ORIGINS OF NORTHERN COSTANOAN *ʃak:en* 'six': A RECONSIDERATION OF SENARY COUNTING IN UTIAN[1]

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Proto-Costanoan numerals for 'one', 'two', 'three', and 'six' are reconstructed by Callaghan (1990), leading her to suggest that Proto-Costanoan may have had a senary (base 6) counting system, as originally proposed by Beeler (1961*a*). This paper suggests (*i*) that Northern Costanoan **ṣak:en* 'six' is a loan from Proto-Eastern-Miwok **ṣak:en* 'six'; (*ii*) that, though there is little evidence for a senary counting system in Costanoan, there is evidence for base 6 counting in Eastern Miwok, from which, it is argued, the term *ʃak:en* 'six' was borrowed into Northern Costanoan and northern Yokuts; and (*iii*) that Proto-Eastern-Miwok **ṣak:en* 'six' is a derived form of the Proto-Eastern-Miwok stem **ṣok:e-*, **ṣyk:e-* 'all, whole, everything', lending further support to a senary count within this subgroup of Miwok. Under this analysis, only the numerals 'one', 'two', and 'three' are reconstructible for Proto-Costanoan. This parallels Callaghan's (1994) findings for Miwok, suggesting a restricted numeral system for Proto-Utian as a whole.

[KEYWORDS: Proto-Costanoan, senary numeral systems, restricted numeral systems]

1. Senary counting in Costanoan? Costanoan and Miwok are two families of Central California languages. There is mounting evidence of a distant genetic relationship between these two families, with the mother language referred to as Utian, after Proto-Utian **ʔoṭi* 'two' (Callaghan 1982; 1983; 1986; 1988).

Beeler (1961*a*) suggests that the borrowing of numerals for 7, 8, 9 from Coast Miwok into Northern Costanoan is evidence of a senary or base 6 counting system in Costanoan. Beeler's argument for this senary system in Costanoan is twofold: first, he argues, only numerals 1–6 were elicited by Kroeber for San Jose (Chochenyo) Costanoan; second, a count ending at 6 would explain why the numerals 7, 8, and 9 were borrowed from Coast Miwok into Northern Costanoan. Note that Beeler's argument is actually not that there was a base 6 system in Costanoan, but that the count simply STOPPED at six. He offers no evidence that, for example, higher numerals were expressed with base 6 in any Costanoan language.

Beeler's arguments for a limited 1–6 count are weakened by additional evidence. First, Kroeber's consultant for Chochenyo was Maria de los Angeles Colos, the same consultant interviewed by Harrington in 1929–30 (Kroeber field notes, 1904, 1909; J. P. Harrington field notes, 1921, 1929–30). In Harrington's elicitations, Colos provides words for numbers 1–10 as well as 20 and 30. Second, the word for 'ten' in Northern Costanoan in Harrington's Chochenyo, Curtin's Niles vocabulary, and Henshaw's Santa Clara and Santa Cruz word lists (Heizer 1955) is *'iwes, ʔiweʃ* from the verb stem *ʔiwe-* 'to finish, to end'. That this served as a base for higher numerals is supported by Harrington's Chochenyo *ʔuṭhin ʔiweʃ* 'twenty, literally two ten' and *kaphan ʔiweʃ* 'thirty, literally three ten'. Finally, if, as Beeler suggests, the Costanoan count was originally limited to 1–6, why, in Callaghan's (1990) careful study of Proto-Costanoan numerals, is it only possible to reconstruct numerals for 'one', 'two', 'three', and 'six'? What happened to 'four' and 'five'?

The following section outlines an alternative history where Northern Costanoan **ṣaken:* 'six' is a loan from Proto-Eastern-Miwok **ṣak:en* 'six', where there was a senary count. This is supported by the fact that at least two Eastern Miwok languages show evidence of a base 6 in higher numerals and by a plausible etymology for Proto-Eastern-Miwok **ṣaken* 'six' from the stem **ṣok:e-*, **ṣyk:e-* 'all, whole, everything'.

Transcriptions from primary sources cited in running text are italicized and enclosed in angle brackets (⟨ ⟩); transcriptions from primary sources in examples and tables are italicized. All other transcriptions are in the International Phonetic Alphabet.

2. Senary counting in Eastern Miwok? I follow Callaghan (1994) in subgrouping the Miwok languages into Eastern and Western groups. The Eastern group includes Sierra Miwok (Northern, Central, and Southern), Plains Miwok, and Bay Miwok, while the Western group includes Coast Miwok (Bodega, Marin) and Lake Miwok.

Though there are no Miwok languages where *ṣak:en* 'six' occurs as a simple numeral, both Northern Sierra Miwok and Central Sierra Miwok show higher numerals where this form occurs as a base 6. These numerals are shown in boldface in (1).

(1) Higher base 6 numerals in Eastern Miwok languages?

	2	12	3	18
N. Sierra	ʔoṭi:ko-	**ʔoṭik-sake:n-y-**	tolo:kos-u-	*tak-cakena*
		ʔoṭik-sake:n-u-		**/tak-ṣaken-a/**

C. Sierra	ʔoṭi:ko-	**ʔoṭik-ṣake:n-y-**	tolo:koṣ-u-	*naatca mu kawinta*
S. Sierra	ʔoṭi:ko-	naʔa:caʔ ʔoṭi-ʔ:yni-ʔ	tolo:koṭ	—
Plains	ʔo:jok:o-	ʔojkop:a-	tel:ok:o-	—
Bay	*ohuothro* /ʔowoṭo/	—	*tolocothro* /tolokoṭo/	—

All Northern Sierra Miwok forms are from Callaghan (1987), with the exception of 'eighteen', which is from Dixon and Kroeber (1907:680). All Central Sierra Miwok forms are from Freeland and Broadbent (1960), with the exception of 'eighteen' which is also from Dixon and Kroeber (1907:680). Southern Sierra Miwok data are from Broadbent (1964), Plains Miwok data are from Callaghan (1984), and Bay Miwok (Saclan) forms are from Arroyo de la Cuesta's (1821) word list. In Appendix A, numerals from all Eastern Miwok data sources consulted in this study are compiled, with forms reflecting *ṣak:en* 'six' in boldface.

Callaghan (1994) analyzes the Northern and Central Sierra Miwok words for 'twelve' as composed of the morphemes *ʔoṭik-* 'two', *sak-* 'continuative?' plus *e:n-y-* 'agentive'. This appears to be the only Miwok number word with a continuative suffix, and certainly the only one with continuative followed by agentive. Given that a near-identical sequence *ṣaken* shows up in Northern Sierra Miwok 'eighteen', and that both twelve and eighteen are multiples of six, I suggest that *sake:n*, *ṣake:n*, *ṣaken* in the number words in (1) reflect Proto-Eastern-Miwok *ṣak:en* 'six' or 'all' (of count). The numeral 'twelve' is literally 'two-six' (2×6), while 'eighteen' may be literally 'three-six' if *tak-* is interpreted as a shortened, reduced form of *tolook-* 'three'.[2] The numeral 24 is not recorded for any Eastern Miwok language, while 18 is unattested for Southern Sierra Miwok, Plains Miwok, and Bay Miwok (Saclan). In this last language, there is no record of any numeral above ten.

Northern Sierra Miwok also has *lus:ak:e:nu-* 'eleven', where initial *lu-* looks like truncated *luti* 'one'. Comparing 'eleven' and 'twelve' makes it look like *sak:en* could also mean 'ten' or 'all'. This is true in Central Sierra Miwok (also known as Tuolomne Moquelumnan) too, where *tolok-sakenu* is recorded for 'thirteen' by Dixon and Kroeber (1907:680). In sum, there is evidence from higher numerals in Eastern Miwok for a numeral formative *ṣak:en* meaning 'six', 'ten', or 'all'.

Within Eastern Miwok, there is a plausible etymology for *ṣak:en* 'six', 'ten', or 'all' which associates it with the end of the count. The stem *ṣak:e-*

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[2] The same short form may occur as the last element in "Huimen" Miwok (Arroyo de la Custa) ⟨*patithrac*⟩ 'six' (2–3) and Bodega Bay Miwok *patʃʃitak* 'six'.

appears to be a variant of Proto-Eastern-Miwok *ṣok:e-, *ṣyk:e- 'all, whole, everything' plus final -n, which could be an adverbial or verbal marker. Comparative data are shown in (2).

(2) Proto-Eastern-Miwok *ṣak:en 'six' < *ṣok:e-, *ṣyk:e- 'everything' + -n

    Northern Sierra Miwok: sok:e 'things, everything', sok:et:i (N. dim.)
      'all, everything, the whole, every'
    Central Sierra Miwok: ʃok:e 'all', suk:e- 'all'
    Plains Miwok: syk:e- 'all, everything, the whole'

The a/o,y vowel difference in the initial syllable of reconstructed forms in (2) has parallels in modern languages, where a/o and a/y, and o/y stem variants occur. Compare, for example, Northern Sierra Miwok te:py-, tep:a- 'to cut off', ka:le- 'phlegm', kol:e- 'to cough up'; Central Sierra Miwok low:a-, lowo:-t- 'to boil', lep:a-, lepy:t- 'to finish', poṭ:a- 'to grind', paṭ:a- 'grinding stone'; Southern Sierra Miwok jyka:-t- 'to shake', jakak:ak:- 'to have the shakes'; and Plains Miwok sala:k-y-, syla:k-y 'to row, to stir', tanuk:a-, tonuk:a 'bow', kawakso-, kawaksy- 'eel'.

Positing Proto-Eastern-Miwok *ṣak:en 'six' requires an explanation for modern words for 'six' in Eastern Miwok languages, illustrated in (3).

(3) Words for 'six' in Eastern Miwok languages

    Northern Sierra Miwok   tem:ok:a
    Central Sierra Miwok   tem:ok:a
    Southern Sierra Miwok   tem:ok:a
    Plains Miwok   tem:epu
    Bay Miwok(Saclan)   *jesmuhi*
                      /hesmuy/, /hesmu'i/?

With the exception of the Bay Miwok form, all of these words for 'six' appear to be based on a stem tem:e- 'big' (cf. Plains Miwok teme-, tem:e- 'big') or possibly a stem tem:V- meaning 'to trade; to go across' (cf. N. Sierra Miwok tema:l-y- 'to trade', teme:N-y- 'to cross, to go across', tem:a- 'to strike back, get even'; S. Sierra Miwok tema:l- 'to exchange'), which could refer to the switch of hands which occurs between five and six. Since, in both cases, tem:ok:a has a plausible Eastern Miwok etymology, it could well be an internal Eastern Miwok form which co-existed with *ṣak:en 'six' or which replaced this form once the count was extended or, in some languages, was restructured as a decimal system.

The evidence in (1) and (2) weakly suggests a senary counting system in Proto-Eastern-Miwok in words for 'twelve' and 'eighteen'. The only other

northern central California language where a higher numeral is claimed to be expressed as a multiple of six is "Northerly Wintun" as recorded by Barrett (1908:85–86), where the word ⟨*tcansem*⟩ means both 'five' and 'thirty'.[3] Beeler's (1961*a*) view of this as a possible senary count might be further supported by Barrett's recording of ⟨*panōʟ*⟩ for 'three' and 'eighteen', where an unexpressed factor of six might indicate the default base. However, there are two weaknesses in this argument. First, Barrett records ⟨*panōʟ*⟩ 'twelve' as well, where the unexpressed factor would be four. Second, Pitkin's (1985) extensive lexicon of Wintu shows two closely related words: *panuλ* 'three' and *panu:λ* 'many'. It is quite possible, especially in light of Barrett's failure to distinguish long and short vowels in these forms, that higher numerals elicited by Barrett which were not multiples of five were simply translated as 'many'.

In **3** below I suggest that Proto-Eastern-Miwok **ṣak:en* 'six' was borrowed into both Northern Costanoan languages and into far northern Yokuts dialects. This differs from the position of Callaghan (1990), who reconstructs Proto-Costanoan **ṣak:en* 'six', and from Beeler (1961*a*), who suggests that far northern Yokuts *saken, ʃaken* 'six' is a borrowing from Northern Costanoan.

3. The spread of Eastern Miwok **ṣak:en* 'six'.

3.1. To Northern Costanoan. I follow Beeler (1961*b*) and Callaghan (1988) in classifying Costanoan languages into three subgroups: Karkin; Northern Costanoan (including Chochenyo, and the languages of Santa Cruz, Santa Clara, and San Francisco Missions); and Southern Costanoan, including Mutsun and Rumsen. Callaghan tentatively classifies Soledad, the southernmost of the Costanoan languages, as Northern Costanoan. For the purposes of this study, Soledad is classified as Southern Costanoan, following Garrett (2002), although conclusions would be similar if it were treated as a Northern language, since it does not have any reflex of **ʃak:en* 'six'.

The most reliable sources of data are the field notes of J. P. Harrington, where Mutsun, Rumsen, and Chochenyo speech is transcribed. Karkin, Soledad, and other Northern Costanoan languages (San Francisco, Santa Clara) are known only from short and sometimes unreliable word lists.

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[3] Pitkin's (1985) authoritative Wintu dictionary has *c'ansem* 'five' (cf. *c'an* 'half, side, one side, one-half', *c'anseh* 'one hand'), but two different forms for thirty, one with base 20 and the other with base 10: *k'ete wintʰuh tiqeles λomi* 'literally one enumerable-unit ten add', where *k'ete wintʰuh* means 'twenty' and *panuλ tiqeles* 'literally three ten'.

Callaghan (1990) reconstructs the Proto-Costanoan numerals shown in (4).

(4)   Proto-Costanoan numerals from Callaghan (1990:table 1)

(4a) *(h)im:en   'one, union'
(4b) *ʔoṭhin   'two'
(4c) *kaphan   'three'
(4d) *ṣak:en   'six'

Callaghan's reconstruction in (4d) is based on two attestations: Chochenyo *ʃak:en* 'six' (from J. P. Harrington) and Rumsen *xali-ʃak:en* 'six' (from Alphonse Pinart), as published in Heizer (1952).[4]

There is little question that *ʃak:en* 'six' should be reconstructed for Proto-Northern-Costanoan. This is the form attested in all Northern Costanoan languages, from Father Vicente Santa Maria's journal pages, which record words from the 1775 Spanish naval expedition into San Francisco Bay, to later records from Chochenyo, Santa Clara Costanoan, and Santa Cruz. Attested words for 'six' in Northern Costanoan languages are shown in (5). From Henshaw's Santa Cruz word list there is also ⟨cak-kĕn-i-yis⟩ 'sixteen' (literally 'six more') and ⟨cak-kĕn´-ĭ-wis⟩ 'sixty' and from his Santa Clara word list ⟨sak-ĕn´-ni-wes⟩ 'sixty', both literally 'six ten' (Heizer 1995).

(5) Northern Costanoan words for 'six'

	As Recorded	Phonemicization	Source
Juichun	*sacken*	/ʃak:en/	Arroyo de la Cuesta
San Francisco	*saquen*	/ʃak:en/	Fr. Vicente Santa María
Chochenyo	*ʃak:en*	/ʃak:en/	Harrington notes
	saken	/ʃak:en/	Kroeber notes
Niles	*säkĕ´n*	/ʃak:en/	Curtin notes
Santa Clara	*shakén*	/ʃak:en/	Mengarini in Powers (1877)
	sak-ĕn	/ʃak:en/	Henshaw (1884) in Heizer (1955)
	caken	/ʃak:en/	Kroeber (1910)
Santa Cruz	*šaken*	/ʃak:en/	Pinart (Costanoan III)
	cak-kĕn´	/ʃak:en/	Henshaw (1884) in Heizer (1955)
	saken	/ʃak:en/	Comelius in Powers (1877)

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[4] Callaghan (1990:128) notes that when I. Meadows was asked about Rumsen *xali-ʃak:en* 'six', she guessed it should be *xale-ṣak:en*.

However, the situation is different for other branches of Costanoan. The Karkin word for 'six' recorded by Arroyo de la Cuesta is ⟨*tanipos*⟩. And, as shown in (6), the range of words for 'six' in Southern Costanoan languages does not support reconstruction of *ʃak:en* 'six' for this subgroup.[5] The stem is found only in Rumsen, where it is the second element of a compound numeral.

(6) Words for 'six' in Southern Costanoan

Language	Original Transcription	Probable IPA	Source
Rumsen	*xali-šakken*	hali-ʃak:en	Pinart (1878)
Rumsen	*hale-caken*	hale-ʃak:en	Kroeber (1910)
Rumsen	*hăl-ĭ-räk´-ĕn*	hali-ʃak:en	Henshaw (1884) in Heizer (1955)
Rumsen	*Hah-lā´ sah´-ke*[6]	hale-ʃak:e	Merriam (1906; 1933)
Mutsun	*nakitci*	nakitʃi	Arroyo de la Cuesta
Mutsun	*heennaktceei*	hin:aktʃi	Merriam (1906; 1933)
Mutsun	*nakči*	naktʃi	Harrington notes
Soledad	*imměnokši*	him:enokʃi	Pinart (1878) in Heizer (1952)
Soledad	*imin-ukca*	him:enokʃe	Hale in Kroeber (1910)

Differences in transcription systems, along with a possible error in Henshaw's writing of *r* and possible omission of final /n/ by Merriam, allow us to interpret all Rumsen forms in (6) as transcriptions of *hále-ʃák:en* 'six', with optional raising of final unstressed /e/ to [i]. Based on other Rumsen numerals, shown in (7), *hále-ʃák:en* 'six' appears to be a compound of *hále* + *ʃak:en*, where *hále* is a reduced form of *ʔimhala* 'one'. Under this analysis, suggested by Callaghan (1990:124), *hále-'is* 'five' is literally 'one hand'; in fact, in one of the earliest transcriptions of this word, *hali-izu* from the 1792 expedition of the Spanish schooners Sutil and Mexicana (Cutter 1990), the final etymological vowel from Proto-Costanoan *ʔis:u* 'hand' is recorded; the same vowel is also found in Rumsen *ʔis:un* 'to get to be five' (Miller 2000:485).

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[5] Recall that Soledad, the southernmost Costanoan language, is sometimes classified as a member of Northern Costanoan (e.g., Callaghan 1988 and Mithun 1999:535). With respect to the word for 'six', however, it patterns with other Southern Costanoan languages, having a form distinct from *ʃak:en*. On methods of reconstitution for poorly attested languages with specific reference to Rumsen, see Broadbent (1957).

[6] Merriam also writes what appears to be a variant form where ⟨*sah-ke*⟩ is inserted after the word ⟨*Hah'-lă-ēs*⟩.

(7) Rumsen numerals 1–3 and 5–8

No.	Original Transcription	Probable IPA	Source
1	*enjalá*	ʔimhala	1792 expedition in Cutter (1990)
1	*imhala*	ʔimhala	Pinart (1878) in Heizer (1952)
1	*im´-ha-la*	ʔimhala	Henshaw (1884) in Heizer (1955)
1	*Eem´-ᶜʰhah-Lah*[7]	ʔimxala	Merriam (1906; 1933)
1	*imxala*	ʔimxala	Kroeber (1910)
2	*ultis*	ʔuthis	1792 expedition in Cutter (1990)
2	*uthis*	ʔuthis	Pinart (1878) in Heizer (1952)
2	*u´-tĭs*	ʔut:is	Henshaw (1884) in Heizer (1955)
2	*Oo´-tis*	ʔut:is	Merriam (1906; 1933)
2	*utis*	ʔut:is	Kroeber (1910)
3	*kappes*	kap:es	1792 expedition in Cutter (1990)
3	*kappes*	kap:es	Pinart (1878) in Heizer (1952)
3	*kăp´-pis*	kap:is	Henshaw (1884) in Heizer (1955)
3	*kah´-pis*	kap:is	Merriam (1906; 1933)
3	*kapes*	kap:es	Kroeber (1910)
5	*hali-izu*	hali-ʔis:u	1792 expedition in Cutter (1990)
5	*xali-is*	haliʔis	Pinart (1878) in Heizer (1952)
5	*hăl-ĭ-is*	haliʔis	Henshaw (1884) in Heizer (1955)
5	*Hah-Lā´-is´*	kap:is	Merriam (1906; 1933)
5	*hale-is*	haleʔis	Kroeber (1910)
5	*hala'is:*	halaʔis:	Harrington notes
6	*hali-shakem*	hali-ʃak:en	1792 expedition in Cutter (1990)
6	*xali-šakken*	hali-ʃak:en	Pinart (1878) in Heizer (1952)
6	*hăl-ĭ-räk´-ĕn*	hali-ʃak:en	Henshaw (1884) in Heizer (1955)

[7] Merriam also writes variants of ⟨*Ē'm-kah´-lah*⟩, ⟨*Im´-hah-lah*⟩, ⟨*Im´-ᶜʰhah-Lah*⟩.

6	*Hahi-lā´ sah´-ke*[8]	hale-ʃake	Merriam (1906; 1933)
6	*hale-caken*	hale-ʃak:en	Kroeber (1910)
8 [sic]	*ultumai-shakem*	ʔuthu-mai-ʃak:en	1792 expedition in Cutter (1990)
7	*učumai-šakken*	ʔuthu-mai-ʃak:en	Pinart (1878) in Heizer (1952)
7	*u-tŭ-mai-säk´-ĕn*	ʔuthu-mai-ʃak:en	Henshaw (1884) in Heizer (1955)
7	*Oo-troo-mi-sah-ken*	ʔuthu-mai-ʃak:en	Merriam (1906; 1933)
7	*utxomai-caken*	ʔuthu-mai-ʃak:en	Kroeber (1910)
7 [sic]	*kapkamai-shakem*	kapxa-mai-ʃak:en	1792 expedition in Cutter (1990)
8	*kapxamai-šakken*	kapxa-mai-ʃak:en	Pinart (1878) in Heizer (1952)
8	*kap-pa-mai-säk´-ĕn*	kap:a-mai-ʃak:en	Henshaw (1884) in Heizer (1955)
8	*Kahp-hah-misah-ken*	kap:a-mai-ʃak:en	Merriam (1906; 1933)
8	*hapxa-is-cak(k)*	kapxa-ʔiʃ-ʃak(:)	Kroeber (1910)

While Callaghan (1990:129) maintains that the compound *hále-ʃák:en* 'six' must be interpreted as 'one unit of six', words for 'seven' and 'eight' show similar compounds with initial elements 'two' and 'three' respectively. The structure of Rumsen numerals 6, 7, and 8 then are parallel, with each of these compound numbers containing a first numeral 1, 2, 3 respectively, followed by the element *ʃak:en* (or in Kroeber's *kapha-'iʃ-ʃak*, a truncated form *ʃak*).[9] Whatever the original meaning of *ʃak:en* and its source, in Rumsen, the 6–7–8 count is only consistent with *ʃak:en* meaning 'five', 'all, whole', or 'the other hand' (with the first part of the compound indicating how many fingers there are on 'the other hand'), or something other than 'six', since combining 2 and 3 with 6 gives 8 and 9 respectively, not 7 and 8.

(8) 6–7–8 count in Rumsen and Soledad

	Rumsen	Soledad	
6	hale-ʃak:en	himmen-okʃi	1+x
7	ʔuthu-mai-ʃak:en	ʔuth-okʃi	2+x
8	kapha-mai-ʃak:en		3+x

The Rumsen 6–7–8 count is repeated in (8) and compared to Soledad, where 6–7 also appear to be compounds whose first elements are 1–2 respectively.

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[8] Merriam also writes what appears to be a variant form where ⟨*sah-ke*⟩ is inserted after the word ⟨*Hah´-lă-ēs*⟩.

[9] The meaning of *mai* in Rumsen words for 'seven' and 'eight' is unknown. Miller's (2000) "Partial Rumsen Dictionary" with over 600 pages of entries from Harrington's notes does not contain numerals six, seven, or eight, or any formative similar to *-mai*.

The shift in meaning from Proto-Northern-Costanoan *ʃak:en 'six' to Rumsen ʃak:en 'five', 'all, whole', or 'other hand' is consistent with *ʃak:en 'six' originally being limited to Northern Costanoan languages and then borrowed later into Rumsen with a different interpretation.[10]

Other Southern Costanoan languages do not show evidence of reflexes of *ʃak:en 'six'. Soledad himmenokʃi 'six' appears to have an initial element himmen 'one', parallel in form to the Rumsen word for six, while Mutsun nakitci 'six' looks like a shortened form of the longer Soledad word, without the initial two syllables.[11]

In sum, an apparent shift in meaning between Northern Costanoan *ʃak:en 'six' and Rumsen ʃak:en along with the limited distribution of ʃak:en in Southern Costanoan languages suggests that *ʃak:en 'six' was originally limited to Northern Costanoan languages and borrowed later into Rumsen.[12] On this basis, *ʃak:en 'six' is not reconstructed for Proto-Costanoan.

3.2. To Far Northern Yokuts. Three Far Northern Yokuts village or tribelet dialects, Tamukan, Tawichi and Yachik (or Chulamni), show evidence of borrowing from Plains Miwok for the numerals 7–10. In all three of these languages, the word for 'six' saken, ʃaken is also clearly borrowed. Beeler (1961a) assumes that this word for 'six' was borrowed from neighboring Costanoan languages, but given the Eastern Miwok source of 7–10, and the attestation of ʃaken in higher numerals in both Central Sierra Miwok and Northern Sierra Miwok noted above, it seems more plausible that numerals 6–10 all have an Eastern Miwok source. The northern Yokuts data are shown in (9) with Eastern Miwok forms for comparison, where NS, CS, and Pl stand for Northern Sierra, Central Sierra, and Plains respectively.

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[10] Victor Golla (personal communication, 2004) suggests that the Rumsen word for 'six' may be a calque on Esselen ⟨pek-walanai⟩, which, Kroeber (1904:61–62) notes, is the first numeral in the second round of what seems to be a strictly quinary system. The Rumsen numerals 1–10 lend themselves to the same analysis, with the exception of pak 'nine' which may be borrowed form Esselen pek 'one', signifying 'one less than the full count'. Golla further notes that this calquing is consistent with ʃak:en as a borrowing from Northern Costanoan. As a borrowing, it could easily be reinterpreted by Esselen-influenced Rumsen speakers as '(a numeral in) the second quinary round'. As argued in the text, if ʃak:en 'six; the end; completion of the first senary round' was inherited, its reinterpretation as a quinary element is harder to justify.

[11] Callaghan (1990:129) recognizes truncation in Soledad 'six' as well but segments the form as heme-noksi. Truncation may also relate Soledad ut-okʃi ? 'seven' with Mutsun taktʃi 'seven', where the Mutsun form has lost an initial syllable.

[12] The alternative, that *ʃak:en 'six' is Proto-Costanoan, involves an explanation for its loss in Karkin, its disappearance in Mutsun and Soledad, and its shift of meaning in Rumsen. Such an alternative cannot be excluded, but seems less likely than the analysis sketched here, especially in light of the Miwok higher numerals mentioned earlier and the Yokuts data discussed below.

(9) Words for 6–10 in Far Northern Yokuts dialects and in Eastern Miwok

	Tamukan (Curtin 1884)	Tawitchi (Curtin 1884)	Yachik (Kroeber 1959)	Eastern Miwok
6	*cäkĕ´n*	*sä´ken*	*cakén*	(earlier *ʃak:en*?)
7	*kidé*	*kínek*	*k'ine*	kenek:ak (NS, CS, Pl)
8	*káwinta*	*kawunta*	*kawünta*	kaw:inta- (NS, CS, Pl)
9	*wai*	*wâ´e*	*wo'é*	woʔe- (NS, CS, Pl)
10	*ékuke*	*ékuke*	*ékuke*	ʔek:uke- (Pl)

While it is possible that the word for 'six' was borrowed from Northern Costanoan into Yokuts, while words for 7–10 were borrowed from neighboring Plains Miwok, to the extent that patterns of numeral borrowing reflect ancient patterns of trade (Beeler 1961a), one might expect the entire 6–10 series to have the same source. This is possible under the current analysis, where *ʂak:en* 'six' is reconstructed for Proto-Eastern-Miwok.

4. Implications: Restricted numeral systems in north central California? If *ʃak:en* with the meaning 'six' cannot be reconstructed for Southern Costanoan, then it remains a unique item in Northern Costanoan, and the numeral system in (4) is reduced to numerals one, two, and three, as shown in (10), where *(h)imhen* is a likely Proto-Costanoan variant for 'one', based on identical variation reported for Chochenyo by J. P. Harrington.

(10) Revised Proto-Costanoan numerals

(10a) *(h)im:en, *(h)imhen   'one'
(10b) *ʔoʈhin   'two'
(10c) *kaphan   'three'

Restricted numeral systems like the Proto-Costanoan system in (10) are common in Australia (Dixon 1980: 107–8) but quite rare in other parts of the world. In Comrie's (2004) recent survey, there are no numeral systems reported outside of Australia with only numerals 1–3. Comrie (personal communication, 2004) is reluctant to rely on the fact that only lower numerals can be reconstructed to classify a numeral system as restricted. This is because of the many well known cases where all but the lowest numerals are either loans or recent creations, but where we know from independent information that the indigenous number system was once much richer. Comrie (2004) mentions, for example, Thai, where Chinese loans go down to 3, but where comparative Tai allows reconstruction of higher numerals.

In the case of Proto-Costanoan, is there any clear evidence that indigenous higher numerals did not exist? Can one counter the argument that these

higher Proto-Costanoan numerals were simply replaced by loans or more recent creations? In this case, an indirect argument exists. If higher Proto-Costanoan numerals existed, then it would be a striking coincidence that loans and innovations covered the numerals 4–10 in all languages, but in distinct ways.

In (11) noncognate forms for numerals 4–10 in the major Costanoan languages are illustrated. Original transcriptions have been rewritten in IPA symbols for the purposes of comparison. See Callaghan (1990) for remarks on possible etymologies for many of these terms.

(11) Numerals above 3 in major Costanoan languages

	Soledad	Rumsen	Mutsun	Chochenyo	Karkin
4	ʔuːt̪it	ʔuːt̪itim	ʔuːt̪it	katwaʃ	cathrahuas
5	parwas	haleʔis	parwes	miʃːur	missuru
6	ʔimin-ukʃa	hale-ʃakːen	nakitʃ, hinnaktʃi	ʃakːen	tanipos
7	ʔut-ukʃa	ʔut̪u-mai-ʃakːen	t̪akitʃi, utaktʃi	keneːtiʃ	kenetis
8	kaphaʔisʃak	kapha-mai-ʃakːen	tayitmin	ʔoʃaːtiʃ	othronacantumus
9	watso	pakke, pak	pakki, watsu	telːekiʃ	talan
10	matsoso	tant̪axt, tansah	tanat̪	ʼiwːeʃ	tagthreithris

None of these numerals is straightforwardly reconstructible for Proto-Costanoan, and 5–8 defy reconstruction within Southern Costanoan also. In addition, borrowing is evident in many cases. I have already discussed Proto-Northern-Costanoan *ʃakːen 'six'. As first noted by Kroeber (1910:249) number words for 7, 8, and 9 in Northern Costanoan show borrowing of stems for 1, 2, and 3 respectively from neighboring Miwok languages. This borrowing cannot be attributed to contact during the mission era, since it is already in evidence in the Northern Costanoan numerals found in Father Vicente Santa Maria's 1775 journal (Beeler 1972).

If numerals above 3 did exist in Proto-Costanoan, then it must be taken as coincidence that there were multiple instances of replacement of just these numerals. Unless some independent principle emerges that makes languages with higher numerals subject to replacement of all and only numerals above three, the most plausible hypothesis is that Proto-Costanoan had the restricted numeral system shown in (10).[13]

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[13] The most plausible alternative, and the only one which can account for the Thai facts noted earlier, is that numeral replacement correlates with frequency: numerals with lower token frequencies are more likely to be replaced via borrowing than those with higher frequencies. In Utian, it is the recurrent and apparently independent replacement of numerals above three in distinct subgroups which needs to be explained. Perhaps these higher numerals were of such low frequency that they were not always transmitted from one generation to the next. Then the question is how low frequencies must go before one refers to the system as a "restricted numeral system."

If this is the case, is it consistent with what we know of Proto-Miwok? The answer is a resounding yes. In Callaghan's detailed study of Miwok numerals, she concludes that "only the numerals for 'one', 'two', and 'three' can be reconstructed with certainty for Proto-Miwok" (Callaghan 1994:174). Given this, Proto-Utian itself may have had a restricted numeral system, with numerals for 'one', 'two', and 'three' only.

It could be that restricted numerals systems of the Proto-Costanoan type have always been "at risk" when in contact with nonrestricted systems (Comrie 2004). If this is the case, then the identification of restricted numeral systems like that reconstructed for Proto-Costanoan in (10) may provide one small piece of evidence for long-term isolation pre-dating borrowing and innovation of higher numerals.

In this study, I have tried to relate the meaning and distribution of the numeral formative *şak:en* in Eastern Miwok higher numerals, Northern Costanoan and Far Northern Yokuts 'six', and Rumsen 'six', 'seven', and 'eight'. The only language in which a plausible etymology for this term can be found is Eastern Miwok, and this is precisely where the word can be associated with a senary count (in 'twelve' and 'eighteen') or with the end of the count (in Northern Sierra Miwok 'eleven' and Central Sierra Miwok 'thirteen'). While the evidence on which this analysis rests is slight, and open to alternative interpretations, it is the only one which relates these disparate facts. This study also offers a novel explanation for the striking finding that only the numerals 'one', 'two', and 'three' can be reliably reconstructed for Proto-Miwok and Proto-Costanoan, the two major branches of Utian.

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APPENDIX A
Eastern Miwok Numerals

	"AMADOR" Dixon and Kroeber (1907)	"TUOLUMNE"	N. SIERRA Callaghan (1987)	C. SIERRA Freeland and Broadbent (1960)	S. SIERRA Broadbent (1964)	PLAINS Callaghan (1984)	BAY Arroyo (1821)
1	luti	keñe	luti:i-	kéŋe-	keŋe-	ken:aty-, **-sak**	luthri
2	otiko	otiko	ʔoṭi:ko-	ʔoṭí-ko-	ʔoṭi:-	ʔo:joko-	ohuothro
3	tolokocu	tolokocu	tolo:kos-u-	toló:koʃu-	tolo:koṭ-	tel:ok:o-	tolocothro
4	oyisa	oyisa	ʔoji:s:a-	ʔój:is:a-	ʔojis:a-	ʔojsek:o-	oisa
5	macoka	macoka	mas:ok:a-	máʃ:ok:a-	mah:ok:a-	kas:ok:o-	supa
6	temoka	temoka	tem:ok:a-	tém:ok:a-	tem:ok:a-	teme:pu-	jesmuhi
7	kenekaku	kenekaku	kenek:ak-y-	kenék:aky-	keŋék:ak	kenek:ak	keneheke
8	kawinta	kawinta	kaw:inta-	káw:inta-	kaw:inta-	kaw:inta-	osocasi
9	wo'e	woe	wo?e-	wo?é-	ʔel:iwa-	wo?e-	telekaka
10	naatca	naatca	na?a:tʃa-	na?a:tʃa-	na?a:tʃa-	ʔek:uke-	usiusius
11	**lu-cakena**	keñ-hateaku	**lus:ak:e:nu-**	képʰeṭija:ky-	na?a:tʃa? keŋe? ?yni?	kentopa-	
12	**otik-cakena**	**otik-sakenu**	**?oṭiksake:n-y-, ?oṭiksake:nu-**	**?oṭiksake:ny-**	na?a:tʃa? ?oṭi? ?yni?	?ojkop:a-	
13	toloti-aku	**tolok-sakenu**	toloķteja:ky-	na?á:tʃa? toló:koʃu? hej:?	na?a:tʃa? tolo:koṭ ?yni?		
14	kolok-aku	kolok-aku	kolo:kak-y-, kolo:kos-u-	na?á:tʃa? ?ój:is:a? hej:?	na?a:tʃa? ?oṭi? ?yni?		
15	yuali			ju?ali-			
16	oy-ota	oyoto					
17	otiko-maiazo	naatch mu kenekaku					
18	**tak-cakena**	naatca mu kawinta					
19	minimi	naatca mu woe					
20	naa	naa	na?:a-	na?:a-	na?:a-		
21	naa-ima luti	naa-mu keñe		na?:a:? kéŋ:e? hej:?	?oṭi:-jak na?a:tʃa? na?:a-		
30	naa tomeakii Naatcai	naa mu naatca		na?:a? na?á:tʃa? hej:?	tokojak na?a:tʃa? na?a:tʃa?		
60	tolok-momo, tolok-muyu	tolok mumu		tolokmumu-	tem:ojak na?a:tʃa? na?a:tʃa?		