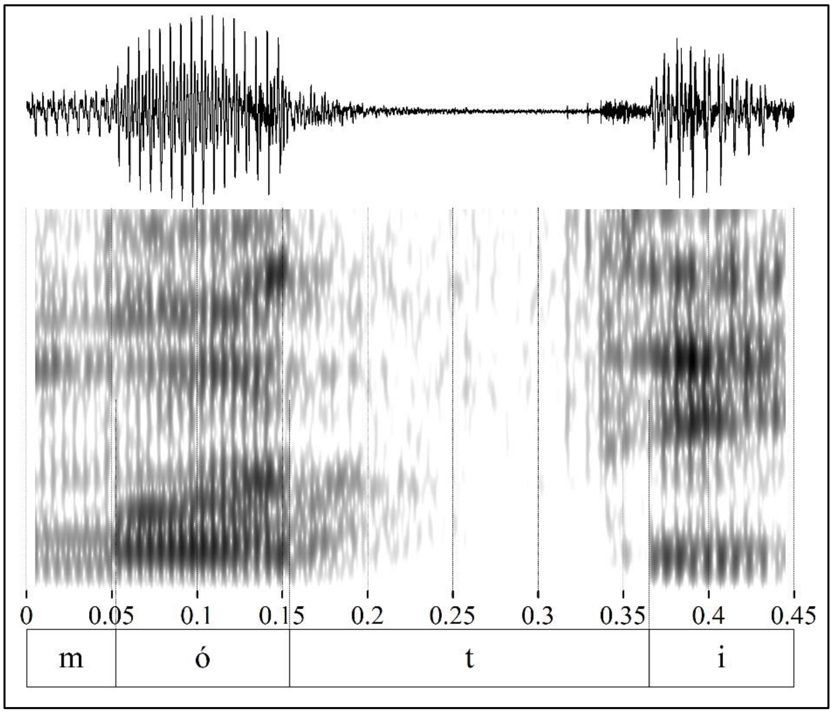
4.15. By contrast, the alveolar /ṭ/ causes not only a small rise in the F2, but a large drop in the F3, such that both formants approach each other at the point of onset of the articulatory closure of the following stop; this can be seen between timecodes 0.1 and 0.15 in Figure 4.16. One caveat is that this description is particular to intervocalic position following the vowel /o/; while the distinction between /t/ and /ṭ/ is mostly consistently held across different phonotactic positions and vowel contexts, each of the two coronal stop phonemes do have some variation in expression according to those contextual differences.

Another distinction between the two stop places is in the characteristics of the release period of the articulators just before the onset of voicing in the following vowel. For the dental /t/, the release is seen as a moderately-intense burst in the mid-to high range of the spectrum, with the peaks in intensity in the burst tracking the formants of the following vowel; this can be seen around timecode 0.35 in Figure 4.15. By contrast, for alveolar /ṭ/, there is a shorter but much more intense release burst, in which the highest points of intensity are found well above the F3 of the following vowel; this can be seen just after timecode 0.3 in Figure 4.16. Perceptually, the release burst of the dental stop /t/ has a (unsurprisingly) dental cast, with the noise of the release being reminiscent of an interdental fricative [θ], while the release burst of the alveolar stop /ṭ/ generally has an alveolar-apical cast, with the noise of the release being reminiscent of an apical sibilant fricative such as [s̺].

Figure 4.15

Spectrogram for Intervocalic /t/[103]

mótis ‘grass used in the grass game’ (WSR 88)

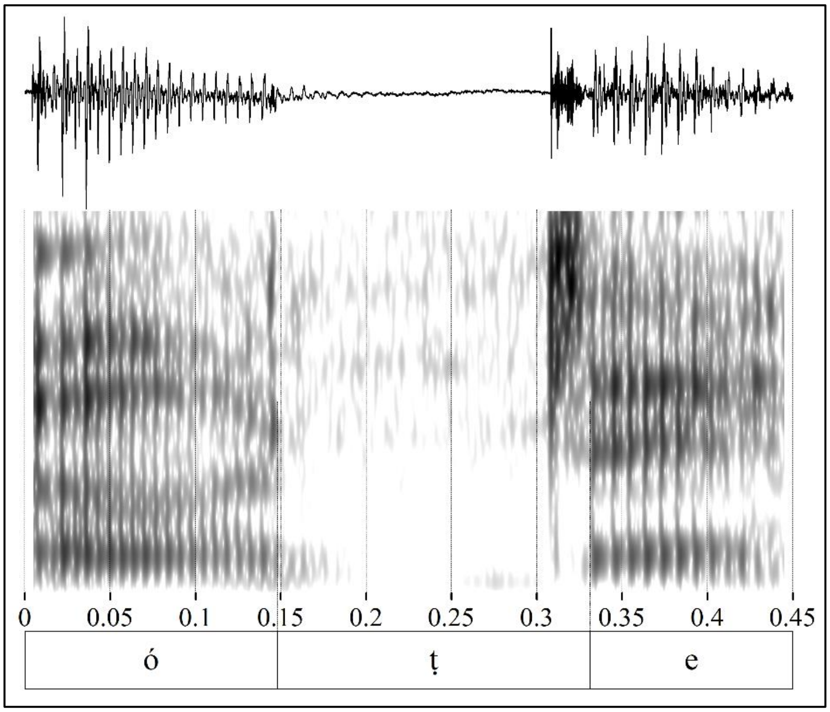


[103] In the elicitation context, it was noted that intervocalic consonants after a stressed vowel tended to be lengthened, as can be seen in the relatively long segment length of /t/ in this figure. However, I believe this to be a pragmatic effect rather than an allophonic one.

Figure 4.16

Spectrogram for Intervocalic /ṭ/

č'óṭe　　　'flea'　　　(WSR 67)



4.4.4 Glottal Stop /ʔ/

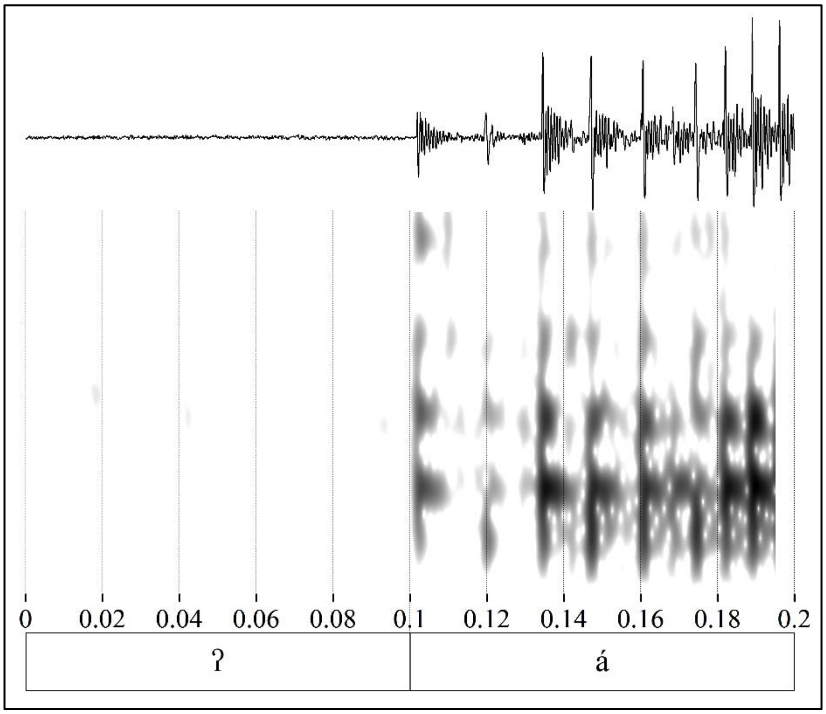
The glottal stop is a frequent segment in the Wappo phoneme inventory (see Chapter 3), and is phonotactically unrestricted. Its realization, however, varies significantly by position in the word, in both duration and quality. In all positions, however, it generally causes glottalization in adjacent vowels, characterized by lower fundamental frequency and a drop in F1.

Word-initial glottal stop is a simple opening of the glottis from a resting state into a following vowel; often the initial portion of the vowel shows glottalization. Figure 4.17 gives an example of word-initial glottal stop.

Figure 4.17

Spectrogram for Word-Initial /ʔ/

ʔáwe ‘kidney; potato’ (WSR 79)

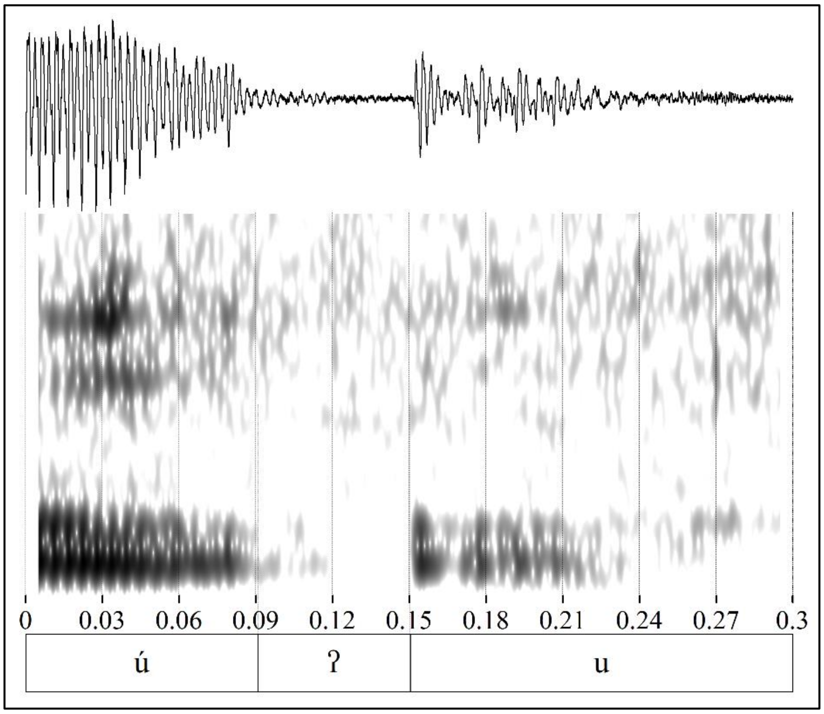


Intervocalic glottal stop is more variable. In careful speech contexts, it is a sharp closure of the glottis, firmly separating the preceding and following vowels. This can be seen in Figure 4.18.

Figure 4.18

Spectrogram for Intervocalic /ʔ/ - careful speech context

húʔu 'ahead, in front' (WSR 98)

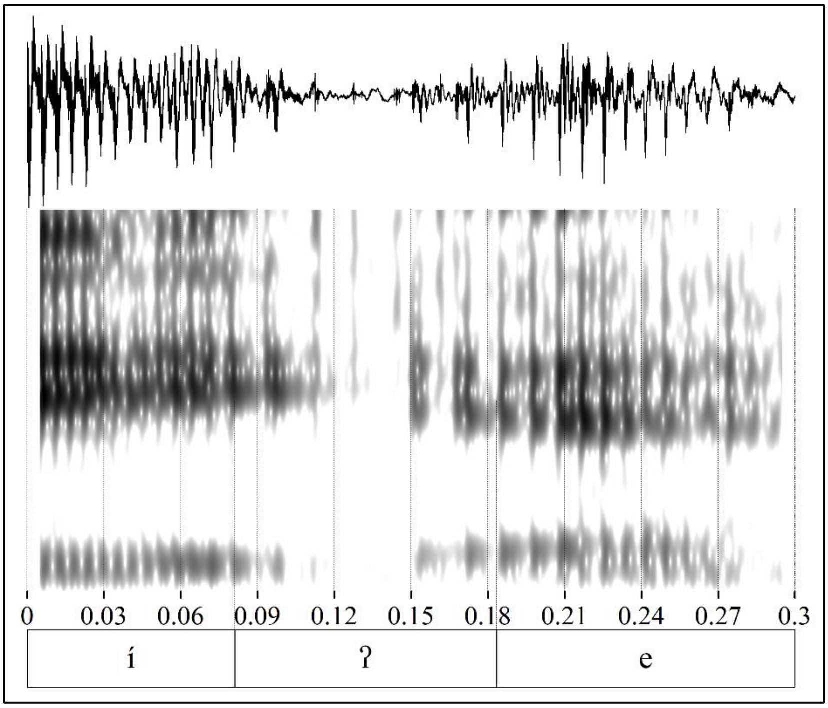


However, in more rapid speech, the intervocalic glottal stop can be 'weakened' into a period of glottalization, with a minimal break in voicing, in the transition between the preceding and following vowel. This can be seen in Figure 4.19.

Figure 4.19

Spectrogram for Intervocalic /ʔ/ - more rapid speech context

šíʔe 'grass' (WSR 90)

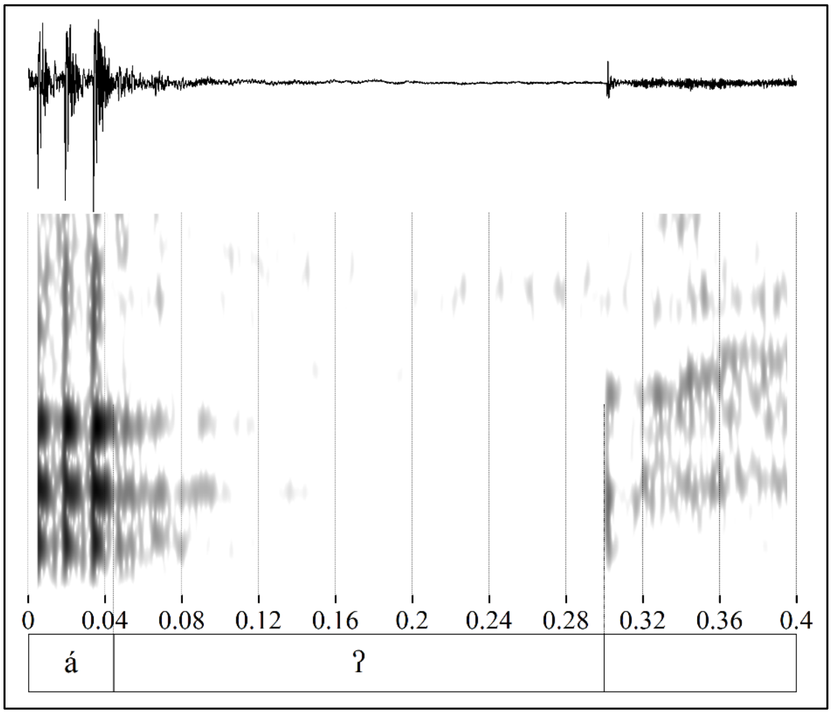


In word-final position, particularly after a stressed vowel, the glottal stop again is realized as a strong closure of the glottis, cutting off any voicing. The duration of this closure can furthermore be quite long; a measurement of 16 tokens of word-final glottal stops after stressed vowels showed an average closure duration of 199 milliseconds. The release of the glottis at the end of the duration then results in a spike in amplitude as the remaining air below the glottis is let out. Figure 4.20 gives a typical example of this type of 'strong' word-final glottal stop:

Figure 4.20

Spectrogram for Word-Final /ʔ/ (strong articulation)

káʔ ‘crow’ (WSR 67)



Lastly, glottal stops occupying a word-internal coda are also often realized as complete closures of the glottis, with the duration of the closure similarly being long; a measurement of 16 examples of word-internal coda glottal stops after stressed vowels showed an average closure duration of 134 milliseconds. In this position, an epenthetic schwa [ə] often surfaces upon the release of the glottis, as a transition between this segment and the following consonant. Figure 4.21 gives an example of a glottal stop in word-internal coda position; the epenthetic schwa [ə] can be seen roughly between 0.27 and 0.30 seconds.

Figure 4.21

Spectrogram for Word-Internal-Coda /ʔ/

kéʔšeʔ ‘to break (of a twig or branch)’ (WSR 117)

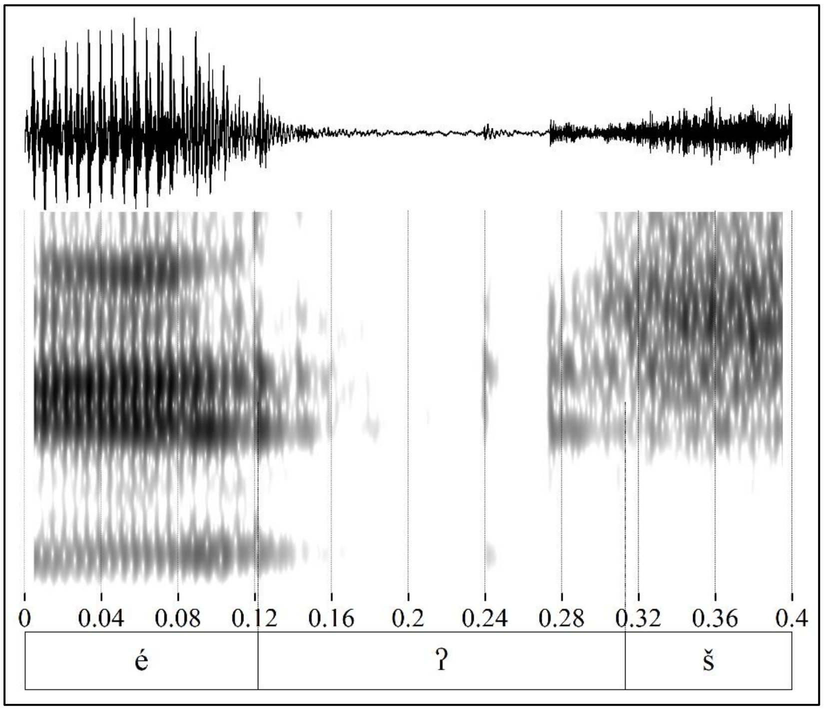


Table 4.12 gives the differences in average duration (in milliseconds) of the glottal stop closure for the three positions of intervocalic, word-final, and word-internal (word-initial glottal stop duration is not measurable in isolation).

Table 4.12

Glottal Stop Durations by Position

	word-initial	intervocalic	word-final coda	word-internal coda
/ʔ/	[not measurable]	62 ms	199 ms	134 ms
		(n=11)	(n=16)	(n=16)

4.4.5 Glottal Fricative /h/

The glottal fricative /h/ of Wappo is phonetically a prototypical ‘h’-sound, as found for example in English or German. Language-internally, it patterns strongly with the glottal stop /ʔ/ in terms of morphophonemic distribution, the alternation between the two phonemes sometimes serving grammatical purposes.

However, in terms of its durational patterns, /h/ is somewhat unique, patterning neither entirely with the /ʔ/ nor entirely with the coronal fricatives /s/ and /š/. While both /ʔ/ and the coronal fricatives /s š/ find their greatest duration in word-final coda position, /h/ is longest in word-internal coda position, similar to the plain sonorants /m n l w y/. Also unlike the coronal fricatives, /h/ is somewhat longer in initial position than in intervocalic position, while the coronal fricatives display roughly equal duration in both positions. /h/ is also longer in absolute terms than /ʔ/ in all positions except word-finally; /h/ averages 130 milliseconds in duration (n=5) in intervocalic position compared to 62 milliseconds (n=11) for /ʔ/; and /h/ averages 190 milliseconds in duration (n=69) in word-internal coda position compared to 134 ms (n=16) for /ʔ/. Table 4.13 gives the overall average durations of the glottal fricative /h/ in all positions:

Table 4.13

Glottal Fricative Durations by Position

	word-initial	intervocalic	word-final coda	word-internal coda
/h/	152 ms (n=15)	130 ms (n=5)	157 ms (n=9)	190 ms (n=69)

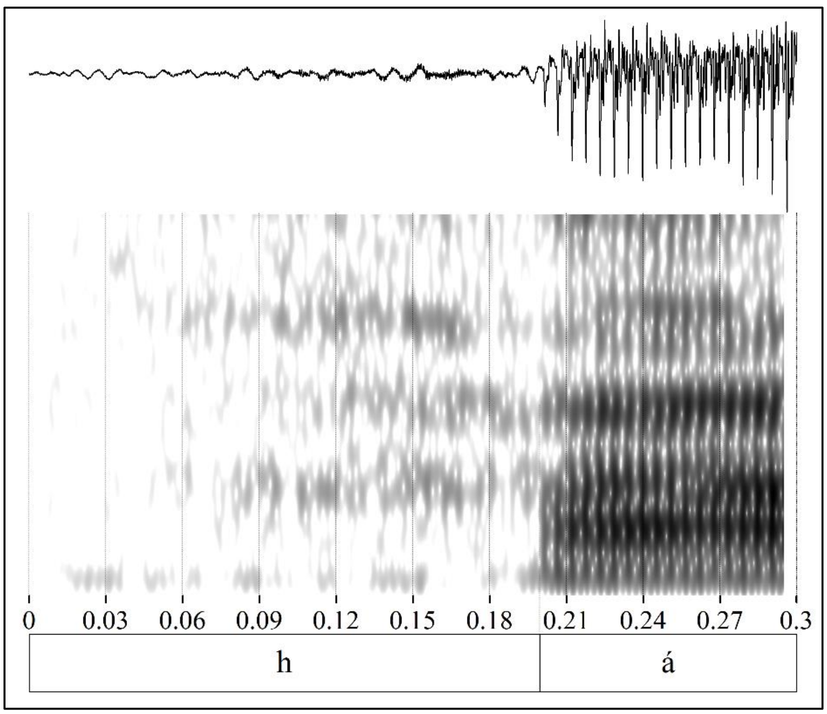
Figures 4.22 through 4.25 give representative examples of /h/ in all four positions.

In word-initial position, the Wappo /h/ is comparable to the /h/ phoneme found in other languages such as English – there is a period of frication noise that largely tracks the formants of the following vowel, but without voicing. This can be seen in Figure 4.22.

Figure 4.22

Spectrogram of Word-Initial /h/

háme ‘guts’ (WSR 114)

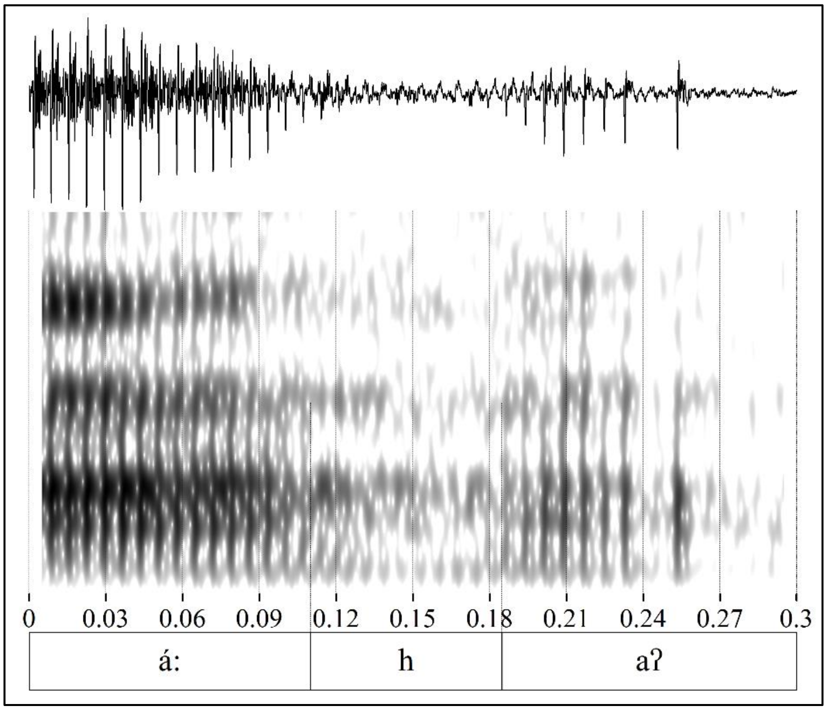


In intervocalic position, there is a minimal disruption of the voicing of the surrounding vowels (Figure 4.23); noise at higher frequencies is reduced, as is the overall intensity of the voice, but the fundamental and first formants are still largely present. Thus, intervocalic /h/ can often be transcribed as [ɦ].

Figure 4.23

Spectrogram of Intervocalic /h/

pá:haʔ 'straw (< Sp. *paja*)'; 'belt, waistband (< Sp. *faja*)' (WSR 107)

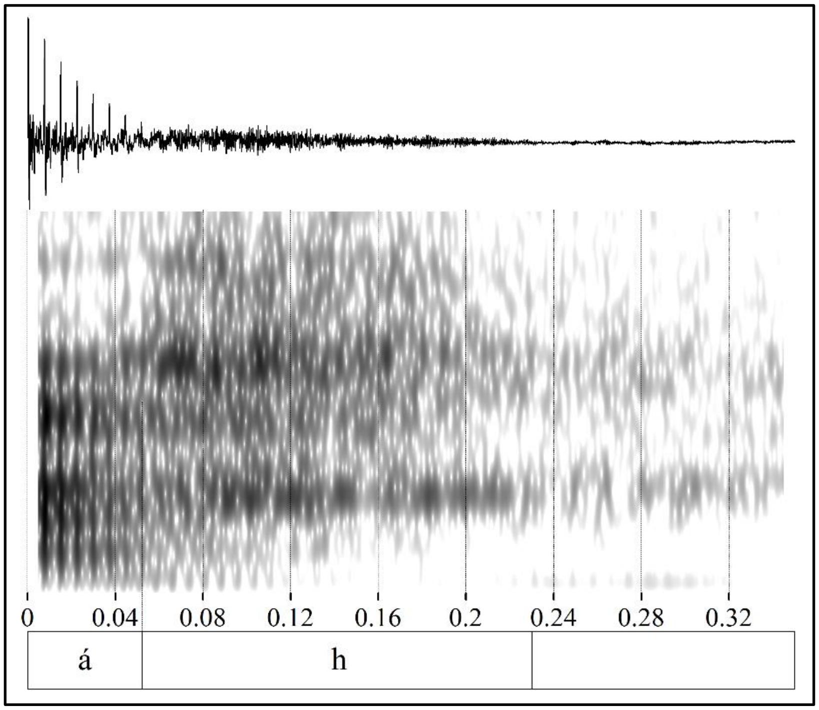


In word-final position, the intensity of the frication noise is much higher than in other positions (Figure 4.24); this may be due to the perceptual need for increased salience of /h/ in this position, as here it can easily be masked by the normal exhalation at the end of a phrase, which, in the elicitation context, often coincides with the end of the word:

Figure 4.24

Spectrogram of Word-Final /h/

šáh ‘tooth’ (WSR 80)

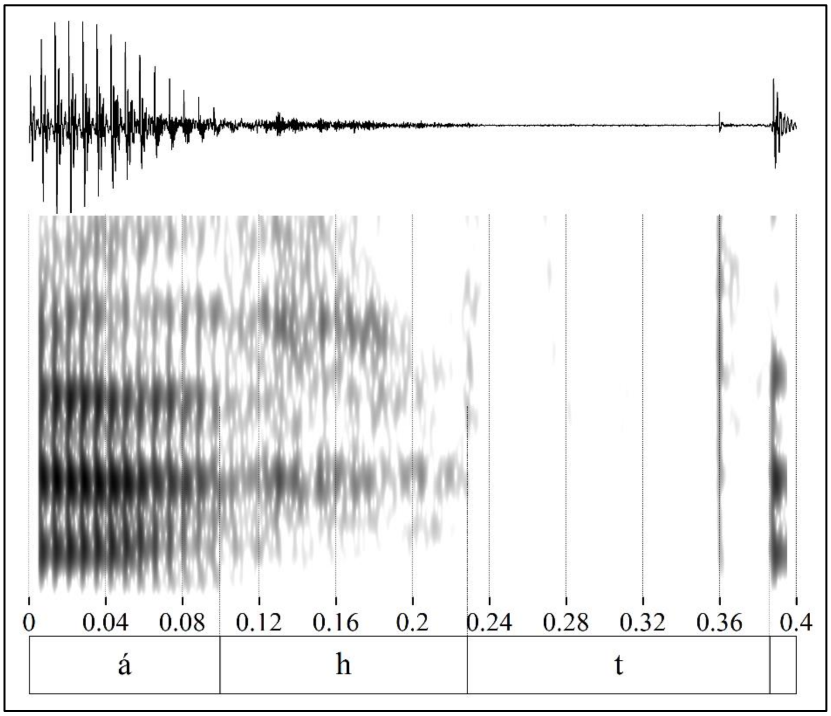


Finally, /h/ in word-internal coda position is similar in its acoustics to word-initial /h/ – a period of frication noise that generally tracks the formants of the preceding vowel, but without voicing (Figure 4.25). Note also here how the frication abruptly stops at the onset of the closure of the articulators for the following /t/.

Figure 4.25

Spectrogram of Word-Internal-Coda /h/

káhtaʔ ‘heard’ (WSR 77)



4.4.6 Glottalized Sonorants

The glottalized sonorant series is one of the most unique features of Wappo phonology; while these sounds are found elsewhere in North America, particularly along the Pacific Coast and on the Columbia Plateau, they are quite rare on a global level (see discussion in Chapter 7). As described in Chapter 2, each of the glottalized sonorants in Wappo is made up of two parts: a sonorant component, one of /m n l w y/, and a glottal component, specifically a glottal closure that halts the voicing of the preceding sonorant and then opens into a following segment, or into silence phrase-finally.

While each of these phonemes includes a sonorant component, this component differs in one principal way from the plain sonorants: it has a shorter duration in all positions than do the plain sonorants, and in particular, it does not undergo the dramatic lengthening in word-internal coda position that plain sonorants do (refer to Figure 4.8, above, for a comparison of the durations). In a sample of 290 plain sonorants of all types (/m n l w y/) across all positions, the average length of the segment was about 142 milliseconds; by contrast, in a sample of 115 glottalized sonorants of all types across all positions, the average length of just the sonorant component was only about 90 milliseconds, or about 63% of the average length of the plain sonorants. Table 4.14 gives the overall average sonorant durations and glottal durations of the five glottalized sonorants /m'/, /n'/, /l'/, /w'/, /y'/ in the positions in which they occur.

One noteworthy observation is that the overall duration of the glottalized sonorants – that is, the combined duration of the sonorant component and the glottal component – is consistently longer than the duration of the equivalent plain sonorant. This holds for all five sonorant types, across all four phonotactic positions. Table 4.15 gives the relevent values.

Table 4.14

Durations (in ms) of Glottalized Sonorants Across Several Phonotactic Positions

"final" = word-final coda, "internal" = word-internal coda, "sonorant" = duration of sonorant portion, "glottal" = duration of glottal portion. n = number of tokens. Glottalized sonorants do not occur in word-initial position.

	intervocalic		final		internal		average	
	sonorant	glottal	sonorant	glottal	sonorant	glottal	sonorant	glottal
/m'/	101	184	92	164	65	150	86	166
n	*10*		*7*		*2*			
/n'/	73	64	111	158	115	160	100	127
n	*11*		*6*		*4*			
/l'/	77	77	87	140	85	107	83	108
n	*11*		*8*		*6*			
/w'/	84	98	89	144	99	136	91	126
n	*11*		*3*		*4*			
/y'/	112	97	57	167	101	140	90	135
n	*10*		*8*		*14*			
average	89	104	87	155	93	139		

Table 4.15

Comparison of Overall Durations (in ms) of Glottalized Versus Plain Sonorants Across Several Phonotactic Positions

"final" = word-final coda, "internal" = word-internal coda, n = number of tokens. Glottalized sonorants do not occur in word-initial position.

		intervocalic	final	internal	average
/m'/		285	256	215	252
	n	*10*	*7*	*2*	
/m/		116	148	213	159
	n	*14*	*4*	*3*	
/n'/		137	269	275	227
	n	*11*	*6*	*4*	
/n/		114	172	192	159
	n	*21*	*14*	*13*	
/l'/		154	227	192	191
	n	*11*	*8*	*6*	
/l/		122	136	175	144
	n	*18*	*18*	*19*	
/w'/		182	233	235	217
	n	*11*	*3*	*4*	
/w/		118	153	247	173
	n	*13*	*14*	*16*	
/y'/		209	224	241	225
	n	*10*	*8*	*14*	
/y/		118	152	174	148
	n	*14*	*16*	*10*	
average glott.		193	242	232	
average plain		118	152	200	

On average, glottalized sonorants are 64% longer overall than their plain counterparts in intervocalic position; 59% longer in word-final coda position; and 16% longer in word-internal coda position. The largest disparity by place/manner is seen in the bilabial nasals: glottalized /m'/ is on average 58% longer than plain /m/ across all relevant phonotactic positions.

Figures 4.26 through 4.30 give an example spectrogram for each of the five glottalized sonorants, in intervocalic position. Note that for each, the first 30 to 50 percent of the duration of the segment is occupied by voicing, representing the sonorant portion, while the other half is mostly silent, representing the glottal closure portion; however, note that in Figure 4.30, for the glottalized palatal approximant /y'/, there was incomplete closure of the glottis, resulting in a long period of glottal pulses (phonetically [i̯], corresponding to the preceding /y/ glide) before transitioning into the following vowel. In all five examples, glottal pulsing can be seen at the onset of voicing of the following vowel; that is, the transition from the closed glottis state at the core of the glottal portion of the glottalized sonorants into the fully voiced state of the following vowel is, in most cases, a gradual transition, rather than an abrupt one.

Figure 4.26

Spectrogram for Intervocalic /m'/

kám'iʔ 'to cry, to weep' (WSR 86)

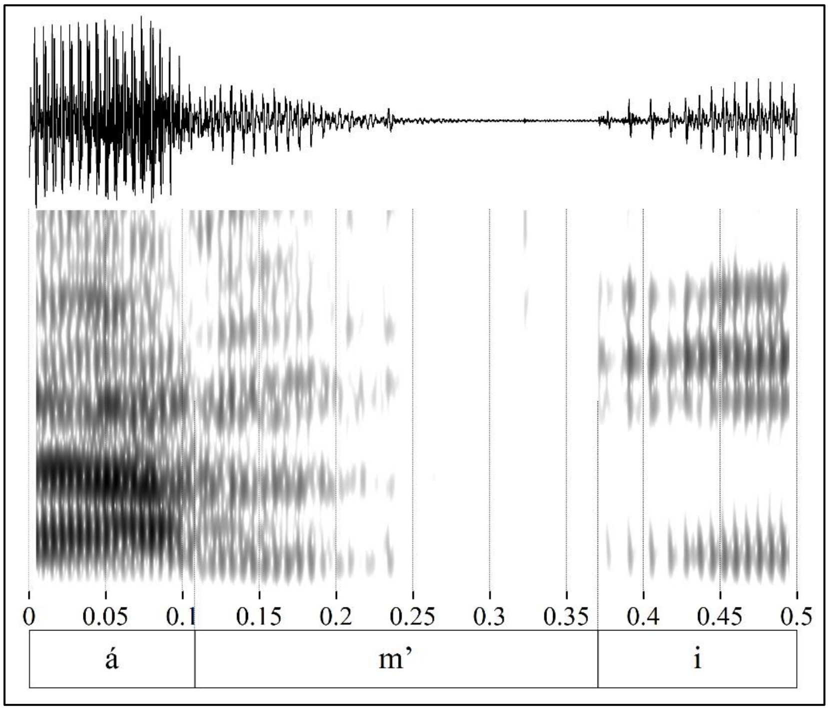


Figure 4.27

Spectrogram for Intervocalic /n’/

ʔón’iʔ ‘to dig deep, dig a trench’ (WSR 99)

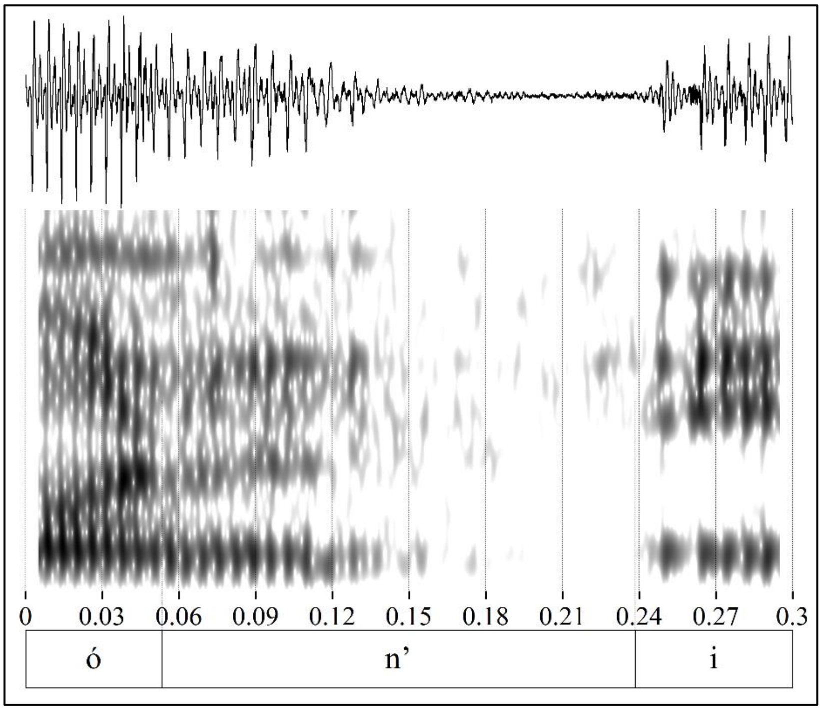


Figure 4.28

Spectrogram for Intervocalic /l’/

ʔél’iʔ ‘to dig (for roots)’ (WSR 99)

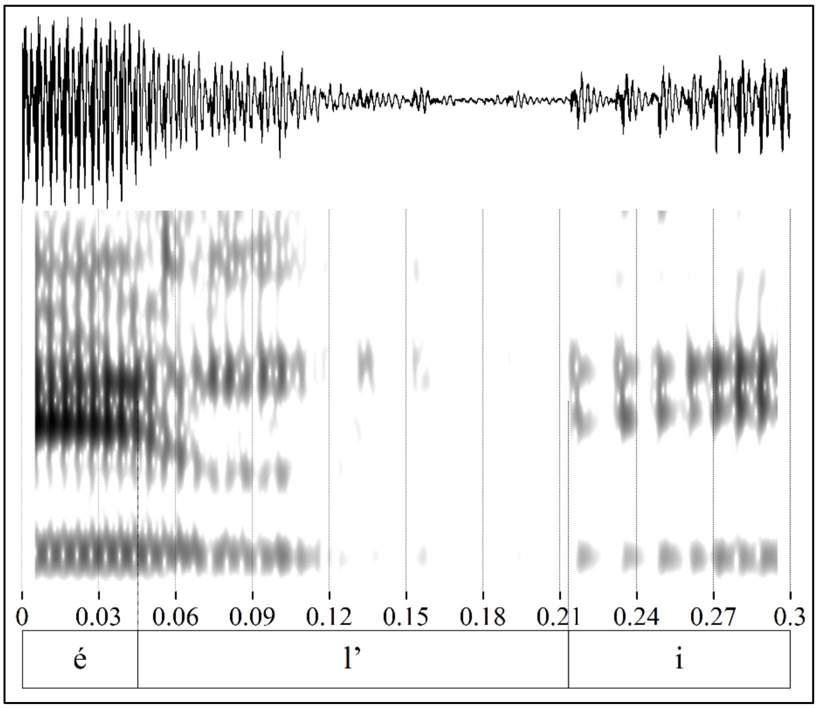


Figure 4.29

Spectrogram for Intervocalic /w'/

náw'iʔ 'see! find! (imperative)' (WSR 72)

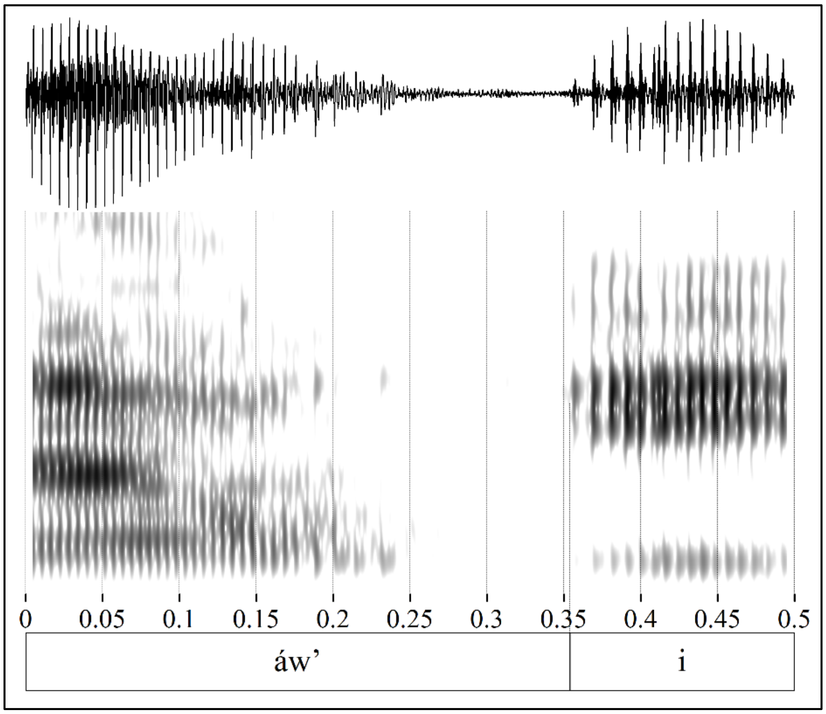
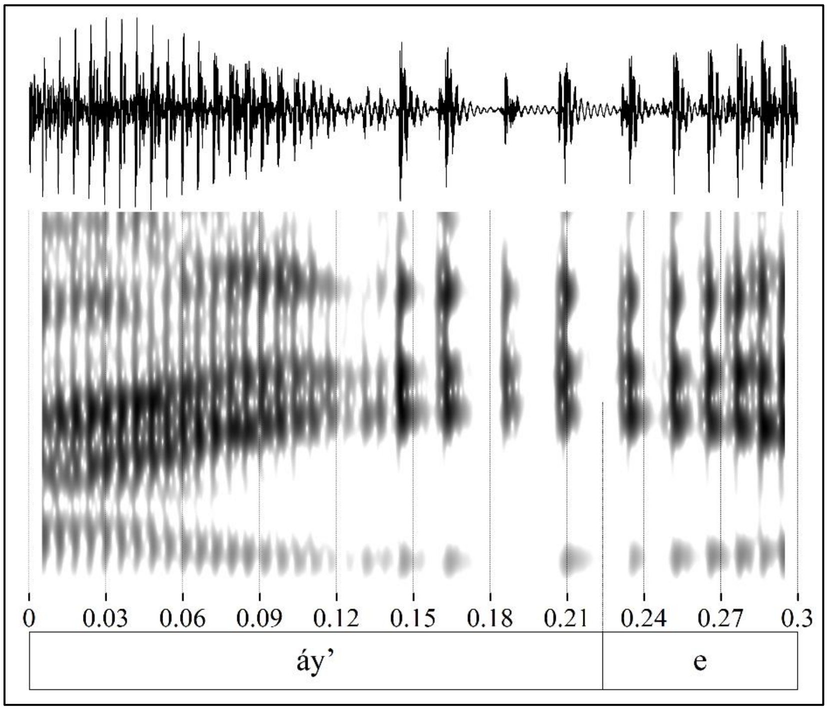


Figure 4.30

Spectrogram for Intervocalic /y’/

k’áy’el ‘white’ (WSR 65)



4.4.7 Aspirated Sonorants

Like the glottalized sonorants, the marginal set of aspirated sonorants in Wappo consist of two portions, a sonorant portion and a glottal portion; for the aspirated sonorants, the glottal portion is a glottal fricative, /h/. As they occur in only a dozen or so lexical roots, there are not many tokens of them present in the Wappo audio corpus. Table 4.16 gives the overall average sonorant durations and aspiration durations of the five aspirated sonorants /m^h/, /n^h/, /l^h/, /w^h/, /y^h/ in the positions in which they occur; however, as a caveat, because of the very small sample size, the average duration figures for these phonemes are much harder to assess and generalize from. For example, the single token of *láy*^{h} 'great; foreign' in word-final position has an unusually long aspiration period because it is occurring at a phrase boundary, which for this particular speaker is marked by a prolonged release of breath. In this context, the duration of the actual aspiration component of the aspirated sonorant was difficult to separate from the phrase-final pragmatic aspiration.

Nevertheless, as is the case with the glottalized sonorants, the sonorant portions of the aspirated sonorant phonemes are shorter on average than their plain sonorant equivalents. In a sample of 26 aspirated sonorants of all types across all positions, the average length of the sonorant component was about 96 milliseconds; this is slightly longer than the average duration of the sonorant component of the glottalized sonorant phonemes (90 milliseconds, n=115), but still notably shorter than the average duration of the plain sonorants themselves (142 milliseconds, n=290).

However, just as the overall duration of the glottalized sonorants (sonorant component plus glottal component) was found to be longer on average than that of their plain equivalents, the overall duration of the aspirated sonorants is likewise longer on average than that of their plain equivalents, though by a slightly smaller margin. Aspirated sonorants are on average 60% longer than their plain counterparts in intervocalic position (glottalized sonorants were 64% longer), and about 14% longer in word-internal coda position (glottalized sonorants were 16% longer). Because only a single token of an aspirated sonorant was found in word-final position, a meaningful comparison to plain sonorants in this position could not be made.

Table 4.16

Durations of Aspirated Sonorants (in milliseconds)

	intervocalic	final	internal coda	*average*
/mʰ/	[no examples]	[no examples]	126 (sonorant) 135 (aspiration) (n=2)	126 (sonorant) 135 (aspiration)
/nʰ/	119 (sonorant) 149 (aspiration) (n=4)	[no examples]	[no examples]	119 (sonorant) 149 (aspiration)
/lʰ/	88 (sonorant) 67 (aspiration) (n=6)	[no examples]	[no examples]	88 (sonorant) 67 (aspiration)
/wʰ/	101 (sonorant) 114 (aspiration) (n=6)	[no examples]	[no examples]	101 (sonorant) 114 (aspiration)
/yʰ/	46 (sonorant) 68 (aspiration) (n=2)	104 (sonorant) 292 (aspiration) (n=1)	64 (sonorant) 129 (aspiration) (n=5)	71 (sonorant) 163 (aspiration)
average	*89 (sonorant)* *100 (aspiration)*	*104 (sonorant)* *292 (aspiration)*	*95 (sonorant)* *132 (aspiration)*	

Figures 4.31 through 4.35 give a representative sample of each of the aspirated sonorant phonemes, in various positions. In each case, we can easily see how the voicing of the initial sonorant portion of the phoneme fades towards a spread-glottis configuration for the latter half of the phoneme, characterized by low-intensity noise at the higher end of the spectrum, often tracking the formants of the following vowel. For the final example, Figure 4.35, note how the noise of the fricative component of /y^h/ terminates abruptly at the point of closure of the following /t/.

Figure 4.31

Spectrogram for Word-Internal-Coda /m^h/

kóm^{h}lu tàkaʔ *a type of basket* (WSR 100)

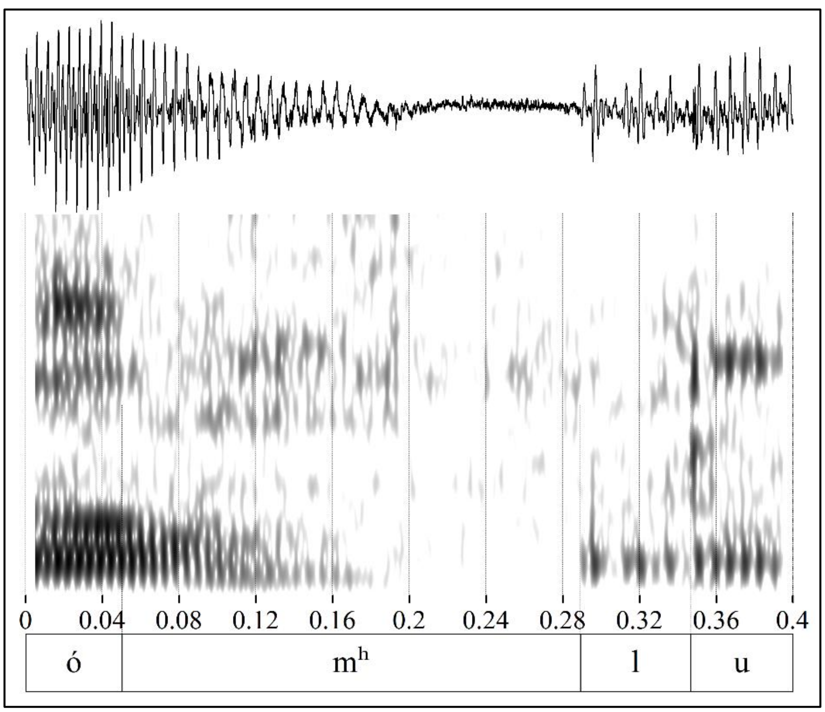


Figure 4.32

Spectrogram for Intervocalic /nʰ/

kʰénʰiʔ 'to peel' (WSR 99)

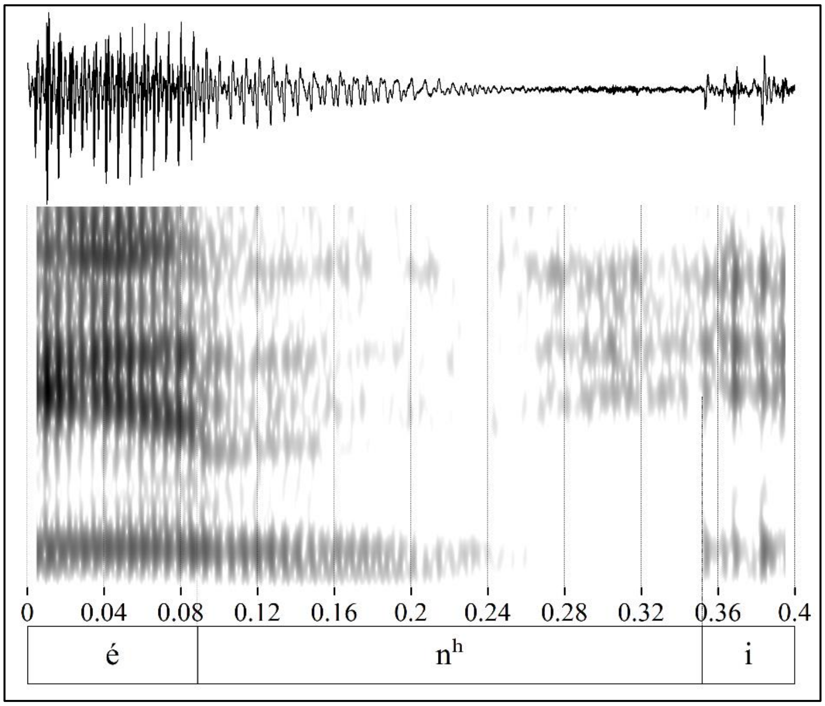


Figure 4.33

Spectrogram for Intervocalic /lʰ/

napišólʰi·yaʔ 'to whisper' (WSR 74)

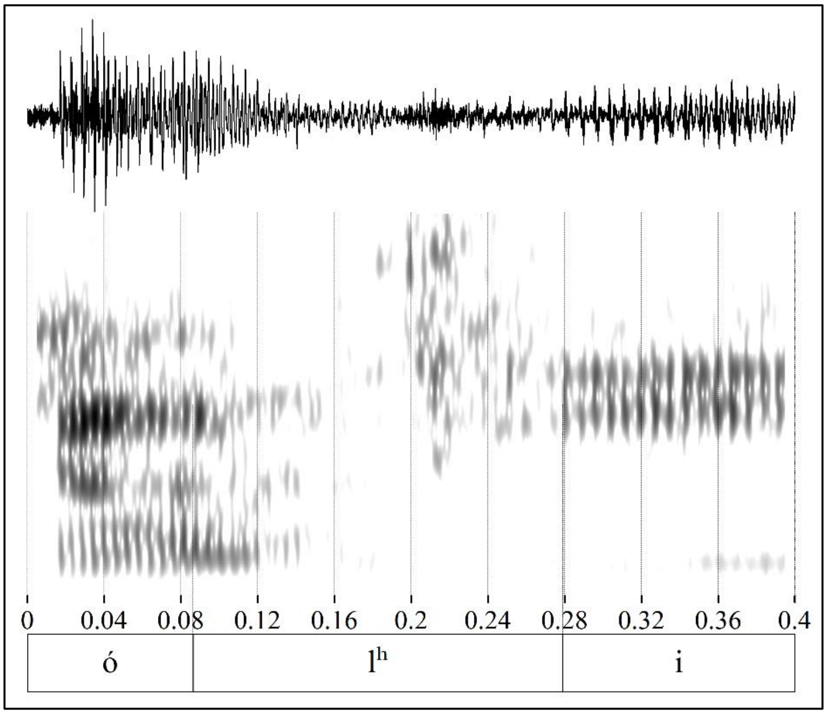


Figure 4.34

Spectrogram for Intervocalic /wʰ/

síwʰi·-yaʔ ‘the sound of wind’ (WSR 117)

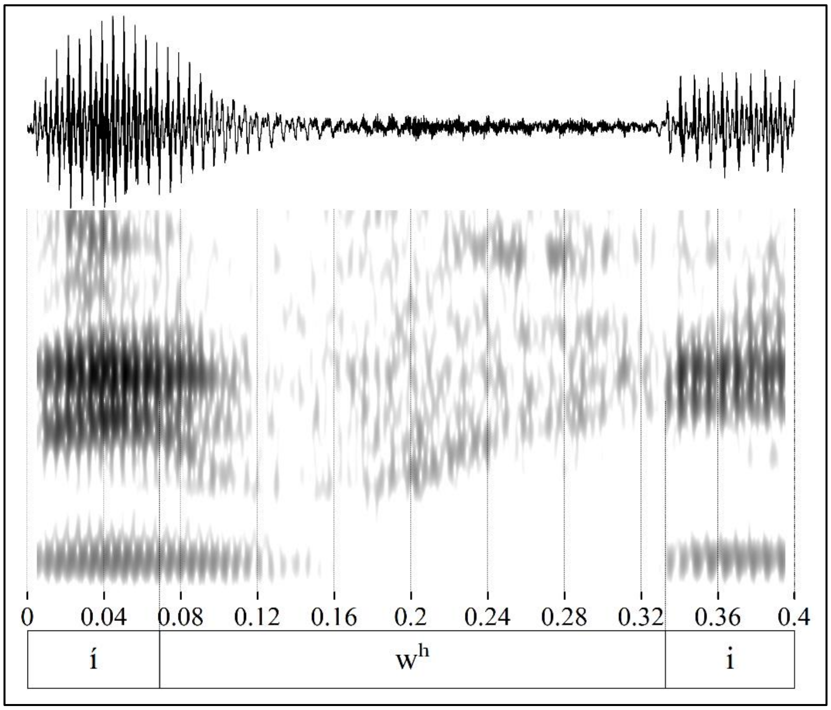
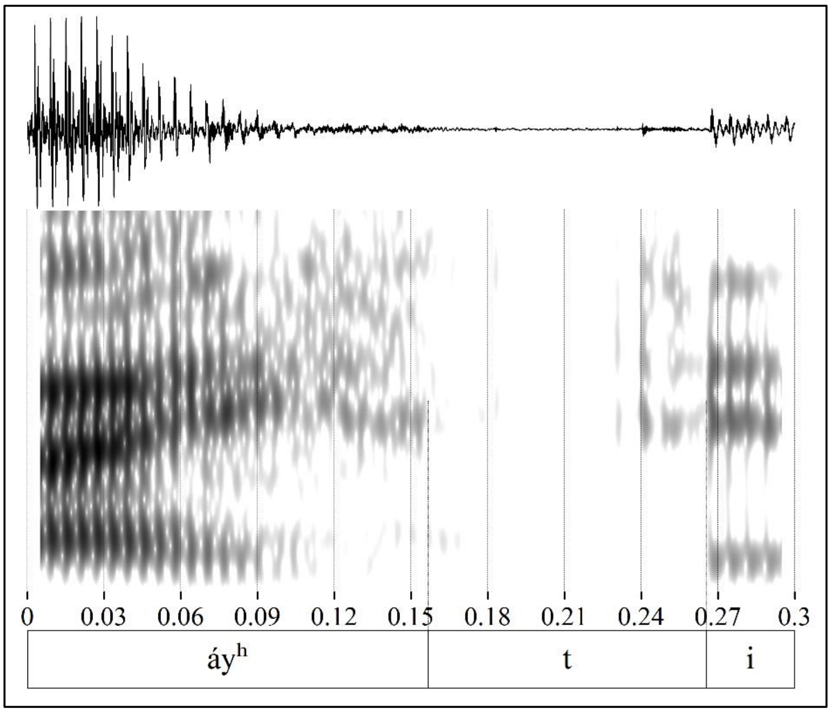


Figure 4.35

Spectrogram for Word-Internal-Coda /yʰ/

láyʰ-t=i te-láhah-kʰiʔ 'the white man is coming' (WSR 75)



4.5 Summary

The segments of Wappo – especially the consonants – are fairly stable in their phonetics, with very little allophony. The coronal place contrast in the stop series is between that of a dental /t/ and an alveolar /ṭ/. The dental /t/ is often accompanied by (inter)dental frication, while the alveolar /ṭ/ is often apical-alveolar in articulation, trending towards retroflexion in a few tokens. The coronal place contrast in the affricate and fricative series, on the other hand, is between that of a laminal-alveolar /c/ and /s/ and a palato-alveolar /č/ and /š/; both articulations are comparable to most other languages with these segments.

The five-vowel system is phonetically typical cross-linguistically, although there is a wide F2 gap between the front vowels and the others, and the back vowels /o/ and /u/ are often centralized. Vowel nasalization only occurs sporadically before a nasal coda, and in the lexical item *hį́ʔį* 'no', while laryngealization in vowels is frequent when these are adjacent to a glottalized stop, affricate, or sonorant, or the glottal stop /ʔ/; intervocalic glottal stop may also be expressed as a period of laryngealization across the vowel-vowel boundary. Vowel length is not phonemically distinct; stressed vowels are phonetically slightly longer in duration than unstressed vowels, and there is a rule converting post-tonic penultimate vowels into a long form when both their syllable and the tonic syllable are open. A small number of lexical items have a stressed phonemic long vowel, and many of these may prove to be loans from surrounding languages where vowel length is phonemically contrastive and common.

Consonant duration varies by position within the word and syllable, with greater duration on average occurring in coda position versus onset position. Fricatives are particularly long in word-final position, while plain sonorants are particularly long in word-internal coda position; the plain glide approximants are converted to equivalent long vowels in this position. Glottalized stops and affricates are strongly ejective in articulation, while glottalized sonorants are post-glottalized, consisting simply of a sequence of a sonorant plus a glottal closure. The rare aspirated sonorants similarly consist of a sonorant plus a glottal fricative. The duration of the sonorant component of the glottalized and aspirated sonorants is shorter in all positions than that of the equivalent plain sonorants, but the overall duration of the glottalized and aspirated sonorants – taking their sonorant and glottal components together – is notably longer in all positions than that of the equivalent plain sonorants.

4.6 Further Research and Application

While the typology of phoneme inventories, phonotactics, syllable structure, tone, and prosody is a well-developed field, taking in data from languages worldwide, the sub-field of phonetic typology is less developed. Languages with similar phonemes may have quite different phonetic realizations of those phonemes, and patterns of allophony in terms of vowel quality, consonant expression, phonation type, segment duration, and other phonetic features may differ substantially from language to language.

It is hoped that the data presented in this chapter on the phonetics of Wappo can be of value to typologists who would like to further develop and refine our understanding of phonetic typology. In particular, the phonetic typology of the languages of western North America, many of which have similar phoneme inventories and phonological structures, is a topic that requires further attention from specialists, who can make use of the under-utilized phonetic descriptions already produced by 20th-century scholarship on the languages of this region, and build upon those descriptions using both archival recordings and experimental analysis of the speech of contemporary speakers. One of the many practical benefits of this type of research, besides enriching our knowledge of phonetic typology as a whole, would be to guide the creation of more accurate and useful pedagogical materials for contemporary Native community members wishing to learn and teach their languages. This feature of the current research will be discussed in more depth in Chapter 8.

CHAPTER 5: WORD-LEVEL PROSODY

5.1 Introduction

We are fortunate that the documentation of Wappo includes a great deal of audio data; this allows us to not only study the phonetic detail of the language's consonants and vowels, but also details of the language's prosody, at the word-, phrase-, and even discourse-level.

This chapter attempts a preliminary analysis of word-level prosody in the language, specifically focusing on words consisting of a single lexical root with additional affixes or clitics. The prosody of compound words, those containing two or more lexical roots, appears to be complex, and will await a future study. Although conversational data does exist in a good amount in the Wappo audio corpus, an analysis of the discourse structure and the pragmatics of Wappo will also have to await a future study, once the more fine-grained structures of the language are better understood.

5.2 Placement of Stress

Wappo is a stress-based language prosodically, rather than one with a pitch accent or tonality. In Wappo, stress placement is always on the lexical root; this means that Wappo has a lexically-specified stress system, rather than one that is metrically specified. However, the exact placement of stress in any given word depends on both morphological structure and word length. In monomorphemic words, regardless of length, stress is always on the first syllable of the morpheme; this results in disyllabic and trisyllabic monomorphemic words always having word-initial stress. In polymorphemic words, however, the location of the lexical root, and thus of the stressed syllable, is much more variable, as the word may have one or more affixes in pre-root and post-root positions. Thus, for example, in contrast to a trisyllabic monomorphemic root, where stress is initial, a trisyllabic polymorphemic word will have second-syllable stress if that syllable is the sole or first syllable of the lexical root, but it will have initial stress if that syllable is the sole or first syllable of the lexical root. The only widespread restriction on the location of the lexical root and hence of the word stress is that most polysyllabic polymorphemic word-forms do not end in a monosyllabic lexical root; thus word-final stress in polysyllabic words is very rare. As a larger number of suffixes than prefixes are admitted in sequence in Wappo words (as well as the fact that there are several polysyllabic suffixes but no such prefixes), there tend to be more post-tonic syllables than pre-tonic syllables in any given phonological word, and thus on average, stress placement is nearer to the beginning of the prosodic word than to the end.

Table 5.1 gives the number of examples in the Wappo audio corpus of words of between one and five syllables (both monomorphemic and polymorphemic) cross-referenced with the placement of the word stress. The tendency for more syllables to occur post-tonically than pre-tonically is also visible by the larger proportion of words in which stress placement is on one of the first two syllables of the prosodic word, seen in the cells highlighted in magenta.

Table 5.1

Placement of Stress By Number of Syllables

# of syllables	1st syll.	2nd syll.	3rd syll.	4th syll.	n (toal: 1,573)
1	**120 (100%)**				120
2	**515 (95.5%)**	**24 (4.5%)**			539
3	**161 (25.5%)**	**466 (73.9%)**	**4 (0.6%)**		631
4	**10 (4.2%)**	**164 (69.5%)**	**62 (26.3%)**	**0 (0%)**	236
5	**2 (4.3%)**	**27 (57.4%)**	**17 (36.2%)**	**1 (2.1%)**	47

As can be seen, the vast majority of 2-syllable words have initial stress, while the majority of 3-, 4-, and 5-syllable words have stress located on the second syllable. Thus the average 2-syllable word is monomorphemic, while the average 3-, 4-, or 5-syllable word has a single prefix and either a monosyllabic root with multiple suffixes, or a polysyllabic root with one to two suffixes.

Complications in stress assignment arise when compounds are created. Wappo allows many types of compounds, but a noun must virtually always be at least one of the members present. In these cases, stress assignment is highly variable, and indeed a few compound pairs are distinguished only by their stress assignment. This suggests that for compounds, Wappo stress assignment is more idiosyncratic, rather than predictable on the basis of the position of the root. I intend to investigate patterns of stress assignment in compounds in a future study.

5.2.1 Disyllabic words

For monomorphemic disyllabic words, stress is universally on the first syllable:

(1)	*hútu*	'snail'	CV́.CV	(WSR 103)
(2)	*káṭik'*	'frog'	CV́.CVC	(WSR 67, 86, 97, 114)
(3)	*méhwa*	'wild grape vine'	CV́C.CV	(WSR 81, 92)
(4)	*tónčiʔ*	'cat'	CV́C.CVC	(WSR 114)

For polymorphemic disyllabic words, stress is always on the syllable that is the lexical root of the word. In all polysyllabic, polymorphemic words, the lexical root is the morpheme that carries the principal semantic content of the word, as well as the morpheme that remains (semi-)constant in its form across all paradigmatic variants. Additionally, since the inventory of clear affixes and clitics in Wappo is limited, and is likewise based on morphological criteria, morphemes that do not fall into the affix/clitic category must conversely be lexical roots. Lexical roots, then, are clearly roots on semantic and morphological grounds, independent of their phonological status.

If a polymorphemic disyllabic word is root-initial with a following suffix, the stress placement will be on the first syllable of the word. Conversely, if a polymorphemic disyllabic word is root-final with a preceding prefix, the stress placement will be on the second syllable of the word. Examples (5) - (10) detail the two types of stress placement in polymorphemic disyllabic words:

1. ROOT-suffix

(5)	*páʔmiʔ*	‘eat’	CV́C.CVC	(WSR 70, 82)
	(*páʔ*- ‘eat’, -*miʔ* durative suffix)			
(6)	*ʔúk’šiʔ*	‘drink’	CV́C.CVC	(Sawyer 1965:32)
	(*ʔúk’*- ‘drink’, -*šiʔ* durative suffix)			
(7)	*múl’ta*	‘always’	CV́C.CV	(WSR 101)
	(*múl’*- ‘all’, -*ta* adverbial suffix)			
(8)	*ṭ’óhma*	‘poison’	CV́C.CV	(WSR 85, 108)
	(*ṭ’óh*- ‘catch, kill’, -*ma* instrument suffix)			

2. prefix-ROOT

(9)	*ʔolól’*	‘a dance’	CV.CV́C	(WSR 77)
	(*ʔo*- undirected activity prefix, *lól’* ‘dance’)			

(10) *mačóʔ* ‘go away!’ CV.CV́C (Sawyer 1965:5, 44)

(*ma-* directional prefix, *čóʔ* ‘go.IMP’)

5.2.2 Trisyllabic words

In monomorphemic words of three syllables, as in monomorphemic words of two syllables, stress is universally on the first syllable:

(11)	*t’áka·la*	‘bat (animal)’[104]	CV́.CV·.CV	(WSR 77)
(12)	*cími·ṭo*	‘hummingbird’	CV́.CV·.CV	(WSR 88, 92)
(13)	*kʰótʰi·šo*	‘black oak tree’	CV́.CV·.CV	(WSR 69, 86, 96)
(14)	*sílo·maʔ*	‘mountain angelica’	CV́.CV·.CVC	(WSR 104, 106, 110)
(15)	*c’ékʰeʔma*	‘swallow (bird)’	CV́.CVC.CV	(WSR 92, 99)
(16)	*ʔépehleʔ*	‘gopher’	CV́.CVC.CVC	(WSR 67)

In trisyllabic words that are polymorphemic, the root is generally either only the first syllable, only the second syllable, or consists of the first two syllables together. Occasionally

[104] For the vowels marked by <·>, see discussion of medial vowel lengthening in Chapter 3.

the root is the second and third syllables, with the first syllable being a prefix. Trisyllabic words where the root is only the final syllable are quite rare.[105]

1. One-syllable root followed by two monosyllabic suffixes:

(17) *šóy'-tis-taʔ* 'burned (TR)' CV́C.CVC.CVC
(WSR 60, 70)
(*šóy'*- 'hot, burn, fire', *-tis* causative suffix, *-taʔ* past tense suffix)

2. One-syllable root followed by disyllabic suffix:

(18) *c'és-e·ma* 'bathtub' CV́.CV·.CV
(Sawyer 1965:8, 101)
(*c'és*- 'swim, bathe', *-ema* instrument/purpose suffix)

3. One-syllable root preceded by monosyllabic prefix and followed by monosyllabic suffix:

(19) *ho-léw'-iʔ* 'hunt, go look for' CV.CV́.CVC
(Sawyer 1965:53, 61)
(*ho*- 'around', *léw'*- 'look for', *-iʔ* durative suffix)

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105 The only common examples of trisyllabic words with a final-syllable root that appear in the audio corpus are *holoṭ'éw'* 'ant' (WSR 61.1, 67, 91, 109); *hopihán* 'eight' (WSR 62, 111); *pawalákʰ* 'nine' (WSR 62, 111); *k'anoʔšíʔ~k'anuʔšíʔ* 'Indian [Indigenous] person' (WSR 63); *ʔonoʔšíʔ* 'Indian [Indigenous] people' (WSR 85); and *maʔahéʔ* 'soon, now, right now, right away' (WSR 98, 101, 105). Most of these are clearly lexical compounds in origin, e.g. *hopihán* (*hópi* 'two', *hán* 'back'), *pawalákʰ* (*páwa* 'one', *lákʰ* 'missing, not have'), *maʔahéʔ* (*máʔa* 'just, only, still', *héʔ* 'now, this'), while the words for 'ant' and 'Indian(s)/Indigenous' appear to contain the roots *hól* 'tree, wood', and *k'á/ʔón* 'person/people', respectively.

(20) *meh-kúč-iʔ* ‘spoon up’ CVC.CV́.CVC

(Sawyer 1965:97)

(*meh*- ‘up’, *kúč*- ‘spoon’, -*iʔ* durative suffix)

(21) *č’a-k’ín-eʔ* ‘tear (it) off!’ CV.CV́.CVC

(Sawyer 1965:74, 102)

(*č’a*- ‘off’, *k’ín*- ‘tear’, -*eʔ* imperative suffix)

4. Two-syllable root followed by monosyllabic suffix:

(22) *páwa·-kʰiʔ* ‘be one, be alone, be by oneself’ CV́.CV·.CVC

(Sawyer 1965:74)

(*páwa* ‘one’, -*kʰiʔ* stative suffix)

(23) *ʔék’a·-pi* ‘daughter’ CV́.CV·.CV

(WSR 77)

(*ʔék’a* ‘child, son’, -*pi* feminine kinship suffix)

5. Two-syllable root preceded by monosyllabic prefix

(24) *pah-léw’a* ‘narrow’ CVC.CV́.CV

(WSR 101)

(*pah*- ‘together’, *léw’a* ‘narrow’)

5.2.3 Words of Four or More Syllables

For words of four or more syllables, the vast majority are polymorphemic.[106] The root is typically either the first syllable, the second syllable, the first and second syllables together, or the second and third syllables together. Occasionally, the root is either the third syllable alone, or the third and fourth syllables together; and in a few cases, the root is the first three syllables. Examples of the attested morphological structures are given below.

1. Root is the first syllable

(25) *ʔén-iya-kʰiʔ* ‘be dangerous’ CV́.CV.CV.CVC

(WSR 103)

(*ʔén-* ‘much; excessive; terrible’, *-iya* adjectival, *-kʰiʔ* stative)

2. Root is the second syllable

- with two monosyllabic suffixes:

(26) *pah-sák-is-kʰiʔ* ‘be two alike, be two of a kind’ CVC.CV́.CVC.CVC

(WSR 93)

(*pah-* ‘together’, *sák-* ‘alike’, *-is* adjectival, *-kʰiʔ* stative)

- with one disyllabic suffix:

(27) *ʔo(h)-yéh-e·ma* ‘trap, snare (n.)’ CV.CV́.CV·.CV

(WSR 84, 85, 100, 109)

[106] Some candidates for monomorphemic words of four syllables include *napáyok'o* ‘madrone tree’, *calaháya* ‘clothing’, *ciṭiwáya* ‘small dark facial spots’, *kóṭomela* ‘big, large (pl.)’, *hu(h)túkulu* ‘owl; moth’, *cʰipiláya* ‘wasp’, *halawéṭis* ‘old man’, *hanakóṭa* ‘bullsnake’, *piliʔčíwkiš* ‘snowbird’, *lolopáte* ‘eagle’, *ʔunuʔcáwaʔ* ‘toyon, Christmas berry’, *méy+picíwilma* ‘aquatic insect sp.’, *méy+načámaṭeʔ/načamáṭeʔ* ‘crab’. Notice the preponderance of faunal words. Some of these may represent loans from other languages; some may be onomatopoeic. There do not appear to be any monomorphemic words of five or more syllables in the language.

(*ʔo(h)*- ?, *yéh*- ‘to trap, to snare’, -*ema* instrument)

3. Root is the first and second syllables

- with two monosyllabic suffixes:

(28) *húčuʔ-sa-nek’* ‘bucking (adj.)’ CV́.CVC.CV.CVC

(WSR 115)

(*húčuʔ* ‘to buck’, -*sa* imperfect, -*nek’* attributive)

- with one disyllabic suffix (here, an enclitic):

(29) *hína=wela* ‘other side’ CV́.CV.CV.CV

(WSR 95)

(*hína* ‘different, other’ =*wela* directional)

4. Root is the second and third syllables

(30) *ʔo-hícu·-miʔ* ‘to pound, to beat (grain)’ CV.CV́.CV·.CVC

(WSR 70, 86)

(*ʔo*- undirected activity, *hícu*- ‘to pound, to beat’, -*miʔ* durative)

5. Root is the third syllable

(31) *na-pah-mús-kʰiʔ* ‘having the lips closed’ CV.CVC.CV́C.CVC

(WSR 74)

(*na*- ‘mouth’ (lexical), *pah*- ‘together’, *mús*- ‘to close’, -*kʰiʔ* stative)

6. Root is the first three syllables

(32) *káwayuʔ=i* ‘horse (NOM)’ CV́.CV.CV.CV

(WSR 74, 115)

(*káwayuʔ*, ‘horse’ (< Sp. *caballo*), =*i* nominative)

5.3 Secondary Stress

Most Wappo words only have a single stressed syllable. However, there are two morphemes that appear to bring a seconday stress into the prosodic word in which they occur: *làh* 'negative', and *yàwmiʔ* 'intentional future'. The secondary stress in these items is realized as a pitch peak that is lower than that of the word's primary stress, but higher than intervening syllables – see Section 5.3.2. Because these morphemes have their own inherent pitch, and are not wholly dependent prosodically on the root to which they attach, they are perhaps better described as a type of independent word that is somewhere along the grammaticization pathway of becoming dependent on a host root – they have characteristics both of independent lexical words, and of dependent material like clitics and affixes. In this chapter, I will mark these morphemes with a grave accent, V̀, to distinguish them from the primary lexical roots discussed above.

5.3.1 Negative Morpheme *làh*

The negative morpheme *làh* occurs as a negator for nouns and adjectives. In this capacity, it behaves like a clitic: it attaches to the final element in a noun phrase, without phonological modification in either direction.

(33)	*c'íti*	'bone, hard'	→	*c'íti=làh*	'lazy'
	bone; hard			bone; hard=NEG	
	(WSR 9)				

(34) *picʰówe* ‘dirty’ → *picʰówe=làh* ‘clean’

dirty dirty=NEG

(WSR 96)

(35) *šáh* ‘tooth, teeth’ → *šáh=làh* ‘toothless; dull (of a knife)’

tooth tooth=NEG

(WSR 5, 96, 97, 99)

(36) *ʔéniya téhla* ‘very far’ → *ʔéniya téhla=làh* ‘not very far’

very far very far=NEG

(WSR 108)

(37) *tʰál=ma hušíʔiya* ‘good for something’

what=BEN good

→

tʰál=ma hušíʔiya=làh ‘good for nothing’

what=BEN good=NEG

(WSR 115)

This morpheme is also the primary marker of negation in verbs. In verbs, however, it usually combines with the stative suffix *-kʰiʔ* to form a verbal negation marker *-làhkʰiʔ*. In this capacity, it behaves more like an affix, selecting particular verbal root allomorphs like the other TAM affixes (see Chapter 6).

The three primary uses of the *-làhk^{h}iʔ* morpheme are as the negator for the durative (present tense, imperfective aspect), for the stative (expressing descriptive or resultant states), and for the imperative.

1. Durative Negative

(38)	*náw-šiʔ*	‘sees’	(WSR 101)
	náwiš-làhk^{h}iʔ	‘does not see’	(WSR 101)

(39)	*hák’-šeʔ*	‘likes, wants’	(WSR 9)
	hák’še-làhk^{h}iʔ	‘does not like/want; dislikes’	(WSR 9, 102)

2. Stative Negative

(40)	*háṭis-k^{h}iʔ*	‘knows; knew’	(WSR:
	háṭasuk^h-làhk^{h}iʔ	‘does not know’	(WSR 9)

3. Imperative negative

(41)	*cám-tiʔ*	‘do!’	(WSR 106)
	cámih-làhk^{h}iʔ	‘don’t do!’	(WSR 98, 106, 109)

(42)	*čóʔ*	‘go!’	(WSR 106, 114)
	čó:-làhk^{h}iʔ	‘don’t go!’	(WSR 93, 106)

(43)	*huh-móy-šeʔ*	‘thinks’	(WSR 9, 75, 93)
	huh-móyel-làhk^{h}iʔ	‘don’t think!’	(WSR 93)

Both nominal/adjectival negation and stative negation can be combined. In such cases, it is perhaps a matter of semantic construal as to whether the morphemic structure is unitary *làhk^{h}iʔ* or dimorphemic *làh-k^{h}iʔ*. (44) shows the two possible syntactic analyses of these structures.

(44)	*šáh_làh_k^{h}iʔ*	‘not be (a) tooth / be toothless’	(WSR 5)

analysis A:	*šáh=[k^{h}iʔ]*	→	*šáh=[làhk^{h}iʔ]*
	tooth=STAT		tooth=[STAT.NEG]
	‘[it is] a tooth’		‘[it is not] a tooth’
analysis B:	*[šáh=làh]*	→	*[šáh=làh]=k^{h}iʔ*
	[tooth=NEG]		[tooth=NEG]=STAT
	‘not a tooth; toothless’		‘it is [not a tooth]; it is [toothless]’

The status of *làh* or *làhkʰiʔ* as an independent word, a suffix, or an enclitic is a difficult one. When acting as a noun or adjective negator, it behaves like a clitic, in that it attaches to the end of a noun phrase – it can attach to a noun if this is phrase-final, or a modifying adjective, if this is phrase-final. In these cases, there is no phonological modification between *làh* and its host, and it maintains its distinctive secondary pitch. In these respects, it behaves like a clitic, or even as a (semi-)independent word, akin to the adpositions or modal particles of many European languages.

However, when acting as a verbal negator, it behaves much more like a suffix, attaching directly to the verb root or to one or more TAM suffixes following the root, and it appears to partially condition the verb's root allomorphy, a behavior much more associated with affixes than with clitics – see (38) through (43), above. It also takes different forms across several different TAM categories, another affix-like feature – in particular, the non-intentional future negative (future 2), *làhkʰusiʔ*, appears to be a grammaticized fusion of *làhkʰi(ʔ)* and *-siʔ* 'non-intentional future (positive)'. However, unlike all other verbal suffixes (except *-yàwmiʔ*, see below), *làhkʰiʔ* and its variants carry secondary stress, implying that they are still not as fully integrated into the verb prosodically as are the other verbal suffixes.

Table 5.2 gives some of the more common TAM negation forms based on *làh*.

Table 5.2

Common TAM negation forms based on làh *'negative'*

TAM category	form	gloss
durative negative	*làhkʰiʔ*	'does not X, is not Xing'
imperative negative	*làhkʰiʔ*	'don't X!'
stative negative	*làh|kʰiʔ*	'is not X'

past negative	*ta-làhkʰiʔ*	'did not X'
intentional future negative (future 1)	*yaw-làhkʰiʔ*	'is not going to X'
non-intentional future negative (future 2)	*làhkʰusiʔ*	'will not X'
causative present negative	*asa-làhkʰiʔ*	'does not make [patient] X'

5.3.2 Intentional Future Morpheme *yàwmiʔ*

Like *làh*, the intentional future (or future 1) morpheme -*yàwmiʔ* bears a secondary stress, the only other non-root material in the language to do so.[107] This morpheme is the regular intentional future form for all verbs, with a meaning akin to English 'going to'. Since it relies on intention, it appears to only occur with human or animate subject referents.

For most verbs, *yàwmiʔ* combines with a two-syllable allomorph of the verbal root. Occasionally, it combines with a one-syllable CV(:) root allomorph ('go'), and there is at least one instance of it combining with a three-syllable allomorph ('fry'). Representative examples are given below.

(45)	Future 1 Form	Gloss	Verb Root and Allomorphic Extension	
	a. *wíye-yàwmiʔ*	'going to fight'	*wíy-e*	(WSR 108)
	b. *ʔúk'i-yàwmiʔ*	'going to drink'	*ʔúk'-i*	(WSR 70)
	c. *mónah-yàwmiʔ*	'going to hide'	*món-ah*	(WSR 3)
	d. *ʔoh-yáwih-yàwmiʔ*	'going to name'	*yáw-ih*	(WSR 108)
	e. *háṭel-yàwmiʔ*	'going to know'	*háṭ-el*	(WSR 9)
	f. *ʔo-kál'te-yàwmiʔ*	'going to speak'	*kál'-te*	(WSR 106)

[107] Though note that the pronominal proclitics take stress when they themselves take case enclitics: cf. *ʔi=ʔáya* 'my father' (1SG=father), but *ʔí=tʰu* 'to me' (1SG=DAT).

g. *čó:-yàwmiʔ* ‘going to go’ *čó:-* (WSR 3, 79, 103)

h. *ʔísal’is-yàwmiʔ* ‘going to fry’ *ʔísal’-is* (WSR 76)

There is also a negated form of this morpheme, *yaw-làhkʰiʔ*, i.e. ‘not going to X’. In this form, which consists of two morphemes that elsewhere have secondary stress independently of each other, the secondary stress remains only on the negation morpheme *làh*, and the *miʔ* component of the positive form disappears. This is strong evidence that the intentional future suffix *-yàwmiʔ* is actually a recently-grammaticized (or still grammaticizing at the time of documentation) auxiliary verb; *-miʔ* is a very common durative suffix, and the alternation *yáw-miʔ* ~ *yáw-làhkʰiʔ* would be typical for a verb of that durative class. In fact, there is such a verb: *yáw-miʔ* ‘to name’, derived from *yáwe* ‘a name’ (WSR 9, 70, 108). It is possible that this is also the verb that has been grammaticizing as a future intentional marker, with a semantic pathway such as ‘to name’ > ‘to announce, to call out’ > ‘to announce an intention’ > ‘to intend to do’ > ‘going to do’.

5.4 Acoustic Correlates of Primary Stress

Wappo appears to have a stress system whose primary acoustic correlate is pitch. Intensity (that is, amplitude or loudness) does not appear to play a significant role; in some stressed syllables, intensity is higher than in surrounding syllables, but in many cases it is equal. Similarly, vowel length does not appear to correlate significantly with stress; while stressed vowels are often somewhat longer than their unstressed counterparts (or conversely, unstressed vowels are somewhat shorter), sometimes the reverse is true – word-final unstressed vowels before a glottal stop coda /ʔ/ appear to be particularly susceptible to lengthening, perhaps as a prosodic feature, and the unstressed vowels that undergo phonetic lengthening in medial position (see Chapter 4) are always much longer than the stressed vowel in the same word. In many word tokens, the duration of vowels is roughly equal, regardless of stress.

To demonstrate these observations in numerical fashion, Table 5.3 gives frequency, intensity, and duration information for a sample of CV́CV words from the Wappo audio corpus.[108] As an average of each category shows, the only feature that differs noticeably between first-syllable vowels and second-syllable vowels is the fundamental frequency – first-syllable vowels have a fundamental frequency that is, on average, about 50 Hz higher than that of second-syllable vowels. In contrast, neither the intensity nor the duration differs much between first-syllable and second-syllable vowels.

Table 5.3

Average Frequency, Intensity, and Duration for a Selection of Vowels from CV́CV Words

(n=39)

	V1			V2		
	F0 (Hz)	int. (dB)	dur. (ms)	F0 (Hz)	int. (dB)	dur. (ms)
average	*179*	*72.6*	*118*	*128*	*71.7*	*113*

Since these tokens were taken from single-word responses to elicitations, phrase-level prosody will have necessarily been superimposed onto the word-level prosody of the word

[108] For the prosodic data in this chapter, words consisting exclusively of open syllables (CV) were preferred, in order to focus on the effects of stress placement and word length on the word-level pitch without the confounding variables of syllable weight, coda consonant duration, etc. As word length increased, however, fewer tokens in the audio corpus were available, so some tokens of 4- or 5-syllable words do incorporate some CVC syllables out of necessity.

token. To control for this effect, a second sample was taken, that of two CV́CV words in succession within the same intonational phrase (n=24). In this new sample, in both the first CV́CV word and the second, the first vowel of the word was still higher in pitch than the second vowel. There were only four anomalous cases: three in which the two vowels of the first word had equal pitch, and one in which the two vowels of the second word had equal pitch.

In trisyllabic words with initial stress, the stressed initial syllable carries the highest pitch, the medial syllable the next highest, and the final syllable the lowest. Table 5.4 gives the average pitch per syllable for words of this type, given in isolation.

Table 5.4

Average Pitch Per Syllable For Trisyllabic Words With Initial Stress

(n=38) All words in this sample have the structure CV́.CV.CV

	1st syllable (tonic)	2nd syllable	3rd syllable
average pitch (Hz)	180	130	118

In a control sample consisting of a trisyllabic word with initial stress followed by a monosyllabic word within the same intonational phrase (n=25), the pitch contour for the trisyllabic word was generally the same (n=20), except for a few anomalous cases where the pitch of the final syllable was slightly higher than that of the medial syllable (n=3), though both were still much lower than the initial syllable; and one case of the second and third syllables being of equal pitch, though again still lower than the first syllable. A particular final anomalous case is one in which the medial syllable was as high in pitch as the first syllable, with a drop to the final syllable, but this same collocation occurred elsewhere with a drop in pitch between the first and second syllables.

In trisyllabic words with medial stress, the first two syllables show a much smaller difference in pitch than that seen in trisyllabic words with initial stress, while the final unstressed syllable is consistently the lowest in pitch. Table 5.5 gives the average pitch per syllable for words of this type given in isolation.

Table 5.5

Average Pitch Per Syllable For Trisyllabic Words With Medial Stress

(n=25) All words in this sample have the structure CV́.CV.CV

	1st syllable	2nd syllable (tonic)	3rd syllable
average pitch (Hz)	154	152	108

A control sample of trisyllabic words with medial stress followed by a monosyllabic word within the same intonational phrase (n=13) found an exceptionless pattern of a drop in pitch between the stressed medial syllable and the final syllable of the trisyllabic word. The initial, pre-tonic syllable was quite variable in pitch, however, with the initial syllable being slightly higher than the tonic (n=5), slightly lower than the tonic (n=5), or equal in pitch to the tonic (n=3).

For words of four syllables, stress placement may occur on any of the first three syllables. For those words in which the stress is on the first syllable, this syllable carries the highest pitch, and the average pitch drops for each subsequent syllable, in a step-like fashion. Table 5.6 displays the pitch values for words of this type. Note that the largest drops in pitch are between the tonic (initial) syllable and the second syllable, and between the penultimate and final syllables; the pitch drop between the two internal syllables (second and third) is much smaller.

Table 5.6

Average Pitch Per Syllable For 4-Syllable Words With Initial Stress (n=17)[109]

	1st syllable (tonic)	2nd syllable	3rd syllable	4th syllable
average pitch (Hz)	171	135	121	64

In a control sample of a 4-syllable word with initial stress followed by a monosyllabic word within the same intonational phrase (n=4), the pattern held for the drop between the tonic and second syllable and the drop between the second and third syllable; the third-fourth syllable transition was somewhat more variable, with a drop (n=2), a flat pitch (n=1), and a slight rise in pitch (n=1). In all tokens, the final two syllables showed strong laryngeal creak, or 'vocal fry', as the pitch neared the bottom of the speaker's range.

For those words in which the stress is on the second syllable, the pitch contour between the initial, pre-tonic syllable and the tonic syllable is almost non-existent; that is, the contour is level across the first two syllables. Likewise, the drop between the penultimate and final syllables is, on average, quite small. The main, stark difference in pitch is between the second, tonic syllable, and the third, post-tonic syllable; this drop is over 30 Hz on average, compared to 3 Hz and 6 Hz drops for the other two transitions. Table 5.7 gives the relevant values.

[109] Maximum number of word tokens in the sample; some pitch values were not measurable within certain tokens.

Table 5.7

Average Pitch Per Syllable For 4-Syllable Words With Second-Syllable Stress (n=28)[6]

	1^{st} syllable	2^{nd} syllable (tonic)	3^{rd} syllable	4^{th} syllable
average pitch (Hz)	154	157	125	119

In a control sample of 4-syllable words with second-syllable stress followed by a monosyllabic word within the same intonational phrase (n=11), a great deal more variability appeared. The expected pattern (a decrease in pitch from tonic to third, and third to fourth syllables) held in only five of eleven cases. In two cases, there was a pitch drop from the tonic to the third, but the third and fourth had equal pitch (a result not far from the averages given in Table 5.7); in two cases there was a drop from the tonic to the third syllable, but a slight pitch rise between the third and fourth; a single case where the tonic and third syllables had equal pitch, followed by a drop to the fourth syllable; and a very unusual case where there was actually a pitch rise from the tonic to the third syllable, followed by a drop.

For those words in which the stress is on the third syllable, the level pitch contour seen in second-syllable stressed words is extended to the third, tonic syllable; that is, three of the word's four syllables have roughly equal pitch. The drop then comes between the third, tonic syllable and the final, post-tonic syllable, and is on average a drop of 35 Hz. Table 5.8 gives the relevant values.

Table 5.8

Average Pitch Per Syllable For 4-Syllable Words With Third-Syllable Stress (n=15)[6]

	1st syllable	2nd syllable	3rd syllable (tonic)	4th syllable
average pitch (Hz)	166	160	160	125

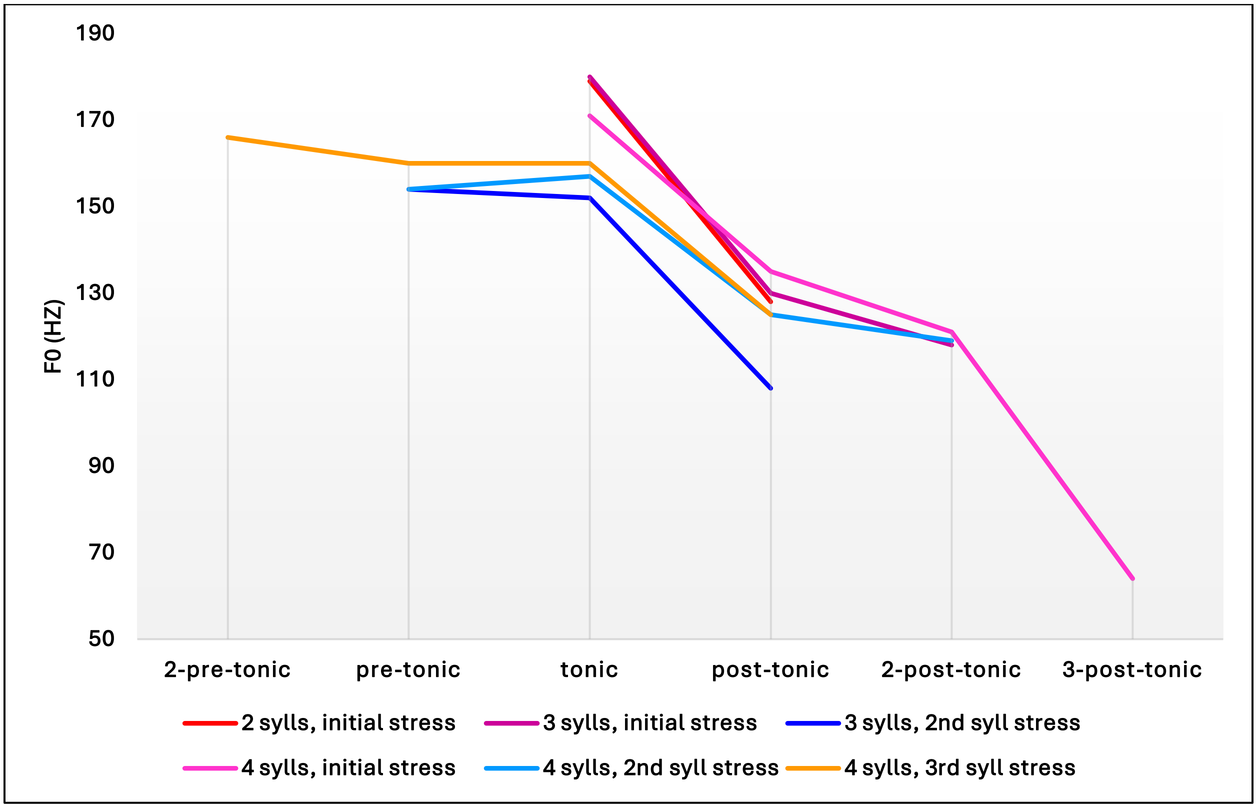
A control sample of a 4-syllable word with third-syllable stress followed by a monosyllabic word within the same intonational phrase (n=3) found a consistent pattern of a pitch drop between the third (tonic) syllable and the fourth syllable. In two of the three tokens, the first two syllables were also lower in pitch than the tonic (with the first being higher than the second), but in the other token, the first syllable was higher in pitch than the tonic (with the second being lower than both).

Figure 5.1 displays all of the different pitch contours described above – words of two, three, and four syllables, with stress placement on the first, second, or third syllable – into a single graph for comparison of pitch values and contours relative to each other.

Figure 5.1

Pitch Contours By Number Of Syllables (2-4) And Placement Of Stress (1^{st}-3^{rd} syllable)

(n=162)



Interestingly, for words with initial stress (indicated in shades of red and fuchsia in Figure 5.1), the pitch contour is largely identical, regardless of the length of the word; each additional syllable simply adds one more drop in pitch from that of the previous syllable. For words with second-syllable stress (indicated in shades of blue in Figure 5.1), the pitch contour is likewise fairly similar, although adding a fourth syllable to these words results in a leveling-out of the overall pitch contour, rather than a continued drop. Finally, words with third-syllable stress (indicated in orange in Figure 5.1) have a fairly level pitch contour across all pre-tonic material, with the pitch drop occurring only between the stressed root and the final syllable.

What is consistently true for lexical prosody in Wappo, across 2-syllable, 3-syllable, and 4+-syllable words, in both isolation and (usually) as part of larger intonational phrases, is that there is a significant pitch drop between the root/tonic syllable and subsequent syllables. While pre-root syllables may have a lower, equal, or higher pitch than the root syllable,[110] they are almost always higher in pitch themselves than the syllables that follow the root; conversely, all syllables following the root are consistently lower in pitch than the root and pre-root syllables. With this fact in mind, we could refine our characterization of the acoustic correlates of stress in Wappo from 'high pitch is the primary acoustic correlate of stress' to 'pitch drop in the transition between the tonic syllable and post-tonic syllable is the primary acoustic correlate of stress.'

5.5 Acoustic Correlates of Secondary Stress

The two morphemes *làh* 'negative' and *yàwmiʔ* 'intentional future' carry their own secondary stress into the prosodic word in which they occur. The primary acoustic correlate of this secondary stress is a pitch drop that is, at its peak, lower than the primary pitch drop of the word's tonic/post-tonic interval, but which is higher than the pitch on the immediately preceding syllable. Interestingly, there is some evidence that a rise in amplitude on these morphemes may also be signaling their secondary stress – a number of tokens in the audio corpus show an amplitude peak on these morphemes that at times is greater than the amplitude of the primary-stress peak.

[110] There is a great deal of pitch variation among pre-tonic syllables across exemplars; more investigation is needed to determine any significant patterns.

Figure 5.2 gives a representative example of the secondary stress of *làh*, in the form of the imperative negator *làhk*^{h}*iʔ*; Figure 5.3 gives a representative example of the secondary stress of the intentional future marker *yàwmiʔ*. In both examples, one can see the ‘dip’ in pitch on the syllable between the higher peak of the primary stress and the lower peak of the secondary stress; the rough location of these two pitch peaks is marked in red, while that of the intervening pitch trough is marked in purple. The higher amplitude on both of the stressed syllables compared to the intervening unstressed syllable can also be seen.

Figure 5.2

Waveform, Spectrogram, and F0 Trace for cámihlàhkʰiʔ *'don't do!'*

(WSR 98)

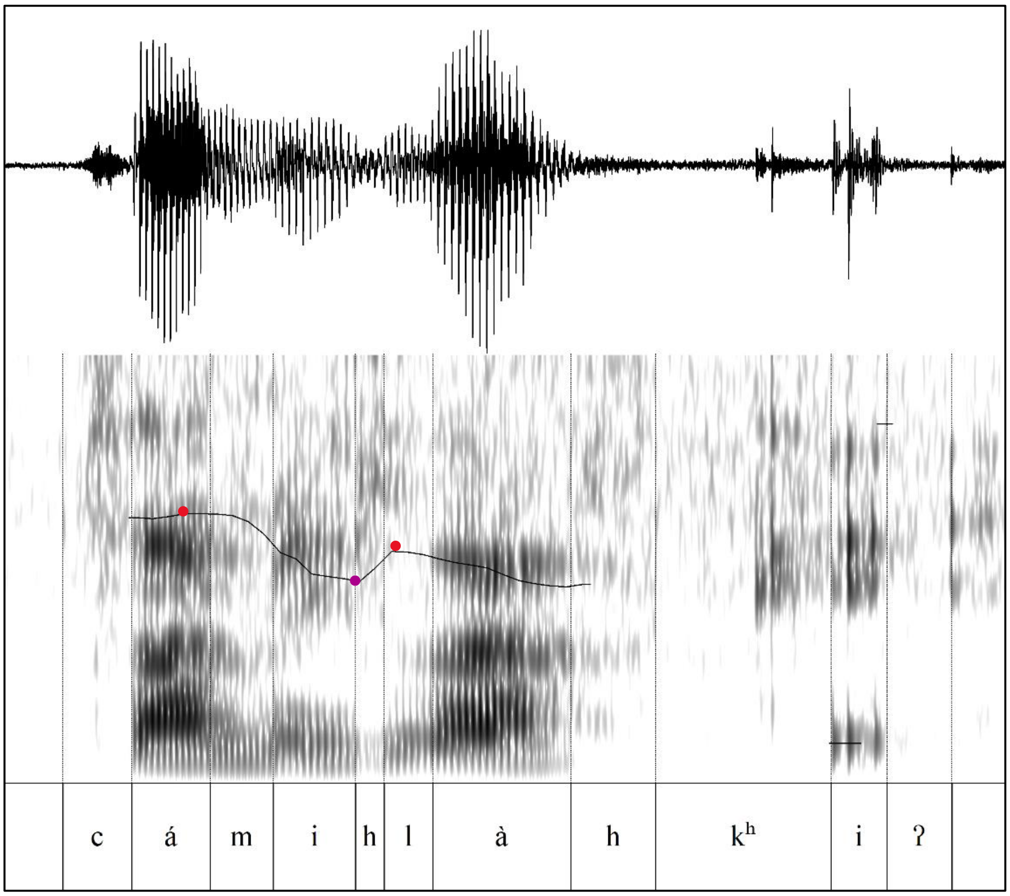
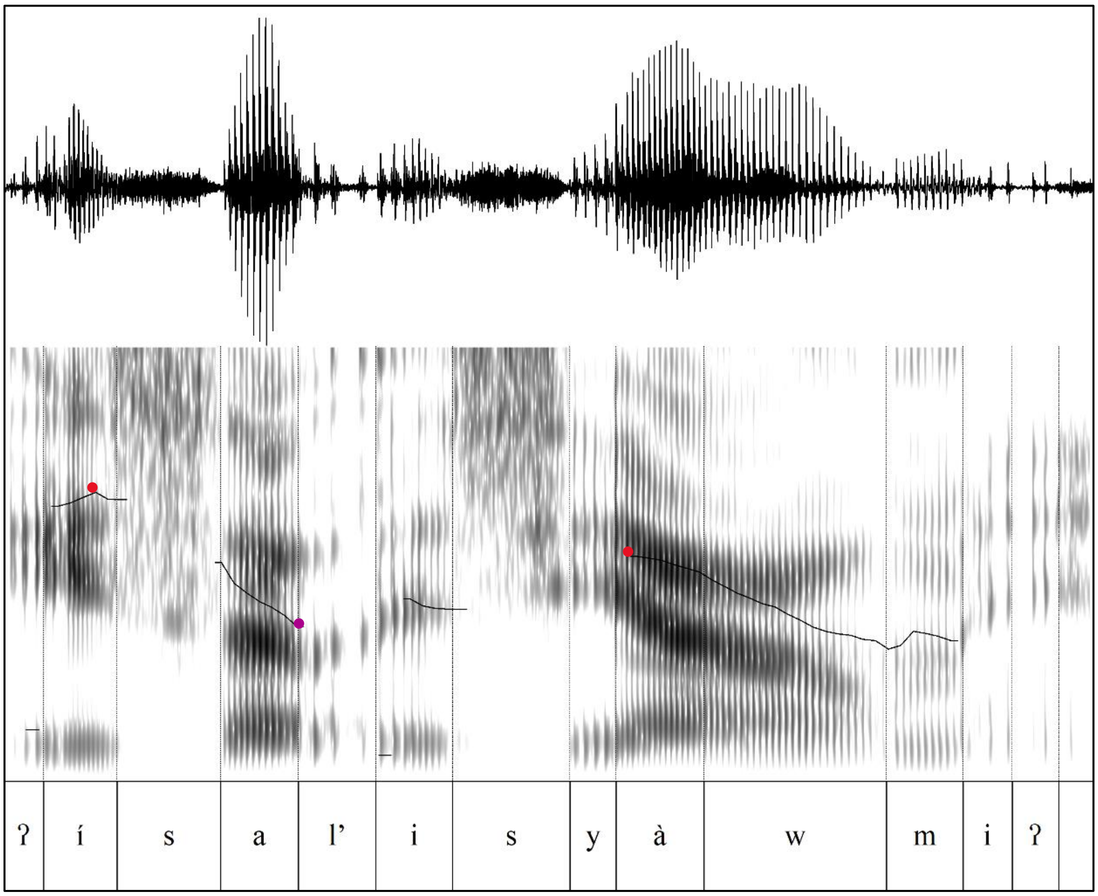


Figure 5.3

Waveform, Spectrogram, and F0 Trace for ʔísal’isyàwmiʔ *‘going to fry’*

(WSR 76)



5.6 Summary

We have demonstrated in this chapter three key observations on word-level prosody in Wappo. First, Wappo makes use of a lexical stress assignment system wherein the first syllable of the morphological/semantic root of a given word is the syllable that bears stress. Second, we have demonstrated that the primary acoustic correlate of stress in Wappo is pitch, rather than intensity or duration. Third, it is the drop in pitch between the tonic syllable and the post-tonic syllable that is the consistent acoustic correlate of stress for words of varying length and varying stress placement.

We have also seen two morphemes, negative *làh* and intentional-future *yàwmiʔ*, that bear a secondary stress. The primary acoustic correlate of this secondary stress is a second pitch drop in the prosodic word that is lower than the preceding drop associated with primary stress, but whose peak is still higher in pitch than that of the intervening unstressed syllable. The distinctive prosodic and structural features of these two morphemes suggest that they are on a grammaticization pathway from independent words to bound affixes.

As with the other phonological topics in this work, a fruitful avenue of further research would be to compare these data on word-level prosody in Wappo with those of other Indigenous languages of the California region and of North America generally, as well as with prosodic patterns found globally.

CHAPTER 6: MORPHOPHONOLOGY

6.0 Introduction

Wappo as it was documented in the twentieth century did not exhibit an extensive system of morphophonemic alternations.[111] The grammar of the modern language is largely straightforwardly agglutinating or fusional, depending on lexical category, with only a handful of productive morphophonemic alternations, the two principal ones being laryngeal alternations and deletion. However, there is some evidence that in older stages of the language, several types of now-obsolete morphophonemic alternations were present and productive, including ablaut, vowel assimilation, reduplication, and consonant gradation. Nevertheless, most had become fossilized and non-productive by the time of the language's twentieth-century documentation.

A fairly complete list of all attested morphophonemic processes in the Wappo lexicon, with examples, is given in this chapter.

6.1 Laryngeal Alternations

The most widespread and productive morphophonemic process in Wappo is that of the loss or change of laryngeal features, involving namely the glottal segments /ʔ/ and /h/, the glottalization and aspiration features /C'/ and /Cʰ/, and sometimes vowel length, i.e. /V ~ V:/. This is a common phenomenon among the languages of the northern Coast Range in California that have glottalization and aspiration as phonemic features, including languages

[111] Especially in comparison to the very complex morphophonemic processes documented for the neighboring Pomoan languages; see e.g. McLendon (1975) for Eastern Pomo, Moshinsky (1974) for Southeastern Pomo, O'Connor (1987) for Northern Pomo, Walker (2013) for Southern Pomo, and Oswalt (1961) for Kashaya Pomo.

of the Pomoan and (Northern) Yukian families (Golla 2011:207). The alternations in Wappo are detailed below.[112]

6.1.1 Glottalization Feature Alternation in Sonorants

In several types of morphological contexts, a glottalized sonorant alternates with its plain (non-glottalized) counterpart. Around 40 lexical roots have been found in the Wappo corpus exhibiting this type of variation. In this section, the varying sonorant segments are marked in red text when glottalized and blue text when plain.

6.1.1.1 Nominal Derivation

In a pair of nouns referring to local flora, a base form with a glottalized sonorant varies with a derived form with a plain sonorant.

(1)	a.	*míl'*	'type of acorn'	(Sawyer 1965:1)
	b.	*míl-o*	'oak tree that produces the *míl'* acorn'	(Sawyer 1965:73)

(2)	a.	*náy'*	'gray pine pinenut'	(Sawyer 1965:79)
	b.	*náy-o*	'gray pine tree'	(Sawyer 1965:79)

One noun was found with two equal variants, with and without a glottalized sonorant:

[112] Throughout this chapter, segments under analysis are presented in red text, unless otherwise noted.

(3) a. *tún'* 'pestle' (WSR 3)

b. *túnuʔ* 'pestle'[113] (WSR 100)

6.1.1.2 Nominal-Verbal Derivation

A small set of words show an alternation between a nominal form with a glottalized sonorant, and one or more verbal forms with the equivalent plain sonorant:

(4) a. *ʔo-lól'* 'a dance' (WSR 77)

b. *ʔo-lól-miʔ* 'to dance' (WSR 82)

(5) a. *c'úl'u* 'a ripple' (WSR 61, 70, 77, 101)

b. *c'úl-* 'to pour' (WSR 78, 98, 109, 114, 115)

(6) a. *cʰúl'* '(woman's) urine' (WSR 64, 78, 92)

b. *cʰúl-eʔ* '(woman) to urinate'[114] (WSR 73, 78)

6.1.1.3 Verbal Inflection

By far the most common type of sonorant variation is across inflections in particular sets of verbs.

While there are a number of exceptional patterns among these verbs, the majority have the inflection schema detailed in Figure 6.1:

[113] Given the final /ʔ/ in the form in (b), it is probable that the form in (a) evolved from (b) through syncopation of the second vowel.
[114] It is possible that the forms in (5) and (6) are etymologically related.

Figure 6.1

Inflection Schema for Verbs with Glottalized Sonorant Variation

	Form A – glottalized	Form B – plain
TAM suffix:	durative in *-iʔ* [115]	past in *-taʔ*
	stative in *-kʰiʔ*	future 1 in *-yàwmiʔ*
	imperative in *-iʔ*	future 2 in *-siʔ*
	various nominal forms	imperative in *-eʔ*
		purposive in *-ema*
		causative in *-(t)as/-(t)is*
		deverbal in *-ukʰ/-okʰ*

Representative examples of this class of verbs are given below.

(7)	a.	*háw'-iʔ*	'to pick, to gather' (durative)	(WSR 75)
	b.	*háw-taʔ*	'picked, gathered' (past)	(WSR 4, 75)
(8)	a.	*p'íl'-iʔ*	'to roll, to hem' (durative)	(WSR 61)
	b.	*p'íle-yàwmiʔ*	'going to roll/hem' (future 1)	(WSR 96)
(9)	a.	*t'úm'-iʔ*	'to buy' (durative)	(WSR 98)
	b.	*t'úm-eʔ*	'buy!' (imperative)	(Sawyer 1965:40, 70)
(10)	a.	*čáy'-iʔ*	'to wind, coil' (durative)	(WSR 99)
	b.	*čáy-ema*	'for winding, coiling' (purposive)	(WSR 114)

[115] Thompson et al.'s "DUR2" class (Thompson et al. 2006:54)

(11)	a.	*kám'-iʔ*	'to cry, weep' (durative)	(WSR 72, 86)
	b.	*káma-tis-taʔ*	'made cry/weep (causative past)	(Thompson et al. 2006:132)

(12)	a.	*cíy'-iʔ*	'to drill, to pierce' (durative)	(Sawyer 1965:8, 32, 78)
	b.	*cíy-ukʰ*	'hole made by piercing' (deverbal)[116]	(Sawyer 1965:52, 78)

(13)	a.	*k'ín'-iʔ*	'to tear' (durative)	(WSR 99)
	b.	*k'ín'te-kʰiʔ*	'torn' (stative)	(WSR 2)

(14)	a.	*háy'-iʔ*	'to count, to say' (durative)	(WSR 9, 75)
	b.	*háy'-iʔ*	'count/say!' (imperative)	(Sawyer 1965:88)

(15)	a.	*c'úl'-iʔ*	'to pour'	(Sawyer 1965:82)
	b.	*c'úl'u*	'ripples, currents'	(WSR 61, 70, 77, 101)

This process appears to be exclusively morphological, and not phonologically motivated. Compare the three forms in (16), where there are two different phonological contexts with the same glottalization feature in (a) and (b), but the same phonological context with two different glottalization features in (b) and (c).

[116] Note that this form appears as *cí·ukʰ* on some pages of Sawyer 1965 (33, 52, 78) but as *cíyukʰ* on another (2). I believe the latter to be the more accurate transcription phonologically, based on this form's variation with a glottalized /y'/.

(16)	a.	*kám’*	‘a cry (n.)’	(Sawyer 1965:25)
	b.	*kám’-iʔ*	‘to cry, to weep (dur.)’	(Sawyer 1965:25, 118)
	c.	*kám-eʔ*	‘cry! (imperative)’	(Sawyer 1965:25)

6.1.2 Laryngeal Segment Alternation

Three attested verbs show a root variation involving forms of the shapes CVh, CV:, CV, CVʔ, that is, with at least two of four different laryngeal states in the root-final consonant (glottal fricative, vowel length, zero, glottal stop):

(17) *téh~té:~té* ‘run, flow, melt’

a.	*(ho-)téh-šeʔ*	‘run, flow’ (dur.)	(WSR 61, 75, 77, 86)
b.	*ho-téhel-kʰiʔ*	‘melted’ (perf.)	(WSR 96)
c.	*(ho-)té:-kʰiʔ*	‘flowing’ (stat.)	(WSR 4, 77)
d.	*hu-téØ{ʔ}ih-kʰiʔ*	‘overflow’	(WSR 78)

(18) *čóh~čó:~čóʔ* ‘go’

a.	*čóh-meʔ*	‘go’ (durative)	(WSR: various[117])
b.	*čó:-kʰiʔ*	‘go’ (perf.)	(WSR 3, 70, 115)
c.	*čó:-yàwmiʔ*	‘go’ (fut. 1)	(WSR 3, 79, 103)
d.	*čó:-siʔ*	‘go’ (fut. 2)	(WSR 3, 100, 108, 114, 115)
e.	*čóʔ*	‘go’ (imperative 1)	(WSR 90, 100, 106, 114, 117)

[117] including WSR 3, 66, 75, 93, 97, 98, 103, 106, 115.

(19) *káh~ká* 'sense: hear/listen, feel, taste, touch'[118]

a.	*káh-šeʔ* ~ *káØ-šeʔ*	'listen; noise/sound occurs'	(WSR 72, 77, 93)
b.	*káh-šiʔ*	'hear'	(WSR 72, 77)
c.	*káh-seʔ*	'taste (intr.); feel (sensation)'	(WSR 77, 82, 93, 117)
d.	*káh-siʔ*	'taste; touch'	(WSR 73, 82)
e.	*káhiš-làhkʰiʔ*	'not listen' (dur. negative)	(WSR 103
f.	*káh-taʔ*	'heard; touched'	(WSR 73, 77, 93)
f.	*káØ-laʔ!*	'listen!' (imperative)	(WSR 72, 109)
h.	*káØ-yàwmiʔ*	'going to touch' (future 1)	(WSR 73)
i.	*káØ-kʰiʔ*	'listening' (stative)	(WSR 72, 77)

6.2 Deletion and Epenthesis

After laryngeal alternation, the next most common morphophonemic processes in Wappo are deletion and epenthesis. These two processes occur exclusively as strategies to avoid vowel hiatus between vowel-final roots and vowel-initial suffixes/enclitics.

6.2.1 Vowel Deletion

Wappo roots are generally either monosyllabic or disyllabic. In disyllabic roots, only the first vowel bears stress, and these stressed vowels cannot be deleted under any circumstances. However, for those disyllabic roots that terminate in an unstressed vowel – those of the shape CV́C(C)V – the second root vowel *is* subject to deletion in order to avoid

[118] The base verb for all of these meanings is the same, the root *káh~ká*. The semantic distinction between the various meanings is signaled with different adverbial lexical prefixes, e.g. *nah-* 'mouth', *nah-ká(h)* 'taste'.

hiatus with a following vowel-initial suffix or enclitic. Below, segments subject to deletion are set in red.

The main example of this process involves two of the language's nominal case enclitics, the nominative enclitic =*i* and the locative enclitic =*u*.[119] Being vowel-initial, their addition to a noun of the shape CV́C(C)V would result in the final vowel of the root and the sole vowel of the enclitic coming into direct contact. To avoid this hiatus, the final vowel of the root is deleted; the clitic vowel could not be similarly deleted without deleting the entire morpheme. Examples are given below.

(20)	a.	*k'éšu*	'deer; meat'	(WSR 64, 113)
	b.	*k'éšØ=i*	'deer; meat (nominative)'	(Sawyer 1965:103)
(21)	a.	*ʔóma*	'world'	(WSR 77)
	b.	*ʔómØ=i*	'world' (nominative)'	(WSR 4, 66, 77)
(22)	a.	*č'éšma*	'bed'	(WSR 96)
	b.	*č'éšmØ=i*	'bed (nominative)'	(WSR 96)

This rule holds even for the small number of trisyllabic vowel-final roots; the third, terminal vowel in these forms is deleted when a vowel-initial enclitic is added:

[119] The morphemes =*i* and =*u* are shown to be enclitics, not suffixes, by the fact that they may attach to the final element of a noun phrase, not always to the noun itself: *[ce k'éw hučéw'iš]=i ʔéw ṭ'óhtaʔ*, 'that happy guy caught the fish', lit. [that man happy]=NOM fish caught (Thompson et al. 2006:18).

(23)	a.	*t'áka·la*	'bat (animal)'	(Sawyer 1965:8)
	b.	*t'áka·lØ=i*	'bat (animal) (nominative)'	(Sawyer 1965:8)

(24)	a.	*cími·ṭo*	'hummingbird'	(Sawyer 1965:53)
	b.	*cími·ṭØ=i*	'hummingbird (nominative)'	(Sawyer 1965:100)

Furthermore, when either of the two vowel-initial case enclitics *=i* (nominative) or *=u* (locative) is added to a stem that includes an unstressed VC sequence, the V of that sequence undergoes syncope. This is the only regular case of syncope documented in the language.

(25)	*ʔopáʔukʰ*	'food'	(Sawyer 1965:2)
	→ *ʔopáʔØkʰ=i*	'food (nominative)'	(Sawyer 1965:2, 41)
	→ *ʔopáʔØkʰ=u*	'food (locative)'	(Sawyer 1965:41)

(26)	*wíyiš*	'tick (arachnid)'	(Sawyer 1965:71)
	→ *wíyØši [wí:ši]*	'tick (arachnid) (nominative)'	(WSR 101)

On the other hand, for verbal roots of the shape CV́, combining with a vowel-initial suffix may result in the deletion of the suffixal vowel; it thus appears that stressed vowels cannot undergo deletion. The only common combination of a CV́ root with a vowel-initial suffix in which the suffixal vowel is deleted is in the formation of the infinitive participle, marked by *-ukʰ*. When this suffix attaches to CV́C roots, they combine without modification, but when it attaches to CV́ roots, the vowel /u/ of the suffix is deleted. This is schematized in Figure 6.2.

Figure 6.2

Schema For Vowel Deletion In The Infinitival Suffix -ukʰ

CV́C + ukʰ → CV́Cukʰ
CV́ + ukʰ → CV́Økʰ

Examples:

(27) CV́C + ukʰ

a. *més-* ‘make’

b. més + ukʰ → *més-ukʰ* ‘making, manufacture’

(WSR 104)

(28) CV́ + ukʰ

a. *k’ó-* ‘cook, boil’

b. k’ó + ukʰ → *k’ó-Økʰ* ‘cooking, boiling’

(Thompson et al. 2006:48)

c. *c’á* ‘lean’

d. c’á + ukʰ → *c’á-Økʰ* ‘leaning’

(WSR 102, 107)

6.2.2 Glottal Stop Epenthesis

Much more common than the suffixal-vowel deletion seen for *-uk^h* is a strategy of glottal stop epenthesis to avoid hiatus. The set of vowel-initial suffixes that occur with this strategy are given in Figure 6.3. In this section, epenthetic glottal stops are marked off in red curly brackets, {ʔ}.

Figure 6.3

Vowel-Initial Suffixes That Require Glottal-Stop Epenthesis With CV́ Roots

-el, -is, -iš, -iya	adjectival
-ema	purposive
-eʔ$_1$	imperative
-eʔ$_2$	durative

(29)	a.	*-el*	adjectival	
	b.	*čʰó-*	‘be sick, die’	
	c.	*čʰó-{ʔ}-el*	‘dead (adj.)’	(WSR 77)
(30)	a.	*-is*	adjectival	
	b.	*ṭʰé-*	‘be silent, quiet, calm’	
	c.	*hu-ṭʰé-{ʔ}-is*	‘not saying much (adj.)’	(WSR 116)
(31)	a.	*-iš*	adjectival	
	b.	*ṭ’í-*	‘be straight’	
	c.	*ṭ’i-{ʔ}-iš*	‘straight (adj.)’	(WSR 75, 99)

(32)	a.	*-iya*	adjectival	
	b.	*ší-*	‘be good, agreeable’	
	c.	*hu-ší-{ʔ}-iya*	‘good (adj.)’	(WSR 82, 93)

(33)	a.	*-ema*	purposive	
	b.	*k’ó-*	‘cook, boil’	
	c.	*ʔo-k’ó-{ʔ}-ema*	‘cooking basket’	(WSR 100, 109)

(34)	a.	*-eʔ*$_1$	imperative	
	b.	*kú-*	‘bend’	
	c.	*kú-{ʔ}-eʔ*	‘bend!’	(WSR 96)

(35)	a.	*-eʔ*$_2$	durative	
	b.	*t’í-*	‘light/start a fire’	
	c.	*mu-t’í-{ʔ}-eʔ*	‘one lights/starts a fire’	(WSR 82)

Regarding the purposive suffix *-ema* in particular, it may be the case that some current Wappo nouns that denote a type of instrument and that end in the sequence *-ma* were originally synchronically marked in *-ema*, with this suffix grammaticizing to a frozen *-ma* over time. The most likely such candidate is *ṭ’áma* ‘walking stick, cane’:

(36) a. *ṭ’á-seʔ* ‘to walk, to step’

b. *ṭ’á-ma* ‘walking stick, cane (i.e. walker, stepper)’

c. *ṭ’á-{ʔ}-ema* ‘step, stairs, ladder (i.e. walker, stepper)’

It is probable that the forms in (b) and (c) represent the same construction, just with (b) having become grammaticized and (c) having been re-coined more recently.[120] Alternatively, it may indicate that the suffix *-ema* formerly employed the deletion strategy seen in Section 6.2.1, where the initial vowel /e/ was deleted to avoid hiatus with the root, but later shifted to the glottal-stop-epenthesis strategy described above.

Finally, a few CV́ verbs also use glottal stop epenthesis to form a new stem that is used for certain parts of the verbal inflectional paradigm, such as the stative/resultative and the future. The additional stem material is set in blue.

(37) a. *lá-m’iʔ* ‘to part, to split’

b. *lá{ʔ}ih-kʰiʔ* ‘opened, split open’ (stative/resultative)

(Sawyer 1965:96, 115)

(38) a. *hú-m’iʔ* ‘to learn, to teach’

b. *hú{ʔ}el-kʰiʔ* ‘having learned’ (stative/resultative)

(WSR 9)

[120] for this root, cf. also *ṭ’áʔ*, ‘leg’

(39) a. *kú-m'iʔ* 'to bend (trans.)'

b. *kú{ʔ}e-siʔ* 'will bend (trans.)' (future, non-intentional)

(WSR 96)

(40) a. *lí-m'iʔ* 'to feel, to squeeze, to press'

b. *lí{ʔ}e-yàwmiʔ* 'going to feel, etc.' (future, intentional)

(WSR 73)

Because many verbal stems take the shape CV́CV(C), especially those for forming the stative/resultative or future, it may be the case that the forms described above, which are converting a CV́ root into a CV́CV(C) root by means of glottal stop epenthesis, were formed more recently on the analogy of those pre-existing CV́CV(C) roots; see example (36) in the next section.

6.3 Alternations in Verb Roots

The internal structure of Wappo verbs is largely non-fusional: a set of prefixes indicate various manner or instrumental meanings, a root gives the primary lexical meaning, and a set of suffixes give the tense, aspect, or mood of the verb (there is no person marking on Wappo verbs, and no number marking, other than suppletive root alternations in a few forms). Each section of the verb is discrete, and there is little fusion between TAM morphemes. Additionally, specific suffixes may be inserted between the root and the set of TAM suffixes to give causative and inchoative meanings.

However, there is a complex set of morphological alternations to the roots of most verbs depending on which TAM suffix follows. For disyllabic roots, three types of alternation occur: between presence and absence of a final vowel, between two different final vowels, or between a final vowel and other material. Those final syllables that do occur, in either group, are from a relatively small set of possible sequences, indicating that these sequences themselves may have in part originated as separate suffixes that became grammaticized over time. The types of allomorphic variation in disyllabic verbal roots is schematized below:

A) variation between presence and absence of a final vowel

CV́CV ~ CV́C

B) variation between two different final vowels

CV́C[V_1] ~ CV́C[V_2]

C) variation with other material

CV́CV/CV́C ~ CV́CX

Among the group labeled (A) above, in which final syllables alternate between final vowel and no final vowel, a subset are clearly based on independent CV́CV words, typically nouns or adjectives. When a certain TAM suffix is added to these words, turning them into verbs, the original final vowel is dropped. Examples are given below.

(41)	a.	*c'áni*	'ice, frost'	(Sawyer 1965:54)
	b.	*c'ánØ-šiʔ*	'to freeze (dur.)'	(Sawyer 1965:42)

(42)	a.	*yáwe*	'name (n.)'	(Sawyer 1965:68)
	b.	*yáwØ-miʔ*	'to name (dur.)'	(Sawyer 1965:68)
	c.	*yáwØ-taʔ*	'to name (past)'	(WSR 108)

(43)	a.	*nóma*	'village, home, place'	(Sawyer 1965:52)
	b.	*nómØ-kʰiʔ*	'to live, to reside (stative)'	(WSR 77, 109)

(44)	a.	*k'éna*	'long'	(Sawyer 1965:60)
	b.	*ʔoh-k'énØ-miʔ*	'to lengthen'	(WSR 96)

(45)	a.	*túč'a*	'big, large'	(Sawyer 1965:10)
	b.	*ʔoh-túč'Ø-miʔ*	'to enlarge, to make bigger'	(WSR 96)

This same type of alternation is also attested for one item with the nominal plural suffix -*ta*:

(46)	a.	*ʔo-k'áni*	'maternal relative'	(Sawyer 1965:80, 84)
	b.	*ʔo-k'ánØ-ta*	'maternal relatives'	(Sawyer 1965:67, 80)

The remainder of the words of type (A) are purely verbal and do not appear to be based on any (extant) noun or adjective; however their morphophonological alternation also involves alternation between presence and absence of a final vowel. In this group, the majority of the alternants with a final vowel are paired with the future tense suffixes:

(47)	a.	*ʔúk’-šiʔ*	‘to drink’	(Sawyer 1965:32)
	b.	*ʔúk’i-siʔ*	‘will drink’	(Thompson et al. 2006:47)
(48)	a.	*wáṭʰ-miʔ*	‘to hit’	(Sawyer 1965:52)
	b.	*wáṭʰi-siʔ*	‘will hit’	(WSR 73, 75)
(49)	a.	*páʔ-miʔ*	‘to eat’	(Sawyer 1965:33)
	b.	*páʔe-siʔ*	‘will eat’	(Thompson et al. 2006:47, 122)
(50)	a.	*k’éč’-iʔ*	‘to cut’	(WSR 4)
	b.	*k’éč’e-siʔ*	‘will cut’	(Thompson et al. 2006:47)

Interestingly, in these future forms, the final vowel of the root is nearly always /i/ or /e/.

The next group of disyllabic roots, labeled type (B) above, show an alternation between two different final vowels. Examples are given below.

(51)	a.	*hópi*	‘two’	(Sawyer 1965:109)
	b.	*hu-hópo-miʔ*	‘to double cloth, to make two layers’	(WSR 101)

(52)	a.	*kápi*	'tied, tied up'	(Sawyer 1965:105)
	b.	*ʔoh-kápu-miʔ*	'to tie a knot'	(WSR 99)
(53)	a.	*míte*	'short'	(Sawyer 1965:91)
	b.	*ʔoh-mítu-miʔ*	'to shorten'	(WSR 96)
(54)	a.	*c^h^ípe*	'red'	(Sawyer 1965:84)
	b.	*c^h^ípi-taʔ*	'to redden (past)'	(Sawyer 1965:84)
(55)	a.	*t^h^úpa*	'stiff'	(Sawyer 1965:99)
	b.	*t^h^úpi-seʔ*	'to stiffen (dur.)'	(Sawyer 1965:99)
(56)	a.	*ṭ'ápi-seʔ*	'to shout'	(Sawyer 1965:91)
	b.	*ṭ'ápa-tiʔ*	'shout!'	(WSR 75)

The last group of disyllabic roots, labeled type (C) above, show an alternation between a CV́CV or CV́C root and a root with other final material. This final material is from a relatively small set of VC or CV sequences – the most common are *-el*, *-is*, *-ih*, *-ah*, and *-te* – suggesting that these sequences were once separate morphemes that over time became fused into the verbal root. Examples follow.

(57)	a.	*hin=cáṭi-seʔ*	'to wake up' (durative)	(Thompson et al. 2006:39)
	b.	*hin=cáṭel-kʰiʔ*	'(having) woken up, awake' (resultative)	(Thompson et al. 2006:39)
(58)	a.	*ʔísal'Ø-saʔ*	'to fry' (durative)	(WSR 2, 69, 86)
	b.	*ʔísal'is-yàwmiʔ*	'going to fry' (future 1)	(WSR 76)
(59)	a.	*cámØ-iʔ*	'do' (durative)	(Sawyer 1965:30)
	b.	*cámih-làhkʰiʔ*	'don't do!' (negative imperative)	(WSR 98, 106, 109)
(60)	a.	*k'úpi-seʔ*	'to rot' (durative)	(WSR 82)
	b.	*k'úpah-kʰiʔ*	'rotten' (stative)	(WSR 82)
(61)	a.	*ʔo-kál'Ø-iʔ*	'to speak' (durative)	(WSR 93, 99, 100)
	b.	*ʔo-kál'te-yàwmiʔ*	'going to speak' (future 1)	(WSR 106)

The varying root-final material can be found attached to the monosyllabic CV roots that make use of glottal epenthesis, as was shown in (37) - (40); in these verbs, the variable material is added to the epenthesized form:

(62)	a.	*tu-lé-seʔ*	'to come (for a visit)'	(Sawyer 1965:116)
	b.	*tu-lé{ʔ}a-tiʔ*	'come for a visit!'	(Sawyer 1965:116))

(63)	a.	*ʔoh-kú-m'iʔ*	'to bend (trans.)'	(WSR 96)
	b.	*ʔoh-kú{ʔ}e-siʔ*	'will bend (trans.)'	(WSR 96)

This raises the question of whether these vowels and other varying syllables are specified by the root or by the following suffix. The fact that a glottal stop segment can be epenthesized into what looks like the center of a root perhaps suggests that the root is really just the pre-glottal material, with the post-glottal material being a separate morpheme. It may alternatively be the case that the final vowel was added to these CV-glottal verbs on the analogy of the larger class of CV́CV verbs.

The question of which TAM suffixes specify which root allomorph is a complicated one. There does not appear to be a fixed, exclusive pattern, but rather a many-to-many correspondence. Most TAM suffixes occur with both CV́C and CV́CV verb roots (though usually with only one particular allomorph per verb), and particular allomorph types do not appear to occur consistently with a single TAM suffix. A few of the most common patterns, though, are detailed below.

1. All vowel-initial TAM suffixes occur exclusively with either CV́C or CV́{ʔ} allomorphs. These include:

durative suffixes *-iʔ, -eʔ, -iyaʔ, -ayaʔ, -alaʔ*

imperative suffixes *-iʔ, -eʔ*

purposive suffix *-ema*

infinitive/gerund suffixes *-ukʰ, -okʰ*

causative suffixes *-is, -as*

inchoative suffixes *-iš, -eš*

In this group, it can be inferred that the suffix is combining either with an underlying CV́C root, with a CV́ root with the help of glottal epenthesis, or with an underlying CV́CV root whose final vowel is then being deleted by the initial vowel of the TAM suffix.

2. The durative suffix *-m'iʔ* occurs almost exclusively with CV́ roots, with only one attestation of its occurrence with a CV́CV root.

3. All other consonant-initial TAM suffixes can occur with CV́C, CV́CV, and CV́ root shapes, as well as with other irregular forms, the most common of which is CV́CVh. These include:

durative suffixes *-miʔ, -šeʔ, -siʔ, -seʔ, -saʔ*

past tense suffix *-taʔ*

inchoative suffix *-šaʔ*

future tense suffixes *-siʔ, -yàwmiʔ*

stative/resultative suffix -*kʰiʔ*

passive voice suffix -*kʰeʔ*

imperative suffixes -*tiʔ, -teʔ, -siʔ, -laʔ, -maʔ*

negative suffix -*làh*

Table 6.1 gives a rough count of the number of root morphs of the five most common types – CV́C, CV́CV, CV́(:), CV́C[V] (i.e. where an inherent final vowel is deleted), and CV́CVh – with each of the most common TAM suffixes.

Table 6.1

Frequency Of Co-Occurrence Of The Most Common Verbal Morphs With The Most Common TAM Suffixes

Final vowels, when consistent, are given in parentheses

TAM category	suffix	CV́C	CV́CV	CV́(:)	CV́C[V]	CV́CVh
durative	-miʔ	119	12 (o/u)	2	7	-
	-šeʔ	76	12 (i)	3	1	-
	-seʔ	38	14	9	-	-
	-šiʔ	31	5 (i/e)	1	3	-
	-siʔ	25	3 (i)	-	1	-
inchoative	-šaʔ	11	8	-	-	-
future	-yàwmiʔ/-siʔ	1	31	4	-	17
stative	-kʰiʔ	53	84	16	4	66
past	-taʔ	101	17 (i)	15	6	2
imperative	-tiʔ	36	19	6	-	1
negative	-làh	4	19	1	-	4

The distribution seen here suggests that, at least at the time of documentation, the pattern of synchronic combinations of various verbal root allomorphs with various consonant-initial TAM suffixes was largely arbitrary. All TAM suffixes shown above preferentially occur with CV́C morphs, except for the future suffixes *-siʔ* and *-yàwmiʔ*, the stative suffix *-kʰiʔ*, and the negative suffix *-làh*, which preferentially occur with CV́CV morphs. All TAM suffixes are attested occurring with both CV́C and CV́CV morphs, and most also occur with CV́(:) morphs. The actual attested cases of TAM suffixes that appear to cause vowel elision of underlyingly CV́CV roots is relatively small, with only 19 examples, and there does not appear to be any unifying and exclusive phonological feature of these 19 roots. These are given in Table 6.2.

Table 6.2

Underlyingly CV́CV Roots That Undergo Final Vowel Deletion With TAM Suffixes

CV́CV form	gloss	form(s) with vowel deletion	gloss
c'áni	'ice, frost'	*c'ánØ-šiʔ*	'to freeze'
c'áy'a	'square, oblong'	*c'áy'Ø-miʔ*	'to even a table'
c'úl'u	'rapids (in a stream)'	*c'úlØ-taʔ*	'poured'
cʰáya	'bad'	*cʰáyØ-šeʔ*	'to dislike'
cʰówe	'black'	*cʰówØ-taʔ*	'blackened'
cʰúc'i/e	'a sneeze'	*cʰúc'Ø-taʔ*	'sneezed'
č'óše	'stores, provisions'	*č'óšØ-miʔ*	'to store, put away'
		č'óšØ-taʔ	'stored, put away'
č'óṭ'a	'shriveled'	*č'óṭ'Ø-siʔ*	'to frown'
káṭ'a	'a laugh'	*káṭ'Ø-šeʔ*	'to laugh'
k'éč'a	'divided'	*k'éč'Ø-taʔ*	'cut, chopped'
k'éna	'long'	*k'énØ-miʔ*	'to lengthen'
mísi	'wife'	*mísØ-taʔ*	'married (took a wife)'
mót'a	'hill, mountain'	*mót'Ø-miʔ*	'to stack, pile, cord up'
		mót'Ø-kʰeʔ	'to be stacked (passive)'
		mót'Ø-kʰiʔ	'to be stacked (stative)'
		mót'Ø-taʔ	'stacked'
		mót'Ø-tiʔ	'stack! (imperative)'
nóma	'home, village'	*nómØ-kʰiʔ*	'to reside'
		nómØ-seʔ	'to migrate'
pók'i/e	'semen'	*pók'Ø-taʔ*	'ejaculated'
šéʔi	'wind'	*šéʔØ-šiʔ*	'for wind to blow'
šóše	'a skin boil'	*šóšØ-miʔ*	'ritual sucking of a cut'
túč'a	'big (sg.)'	*túč'Ø-miʔ*	'to enlarge'
		túč'Ø-taʔ	'enlarged'
yáwe	'name'	*yáwØ-miʔ*	'to name'
		yáwØ-kʰeʔ	'to be named (passive)'
		yáwØ-taʔ	'named'

6.4 Other Root Alternations

One set of alternations that is seen in a specific set of nouns is a variation between final *-e* and final *-ay*. The *-ay* form is specified by the addition of the two vowel-initial enclitics, *=i* (nominative) and *=u* (locative); the *-e* form is used for the remaining consonant-initial case enclitics, as well as the plural suffix *-te*. Examples are given below.

(64)	a.	*mét'e*	'woman'	(WSR 63, 112)
	b.	*mét'ay=i*	'woman (nom.)'	(WSR 93)
	c.	*mét'e-te*	'women'	(WSR 112)

(65)	a.	*šíʔe*	'grass'	(WSR 90)
	b.	*šíʔay=i*	'grass (nom.)'[121]	(Thompson et al. 2006:37)

(66)	a.	*sóke*	'star'	(WSR 66)
	b.	*sókay=i*	'star (nom.)'	(Sawyer 1965:98)

(67)	a.	*c^hóke*	'hip'	(Sawyer 1965:40)
	b.	*c^hókay=u*	'on the hip (loc.)'	(Sawyer 1965:19)

(68)	a.	*méy+léle*	'lake'	(WSR 66, 72, 77)
	b.	*méy+lélay=u*	'in the lake (loc.)'	(WSR 72)
	c.	*méy+léle=h*	'in the lake (loc.)'[122]	(WSR 72)

[121] also attesed with regular formation, *šíʔi* (šíʔe=i) (WSR 77)

It is likely that the forms ending in *-ay* are the original form of the root, with the *-ay* being monophthongized to *-e* in contexts where no other vowel follows. Evidence to support the forms ending in *-e* as being derived from the forms ending in *-ay* includes the fact that there are many roots ending in *-e* that do not appear to vary with an *-ay* form; thus historically, the former group likely represents roots ending in original **-ay* and the latter group likely represents roots ending in original **-e*.

There is additionally a set of verbs marked by the TAM suffix *-ayaʔ* (which appears to have an inchoative meaning) that may be related to the group of *-e~-ay* nouns described above; most of them appear to derive synchronically from nouns ending in *-e*. If this is the case, the *-ay* portion is part of the root, and the true durative/present suffix is *-aʔ*. Examples follow.

(69)	a.	*ʔo-cáwe*	'flower'	(WSR 93, 103)
	b.	*cáwayaʔ*	'to bloom'	(WSR 70)
	cf.	*cáwe-kʰiʔ*	'to bloom'	(WSR 93)

(70)	a.	*k'éme*	'gray (of hair)'	(WSR 69)
	b.	*k'émayaʔ*	'(a person) to turn/go gray'	(WSR 75)

(71)	a.	*méye*	'sweat'	(WSR 73)
	b.	*méyayaʔ*	'to sweat'[123]	(WSR 69, 73)
	cf.	*méye-kʰiʔ*	'to sweat'	(WSR 69, 73)

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[122] Both *=u* and *=h* appear to be locative case enclitics; the semantic difference between them is unclear from the available attestations.
[123] cf. *méy* 'water'

(72) a. *píʔe* ‘fat (adj.)’ (WSR 97, 114)

b. *píʔayaʔ* ‘to fatten’ (WSR 59)

cf. *píʔe-kʰiʔ* ‘to be fat (stative)’ (WSR 64, 76)

(73) a. *hu-šúwʰe* ‘steam’ (WSR 81)

b. *hu-šúwʰayaʔ* ‘to be steaming’ (WSR 81, 90, 100)

However, one root without *-e* also takes *-ayaʔ*, complicating this analysis:

(74) a. *cʰácʰ* ‘cold’ (WSR 61, 81)

b. *cʰácʰayaʔ* ‘to get/become cold’ (Sawyer 1965:22)

Of course, it is possible that *cʰácʰ* joined this paradigm due to analogy, perhaps on a semantic basis, as most of the verbs of this type appear to be physical change-of-state verbs.

6.5 Ablaut

Several lexical items in Wappo exhibit vowel ablaut, mostly signaling derivational processes. The attested examples of ablaut are described below. The only pattern that occurs more than once is a change from a base vowel //a// to a derived vowel //e//.[124] Four examples of this change are attested, all of which are employed for derivational purposes. The remaining examples of ablaut are unique instantiations.

The principal ablaut pattern is between a base vowel //a// and a derived vowel //e//; this is schematized in Figure 6.4.

Figure 6.4

Primary Ablaut Schema

//a//	↔	//e//
base vowel		ablaut vowel

Throughout this section, ostensible base vowels will be marked in blue text, while ostensible ablaut vowels will be marked in fuchsia text (and in red text for any additional ablaut variants).

(75)	a.	*ʔácʰa*	'male cousin'	(Sawyer 1965:24, 62)
	b.	*ʔécʰØ-pi*	'female cousin'	(Sawyer 1965:24, 37, 69, 120)

[124] Double forward slashes, //, are used here to denote morphophonemic transcription.

Note also the forms *ʔécʰ-is* ‘nephew, husband of a niece’ and *ʔécʰa* ‘elder sister’, which, with the forms meaning ‘cousin’, may all trace back to an original form **ʔVcʰa*, with a presumably more general kinship meaning.

(76)	a.	*ʔoh-táʔ-i·ya*	‘heavy’	(Sawyer 1965:50)
	b.	*téʔ-i·ya*	‘slow’	(Sawyer 1965:2, 93)

Whether these two forms are etymologically related is uncertain, though the semantic relationship suggests that it is at least plausible. In this case, it is also difficult to tell which form is the base and which is the derivation.

(77)	a.	*mákʰ*	‘rain (n.)’	(Sawyer 1965:84)
	b.	*mékʰ-šiʔ*	‘drop, fall (v.)’	(Sawyer 1965:32, 33, 36)
	c.	*mékʰi·-kʰiʔ*	‘dropped, fallen (v. stative)’	(Sawyer 1965:33)

This group may represent an old ablaut derivation process for transforming nouns into verbs.

(78)	a.	*ʔo-kál’-iʔ*	‘talk, speak (v.)’	(Sawyer 1965:25, 58, 67, 96, 102)
	b.	*ʔókel*	‘language, voice, word’	(Sawyer 1965:58, 61, 116, 122)

The variation between the root *ʔo-kál{’}* ‘speak’ and *ʔó-kel* ‘language, voice, word’, is unique among the examples of ablaut, and of morphophonological alternation in Wappo in general, in that it involves a change of stress. *ʔo-* is a very common verbal prefix in Wappo, generally indicating habitual aspect, undirected activity, or lack of a specified patient (i.e. detransitivization). Being a prefix, it never receives phonological stress, except in this one lexical item. Audio data confirm that the placement of an accent on *ʔo-* here is indeed correct, and not a typographical error in the written sources (WSR 3, 74, 106).

There is a single attested example of inflectional ablaut in Wappo, namely the pluralization of the word meaning ‘child, baby; son’. Unlike the prior group, this pair uses a unique ablaut schema //e-a// → //o-o//

(79)	a.	*ʔék’a*	‘child, baby; son (singular)’	(WSR 63, 86, 97)
	b.	*ʔók’o·-to*	‘children, babies; sons (plural)’	(WSR 97, 100)

This example is also notable in that not only the stressed first vowel of the root, but the unstressed second vowel of the root also appears to be subject to ablaut: //ʔék’a// → //ʔók’o//. Note that this example also exhibits vowel assimilation in the plural suffix, *-to*; the typical plural suffix for nouns is *-te*.[125] The result is that the plural form has a consistent vowel /o/ throughout all of its syllables. Vowel assimilation is discussed further in Section 6.6.

The remaining attested examples of ablaut in Wappo are much more sporadic, involving no consistent pattern of vowel change; for many of them, it is indeed unclear whether an ablaut relationship is present at all.

[125] A small number of nouns and adjectives take a plural marker *-ta* instead of *-te*, e.g. *k’éw* ‘man’, *k’éwta* ‘men’; *nókʰ* ‘friend’, *nókʰta* ‘friends’. The variation between *-te* and *-ta* is most likely the vestige of an old noun class system, potentially one based on a human/non-human dichotomy; the primary evidence for this is two pluralizations of the adjective *šíc’* ‘young, new’: *šíc’ta* ‘young (pl.)’, with human referents; and *šíc’te* ‘new (pl.)’, with non-human referents.

(80) a. *šéš* 'wound, sore, scab' (Sawyer 1965:88, 95, 122)

b. *šóše* 'boil that comes to a head and breaks' (Sawyer 1965:12)

The semantic connection between these two items is fairly strong, and there is also a root *šíš*- 'to blow the nose' that may be related (through the equation 'snot' = 'pus').

A particular group of roots also appear to be sharing an ancient ablaut relationship; they have the consonantal frame //w-l// (with some inflected forms exhibiting a glottalized /l'/) with a variation between the vowels /e/, /o/, and /u/. What suggests that these roots may be historically related is their general semantic values, having to do with repetitive to-fro, circular, or back-and-forth motions. This set is given below.

(81) a. *wél*- '-wards'; 'return'; 'roll out'; 'wrap' (WSR 79, 99)

b. *wól*- 'stir, paddle' (WSR 90)

c. *wúl*- 'rock back and forth' (Sawyer 1965:13)

Finally, two pairs of roots appear to show a frozen ablaut relationship, as indicated by the semantics of each pair:

(82) a. *č'úṭʰ*- 'to scrape' (WSR 61.2, 69, 70, 75, 86, 102)

b. *č'áṭʰ*- 'to scratch' (WSR 3, 102)

(83) a. *k'úp-* 'to rot' (WSR 82, 93, 99)

b. *k'óp-* '(ice) to melt' (WSR 4)

6.6 Vowel Assimilation

One enclitic, one suffix, and a small number of word-final syllables in Wappo exhibit vowel assimilation, that is, their inherent vowel changes to match the vowel of the syllable immediately preceding them. Unlike the well-known pattern of vowel assimilation seen, for example, in the Turkic languages, the vowel assimilation seen in Wappo only obtains between a suffix/enclitic and the immediately preceding syllable, not the entire word; however, more extensive patterns of vowel assimilation are seen in a small number of reduplicative, largely onomatopoeic words – see Section 6.7.3.

The only productively assimilating morpheme at the time of documentation was the polar interrogative enclitic *=hVʔ*, which is generally attached to the end of a verb in a verbal clause, or to the final element in an isolated nominal clause,[126] and denotes a yes/no question. Some examples are given below; the vowels involved in the assimilation process are underlined:

(84) *míʔ ʔi=hák'šeʔ=heʔ* 'do you like me?'

2SG.NOM 1SG.O=like=PQ (Thompson et al. 2006:91)

(85) *k'éw=i mi=náwtaʔ=haʔ* 'did the man see you?'

man=NOM 2SG.O=see.PST=PQ (Thompson et al. 2006:90)

[126] Other placements are possible, but the syntactic or pragmatic rules governing them has not yet been fully worked out.

(86) *túy̲'=hi̲ʔ* 'is it true?'[127]

truth=PQ (Sawyer 1965:108)

(87) *háṭiskʰi̲ʔ=hi̲ʔ míʔ* *[ʔi tʰál ʔič[ʰ]ál'iš]* 'do you know what I'm saying?'

know=PQ 2SG.NOM [1SG.UM what say.DEP] (Thompson et al. 2006:92)

There is also evidence that the nominal/adjectival plural marker, generally *-te*, was once subject to vowel assimilation. The word for 'child, baby; son' is repeated from (79) above:

(88) a. *ʔék'a* 'child, baby; son' (sg.) (Sawyer 1965:6)

b. *ʔók'o·-to̲* 'children, babies; sons' (pl.) (Sawyer 1965:20)

Here, the plural marker takes the form *-to* rather than expected *-te*, harmonizing with the ablauted root *ʔók'o·-*.[128] In the remainder of this section, vowels displaying vowel harmony will be marked in magenta text.

Four lexical items appear to include a fossilized suffix *-lVʔ* that at one time exhibited vowel assimilation. In all four items, the vowel of the final *-lVʔ* sequence assimilates to the vowel of the stressed syllable, while in two of these items, *ʔépehleʔ* and *ṭúpu·luʔ*, both the stressed initial syllable and the medial syllable before the *-lVʔ* syllable exhibit two copies of

[127] The vowel in this form of the enclitic *hVʔ* might instead be assimilating to the coda consonant /y'/; alternatively, the coda consonant, being a phonologically 'complex' glottalized sonorant, is somehow blocking the assimilation process, in which case the vowel of the enclitic defaults to an inherent /i/. This is the only example of its kind in the corpus, so the process here is ambiguous.

[128] Whether the change from *-e-a* to *-o-o* in the forms *ʔék'a* ~ *ʔók'o·to* represents a formerly-productive pattern of whole-word vowel assimilation must remain an open question; this item is the only attested one to show this type of vowel ablaut pattern.

the same vowel. This perhaps points to an ancient rule where (some) words were obliged to display an internally consistent set of vowels, a type of vowel harmony.

(89)	a.	*wíh-li?*	"rattle; bell"	(WSR 103)
	b.	*čúh-lu?*	"sickly, invalid"	(WSR 104)
	c.	*?épeh-le?*	"gopher sp."	(WSR 67)
	d.	*ṭúpu·-lu?*	"bead, clamshell bead"	(Sawyer 1965:21)

These are the only attested native lexical items in which the final syllable has the shape *-lV?*. The final syllable in these items may thus represent an old suffix **-lV?* which would have assimilated with the vowel(s) of the preceding syllable(s).

Two further lexical items appear to exhibit a similar process, though with a different final syllable:

(90)	a.	*hún-tu?*	'corpse, the dead one, used in order to avoid the name of the dead person'[129]	(Sawyer 1965:24)
	b.	*yóm-to?*	'shaman, doctor'	(Sawyer 1965:90)

Here, *-tV?*, as with *-lV?* in the previous examples, may be a fossilized suffix that at one time was subject to vowel assimilation with its root. Its semantic value is unknown, though it may

[129] Sawyer hypothesized that this item may be of Spanish origin (Sawyer 1965:24); the only candidate that I could think of that matches phonologically would be *junto* 'together', but this is not a plausible source on semantic grounds.

have been a type of nominalizer or agentive suffix. As in the cases with -*lVʔ*, these two words with -*tVʔ* are the only attested items of their type.

Finally, there are a small number of opaque lexical items of three to four syllables in which a single vowel occurs throughout the word:

(91)	*t'áka·la*	'bat (animal)'	(WSR 77)
(92)	*p'áma·la*	'wildcat, bobcat'	(WSR 9)
(93)	*k'áta·ma*	'mountain lion'	(Radin 1929:185)
(94)	*sóṭ'o·ko*	'elk'	(WSR 9, 101, 113)
(95)	*ʔunuʔčúkuʔ*	bird sp.	(WSR 100)

The form in (95) is most likely onomatopoeic in nature; but the fact that all of these forms refer to local fauna, coupled with their unique phonological shape, means that these items may be candidates for origin in a pre-Wappo substrate.

6.7 Reduplication

There is a good amount of evidence that, at least at one point in the history of Wappo, a productive reduplication process existed, used for a variety of morphological and semantic purposes. There are only a moderate number of attested reduplicated forms, some with unknown base forms, but even so, the range of functions of reduplication are apparent in the forms that do occur.

The reduplication schema in the attested Wappo vocabulary is of two main types. In these schema, the ‘>’ indicates the boundary between base and reduplicant.

A. [CV́(C)]>[CV(C)] whole-syllable reduplication of CV́(C) forms

B. [CV́]$_1$.[CV]$_2$>[CV]$_2$ reduplication of the second syllable of CV́CV forms

Additionally, a few items exhibit a third type:

C. C[V́C]>[VC] reduplication of the nucleus and coda of CV́C forms

In the examples that follow, the putative base form is marked in blue text, while the reduplicated material is marked in red text.

6.7.1 Interjectional

The common interjection *ʔí:ʔi*, ‘yes’, is a reduplicated form. Unlike the other reduplications discussed below, it also shows phonemic lengthening of the first vowel, likely rooted in pragmatic effects:

(96) *ʔí:ʔi* ‘yes’ (WSR 74, 105)

This is a type A reduplication in which a single CV syllable is doubled.

6.7.2 Verbal Derivation

Several attested verbs appear to show a reduplicated form for a continuative, iterative, or distributive aspect or semantic referent, a common use of reduplication cross-linguistically:

(97)	a.	*ʔo-šóko·-miʔ*	'a kind of hollow sound, or thumping, or like paper rustling'	(WSR 117)
	b.	*šóko·>ko·-siʔ*[130]	'sound of rain'	(WSR 117)
(98)	a.	*ʔo-c'íṭ'-miʔ*	'squeak'	(WSR 109)
	b.	*c'íṭ'i·>ṭ'i·-siʔ*	'squeak continuously'	(WSR 109)
(99)	a.	*me-líp'-šiʔ*	'poking the finger in a hole and feeling around'	(WSR 95)
	b.	*na-líp'i·>p'i·-kʰiʔ*	'[the ground] is full of chuckholes'	(WSR 75)
(100)	a.	*síwʰ-i·yaʔ*	'the sound of wind'	(WSR 117)
	b.	*síwʰi·>wi·-saʔ*	'[the wind] is whistling'	(WSR 117)

[130] The durative suffix *-siʔ* appears to occur disproportionately with verbs of physical/bodily or sound-symbolic actions, e.g. verbs meaning 'bite', 'chew', 'clink', 'gnaw', 'itch', 'nibble', 'sprinkle', 'shake', 'squeak', 'squirm', 'thump', 'tickle', and many others.

The reduplications in these verbal forms are all of the B type, the copying of the second syllable of the root only.

The reduplicated forms in (97) through (100), given in (b) in each example, have a root that is attested in non-reduplicating forms, given in (a) in each example. This is another example of the morphophonological alternation found in many verb roots, discussed in Section 6.3 above.

Intriguingly for the analysis of the aspirated sonorant phonemes in Wappo, the form in (100) shows the loss of the aspiration feature on the glottalized sonorant /w^h/ when it is copied from the base to the reduplicant. This is the sole example of its kind, but even so, it may point to an analysis in which the aspirated sonorants are not entirely phonemic in the way that the aspirated stops and affricates are; compare the form in (105), in the next section, in which an aspirated labial stop /p^h/ retains its aspiration across the reduplication.

6.7.3 Adjectival Derivation

Several attested adjectives appear to have been formed through reduplication, with the addition of a final glottal stop *ʔ*.

(101)	*šók'o·>k'o-ʔ*	'striped, straight-striped'	(WSR 5, 95)
(102)	*tónčiʔ kíti·>ti-ʔ*	'striped cat, Maltese cat' (*tónčiʔ* 'cat')	(WSR 95)

As with the verbal reduplication described above, these adjectives use the type B reduplication. There are no attested standalone base forms for these items.

The lexical item ‘freckle, polkadot’ likewise shows this reduplication structure. Though the gloss given in Sawyer (1965) (and the elicitation in the audio corpus) implies that it is a noun, its morphological form is identical to the adjectives given in (101) and (102) above, and thus a gloss ‘freckled, polkadotted’ may be more accurate.

(103) *tót’o·>t’o-ʔ* ‘freckle[d], polkadot[ted]’ (Sawyer 1965:42, 81, 85) WSR 5

As with the aspectual derivation, this adjectival derivation may also be partly symbolic, the reduplication iconically representing the repeated pattern of ‘stripes’ or ‘freckles/polkadots’.

Two additional items from the audio corpus but that do not occur in Sawyer (1965) are given below.

(104) *téle·>le-ʔ* ‘checkered or plaid’ (WSR 5)

(105) *tápʰa·>pʰa-ʔ* ‘spotted, with round spots’ (WSR 5)

These show the same structural and semantic patterns as the previous items: B-type reduplication with an additional glottal stop, and the semantics of a distributed visual pattern.

One other adjective shows a unique reduplication pattern not seen elsewhere:

(106) *noʔo>nóʔ-is* 'having one leg shorter than the other' (WSR 97)

This form shows reduplication of the entire CV́CV root, not just the second syllable (though the final vowel of the reduplicant is deleted with the addition of the adjectival derivational suffix -*is*). Furthermore, it is the reduplicated segment that bears the word stress, not the base segment; no other attested reduplicated word in the language shows this type of word accent.[131]

6.7.4 Nominal Derivation

Along with the verbal and adjectival forms discussed above, there are a number of nouns that appear to be built on a reduplicated root. However, unlike the verbal and adjectival reduplications, the nominal reduplications generally involve the A-type reduplication, the copying of an entire CV(C) root.

Four of the attested nominal reduplications refer to species of bird:

(107) *pípi* 'quail, valley quail' (Sawyer 1965:83)

(108) *téktek*^{h} 'hawk'[132] (Sawyer 1965:11, 49)

(109) *c*^{h}*ipiṭókṭok*^{h} 'robin' (Sawyer 1965:86)

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[131] An alternative analysis is that the first two syllables are prefixes, *no-, ʔo-*, which are indeed attested in other words. This analysis would then remove this item from the list of reduplicated forms in the language.

[132] Note that in (108) and (109), the coda consonant /k/ of the root acquires aspiration in the reduplicant. This is one of the primary pieces of evidence for positing that (at least some) word-final aspirated stops are underlyingly unaspirated; see Chapter 3.

(110) *šíma napiców'cow'* bird sp. (WSR 92)

The first item, 'quail' may be a purely iconic imitative form, representing the bird's call. The second and third, 'hawk' and 'robin', appear to be related in several ways. First, the two words may share an ancient ablaut alternation between /e/ and /o/. Second, they may also share a consonant gradation alternation between /t/ and /ṭ/ (see Section 6.8 for further discussion of consonant gradation). The pairing of the front vowel /e/ with the dental stop /t/, and the back vowel /o/ with the alveolar stop /ṭ/ is to be expected on articulatory grounds, as both /e/ and /t/ are articulated with the tongue body further forward, and /o/ and /ṭ/ with the tongue body further back. All of these phonological patterns suggest that the two forms *téktek*ʰ and *ṭókṭok*ʰ may historically be alternants of the same root.[133] However, the purpose of the reduplication, ablaut, and consonant gradation in these two forms, with respect to the semantics of the referents, is not clear.

The final item, *šíma napiców'cow'*, appears to contain the word *šíma* 'nose', and a reduplicated adjectival form *napiców'cow'*; however, the root *ców'* occurs only in this item, so its ultimate meaning is unknown.

(111) *pápa* 'father's mother (paternal grandmother)' (Sawyer 1965:36, 65)

This form strongly resembles the general child-speech form found in many languages for 'father'; its current meaning of 'father's mother' may simply be a later metonymic shift.

[133] The first half of the word for 'robin', *c*ʰ*ipi-*, appears to be based on the word for 'red', *c*ʰ*ípe*.

(112) *k'áʔk'aʔ* 'ghost, spook' (Sawyer 1965:44, 97)

This word may be based on the simplex root *k'áʔ*, glossed as 'something dead a long time' (Sawyer 1965:28, 29).

Another group of reduplicated forms involves the reduplication of a CV root with the addition of a final -*ʔ*, similar to the adjectival items presented in Section 6.7.3.

(113) *wówo*-*ʔ* 'any great aunt or uncle or their husbands or wives'[134] (Sawyer 1965:54, 109)

(114) *wéwe*-*ʔ* 'sexual intercourse' (Sawyer 1965:23)

(115) *lúlu*-*ʔ* 'leg from the knee down to the ankle' (Sawyer 1965:4)

The reduplication in *wówoʔ* may be rooted in child speech, where terms for family members often show a simple reduplicated syllable cross-linguistically. This may also be the case for *wéweʔ*, originating as a child-speech euphemism; alternatively, the reduplication for this term may represent verbal iconicity. The motivation behind the reduplication of *lúluʔ*, on the other hand, is unclear.

Another CV reduplication is attested with derivational affixes that produce adjectival, nominal, and verbal forms:

[134] This item may be a borrowing from Pomoan, as a very similar item is found in Southeastern Pomo: *wówo*, '(great) grandfather' (Moshinsky 1974:44, 103).

(116)	a.	*káka-ʔ*	'faded, pale'	(Sawyer 1965:36, WSR 42)
	b.	*[káka-ʔ]-iš*	'faded, pale; paleness'	(Sawyer 1965:11, 35, WSR 73)
	c.	*[káka-ʔ]-šaʔ*	'turning pale'	(WSR 73)

Like the previous examples, these items also represent a CV reduplication with the addition of a glottal stop -ʔ.

Two further nominal reduplications are the words for 'clay' and an unidentified plant species. Unlike the other nominal derivations discussed above, these forms use the type-B reduplication seen previously in verbs (see Section 6.7.2).

(117) *wála·>l-is* 'clay' (WSR 78, 114)

(118) *c'áṭa·>ṭa-ʔ* 'type of bush' (WSR 105)

The form *wála·lis* appears to be a nominal derivation from another noun, specifically a presumed root **wála*, perhaps related to the word *wálma* 'mud'. The underlying reduplicated form would thus be //*wála>la*//, to which is added the suffix *-is*, which appears to be acting as a collective marker here; cf. *p'éṭʰaʔ* 'egg', *p'éṭʰaʔte* 'eggs', *p'éṭʰaʔis* '(some) eggs, mass of eggs' (Sawyer 1965:70). The suffix also deletes the final vowel of the reduplicated form.

The form *c'áṭa·ṭaʔ* is similar in construction; however, it has a glottal suffix *-ʔ*, like several of the items in Section 6.7.3, while the presumed root **c'áṭa-* is otherwise unattested.

The semantic motivation for reduplication in these two forms is unknown; for the form meaning 'clay', the reduplication could be a distributive from an original meaning of 'stone', 'pebble', 'mud', or the like. For the form referring to a type of bush, it may be distributive iconicity for its flowers or berries; the identity of this bush was apparently unknown to Sawyer.

One final nominal reduplication is a word meaning 'gonorrhea':

(119) *ʔósos* 'gonorrhea'[135] (Sawyer 1965:45)

Unlike any of the other reduplications seen thus far, this one involves the copying of just the vowel and coda consonant of the base, without the base's onset, and thus constitutes a C-type reduplication. The expected type-A reduplication form would be **ʔósʔos*; the fact that the initial glottal stop is not copied in the reduplicant may have implications for the phonemic status of word-initial glottal stop in Wappo; see Chapter 3.

6.7.5 Other Reduplications

A few unique reduplications are discussed here.

[135] Sawyer suggests that this item may be a loanword, but does not otherwise suggest a source (Sawyer 1965:45). It does not appear to be of Spanish origin, but may perhaps be from another local language.

(120) a. *céʔ/héʔ* distal/proximal copula (short form)

(WSR 97, Sawyer 1965:121)

b. *céʔeʔ/héʔeʔ* distal/proximal copula (long form)

(WSR 3, 18, 61, 66, 98)

These copulae are formed from the demonstrative particles *ce* (distal/neutral) and *he* (proximal). From an analysis of the written corpus, the short forms appear to be used more in casual speech, while the long forms are associated more with careful speech. A single glottal stop transforms the demonstrative particles into their equivalent copulae, i.e. the short forms; the long forms are then transparently created as a reduplication of the short forms. The reduplication schema here is unique, however, in that it involves the copying of just the vowel and coda of the base, not the base's onset; thus, they are a type-C reduplication.

(121) a. *ṭʰúṭu·is*

'unidentified small, brown, top-knotted brush bird'

(Sawyer 1965:11; WSR 92)

b. *hu-ṭʰúṭu·-kʰiʔ*

'hair sticking up, or feathered tuft on the head of a bird; topknot' [verbal form]

(WSR 91, 99)

If these items are an example of a reduplication, the reduplication function would be the copying of a CV root, here *ṭʰú-*, but with the deletion of the aspiration feature of the onset consonant. The deletion here might be connected to the tendency against co-occurrence of aspiration on identical segments in a single root (see Chapter 3). Alternatively, this item may not be an example of reduplication, with the root simply being *ṭʰúṭu*, with harmonic vowels.

(122) *meh-yúhyuʔ* 'careless, reckless' (Sawyer 1965:18, 84)

The *meh-* element here is a common verbal prefix, but the presumed root **yúh* is unattested anywhere else. What is unusual here is the change from /h/ to /ʔ/ between the root and the reduplicate. Either there is a glottal consonant gradation between these two, or this is an exceptional example of an onset and nucleus being reduplicated, rather than a nucleus and coda, with an additional glottal stop suffix *-ʔ* being added to the result. The two possible analyses can be schematized as:

(123) a. *meh-yúh*>*yuʔ* (gradation in the coda consonant between /h/ and /ʔ/)

b. *meh-yúh*>*yu-ʔ* (reduplication of just the onset and nucleus, with an additional suffixal *-ʔ*)

Another unique reduplication pattern is given in (124):

(124) a. *t'úh-šiʔ* 'to drip, to leak'

(WSR 75, 78, 86)

b. *na-pi-t'úhu·t'u-saʔ* 'rain lightly and continuously'

(Sawyer 1965:9, 23, 84, 113)

Here, the root, apparently a disyllabic form **t'úhu*, is subject to reduplication only for its first syllable. This produces a new reduplicated trisyllabic root **t'úhu·t'u-* (with phonetic lengthening of the medial syllable) to which are then added the verbal suffix *-saʔ* and a pair of lexical prefixes *na-* and *pi-*, whose function in this word, however, is unclear. As can be seen in (a), the root **t'úhu* elsewhere appears as just *t'úh-*. However, the form in (b) suggests that the root is underlyingly disyllabic *t'úhu-*, and is reduced to *t'úh-* in the derivation in (a), like the forms seen in Section 6.7.2. The semantic component of the reduplication in this term is likely aspectual, indicating the manner of the raining action.

(125) *kučuyúčuʔ* 'Jerusalem cricket, potato bug' (Sawyer 1965:25, 56)

This word exhibits a form of reduplication of the type seen in such English words as "willy nilly" or "helter skelter" – schematically, it involves the reduplication of a CVCV string with the first C being changed between the base and the reduplicate in the process, in this case from /k/ to /y/. Due to this unique pattern, it is possible that this word is not Wappo in origin.

Two more reduplicated elements are given below. Each involves the reduplication of a /lV/ syllable.

(126) *lolopáte* ‘eagle’[136] (WSR 99, 114)

This word does not appear to be analyzable, as neither of the elements *lolo* or *pate* are found elsewhere. Since it is a faunal name, it may originate outside of Wappo.

A similar form *lele-* is found in a number of items:

(127)

(127)	a.	*lelec’úy*	‘frog sp.’	(WSR 88)
	c.	*lelekópa*	‘toad’	(WSR 67, 88, 114)
	b.	*lelecále*	‘gravel’	(WSR 66)
	d.	*meyléle*	‘lake’	(WSR 66, 72, 77)

The meaning of the element *lele* in this group of words is suggested by the item in (d.), *meyléle*, ‘lake’. The element *mey* means ‘water’, and since frogs,[137] toads, and even gravel are things that may be found in the physical environment of lakes, the element *lele* may just mean ‘lake’ by itself, at least in origin (if so, the compound *meyléle* would then be pleonastic). Interestingly, *meyléle* has an allomorph *meyléla·y-* that occurs with vowel-initial case enclitics, suggesting that *lele* may not originate as a reduplication; there are a number of Wappo roots ending in *-e* in the unmarked form that alternate with a form ending in *-a·y* with vowel-initial enclitics; see Section 6.4.

[136] Sawyer (1965:33) has *lolopátih*, but WSR 99, 114 suggest a transcription *lolopáte*.

[137] *c’úy* means ‘flicker, yellowhammer’, a local bird species (WSR 77, 90, 92, 114), and thus *lelec’úy* as the name of a frog species may be referencing the sound of the frogs as being similar to the bird’s call.

6.8 Consonant Gradations

Finally, there are a small number of Wappo lexical items that exhibit ‘consonant gradations,’ that is, shifts in particular consonantal features (whether place, manner, or both) that seem to serve a morphological purpose. Consonant gradation is a well-known areal feature of California (see Golla 2011:210, 214, 223-5), and thus its presence in Wappo is unsurprising, although Wappo does not make use of it nearly to the extent that many other languages of the California region do. The known examples present in the Wappo corpus are given below.

6.8.1 Variation that Signals Different Patient Referents

(128)	a.	*pah-mút-el-kʰiʔ*	‘closed up, of a hole (e.g. pierced ears)’	(Sawyer 1965:21)
	b.	*pah-mús-kʰiʔ*	‘closed, of the mouth or lips’	(Sawyer 1965:21)
	c.	*pah-múč’-kʰiʔ*	‘closed, of the eyes’	(Sawyer 1965:21)

(129)	a.	*lúkʰ-iʔ*	‘pick, as fruit or nuts off a tree’	(Sawyer 1965:78)
	b.	*lúh-iʔ*	‘pluck, as large feathers off a bird or leaves off a tree; pick leaves off a tree’	(Sawyer 1965:80)

6.8.2 Variation that Signals Semantic Degrees of Intensity

(130)	a.	*kút’-i·ya*	‘small’	(Sawyer 1965:93)
	b.	*kúc’-i·ya*	‘very small, tiny’	(WSR 93)

(131)	a.	*hu-cʰát-is*	'rough, not smooth'	(Sawyer 1965:2)
	b.	*hu-cʰás-is*	'rough, very rough'	(Sawyer 1965:49)

6.8.3 Variation that Signals Lexical Derivation

(132)	a.	*č'épʰ-is*	'bent, bowed (adj.)'	(Sawyer 1965:2)
	b.	*č'ép'-iš*	'rattlesnake, worm (n.)'	(Sawyer 1965:84)

Note that the consonant of the suffix *-iS* also varies between the two forms in (132).

6.8.4 Variation that Signals Various Types of Irregular Semantic Change

(133)	a.	*héyʰ-iʔ*	'to saw' (i.e. cut wood)	(Sawyer 1965:88)
	b.	*héy'-iʔ*	'to sharpen, to grind, as an axe or beads'	(Sawyer 1965:90)

(134)	a.	*hu-c'íw'-is*	'thin, fine, slim'	(Sawyer 1965:104)
	b.	*hu-c'íy'-is*	'narrow' (or *hu-c'íʔ-is*)	(Sawyer 1965:68)

(135)	a.	*me-tíl-siʔ*	'tinkling, like a bell, dishes, or glasses'	(WSR 3)
	b.	*me-cíl-siʔ*	'clinking, like coins or a chain'	(WSR 3)

(136)	a.	*č'a-č'ów'-eʔ*	'to remove bark'	(WSR 93)
	b.	*č'a-c'úw'-eʔ*	'to take the clothes off of the line'	(WSR 93)

(137)	a.	*ṭ'ás-miʔ*	'to snap the fingers'	(WSR 73)
	b.	*ṭác'-miʔ*	'to clap the hands'	(WSR 73)

The examples in (135) and (136) show variation in the root's onset consonant, rather than its coda consonant as in the earlier examples, while example (137) shows variation in both the onset and the coda consonant of the root. Example (136) additionally shows variation in the vowel of the root.

Even more than in the other morphophonemic processes described above, the instances of consonant gradation in Wappo show no discernible consistent pattern, and must be considered vestigial in the modern language.

6.9. Conclusion

Though a decent variety of morphophonemic processes were attested in the Wappo lexicon as it existed in the mid-20th century, virtually none of them were productive processes at that point in the language's history. The reason for this is likely twofold.

One reason may have simply been an internal trend in the language to a more regular, agglutinating morphology, marking a shift away from an earlier state of more complex and varied morphophonemic alternation. This could have been purely a language-internal typological shift, or it may possibly have been connected to larger areal affects; this assertion would require further investigation into the diachronic morphological patterns of the other Indigenous languages of the region.

The other reason may have been the direct effect of language attrition: as the Wappo speech community, impacted by the settler-colonial invasion in the 19th century, continued to shrink throughout the 20th, the acquisition of the more complex morphophonemic alternations by each generation of speakers may have been less and less complete. As a result, the functions that many of these processes carried would have been picked up by more straightforwardly agglutinating processes. The more complex patterns that did survive, survived in only two parts of the lexicon: the most frequent items, such as the word for 'child/children' or the polar interrogative enclitic; and some of the less frequent items, where, if they were acquired, would not have been subject to analogical leveling due to their relative rarity in conversation. In any case, by the time of the primary documentation of Wappo in the 1960s, all of these formerly more-widespread complex morphophonemic processes had become non-productive and fossilized.

CHAPTER 7: WAPPO PHONOLOGY IN AREAL PERSPECTIVE

This chapter situates the phonological structure of Wappo within two distinct areal contexts: that of the California Linguistic Area (Golla 2011), and that of a purported "Clear Lake Linguistic Area" (Kroeber 1925;[138] Berman 1973; Sherzer 1976:159; Mithun 1999:317; Golla 2011:8, 309 [fn91]). The first comparison is intended to assess to what degree the structures and patterns of Wappo phonology reflect those of the phonologies of the California Linguistic Area as a whole, a region that is marked by several unique conjunctions of phonological traits (Golla 2011:203-9), while the second comparison is intended to test the hypothesis of a unique 'micro-area' around Clear Lake, as asserted by various researchers in California Indigenous languages.

The data on Indigenous California languages in this chapter, as well as typological data on North American languages generally, is drawn from individual reference grammars and articles, as well as from Golla (2011). Global typological data is drawn from two sources: Maddieson's *Patterns of Sounds* (1984), based on the UPSID (UCLA Phonological Segment Inventory Database), a genetically-balanced sample of the phoneme inventories of 317 languages at the time of the publication of *Patterns of Sounds* (Maddieson 1984:5-6); and LAPSyD[139] (Lyon-Albuquerque Phonological Systems Database), a much larger database of phoneme inventories from all parts of the world, with new inventories and finer detail being continually added.

[138] While Berman, Sherzer, Mithun, and Golla's references to the idea of a Clear Lake Linguistic Area seem to trace back to work done by Kroeber (in particular, Berman 1973 references Kroeber 1925), I was not able to find any mention of specific assemblages of languages or specific linguistic traits thought to define the area in Kroeber's work.

[139] https://lapsyd.huma-num.fr/lapsyd/

7.1 Phonological Features of California Languages

In his comprehensive 2011 survey of the languages of California, Victor Golla describes a number of phonological features that are common in at least some of the languages and language families of the California region (which in his study, extends also to certain languages and language families of the US states of Oregon, Nevada, and Arizona, and the Mexican states of Baja California, Baja California Sur, and Sonora) (Golla 2011:204-10). Many of these features are present in Wappo, though by no means all, and many are also found in Wappo’s linguistic neighbors around the Clear Lake region, though not always shared with Wappo or with each other. Table 7.1 lists the phonological feature categories and values that Golla (2011) gives for the languages of the California region.

Table 7.1

Phonological Features Of The California Region According To Golla (2011)

Feature Category	Values	Golla (2011) section (page)
Laryngeal feature contrasts	plain glottalized aspirated voiced	4.1.1 (204)
Stop places	one (t) versus two (t ṭ) coronal stop places one (k) versus two (k q) dorsal stop places	4.1.2 (205) 4.1.2 (205-6)
Affricate places	/c/, /č/, /č̣/[140]	4.1.2 (205)
Labiovelars	presence of labiovelar phonemes (e.g. /k^w/, /x^w/)	4.1.2 (206)
Lateral Affricate	presence of lateral affricates (e.g. /ƛ’/[141])	4.1.2 (206)
Fricatives	/s/, /š/, /ṣ/,[142] /x/, /x̣/[143], /θ/, /ɬ/[144]	4.1.3 (206-7)

[140] voiceless retroflex affricate, IPA [t͡ʂ]
[141] voiceless coronal ejective lateral affricate, IPA [t͡ɬ’]

Nasals	/m/, /n/, /ñ/,[145] /ŋ/, /ṇ/[146] glottalized nasals voiceless nasals[147]	4.1.4 (207)
Approximants and Flaps	/w/, /y/ /l/, /l^y/,[148] /r/ glottalized approximants voiceless approximants	4.1.5 (207)
Laryngeals	/ʔ/, /h/ labialized laryngeals (e.g. /h^w/)	4.1.6 (207)
Consonant length	presence of phonemic consonant-length contrasts (i.e. phonemic consonant gemination)	4.1.7 (207)
Vowel qualities	/i e a o u/ presence of /ï/,[149] /ə/ absence of /e/, absence of /o/ or /u/ 5-vowel system, 4-vowel system, 3-vowel system	4.2.1 (207-9)
Vowel length	presence of phonemic vowel length contrasts	4.2.2 (209)
Minor vowels	presence of reduced or epenthetic vowels	4.2.3 (209)
Nasalized vowels	presence of a phonemic nasal vowel contrast	4.2.4 (209)
Rhotic vowels	presence of rhotic (rhotacized) vowels	4.2.5 (209)
Pitch accent/Tone	presence of pitch accent or tone	4.3 (209)

Due to uneven or missing documentation on many of the languages of California, three of the feature categories that Golla cites – contrastive consonant length, reduced and epenthetic vowels, and pitch accent and tone – will not be dealt with in this chapter.

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[142] voiceless retroflex spirant fricative, IPA [ʂ]
[143] voiceless uvular fricative, IPA [χ]
[144] voiceless coronal lateral fricative, IPA [ɬ]
[145] voiced palatal nasal, IPA [ɲ]
[146] voiced retroflex nasal, IPA [ɳ]
[147] some of which may prove to be phonologically aspirated rather than voiceless; see argumentation in Botma (2012)
[148] voiced palatal lateral approximant, IPA [ʎ]
[149] high central unrounded vowel, IPA [ɨ]

In order to assess the patterns of features which Wappo displays vis-à-vis California as a whole, as well as to determine which languages of the region might have a special areal connection to Wappo in particular, I have compiled the phoneme inventories of 71 languages and language varieties of the greater California region, representing 16 recognized families and 7 isolates.[150] This sample, which I will refer to in this chapter as the 71-member sample, is given in Table 7.2:

[150] For the classifications of the languages used in this chapter, I have referred largely to Mithun (1999) and Golla (2011).

Table 7.2

The 71-Member Sample For Assessing The California Linguistic Area

Family	*Branch:* Language(s)
Algic	*Wiyot:* Wiyot *Yurok:* Yurok
Athabaskan (Dené)	*California*: Bear River,[151] Hupa,[152] Kato, Mattole, Wailaki[153] *Oregon*:[154] Galice-Applegate (a.k.a Upper Rogue River), Lower Rogue River,[155] Tolowa-Chetco
Chumashan[156]	*Central*: Barbareño, Ineseño, Purisimeño, Ventureño *Island*: Island Chumash (a.k.a. Cruzeño) *Northern*: Obispeño
Coosan	Miluk (a.k.a. Lower Coquille)
Kalapuyan	Yoncalla (a.k.a. Southern Kalapuya)
Maiduan[157]	Konkow, Maidu (proper), Nisenan
Miwokan	*Eastern:*[158] Central Sierra Miwok, Northern Sierra Miwok, Plains Miwok, Southern Sierra Miwok *Western:* Coast Miwok,[159] Lake Miwok
Ohlonean[160]	*Karkin:* Karkin

[151] Though Bear River and Mattole are considered dialects of a single language (Golla 2011:78), they have enough phonological differences to warrant including separately in this study.
[152] proxy member for the larger Hupa-Chilula-Whilkut dialect group; the Chilula and Whilkut varieties have less attestation than Hupa proper
[153] proxy member for the larger Eel River Athabaskan dialect group (Wailaki-Lassik-Nongatl-Sinkyone)
[154] A fourth Oregon Athabaskan variety, Upper Umpqua, is too poorly attested to be included in the sample.
[155] a dialect network consisting of the varieties Joshua/Tututni, Mikwanutni, Chasta Costa, Euchre Creek, Sixes, and Pistol River (Golla 2011:70, 73). The internal classification of Oregon Athabaskan given in Golla (2011:70) divides the group into three branches: Upper Umpqua, Rogue River, and Tolowa-Chetco; the Rogue River branch is in turn divided into Upper Coquille, Lower Rogue River (described above), and Galice-Applegate/Upper Rogue River. This suggests that the Upper Coquille dialect may be at least as distinct from the other Lower Rogue River dialects as is Galice-Applegate/Upper Rogue River.
[156] A seventh Chumashan variety traditionally known as 'Interior Chumash' may in fact be spurious; see Beeler & Klar (1977).
[157] A fourth Maiduan variety, Chico or Valley Maidu, is not included due to lack of detailed sources.
[158] A fifth Eastern Miwok variety, Saclan or Bay Miwok, is too poorly attested to be included in the sample.
[159] This study uses data specifically from the Bodega dialect of northwestern Marin County, the best-attested dialect of Coast Miwok.
[160] The Ohlonean varieties Awaswas, Ramaytush, and Tamyen are too poorly attested to be included in the sample. Ramaytush and Tamyen are often identified, along with Chochenyo, as a 'San Francisco Bay

	Northern: Chochenyo, Chalon[161] *Southern:* Mutsun, Rumsen
Palaihnihan	Achumawi, Atsugewi
Plateau[162]	Klamath-Modoc, Molala
Pomoan	Central Pomo, Eastern Pomo, Kashaya Pomo, Northeastern Pomo, Northern Pomo, Southeastern Pomo, Southern Pomo
Shastan[163]	Konomihu, Shasta (proper)
Uto-Aztecan	*Numic:* Kawaiisu, Northern Paiute,[164] Western Mono *Takic:*[165] Kitanemuk *Tübatulabal:* Tübatulabal
Wintuan	*Northern:* Nomlaki, Wintu *Southern:* Patwin[166]
Yokuts	*Poso Creek:* Palewyami Yokuts *Buena Vista:* Hometwoli Yokuts *Tule-Kaweah:* Wukchumni Yokuts (a.k.a. Wikchamni) *Gashowu:* Gashowu Yokuts *Kings River:* Choynimni Yokuts *Northern Valley Yokuts:* Chukchansi Yokuts *Southern Valley Yokuts:* Yawelmani Yokuts (a.k.a. Yowlumne)

Costanoan' language (Golla 2011:164); Awaswas may be an independent Ohlonean language, or may represent a post-missionization mixed variety of Mutsun and San Francisco Bay (Golla 2011:165-166).

[161] 'Northern' classification uncertain (Golla 2011:167)

[162] This family is not universally agreed upon. It was first proposed by Edward Sapir (1929), and the grouping is cautiously supported by Berman (1996), DeLancey & Golla (1997), Campbell (1997), Rude (2000) and Müller et al. (2013); Klamath-Modoc and Molala are alternatively isolates. If Plateau is valid, it also includes the Sahaptian family of the Columbia River basin (consisting of Sahaptin and Nez Perce); some authors have also included the poorly-attested Cayuse language of northeastern Oregon (Sapir 1929; see also Rigsby 1969), which is otherwise largely considered unclassified. The Maiduan family appears to share a close relationship with Plateau as well (Golla 2011:251).

[163] The Shastan variety New River Shasta is too poorly attested to be included in the sample. The variety known as Okwanuchu may not have been properly a Shastan language at all, but rather represented a mixed attestation of a Shastan and a non-Shastan variety (Golla 2011:94-5).

[164] This study uses data specifically from the northern dialect of Northern Paiute described in Thornes (2003).

[165] or Serran; the validity of a unified "Takic" branch has recently been called into question (Hill 2011:270; Shaul 2014:25-6, 209-10), and a division of the branch into a northern 'Serran' group (consisting of Kitanemuk and Serrano) and a southern 'Cupan' group (consisting of Tongva, Luiseño-Juaneño, Cupeño, and Cahuilla) has been proposed (Hill 2011:272).

[166] This study uses data specifically from the Hill dialect as described in Lawyer (2015), spoken along the Coast Range/Sacramento Valley transition, which is the best-attested of the Patwin varieties.

Yukian	*Northern:* Coast Yuki, Huchnom, Yuki (proper) *Southern:* Wappo	
isolates	Chimariko, Esselen, Karuk, Salinan, Takelma, Washo, Yana[167]	

The 71-member sample consists mostly of languages native to the territory of the modern US state of California. However, the sample of "California" languages for this study was extended into Oregon to include the following languages, with the purpose of identifying a northern limit to the pre-contact California linguistic area:

1. Two members of the Plateau[168] family: Klamath-Modoc, which is spoken in both northeastern California and south-central Oregon; and Molala, which is spoken in the Cascade range in west-central Oregon. The other members of the Plateau family, the Sahaptian languages Sahaptin and Nez Perce, were excluded from this sample due to excessive distance from the California region (they are spoken in the Columbia River basin in northeastern Oregon, southeastern Washington, and western Idaho).

2. Members of the Oregon Athabaskan sub-family: Tolowa-Chetco, which is spoken in both northwestern California and southwestern Oregon, and its relatives Galice-Applegate (Upper Rogue River) and Lower Rogue River Athabaskan, both spoken in southwestern Oregon. A fourth Oregon Athabaskan language of the area, Upper Umpqua, was excluded due to poor attestation.

[167] Specifically the Yahi dialect; all of the Yana varieties appear to have the same phoneme inventory (Jacobsen 1976).
[168] known as Plateau Penutian when included in the larger Penutian hypothesis (Golla 2011:128-9)

3. One member of the Coosan languages, Miluk, spoken on the southwestern Oregon coast immediately adjacent to Lower Rogue River Athabaskan.

4. One member of the Kalapuyan[169] languages, Yoncalla (Southern Kalapuya), spoken in southwestern Oregon adjacent to the Athabaskan language Upper Umpqua and to the Plateau language Molala.

At the same time, the languages of desert Southern California and adjacent western Arizona, Baja California, and Sonora were mostly excluded from the sample, as the languages of this region are of a more uniform phonological type with fewer features in common with "core" California;[170] it was feared that their inclusion in the sample would skew the assessment for what constitutes typical features of the "core" California region, the central and northern regions of the modern US state. Two languages from this area were nevertheless included, in order to identify the southern limit of "core" California:

5. Kawaiisu, of the Numic branch of the Uto-Aztecan family, spoken in the Mojave Desert to the south and southeast of the southern end of the Sierra Nevada mountains.

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[169] Kalapuyan has traditionally been included within an 'Oregon Penutian' branch of the hypothetical Penutian stock, with a particularly close connection to Takelma, an isolate of southwestern Oregon. 'Oregon Penutian' also includes the Coosan and Alsean families and the Siuslaw isolate of the central Oregon coast, often grouped together as 'Coast Oregon Penutian' (Golla 2011:129).

[170] Features common among the languages of desert southern California (consisting of members of the Uto-Aztecan and Yuman-Cochimí families) that are not as commonly found in the languages of central and northern California include: labiovelar stops and fricatives (k^w, x^w); uvular stops (q); voiced fricatives (Z), palatal and velar nasals (ñ, ŋ); palatal laterals (l^y); rhotics (r); central vowels (ï, ə); and the absence of phonemically glottalized consonants, as well as a higher proportion of binary plain-aspirate distinctions in consonants rather than the binary plain-glottalized ones common further north (Appendix A).

6. Kitanemuk, of the Takic (or Serran) branch of the Uto-Aztecan family, spoken at the northwestern extremity of the Mojave desert, in the desert plains east of the Tehachapi Mountains.

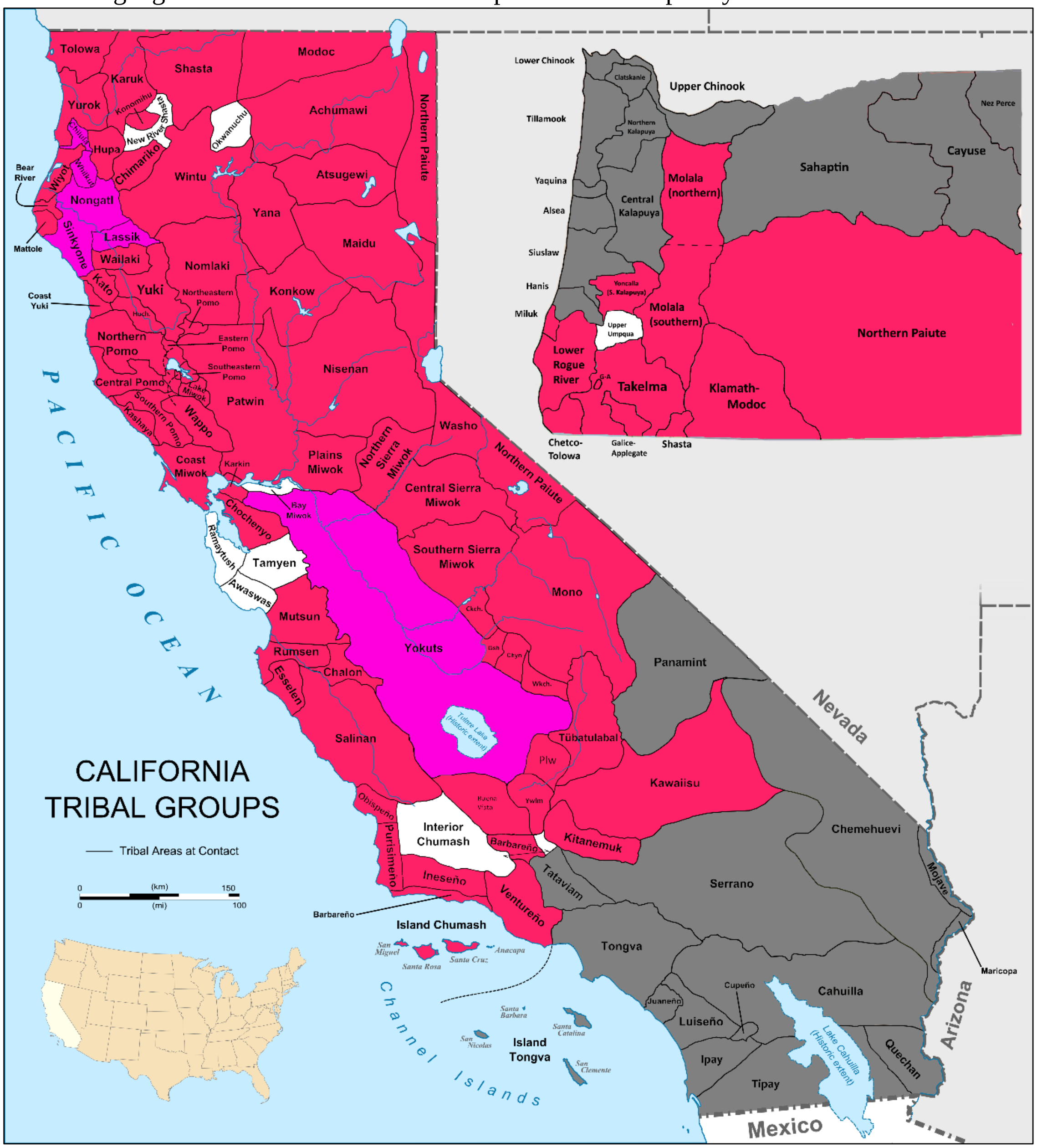
Finally, to assess the eastern boundary of the California Linguistic Area, the Northern Paiute language, of the Numic branch of Uto-Aztecan, was also included in the sample. This language is spoken in a large area from the arid plateau of central and southeastern Oregon, across northwestern Nevada, and into parts of northeastern and east-central California. Speakers of Northern Paiute were historically in contact with all of the central Oregon and eastern California languages spoken along the Cascade/Sierra Nevada front, as far south as Mono Lake in east-central California (Golla 2011: 97, 98, 103, 173, 251).

In summation, Map 7.1 gives the location of each member language of the 71-member sample within the California-Oregon region.

Map 7.1

Location Of The Languages Of The 71-Member Sample[171]

Languages and varieties constituting the 71-member sample
Dialects connected to or subsumed within one or more members of the sample
Languages and varieties outside of the sample
White: languages and varieties within the sample area but too poorly attested to include



[171] All maps used in this chapter are adapted from Wikipedia user Concerto's map of California Indigenous languages (https://commons.wikimedia.org/wiki/File:California_tribes_%26_languages_at_contact.png) and a map of Oregon Indigenous languages found on the Pacific University of Oregon website, credited to the Portland State University Center for Geography Education in Oregon (https://pacificu.libguides.com/c.php?g=1050460&p=7636236) (accessed December 2021)

7.2 Phonological Features of the 71-Member Sample

The feature categories that I have extracted from the 71-member sample, along with the individual features that are found within each category, are detailed in Table 7.3. Some of these features are also dominant globally – for example, a language having (only) plain voiced sonorants, or lacking uvular stops – and these 'dominant' traits are marked as such. (Judgments of global dominance are derived from both Maddieson (1984) and the LAPSyD database). All others are non-dominant globally, but many of these are nevertheless the norm within the California region.

Table 7.3

Phonological Traits Of The California Linguistic Region, Derived From The 71-Member Sample

Feature category	Feature	Proportion of sample	Global typological status
1. laryngeal feature contrasts in obstruents	a1) plain stops	71/71	dominant
	a2) glottalized stops	53/71	
	a3) aspirated stops	41/71	
	b1) plain affricates	67/71	dominant
	b2) glottalized affricates	53/71	
	b3) aspirated affricates	34/71	
	c1) plain fricatives	71/71	dominant
	c2) glottalized fricatives	9/71	
	c3) aspirated fricatives	6/71	
2. laryngeal feature contrasts in sonorants	1) plain sonorants	71/71	dominant
	2) glottalized sonorants	30/71	
	3) aspirated/voiceless sonorants	5/71	
3. voicing in obstruents	a1) unvoiced stops	71/71	dominant
	a2) voiced stops	18/71	dominant
	b1) unvoiced affricates	67/71	dominant
	b2) voiced affricates	2/71	

	c1) unvoiced fricatives	71/71	dominant
	c2) voiced fricatives	14/71	
4. labialized obstruents	0) labialized obstruents	14/71	
5. palatalized obstruents	0) palatalized obstruents	5/71	
6. coronal stop places	1) one place only	41/71	dominant
	2) two contrasting places	30/71	
7. coronal affricate places	1) laminal-alveolar /c/	42/71	
	2) palato-alveolar /č/	54/71	
	3) retroflex or apical /č̣, c̠/	6/71	
	4) alternating /č~č̣/	2/71	
	5) alternating /c~č/	1/71	
	6) alternating /c~č~č̣/	1/71	
8. coronal sibilant places	1) laminal-alveolar /s/	38/71	dominant
	2) palato-alveolar /š/	36/71	
	3) retroflex or apical /ṣ, s̠/	39/71	
	4) alternating /š~ṣs̠/	5/71	
	5) alternating /s~ṣs̠/	3/71	
	6) alternating /s~š~ṣs̠/	1/71	
9. dorsal stop places	1) velar /k/	69/71	dominant
	2) uvular /q/	21/71	
10. dorsal fricative places	1) dorsal fricatives absent	33/71	dominant
	2) velar /x/	27/71	
	3) uvular /x̣/	10/71	
	4) alternating /x~x̣/	1/71	
11. lateral obstruents	1) lateral fricative /ɬ/	19/71	
	2) lateral affricate /ƛ/	10/71	
12. nasal places	1) bilabial /m/	69/71	dominant
	2) alveolar /n/	71/71	dominant
	3) velar /ŋ/	16/71	
	4) palatal /ñ/	3/71	
13. approximant places[172]	1) palatal /y/	71/71	dominant
	2) labiovelar /w/	66/71	dominant
14. lateral approximant places	1) alveolar /l/	65/71	dominant
	2) palatal /ʎ/	1/71	
	3) lateral approximants absent	6/71	
15. rhotics	1) rhotics absent	51/71	
	2) one rhotic place/type	19/71	

[172] i.e. vocoid/semivowel approximants

	3) two contrasting rhotic places/types	1/71	
16. laryngeals	1) glottal fricative /h/	68/71	dominant
	2) glottal stop /ʔ/	69/71	
	3) labialized glottal fricative /hʷ/	3/71	
	4) alternating /ʔ~h/	1/71	
17. vowel systems	1) at least /i e a o u/	50/71	dominant
	2) /i a o u/, /e/ absent	4/71	
	3) /i e a U/, 1 phonemic back vowel	11/71	
	4) /i a U/, /e/ absent, 1 phonemic back vowel	5/71	
	5) /e a U/, /i/ absent, 1 phonemic back vowel	1/71	
	6) additionally, 1 phonemic central vowel, /Ë/	24/71	
	7) additionally, 2 contrasting phonemic central vowels, /ï ə/	5/71	
	8) additionally, rhotic vowels	1/71	
18. phonemic vowel length contrast	0) phonemic vowel length contrast	54/71	
19. phonemic nasal vowels	0) phonemic nasal vowels	2/71	
20. additional segments	1) voiced bilabial or labiodental fricative/ approximant /β, v/	5/71	
	2) voiceless bilabial or labiodental fricative /ɸ, f/	5/71	
	3) implosive stops /ɓ ɗ/	3/71	
	4) voiceless pharyngeal or epiglottal fricative/ approximant /ħ, ʜ/	2/71	
	5) voiceless dental fricative /θ/	1/71	
	6) dorsal affricate /k͡x/	1/71	
21. gaps	1) absence of /p/	2/71	
	2) absence of /k/	2/71	

Linguistic areas are defined by the presence of shared features that are a) not attributable to common genetic descent (at least not exclusively) and b) not the fallout of linguistic universals, i.e. not attributable to commonly-occurring structural properties that are basic to human language as currently understood.[173]

The low-level genetic units of California are well understood; for example, the seven Pomoan languages clearly constitute a group of languages descended from a common ancestor, and each of the languages of the group exhibits regular sound correspondences with its siblings. However, the higher-order genetic units, in particular the "Hokan" and "Penutian" groupings,[174] are as yet unconfirmed. Therefore, in assessing the features shared between Wappo and the other languages of the California region, I will take into account the influence of the lower-level groupings, but not the unsubstantiated "Hokan" and "Penutian" groupings. For the purposes of this chapter alone, I will also remain agnostic even on the Yuki-Wappo relationship itself, as Sawyer did (Sawyer 1980).

7.2.1 Globally-Dominant Features in California

Some of the phonological patterns seen within California are clearly reflecting global typological tendencies. For example, many of the languages in the region have only plain

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[173] For discussion of linguistic areas and the research challenges associated with them – including their possible spuriousness as a real phenomenon – see Bickell & Nichols (2006), Blevins (2017), Campbell (2006, 2017), Hill (2019), Thomason (2000).

[174] "Hokan" and "Penutian" are two long-standing macro-family hypotheses that would unite most of the scattered families and isolates of the Pacific margin of North America south of the Columbia River that are not Algic, Dené, or Uto-Aztecan (Tsimshianic of British Columbia and Alaska is also included in Penutian; some authors have discussed extending both Hokan and Penutian to various languages of the US Southwest, Mexico, and Central and South America (Golla 2011:82-4, 128-30)). For Hokan proposals, see discussion in Bright (1956), I. Goddard (1979), Golla (1986), Good (2002), Haas (1963), Haas (1964), Jacobsen (1979), Jany (2017), Kaufman (1988, 2010), Kroeber (1915), Langdon & Silver (1976), McLendon (1964), Sapir (1917, 1921b), Silver (1964), among others; for Penutian proposals, see discussion in Barrera-Vásquez (1943), Berman (1983, 1989, 2001), Callaghan (1958, 1967), DeLancey (1996, 2018), DeLancey & Golla (1997), Gamble (1991), Golla (2002), Grant (1997), Hymes (1957), Pitkin & Shipley (1958), Sapir (1921a), Sapir & Swadesh (1953), Shipley (1966, 1980), Silverstein (1972, 1975, 1979a, 1979b), Swadesh (1954, 1956), Tarpent (1997, 2002), among others.

sonorants (as opposed to both plain and glottalized sonorants), or have only velar stops in the dorsal area (as opposed to both velar and uvular stops). These values are consistent with the majority of languages globally, and thus cannot in themselves be used to point to the existence of an areal relationship between languages exhibiting them. On the other hand, they may be useful if they are analyzed in conjunction with globally non-dominant values; for example, two adjacent languages that are not demonstrably related and have a globally dominant value, but are surrounded by languages with a globally non-dominant value, may have reinforced each other in their resistance to acquiring the non-dominant value, and could thus be said to be in an areal relationship. Nevertheless, such cases are difficult to prove, and so globally dominant values will in general not be used here to demonstrate any areal relationships.

To begin with, Table 7.4 gives the phonological features found in the California region that *do* reflect globally dominant patterns. Excluding these values and their distribution will begin to allow us to focus in on those values that are more likely to be indicative of linguistic influences within the region.

Table 7.4

Globally Dominant Phonological Features Within The California Linguistic Area

Feature category	Feature	Proportion in sample
1. laryngeal feature contrasts in obstruents	a1) plain stops	71/71
	b1) plain affricates	67/71
	c1) plain fricatives	71/71
2. laryngeal feature contrasts in sonorants	1) plain sonorants	71/71
3. voicing in obstruents	a1) unvoiced stops	71/71
	a2) voiced stops	18/71
	b1) unvoiced affricates	67/71
	c1) unvoiced fricatives	71/71
6. coronal stop places	1) one place only	41/71
8. coronal sibilant places	1) laminal-alveolar /s/	38/71
9. dorsal stop places	1) velar /k/	69/71
10. dorsal fricative places	1) dorsal fricatives absent	33/71
12. nasal places	1) bilabial /m/	69/71
	2) alveolar /n/	71/71
13. approximant places	1) palatal /y/	71/71
	2) labiovelar /w/	66/71
14. lateral approximant places	1) alveolar /l/	65/71
16. laryngeals	1) glottal fricative /h/	68/71
17. vowel systems	1) at least /i e a o u/	50/71

For the purposes of identifying the distinctive phonological features of the California region then, we can safely eliminate most of these features from consideration. However, three items in the table are worthy of note.

First, the prevalence of voiced stops in this sample of California languages (feature 3-a2) is quite a bit lower than it is on a global level. Out of the 71 languages in the sample, all of which have voiceless stops, only 18 languages also have (phonemic) voiced stops, a frequency of 25.4%. This is compared to 195 incidences of voiced stops to 309 incidences of voiceless stops in Maddieson's *Patterns of Sounds*, or a frequency of about 63% (Maddieson 1984:35). This relative scarcity of phonemic voiced stops in California actually reflects a more general pattern in North America as a whole; in a sample of 264 Indigenous languages and language varieties of the United States, Canada, Greenland, and northern Mexico that I compiled, only 85, or 32.2%, had phonemic voiced stops, a frequency not very much higher than that of the California sample.

Second, the prevalence of the laminal-alveolar sibilant fricative (/s/ [s̻]) (feature 8-1) is likewise lower in this sample than it is on a global level. Out of the 71 languages in the sample, only 38 have a laminal-alveolar sibilant fricative /s/, a frequency of 53.5%. This is compared to the finding in *Patterns of Sounds* that of the languages in the UPSID database which have fricatives, 88.5% of them have some type of front-coronal /s/ sound, whether dental or alveolar in articulation (Maddieson 1984:44). However, a major caveat of this comparison is that much language documentation, carried out in all parts of the world, has failed to describe the precise features of articulation of coronal segments, including coronal fricatives (Maddieson 1984:31-2, 44; Bright 1984:35-6). Many of the reference grammars that assert a language as having a coronal fricative "s" fail to specify whether this is dental in articulation ([s̪]), laminal-alveolar ([s̻]), or apical-alveolar ([s̺]), or even other types of articulations. Therefore, 88.5% of languages with fricatives worldwide having an "s"-sound may not be a figure that is directly comparable to the proportion of 53.5% of languages with a specifically laminal-alveolar [s̻] in the 71-member California sample discussed in this chapter.

Finally, the lower-than-expected values of two other features – 'one coronal stop place' (feature 6-1) and 'dorsal fricatives absent' (feature 10-1) – are reflecting the locally higher rate of their complements in the California region: a two-place coronal stop contrast, in which two different phonemic coronal stop palces (usually dental vs. alveolar) are present; and the presence of dorsal fricatives, usually velar /x/ and/or uvular /x̣/.

7.2.2 Globally Non-Dominant Features in California

Table 7.5 gives the set of the remaining features that are both non-dominant globally, and present in more than 50% of the 71-language sample, sorted by frequency. These are the features that can be considered 'typical' of the California Linguistic Area, although not necessarily defining of it; many of them are also found in adjacent North American areas, in particular the Northwest Coast and the Plateau.[175]

[175] In the Plateau linguistic area, as in California, glottalized stops and affricates (contrasting with plain ones) predominate, and glottalized sonorants are even more common than in California. In the Northwest Coast linguistic area, glottalized stops and affricates again predominate, and glottalized sonorants are about as common as in California. In both regions, rhotics are also uncommon, just as in California. A major difference between these northern areas and California, however, is the preponderance of labiovelar stops and fricatives (k^w, x^w) and lateral obstruents (ɬ, ƛ) in the former, compared to their near-absence in California (Appendix A). Additionally, Haida and several languages of the Salishan and Wakashan families of the Northwest Coast and Plateau possess pharyngeal consonant phonemes (Mithun 1999:17-18), which are found in California only in the two Palaihnihan languages Achumawi and Atsugewi, and even in these languages they are not realized phonetically as prototypical pharyngeals (Good et al. 2003:3; Good 2004:2; Nevin 1998:144-9).

Table 7.5

Features That Are Non-Dominant Globally But Prevalent In California

Features are sorted in order of the proportion of languages in the 71-member sample that exhibit this feature

Feature category	Feature	Proportion in sample
16. laryngeals	2) glottal stop /ʔ/	69/71
7. coronal affricate places	2) palato-alveolar /č/	54/71
18. phonemic vowel length contrast	0) phonemic vowel length contrast	54/71
1. laryngeal feature contrasts in obstruents	a2) glottalized stops	53/71
1. laryngeal feature contrasts in obstruents	b2) glottalized affricates	53/71
15. rhotics	1) rhotics absent	51/71
7. coronal affricate places	1) laminal-alveolar /c/	42/71
1. laryngeal feature contrasts in obstruents	a3) aspirated stops	41/71
8. coronal sibilant places	3) retroflex or apical /ṣ, s̠/	39/71
8. coronal sibilant places	2) palato-alveolar /š/	36/71

The most prevalent non-globally-dominant feature in the region is a phonemic glottal stop /ʔ/, which occurs as a fully distinct phoneme in all but two of the languages in the sample, or about 97% (compare to the global frequency of about 44.9% of languages).[176] This is followed by a palato-alveolar affricate /č/ and a phonemic vowel length contrast, which occur in about 76% of the sample each (compare to 45.6% for /č/ and 39.9%, for vowel length); glottalized stops and affricates, which occur in more than 74% of the sample

[176] All global frequency values in this section are taken from LAPSyD (accessed May 2024).

each (12.3% globally for stops, 11.4% globally for affricates); the absence of any rhotic phonemes, characteristic of about 72% of the sample (only 23.4% of languages globally lack a coronal rhotic phoneme, 76.6% possessing at least one such phoneme); a laminal-alveolar affricate /c/, found in about 59% of the sample (26.3% globally); aspirated stops, found in almost 58% of the sample (20.3% globally); and retroflex or apical-alveolar spirant fricatives /ṣ, s̠/, which are found in about 55% of the sample (around only 7% globally – these segments are massively more frequent in the California region than globally on average).

Of these typical features of the California region, Wappo has all except a phonemic vowel length contrast and a retroflex/apical spirant fricative. As seen in Chapters 2 and 4, there are only a handful of lexical items that have a phonemically long vowel in Wappo, while all other instances of vowel length are allophonic in nature, not phonemic. There are a few other languages of the California region that also lack phonemic vowel length;[177] however, as phonemic vowel length is a minority feature globally, its absence cannot be used to definitively tie Wappo to other languages of California that also lack this feature. Similarly, neither of the two phonemic fricatives of Wappo, /s/ and /š/, are retroflex or apical-alveolar in nature; Wappo /s/ is a laminal-alveolar fricative similar to the French /s/ (e.g. *ça*), while /š/ is a palato-alveolar fricative, similar to the French /š/ (e.g. *chat*). Wappo therefore does not participate in the areal feature known as "California 'S'", a default retroflex or apical-

[177] Among the languages of the 71-member sample, these are Kitanemuk, Maidu (proper), Wiyot, all of the Chumashan languages, and the three Northern Yukian languages. In Chimariko, as in Wappo, phonemic vowel length has a marginal status (Jany 2009:20-1), while in the Oregon Athabaskan languages Tolowa-Chetco and Lower Rogue River, vowel length appears to be a function of syllable structure (Bright 1964:105, Golla 1976:219). Meanwhile, the phonemic status of vowel length in the Coosan language Miluk is unrecoverable from the available documentation (Doty 2012:18).

alveolar pronunciation for the sole or non-palatal spirant fricative, as described in Bright (1978).[178]

7.2.3 Minority Features in California that Appear in Wappo

Table 7.6 now gives the features that are present in Wappo, but that are both non-dominant globally and found in less than 50% of the California sample. This will begin to give us a picture of which languages among the 71-member California sample may share contact-induced traits with Wappo specifically.

Table 7.6

Wappo Features That Are Neither Dominant Globally Nor Dominant In California

Features are sorted in order of the proportion of languages in the sample that exhibit this feature

Feature category	Feature	Proportion in sample
1. laryngeal feature contrasts in obstruents	b3) aspirated affricates	34/71
6. coronal stop places	2) two contrasting places	30/71
2. laryngeal feature contrasts in sonorants	2) glottalized sonorants	30/71
2. laryngeal feature contrasts in sonorants	3) aspirated/voiceless sonorants	5/71

Wappo possesses the phonemically-aspirated affricates /c^h $č^h$/, two contrasting coronal stop places – dental /t/ and alveolar /ṭ/ – and the glottalized sonorant series /m’ n’ l’

[178] This is based, however, exclusively on data from Wappo speaker Mrs. Laura Somersal; there is some evidence that speaker Clara Leger utilized a retroflex pronunciation for the back-coronal fricative /š/, e.g. in *mákiš̱* ‘rain (n.)’ (WSR 8), but it is not clear if this reflects a dialectal difference within the Wappo speech community or is due to Leger’s own individual speaker history.

w' y'/; additionally, it has a marginal series of aspirated sonorants /m^h n^h l^h w^h y^h/. Each of these features is both non-dominant globally and is present in less than 50% of the 71-member California sample. It is these four features then that will be most diagnostic of specific areal relationships between Wappo and other languages of California.

To begin with, Tables 7.7, 7.8, 7.9, and 7.10 give the languages of the 71-member sample, including Wappo, that share each of the four minority features described in Table 7.6.

Table 7.7

Languages Of The 71-Member Sample That Have Phonemic Aspirated Affricates /$Č^h$/

Bold text: family, *italic* text: language, ***bold-italic*** text: language isolate

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Algic: *Wiyot*

Athabaskan: *Bear River, Galice-Applegate, Hupa, Kato, Lower Rogue River, Mattole, Tolowa-Chetco, Wailaki*

Chimariko

Chumashan: *Barbareño, Ineseño, Island, Obispeño, Purisimeño, Ventureño*

Palaihnihan: *Achumawi, Atsugewi*

Plateau: *Klamath-Modoc*

Pomoan: *Central, Eastern, Kashaya, Northeastern, Northern, Southern*

Yana

Yokutsan: *Choynimni, Chukchansi, Gashowu, Hometwoli, Palewyami, Wukchumni, Yawelmani*

Yuki-Wappo: *Wappo*

Table 7.8

Languages Of The 71-Member Sample That Have Two Contrasting Coronal Stop Places

/t ṭ/

Bold text: family, *italic* text: language, ***bold-italic*** text: language isolate

Chimariko

Esselen

Miwokan: *Central Sierra, Coast, Lake, Northern Sierra, Southern Sierra*

Ohlonean: *Chalon, Chochenyo, Karkin, Mutsun, Rumsen*

Pomoan: *Central, Eastern, Kashaya, Northeastern, Northern, Southeastern, Southern*

Salinan

Yokutsan: *Choynimni, Gashowu, Hometwoli, Palewyami, Wukchumni, Yawelmani*

Yuki-Wappo: *Coast Yuki, Huchnom, Wappo, Yuki*

Table 7.9

Languages Of The 71-Member Sample That Have Glottalized Sonorants /R'/[179]

Bold text: family, *italic* text: language, ***bold-italic*** text: language isolate

Algic: *Yurok*

Athabaskan: *Hupa, Kato, Tolowa-Chetco, Wailaki*

Chumashan: *Barbareño, Ineseño, Island, Obispeño, Purisimeño, Ventureño*

Coosan: *Miluk*

Palaihnihan: *Achumawi, Atsugewi*

Plateau: *Klamath-Modoc*

Pomoan: *Kashaya*

Salinan

Shastan: *Konomihu*

Yana

Yokutsan: *Choynimni, Chukchansi, Gashowu, Hometwoli, Palewyami, Wukchumni, Yawelmani*

Yuki-Wappo: *Coast Yuki, Huchnom, Wappo, Yuki*

Table 7.10

Languages Of The 71-Member Sample That Have Aspirated Or Voiceless Sonorants /R^h/

Bold text: family, *italic* text: language, ***bold-italic*** text: language isolate

Plateau: *Klamath-Modoc*

Pomoan: *Eastern, Kashaya*

Washo

Yuki-Wappo: *Wappo*

[179] <R> ('resonant') denotes the class of sonorants.

7.2.3.1 Aspirated Affricates

Of these four features, aspirated affricates are perhaps the most likely to develop from language-internal processes specifically in those languages that already have aspirated stops, due to the well-known diachronic and synchronic relationship between stops and affricates in many languages. All of the languages in the 71-member sample that have aspirated affricates also have aspirated stops; in fact, it is also the case that all of the languages in the sample with *glottalized* affricates also have *glottalized* stops. It seems only natural that a language, having developed aspirated stops and/or glottalized stops, would have no problem extending the aspiration or glottalization feature to its affricates as well, precisely because affricates in many languages often originate diachronically from stops; for example, the affricate /t͡ʃ/ in native English vocabulary, such as *chin*, evolved from a conditioned allophone of proto-West Germanic */k/ before front vowels, and in the California region itself, an original glottalized velar stop */k'/ became a glottalized palato-alveolar affricate /č'/ unconditionally in Northeastern Pomo, Northern Pomo, and Southern Pomo (McLendon 1973:23). Therefore, in the case of the languages in the California sample that have aspirated affricates, it is very possible that the feature arose independently in each language from language-internal processes, rather than necessarily being spread from language to language due to contact.

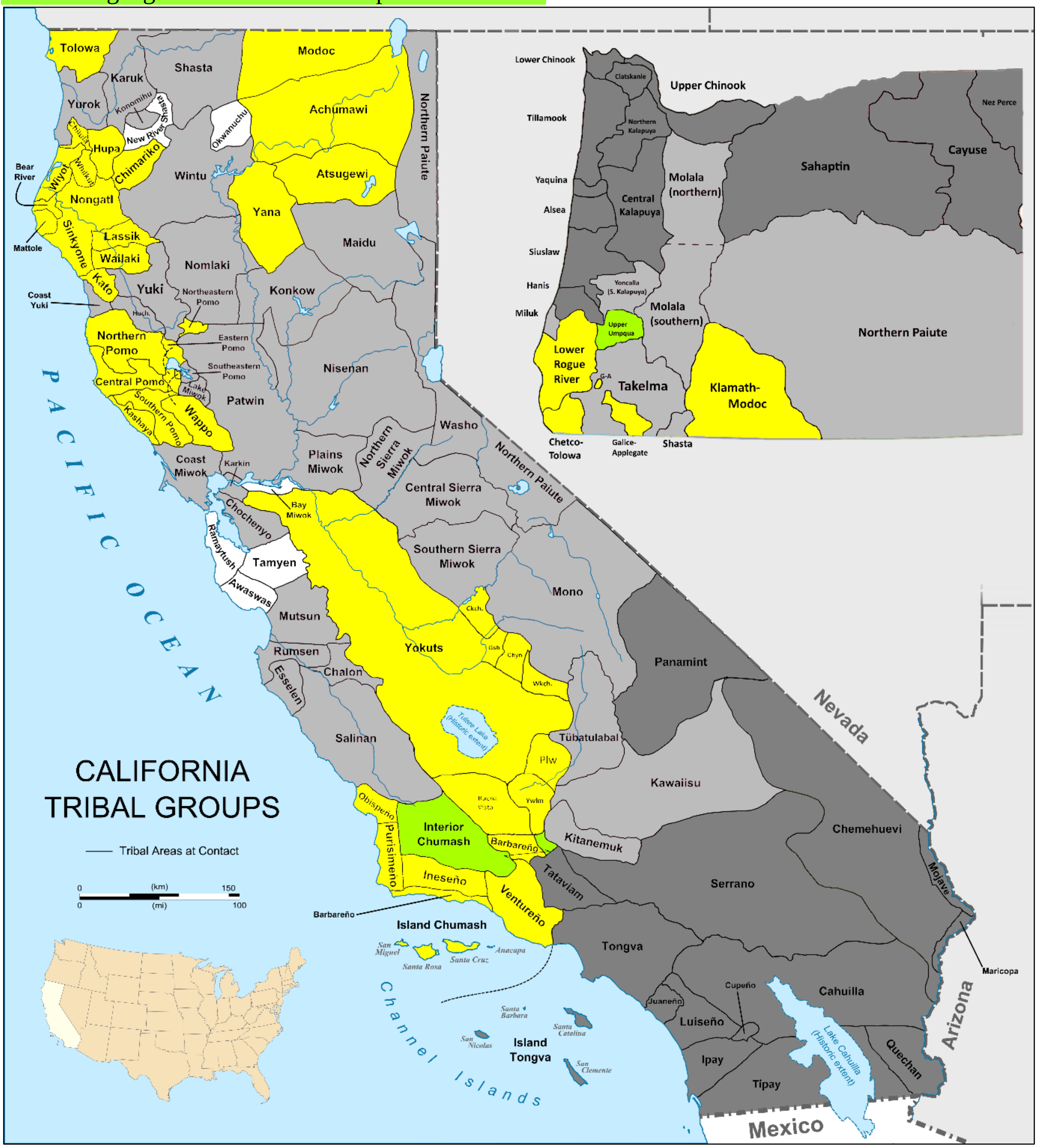
Data from the phonological database LAPSyD reinforces the observation here that aspirated affricates are typologically linked to aspirated stops, and thus their distribution is more typologically driven than contact driven. In the 2021 LAPSyD sample of 859 languages, 124 languages had aspirated affricates, and 174 had aspirated stops. Of these sub-samples, 54 languages had aspirated stops but no aspirated affricates, while only four languages had aspirated affricates but no aspirated stops. Thus, there is a marked tendency for the presence of aspirated affricates to be dependent on the presence of aspirated stops. This pattern is true of the relationship between stops and affricates more generally: in LAPSyD 2021, all 859 sample languages had pulmonic stops, but only 298 had affricates, or about 35% of the sample. There were no languages in the sample that had affricates without also having stops.

Map 7.2 gives the location of the languages in the 71-member sample that have aspirated affricates.

Map 7.2

Distribution Of Languages In The 71-Member Sample That Have Aspirated Affricates

languages with aspirated affricates
related languages assumed to have aspirated affricates



In the northwest of California, nearly all of the languages with aspirated affricates are members of the Athabaskan language family, and in fact this feature is found in every single member of that family, from Alaska to Texas (Appendix A), as well as being reconstructed for Proto-Athabaskan (Hargus 2010:1021-2). The fact that the Chimariko language, adjacent to the Athabaskan varieties Hupa and Nongatl,[180] also has aspirated affricates may be due to contact with these varieties. More likely however, it may have been due to ancient contact between Chimariko and the Pomoan languages spoken further south, most of which also have aspirated affricates; as will be seen below, these two groups also share the feature of a coronal stop place contrast, as well as various other structural features (Golla 2011:242). By contrast, Wiyot, also adjacent to most of the California Athabaskan languages, apparently already possessed aspirated affricates that trace at least in part back to Proto-Algic (Proulx 1984:177), and so the occurrence of these segments in both Wiyot and California Athabaskan is most likely coincidental.

The Pomoan languages all have aspirated affricates, with the exception of Southeastern Pomo.[181] However, McLendon (1973) does not reconstruct aspirated affricates for Proto-Pomoan, so they must have arisen after Southeastern Pomo had already separated from the rest of the family (for instance, in at least some members, /$\check{c}^h$/ came from earlier */k^h/). The only language in contact with Pomoan that also has aspirated affricates is, in fact, Wappo, and this, coupled with the fact that Wappo's supposed relative Northern Yukian lacks aspirated affricates, is strong evidence for Wappo having developed them under

[180] Nongatl is one variety of the Eel River Athabaskan language, along with Wailaki, Sinkyone, and Lassik. Wailaki is the proxy member in the 71-member sample for all four varieties of Eel River Athabaskan.
[181] All of the Proto-Pomoan aspirated stops became fricatives in Southeastern Pomo (with the exception of */t^h/ and some cases of */q^h/, which de-aspirated to /t/, /q/), e.g. Proto-Pomoan */p^h/ > Southeastern Pomo /f/ (McLendon 1973:24, 52).

Pomoan influence. This constitutes our first example of a phonological feature of Wappo that likely originated from language contact.

In the center and south of California, languages of the Yokutsan and Chumashan families also have aspirated affricates. They are uniformly present in Chumashan, while in Yokutsan they appear to be present in (nearly) all varieties, although the documentation of many varieties of Yokutsan is fragmentary and individual phonemes may not always be attested. Aspirated affricates (and aspirated stops) are reconstructed for both Proto-Chumashan (Klar 1977:11-14)[182] and Proto-Yokutsan (Golla 1964:56; Whistler & Golla 1986:334). As will be seen in Section 7.3, Proto-Chumashan and Proto-Yokutsan appear to have been spoken relatively near each other, and so it is possible that one of the protolanguages developed an aspirated stop/affricate series due to contact with the other.

Only in the northeast of California do we find an area where the distribution of aspirated affricates is likely due solely to language contact; here they are present in three unrelated but adjacent groups: the isolate Yana, the Palaihnihan languages (Achumawi and Atsugewi), and Klamath-Modoc of the Plateau family. Klamath-Modoc in particular may have acquired them under Palaihnihan influence, as they are absent in the other attested Plateau languages (Molala, Sahaptin, and Nez Perce). Aspirated affricates are reconstructed for Proto-Palaihnihan[183] (Good et al. 2003:5). As Palaihnihan is located between Klamath-Modoc and Yana, it is possible that this feature originated in Palaihnihan and spread to both (pre-)Yana and (pre-)Klamath-Modoc; alternatively, they are an original feature in both Yana and Palaihnihan.

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[182] Aspirated stops and affricates are reconstructed by Klar for Proto-Chumashan, but she asserts that in the proto-language their existence was predictable from synchronic morphophonemic processes (Klar 1977:13-14), suggesting that pre-Proto-Chumash had only a plain-glottalized distinction in its obstruents.
[183] But note that Nevin (2019) is not convinced that a unique 'Palaihnihan' family has yet been demonstrated.

The distribution of aspirated affricates in California is thus partially attributable to typological motivation, partly to genetic inheritance, and partly to contact. They are only present in those languages that also have phonemically aspirated stops. They are uniformly present in the Athabaskan, Chumashan, Palaihnihan, and Yokutsan families, and are reconstructible to the protolanguages of each family. They developed in Pomoan after the separation of Southeastern Pomo, and this could either be a common innovation that defines a genetic subgrouping of the family, or an example of an intra-family contact zone. The main evidence of aspirated affricates spreading through contact is the case of Wappo, which appears to have acquired them from Pomoan, and the case of the northeastern California area, in which at least Klamath-Modoc, and possibly Yana, may have acquired them from Palaihnihan. Chimariko may also have acquired them from ancient contact with Pomoan, or less likely from more recent contact with Athabaskan. In all of these cases however, aspirated affricates may also simply have arisen independently through the diachronic extension of the aspiration feature from stops to affricates, or the diachronic change of some aspirated stops into aspirated affricates, as indeed is attested in some cases.

7.2.3.2 Coronal Stop Place Contrast

Of the four minority phonological features found in Wappo, the coronal stop place contrast is the most likely candidate for a feature spread entirely through contact rather than solely through language-internal development. There are two reasons for this assumption.

First, cross-linguistic diachronic patterns suggest that it is less likely for a language-internal phonemic split of an original unmarked coronal stop to result in one unmarked and one marked coronal stop (the pattern of two contrasting coronal stops itself being a marked configuration), rather than an unmarked coronal stop and a coronal affricate or fricative. For example, a coronal stop before a high front segment has historically become an affricate (such as /t͡s/) or a fricative (such as /s/) in many languages, with the same original coronal stop remaining a coronal stop in other environments (e.g. the First Palatalization in the history of Proto-Hellenic, wherein Proto-Indo-European */t/ */d/ before PIE */y/ became Proto-Hellenic */ts/ */dz/, respectively, whereas the same PIE segments remained stops in other environments in Proto-Hellenic (Sihler 1995:190). For those languages that do have a coronal stop place contrast – usually a more anterior stop contrasting with a more retracted stop, and/or an apical stop contrasting with a laminal stop – some diachronic evidence suggests that the retracted or apical member of the pair (most prototypically a retroflex) may arise through a type of progressive assimilation of an original unitary stop to a preceding liquid phoneme that is itself retroflex, e.g. /ɻ/, /ɭ/ – see argumentation and examples in Arsenault (2012). As retroflex consonants are fairly rare worldwide, present in only about 11% of languages (Maddieson 1984:32), this suggests that allophones of unmarked coronal stops will much more frequently evolve into unmarked coronal affricates or fricatives than they will into marked retroflex or retracted stops.

Second, the global distribution of languages that do have two (or more) contrasting coronal stop places is strongly areal in nature. Two large regions where such a feature is the norm are the Indian subcontinent and Australia (Langdon & Silver 1984:150; Blevins 2017:15-17; Arsenault 2012); within these regions, virtually every language, regardless of genetic affiliation, has the contrasting coronal stop place feature, while the feature nearly vanishes at the boundaries of the region (adjacent parts of Eurasia vis-a-vis India, and New

Guinea and Melanesia vis-a-vis Australia). All of this suggests that the coronal stop place contrast in California is a good candidate for being a genuine areal feature as well.

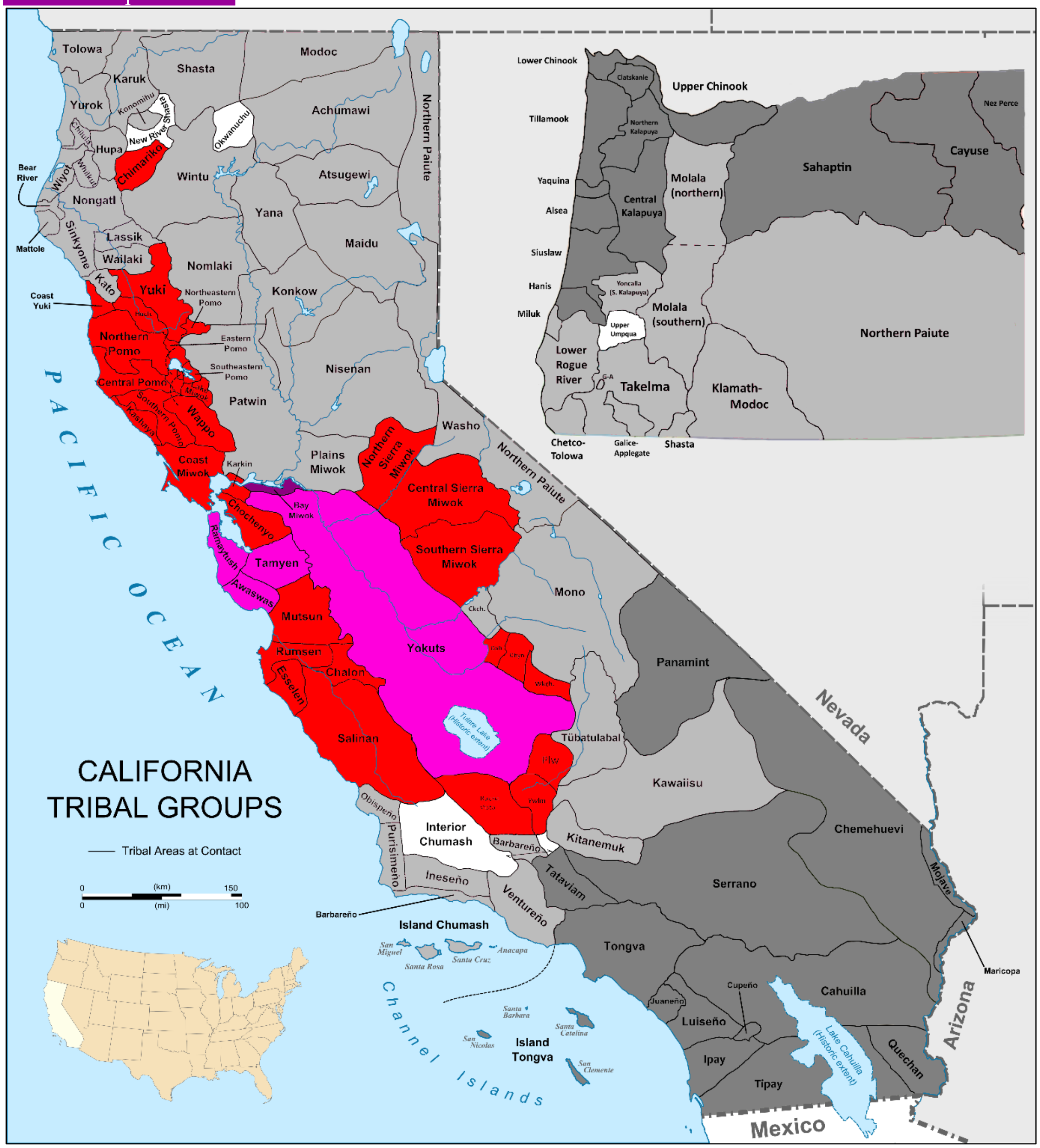
Langdon & Silver (1984) had already identified the geographic distribution of the coronal stop place contrast in California: "When all languages exhibiting the contrast in California are mapped… we find that their territory encompasses about half the state, including a large continuous area extending north and south of San Francisco Bay, with one lone northern outlier (Chimariko) and a set of southern outliers (all Yuman)" (Langdon & Silver 1984:141). When we again map the location of the languages of California that have this contrast, we see Langdon & Silver's findings confirmed. This is shown in Map 7.3.[184]

[184] Excluding the Yuman languages with this contrast, which were not part of the 71-member sample.

Map 7.3

Distribution Of Languages In The 71-Member Sample That Have A Coronal Stop Place Contrast

languages with a coronal stop place contrast
related languages known or assumed to have a coronal stop place contrast
evidence equivocal[185]



[185] Bay Miwok (Saclan), which has very minimal attestation, may or may not have had a coronal stop place contrast. Such a contrast is reconstructed for Proto-Miwokan (Callaghan 1972:4), and is found in the three Sierra Miwok varieties as well as Lake Miwok and Coast Miwok; however, it was lost in Plains Miwok (Callaghan 1984:12), the closest neighbor and possible closest genetic relative of Bay Miwok, and therefore it is possible that this contrast was lost in Bay Miwok as well.

The languages of California with a coronal stop place contrast are all geographically contiguous, with the exception of Chimariko, located somewhat to the north of the main cluster. However, since the languages that are found between Chimariko and the main cluster are members of the Athabaskan and Wintuan families, which are known to have entered California in more recent times (Golla 2011:68-9; Whistler 1977), it is possible that the unrecorded languages that occupied the intervening space prior to the Athabaskan and Wintuan arrival likewise exhibited the feature. Alternatively, Chimariko may have originally been spoken further to the south, in direct contact with the Pomoan and/or Northern Yukian languages, and subsequently arrived at its ethnographic location through migration.[186]

Other than the Miwokan languages, which extend across the Central Valley floor into the central Sierra Nevada, and the Yokutsan languages, which occupy the whole extent of the southern half of the Central Valley and the adjacent Sierra Nevada foothills, all of the languages that possess a coronal stop place contrast are found in the California Coast Ranges, both north and south of San Francisco Bay. This must then be the region where this areal feature originated. This is supported by the internal structure of the Miwokan and Yokutsan families themselves; the center of diversity in both groups is located within or near the Coast Ranges, at the western (Miwokan) and southern (Yokutsan) extremities of their ethnographic territories, rather than in the Sierra Nevada or the Central Valley (Golla 2011:253; Whistler & Golla 1986:320; Golla 2011:149-50).

[186] Chimariko shares multiple phonological features with (at least some) Pomoan languages, including a coronal stop place contrast, glottalized stops and affricates, aspirated stops and affricates, two sibilant fricatives, two dorsal fricatives, a uvular stop, and a rhotic (Jany 2009:16; McLendon 1973:9-12). By contrast, it has relatively fewer features in common with Northern Yukian, suggesting that if it had been spoken further south at one point, it was likely in closer contact with Pomoan speakers than with Northern Yukian speakers. Note too that both Chimariko and Pomoan are included within the Hokan hypothesis, while Northern Yukian is not.

Interestingly, languages of the Yuman-Cochimí family, which are spoken at the extreme southeastern edge of the modern state of California, as well as in much of Arizona and the Baja California peninsula, also largely exhibit a coronal stop place contrast. Within Yuman-Cochimí, only Cochimí itself and the Yuman languages Kiliwa and Yavapai lack the contrast (Mixco 2013:82; Shaterian 1983:26). However, the contrast is *not* reconstructible to Proto-Yuman (Langdon 1996), suggesting that most of the languages of the family developed the contrast after the breakup of both Proto-Yuman-Cochimí and Proto-Yuman.

As the Yuman languages are separated from the nearest other groups with a coronal stop place contrast – Chumashan and Yokutsan – by a number of Uto-Aztecan languages, which entered this region of California more recently (Golla 2011:254-5), it is possible either that varieties of Yuman used to be in direct contact with Chumashan and/or Yokutsan in the past, before being pushed south to their ethnographic location by the expansion of Uto-Aztecan from the east, or that the unrecorded pre-Uto-Aztecan languages of the area had participated in the coronal stop place contrast and had helped to spread the contrast from Chumashan/Yokutsan to Yuman before the Uto-Aztecan arrival. One piece of evidence for this latter hypothesis is that one of the Uto-Aztecan languages of the region, Serrano, features a coronal stop place contrast (Langdon & Silver 1984:149); this was probably adopted from a pre-Uto-Aztecan substrate, either Yuman, Chumashan, unrecorded relatives of these, or another group entirely.[187] On the other hand, Langdon & Silver (1984:150) believe it is due to contact specifically between Serrano and southern varieties of Yokuts.

[187] See further discussion in Jones & Klar (2007:74-5).

7.2.3.3 Glottalized Sonorants

Like the aspirated affricates examined earlier, glottalized sonorants among the languages of this sample may also have originated through language-internal processes; on a global typological level, these segments are often assumed to arise through a process of phonemicization of clusters of sonorants and glottal stops, often across morpheme boundaries or brought together due to syncope of intervening vowels (Urbanczyk 1992:531; Plauché et al. 1998:383). All of the languages in the 71-member sample that have glottalized sonorants also have a phonemic glottal stop,[188] as well as glottalized stops and affricates, and thus their presence is highly typologically dependent on glottalization already being present as a feature elsewhere in the phoneme inventory. It is probable that in many of these languages, glottalized sonorants are simply the result of language-internal processes that extended glottalization into the sonorant series. Nevertheless, as with the aspirated affricates, it is entirely possible that, in some cases, areal influence played a role in spreading glottalized sonorants from language to language, alongside their natural development within individual languages; indeed, it is likely that both processes occurred historically and have reinforced each other, as may also have occurred with aspirated affricates.

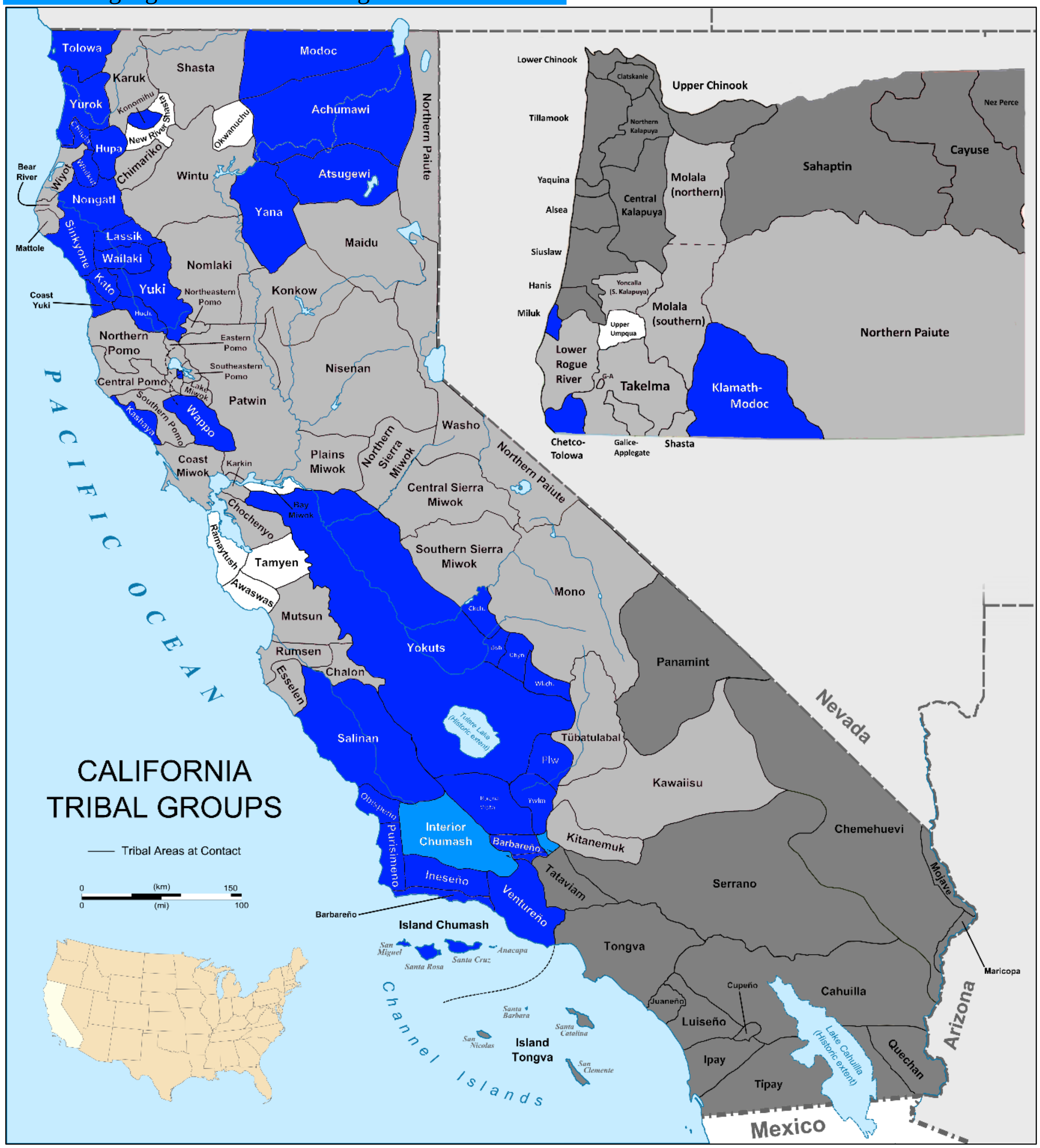
Map 7.4 gives the location of the languages in the 71-member sample that possess glottalized sonorants.

[188] The two exceptions are Achumawi, whose glottal stop is not entirely phonemic, and Konomihu, whose documented corpus includes the glottalized glide /w'/ but no other glottalized segments (Silver 1980), though this may be an artifact of the sparse attestation of this language.

Map 7.4

Distribution Of Languages In The 71-Member Sample That Have Glottalized Sonorants

languages with glottalized sonorants
related languages assumed to have glottalized sonorants



As with the aspirated affricates, we see a similar scattered pattern wherein glottalized sonorants appear in certain discrete pockets around the region. Interestingly, we see the reappearance of a Klamath-Modoc/Palaihnihan/Yana grouping, further solidifying this region as a potential linguistic sub-area; whether the same conjectured pattern described above, that of an origin of the feature within Palaihnihan followed by diffusion into Klamath-Modoc and possibly Yana, obtains for glottalized sonorants as it may for aspirated affricates, is unknown. We also see the reappearance of the whole Yokutsan and Chumashan families. As the internal configuration of the Yokutsan family suggests that its point of origin was around the southern end of the Central Valley, not far from the Chumashan language space (Whistler & Golla 1986:320; Golla 2011:149-150, map 29; table 37), we can conjecture that the presence of glottalized sonorants and aspirated affricates in both of these families may stem from ancient contact, possibly involving a Chumashan or para-Chumashan substratum in Yokuts (Golla 2011:252). To this grouping we can also add the Salinan language, spoken to the north of Chumashan and to the west of Yokutsan, within the southern Coast Ranges and along the central California coast.

In the northwest, we find a new, fairly cohesive sub-area in which Tolowa-Chetco, Yurok, Konomihu, Northern Yukian, and all of the California Athabaskan languages except Mattole-Bear River all share glottalized sonorants; to this group could also be added Miluk, spoken somewhat to the north of Tolowa-Chetco. Yurok is the only Algic language with glottalized sonorants (indeed, the only Algic language with glottalized segments of any kind (Blevins 2017:13)), while Miluk, a Coosan language, is the only member of its family to possess glottalized sonorants, its close relative Hanis lacking them (Pierce 1971). All three members of the Northern Yukian family possess glottalized sonorants, as does their supposed relative Wappo. The Shastan language Konomihu has some evidence for glottalized sonorants as well; a glottalized glide /w'/ appears in some of the lexical items cited in Silver (1980), although their phonemic status is not clear from the limited attestation of the language. Finally, glottalized sonorants are found in many of the Pacific Coast Athabaskan languages: Hupa has a full set of glottalized sonorants /n' ŋ' l' w' y'/ (Gordon 1996:167-8), Tolowa-Chetco has /m' n'/ (J. Bright 1964:103-4), Wailaki has /n'~ŋ' l'/ (Begay 2017:24, 30-4), and Kato has /ŋ' l'/ (P. E. Goddard 1912:5, 7). Given that these sounds in Pacific Coast Athabaskan may not be entirely phonemic synchronically – many of them appear to be synchronic juxtapositions of a sonorant and a glottal stop /ʔ/, e.g. in Wailaki (Begay 2017:24) – it is possible that the other Pacific Coast Athabaskan languages, Mattole-Bear River, Galice-Applegate, and Lower Rogue River, have them as well, but simply as a synchronic phonetic phenomenon rather than a phonemic one, and that the different analyses of various authors is responsible for assigning them phonemic status in some languages but not others. This interpretation is reinforced by the fact that glottalized sonorants are *not* among the consonant segments reconstructed for Proto-Athabaskan (Hargus 2010:1021-2).

The presence of glottalized sonorants in Miluk, Yurok, Pacific Coast Athabaskan, and possibly Konomihu may also be an indicator that some of these languages have a period in their history in which they were in close contact with the languages of the Northwest Coast linguistic area, where such segments are common,[189] before settling in their ethnographic locations around the modern California-Oregon border; such a migration is assumed for the

[189] In a sample of 40 languages of the Northwest Coast culture area, 25 had glottalized sonorants (62.5%), including members of the Alsean, Chimakuan, Coosan, Athabaskan, Salishan, Tsimshianic, and Wakashan families, as well as the isolate Haida. A sample of 16 languages of the adjacent Plateau linguistic area contained 11 languages with glottalized sonorants (68.8%), including members of the Salishan and Sahaptian families, and the isolates Klamath-Modoc and Kutenai (Appendix A).

Pacific Coast Athabaskan languages at least, and is likely for Yurok.[190] In the case of Miluk, some genetic or areal connection to the Salishan languages appears likely (see Doty 2012). In northeastern California, while Klamath-Modoc is assumed to have a very long-standing presence in its ethnographic location (Golla 2011:251), it also seems probable that languages with glottalized sonorants were at one time spoken in the region to the east of Klamath-Modoc as well, before the arrival in the area of the Uto-Aztecan Numic speakers – such languages may have been close relatives of Klamath-Modoc, or of other Penutian groups of Plateau/Great Basin origin, such as Maiduan, pre-Yokuts, or Sahaptian (Golla 2011:251-2).

Finally, we also see that Wappo and Kashaya Pomo, two languages spoken near Clear Lake, possess glottalized sonorants. While the emergence of glottalized sonorants in Kashaya Pomo seems to be from language-internal processes (Buckley 1990:84), it is not impossible that their development was triggered by contact with Wappo, in which glottalized sonorants are assumed to be an original feature (see discussion below). In fact, given that most models of internal Pomoan development place the geographical point of origin of the family close to Clear Lake, with a much later expansion westward to the Pacific coast and southward towards San Francisco Bay, it is even possible that a Yuki-Wappo or related substratum underlies the western Pomoan varieties, including Kashaya Pomo (Golla 2011:241). This substratum may in turn have spurred the development of glottalized sonorants within Kashaya Pomo specifically (though the fact that Southern Pomo, spoken between the Kashaya and Wappo speech areas, did not develop glottalized sonorants, weighs against this).

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[190] All members of the Pacific Coast Athabaskan languages are assumed to have reached their current locations in California and Oregon after a migration from somewhere in present-day Canada (Golla 2011:68-9); meanwhile, the two California Algic languages, Wiyot and Yurok, are assumed to have arrived at the Pacific coast after a migration from somewhere on the Columbia Plateau, the region where the split between pre-Yurok, pre-Wiyot, and pre-Algonquian is thought to have taken place (see discussion in Jones & Klar 2007:71-4).

Both Wappo and the Northern Yukian languages have glottalized sonorants. This is one of the pieces of evidence to support a genetic relationship between these two linguistic groups, given the typological rarity of glottalized sonorants in general, and given the fact that the two language varieties are not geographically adjacent (at least in recent times). If they are indeed related, it would suggest that glottalized sonorants were a feature of Proto-Yuki-Wappo, and may also be used as evidence to areally connect the Yuki-Wappo family as a whole to the other isolates and small families of the California region that possess glottalized sonorants – in particular Chumashan and the Hokan groups Palaihnihan, Yana, and Salinan, thought to be among the most long-standing of the attested linguistic groups of California – though certainly at a remote time depth. Even if we assume that Wappo and the Northern Yukian group are not ultimately genetically related to each other, the shared presence of glottalized sonorants would suggest some kind of contact relationship between them – or between each group and other ancient Californian groups – at some time in the past.

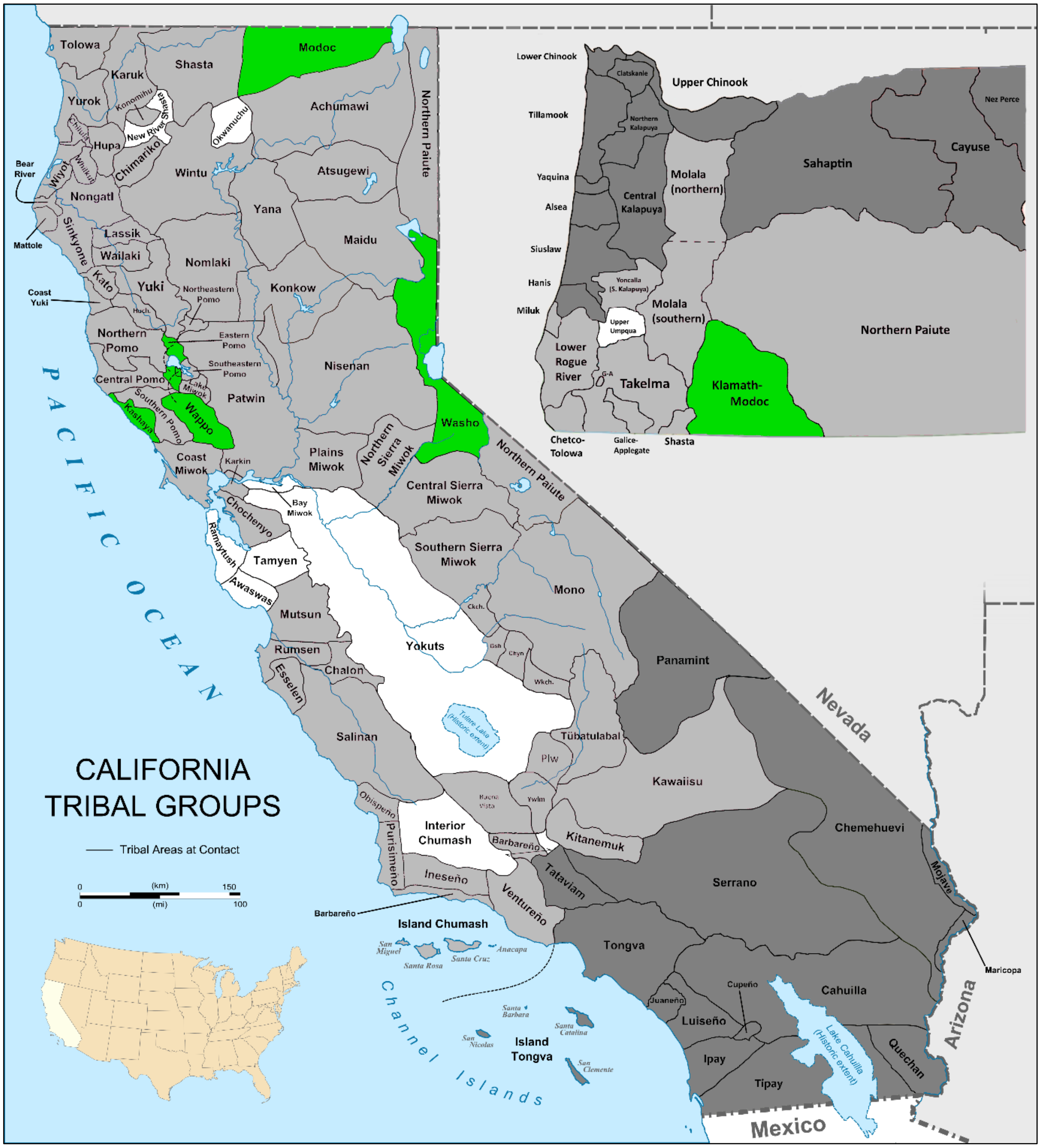
7.2.3.4 Aspirated/Voiceless Sonorants

Finally, the least common feature found in both Wappo and the 71-member sample is that of a series of phonemically aspirated or voiceless sonorants. Map 7.5 gives their distribution.

Map 7.5

Distribution Of Languages In The 71-Member Sample That Have Aspirated Or Voiceless Sonorants

languages with aspirated/voiceless sonorants



As seen in Chapters 2 and 4, Wappo has a marginal series of aspirated sonorants /m^h n^h l^h w^h y^h/ that appear in just a few dozen roots of the language. Though an internal reconstruction of Wappo has yet to be carried out, it will likely turn out that these sounds, at least in some cases, resulted from the syncope of old vowels between sonorants and /h/, or alternatively that they were imported through borrowings from Eastern Pomo and/or Kashaya Pomo, which have a full series of aspirated sonorants, or that both origins are responsible in different cases. Aspirated sonorants appear to have arisen organically in both Eastern Pomo and Kashaya Pomo exactly through the process of syncope of sonorant-vowel-/h/ clusters, or through the phonotactic juxtaposition of sonorants and /h/ (McLendon 1973:27-30; Buckley 1990:84). Given the seemingly random distribution of these sounds around California (with the exception of Pomoan-Wappo), such language-internal processes are the most likely explanation for their origin.

Interestingly, while the presence of aspirated/voiceless sonorants is correlated with the presence of aspirated stops and affricates in Wappo, Eastern Pomo, Kashaya Pomo, and Klamath-Modoc, the Washo language has aspirated/voiceless sonorants without having aspirated stops or affricates. Likewise, unlike Wappo, Kashaya Pomo, and Klamath-Modoc, which all have glottalized sonorants as well as aspirated/voiceless sonorants, Eastern Pomo and Washo lack glottalized sonorants but nevertheless still have aspirated/voiceless sonorants. The interrelationship between glottalization and aspiration on the one hand and their extension from stops to affricates to sonorants (and sometimes fricatives) on the other, particulary in the context of North American Indigenous languages, should be an area of interest for the field of phonological typology more generally.

7.2.4 Summary

Putting all of the evidence together from the distribution of these four minority features – aspirated affricates, two contrasting coronal stop places, glottalized sonorants, and aspirated/voiceless sonorants – we can make the following statements about the position of Wappo within the California Linguistic Area:

1. If Wappo is indeed genetically related to the Northern Yukian languages, then it most likely developed phonemic aspiration of both stops and affricates as the result of contact with the Pomoan languages; the Northern Yukian languages lack phonemic aspiration entirely.

2. The presence of a coronal stop place contrast in both Wappo and Northern Yukian, as well as in many other diverse families and isolates located in or traced back to the California Coast Ranges, suggests that this is an ancient areal feature of this part of California, and was likely already present when Proto-Yuki-Wappo (or their unique ancestors) was spoken.

3. The presence of glottalized sonorants in both Wappo and the Northern Yukian languages suggests that glottalized sonorants are an ancient feature of Wappo, either inherited from Proto-Yuki-Wappo or arising through ancient contact between Wappo and Northern Yukian. Their simultaneous presence in Kashaya Pomo, spoken not far from the Wappo speech area, could be due to a Yuki-Wappo or related substratum in the southwestern part of the Pomoan speech area, or could be an independent development. Their presence on the other side of the Central Valley in the Yana, Palaihnihan, and Klamath-Modoc languages, as well as in the Salinan, Chumashan, and Yokuts languages of central and southern California, could also

represent a remnant distribution of glottalized sonorants as once being more widespread in California, perhaps as a feature of Proto-Hokan, if that superfamily proposal is a valid one.

4. The presence of aspirated/voiceless sonorants in Wappo, Eastern Pomo, and Kashaya Pomo most likely represent independent developments, but it could also reflect an Eastern Pomo (and/or Kashaya Pomo) influence on Wappo, given that the aspirated sonorant series are common phonemes in the former but marginal in Wappo; it is also possible that both factors are responsible. A connection to the aspirated sonorants of Washo and Klamath-Modoc, however, does not appear likely, given the geographical distance, and instead the presence of aspirated/voiceless sonorants in these languages probably represent independent developments.

7.3 Larger Patterns of Contact

Returning to the features that Wappo possesses, we can also examine those features that are found in more than 50% of the 71-member sample, in order to identify some broader subsets of languages that Wappo may share an areal connection with, though a connection that is less strict than the ones described in Section 7.2. The relevant features are repeated from Table 7.5, above, as Table 7.11.

Table 7.11

Majority Features Of The 71-Member Sample That Are Non-Dominant Globally

Features are sorted in order of the proportion of languages in the sample that exhibit this feature

Feature category	Feature	Proportion in sample
16. laryngeals	2) glottal stop /ʔ/	69/71
7. coronal affricate places	2) palato-alveolar /č/	54/71
18. phonemic vowel length contrast	0) phonemic vowel length contrast	54/71
1. laryngeal feature contrasts in obstruents	a2) glottalized stops	53/71
1. laryngeal feature contrasts in obstruents	b2) glottalized affricates	53/71
15. rhotics	1) rhotics absent	51/71
7. coronal affricate places	1) laminal-alveolar /c/	42/71
1. laryngeal feature contrasts in obstruents	a3) aspirated stops	41/71
8. coronal sibilant places	3) retroflex or apical /ṣ, s̱/	39/71
8. coronal sibilant places	2) palato-alveolar /š/	36/71

As the glottal stop is close to ubiquitous in California (only two languages in the 71-member sample lack a clearly phonemic glottal stop[191]), it will not be of much use in identifying more specific connections between Wappo and its California neighbors, so it will be ignored here. Similarly, as Wappo does not possess a phonemic vowel length contrast, nor does it possess a retroflex or apical fricative /ṣ, s̱/, these features will likewise be set aside.

[191] These are Achumawi and Wiyot. In Achumawi, the distribution of the glottal stop [ʔ] is largely predictable (Nevin 1998:55); in Wiyot, a glottal stop [ʔ] is in complementary distribution with a glottal fricative [h], and thus the two sounds form a single laryngeal phoneme, though the glottal stop could be considered the primary allophone (Teeter 1964:14).

Finally, since glottalized stops and glottalized affricates have an identical distribution within the 71-member sample, we can address them as a single feature.

The resulting six majority features that Wappo possesses – presence of palato-alveolar affricate /č/, presence of glottalized stops/affricates, absence of rhotics, presence of a laminal-alveolar affricate /c/, presence of aspirated stops, and presence of a palato-alveolar fricative /š/ – can then be added to the four minority features discussed in the previous section – presence of aspirated affricates, presence of a coronal stop place contrast, presence of glottalized sonorants, and presence of aspirated/voiceless sonorants – resulting in a set of ten specific features that are found in both Wappo and in at least one other language of the California region, but which are not dominant globally. In this section, these ten features will be referred to as 'California-type' features.

At this point, in order to compare Wappo meaningfully to all of the other languages of the 71-member sample, it will be helpful to introduce some statistical analyses. This will involve 1) identifying the frequency of individual features within the 71-member sample, and 2) calculations of the probability of any two (or more) languages in the sample sharing a given conjunction of features. Some features are of course more frequent in the sample than others, and thus, inversely, it is of less statistical significance for any two languages to share these higher-frequency features than it is for them to share lower-frequency features. Put another way, two languages sharing a relatively rare sample feature is much more significant, and must receive more scrutiny, than two languages sharing a relatively common sample feature.

To quantify the significance of Wappo and any other language in the sample sharing a given feature, we can perform the type of calculation used to determine independent probability – that is, the likelihood of X and Y both occurring when the probabilities of X and Y are known and independent of each other.[192] An independent probability calculation simply multiplies these probabilities (expressed as decimals) together. Thus, for Wappo and each other member of the 71-member sample, we can multiply the probability of each shared feature (taken from the frequency of the feature in the overall sample) together to arrive at a specific number value (which I will term an 'index') for each pair of Wappo plus another language, a number that represents the statistical likelihood of two languages within the 71-member set sharing exactly that set of features, if the distribution were random. Finally, we can rank all of the number values ('indices'), so that each relationship is assessed not just by the number of shared features, but by their relative importance based on their statistical significance. The results of this computation – carried out between Wappo and each of the other 70 languages in the sample, using the frequencies of the California-type features described above – are given in Table 7.12.

Table 7.12

Relative Strength Of Shared Features Between Wappo And Other Members Of The 71-Member Sample

Smaller index = greater statistical significance

Rank	Language(s)	Family	Index
1	Kashaya Pomo	Pomoan	0.0007
2	Eastern Pomo	Pomoan	0.0014
3	Klamath-Modoc	Plateau	0.0034
4	Hometwoli Yokuts Palewyami Yokuts	Yokutsan Yokutsan	0.0060
5	Choynimni Yokuts	Yokutsan	0.0102

[192] Leaving aside for the moment that some linguistic features are not independent, but rather typologically dependent on others.

	Gashowu Yokuts	Yokutsan	
	Wukchumni Yokuts	Yokutsan	
6	Kato	Athabaskan	0.0143
	Tolowa-Chetco	Athabaskan	
	Wailaki	Athabaskan	
	Barbareño Chumash	Chumashan	
	Ineseño Chumash	Chumashan	
	Island Chumash	Chumashan	
	Obispeño Chumash	Chumashan	
	Purisimeño Chumash	Chumashan	
	Ventureño Chumash	Chumashan	
	Central Pomo	Pomoan	
	Northern Pomo	Pomoan	
	Southern Pomo	Pomoan	
7	Yawelmani Yokuts	Yokutsan	0.0157
8	Washo	*isolate (Hokan)*	0.0223
9	Hupa	Athabaskan	0.0282
10	Salinan	*isolate (Hokan)*	0.0304
11	Northeastern Pomo	Pomoan	0.0336
12	Bear River	Athabaskan	0.0338
	Galice-Applegate	Athabaskan	
	Lower Rogue River	Athabaskan	
13	Chukchansi Yokuts	Yokutsan	0.0371
14	Chimariko	*isolate (Hokan)*	0.0392
15	Achumawi	Palaihnihan	0.0477
16	Miluk	Coosan	0.0517
17	Southeastern Pomo	Pomoan	0.0680
18	Coast Yuki	Northern Yukian	0.0728
	Huchnom	Northern Yukian	
19	Lake Miwok	Miwokan	0.0774
20	Atsugewi	Palaihnihan	0.0872
	Yana	*isolate (Hokan)*	
21	Mattole	Athabaskan	0.0877
22	Yuki	Northern Yukian	0.0957
23	Chochenyo Ohlone	Ohlonean	0.0964
24	Southern Sierra Miwok	Miwokan	0.1170
25	Yurok	Algic	0.1216
26	Wiyot	Algic	0.1244
27	Chalon Ohlone	Ohlonean	0.1629
	Rumsen Ohlone	Ohlonean	

28	Tübatulabal	Uto-Aztecan	0.1639
29	Molala Takelma Yoncalla	Plateau *isolate (Penutian)* Kalapuyan	0.1832
30	Mutsun Ohlone	Ohlonean	0.1901
31	Nisenan	Maiduan	0.2068
32	Konomihu	Shastan	0.2266
33	Kawaiisu	Uto-Aztecan	0.2281
34	Central Sierra Miwok Coast Miwok Northern Sierra Miwok	Miwokan Miwokan Miwokan	0.2308
35	Nomlaki	Wintuan	0.2355
36	Esselen	*isolate (Hokan)*	0.2500
37	Karkin Ohlone	Ohlonean	0.3214
38	Northern Paiute	Uto-Aztecan	0.3232
39	Patwin Wintu	Wintuan Wintuan	0.3279
40	Shasta	Shastan	0.3358
41	Karuk	*isolate (Hokan)*	0.3856
42	Maidu	Maiduan	0.4078
43	Western Mono	Uto-Aztecan	0.4249
44	Konkow	Maiduan	0.5362
45	Plains Miwok	Miwokan	0.5463
46	Kitanemuk	Uto-Aztecan	0.5915

This procedure reveals Kashaya Pomo, Eastern Pomo, Klamath-Modoc, and five out of the seven Yokutsan languages in the sample, to be the most-similar languages to Wappo overall, occupying the first five ranks. Taking this as a starting point, we see the following rankings for the Pomoan and Yokutsan families overall, as well as Klamath-Modoc:

Pomoan:	1st, 2nd, 6th, 11th, 17th
Yokutsan:	4th, 5th, 7th, 13th
Klamath-Modoc:	3rd

Following the list further, the next two groupings we find with high similarity to Wappo are the Athabaskan and Chumashan languages. Their rankings are as follows:

Athabaskan:	6th, 9th, 12th, 21st
Chumashan:	6th

Following the list all the way to the first (presumed) genetic relatives of Wappo, namely Coast Yuki and Huchnom (18th), we find:

Washo:	8th
Salinan:	10th
Chimariko:	14th
Palaihnihan:	15th, 20th
Miluk:	16th

And following the list to the last genetic relative of Wappo, Yuki (proper), we find:

Lake Miwok:	19th
Yana:	20th

What is most interesting in these results is the strong similarity of four genetic units in particular to Wappo: the Pomoan languages, Klamath-Modoc, the Yokutsan languages, and the Chumashan languages. All of these groups are more similar to Wappo, in terms of California-type phonological features, than are Wappo's own supposed genetic relatives, the Northern Yukian languages; they are also more similar to Wappo than two of Wappo's direct neighbors, Lake Miwok and Patwin. To these units could also be added the Athabaskan languages; however, an examination of the features in California and Oregon Athabaskan that are shared with Wappo reveals that all of them trace back to Proto-Athabaskan – that is, they existed in these languages long before their arrival on the California and Oregon coasts.[193] Thus, we must conclude that the (albeit high degree of) similarity between Wappo and Athabaskan is coincidental.

Since our ranking here is based on the set of ten 'California-type' features, it would be useful to return to these features and see just how they are distributed among these groups of languages. This distribution is given in Table 7.13 (Athabaskan is included for comparison).

Table 7.13

Distribution Of 'California-Type' Features Among Wappo And Four Similar Groups

č = palato-alveolar affricate, P'Č' = glottalized stops and affricates, -r = absence of rhotics, c = laminal-alveolar affricate, P^h = aspirated stops, š = palato-alveolar fricative, $Č^h$ = aspirated affricates, t ṭ = coronal stop place contrast, R' = glottalized sonorants, R^h = aspirated/voiceless sonorants
+ = presence of feature, - = absence of feature

Feature:	č	P'Č'	-r	c	P^h	š	$Č^h$	t ṭ	R'	R^h
Percentage of Sample:	76%	75%	72%	59%	58%	51%	48%	42%	42%	7%
Wappo	+	+	+	+	+	+	+	+	+	+
Klamath-Modoc	+	+	+	-	+	-	+	-	+	+
Pomoan (7 langs.)	6/7	+	5/7	6/7	6/7	+	+	+	1/7	2/7
Yokutsan (7 langs.)	5/7	+	+	4/7	+	5/7	+	6/7	+	-
Chumashan (6 langs.)	+	+	+	+	+	+	+	-	+	-
Athabaskan (8 langs.)	+	+	+	+	+	+	+	-	(+)[194]	-

[193] The only exception is glottalized sonorants, which were not present in Proto-Athabaskan but have developed phonemically in Hupa and Tolowa-Chetco, and phonetically in Wailaki and Kato. These could be the result of contact, but they could also be language-internal developments, just as with glottalized sonorants in the other groups discussed in this chapter – glottalized sonorants are also reported in the Northern Athabaskan languages Deg Xinag and Tahltan, and are present phonetically in Navajo (Appendix A).
[194] Not wholly phonemic in all member languages.

As the table shows, these five genetic units share a large number of the California-type features. All ten of the features present in Wappo are also found in the other four groups, with only the following major exceptions:

1. Klamath-Modoc lacks a laminal-alveolar affricate /c/, a palato-alveolar fricative /š/, and a coronal stop place contrast
2. Pomoan generally lacks glottalized and aspirated/voiceless sonorants – they are only present in Kashaya Pomo and Eastern Pomo
3. Yokutsan lacks aspirated/voiceless sonorants
4. Chumashan lacks a coronal stop place contrast and aspirated/voiceless sonorants

Thus, we can say that any linguistic sub-area of California that includes Wappo is also likely to include Pomoan, Yokutsan, Chumashan, and Klamath-Modoc. We will term the conjunction of these five groups 'the 5-unit sample'.

Looking at the intersection of the ten California-type features with the five genetic units described above, we can see that their frequency within this smaller five-unit sample is different from their frequency in the larger 71-member sample. Using the 'percent difference formula'[195] to arrive at a meaningful mathematical difference in frequency between the two sets, and ranking the results from largest difference to smallest, we obtain the following:

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[195] $(|n_1-n_2|/(n_1+n_2/2))\cdot 100$, where n_1 and n_2 are the two percentages being compared.

Table 7.14

Ranking Of The Differences In Frequency Of The 'California-Type' Traits Between The Original 71-Member Sample And The New 5-Unit Sample

Feature	71-member sample frequency (n=71)	5-unit sample frequency (n=22)	Percent Difference
aspirated/voiceless sonorants (R^h)	7%	18%	**+88.0%**
aspirated affricates ($Č^h$)	48%	100%	**+70.3%**
glottalized sonorants (R')	42%	73%	**+53.9%**
palato-alveolar fricative (š)	51%	86%	**+51.1%**
aspirated stops (P^h)	58%	95%	**+48.4%**
coronal stop place contrast (t ṭ)	42%	64%	**+41.5%**
glottalized stops/affricates (P'Č')	75%	100%	**+28.6%**
laminal-alveolar affricate (c)	59%	77%	**+26.5%**
absence of rhotics (-r)	72%	91%	**+23.3%**
palato-alveolar affricate (č)	76%	86%	**+12.3%**

These results tell us which features among the new 5-unit sample have the most significantly different frequency of occurrence from the same set of features in the original 71-member sample. We find three of the features we examined earlier as being most meaningful in finding similar languages to Wappo – aspirated/voiceless sonorants (R^h), aspirated affricates ($Č^h$), and glottalized sonorants (R') – but also two new features we had not considered before – the palato-alveolar fricative (š) and aspirated stops (P^h) – before we find our fourth feature from earlier, the coronal stop place contrast (t ṭ). Crucially, three of these features can be abstracted to a larger 'archi-feature': phonemic aspiration (X^h), whether on stops (P^h), affricates ($Č^h$), or sonorants (R^h). Thus, these features are excellent candidates for features characteristic of a hypothetical sub-area of California that would include Wappo and the languages most similar to it.

Searching again the 71-member sample for the distribution of this new feature set – phonemic aspiration (X^h), a palato-alveolar fricativce (š), glottalized sonorants (R’), and a coronal stop place contrast (t ṭ) – gives us the following distribution:

Table 7.15

Distribution Of The New Diagnostic Features Derived From Table 7.14 in the 71-Member Sample

‘index’ number represents the statistical likelihood that any given language in the sample would have the given conjunction of features; smaller index, greater significance

X^h	š	R’	t ṭ		Languages and families with the relevant feature combination	
42/71	42/71	30/71	30/71	index		
+	+	+	+	.0159	Choynimni Yokuts Gashowu Yokuts Hometwoli Yokuts Palewyami Yokuts Wukchumni Yokuts	Kashaya Pomo Wappo
+	-	+	+	.0378	Yawelmani Yokuts	
-	+	+	+	.0378	Salinan	all Northern Yukian
+	+	+	-	.0529	Tolowa-Chetco Kato Wailaki	all Chumashan
+	+	-	+	.0529	Central Pomo Eastern Pomo Northern Pomo Southern Pomo Northeastern Pomo	Chimariko
+	-	+	-	.1260	Yana all Palaihnihan Klamath-Modoc	Chukchansi Yokuts Hupa

-	+	-	+	.1260	Chalon	Southern Sierra Miwok
					Chochenyo	
					Rumsen	Southeastern Pomo
					Esselen	
-	+	+	-	.1260	Yurok	Konomihu
					Miluk	
+	-	-	+	.1260	Lake Miwok	
+	+	-	-	.1764	Bear River	
					Galice-Applegate	
					Lower Rogue River	
-	-	-	+	.3000	Coast Miwok	Karkin
					Northern Sierra Miwok	Mutsun
					Central Sierra Miwok	
+	-	-	-	.4200	Wintu	Wiyot
					Nomlaki	
					Patwin	Mattole
					Takelma	Washo
					Molala	
					Yoncalla	
-	+	-	-	.4200	Kawaiisu	Karuk
					Tübatulabal	
						Nisenan

This procedure confirms a special significance for the resemblance between Wappo, Yokutsan, Pomoan, Chumashan, and Klamath-Modoc, as well as the coincidental resemblance between these and the Athabaskan languages. However, it also identifies several more languages from the sample as being especially similar to Wappo in various ways:

1. Salinan (a Hokan isolate), and the three Northern Yukian languages. These languages share all of the relevant features with Wappo except for phonemic aspiration (X^h)
2. Chimariko (a Hokan isolate). This language shares all of the relevant features with Wappo except for glottalized sonorants (R')

And at a somewhat lower level of statistical significance to the languages above, though equal among themselves:

3. Yana (a Hokan isolate), and the two Palaihnihan languages. These share phonemic aspiration (X^h) and glottalized sonorants (R') with Wappo, but lack the palato-alveolar fricative (š) and the coronal stop place contrast (t ṭ). Klamath-Modoc is at this level of resemblance as well.
4. Esselen (a Hokan isolate), three of the five Ohlone languages, Southern Sierra Miwok, and Southeastern Pomo. These share the palato-alveolar fricative (š) and the coronal stop place contrast (t ṭ) with Wappo, but lack phonemic aspiration (X^h) and glottalized sonorants (R'). They are thus the inverse of the group in (3)
5. Yurok, Miluk, and Konomihu, which share the palato-alveolar fricative (š) and glottalized sonorants (R') with Wappo, but not phonemic aspiration (X^h) or a coronal stop place contrast (t ṭ)
6. Lake Miwok, which shares phonemic aspiration (X^h) and a coronal stop place contrast (t ṭ) with Wappo, but not the palato-alveolar fricative (š) or glottalized sonorants (R'). It is the inverse of the group in (5)

To summarize, Wappo appears to share a particularly significant conjunction of features with nearly all of the Yokutsan languages, nearly all of the Pomoan languages, the Northern Yukian languages, the Chumashan languages, as well as the isolates Salinan and Chimariko. The resemblance between Wappo and Klamath-Modoc has slipped somewhat in the rankings from earlier, and there is a relatively weak resemblance with Yana, Palaihnihan, Esselen, and some Ohlonean and Miwokan languages, including Lake Miwok, as well as a handful of disparate languages of the California-Oregon border region. There is also the previously-discussed coincidental resemblance to some of the Athabaskan languages.

When thinking of the geographical distribution of the languages of the more significant group (Wappo, Pomoan, Yokutsan, Chumashan, Northern Yukian, Salinan, Chimariko), we find that they cluster into two areas:

1. Wappo, Pomoan, Northern Yukian, and Chimariko are found in the Northern Coast Ranges, between San Francisco Bay and northwestern California
2. Salinan, Chumashan, and Yokutsan are found in the Southern Coast Ranges, from the central coast of California to the edge of the Mojave Desert, with Yokutsan also extending into the San Joaquin Valley and the Sierra Nevada foothills.

The conclusion that emerges from this distribution is that there appears to be a "Coast Range" linguistic sub-area of the larger California Linguistic Area, and that it includes languages of the Northern Yukian, Pomoan, Chumashan, and Yokutsan families, as well as Wappo, Chimariko, and Salinan. The two most defining features of this sub-area would then be the presence of glottalized sonorants (R'), and the presence of a coronal stop place contrast (t ṭ), with Northern Yukian and Wappo in the north, and Salinan and Yokutsan in the south, possessing both features; Pomoan and Chimariko, in the north, possessing the coronal stop place contrast but not glottalized sonorants (except for Kashaya Pomo); and Chumashan, in the south, possessing glottalized sonorants but not the coronal stop place contrast. Two slightly less significant features of this region would be the presence of phonemic aspiration (X^h) and a palato-alveolar fricative (š), with Wappo, Chumashan, Pomoan (except Southeastern Pomo), Yokutsan (except Yawelmani), and Chimariko possessing both features; Yawelmani possessing only phonemic aspiration; and Northern Yukian and Salinan possessing only the palato-alveolar fricative.

In addition to the Northern Coast Range and Southern Coast Range clusters described above, there is a third, outlier cluster with some of these same features, consisting of the Yana, Palaihnihan, and Klamath-Modoc languages. The languages of this cluster lack the coronal stop place contrast (t ṭ) and the palato-alveolar fricative (š), but do have glottalized sonorants (R’) and phonemic aspiration (X^h).

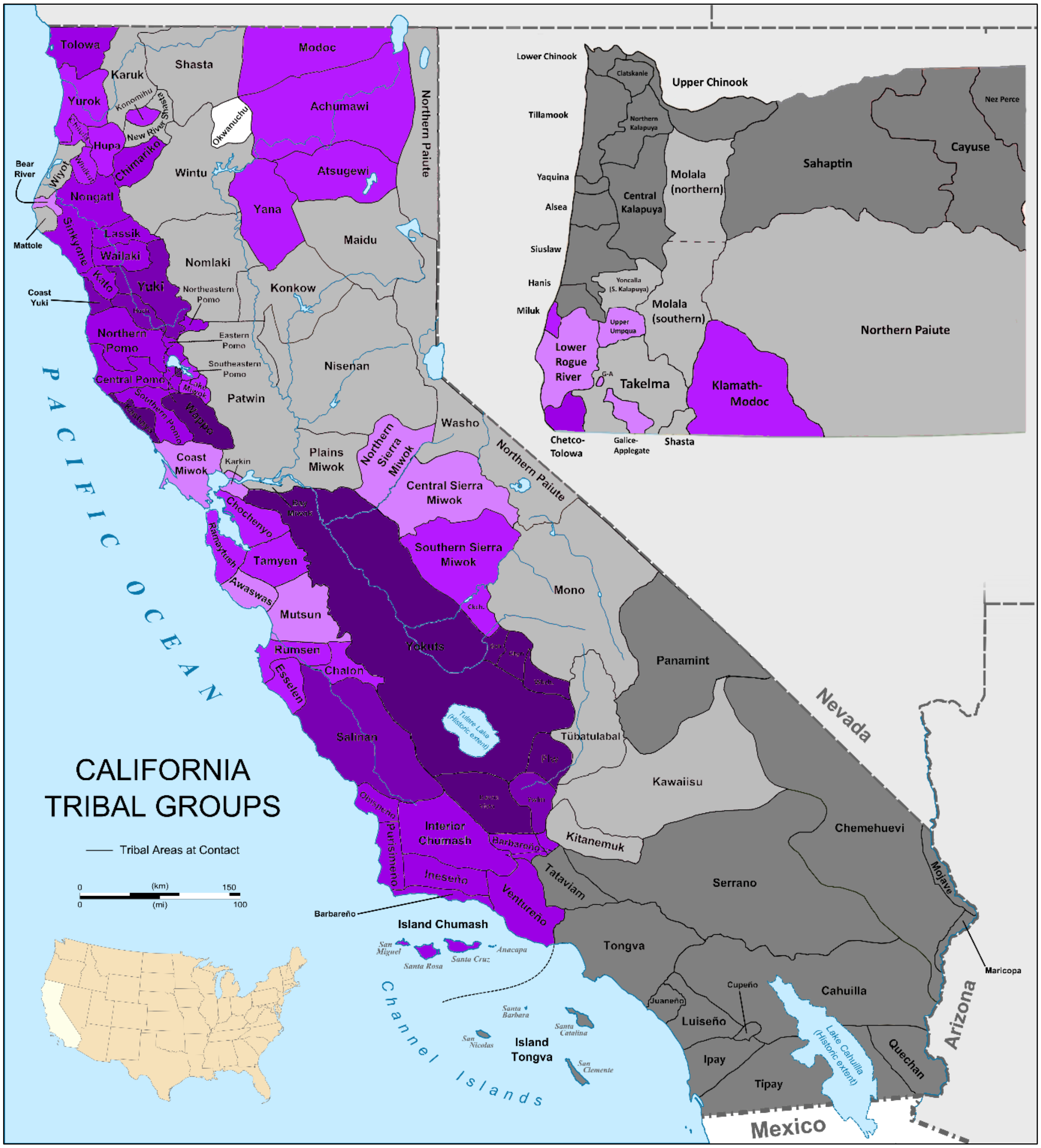
Map 7.6 gives the distribution of the four features – glottalized sonorants, a coronal stop place contrast, phonemic aspiration, and a palato-alveolar fricative – that appear to define a “Coast Range” linguistic sub-area of California.

Map 7.6

The "Coast Range" Linguistic Sub-Area of the California Linguistic Area

Based on the four features 1) coronal stop place contrast, 2) glottalized sonorants, 3) palato-alveolar fricative /š/, 4) phonemic aspiration

Darker shade = more significant concentration of the four features



It may seem strange to posit a linguistic area that consists of three non-contiguous parts. But based on the results obtained here, as well as on a range of linguistic, archaeological, and anthropological evidence compiled over decades by other researchers on California Indigenous languages, it becomes clear what has occurred: an originally unified linguistic area has been split into three parts by the arrival in Central California of linguistic groups that were not originally part of the area.

The first of these groups appears to be the speakers of proto-Utian, the ancestral language of both the Ohlonean and Miwokan languages, and recently shown to be the sister language of Proto-Yokutsan (Golla 2011:252). The time-depth for the split between Miwokan and Ohlonean has been dated to between 3,500 and 3,000 years before present (i.e. between 1500 and 1000 BCE), and so the split from pre-Proto-Yokutsan must predate that timeframe. Proto-Utian was probably first established in the very heart of California, the northern San Joaquin Valley where the San Joaquin and Sacramento Rivers meet and form the marshes of the Sacramento-San Joaquin Delta before spilling into San Francisco Bay. From here, speakers of pre-Miwokan appear to have migrated northwestward into the lower end of the Northern Coast Ranges, precisely where Wappo is found today; Miwokan may have been the previous language of both Wappo and Patwin territory (Golla 2011:253). Meanwhile, speakers of pre-Ohlonean migrated southwestward into the northern end of the Southern Coast Ranges, in today's Alameda, Santa Clara, and San Benito counties, south of San Francisco Bay. Both the Miwokan and Ohlonean languages, like their nearest relative, Yokuts, adopted some features of the Coast Range linguistic area: in particular, a coronal stop place contrast, which suggests a period of residency among other Coast Range cultures before the diversification and expansion of the two families: Ohlonean across the San

Francisco Bay Area and the adjacent Pacific coast as far south as Monterey, as well as the interior Southern Coast Ranges; and Miwokan into the Marin Peninsula and later back across the Delta and Central Valley into the central Sierra Nevada mountains (Golla 2011:253). The settling of the Miwok and Ohlone in the Delta-Bay region would have marked the first fracture in the original Coast Range area – Miwokan and Ohlonean lack phonemic aspiration and phonemic glottalization, and today only Lake Miwok has acquired these features from its neighbors. One other genetic unit of this central area, Esselen, likely represents the last remnant of peoples who inhabited the San Francisco Bay Area and adjacent areas east and south of the Bay before the arrival of the Ohloneans; it is possible that Esselen once had a phonological profile more similar to other Coast Range languages like Pomoan and Salinan, including phonemic glottalization and aspiration, but lost these due to contact with Ohlonean.

Much later, the Maiduan-speaking peoples arrived over the northern Sierra Nevada from a homeland in the Great Basin, likely displaced by the expansion of Numic speakers across the basin (Golla 2011:251). Golla speculated that the northwestern Great Basin, the region that is today near the junction of Oregon, California, and Nevada, was the home of several ultimately-related groups, including the Maiduan, the Klamath-Modoc, the Molala, and the Sahaptin-Nez Perce; all of these have been included in the Penutian hypothesis (Golla 2011:249).

The final group to enter were the Wintuans, sometime in the mid 1st millennium CE (Golla 2011:250). The Wintuans migrated southward from a homeland somewhere in southwestern Oregon, northwest of Mt. Shasta and the Trinity River. They followed the western side of the Sacramento Valley as far as the northern end of the Delta just above San Francisco Bay, and the southernmost Wintuan speakers, the Patwins, were still in the process of moving into the Bay region at the time of European contact (Golla 2011:250). Unlike Miwok and Ohlone, Wintuan did not acquire a coronal stop place contrast, nor does it have glottalized sonorants, although it appears that it did already possess phonemic aspiration, suggesting that its homeland in southwestern Oregon could have originally represented a northern extension of features characteristic of the Coast Range. The Wintuan migration separated the peoples of the Northern Coast Ranges from the third part of the linguistic area, the Northeast, and led to the isolation of the Northeastern cluster of languages we identified above: Yana, Palaihnihan, and Klamath-Modoc.

One more migration is necessary to mention: that of the Yokuts. The shallow diversification of the historically-attested varieties of Yokuts points to a very recent migration – perhaps more recent even than the Wintuan – across much of the San Joaquin Valley and the central foothills of the Sierra Nevada. However, the further south one goes in the Yokuts speech area, the deeper the splits become among the dialects, indicating that the point of origin of the family was at the southern end of its attested range, specifically near the Kern River and the Tehachapi Mountains, geographical barriers that separate the San Joaquin Valley from the desert regions of Southern California, largely inhabited by Uto-Aztecan and Yuman-speaking peoples. This places Proto-Yokuts near the southern end of the Coast Ranges, not far from the historically-attested areas of Chumash speech. However, Yokuts is now thought to be the closest relative of the Utian languages, Ohlonean and Miwokan, whose own point of diversification was in the vicinity of the Delta, at the opposite end of the historical Yokuts range. How to account for this discrepancy? It would appear that the ancestors of the Yokutsan peoples spent two relatively long periods in two different locations before their recent spread and diversification. The first location must have been somewhere nearer the Delta, where proto-Utian was spoken – in fact, probably in the Great Basin, directly east of this area but over the high ridge of the Sierra Nevada, since proto-Yok-Utian, the ancester of all three groups, shares genetic and typological connections with the Maiduans and probably the Klamath-Modoc, all of whom are traced to the Great Basin (Golla 2011:249). After a migration out of this original area, they would have arrived at the southern end of the San Joaquin Valley, near the southern Coast Ranges, and then would have spent a relatively long time in place, enough to account for the development of a coronal stop place contrast in Proto-Yokuts, the single most defining feature of the Coast Range area. It is not currently known if Proto-Yokuts already possessed phonemic aspiration and glottalized sonorants inherited from Proto-Yok-Utian (implying that these features were later lost in its sibling, Proto-Utian) or if Proto-Yok-Utian lacked these features and they were later acquired by Proto-Yokutsan at the same time as the coronal stop place contrast, through contact with Coast Range languages – in particular Chumash, which possesses both of these features (Golla 2011:252, 240).[196] Either way, these features were then spread back through the whole of the Central Valley and into the Sierra Nevada foothills with the recent Yokuts expansion from their second, southern homeland.

To summarize this section, a wider investigation of significant features that Wappo shares with other languages of California reveals a specific linguistic sub-area across the northern and southern Coast Ranges of California, to which Yuki-Wappo, Pomoan, Chimariko, Salinan, Chumash, and Yokuts belong (as well as possibly an earlier form of Esselen), and a northeastern extension of this area to the edge of the Great Basin, encompassing Yana, Palaihnihan, and Klamath-Modoc. Sometime after the formation of this

[196] Some linguistic evidence suggests that Chumash-like and Salinan-like languages underlie Proto-Yokuts as substrates (Golla 2011:252).

linguistic area, it was fragmented by subsequent migrations of other groups: Miwok and Ohlonean (Utian) speakers from Delta region, Maiduan speakers from the Great Basin, and Wintuan speakers from southwestern Oregon. Finally, a back-expansion of the Miwok into the central Sierra Nevada, and a back-expansion of Yokuts north across the whole of the San Joaquin Valley and into the Sierra Nevada foothills, was responsible for an extension of some Coast Range features, most notably the coronal stop place contrast, into the Sierra Nevada range.

7.4 Wappo and the "Clear Lake Linguistic Area"

Previous researchers on California Indigenous languages, in particular those researching Pomoan, Lake Miwok, Wappo, and Patwin, have posited a unique linguistic 'micro-area' around Clear Lake, the large ancient lake found in the northern Coast Ranges about 100 kilometers north of San Francisco Bay. Among the authors that have mentioned or discussed Clear Lake as a linguistic area are Callaghan (1964, 1987), Berman (1973), Sherzer (1976), Mithun (1999), Golla (2011), and Lawyer (2015), and these works cite earlier discussions of the shared linguistic and cultural patterns of the peoples of the Clear Lake area, such as those in Barrett (1908), Kroeber (1925, 1932), Loeb (1932), Merriam (1955), and Whistler (1977). In particular, observations that likely trace back to Kroeber describe the Clear Lake linguistic area as consisting specifically of the Pomoan languages Eastern Pomo and Southeastern Pomo; the Miwokan language Lake Miwok; the Wintuan language Patwin; and Wappo.[197]

[197] The eastern extremity of Northern Pomo territory also abuts the western shore of Clear Lake (McCarthy et al. 1985:218), but this distribution may date to the post-contact period (Golla 2011:109).

While the present chapter can only comment on the phonological aspects of language contact at Clear Lake, rather than on the phonetic, morphosyntactic, and lexical aspects, the evidence from the synchronic and diachronic patterns of the phoneme inventories alone does in fact appear to support the presence of some kind of linguistic convergence area around Clear Lake – though not in exactly the configuration that previous authors have described.

The hallmark of a classic linguistic area is that the languages within it share more traits with each other than they do with languages outside of the area, especially genetic relatives, which would naturally share some number of similarities through common descent. Thus, one way to identify a linguistic area would be to compare the hypothesized members to their respective relatives outside of the area, in order to compare the patterns of similarities within the area to the genetic ones extending outside of the area.

For each of the five hypothesized languages of the Clear Lake area, there are fortunately a large number of close genetic relatives outside of the area that can be used for this type of comparison. This 'test set' of area-external languages is given in Table 7.16. Note that, while I have been agnostic on the Yuki-Wappo relationship throughout this chapter, in this section I will use the Northern Yukian languages as the control set for Wappo, as otherwise Wappo must be considered a genetic isolate. Also note that Eastern Pomo and Southeastern Pomo will be used as control languages for each other, along with their relatives outside of the area.

Table 7.16

Test Set For Determining The Validity Of A Clear Lake Linguistic Area

Candidate language	Genetic relatives outside of the hypothesized area
Wappo	Coast Yuki, Huchnom, Yuki
Southeastern Pomo	Central Pomo, Eastern Pomo, Kashaya Pomo, Northeastern Pomo, Northern Pomo, Southern Pomo
Eastern Pomo	Central Pomo, Kashaya Pomo, Northeastern Pomo, Northern Pomo, Southeastern Pomo, Southern Pomo
Lake Miwok	Central Sierra Miwok, Coast Miwok, Northern Sierra Miwok, Plains Miwok, Southern Sierra Miwok
Patwin	Nomlaki, Wintu

Using the same procedure as employed in Section 7.3 to identify a Coast Range linguistic area, we can take the five languages to be tested along with their genetic relatives, identify the frequency of each feature possessed by each language (the frequency being taken from the 71-member sample), and, for any given pair of test languages, multiply the frequencies of the shared features together to yield an 'index' of relatedness between the two members of the pair. Repeating this for all members of the test set, we can obtain a ranked list for each member language consisting of all of the other languages in the set, sorted by not just the number of shared features, but the relative importance of which features are shared.

The results of this procedure for the five Clear Lake languages, including their genetic relatives as controls, are given in Table 7.17.

Table 7.17

Ranked Relations Among The Clear Lake Linguistic Area Test Sample And Genetic Relatives

Yuki-Wappo family   Pomoan family   Miwokan family   Wintuan family

bold type = the original five-language Clear Lake proposal

language	ranked list of languages by similarity
Wappo	Kashaya Pomo > **Eastern Pomo** > Northern/Central/Southern Pomo > Northeastern Pomo > **Southeastern Pomo** > Coast Yuki/Huchnom > Yuki > **Lake Miwok** > Southern Sierra Miwok > Central Sierra Miwok > Nomlaki > Coast/Northern Sierra Miwok > **Patwin**/Wintu > Plains Miwok
Southeastern Pomo	**Eastern Pomo**/Central Pomo > Northeastern Pomo > Wintu > Nomlaki > Northern/Southern Pomo > Kashaya Pomo/**Lake Miwok** > **Wappo** > Coast Yuki/Huchnom/Yuki > **Patwin** > Southern Sierra Miwok > Central Sierra Miwok > Coast/Northern Sierra Miwok > Plains Miwok
Eastern Pomo	Kashaya Pomo > Northeastern Pomo > Central Pomo/Wintu > **Wappo** > **Southeastern Pomo** > Northern/Southern Pomo > **Lake Miwok** > **Patwin** > Nomlaki > Southern Sierra Miwok > Coast/Central Sierra Miwok > Coast Yuki/Huchnom > Yuki > Northern Sierra Miwok > Plains Miwok
Lake Miwok	Northeastern Pomo > **Eastern Pomo** > Northern/Central/Southern Pomo > Nomlaki > **Patwin**/Wintu > **Southeastern Pomo** > Kashaya Pomo > **Wappo** > Coast/Central Sierra/Southern Sierra Miwok > Coast Yuki/Huchnom/Yuki > Northern Sierra Miwok > Plains Miwok
Patwin	Wintu > Nomlaki > Northeastern Pomo > **Eastern Pomo** > **Lake Miwok** > Northern/Central/Southern Pomo > Kashaya Pomo > **Southeastern Pomo** > **Wappo** > Coast/Plains/Central Sierra/Southern Sierra Miwok > Coast Yuki/Huchnom > Yuki > Northern Sierra Miwok

Examining this table, we see that for Wappo and Lake Miwok in particular, the languages that appear to be most similar to them phonologically are *not* their genetic relatives;

in fact, for both languages, the most similar genetic relative is quite far down the list – after seven languages for Wappo, and after eleven languages for Lake Miwok. Instead, the non-Yuki-Wappo languages that are most similar to Wappo phonologically are all of the Pomoan languages, while the non-Miwokan languages that are most similar to Lake Miwok phonologically are all of the Pomoan languages, all of the Wintuan languages, and Wappo. With this result, we can already begin to picture an areal relationship that has had a particularly strong influence on Wappo and Lake Miwok, drawing them away in phonological structure from their genetic relatives.

On the other hand, for neither Wappo nor Lake Miwok is the single most similar language in the set actually one of the original five Clear Lake languages. For Wappo, the most similar of the five is Eastern Pomo, but this is only Wappo's second most similar partner, the top spot being taken by Kashaya Pomo, spoken on the Pacific coast to the southwest of Clear Lake. For Lake Miwok, the most similar of the five is also Eastern Pomo, but only after Northeastern Pomo, spoken in a detached area on the border of the Coast Range and the Sacramento Valley somewhat north of Clear Lake. This is our first hint that, if there is indeed a Clear Lake linguistic area, it may have a different configuration of languages than the original five hypothesized.

Unlike Wappo and Lake Miwok, the other three members of the original set all have close genetic relatives as their most similar partners phonologically. For Southeastern Pomo, its most similar partners are a tie between Eastern Pomo and Central Pomo, while for Eastern Pomo, its most similar partner is Kashaya Pomo, the same as for Wappo. Finally, for Patwin, its genetic relative Wintu is its most similar partner in the test set.

Having identified which languages in the test set are most similar to each of the original five, it would be helpful to identify just how similar each of the five are to each other. A ranking of second or third would still be strong evidence for an areal relationship among a given pair; but a ranking of eighth or ninth would suggest that there is no special areal relationship that we can identify, at least in a particular direction within the pair.

For Wappo, Eastern Pomo is its second most similar partner, Southeastern Pomo is fifth, Lake Miwok is eighth, and Patwin is a distant thirteenth. Wappo's hypothesized genetic relatives, the Northern Yukian languages, fall in the middle of this distribution, behind the two Pomoan languages but ahead of Lake Miwok and Patwin. This suggests that any influence Wappo has experienced from its neighbors is largely from the direction of the Pomoan group, rather than from Lake Miwok or Patwin, despite these two languages being spoken directly to the east of the Wappo speech area.

For Southeastern Pomo, Eastern Pomo is its most similar partner (along with Central Pomo), Lake Miwok is sixth, Wappo is seventh, and Patwin is ninth. Surprisingly, all of Southeastern Pomo's genetic relatives rank higher in similarity to it than do Lake Miwok, Wappo, or Patwin, all of which are direct neighbors (though Kashaya Pomo is equal to Lake Miwok in the ranking). This suggests that Southeastern Pomo has not had any appreciable influence from the non-Pomoan languages of the Clear Lake area.

For Eastern Pomo, Wappo is its fourth most similar partner, Southeastern Pomo is fifth, Lake Miwok is seventh, and Patwin is eighth. Three of Eastern Pomo's relatives rank higher than any member of the original five, but Wappo is more similar to Eastern Pomo than the remaining three, including Southeastern Pomo, while Lake Miwok and Patwin come after all of the Pomoan languages and Wappo. Thus, the only non-Pomoan language that appears to share meaningful similarities with Eastern Pomo is Wappo, spoken directly to its south.

For Lake Miwok, Eastern Pomo is its second most similar partner, Patwin is fifth, Southeastern Pomo is sixth, and Wappo is eighth. Interestingly, all four of the other Clear Lake Languages are more similar to Lake Miwok than its own genetic relatives, the remaining Miwokan languages. This confirms then that Lake Miwok appears to have experienced a strong areal influence from all of its Clear Lake neighbors, sufficient to draw it away completely from its genetic relatives.

Finally, for Patwin, Eastern Pomo is its fourth most similar partner, Lake Miwok is fifth, Southeastern Pomo is eighth, and Wappo is ninth. However, both of Patwin's genetic relatives, Nomlaki and Wintu, are more similar to it than are any other language in the test set. This suggests that, to the extent Patwin participates in the Clear Lake linguistic area, it is as a donor of features, not as a recipient.

To summarize this section, Table 7.18 gives the mutual rankings of all five members of the original Clear Lake area hypothesis.

Table 7.18

Similarity Rankings For The Original Five-Member Clear Lake Group

For each box, 'Xth' means that the language in the column is the Xth most similar language to the language in the row, out of the five languages of the group

	Wappo	Southeastern Pomo	Eastern Pomo	Lake Miwok	Patwin
for **Wappo**	-	5th	2nd	8th	13th
for **Southeastern Pomo**	7th	-	1st	6th	9th
for **Eastern Pomo**	4th	5th	-	7th	8th
for **Lake Miwok**	8th	6th	2nd	-	5th
for **Patwin**	9th	8th	4th	5th	-

We can now make the following summary statements about a hypothesized Clear Lake Linguistic Area, based on the original five-member proposal:

1. Lake Miwok has been strongly influenced by Pomoan, Wappo, and Patwin
2. Wappo has been moderately influenced by Pomoan
3. Eastern Pomo shares a moderate amount of similarity with Wappo, though the direction of influence is unclear at the moment
4. Patwin appears to have influenced some of its neighbors, but does not appear to have been much influenced by them
5. Southeastern Pomo does not appear to have been influenced much at all by any of its non-Pomoan neighbors

As interesting as these results are, however, we have to acknowledge the fact that these five languages do not share an areal relationship that is exclusive to themselves; for all of the pairwise comparisons among them, other than Eastern Pomo to Southeastern Pomo, other languages that are not one of the five turned out to be more similar to members of the five, to varying extents, than the five are to each other. This suggests to us that, while there are meaningful patterns of areal influence among the five proposed members, they are not exclusive to these five, and therefore that the hypothesis of a Clear Lake linguistic area must be expanded to include some of the other languages used in the test set that turned out to have closer relationships with the original five, in varying combinations, than any of the original five have with each other. We will do this in the next section.

7.5 A Broader Approach

Rather than discard the notion of a Clear Lake linguistic area, it would seem instead that we must expand the boundaries of the area to include more languages than the five proposed in the original hypothesis.

We have seen that all of the Pomoan languages rank high on the list of phonologically similar languages for each of the non-Pomoan members of the original five, in particular for Lake Miwok and Wappo. By contrast, the Miwokan languages – Coast Miwok, Plains Miwok, and the three Sierra Miwok varieties – are quite low on the lists for all five original members. Thus, it seems appropriate to attempt to expand the ‘Clear Lake’ area to include all of the Pomoan languages, while all of the Miwokan languages other than Lake Miwok should be excluded.

The case for expanding the linguistic area to include the other Wintuan languages and the Northern Yukian languages is weaker, but worth examining. All three of the Wintuan languages are highly similar to each other, as in fact they likely diverged much more recently than any of the other three families present at Clear Lake. Thus, any similarities between the Clear Lake languages and Nomlaki, or especially between those languages and Wintu, spoken hundreds of kilometers away from Clear Lake, will probably be a statistical artifact of Nomlaki and Wintu's similarity to Patwin. Nonetheless, speakers of Nomlaki are known to have been in contact with one Pomoan language, Northeastern Pomo (Walker 2016; Golla 2011:8), so it may be useful to try to identify specific linguistic evidence for Nomlaki-Northeastern Pomo contact, rather than eliminating Nomlaki at this stage.

Similarly, the Northern Yukian languages share certain types of similarities with the original five Clear Lake languages that could place them in the linguistic area; in particular, the Northern Yukian languages are more similar to both Wappo and Southeastern Pomo than Patwin is to these two languages. As with Nomlaki, specific evidence for language contact should be sought in order to determine Northern Yukian's connection to the Clear Lake linguistic area.

Table 7.19 gives the set of individual phonological features present among Pomoan, Wappo, Lake Miwok, Nomlaki, Patwin, and Northern Yukian, ordered by prevalance within the set. In particular, features that are innovative in a given language (relative to its protolanguage), and thus may have arisen due to contact, are given in red text. In this set, the three members of the Northern Yukian family will be treated as a single language, since they are identical in all of the relevant features of the set.

Table 7.19

Features Of The 12-Member ‘Greater Clear Lake’ Test Set

P’Č’ = glottalized stops and affricates, V: = phonemic vowel length, P^h = aspirated stops, B = voiced stops, t ṭ = coronal stop place contrast, č = palato-alveolar affricate, š = palato-alveolar fricative, $Č^h$ = aspirated affricates, c = laminal-alveolar affricate, ṣ/s̠ = retroflex or apical-alveolar fricative, s = laminal-alveolar fricative, q = uvular stop, ɬ = lateral fricative, r = rhotics, R^h = aspirated or voiceless sonorants, R’ = glottalized sonorants, x = velar fricative, x̣ = uvular fricative, ƛ’ = glottalized lateral affricate, ɸ~f = labial fricative, S’ = glottalized fricative, S# = number of distinct coronal sibilant places
Po. = Pomo, C = Central, K = Kashaya, N = Northern, S = Southern, E = Eastern, NE = Northeastern, SE = Southeastern, Wa. = Wappo, L Mi. = Lake Miwok, Pat. = Patwin, Nom. = Nomlaki, N Yu. = Northern Yukian
blue text: retensions from the proto-language; red text: innovations from the proto-language; black text: proto-language value unknown. *Pres.* column indicates number of languages in the set the feature is present in. Gray shading indicates presence of feature for given language.
(parentheses) = marginal feature, [brackets] = present only allophonically or phonetically

	C Po.	K Po.	N Po.	S Po.	E Po.	NE Po.	SE Po.	Wa.	L Mi.	Pat.	Nom.	N Yu.	*pres.*
P’Č’	P’Č’	P’Č’	P’Č’	P’Č’	P’Č’	P’Č’	P’Č’	P’Č’	P’Č’	P’Č’	P’Č’	P’Č’	12
V:	V:	V:	V:	V:	V:	V:	V:	(V:)	V:	V:	V:		11
P^h	P^h	P^h	P^h	P^h	P^h	P^h	Ø	P^h	P^h	P^h	P^h		10
B	B	[B][198]	B	B	B	B	B		B	B	B		10
t ṭ	t ṭ	t ṭ	t ṭ	t ṭ	t ṭ	t ṭ	t ṭ	t ṭ	t ṭ			t ṭ	10
č	č	č	č	č	č	č	[č][199]	č	Ø	č	č	č[200]	10
š	š	š	š	š	š	[š]	š	š				[š]	9
$Č^h$	$Č^h$	$Č^h$	$Č^h$	$Č^h$	$Č^h$	$Č^h$		$Č^h$					7
c	c	Ø	c	c	c	Ø	c	c	c				7
ṣ/s̠	Ø	ṣ/s̠	Ø	Ø	ṣ/s̠	[ṣ/s̠]	Ø	Ø	ṣ/s̠	ṣ/s̠	ṣ/s̠	[ṣ/s̠]	7
s	s	Ø	s	s	Ø	Ø	s	s				s	6
q	q	q	Ø	Ø	q	Ø	q			Ø	q		5
ɬ						ɬ			ɬ	ɬ	ɬ		4
ƛ’						(ƛ’)			(ƛ’)	ƛ’	ƛ’		4
r					r	r				r	Ø		3
R^h		R^h			R^h			(R^h)					3
R’		R’						R’				R’	3
x	Ø	Ø	[x][201]	Ø	x	Ø	x			Ø	Ø		2
x̣	Ø	Ø	Ø	Ø	Ø	Ø	x̣			Ø?	x̣		2
ɸ~f						ɸ~f	ɸ~f						2
S’	[S’]	S’	[S’]									[S’]	1
S#	2	2	2	2	2	1	2	2	1[202]	1	1	2	n/a

[198] Kashaya Pomo’s two voiced stops [b] and [d] are analyzed by Buckley (1990) as being contextual realizations of underlyingly glottalized sonorants /m’/ and /n’/, respectively.
[199] SE Pomo has [č] only as an allophone of /c/ before high front segments.
[200] Yuki /č/ varies between [č] and [č̣]; all Northern Yukian /š/ varies between [š] and [ṣ] (Balodis 2011:63).
[201] Phonetic [x] re-emerged in Northern Pomo as an allophone of /k^h/ before /a, o/ (McLendon 1973:16, fn.5).

7.6 Features of the Greater Clear Lake Area

There are ten common features found in the twelve languages of the Greater Clear Lake set, defined as those features which occur in greater than 50% of the set languages. Each of these features is listed below, along with its prevalence (expressed as proportions and percentages) in both the 12-member Greater Clear Lake set and the 71-member California sample detailed at the beginning of this chapter. The features are ranked according to the percent difference[203] between their prevalences in the two sets, i.e. the highest-ranked features are those that most distinguish the Greater Clear Lake set from the rest of the 71-member California sample

1. **Voiced stops** (10/12, 83.3% of the Greater Clear Lake set; 18/71, 25.4% of the 71-member California sample; difference: **106.5%**). These are found in all seven Pomoan languages,[204] as well as in Lake Miwok, Patwin, and Nomlaki. They are not found in Wappo or Northern Yukian. Voiced stops were present in both Proto-Pomoan and Proto-Wintuan, but not in Proto-Miwokan or Proto-Yuki-Wappo.[205]
2. **Coronal stop place contrast** (10/12, 83.3% of GCL set; 30/71, 42.3% of Cal. sample; difference: **65.3%**). This contrast is found in all seven Pomoan languages, in Wappo, in Northern Yukian, and in Lake Miwok. It is not found in Patwin or Nomlaki. It is

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[202] Though Proto-Miwokan is reconstructed as having two contrasing sibilant phonemes, */s/ and */ṣ/ (Callaghan 1972:4), Proto-Western-Miwokan, the immediate ancestor of Lake Miwok and Coast Miwok, is reconstructed as having a single sibilant phoneme */ṣ/ (Callaghan 2014:78). Thus, the single sibilant phoneme /ṣ/ of Lake Miwok may be considered a retention.

[203] $(|n_1-n_2|)/((n_1+n_2/2)\cdot 100)$, n_1, n_2 = the two percentages

[204] Including the segments in Kashaya Pomo that are phonetically voiced stops in certain contexts but are phonemically glottalized sonorants – see Buckley (1990).

[205] There is currently no published reconstruction of Proto-Yuki-Wappo, only of Proto-Northern Yukian – that of Schlichter (1985). Statements here about conjectured features of Proto-Yuki-Wappo are my own opinions.

reconstructed for Proto-Pomoan, Proto-Yuki-Wappo, and Proto-Miwokan, but not Proto-Wintuan.

3. **Palato-alveolar fricative /š/** (9/12, 75% of GCL set; 36/71, 50.7% of Cal. sample; difference: **38.7%**). This is found in all seven Pomoan languages, in Wappo, and in Northern Yukian (where it varies with a retroflex /ṣ/). It is not found in Lake Miwok, Patwin, or Nomlaki. It is not reconstructed to any of the relevant proto-languages, but may have been present phonetically or allophonically in Proto-Northern-Yukian and Proto-Yuki-Wappo.
4. **Aspirated stops** (10/12, 83.3% of GCL set; 41/71, 57.7% of Cal. sample; difference: **36.3%**). These are found in all languages of the set except Southeastern Pomo and Northern Yukian. They are reconstructed for Proto-Pomoan and Proto-Wintuan, but not Proto-Miwokan or Proto-Yuki-Wappo.
5. **Glottalized stops and affricates** (12/12, 100% of GCL set; 53/71, 74.6% of Cal. sample; sig. difference: **29.1%**). These are found in all twelve members of the Greater Clear Lake set. They are reconstructed for Proto-Pomoan, Proto-Wintuan, and Proto-Northern Yukian, but not Proto-Miwokan.
6. **Aspirated affricates** (7/12, 58.3% of GCL set; 34/71, 47.9% of Cal. sample; difference: **19.6%**). These are found in Wappo and in all of the Pomoan languages except Southeastern Pomo. They are not found in Northern Yukian, Lake Miwok, Patwin, or Nomlaki. They are only reconstructed to Proto-Wintuan.
7. **Phonemic vowel length** (10/12, 83.3% of GCL set; 54/71, 76.1% of Cal. sample; difference: **9%**). This is found in all members of the set except Northern Yukian and Wappo. However, Wappo does have a small number of lexical items with an inherent

long vowel (see Chapters 2 and 4). The feature is reconstructed to Proto-Pomoan, Proto-Wintuan, and Proto-Miwokan, but not Proto-Yuki-Wappo.

8. **Palato-alveolar affricate /č/** (10/12, 83.3% of GCL set; 54/71, 76.1% of Cal. sample; difference: **9%**). This segment is found in all of the Pomoan languages except Southeastern Pomo (where it nevertheless occurs as an allophone of /c/ (Moshinsky 1974:35)), and is also found in Wappo, Northern Yukian, Patwin, and Nomlaki. It does not occur in Lake Miwok. It is reconstructed to Proto-Wintuan, Proto-Miwokan, and Proto-Yuki-Wappo, but not to Proto-Pomoan.
9. **Retroflex or apical-alveolar fricative /ş, s̱/** (7/12, 58.3% of GCL set; 39/71, 54.9% of Cal. sample; difference: **6%**). This occurs in Kashaya Pomo, Eastern Pomo, and Northeastern Pomo, and in Lake Miwok, Patwin, and Nomlaki; it also occurs in variation with [š] in Northern Yukian. It does not occur in the other Pomoan languages, or in Wappo. This segment is reconstructed to Proto-Wintuan and Proto-Miwokan, and possibly to Proto-Pomoan and Proto-Yuki-Wappo.
10. **Laminal-alveolar affricate /c/** (7/12, 58.3% of GCL set; 42/71, 59.2% of Cal. sample; difference: **1.5%**). This is found in all of the Pomoan languages except Kashaya and Northeastern, and also occurs in Wappo and Lake Miwok. It does not occur in Northern Yukian, Patwin, or Nomlaki. It is only reconstructed to Proto-Pomoan.

An additional eleven features are found in 50% or less of the Greater Clear Lake set; these will be further analyzed in order to detect evidence of language contact in their distribution.

11. **Aspirated/voiceless sonorants /Rʰ/** (3/12, 25% of Greater Clear Lake, 5/71, 7% of Cal. sample; difference: **112.5%**). Aspirated or voiceless sonorants occur in Kashaya Pomo, Eastern Pomo, and (marginally) in Wappo. They are not reconstructed to any of the protolanguages.
12. **Voiceless labial fricative /ɸ~f/** (2/12, 16.7% of Greater Clear Lake, 5/71, 7% of Cal. sample; difference: **81.9%**). Voiceless labial fricatives are found in Northeastern Pomo and Southeastern Pomo. They are not reconstructed to any of the protolanguages.
13. **Glottalized lateral affricate /ƛ'/** (4/12, 33.3% of Greater Clear Lake, 10/71, 14.1% of Cal. sample; difference: **81%**). This segment is found in both of the Wintuan languages in the Greater Clear Lake area, Patwin and Nomlaki. It is also found in four lexical items in Lake Miwok (Callaghan 1963:30-1) and a single attested lexical item in Northeastern Pomo (Walker 2016:72). It is reconstructed to Proto-Wintuan.
14. **Velar fricative /x/** (2/12, 16.7% of Greater Clear Lake, 27/71, 38% of Cal. sample; difference: **-77.9%**). A velar fricative is found in Eastern Pomo and Southeastern Pomo. It is reconstructed to Proto-Pomoan and Proto-Wintuan, but the correspondences are complex in the former.
15. **Glottalized sonorants /R'/** (3/12, 25% of Greater Clear Lake, 30/71, 42.3% of Cal. sample; difference: **-51.4%**). Glottalized sonorants occur in Kashaya Pomo, Wappo, and Northern Yukian. They are only reconstructed to Proto-Yuki-Wappo.
16. **Uvular stop /q/** (5/12, 41.7% of Greater Clear Lake, 21/71, 29.6% of Cal. sample; difference: **33.9%**). Uvular stops are found in four of the seven Pomoan languages:

Central Pomo, Kashaya Pomo, Eastern Pomo, and Southeastern Pomo. They are also found in Nomlaki. They are reconstructed to Proto-Pomoan and Proto-Wintuan.

17. **Glottalized fricative /S'/** (1/12, 8.3% of Greater Clear Lake, 8/71, 11.3% of Cal. sample; difference: **-30.6%**). A glottalized fricative, specifically the glottalized apico-alveolar fricative /s̠'/, is found as a phoneme in Kashaya Pomo, as well as phonetically in Northern Pomo and possibly in Central Pomo and Northern Yukian. It is not reconstructed to any of the protolanguages.
18. **Lateral fricative /ɬ/** (4/12, 33.3% of Greater Clear Lake, 19/71, 26.8% of Cal. sample; difference: **21.6%**). A lateral fricative is found in Northeastern Pomo, Lake Miwok, Patwin, and Nomlaki. It is reconstructed to Proto-Wintuan.
19. **Uvular fricative /x̣/** (2/12, 16.7% of Greater Clear Lake, 10/71, 14.1% of Cal. sample; difference: **16.9%**). This is found in Southeastern Pomo and Nomlaki. It is reconstructed to Proto-Pomoan and possibly to Proto-Wintuan, but the correspondences are complex in the former.
20. **Rhotic phoneme /r/** (3/12, 25% of Greater Clear Lake, 20/71, 28.2% of Cal. sample; difference: **12%**). This is found in Eastern Pomo, Northeastern Pomo, and Patwin. It is reconstructed to Proto-Wintuan.
21. **Laminal-alveolar fricative /s/** (6/12, 50% of Greater Clear Lake set, 38/71, 53.5% of 71-member California sample; difference: **-6.8%**). This is found in four of the seven Pomoan languages: Central Pomo, Northern Pomo, Southern Pomo, and Southeastern Pomo. It is also found in Wappo and Northern Yukian. This segment is reconstructed to Proto-Miwokan (though not Proto-Western-Miwokan) and Proto-Yuki-Wappo, and possibly to Proto-Pomoan.

22. **Sibilant fricative number** (1 sibilant: 4/12, 33.3% of Greater Clear Lake, 25/71, 35.2% of Cal. sample; difference: **-5.8%** | 2 sibilants: 8/12, 66.7% of Greater Clear Lake, 41/71, 57.7% of Cal. sample; difference: **14.5%** | 3 sibilants: 0/12 of Greater Clear Lake, 5/71, 7% of Cal. sample). Though not a specific feature in itself, the division between languages in the set with 1 sibilant fricative and those with 2 contrasting sibilant fricatives may have a contact-induced distribution (see Section 7.6.1.3 below). While most members of the Greater Clear Lake set have two contrasting sibilant fricatives, Lake Miwok, Northeastern Pomo, Patwin, and Nomlaki each have a single sibilant fricative phoneme. The balance of sibilant configurations tilts more towards two sibilants (and therefore less towards a single sibilant) in the Greater Clear Lake set than in the 71-member sample.

7.6.1 Analysis of Shared Features

In this section, detailed discussion of each of the features identified in the previous section for the Greater Clear Lake language set is given, including their distribution, language-internal details, connections to protolanguage reconstructions, and any evidence for contact-induced spread.

7.6.1.1 Voiced Stops

Voiced stops are found in all members of the Pomoan and Wintuan languages, and are reconstructible to the proto-language of each family. Since the two families originated in different geographical areas, the presence of voiced stops in both is coincidental. However, Lake Miwok, in contact both with Pomoan varieties and with the Wintuan language Patwin, is the only language in its family (Miwokan) to have voiced stops. Thus, we can assume that Lake Miwok acquired voiced stops through contact with either Pomoan, Patwin, or both. In fact, in all three groups, the same set of voiced stops occurs: a voiced bilabial /b/, and a voiced alveolar /d/.

Outside of the Clear Lake area and the Pomoan and Wintuan families, phonemic voiced stops are quite rare in the California Linguistic Area. Among the Hokan, Penutian, Yuki-Wappo, and Chumashan stocks of the region (those with a more ancient local presence than the Uto-Aztecan, Athabaskan, and Algic languages), they occur only in Washo (possibly due to contact with Uto-Aztecan languages); the Maiduan languages (reconstructed to the proto-language, realized in the daughters as voiced implosives, a very rare phoneme type in North America); and potentially the Proto-Coosan language, ancestor of Miluk and Hanis in southwestern Oregon (Douglas-Tavani 2021; Appendix A). Thus, voiced stops are the single most important phonological feature distinguishing a Greater Clear Lake linguistic sub-area from the rest of the California Linguistic Area.

Areal feature 1: presence of voiced stops in Lake Miwok (< Pomoan, Patwin)

7.6.1.2 Coronal Stop Place Contrast

A coronal stop place contrast is found in all members of the Pomoan, Yuki-Wappo, and Miwokan families, with the exception of Plains Miwok, where it has been lost.[206] This contrast is reconstructible to the proto-languages of all three families. The Proto-Pomoan and Proto-Miwokan languages are assumed to have been spoken in the general vicinity of Clear Lake (Golla 2011:246, 253), and it seems probable that Proto-Yuki-Wappo was spoken in this general area as well. Thus, the presence of a coronal stop place contrast in all three

[206] Bay Miwok (Saclan) may also have lost this contrast.

families is assumed to be the result of ancient contact between all three at a remote point in the past, or indeed, as a substrate feature in all three that was inherited from even older stocks and languages of the Coast Range area, now vanished. The Wintuan languages, which do not originate in this region, lack the feature entirely.

Areal feature 2: presence of coronal stop place contrast (t ṭ) in Pomoan, Miwokan, and Yuki-Wappo (ancient areal convergence)

7.6.1.3 Sibilant Fricative Series

The distribution of sibilant fricatives in the Clear Lake area, as in the rest of California, is complex. A laminal-alveolar fricative /s/ is found in Central Pomo, Northern Pomo, Southern Pomo, Southeastern Pomo, Wappo, and Northern Yukian. A palato-alveolar fricative /š/ is found in all seven Pomoan languages[207] and Wappo. A retroflex or apical-alveolar fricative /ṣ, s̠/ is found in Kashaya Pomo, Eastern Pomo, Northeastern Pomo, Lake Miwok, Patwin, and Nomlaki. In Northern Yukian, a single back-apical sibilant /Š/ varies in realization between palato-alveolar [š] and retroflex [ṣ]. Lake Miwok, Northeastern Pomo, Patwin, and Nomlaki all have a single sibilant fricative, while the remaining Pomoan languages, Wappo, and Northern Yukian each have two contrasting sibilant fricatives. A single sibilant is reconstructed for Proto-Pomoan (McLendon 1973:52) and Proto-Wintuan (Shepherd 2006:6), while two contrasting sibilants are reconstructed for Proto-Miwokan; however, a single sibilant is reconstructed for Proto-Western-Miwokan, the immediate ancestor of Lake Miwok and Coast Miwok. Two contrasting sibilants are probably reconstructed for Proto-Yuki-Wappo. Thus, we have a case of one original sibilant fricative

[207] Northeastern Pomo /š/ may however have been [ṣ], or may have varied between [š] and [ṣ], based on early documentation of the language (Walker 2016:83-4).

phoneme being replaced by two contrasting phonemes in all Pomoan except Northeastern Pomo, while two original sibilants remain so in Northern Yukian and Wappo, and one original sibilant remains so in Lake Miwok as well as in Patwin and Nomlaki.

In the case of the Pomoan languages, the development of two contrasting sibilant phonemes may constitute evidence of contact with Yukian and/or Wappo; by contrast, the preservation of a single sibilant phoneme in Northeastern Pomo may have been reinforced by contact with Patwin and Nomlaki.

Areal feature 3:

- **change of 1 sibilant to 2 sibilants in (most) Pomoan (< Yuki-Wappo?)**
- **preservation of 1 sibilant in NE Pomo (< Wintuan?)**

7.6.1.4 Aspirated Stops and Affricates

Unlike glottalization, which in every language of the 71-member sample is present equally among stops and affricates, aspiration seems to more readily associate with stops than with affricates; while 41 of the 71 sample languages have aspirated stops (57.7%), only 34 have aspirated affricates (47.9%). In the Greater Clear Lake area, all members of the Pomoan family have both aspirated stops and aspirated affricates, except for Southeastern Pomo, which has neither. Aspirated stops are reconstructed to Proto-Pomoan, but aspirated affricates are not (McLendon 1973:52), and so the absence of the latter in Southeastern Pomo must be a retention, while its presence in the other six Pomoan languages must be innovations. According to Oswalt (1964)'s proposal of internal Pomoan phylogeny, Southeastern Pomo forms a primary branch of the family, and so was among the first to split from the protolanguage (Golla 2011:106), which suggests that the development of aspirated affricates in the other six Pomoan languages postdates the divergence of Southeastern Pomo.

Outside of Pomoan, Wappo has both aspirated stops and affricates, while Lake Miwok and the three Wintuan languages have aspirated stops[208] but lack aspirated affricates.[209] As aspirated stops were present in both Proto-Pomoan and Proto-Wintuan, their joint distribution in these families is coincidental, as was the case for voiced stops. However, in the cases of Wappo and Lake Miwok, neither Wappo's relatives the Northern Yukian languages, nor Lake Miwok's other Miwokan relatives have phonemic aspiration of any kind. Thus, Wappo and Lake Miwok must have acquired aspiration as a feature through contact with extra-familial neighbors. In the case of Wappo, the likely donor is one or more of the Pomoan languages, since, like general Pomoan, Wappo has both aspirated stops and aspirated affricates. For Lake Miwok, it is more likely to be through contact with Patwin, as Lake Miwok is similar to Patwin and the other Wintuan languages in having aspirated stops but not aspirated affricates; indeed Golla (2011:8) notes that Lake Miwok is permeated with Patwin borrowings, which could have been the vehicle for introducing aspirated stops (and voiced stops) into Lake Miwok.

Areal feature 4:

- **presence of aspirated affricates in all Pomoan except SE Pomo (< family-internal convergence)**
- **presence of aspirated stops and affricates in Wappo (< Pomoan)**

[208] However, Wintu proper has lost aspiration on its dorsal stops, i.e. Proto-Wintuan */k^h/ > Wintu /k/ (Shepherd 2006:6).

[209] Proto-Wintuan is reconstructed as having a single aspirated affricate */č^h/; in Wintu and Nomlaki, this phoneme de-aspirated to plain /č/, while in Patwin, all three of the Proto-Wintuan affricates */č *č' *č^h/ were fronted to coronal stops /t t' t^h/ as part of a chain shift affecting Wintuan dorsal and palatal stops/affricates. The preservation of an aspirated /t^h/ in this process in Patwin is apparently the sole evidence for the presence of a phonemic aspirated affricate in Proto-Wintuan. See Shepherd (2006:6).

- **presence of aspirated stops in Lake Miwok (< Patwin)**

7.6.1.5 Glottalized Stops and Affricates

Glottalized stops and affricates are present in all members of the Clear Lake area, and can be reconstructed to the protolanguages of the Pomoan, Yuki-Wappo, and Wintuan families, so their presence across these three families at Clear Lake is apparently coincidental (recall that glottalized stops/affricates are in fact a common feature across California and western North America more generally). However, Proto-Miwokan, the ancestor of Lake Miwok, had neither glottalized stops nor affricates, nor indeed glottalized segments of any kind. Therefore, the presence of both glottalized stops and affricates in Lake Miwok must represent diffusion from one or more Pomoan languages, from Wappo, or from Patwin, or from a combination of these at different historical stages and for different segments of the lexicon.

Areal feature 5: presence of glottalized stops and affricates in Lake Miwok (< Pomoan, Wappo, Patwin)

7.6.1.6 Phonemic Vowel Length Contrast

All languages of the Greater Clear Lake area have a phonemic vowel length contrast, with the exception of Northern Yukian and Wappo – though, as shown in Chapters 2 and 4, there is a small subset of the Wappo lexicon that does have genuine long vowels, probably representing borrowings from other Clear Lake languages. A phonemic vowel length contrast is reconstructed to Proto-Pomoan, Proto-Miwokan, and Proto-Wintuan, and as with glottalized stops/affricates, its presence across these three families is coincidental. Indeed, a phonemic vowel length contrast is a prominent feature of California as a whole, occurring in 54 out of the 71 sample languages, or 76.1%.[210] However, it is not present in the Northern Yukian languages, and not reconstructible to Proto-Northern Yukian, so its absence in Wappo is likely a retention of the state of affairs in Proto-Yuki-Wappo.

Areal feature 6: small number of lexical items with long vowels in Wappo (< Pomoan, Lake Miwok, Patwin)

7.6.1.7 Palato-Alveolar Affricate /č/ in Pomoan

While Proto-Pomoan only had a laminal-alveolar affricate */c/, all of the descendant Pomoan languages have innovated a palato-alveolar affricate /č/ in some capacity. A /č/ is fully phonemic in six of the seven Pomoan languages, and is present synchronically as an allophone of /c/ in Southeastern Pomo before /i/ and /y/ (Moshinsky 1974:35). /č/ emerged from a diachronic palatalization of Proto-Pomoan */c/ in some contexts in Northeastern Pomo, Eastern Pomo, Central Pomo, and Kashaya Pomo, and also from a diachronic palatalization of Proto-Pomoan */k/ in all Pomoan languages except Southeastern and Eastern (McLendon 1973:20-33). Southeastern Pomo alone did not innovate /č/ from either of these sources.

The general emergence of a palato-alveolar affricate in Pomoan when it was absent in the protolanguage may be due to ancient contact with Yukian or Miwokan, which have always had this segment (as has Wintuan, though Pomoan-Wintuan contact is probably too late to account for its presence in general Pomoan); or it could be a Pomoan-internal process that was reinforced exclusively among Pomoan languages. The fact that all Pomoan

[210] Note that Doty (2012:18) remains agnostic on the presence of phonemic vowel length in Miluk, due to limitations in the available data. I have marked Miluk as lacking phonemic vowel length in the 71-member sample.

languages other than Southeastern Pomo innovated this segment as a new phoneme could assist in the problem of subgrouping within Pomoan.

Areal feature 7: presence of /č/ in all Pomoan except SE Pomo

(< Miwokan? Yuki-Wappo?)

7.6.1.8 'California S' in the Clear Lake Area

Because more exhaustive documentation and research is necessary into the exact distribution in California of what Bright (1978) called "California S", i.e. an apical-alveolar /s̠/ (or retroflex /ṣ/), rather than the laminal-alveolar /s/ or palato-alveolar /š/ familiar from some European languages, we can only make tentative statements about the distribution of the three types of sibilant fricatives in the Clear Lake area. The following is a relatively complete description of this distribution.

- Lake Miwok retroflex /ṣ/ continues Proto-Western-Miwokan */ṣ/, the sole sibilant of this branch of the family (/ṣ/ is also found as the sole sibilant fricative in Lake Miwok's sister language, Coast Miwok). The remaining Miwokan languages have a more complex outcome of the original two sibilant fricatives of Proto-Miwokan, */s/ and */ṣ/. (Callaghan 2014:119-24)
- Patwin and Nomlaki apical-alveolar /s̠/ continue the sole Proto-Wintuan sibilant */s̠/, also found in Wintu.
- Northern Yukian contrasts a laminal-alveolar /s/ with a back-sibilant phoneme /Š/ that varies in realization between palato-alveolar [š] and retroflex [ṣ] (Balodis 2011:63). Meanwhile, Wappo contrasts a laminal-alveolar /s/ with a palato-alveolar /š/. It is possible that the original Proto-Yuki-Wappo sibilants were thus a laminal-alveolar

*/s/ versus a retroflex */ṣ/ that varied to more palatal pronunciations in certain contexts. This variation in the back-sibilant phoneme was carried on into modern Northern Yukian, but Wappo would have lost the variation, settling only on a palato-alveolar [š] realization of the phoneme, possibly under the influence of those Pomoan languages – Central Pomo, Northern Pomo, Southeastern Pomo, and Southern Pomo – that contrast laminal-alveolar /s/ with palato-alveolar /š/, or of older precursor Pomoan varieties with this contrast. Alternatively, given the presence of a palato-alveolar affricate /č/ in general Yuki-Wappo, language-internal pressure to change an original */ṣ/ to /š/ to align with /č/ could be responsible for the change in Wappo, with an incomplete realignment in Northern Yukian.[211]

- Two Pomoan varieties – Eastern Pomo and Kashaya Pomo – contrast an apical-alveolar /s̠/ with a palato-alveolar /š/. In both languages, the apical-alveolar /s̠/ continues the sole Proto-Pomoan sibilant */S/, while in Kashaya only, some instantiations of /s̠/ are also from the Proto-Pomoan affricate */c/ before */i/ (McLendon 1973:22). Surprisingly, in both Eastern and Kashaya Pomo, as well as all other Pomoan varieties except (partially) Southeastern and Northeastern, current /š/ traces back to the Proto-Pomoan velar segments */x/ and */k^h/, not to a sibilant fricative.[212] This leaves the exact phonetic identity of the sole Proto-Pomoan sibilant phoneme */S/ difficult to determine. If it was apical-alveolar, i.e. */s̠/, then only Eastern and Kashaya Pomo maintain the original pronunciation, the other languages having changed it to a laminal-alveolar articulation. More likely however, the original

[211] Though note that Yuki /č/ shows variation between palato-alveolar [č] and retroflex [č̣].
[212] Some Kashaya /š/ appear to also come from Proto-Pomoan */ṭ^h/ before */u/ (McLendon 1973:22).

phoneme was laminal-alveolar */s/,[213] and in the course of the evolution and diversification of the Pomoan languages, this phoneme remained laminal-alveolar in all but Eastern and Kashaya Pomo, while shifting completely to palato-alveolar /š/ (or deleting) in Northeastern Pomo, possibly under Wintuan influence. Meanwhile, a new palato-alveolar /š/ developed in all seven languages from either Proto-Pomoan */x/, */kʰ/, or */ṭʰ/, depending on context and language. If this latter account is the true one, then it is possible that Kashaya and Eastern Pomo developed an apical-alveolar /s̠/ under Miwokan influence. There is evidence that a variety of Miwok was the pre-Wappo language of the Napa Valley, directly to the south of the Eastern Pomo area (Golla 2011:241). Kashaya Pomo adjoins the northern edge of Coast Miwok territory, and since Proto-Pomoan is thought to have originated very near Clear Lake, and since Kashaya Pomo territory is on the Pacific Coast at the southwestern edge of the range of Pomoan speech, it is possible that varieties of Miwokan were the previous languages of this area and were later assimilated by incoming speakers of pre-Kashaya. This scenario is, however, speculative; it is also possible that Proto-Pomo */s/ simply drifted toward an apical-alveolar pronunciation over time in both Kashaya and Eastern Pomo, independently of any outside influence.[214]

- Finally, Northeastern Pomo, unlike all other Pomoan languages, no longer has an alveolar sibilant, whether laminal /s/ or apical /s̠/; its sole sibilant fricative is palato-alveolar /š/. This fricative is the result of the merger of Proto-Pomoan */s/ and Proto-

[213] Further support for Proto-Pomoan */S/ being laminal-alveolar [s] is that certain instances of modern laminal-alveolar /s/ in Southeastern, Northern, Central, and Kashaya Pomo come from the Proto-Pomoan affricate */c/ (McLendon 1973:22-3), a segment that was likely laminal-alveolar in articulation because that is the overwhelming norm for front-coronal affricates in California (see Table 7.3, box 7). Furthermore, Kashaya Pomo was phylogenetically one of the last Pomoan varieties to emerge (Oswalt 1964; McLendon 1973:4-5), and so would not be expected to maintain a proto-phoneme that its closest relatives had already lost.

[214] One other complication is that Southern Pomo, spoken between Kashaya and Eastern Pomo geographically, does not have an apical-alveolar /s̠/.

Pomoan */x/; while */x/ became /š/ in all Pomoan languages but Southeastern, only in Northeastern Pomo did Proto-Pomoan */s/ also become /š/. Walker (2016:83-4) speculates that this outcome in Northeastern Pomo may possibly be due to influence from Patwin or Nomlaki; in those languages, there is a single sibilant fricative phoneme that is realized as an apical-alveolar sibilant /s̠/, or as ranging between a more alveolar and a more palatal pronunciation depending on context. This 'perceptual magnet' (see Blevins 2017) may have drawn the pronunciation of an original */s/ - */š/ opposition in Northeastern Pomo in the direction of a single sibilant phoneme that was acoustically intermediate between laminal-alveolar and palato-alveolar, or that ranged between the two realizations. Additionally, there is evidence from the early documentation of Northeastern Pomo by Barrett (1900-1908) (Walker 2016:83-4) that the single sibilant phoneme in Northeastern Pomo was at least sometimes pronounced as an apical-alveolar fricative /s̠/; this is evidenced by Barrett's vacillating transcription of the sound as sometimes <s>, sometimes <š>, a practice that, among other early Anglophone researchers of California languages, indicates an inability to clearly perceive an apical-alveolar sibilant present in the language (see Bright 1978).

Areal feature 8:

- **Proto-Yuki-Wappo */ṣ~š/ > Wappo /š/ (< Pomoan?)**
- **Proto-Pomo */s/ > E Pomo, K Pomo /s̠/ (< Miwokan?)**
- **Proto-Pomo */s/ > NE Pomo /š/ (< Patwin/Nomlaki)**

7.6.1.9 Laminal-Alveolar Affricate /c/

The laminal-alveolar affricate /c/ is found in all members of the Pomoan languages except Northeastern Pomo,[215] and is also found in Wappo and Lake Miwok. It is not found in Patwin. Since Northern Yukian does not have the /c/ affricate, it is likely the case that Wappo acquired this phoneme through contact, and since Pomoan is the only other language family in the area that has this phoneme, one or more Pomoan languages must be the donor of this phoneme to Wappo. Similarly, Lake Miwok has only a laminal-alveolar affricate /c/, while all other Miwokan languages have a palato-alveolar affricate /č/; Proto-Miwokan had only */č/. The fact that Lake Miwok has entirely switched to a laminal-alveolar affricate could be due to contact with Southeastern Pomo specifically, which was spoken immediately to its north and also only has a laminal-alveolar affricate. It could also be due to contact with Wappo, spoken immediately west and south of Lake Miwok, which developed a laminal-alveolar /c/ in addition to a palato-alveolar /č/, but unlike many other features of Lake Miwok, it cannot be due to contact with Patwin, which only has a palato-alveolar /č/.

Conversely, the only Pomoan language to entirely lack the /c/ affricate is Northeastern Pomo, which was historically in contact with Patwin and Nomlaki (and possibly with Yuki). As Patwin and Nomlaki lack /c/ (as does Yuki), it is possible that Northeastern Pomo's loss of this phoneme is due to contact with Patwin/Nomlaki and/or Yuki.

Areal feature 9:

- **presence of /c/ in Wappo (< Pomoan)**

[215] In Central Pomo, the laminal affricate /c/ does not participate in the full range of the language's laryngeal contrasts, unlike the other obstruents. Central Pomo lacks an aspirated member */c^h/, and the plain member /c/ is marginal; only the glottalized member /c'/ is primary (Walker, n.d.:1). In Kashaya Pomo, a glottalized apical-alveolar affricate /c̱'/ is in free variation with a glottalized apical-alveolar fricative /s̱'/ (Oswalt 1961:24).

- **change of */č/ to /c/ in Lake Miwok (< SE Pomo? Wappo?)**
- **absence of /c/ in Northeastern Pomo (< Patwin/Nomlaki/Yuki)**

7.6.1.10 Aspirated/Voiceless Sonorants

Aspirated or voiceless sonorants are found in three languages of the Clear Lake area: Kashaya Pomo, Eastern Pomo, and Wappo. In Eastern Pomo, they appear to have arisen language-internally from earlier clusters of /h/ plus sonorant, e.g. Eastern Pomo /m̥/ < Proto-Pomoan */-hm-/ (McLendon 1973:27-30). A similar process, though of more recent origin, appears to be responsible for their presence in Kashaya Pomo as well (Buckley 1990:84). However, in Wappo, they are a marginal set of phonemes, restricted to fewer than a dozen lexical roots, and they have no parallel in Wappo's supposed relatives Northern Yukian. Given the proximity of the Eastern Pomo speech area to Wappo (immediately to the north of the northernmost Wappo dialects, and indeed enclaving the small Lile'ek Wappo community on the south shore of Clear Lake), the possibility should be considered that at least some of the aspirated sonorants of Wappo could have entered the language through borrowings from Eastern Pomo.

As with many attested cases of 'voiceless' sonorants worldwide (see Botma 2012; Buckley 1990:79-80), the 'voiceless' sonorants of Wappo are actually partially voiced and partially devoiced across their duration (in Wappo, the direction of transition is voiced→voiceless), and this is the basis for my describing them as aspirated rather than voiceless. While the relevant segments in Eastern Pomo have traditionally been labeled 'voiceless' (e.g. by McLendon 1975:26), the relevant segments in Kashaya Pomo have been labeled 'aspirated' by Buckley (1990); thus, the Eastern Pomo segments might be better termed ‘aspirated’ phonologically (especially if they have a voiced-voiceless transition phonetically). In abstract phonological terms, these segments could be described as inherently voiced sonorants that have a [+spread glottis] feature associated with them, in much the same way that aspirated stops are inherently voiceless stops that have a [+spread glottis] feature associated with them (Buckley 1990:77).

Further etymological investigation of the roots in Wappo that display an aspirated sonorant is necessary in order to test the hypothesis of a (partial) Eastern Pomo origin for these segments; it may just as well be the case that they arose through the same word-internal processes independently in all three languages – that is, from clusters of sonorants and /h/, perhaps brought about by syncope – and indeed, the fact that all three languages have aspirated stops and affricates, glottalized stops and affricates, and, except for Eastern Pomo, glottalized sonorants as well, creates internal conditions favorable to the emergence of aspirated sonorants in the phonological system.

Areal feature 10: presence of /R^h/ in K Pomo, E Pomo, Wappo (joint or internal emergence)

7.6.1.11 Labial Fricative

Both Northeastern Pomo and Southeastern Pomo have a labial fricative /ɸ~f/, which is otherwise quite rare in California. As no other languages in the region have this phoneme, and it is not reconstructible to Proto-Pomoan, it must be an internal development in the two languages, and indeed, McLendon (1973) has demonstrated that the /ɸ~f/ phoneme in both Northeastern Pomo and Southeastern Pomo developed from Proto-Pomoan */p^h/ (McLendon 1973:20-1). It is entirely possible that the two languages developed this labial fricative independently, as [aspirated stop > fricative] is a common sound change attested worldwide.[216] But if influence between the two was involved, the direction of influence would likely be from Southeastern Pomo to Northeastern Pomo, since the former spirantized all of its original aspirated stops, while Northeastern Pomo only spirantized the labial stop.

Areal feature 11: presence of labial fricative /ɸ~f/ in NE Pomo and SE Pomo (mutual or independent development)

7.6.1.12 Lateral Obstruents

Two lateral obstruent phonemes are found in the Clear Lake area, a lateral fricative /ɬ/ and a glottalized lateral affricate /ƛ'/. Both phonemes are found generally in Patwin and Nomlaki, and they are also marginally present in Lake Miwok and Northeastern Pomo – the distribution of /ƛ'/ is restricted to only four words in the former (Callaghan 1963:30-1), and a single word in the latter (Walker 2016:72). Lateral obstruents are not otherwise present in the Pomoan or Miwokan languages. It seems probable then that both Lake Miwok and Northeastern Pomo acquired these phonemes through contact with Patwin (and/or Nomlaki in the case of Northeastern Pomo). Lateral obstruents are atypical of central and northern California; they are much more associated with languages of the Northwest Coast and Plateau language areas (Appendix A), and in central/northern California they are found only in the Athabaskan languages, the Algic languages Wiyot and Yurok, the Wintuan languages, and Lake Miwok and Northeastern Pomo. As Wintuan is conjectured to have originated at the southern extremity of the Northwest Coast region (likely in modern-day southwestern Oregon), and later spread into the Sacramento Valley through migration, the presence of lateral obstruents among Wintuan and in Lake Miwok and Northeastern Pomo could in a

[216] Cf. for example Ancient Greek /pʰ/ > Modern Greek /f/.

sense be considered a ‘spillover’ of Northwest Coast linguistic area features into the California linguistic area.[217]

Areal feature 12: presence of /ł/ and /ƛ’/ in Lake Miwok and NE Pomo (< Wintuan)

7.6.1.13 Dorsal Fricatives

Dorsal fricatives are found in Eastern Pomo and Southeastern Pomo, but in no other Pomoan language;[218] Eastern Pomo has velar /x/, while Southeastern Pomo has both velar /x/ and uvular /x̣/.

Dorsal fricatives are reconstructible to Proto-Pomoan, as velar */x/ and uvular */x̣/, but the history of developments of dorsal fricatives in the Pomoan languages is not a linear one. Eastern Pomo velar /x/ derives variously from Proto-Pomoan */x̣/, */qʰ/, and */-qʔ/. Southeastern Pomo velar /x/ directly continues Proto-Pomoan */x/, but possibly also */kʰ/, while Southeastern Pomo uvular /x̣/ derives variously from Proto-Pomoan */x/, */x̣/, and */qʰ/. In all other Pomoan languages, Proto-Pomoan */x/ became /š/ (including in Eastern Pomo), and Proto-Pomoan */x̣/ became /h/ (McLendon 1973:26). These uniform developments of */x/, */x̣/ to /š/, /h/ in all Pomoan except Southeastern and (partially) Eastern suggests either a period of genetic unity encompassing the languages that underwent the change, or a diachronic areal relationship between them (or both). Conversely, the

[217] Note however that as one moves south, lateral obstruents reappear in a few languages of the Southern California-Arizona-Baja California region, namely Obispeño Chumash, the Yuman languages Kumeyaay/Central Diegueño, Tipai/Southern Diegueño, Cocopah, and Paipai, and the isolate Seri (Appendix A). As is the case with glottalized sonorants, discussed earlier in this chapter, lateral obstruents may prove to be an extremely ancient areal feature of the Pacific coast of North America, now found in fragmented pockets from Alaska all the way to northwestern Mexico.
[218] Northern Pomo has [x] synchronically as an allophone of /kʰ/ before /a, o/ (McLendon 1973:16, fn.5).

retention of dorsal fricatives at all in Eastern Pomo and Southeastern Pomo may have been a mutually-reinforcing development between these two neighboring languages.

Unrelated to these developments in Pomoan, a uvular fricative /x̣/ is found in Nomlaki, although it is only found in a single audio attestation with unreliable phonetic quality. The evidence for this segment being present in Proto-Wintuan is likewise meager, being based on only four correspondence sets, one of which may be sound-symbolic. If there was no */x̣/ in Proto-Wintuan, the sets in question should be reconstructed with */q^h/ (Shepherd 2006:8, fn.4).

Areal feature 13:

- **shift of */x/, */x̣/ to /š/, /h/ in most Pomoan (family-internal contact?)**
- **retention of dorsal fricatives in E Pomo and SE Pomo (mutual reinforcement)**

7.6.1.14 Glottalized Sonorants

Both Wappo and Northern Yukian have a fully phonemic set of glottalized sonorants, and these were probably present in Proto-Yuki-Wappo, or originated in at least one of the groups before spreading to the other due to contact, perhaps pointing to a time when Wappo in particular was spoken further north than today, or was in some other way in closer contact with Northern Yukian.[219] Kashaya Pomo, uniquely among the Pomoan languages, also possesses a set of glottalized sonorants; the glottalized sonorants /m'/ and /n'/ further transform into the voiced stops [b] and [d] in certain synchronic contexts. As discussed in Section 7.2.3.3, the presence of glottalized sonorants in Kashaya Pomo are attributable to

[219] The two most likely scenarios for Yuki-Wappo prehistory are 1) a Pomoan expansion splitting a larger, previously contiguous Yuki-Wappo speech area into northern (Yukian) and southern (Wappo) fragments; or 2) a migration of pre-Wappo from the vicinity of the current Northern Yukian speech area to the current Wappo speech area.

either internal phonological developments (that may in fact have antecedents in Proto-Pomoan), or to contact with Wappo or an undocumented relative of Wappo, or indeed through both processes.[220]

Areal feature 14: /R'/ in K Pomo, Wappo, Northern Yukian (independent or contact)

7.6.1.15 Uvular Stop

A uvular stop /q/ is found in four of the Pomoan languages – Central Pomo, Kashaya Pomo, Eastern Pomo, and Southeastern Pomo – as well as in two of the Wintuan languages, Wintu and Nomlaki. However, as */q/ is reconstructible to both Proto-Pomoan and Proto-Wintuan, its presence in both families is coincidental. The /q/ series has subsequently been lost in Northern Pomo, Southern Pomo, Northeastern Pomo, and Patwin;[221] it is possible that each of these four languages lost the uvular series due to contact with neighboring languages that lacked it – Northern Yukian in the case of Northern Pomo, Wappo in the case of Southern Pomo, and potentially Northeastern Pomo in the case of Patwin (see discussion of this last in Walker 2016:84-5).[222]

Areal feature 15: loss of */q/ in N Pomo, S Pomo, NE Pomo, Patwin

- **N Pomo, NE Pomo? (< N Yukian)**
- **S Pomo (< Wappo)**

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220 Note that Southern Pomo, spoken in the region between Kashaya Pomo and Wappo, could also be analyzed as having glottalized sonorants similar to those of Kashaya, varying with homorganic voiced stops – see discussion in Walker (2013:46-54). If Southern Pomo has glottalized sonorants, they would have emerged from the same mechanisms as those of Kashaya Pomo.

221 In all four languages, */q/ was lost through a fronting chain shift in which */q/ became /k/.

222 Walker (2016:89) also concludes that Northeastern Pomo is the remnant of a more widespread Pomo speech area in the Sacramento Valley, most of which was assimilated by incoming Wintuan speakers (the ancestors of the Patwin and Nomlaki). If this is the case, an early chain shift and loss of */q/ in Northeastern Pomo may have been the ultimate cause of the same chain shift in Patwin, as a substrate effect (the shift in Northeastern Pomo may in turn have been due to contact with Northern Yukian).

- **Patwin (< NE Pomo substrate)**

7.6.1.16 Glottalized Fricative

Kashaya Pomo has developed a semi-phonemic glottalized fricative /s'/; according to Oswalt (1961), this phoneme was in free variation with a glottalized affricate /c'/, and younger speakers were already beginning to de-glottalize it (Oswalt 1961:24). Kashaya /s'/ derives from Proto-Pomoan */c'/, and generally corresponds to /c'/ or /č'/ in other Pomoan languages. Northern Pomo apparently has a similar free variation between /c'/ and /s'/ (O'Connor 1987:8), and Central Pomo had a synchronic collocation of /s/ and /ʔ/ in some forms that could approximate a /s'/ phonetically (Mithun, p.c.).[223] In addition, a /s'/ has been proposed as a phoneme in at least the Northern Yukian languages Huchnom and Coast Yuki, but its phonemic status appears doubtful (Balodis 2011:63-5). While the sporadic development of this phoneme could be due to contact (all four language groups in which it is present are contiguous), a natural predisposition for a phoneme /c'/ to drift towards or vary with /s'/ over time is perhaps a better explanation.

Areal feature 16: sporadic development of glottalized fricative /s'/ in Kashaya Pomo, Northern Pomo, Central Pomo, Northern Yukian

7.6.1.17 Rhotic Phonemes

A rhotic phoneme /r/ is present in Patwin; it was present in Proto-Wintuan, but was lost in Nomlaki. Two of the Pomoan languages, Northeastern Pomo and Eastern Pomo, likewise have a rhotic phoneme /r/. Patwin, Northeastern Pomo, and Eastern Pomo are the

[223] In McLendon (1973), Central Pomo is asserted to have a fully phonemic /s'/ (McLendon 1973:10), but Mithun confirms that this should be /c'/ (Mithun, p.c.).

only languages in the Clear Lake region to have a rhotic phoneme, and such a phoneme is in fact uncommon generally throughout California (only 20 of the 71 sample languages have rhotic phonemes, 28.2%). Northeastern Pomo /r/ comes from Proto-Pomoan */ṭ/ in intervocalic position, while Eastern Pomo /r/ comes from this source as well as from Proto-Pomoan */d/ under certain conditions (McLendon 1973:22). It is possible that the presence of a rhotic phoneme in Patwin acted as a 'perceptual magnet' for the development of a rhotic phoneme out of, presumably, near-rhotic allophones of original */ṭ/ in Northeastern Pomo, whose speakers were in direct contact with northern speakers of Patwin. This is unlikely to account for the Eastern Pomo rhotic, since Eastern Pomo was spoken further into the Coast Range, away from Patwin territory. Alternatively, the presence of rhotic phonemes in both Patwin and the two Pomoan languages could be coincidental.

Areal feature 17: presence of rhotic phoneme in NE Pomo (< Patwin)

7.6.1.18 Spirantization

Southeastern Pomo has lost the Proto-Pomoan aspirated stop series /*p^h *t^h *ṭ^h *k^h *q^h/. Proto-Pomoan */t^h/ de-aspirated to /t/; Proto-Pomoan */q^h/ de-aspirated to /q/ in some contexts; and the remaining original aspirated stops all became fricatives, with */p^h/ becoming /f/, */ṭ^h/ becoming /š/, */k^h/ becoming /š/ or /x/, depending on context, and remaining */q^h/ fricativizing to /x̣/ (McLendon 1973:20-4). This does not appear to have been brought about by contact, but it is mentioned here for its relevance to the phonological distinctiveness of Southeastern Pomo from the rest of the Pomoan family.

7.6.2 Diffusion of Shared Features in the Clear Lake Linguistic Area

To summarize the previous sections, the diachronic phonological areal developments within the Greater Clear Lake area are given in Tables 7.20-23. They are sorted into four general groups of processes:

1. Ancient areal contact at the pre-protolanguage and protolanguage stage
2. Areal contact across language families
3. Areal contact between languages of the same family
4. Language-internal developments that may or may not be contact-induced

Key to Tables 7.20-23:
/t ṭ/ = coronal stop place contrast, P’ = glottalized stops, Č’ = glottalized affricates, V: = phonemic vowel length, P^h = aspirated stops, $\check{C}^h$ = aspirated affricates, /ṣ, s̠/ = retroflex or apical sibilant fricative, /š/ = palato-alveolar sibilant fricative, /c/ = laminal-alveolar affricate, /č/ = palato-alveolar affricate, R’ = glottalized sonorants, R^h = aspirated/voiceless sonorants, /ɬ/ = voiceless coronal lateral fricative, /ƛ’/ = glottalized coronal lateral affricate, /q/ = uvular stop, /ɸ/ = bilabial fricative, /x/ = velar fricative, /x̣/ = uvular fricative, S’ = glottalized fricatives

Table 7.20

Shared Features That Predate The Clear Lake Area

POMOAN, YUKI-WAPPO, WINTUAN:	P’, Č’
POMOAN, YUKI-WAPPO, MIWOKAN:	/t ṭ/
POMOAN, MIWOKAN, WINTUAN:	V:

Glottalized stops and affricates are reconstructed to Proto-Pomoan, Proto-Wintuan, and assumed for Proto-Yuki-Wappo. A coronal stop place contrast is reconstructed to Proto-

Pomoan, Proto-Miwokan, and likewise assumed for Proto-Yuki-Wappo. Phonemic vowel length is reconstructed to Proto-Pomoan, Proto-Miwokan, and Proto-Wintuan.

Glottalized stops and affricates, and phonemic vowel length, are widespread features of the languages of western North America generally,[224] and so their presence in all of the Clear Lake groups mentioned above cannot be attributed to specific, relatively recent interactions in the Clear Lake-Coast Ranges region; these features must instead be of great antiquity in North America, and discovering their origin requires a great deal of further research.

On the other hand, the presence of a coronal stop place contrast in North America is tightly restricted to a collection of families and isolates in and around the California Coast Ranges (see Section 7.2.3.2); as this feature is assumed for Proto-Yuki-Wappo and reconstructed to Proto-Pomoan and Proto-Miwokan (though not to Proto-Wintuan, which is thought to have originated in Oregon), it is very likely that the presence of this feature in these families is due to historical language contact specifically within the Northern Coast Ranges region.

Table 7.21

Contact-Induced Distributions: Inter-Family

<u>1. Influences originating in Pomoan</u>

1a)

POMOAN	→	Wappo	presence of aspirated stops/affricates (P^h, $Č^h$)

[224] For North America west of the Great Plains, the only families and languages that do not feature phonemic glottalized stops/affricates are: Wiyot, Yuman-Cochimí, Utian (Miwok-Ohlone) (with the exception of Lake Miwok), Uto-Aztecan, and the isolates Esselen and Karuk (California), Siuslaw (Northwest Coast), Cayuse (Plateau), Seri and Waikuri (Gulf of California), and Zuni (Southwest) (Appendix A).

1b)

POMOAN → Wappo change of */ṣ~š/ to /š/ in Wappo

1c)

POMOAN → Wappo, Lake Miwok presence of /c/

1d)

K Pomo, E Pomo → Wappo presence of aspirated/voiceless sonorants (R^h)

alternatively: independent parallel development

1e)

NE Pomo → Patwin loss of */q/

substrate effect

<u>2. Influences originating in Wintuan</u>

2a)

WINTUAN → Lake Miwok, NE Pomo presence of /ɬ/, /ƛ/

from Patwin in Lake Miwok, equally likely from Patwin and Nomlaki in NE Pomo

2b)

WINTUAN → NE Pomo preservation of single sibilant

equally likely from Patwin and Nomlaki

2c)

WINTUAN → NE Pomo change of */s/ to /š (or ṣ)/

2d)

Patwin → Lake Miwok presence of aspirated stops (P^h)

2e)

Patwin → NE Pomo presence of rhotic phoneme (r)

3. Influences originating in Yuki-Wappo

3a)

Yuki-Wappo → POMOAN 1 sibilant > 2 sibilants

via a Yuki-Wappo substrate in part of Pomoan?

3b)

Wappo → Kashaya Pomo presence of glottalized sonorants (R')

alternatively: coincidental

3c)

Wappo → Southern Pomo loss of */q/

alternatively: independent random development

3d)

N Yukian → N Pomo, NE Pomo? loss of */q/

alternatively: independent random development

4. Influences originating in Miwokan

4a)

MIWOKAN → K Pomo, E Pomo presence of /s̲/

alternatively: independent random development

5. Influences originating in multiple families, or evidence ambiguous

5a)

POMOAN/MIWOKAN/Patwin → Wappo sporadic V:

5b)

POMOAN/Wappo/Patwin	→	Lake Miwok	presence of glottalized stops/affricates (P’Č’)

5c)

POMOAN/Patwin	→	Lake Miwok	presence of voiced stops /b d/

5d)

WINTUAN(or N.YUKIAN)	→	NE Pomo	loss of /c/

equally likely from Patwin and Nomlaki

5e)

SE Pomo/(Wappo?)	→	Lake Miwok	loss of /č/

Table 7.22

Contact-Induced Distributions: Family-Internal

all Pomoan except SE Pomo:	presence of /č/
all Pomoan except SE Pomo:	presence of aspirated affricates ($\check{C}^h$)
all Pomoan except E and SE Pomo:	loss of dorsal fricatives

E Pomo	↔	SE Pomo	retention of dorsal fricatives (X)
NE Pomo	↔	SE Pomo	presence of /ɸ~f/

Table 7.23

Language-Internal Developments

SE Pomo:	loss of aspirated stops
K Pomo:	emergence of /S'/

7.7 Summary

Based on the evidence from this larger sample of languages around Clear Lake, it appears that there are indeed grounds for positing a "Clear Lake Linguistic Area", but one that comprises more languages than previous authors had proposed. Rather than just consisting of Wappo, Eastern Pomo, Southeastern Pomo, Lake Miwok, and Patwin, a "Greater Clear Lake Linguistic Area" would consist of all seven members of the Pomoan family, plus Wappo, Lake Miwok, and Patwin. More marginally, it would include some contributions from Nomlaki and Northern Yukian. That is, it would include at least 14 languages, rather than the original five that were proposed.

Additionally, this linguistic area is not a 'melting pot' of features from all of its member languages; rather, most of the identified features that define the area appear to be exclusively of Pomoan and Wintuan origin, with only moderate contributions from Yuki-Wappo, and a small number of contributions from Miwokan. Several contributions may have come from multiple families simultaneously. A subset of contributions passed exclusively among the Pomoan languages.

Regarding the contributions of Wappo specifically, the likeliest candidates are the presence of glottalized sonorants in Kashaya; the loss of original */q/ in Southern Pomo; the change in much of Pomoan from an original single sibilant to two contrasting sibilants (possibly via a Wappo or Wappo-like substrate in part of the Pomoan area); and, at least in part, the presence of glottalized stops and affricates in Lake Miwok. However, many of these, in particular glottalized sonorants in Kashaya, loss of */q/ in Southern Pomo, and the development of contrasting sibilants in Pomoan, could equally as well have been independent developments.

More securely established are the effects that other languages have had on Wappo. These include: the presence of aspirated stops and affricates (from Pomoan); presence of the affricate /c/ (from Pomoan); the presence of aspirated sonorants (probably from Eastern Pomo, possibly also from Kashaya Pomo, and possibly partially from internal developments); and the subset of the Wappo vocabulary with phonemic long vowels (equally likely from Pomoan, Miwokan, and Patwin). To these could be added the stabilization of */ṣ~š/ to /š/, under general Pomoan influence, assuming that pre-Wappo had the same type of back-sibilant variation seen in Northern Yukian.

7.8 Conclusion

In this chapter, we have examined the phonological features of Wappo and compared them to those of languages in the immediate vicinity – Clear Lake and the Northern Coast Ranges – as well as to languages across the California cultural area, encompassing central and northern California and southwestern Oregon. We have seen how the phonological inventory of Wappo is typical for this region, with the major exception of Wappo's lack of phonemic vowel length, though a few other languages of the region also lack this feature. We have also speculated on which aspects of Wappo's phonological system are the product of original genetic features (assuming a genetic relationship between Wappo and the Northern Yukian languages), and which are the likely product of areal influence; for these latter, we have speculated on both the relative chronology of the spread of these features, and their source and direction of borrowing.

The picture that emerges is one that places Wappo squarely in the 'core' group of California languages. This group is defined largely by the presence of two phonological features: the presence of glottalized and aspirated segments alongside ‘plain’ segments, and a coronal stop place contrast. While glottalization as a contrastive phonation type is widespread across the western half of North America (and many parts of the east as well), the presence of aspiration as a phonation type contrasting with both glottalization and plain phonation is more heavily associated with the Pacific margin of North America (with the main outliers being Keresan and Kiowa-Tanoan in the Southwest and Siouan in central North America), and so the presence of both types of segments in Wappo suggests a historic connection to this western region. Even more significantly, a coronal stop place contrast is almost exclusively associated with the California Coast Ranges, and so its presence in particular in Wappo suggests that Wappo has a long history in California specifically.

If the Hokan and Penutian hypotheses are correct (in the configurations in which they have traditionally been proposed), then it appears that Hokan is one of the oldest extant stocks of the California region, while Penutian is a much more recent arrival. All of the Hokan groups of the Coast Ranges – Chimariko, Pomoan, Esselen, and Salinan – exhibit the coronal stop place contrast, as do Wappo and the three Northern Yukian languages. Since Yuki and Wappo are not thought to be related genetically to Hokan, then there are four possibilities that explain the origin of the coronal stop place contrast in this region: 1) it is an original feature of Hokan that diffused into Yuki-Wappo; 2) it is an original feature of Yuki-Wappo that diffused into Hokan; 3) it is an original feature of one or more unknown extinct phyla that diffused into both Hokan and Yuki-Wappo; and 4) it is an (at one time) innovative feature that arose independently in members of one or more of these groups through language-internal processes and which subsequently spread through contact and mixing of populations.

The fact that a coronal stop place contrast is also found in two Penutian branches – Miwokan-Ohlonean and Yokutsan – suggests that these branches have a close historical association with the Coast Ranges area. Current hypotheses suggest that these linguistic groups entered the Central California region from the Great Basin to the east (Golla 2011:252), with an ultimate origin east of the Cascades and south of the Columbia River, where other Penutian branches (Klamath-Modoc, Molala, Sahaptian) are still found. The work of Geoffrey Gamble and Catherine Callaghan (Gamble 1991; Callaghan 1997; Callaghan 2001) has also shown that Miwokan-Ohlonean and Yokutsan themselves form a genetic clade, which Gamble has termed 'Yok-Utian' (Gamble 1991). If this clade is valid, then the Yokutsan group appears to have been the first to branch off, while Miwokan and Ohlonean later split from each other after their common ancestor had arrived in central California, in the vicinity of the Sacramento-San Joaquin Delta (Golla 2011:252-3). Evidence points to Miwokan becoming established in the region between San Francisco Bay and Clear Lake, with a much later spread back to the east across the Central Valley and into the Sierra Nevada (Golla 2011:253). Ohlonean by contrast appears to have established itself in the region east of San Francisco Bay, later spreading west into the bay itself and south towards the Monterey Bay and Southern Coast Ranges (Golla 2011:253). Finally, Yokutsan, long separated from the other two groups, and likely remaining in the Great Basin for some time after the departure of the Proto-Utian speech community (Golla 2011:252), came to be established far to the south, in the vicinity of the Kern River and Tehachapi Mountains. From this region, Yokutsan likewise had a more recent spread northward across the entirety of the San Joaquin Valley and the Sierra Nevada foothills all the way to the Sacramento-San Joaquin Delta. For all three groups – Miwokan, Ohlonean, Yokutsan – early association with the Coast Ranges must have led to their acquisition of a coronal stop place contrast, possibly through absorption of a Hokan substrate (there is evidence of an Esselen-like substrate in some of the Ohlonean languages for example (Golla 2011:253), and a Chumash- or Salinan-like substrate in Yokuts (Golla 2011:252), or through adstratal contact with extant or extinct Hokan languages and/or Chumash.

The coronal stop place contrast is the phonological feature of the California region that is most likely to have diffused primarily through contact, rather than through genetic inheritance or coincidental internal developments. It is present in only those Hokan languages that are found in the Coast Ranges, and not the ones farther to the northeast, east, and south,[225] which suggests that it may not have been present in Proto-Hokan.[226] Since Yuki-Wappo, if it is a valid clade, likely cannot be reconstructed to an earlier period than Proto-Hokan (Yuki and Wappo are more similar to each other than many of the proposed Hokan groups are to each other), it seems unlikely that the Coast Range Hokan languages acquired the feature from Yuki-Wappo. This suggests then that the feature is in fact older than both stocks, and likely traces back to unknown linguistic stocks of the Pacific coast of California that have long since gone extinct, possibly even dating to the period of the first human habitation of the region.

The languages of California can be placed along a continuum according to the relative presence and degree of glottalization and aspiration contrasts. At the beginning of this continuum are languages and families that completely lack these contrasts, having only plain (voiceless/unaspirated) stops and affricates. In California, this configuration – which is

[225] Recall that while the contrast is found in many of the modern Yuman-Cochimí languages, a Hokan group, it is not reconstructed to Proto-Yuman – see Section 7.2.3.2
[226] Langdon & Silver (1984:144) concurs: "…although the [coronal stop place] contrast in the Pomoan languages is of some antiquity, evidence of great time depth for it in Hokan languages is meager; therefore, these languages are not very good candidates for the donor role."

otherwise the norm on a global level – is closely associated only with particular families, namely Utian, Uto-Aztecan, and Yuman-Cochimí. Within Utian, which unites the Miwokan and Ohlonean languages, all members, as well as the relevant proto-languages (Proto-Miwokan, Proto-Ohlonean, and their shared ancestor Proto-Utian) lack any glottalized or aspirated obstruents, with the notable exception of Lake Miwok, which as we have seen in this chapter, developed glottalized and aspirated segments under recent Wintuan, Pomoan, and Wappo influence. Further afield, no member of the enormous Uto-Aztecan family, whether within or outside of California, has glottalized segments, and only Hopi, in the Southwest, has aspirated segments; likewise, members of the Yuman-Cochimí family, found in the deserts of the California-Arizona-Baja region, completely lack glottalized segments, and only three – Yavapai, Walapai, and (marginally) Havasupai – have aspirated segments, which are not reconstructed for Proto-Yuman (Langdon 1996). Outside of Utian, Uto-Aztecan, and Yuman-Cochimí, the only other languages of the California region to lack glottalized and aspirated segments are the putative Hokan isolates Esselen and Karuk.[227]

Much, much more widespread and varied are those languages that have glottalized segments in addition to plain ones. Glottalized stops and affricates are a feature that practically defines western North America, and one that also extends (sometimes in a disjunct character) all the way down the Pacific margin of the Americas, including South America (Haas 1976:351). Such a distribution suggests that glottalization as an areal feature must have been spread by the migration of peoples along the Pacific American coasts, either during the initial peopling of the Americas, during subsequent trade and migration, or both.

[227] Two isolates from the Gulf of California, Seri and Waikuri, also lack these segments, and one isolate – Siuslaw – and one unclassified language – Cayuse – of Oregon also lack them. Cayuse and Siuslaw are the furthest-northwest recorded languages in North America to lack phonemic glottalized segments until one reaches the Eskaleut languages of the Arctic.

The languages with glottalized segments can be further divided into those that also have an aspiration contrast, and those that do not – that is, one group contrasts two series of phonation types, plain and glottalized, while the other contrasts three series, plain, glottalized, and aspirated. Unlike in much of the rest of the world, in much of California glottalization appears to be the less-marked phonation type relative to aspiration; while there are dozens of languages in the region that have glottalized segments but no aspirated ones, there is only a single language – Wiyot, of the Algic family – that has aspirated segments but no glottalized ones. Uniquely from a global perspective, aspiration in California is more marked than glottalization, both geographically and typologically.

Phonemically-distinct aspiration that contrasts with glottalization and plain phonation is found as a universal feature among the Athabaskan-Eyak-Tlingit (or Dené) languages, including those found in Oregon and California, marking the principal genetic association for this feature in western North America. Otherwise, the feature has a strong areal association with California and Oregon. Within the region extending from central California to southwestern Oregon, it is found in the Hokan varieties Chimariko, Palaihnihan (reconstructed to the protolanguage), Yana, and Pomoan (reconstructed to the protolanguage for stops but not affricates, with most daughters subsequently developing aspirated affricates); in the Penutian varieties Yokutsan (reconstructed to the protolanguage), Wintuan (reconstructed to the protolanguage, but subsequently lost in affricates in all daughters), Lake Miwok (acquired through contact with Wintuan), Klamath-Modoc, Molala (in stops but not affricates), Takelma (in stops but not affricates), Kalapuyan (reconstructed to the proto-language for stops but not affricates, with Central Kalapuya subsequently developing aspirated affricates), and the Coosan language Hanis; and finally in the Chumashan languages (though it may have only had allophonic status in the proto-language (Klar 1977:13-14)) and in Wappo (where it most likely developed through contact with Pomoan). Outside of this compact, contiguous region, phonemic obstruent aspiration as a third phonation contrast accompanying plain and glottalized obstruents is largely absent from western North America – it reappears only in a few scattered languages, including in the isolate Haida and the Wakashan languages Haisla and Heiltsuk in the Northwest Coast region, and in Keres and a few of the Tanoan languages of the Southwest. Interestingly, one other language that appears to have had this tripartite phonation contrast in the past is Proto-Algic, the common ancestor of Wiyot, Yurok, and the Algonquian languages (Proulx 1984:202). This provides another piece of evidence for locating the point of origin of the Algic family somewhere in the vicinity of northern California/Oregon/the Columbia Plateau, as researchers on Algic have postulated based on other lines of evidence (Golla 2011:256-7). Of note too is the presence of this contrast in many of the Siouan languages, found in the Great Plains and in eastern North America, though the phonological configuration of these contrasts is rather different in Siouan from what is found in the California-Oregon region (Appendix A).

Along with glottalized and aspirated stops and affricates, many languages of the California region, including Wappo, have glottalized and aspirated sonorants. As with glottalized stops/affricates, glottalized sonorants are fairly widespread in western North America, while being rare further east. However, they are clearly typologically dependent on glottalization in stops/affricates: all attested languages in North America with glottalized sonorants also have glottalized stops and affricates,[228] as well as a glottal stop phoneme,[229] while dozens of languages on the continent have glottalized stops and affricates but no glottalized sonorants. This pattern largely holds for aspirated/voiceless sonorants as well; most of the languages with these segments, especially the ones with a full series of them, also have aspirated stops and affricates, as well as a phonemic glottal fricative.

What this pattern tells us is that the presence and distribution of glottalized and aspirated sonorants in North America is very likely to be attributable mostly to language-internal diachronic factors, rather than solely (or even primarily) to language contact. Many of the glottalized sonorants found in the region, for example, likely arose through adjacency of independent glottal stop and sonorant segments brought about by processes such as vowel syncope in unstressed syllables, or fusion across morpheme boundaries. This does not rule out contact as a mechanism for the spread of glottalized and aspirated sonorants, but with glottalization and aspiration in general as such pervasive features in most of the languages of western North America, usually with complete series of glottalized and aspirated stops and affricates, phonemic glottal stop and /h/, and in some cases glottalized fricatives as well, it seems natural and parsimonious to assume that these glottal segments are often responsible for the language-internal development of glottalized and aspirated sonorants in any given language over time.

The fact that Wappo possesses 1) a coronal stop place contrast, 2) a plain/glottalized/aspirated phonation contrast in both its stops and affricates, and 3) glottalized and (more marginally) aspirated sonorants, indicates that it has a long-standing

[228] A single exception appears to be Chemehuevi, a member of the Colorado River Numic dialect continuum, part of the Uto-Aztecan family. Chemehuevi has a full series of glottalized nasals and glides /m’ n’ ŋ’ w’ y’/, but no other glottalized segments (Press 1979:12).
[229] A semi-exception is Achumawi, of the Hokan Palaihnihan family. The glottal stop in Achumawi is not fully phonemic, in the sense that its distribution is largely predictable (Nevin 1998:55).

presence in not just western North America, but specifically the region of the California Coast Ranges, in close contact with members of the Pomoan family. Much more work remains to be done on the historical linguistics of Wappo, Northern Yukian, and the various families and isolates of California more generally, but the broad outline, judging purely from the phonological evidence, is that Wappo belongs to an ancient stratum of languages in the California region, and has a long-standing areal relationship with both its immediate neighbors and other languages of the region. However, many more lines of linguistic evidence – phonetic, morphological, syntactic, semantic – as well as anthropological and archaeological evidence – will need to be examined and synthesized in order to paint a complete picture of the history of the Wappo people and their language.

CHAPTER 8: THE WAPPO SPEECH COMMUNITY IN PAST AND PRESENT

8.1 The Language of the Land

The Wappo have lived in their lands for an unknown number of millennia. In the pre-contact period, the Wappo people lived in communities around the Napa Valley, the Mayacamas and Sonoma Ranges, the Russian River, and Clear Lake. They lived in small village communities, enjoyed native foods, and lived in traditional houses, made from local resources. (Heidenrich 2007:19).

The Wappo, and their neighbors, were part of a trade network that extended across various parts of northern and central California, joining the far north with San Francisco Bay, and the Pacific with the Sierra Nevada. Trade goods, including obsidian from volcanic sources, clam shells from the coast, flint and magnesite, shell and feather ornaments, even bows for shooting, all passed through the Wappo lands on their way to or from other Indigenous communities. A source of obsidian was (and still is) present within the Wappo lands, giving the Wappo a monopoly on regional production (Heidenrich 2007:19, 22). Trade would have necessitated inter-language contact, and so multilingualism in pre-contact California was almost always the norm, for the Wappo as for other cultures of the region (Golla 2011:6-8). As was common for other California peoples, the individual settlements of the Wappo were small, and exogamous intermarriage with non-Wappo people was common (Heidenrich 2007:19-20). This remains the case in the contemporary community.

The Wappo have long been closely connected to the Pomo and Miwok peoples, and all three cultures share many cultural features, due to travel, trade, and common resources (Heidenrich 2007:21). The Wappo obtained maritime products from the Miwok and Pomo peoples living on the coast of today's Sonoma and Marin Counties, products they used for themselves, but also traded with peoples further inland. Clam shell beads, a currency in pre-contact Central California, were a particularly important item. The Wappo also obtained seafood resources from annual trips to the coast, as well as freshwater food resources from Clear Lake, at the northern end of their territory (Heidenrich 2007:21-23). Ceremonial life and religion, including the dance house and sweat lodge, were other features shared among the Wappo, Pomo, and Miwok (Heidenrich 2007:26-34).

More recently, the Wintuan migrations brought the Patwin into the regional community as well. The Patwin appear to have still been moving southward into the lands between Napa Valley and San Pablo Bay at the time of European contact (Heidenrich 2007:38), and there was subsequently a great deal of interaction between the Wappo and Patwin during the Spanish and Mexican period (Heidenrich 2007:70-71). Like the Pomo and Miwok, the Patwin shared many material and cultural features with the Wappo, including hunting and gathering of local food resources, participation in trade, and features of ceremonial and religious life (Heidenrich 2007:38-9, 62-3).

The Wappo language, like all languages, shows the history of its culture and contacts in its own structure, including the phonological and phonetic structures we have examined in this work. Through the regional trade networks that encompassed the Wappo, Pomo, Miwok, and Patwin communities, words for trade items, food resources, and plants and animals have spread back and forth among the languages of the region for centuries. It is probable that the phonological similarities among these languages that we explored in Chapter 7 may have in part been spread through the adoption of these trade- and economy-related loanwords. It is also probable, given the attested level of multilingualism in most California Indigenous communities pre-contact (Golla 1911:7-8), that the spread and adoption of phonological features among these languages happened primarily in the minds of multilingual speakers. The patterns of shared vocabulary and phonological similarity seen among the Wappo, Pomo, Miwok, and Patwin all reflect the shared histories and lifeways of these peoples, and these patterns of interconnection and similarity, in both language and culture, continue to characterize these communities today.

8.2 Language Contact and Language Attrition: 1820 – 1990

First contact between the Wappo and Europeans took place in the late 18th or early 19th century, during the era when California was claimed by the Spanish Empire as part of the Viceroyalty of New Spain, governed from Mexico City. After two and a half centuries of sporadic coastal contact, Spanish settlement in California began in 1769 with the establishment of Mission San Diego, and ended with the successful independence of Mexico from Spain in 1821. During this time, however, Spanish contact with the Wappo was minimal; until 1823, the nearest Spanish settlements to the Wappo homeland were along the shores of San Francisco Bay to the south, and Spanish missionization and forced collectivization efforts largely targeted the Ohlone and Miwok populations of these regions. Despite a lack of direct contact, the Wappo became aware of the Spanish through interactions with peoples of other tribes who had escaped the missions along San Francisco Bay (Heidenreich 2007:57-8).

Upon the independence of Mexico, and following the short-lived First Mexican Empire, a final mission, Mission San Francisco Solano, was founded by Franciscan and military settlers near present-day Sonoma, in the Wappo homeland, in 1823 (Heidenreich

2007:40-1). It was during this period of Mexican and Franciscan presence in Napa between 1821 and 1848 that the first substantial – and violent[230] – incursions of Western societies into the Wappo homeland occurred (Heidenreich 2007:42). The establishment of Mission San Francisco Solano brought religious and military settlers into the area, attracted by the promise of land and encouraged by the Mexican government as a way to colonize the sparsely-populated (from a European point of view) northern territories of the country (Heidenreich 2007:42-8). These settlers were the *Californios*: Spanish and Mestizo (mixed Spanish-Indigenous) people who had immigrated to California, largely from central and northwestern Mexico, as part of the colonization process spearheaded by the mission system, and of whom many would end up as large landowners throughout the future state (Heidenreich 2007:8, 43). In the region of the Wappo homeland, several *Californio* families came to be prominent: the Juárezes, the Berryessas, and above all, the Vallejo family, led by patriarch Mariano Guadalupe Vallejo in the critical late-Mexican period of the 1830s and 1840s (Heidenreich 2007:43)[231]. Vallejo, in establishing and maintaining his authority in California, oversaw military campaigns against local Indigenous peoples, particularly the Wappo, even as many Wappo men, women, and children came to be employed on the haciendas and ranchos of the *Californio* community in the Napa valley, or even joined the mission communities (Heidenreich 2007:70-71, 100, 102-3). Vallejo also exploited divisions

[230] Cook (1976) estimates that as much as 21% of the pre-contact Wappo population died as a result of Spanish and Mexican settler-colonial violence between 1770 and 1848 (Cook 1976:207). In the same work, he presents estimates that the Wappo population was around 800 in the period 1848-1852, but only 50 in 1880, the decline occurring during the intensive phase of Euro-American settlement of California following the outbreak of the 1849 California Gold Rush. Much of this decline in the American period appears to be due to disease and demographic collapse, rather than directly due to violence (Cook 1976:351, 357); but note the Bear Flag Insurrection, during which white settlers attacked Wappo communities in the Napa Valley (Heidenreich 2007:75-92), and the Clear Lake Massacre of 1850, in which US cavalry murdered a large number of Pomo and Wappo people (Madley 2016:205-214).

[231] Today there is a major city named after Vallejo, situated just south of the Napa Valley on the northern side of the Carquinez Strait, in Karkin Ohlone territory.

between the Wappo and neighboring Patwin by enlisting the Patwin leader Sem Yeto and his men as military allies and scouts in campaigns against other Indigenous peoples of the area rebelling against Mexican rule (Heidenreich 2007:47, 67-9).

Both peaceful and violent contact with *Californio* society began to have a cultural and linguistic impact on the Wappo community. While most Wappo remained in their homeland during this period, some joined (willingly or not) the mission communities at Mission San Francisco Solano and Mission San Francisco de Asís (in modern San Francisco), while others became seasonal or permanent agricultural workers on the estates of the *Californios* (Heidenreich 2007:57-58). As a result of this contact, many Wappo adopted the Catholic faith and Spanish names, as well as European-style clothing and the agricultural and ranching lifestyle of the *Californios*, and they thus entered the Spanish-Mestizo-Indigenous racial hierarchy long established throughout Hispanic America (Heidenreich 2007:45). Due to this contact and social transformation, Spanish vocabulary began to enter the Wappo language, chiefly in the form of words related to European religion, agriculture, cattle-raising, horsemanship, and hacienda artisanry (Sawyer 1964b). Lexical borrowing from Spanish of this type is characteristic of the Indigenous languages spoken throughout Hispanic America, in contact with Spanish for the last five centuries, and has been recorded for most of the Indigenous languages of central and southern California that were in contact with the mission system and *Californio* society, including Ohlone, Miwok, Patwin, and many others (Shaul 2012; Callaghan 1981; Bright & Bright 1959). With these linguistic importations, the Wappo language also acquired several new phonemes of Spanish origin, as detailed in Chapter 2.

White anglophone incursions into California began in the 1840s while the region was still under Mexican sovereignty, in the form of settler parties arriving overland in wagon trains from the United States, or by ship from the United States and Europe (Heidenreich 2007:77-82; Madley 2016:74-5). First contact between the Wappo and white anglophones – as well as the first violence committed by white anglophones against Wappo people – occurred in the process of the Bear Flag insurrection of June 1846, an attempt by local American and European settlers to stage a coup against the seat of local Mexican authority at Sonoma and declare an independent white American republic in California in tandem with the outbreak of the Mexican-American War (Heidenreich 2007:75-92). Following the US victory in that war in 1848, Mexico was forced to cede California and its other northern territories to the United States in the Treaty of Guadalupe Hidalgo. The period of American rule that began in 1848 and has lasted to the current day has been by far the most deleterious to Wappo culture and sovereignty, as it has with most other Indigenous peoples of California. In particular, the two decades following the inception of the California Gold Rush in 1849 saw a horrific genocide against the Indigenous population of the region, encouraged by the elected white government of the State of California (from 1850), and carried out by both white civilian settlers and the United States military (Cook 1976; Madley 2016; Reed 2020). By 1870, the Indigenous population of California had crashed by 80%, from an 1846 population of around 150,000 down to only around 30,000 (Madley 2016:21), and many of the nearly 100 pre-contact languages of the region had already taken a heavy blow.

White settler violence heavily impacted the Wappo and other Indigenous groups of the region during the height of white anglophone settler incursions in the 1850s. The most infamous such case was the Clear Lake Massacre of 1850, in which the US military and white militia attacked Pomo and Wappo communities around Clear Lake, killing hundreds, at the explicit demand of the white settler population (Madley 2016:205-14). In 1851, the US military deported a portion of the Wappo people to a reservation north of the homeland (Heidenreich 2007:129-30), while much of the remaining population survived in the ensuing decades as agricultural workers in the Napa area, enduring the white supremacist social and legal framework established by the new anglophone settler order as best they could (Heidenreich 2007:91, 142-3). Even after the most intense period of violence came to an end around 1880, land sales to white Americans, and the increasing marginalization of both Indigenous people and *Californios* within the new white-supremacist system, eventually resulted in the entirety of the Wappo homeland falling under white American ownership (Heidenreich 2007:144-8).

There are no clear records indicating the status of the Wappo speech community during the second half of the 19th century, but it is probable that Wappo continued to be the first language of most of the ethnic community as late as 1900, along with almost certain widespread bilingualism in Spanish, indicated by the large number of Spanish loanwords (several hundred) attested in the 20th century documentation of the language (Sawyer 1964a, 1964b). At the same time, the use of English, a language with which the Wappo first came into contact in the 1840s, most likely underwent a steady growth throughout the rest of the century as contact with white American anglophone culture became more permanent, with the first generation of English-Wappo bilinguals possibly appearing as early as the 1850s.

After 1870, white American settlement and population growth in the traditional Wappo homelands in the Napa Valley, Mayacamas Mountains, and Russian River Valley accelerated; the three principal current cities of the Napa Valley, Napa, St. Helena, and Calistoga, were incorporated in 1872, 1876, and 1886, respectively. With more white American anglophone settlement in the area, more Wappos would have begun to learn

English, first as a second language, and later as part of a multilingual community in which Wappo, Spanish, and English were all generally utilized; knowledge of Pomo, Lake Miwok, and Patwin among the Wappo would have continued throughout the period as well, chiefly in mixed-community marriages (Mrs. Laura Somersal's father for instance was a native speaker of Southern Pomo).

By the time of the first extensive documentation of Wappo by Paul Radin during the 1910s and 1920s, it is clear that most Wappo were fluent or even native in English. According to remarks by Radin on the fluency of his consultants and on the knowledge of the Wappo language in the community, it seems that by 1917 there were only around twenty fluent speakers of Wappo left, out of an ethnic population somewhere in the hundreds (Radin 1929:7), and that his two main consultants, Jim Tripo and Joe McCloud, were in their sixties, giving a birth year in the 1860s. This suggests that the "tip" of language shift, the point where rapid shift from a prior language to a subsequent language occurs (see Mertz 1989), most likely occurred in the Wappo community, from Wappo to English, sometime during the period 1880 – 1910, and probably towards the beginning of this period. After Radin's period of work, the number of fluent Wappo speakers continued to decline, most likely because younger generations ceased to acquire Wappo as their first language. In fact, the last generation of native Wappo speakers may already have been born by the time of Radin's fieldwork; this generation would have been young adults in Radin's time, and older adults by the time of Jesse Sawyer's fieldwork in the 1950s through 1980s, including Mrs. Laura Somersal, Sawyer's primary consultant.

Jesse Sawyer was only the second linguist to work with the Wappo community, after Paul Radin, but he spent the longest period of time with them. Given this, we can deduce from the number of speakers that he worked with – approximately seven different speakers appear in his audio corpus compiled during the 1960s and 1970s – that by the end of his primary data collection around 1975, there were fewer than ten fluent speakers of the language left, with perhaps another 20 to 30 partial speakers; the fluent speakers appear to have all been above the age of 60, and maybe even 70, which is the primary evidence for the generation born around 1900-1910 being the last to acquire Wappo as a first language and maintain fluency in it.

The final audio recordings of native speakers of Wappo were made in the early-mid 1970s by Jesse Sawyer; while he continued to conduct and publish research on Wappo until his passing in 1990, he does not appear to have made any more audio recordings after about 1975. Mrs. Laura Fish Somersal, Jesse Sawyer's primary consultant and one of the best-known Wappo speakers in the mid-late 20th century, passed away in 1990 around the age of 100. Jesse Sawyer's other principal consultants, Irene Alturas Amante and Clara Leger, had also passed away by the end of the century. By the year 2000, Wappo no longer had any known first-language speakers, but still had a population of semi-speakers or 'rememberers' from the generations born after 1910.

While the pre-contact size of the Wappo population can only be estimated, Kroeber believed it was between about 1,000 and 1,600 in the year 1770 (Kroeber 1925:883); this is similar to the pre-contact population size estimates for many other Indigenous communities of California. Assuming that by definition all members of the pre-contact Wappo population were native speakers of the Wappo language, we can estimate that there were between 1,000 and 2,000 speakers of Wappo at the beginning of the 19th century. By the end of the century, the number may have been around thirty or less, based on Paul Radin's statement in the mid-

1920s that there remained only twenty or so fluent speakers during his fieldwork. Thus, the vast majority of the decline of the Wappo language took place during the 19th century, most likely during the latter half of this period, after the end of Mexican rule in California, due to the steady growth of the white American anglophone population in the Wappo homeland.

8.3 The Current State of the Wappo Speech Community

The current oldest generation within the Wappo community are those born before 1950; given that they overlapped with the last generation of native speakers for about 40 years, many of the members of this generation had or have passive knowledge of the Wappo language; from my own personal conversations with people of this generation, many of them attest to hearing their grandparents and great uncles/aunts converse in Wappo when they were children, and could even understand or respond to grandparents in the language at that time. However, given that all the members of this pre-1950 generation passed through monolingual anglophone schooling during their formative years, very few retained knowledge of the language into adulthood.

This passive knowledge is also found among some of the generation born between 1950 and 1970, who are currently between 50 and 70 years of age. Grandparents, great-uncles and -aunts, and other community elders provided some exposure to the language during the childhoods of this generation, which occurred during the time of Jesse Sawyer's work with the community.

For the generations born after 1970, however, there appears to be very little first-hand knowledge of the language. These individuals would have interacted with some of the last native speakers of Wappo when these speakers were at a very advanced age, and the interactions that did occur seems to have largely been in English. Members of these generations, under the age of 50, in some cases know a few words or expressions in the language, especially exclamations, set phrases, and a few basic vocabulary items. This knowledge is itself passive, and does not appear to be utilized spontaneously unless specifically elicited. Thus, by most definitions, Wappo has been a dormant language since the passing of the final native speakers around 1990, that is, for the past 30 years.

8.4 Revitalization: 2012 – Present

I first began working with the Wappo community in the spring of 2012, shortly after completing my Ph.D. classes at the University of New Mexico, and returning to the San Francisco Bay Area, where I was born and raised. I initially met Wappo singer and activist Desirae Harp and her mother Tektekh, who requested help in interpreting the Americanist linguistic transcription that most Wappo material is written in. In May of 2012, Desirae, Tektekh, and I participated in the Breath of Life workshop at the University of California, Berkeley, where we were introduced to the Bancroft Library's collections on Wappo material, and where I was made aware of the audio corpus of Wappo housed at the Survey of California and Other Indian Languages archive, SCOIL (now in the California Language Archive, CLA). During the summer of 2012, Desirae's cousin Joanne Torres joined the group, and in late 2012, we all presented a proposal for a language revitalization program for the Wappo language to the Wappo tribal council, which was subsequently approved.

Throughout 2013, we held weekly language classes at the Wappo tribal offices in Santa Rosa, California, which continued into early 2014. In March of 2013, I presented on the nascent revitalization project at the Endangered Languages Workshop at the University of

Hawai'i at Mānoa; here I met linguistics undergraduate student Emmy Akin, who joined our project upon her return to California that spring. Desirae, Joanne, Emmy, and I would form the core membership of the project thereafter, and we attended and presented at several Indigenous language workshops and linguistics conferences in 2013. Meanwhile, in the spring of 2013, I presented my dissertation proposal, a study of Wappo morphosyntax; however, upon the advice of my committee, I changed my topic to phonology, since this part of the language had been under-documented in the past.

The weekly classes were the first iteration of our revitalization project, and they were structured like a typical language conversation group. At the beginning of each session, we would introduce a new set of vocabulary items, typically no more than ten, as well as some relevant points of grammar. Then we would spend the rest of the class using the new vocabulary and grammatical structures in sentences and conversation. We often structured our lessons around games, including card and dice games, matching games, and conversational turn-based games, many of which were borrowed from basic language curricula developed for ESOL or Spanish. In fact, as all of us had studied Spanish as a second language in the US school system, we drew on much of our own classroom experiences as Spanish learners and adapted the strategies we were familiar with to teaching Wappo.

After a year of weekly classes and much advance in our learning and knowledge of the language, we decided however to suspend the classes in early 2014. This was for two reasons. Firstly, attendance, which had begun with the four core participants, and had swelled to include up to ten participants at its height, had dwindled again by early 2014. It was clear that for most of the Wappo community, work and family engagements and lack of transportation made attending a weekly in-person class – especially consistently – difficult. Secondly, many of the participants had found the use of the traditional Western grammar terms confusing and off-putting. Many expressed the wish to learn through immersion rather than through explanation in a classroom setting.

After suspending the classes, all of us turned to personal obligations, and so work on the revitalization project slowed down. However, during 2014, we were approached by linguist Jessica Kirchner who had become interested in the program and offered to develop software for a Wappo-learning website or app. We collaborated with her for part of the year, but ultimately concluded we were not ready for this step; however, Jessica, along with linguist Alex Walker, would eventually record one of the older partial speakers of Wappo in a private session which the researchers later made available to the community.

I had already decided in 2012 to make some aspect of the Wappo language my chosen dissertation topic, both for the opportunity to carry out research on Wappo that working on the revitalization program would afford, and to avoid spending time and energy on research topics that were not connected to the revitalization program. When I presented my dissertation proposal in the spring of 2013, my advisors and I ultimately settled on a study of the phonetics and phonology of the Wappo language. Health issues throughout 2014 intervened to prevent me from beginning my research, but at the beginning of 2015, I began in earnest, starting with transcribing both Sawyer's 1965 *English-Wappo Vocabulary* and Thompson et al.'s 2006 *A Reference Grammar of Wappo* into spreadsheet files for quick reference, sorting, parsing, analysis, and comparison. I also began transcribing the contents of the Jesse O. Sawyer Collection of Wappo Sound Recordings from the SCOIL archive;

copies of the recordings had already been recorded to CD and distributed to the Wappo community in 2012.

In 2016, Emmy Akin and I presented a survey of Wappo community attitudes towards language revitalization at the Putting Fieldwork on Indigenous Languages to New Uses (PFILNU) workshop at the University of Campinas in São Paulo state, Brazil. While all of us were still engaged in our own personal commitments, we continued to brainstorm ways to further the revitalization project without formal classes, including through informal lessons among ourselves, and the creation of teaching materials for a future Wappo self-study workbook. In 2017, I began using the language-learning app Memrise for my own self-study purposes, and discovered that one could create one's own tailored language course on this app, complete with audio. Thus, I set about creating a basic course on Wappo, including both individual words and phrases, and by the end of the year the course consisted of twenty lessons and four hundred vocabulary items. My Wappo partners then tested the course, and we modified it according to their feedback. The course is currently available on the Memrise platform, and a few other Wappo community members have used it, but ultimately we would like to put together a more comprehensive app that includes images and video as well as writing and audio, and especially an app that will only be accessible to the Wappo community – published Memrise courses only have a public setting.

By 2018, I had mostly completed my data collection, and began writing draft chapters of this dissertation; the writing, revision, and additional research phases would last through 2021, prolonged by teaching and work commitments, and then the disruption of the Covid-19 pandemic. During this time, I continued to stay in touch with my Wappo partners; in the early months of the pandemic in 2020, as we were all in lockdown, we engaged for a time in weekly Wappo conversation/learning sessions using the video conference platform Zoom.

In late 2021, Desirae Harp and I resumed teaching Wappo to the larger Wappo community for the first time since 2014, using the Facebook Messenger app as a platform. Desirae chose the topic or theme for each weekly lesson, while my task was to find and edit relevant audio samples from the Sawyer recordings that could be shared with the class participants on Messenger. We continued this class into mid-2022, but once again began experiencing a decline in attendance and participation, for much the same reasons as before – lack of time to be able to devote to the class on the part of participants, all of whom have job and family obligations, and the challenging nature of learning a second language in a group setting where style and pace are difficult to tailor for each learner.

At the time of publication, we are planning our next steps to try to tackle and overcome these obstacles. One new development that began in 2023 and has continued into this year is a seasonal cultural immersion camp, organized by Desirae, Tektekh, and other community members, at the Sugarloaf Ridge State Park in Sonoma County, in the mountains between Napa and Sonoma – the state park and its surrounding areas are within the Wappo homeland. Desirae has worked at the state park for the last few years as a park ranger, and as such, has been able to obtain open access by all Wappo community members to the park's facilities, including an astronomical observatory. In July 2023, December 2023, and March 2024, cultural immersion camps for Wappo and some Pomo youth were held that included lessons in traditional crafts, nature walks to identify native and traditional plants and their uses, preparation and enjoyment of traditional foods, astronomical observation in the context of Wappo culture, and lessons in the Wappo language, which I have helped facilitate. These camps have been a resounding success, with high and enthusiastic attendance by community members of all ages, and more are scheduled for 2024. They are sure to be a central component of the Wappo cultural and language revitalization program going forward.

8.5 The Future

Throughout the last twelve years, my Wappo partners and I have learned a great deal about the process of language revitalization, both through information and experiences garnered from other revitalization projects presented at the various conferences, workshops, and online spaces in which we have participated over the years, and from our own trials and errors in working directly with the larger Wappo community. Our learning can be summarized as follows:

1. Attitudes toward language revitalization have consistently been positive and hopeful among the Wappo community. There is no sense that the language is low-prestige, useless, or a hindrance to social mobility, as has been reported in the literature for many other minority communities around the world. Ironically, this is probably due to the language's current dormant status; its absence is felt directly, and as all community members are fluent native speakers of English, there is no perceived competition between the two languages.
2. The reality of the current Wappo community is that there are no fluent, native speakers that could act as teachers or language mentors, as there are for some of the other California Indigenous communities. Therefore, all instruction must either come from one of the long-term core participants, or must be entirely self-directed. Other

commitments on the part of the core participants – family obligations, work and school, even other decolonization efforts – necessarily limit the amount of time these participants can devote to language revitalization.

3. The larger societal context in which revitalization is taking place has posed a number of challenges to the project. All project participants and community members have immediate commitments to families, employers, and the community that often take precedence over participation in the project. Intermittent or chronic health issues, lack of access to the internet, and lack of access to transportation are other continual and serious challenges faced by both community members and core participants. These challenges all represent a fallout of the larger societal context in which the program is being carried out – that of a contemporary American society characterized by rising economic inequalities, exploitation and marginalization of the working class, poor, and minorities, increasing political and social divisions, heightened threat of intrasocietal conflict, and the impacts and dislocations of climate change. In such a context of societal disruption, taking care of immediate and ongoing basic needs, such as maintaining employment and income, providing materially for one's family, and preserving one's physical and mental health, have often taken priority over more long-term efforts such as language revitalization.
4. Pedagogical challenges have also played a role in the project. There is no single way to teach a language, and personal preference, experience, and learning styles all play an important role in the success of any language learning effort, especially one organized as a community program and not just as individual study. While some participants prefer the traditional classroom pedagogy familiar from US schooling,

others prefer a more organic, natural approach based on conversation, community activities, and intergenerational dialogue. With few resources and instructors available, it has proven challenging to provide enough different paths of language study to meet the needs of all learners.

In response to these learnings, I make the following proposals:

1. Instruction in the language should focus, for now, on a small group of highly-motivated students that are willing to make a firm time commitment to studying the language up to the point of mastery sufficient to teach. This could be the current core participants, or it could be other community members. This group of motivated students could more easily mutually reinforce each other's learning, to compensate for the lack of fluent native speakers, and, especially if they are youth, could have much more free time to devote to language learning and revitalization activities without concerns such as working full time or supporting a family that are more heavily impacting older community members.
2. For those who prefer self-study to group study, a new language app should be developed. Given the proliferation of apps in the online space over the last decade, it should not be an extreme challenge to adapt an existing app or design a new one, either by a community member with the requisite skills and education in programming, or a similarly qualified individual outside of the community who could be hired. A language-learning app would make studying and practice much more convenient, and would eliminate difficulties such as coordinating schedules or

commuting to a single location for language learning. It would also enable a core group of learners to proceed much faster than would be possible with group learning only, where the pace must necessarily be slower so as to accommodate all learning speeds.

3. An orthography should be finalized for Wappo. Initially in the 2012-2014 period, we used a simplified orthography that tried to avoid diacritics and was based more on English spelling conventions. The desire to avoid diacritics was both to make the written language look less foreign or unfamiliar to the English-speaking Wappo community, and to facilitate its use on social media and in online spaces, where diacritics are not always readily available. However, in the post-2021 revival of the language classes and revitalization activities, we have adopted the Americanist transcription conventions as the preferred orthography for Wappo; this was the choice of Desirae Harp, with the motivation being to make the already-published academic materials on Wappo accessible to current and future community members. A single, standardized orthography would serve two purposes: it would make learning materials across the community more consistent and thus more easily reinforced between community participants; and it would provide a socio-esthetic visual symbol for the Wappo language and in turn for Wappo sovereignty and cultural autonomy within the hegemonic American context. Further community consultation will be necessary to decide on the final form of any orthography, and its domains of use.

The challenges described here are not unique to the Wappo community, but rather are commonplace among language revitalization programs in North America and around the world. Especially for those communities, like the Wappo, that lack fluent native speakers from whom to acquire the language directly, any attempt to learn the language requires a good deal of effort, commitment, and passion.

Another potential avenue forward that we have not yet explored would be partnering with other language revitalization projects in the San Francisco-Clear Lake region, especially those of the Pomo and Ohlone communities, who have several well-established programs in place. This would not only allow us to consult on best practices and pedagogical strategies, but it would also allow for mutual encouragement, support, and reinforcement. Such a collaboration would come at a good time, one in which Indigenous communities are increasingly organizing and collaborating in both public and online spaces, and in which the national mood of youth in the United States is at a point of transition away from the white supremacist and colonizing past towards a multicultural, decolonized future.

APPENDIX A: REFERENCES FOR TYPOLOGICAL STATEMENTS ON NORTH AMERICAN INDIGENOUS LANGUAGES

The statements on the distribution of various phonological features among the Indigenous languages of North America made throughout this work were based on a compilation of phoneme inventories and phonological descriptions from hundreds of reference grammars and articles that I amassed over the years of working on this dissertation. As these sources relate to studies outside the scope of this work, I have created a separate document that lists these sources, and have uploaded it to the following URL for access by interested readers.

https://docs.google.com/document/d/1YSd1VD1x4xUnK_WCX6eymqBSvyxOIu3S9SKQXKxU9Tc/edit?usp=sharing

The languages covered include all those of Canada, Greenland, the United States, and Mexico north of the Mesoamerican Linguistic Area – that is, the Mexican regions of Baja California, the Sonoran Desert, and the Rio Grande Valley – that have sufficient attestation to enable a description of their phoneme inventory.

Additionally, interested readers or those with any questions or requests may contact me directly at aaronmarks1919@gmail.com.

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