OSU Working Papers in Linguistics 52, 63-75

Ringe Revisited: Comments on Ringe's Probabilistic Comparison Method*

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0. Introduction

Ringe (1992) seeks to design a "completely objective criterion of proof" (p. 80) for eliminating the "factor of chance" in investigating possible genetic relationships between languages. The method is presented as a *necessary* starting point in language comparison: "It is urgently necessary to subject all controversial 'demonstrations' of language relationship to investigation by the probabilistic method , so as to prove the truth of those claims or show that they are beyond objective proof." (p. 81) Ringe clearly states that it is only worthwhile to apply the traditional comparative method if the probabilistic method yields a positive result. Of a comparison of English and Latin, Ringe states:

> [t]o be sure, the probabilistic method does demonstrate that English and Latin are related, and such a demonstration *is necessary* before we can embark on further meaningful comparative work. (emphasis added) (p. 47)

A negative result, by contrast, signals that any relationship between two languages is not demonstrable and that therefore no further comparison should be attempted. Ringe is motivated by the claims of Nostraticists and Proto-World linguists who argue for the provability of long-distance relationships among language families or indeed among all spoken human languages. These linguists challenge the view of traditionalists who argue

* This paper is the result of combining and refining two individually written manuscripts on this topic. We wish to thank Brian Joseph for inviting us to contribute to this volume, which is what prompted us to pool our previous work. We also thank Keith Johnson for useful discussion of statistical issues. Any errors are, of course, our own.

that even if all (spoken) human languages do share a common ancestor, such far-flung relationships cannot be proven because evidence of relatedness has been obliterated by time. Ringe's stated goal is "to provide an objective test of the validity of such challenges" (p. 1). He argues that proponents of the provability of long-distance relationships have failed to adequately discount the possibility that sound correspondences used as evidence for a genetic relationship are actually chance resemblances.

In this paper, we summarize several of the language comparisons that have been conducted using Ringe's method, including the comparisons in Ringe's original paper, those reported in Baxter and Manaster Ramer's (1996) review article, and a number of comparisons that we have done ourselves. We make two primary criticisms of the Ringe method. First, the method yields results whose interpretation is not clear. Second and more importantly, the distance of relationship between two languages has little bearing on the strength of the result returned by Ringe's test.

1 Outline of the method

1.1 Compilation of a Swadesh list

Ringe compares the phonological similarity of words from two languages that share a common meaning. In designing a list of words, one must eliminate words whose phonological shape is non-arbitrary — nursery words and onomatopoetic words. Words that are not inherited but borrowed from another language are also excluded. Ringe stresses the importance of not admitting words of related but non-identical meanings into a comparison (contra the practices of Nostraticists and Proto-World linguists). To reduce the possibility of including borrowings, Ringe uses Swadesh lists[1] of 100 and 200 basic meanings, reasoning that this basic vocabulary is less likely to be borrowed.

1.2 Applying the method

Use Swadesh lists for two languages to conduct pairwise comparisons of corresponding forms (i.e., words sharing the same meaning) in two languages. This process is illustrated below with a comparison of English and Hawaiian.

Step 1: Choose a word position to examine. We examine here segments occurring in word-initial position.

Step 2: For each language, calculate the probability that a word from the Swadesh list (not from a larger sample of the language's vocabulary) will have a given segment in that position. The English Swadesh list (see Appendix) has 17 possible initial consonants (counting Ø as a consonant for vowel-initial words). For each of the 17 consonants, the number of times that consonant appears in word-initial position must be tabulated. For example, the phoneme /h/ appears in initial position 8 times in the English Swadesh list. To obtain the probability of initial /h/, 8 is divided by the number of words in the list, in

[1] A list of core vocabulary presumed to be resistant to borrowing, named for Morris Swadesh.

this case 100. The resulting number, here 0.08 or 8%, is the probability that the given consonant will appear by chance in the chosen position.

Step 3: Calculate the probability of all possible correspondences between phonemes in the two languages in the chosen position. Since the English list has 17 possible initial consonants and the Hawaiian list has 9, the probabilites for the 153 (i.e., 17 x 9) correspondences have been calculated, and are shown in Table 1.

Table 1: Expected number of matches for English-Hawaiian initial phonemes

		Haw								
		p	k	m	n	h	w	l	ʔ	Ø
Eng	Ø	.64	.64	1.04	.4	.64	.48	.88	1.92	1.2
	b	.8	.8	1.3	.5	.8	.6	1.1	2.4	1.5
	d	.24	.24	.39	.15	.24	.18	.33	.72	.45
	f	.64	.64	1.04	.4	.64	.48	.88	1.92	1.2
	g	.24	.24	.39	.15	.24	.18	.33	.72	.45
	h	.64	.64	1.04	.4	.64	.48	.88	1.92	1.2
	k	.4	.4	.65	.25	.4	.3	.55	1.2	.75
	l	.4	.4	.65	.25	.4	.3	.55	1.2	.75
	m	.4	.4	.65	.25	.4	.3	.55	1.2	.75
	n	.64	.64	1.04	.4	.64	.48	.88	1.92	1.2
	p	.08	.08	.13	.05	.08	.06	.11	.24	.15
	r	.48	.48	.78	.3	.48	.36	.66	1.44	.9
	s	1.12	1.12	1.82	.7	1.12	.84	1.54	3.36	2.1
	θ	.64	.64	1.04	.4	.64	.48	.88	1.92	1.2
	ð	.16	.16	.26	.1	.16	.12	.22	.48	.3
	w	.56	.56	.91	.35	.56	.42	.77	1.68	1.05
	y	.64	.64	1.04	.4	.64	.48	.88	1.92	1.2

Selecting one example out of these 153, consider the probability for a correspondence between English initial /h/ and Hawaiian initial /l/. The probability for initial /h/ in English is 0.08; the probability for initial /l/ in Hawaiian is 0.11. The probability that for a given meaning the English word will have initial /h/ and the Hawaiian word will have initial /l/ is the product of these two probabilities (0.08 x 0.11 = 0.0088) or 0.88%. To obtain the number of expected matchings, this probability is multiplied by the number of words on the list. Our list has 100 words, so about one match is to be expected by chance alone (0.0088 x 100 = 0.88).

Step 4: Count the actual number of correspondences for every combination of phonemes. Results are shown in Table 2 (boldfaced and underlined entries will be discussed shortly). As it happens, there are three instances of English initial /h/ corresponding to Hawaiian initial /l/: hair [of head]/lauoho, hand/lima, hear/lohe.

Table 2: Actual number of matches for English-Hawaiian initial phonemes.

		Haw								
		p	k	m	n	h	w	l	?	Ø
Eng	Ø	1	0	1	0	1	0	2	1	**8**
	b	0	1	1	**2**	0	0	0	4	2
	d	0	0	**2**	0	0	0	0	0	1
	f	1	0	1	0	1	1	1	1	2
	g	0	0	1	0	1	0	0	1	0
	h	2	1	0	0	0	**2**	**3**	0	0
	k	1	0	1	0	1	0	0	0	2
	l	0	0	1	0	0	0	2	1	1
	m	0	1	2	1	0	1	0	0	0
	n	1	1	0	0	1	0	0	3	2
	p	0	0	0	0	0	0	0	0	**1**
	r	**2**	1	0	0	0	0	0	1	2
	s	1	1	1	1	1	0	1	5	3
	T	0	0	0	1	1	0	2	0	1
	D	0	**2**	0	0	0	0	0	0	0
	w	0	1	1	0	1	**2**	0	1	1
	Y	0	0	1	0	0	0	0	1	0

Step 5: For each phoneme correspondence, check using the binomial distribution to see whether the observed number of matches could be expected to occur by chance. Ringe includes only matches whose number of occurrences is in the 99th percentile. That is, if there is less than a one in 100 chance that the observed number of correspondences could occur by chance ($p < 0.01$), the match is included. Binomial distributions can be calculated using published charts or statistical software packages. Ringe gives a number of binomial distribution charts. A sample of binomial distribution charts (from Ringe) is given in Table 3.

Table 3: Sample binomial distribution chart

p <0.0088	
Number of matches (out of 100 word pairs)	percentile
5	0.99972680
4	0.99801103
3	0.98794550
2	0.94119314
1	0.77998859

For example, the probability of there being a match between English /h/ and Hawaiian /l/ by chance is 0.0088. The actual number of matches is 3. The chart shows that there is therefore a 99% chance (0.98794550, rounded to two significant digits) that these three matches did not occur by chance alone. This set of matches meets Ringe's standard.

Step 6: Count the number of matchings that meet the 99th percentile criterion. For convenience, we will follow Baxter and Manaster Ramer (1996) in referring to this number as M. In addition to the /h/:/l/ matches in the English/Hawaiian comparison, there are 8 other matches that meet the 99th percentile criterion: /r/:/p/, /ð/:/k/, /d/:/m/, /b/:/n/, /h/:/w/, /w/:/w/. /Ø/:/Ø/, /p/:/Ø/. These are indicated in Table 2 above, underlined and in boldface type.

Step 7: Repeat Steps 1 - 6 using a different word position. Ringe does not specify a minimum number of positions to examine before drawing a conclusion.

Step 8: Draw a conclusion based on the results.

2 Evaluation of the method

2.1 How "high" numbers are interpreted

Using this simple procedure, we compute one number for each word position in each two-language comparison. Ringe, however, gives us no real criteria for interpreting these numbers, and does not indicate how many word positions must be examined before a conclusion is drawn. We therefore closely examine the conclusions Ringe draws from his own comparisons.

Ringe starts with a comparison of two closely related languages, Standard American English and Standard High German. The results of a comparison of a single word position are enough to convince him the two are related: "... there are sixteen [initial position matches that meet the 99th percentile criterion]. That alone would be enough to demonstrate beyond a reasonable doubt that English and German are related languages." (p.23) Although he draws the conclusion that the two languages are related from the comparison of a single word position, Ringe does go on to apply the method to several other word positions, noting that the results provide overwhelming support for his initial conclusion. "The probabilistic method of investigation employed here clearly provides massive evidence of the close relationship between English and German."(p. 35).

In a comparison of English and Latin, languages whose relationship is more distant, but also well documented, Ringe finds seven word-initial consonant matches that meet the 99th percentile criterion. He remarks "[t]hat is far fewer than in the case of English and German, and it shows that English and Latin are not nearly so closely related." (p.42) The interpretation of this statement is not clear. Ringe may mean that the finding of seven word-initial consonant matches indicates that English and Latin are definitely related or he may mean that if English and Latin are related, they must be less closely related than English and German. He also examines matchings between second-position consonants, concluding "[t]he numbers found look absolutely random, except for [one matching]." A comparison of first-syllable vowels finds no matches meeting the 99% percentile. A comparison of consonants immediately following first-syllable vowels

finds two matches meeting the 99% percentile, English /r/: Latin /r/ (six word pairs) and English /t/: Latin /d/ (six word pairs). Ringe notes that "the lexical correlation of matchings is not impressive" since only seven word pairs have significant matches for more than one word position. He nevertheless concludes "[t]o be sure, the probabilistic method does demonstrate that English and Latin are related, and such a demonstration is necessary before we can embark on further meaningful comparative work." (p. 47) He notes that while the mathematical method finds the English:Latin matching *t:d* to be significant only for the position immediately after the first vowel, the comparative method reveals that correspondence exists word-intially (as in *two: duo*) and postconsonantally (as in *heart: cord-*). Ringe seems to offer this as an example of how the probabilistic method offers a starting point to the comparative method, stating "this case, then, also demonstrates that the probabilistic and comparative methods complement each other, each contributing something of value" (p. 47).

To summarize, Ringe's treats the discovery of sixteen matches reaching the 99th percentile criterion in a one-position comparison of English:German as evidence "beyond a reasonable doubt" that the two languages are related. Although the probabilistic method finds for the English and Latin comparison only seven matches reaching the 99th percentile criterion for one position and two matches reaching the criterion for another position (with only nine word pairs with two matchings reaching the 99th percentile), Ringe concludes that the method proves that the two languages are related. If a comparison of two other languages yields similar results, we should therefore be able to conclude that those two languages are related.

We do in fact find results that may be comparable to those found in the English:Latin comparison. Recall that a comparison of English and Hawaiian, two languages generally believed not to be related, yielded nine word-initial matches reaching the 99th percentile criterion: /Ø/:/Ø/ (eight word pairs); /h/:/l/ (three word pairs); /r/:/p/, /ð/:/k/, /d/:/m/, /b/:/n/, /h/:/w/, /w/:/w/ (two word pairs each), and /p/:/Ø/ (one word pair). The number of matches is eight if we follow Ringe in excluding the /p/:/Ø/ match since it occurs in only one word pair. In another comparison of two languages not known to be related, Ringe examined English and Navajo initial consonants, vowels, and non-initial consonants, finding no matchings and concluding: "[t]hus the probabilistic method asserts unequivocally that English and Navajo are not demonstrably related. The comparative method concurs" (p. 54). In fact, our own computations show that there are 9 English: Navajo word-initial matches that meet Ringe's criteria (in the 99th percentile, match is found in more than a single word pair). These matches are /t/:/c/, /h/:/d/ (three word pairs each); /d/:/c/, /Ø/:/ɬ/, /f/:/t'/, /k/:/k'/, /b/:/b/, /Ø/:/y/, /s/:/s/ (two word pairs each). When we consider first syllable vowels, we find 4 matches meeting Ringe's criteria, namely /e/:/i/, /ɔ/:/á/, /ɔ/:/áá/, /u/:/oo/. There are also 17 other matches which meet the 99th percentile criterion, but are found only in single word pairs ("single matches") and so would be discarded by Ringe. A comparison of consonants occurring immediately after the first vocalic nucleus yielded one match (/n/:/ɬ/) which meets Ringe's criterion. In addition there are 15 single matchings which meet the 99th percentile criterion. If we exclude single matches, there is no English:Navajo word pair

which contains criteria-reaching matches in more than one word position. The results of the English:Navajo comparison seem similar to those of the English:Latin comparison.

	word-initial consonant	vowel of first syllable (V1)	consonant following V1	word pairs with >1 significant match
English/Latin	7	0	2	7
English/Navajo	9	4	1	0

What conclusion are we to draw from these results? Ringe's interpretation of the English:Latin comparison suggests that we might conclude from the results of these two comparisons that English and Hawaiian are related and that English and Navajo are related, and that it is therefore worthwhile to apply the comparative method to explore the details of their relationship.

2.2 How "low" numbers are interpreted

Even if the method sometimes yields "high" numbers which cannot be reliably interpreted as proof of a language relationship, it might be worthwhile to apply the method if it consistently yielded "low" numbers *only* in comparisons of two unrelated languages. Unfortunately, as Baxter and Manaster Ramer point out, comparisons of demonstrably related languages sometimes yield numbers between zero and two.

Comparisons of two languages not known to be related do often yield lower numbers than do comparisons between two languages whose relationship is well-established. Ringe compares English and Turkish, two languages not generally believed to be related. He finds two initial consonant matchings (English /b/: Turkish /k/ and English /j/: Turkish /s/) that meet the 99% percentile.[2] He examines the eight word pairs involved in these matchings, using what we know about the history of the two languages, and concludes that there is no historical relationship between the pairs of words. That result, combined with the absence of matchings in comparisons of first syllable vowels and consonants immediately following the first syllable vowel, leads Ringe to conclude that English and Turkish are not demonstrably related. Remarking on the fact that two, rather than zero, word-initial matches reaching the 99th percentile criterion were found, Ringe writes "...two numbers of matchings in the 99th percentile of their expected ranges will not be remarkably high. It follows that two 99th-percentile numbers of matchings for a single phonotactic position in a single list-comparison *must not* be taken as evidence for linguistic relationship without further investigation. Random chance does not present us with such cases very often, but it does so occasionally" (p. 51, emphasis in the original). Ringe seems to be cautioning us that we do not necessarily need to obtain a result of zero for every comparison in order to conclude that two languages are not demonstrably related. Indeed, Baxter and Manaster Ramer's (1996) comparison of word-initial

[2] In fact, according to our calculations, there are two other matches, English /s/: Turkish /k/ and English /t/: Turkish /d/, that meet the 99th percentile criterion when rounded to two significant digits. These two matches bring the total number of word-initial consonant matches to four. It is unclear how this number would be interpreted.

consonant matches in a Dutch and Hebrew, two languages not generally believed to be demonstrably related, yielded a result of two.

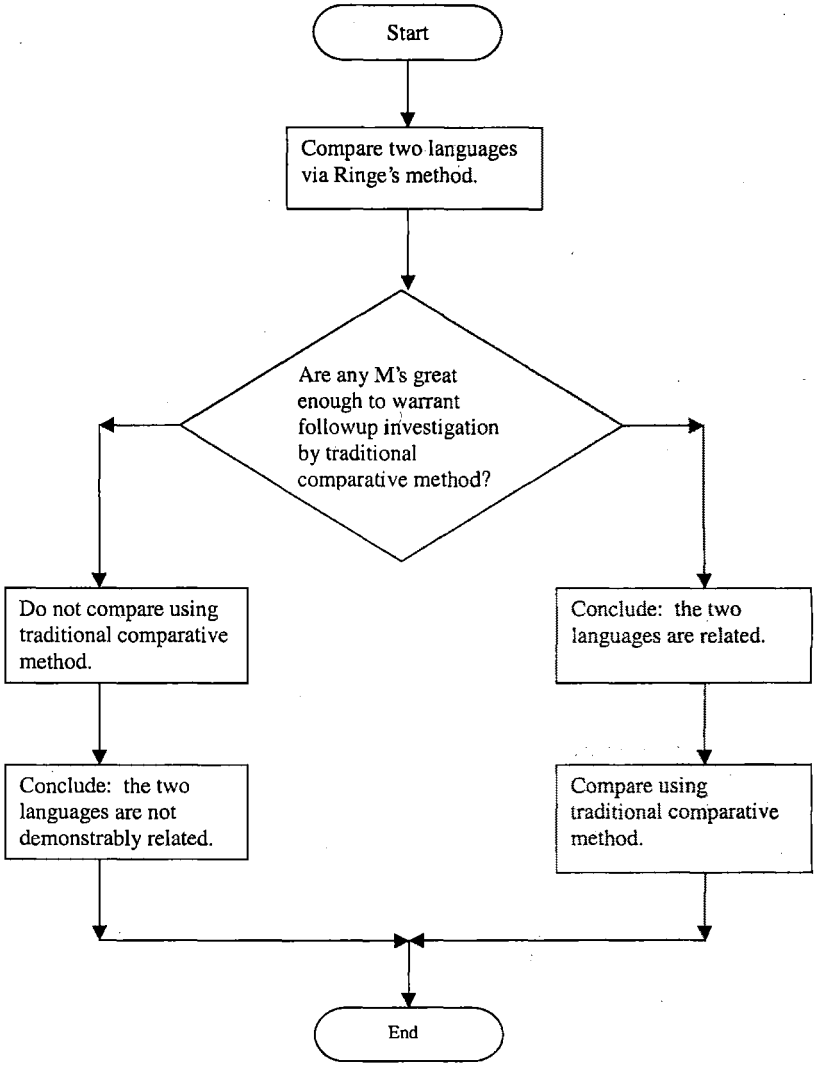
The same low numbers are found, however, in comparisons of languages known to be demonstrably related. Baxter and Manaster Ramer (1996) found no matches meeting the 99% percentile criterion in their comparison of initial consonants in Modern Hebrew and Hausa, two Afro-Asiatic languages, and only one such match in a comparison of Albanian and Welsh, two Indo-European languages. Baxter and Manaster Ramer observe that "[s]uch a situation illustrates the crucial mathematical problem with Ringe's method: though he wishes to use the statistic M to determine whether observed similarities are significantly greater than expected by chance, he does not give any method of determining how likely a particular value of M is to occur by chance, either in general or in any specific comparison. Without this information, there can be no test of the significance of any particular result..." (p. 377).

3 Conclusion

The following flowchart illustrates, to the best of our understanding, Ringe's proposal for the interaction of the comparative method and his probabilistic method. The method is presented as a litmus test — if the method yields a positive result, investigation by the comparative method is warranted; if the method yields a negative result, the conclusion is drawn that two languages being compared are not demonstrably related and the investigation stops before the comparative method is applied.

Our criticisms begin at the decision diamond, with the question, "Are any matches meeting the 99th percentile criterion great enough to warrant followup investigation by the traditional comparative method?" It is unclear what it means to answer 'yes' to this question. How many matches are enough? How many word positions must be examined? The finding of 16 matches for word-initial consonants led Ringe to conclude that English and German are related "beyond a reasonable doubt" (p. 23). For the English:Latin comparison, however, it took 7 word-initial matches and three additional matches at other positions to determine that the two languages were related. If the mathematical method does not clearly indicate whether we can draw similar conclusions of relatedness in comparisons like English:Hawaiian and English:Navajo, then what is its value?

According to Ringe, if we decide that a mathematical comparison of two languages has been successful and choose "yes" at this point in the chart, we can claim to have proved a relationship and should follow up with the comparative method to learn more details of the relationship. If we decide that the comparison has failed and choose "no" at this point in the chart, we conclude that the two languages are unrelated and end the investigation, thus saving valuable time which might otherwise have been spent on exploring dead ends. After all, if the comparative method is to be invoked whether the answer is yes or no, Ringe's method would offer little if any benefit. We have seen, however, in Baxter and Manaster Ramer's Hebrew:Hausa and Albanian:Welsh


Start
Compare two languages via Ringe's method.
Are any M's great enough to warrant followup investigation by traditional comparative method?
Do not compare using traditional comparative method.
Conclude: the two languages are not demonstrably related.
Conclude: the two languages are related.
Compare using traditional comparative method.
End

comparisons, instances where two languages which are demonstrably related by the comparative method yield low numbers when submitted to Ringe's mathematical method.

In addition, the mathematical method does not always yield the neat continuum with high scores for most closely related languages, medium scores for more distantly related languages, and low scores for unrelated languages that Ringe found in his German:English, Latin: English, and Navajo:English/Turkish:English comparisons. This pattern failed to hold in our comparison of word-intial matches between Ojibwa and its close relative Cree (7 matches: n:n, g:k/k^h, m:m/m^h, w:w, z̨:w, b:p^h, d:t/t^h), Ojibwa and the more distant Arapaho (5 matches: n:n, m:b, b:č, d:t, š:s), and Ojibwa and the quite distant Yurok (9 matches: g:k, w:t, k:w, z:t, Ø:w, m:r, d:s, k:m).

While a simple mathematical model to determine the likelihood of genetic relationships among languages would be a powerful tool, Ringe (1992) does not supply us with such a tool. If both demonstrably related pairs of languages and languages whose relationship to each other is not known receive low values, then it is clear that a low value indicates nothing about the relatedness of two languages. As Baxter and Ramer note, particularly high values may indeed indicate that two languages are closely related. This may not be particularly helpful though, since it may be also be the case that the relationship between two languages whose comparison yields a "high" value (such as English and German) is likely to already be known. Comparison of two languages which have, at best, a very distant relationship, are likely to produce low values from which no reliable conclusions can be made.

Ringe recognizes the importance of the rigorous application of the comparative method, and offers his probabilistic method as a complement to the comparative method. He asserts that the application of the probabilistic method can, indeed *must*, be used as a first step to determine whether an investigation using the comparative method is merited, stating "[a] probabilistic demonstration of language relationship (either by adherence to traditional guidelines or by explicit calculation) *is always necessary*, but the comparative method enables us to arrive at trustworthy results that do not proceed directly from probabilistic work" (emphasis added, p. 40). Since the results of Ringe's methods are not consistently interpretable at best and misleading at worst (in the case of the "discovery" of a non-relationship between Albanian and Welsh, for example) we must, however, reject the validity of Ringe's method, even as a first step.

Appendix: Swadesh lists

	English	Hawaiian	Ojibwa	Cree	Arapaho	Yurok
1	all (pl)	apau	gkınə	kʰəkiy-	he:yow	ču
2	ashes	lehu	bgwɪ	pʰɪku-	če?iθe:	pontet
3	bark	?ili	nəgɛk	wəyəkesko	nó o:x	-ɻkʷeč
4	belly	?oopuu	məsəd	mətəy	nót	-yah
5	big	nui	gčɪ	mɪsɪkɪt-	be	peloy-
6	bird	manu	bnɛši	piyesɪw	ni:?ehi	č'uč'is
7	bite	nahu	dkuɲɛd	makʰwə-	tó:yo-	čeykum
8	black	?ele?ele	mkədɛ	kəskɪt-	wo:?te:	lo?ogey-
9	blood	koko	mskwɪ	mʰiko	be?	pekoyek
10	bone	iwi	kənɛ	oskən	hix	wɻkɻ?
11	breast(s)	uu	dodoš	toˈtos	θen	newon
12	burn [intr]	?aa	zkɪdɛg	pəsɪ-	nonò:té:?	lo?op
13	claw	miki?ao	škəž	skəsi	?ox	welketeg
14	cloud	ao	ankud	wəsko	hí:no:nó?et	leptenok
15	cold	anu	dkaba	tʰəkis-	to:yò:	sa:won
16	come	hele mai	ɪtɪyad	ɪtot-	héič-	nes-
17	die	make lao	nbud	nɪp-	če:tó?o-	kmoyl-
18	dog	?	nɪm	ətɪm	heθ	čišah
19	drink	inu	mnɪkwɛd	mɪnʰikwewɪn	bé:ne-	rekʷoh
20	dry	malo?o	batɛg	pʰako-	henítxoˈ	če?loy-
21	ear	pepeiao	təwəg	towəki	notono	čpega?r
22	earth	lepo	žəškɪ	əsɪski	bí:to?owu?	łkeł
23	eat	?ai	wisnɪd	mičɪ-	biθih-	nep-
24	egg	hua	wawən	wawi	nom	wɻył
25	eye	maka	škižɪg	kisɪk	si:se?	-lin
26	fat [nn]	momona	winən	pɪmi	ni:nen	pemey
27	feather	hulu	migo	opiwəy	bi:i	rego?
28	fire	ahi	škudɛ	ɪskut-	síte:	meč
29	fish	i?a	gigo	kɪnuseo	neb	nepe?wis
30	flesh	?i?o	wiyas	wiyas	θebéx	tewon
31	fly [vb]	lele	bmɪbdɛg	pɪmiy-	čebíh?ohú-	la:yol
32	foot	waawae	zɪd	sɪt	?o:θ	čkah
33	full	piha	mošknɛg	sakəskɪn	heni:	kohčewe
34	give	haa?awi	migwɛd	mek-	bi:n-	čin-
35	good	maika?i	nbwakad	miyo	hi:θéih-	skuyep-
36	green	?ooma?oma?o	žawškuzɪd	əskɪtəko-	če:né:te:	wɻh-
37	hair [of head]	lauoho	ninzɪs	stəkəy	θe?e:	leptoy
38	hand	lima	nɪnǰ	čʰiči	čét	čewes
39	head	po?o	ndɪb	tɪkwan	kuhú?e	mołkʷohł
40	hear	lohe	nodəŋ	pʰətow-	ní:tone-	ko?m-
41	heart	puʔuwai	dɛ	teh	te:	čekʷs

42	horn	kiwi	dɛškən	eskən	niːnis	sʔečph
43	hot	wela	gžizʊd	kɪsi-	woté?	taʔanoy-
44	human	?	nɪšna	inɪnɪw	?	ʔoːl
45	I	au	nin	niyə	ninoː	nek
46	kill	pepehi a make	nšɪwɛd	nɪpeh-	noh-	sr̥mr̥t
47	knee	kuli	ŋgɔdɔg	čikwən	čeʔiteyéî	ʔr̥kr̥ɬ
48	know	ʔike	gkɛdəŋ	kɪskeyim-	heːʔino-	kom-
49	leaf	lau	nibiš	niːpi	biːčiːs	kaːp'
50	lie	moe	ggiwɪd	pɪmɪ-	séʔis-	kmoyɬ
51	liver	ake	kʊn	oskun	his	wr̥lkun
52	long	loa	gnag	kɪnos-	heːyoːʔ	noʔom-
53	louse	ʔuku	kǒjis	hɪkwe	tei	mohkoh
54	man	kane	nɪnɪ	napeo	hinen	pegrk
55	many	nui	nibwə	mičat	?	ten-
56	moon	mahina	gizɪs	-pisɪm	biːkóusíːs	wonewsleg
57	mountain	mauna	kʊsǰɪgən	wəči-	hóheʔ	mr̥kʷr̥ɬ
58	mouth	waha	do	tun	tiː	luɬ
59	name	inoa	nazwɪn	ɪssinɪka-	niːsihʔíːt	hew
60	neck	ʔaaʔii	kwɛgən	kwəyaw	sonon	pahtun
61	new	hou	škɪ	oski-	wonoːnéíh-	ča?anar
62	night	poo	dbɪk-	tɪpɪsk-	téče?	nahsčewen
63	nose	ihu	ǰaž	kut	iʔis	hrpr̥ʔn
64	not	ʔaʔole	ga	nəmə	hoːwûːní	mos
65	one	ʔekaahi	bežɪg	peyək	čeːsey	koh-
66	path	ala	miknas	meskənaw	bóo	laːyekʷ
67	rain [nn]	ua	zɪg	kɪmiwən	oˈsó	ten-
68	red	ʔula	msku-	mʰiko-	beːé	pr̥kry-
69	root	aʔa	ǰibɪk	očepɪk	θeičiʔ	wr̥ʔlpitr̥k
70	round	poepoe	wawyɛ	wawiye-	čeːteyóːʔ	yr̥hpr̥h
71	sand	one	nɛgəw	yekaw	nèʔí	čaɬ
72	say	ʔoolelo	kɪdʊd	əyəm-	nihí-	nahč-
73	see	ʔike	wabɪd	wapəm-	nonoːho-	new-
74	seed	ʔanoʔano	mika	kɪstɪkan-	θòːxúː	hoːleɬ
75	sit	noho	nmədbɪd	əp-	čenók-	ček-
76	skin	ʔili	nəgʔəy	əsəkəy	nóx	wrskun
77	sleep	moe	nbad	nɪp-	noːkohu-	čkey
78	small	iki	bbiwag	əpɪsis-	čes-	čeyk-
79	smoke	uahi	bkwenɛ	pʰəst-	čèːtèː	meraː
80	stand	ku	nanibwɪd	nːpow-	θíʔoːkuː	koːʔ-
81	star	hookuu	nəŋ	ecəkus	hóθoʔ	hogeč
82	stone	poohaku	si	əsɪnni	hoʔnóːke-	haʔaːg
83	sun	laa	gɪzɪs	-pisɪm	hiːsíːs	kečoyn hegoː
84	swim	ʔau	bgɪzʊd	pɪmatək-	wóuwú-	kepoyur
85	tail	huelo	zow	mɪsoəy	tíhi	wrlry

86	that (nt.)	keelaa	ow	owə	núhu?	wek
87	this (nt.)	keeia	iw	ənə	híneˈ	wek
88	tongue	alelo	dɛnniw	teyəni	iθon	hipɬ
89	tooth	niho	ibɪd	pɪt	ičiθ	ɾpeɬ
90	tree	laa?au	mtɪg	hatɪk	hoho:t	tepo:
91	two	lua	níž	ni:su	ni:s	na?-
92	walk	hele waawae	sɛd	pɪmʰot-	čebis-	heg-
93	water	wai	nbɪ	nɪpi	neč	pa?ah
94	we	maakou	ninwɪ	kiyan-	no?	nekɑh
95	what	aha	wagʷnɛn	kekwan	hitóu	ti?n
96	white	ke?oke?o	wab	wap-	nóno:k	munče-
97	who	wai	wɛnɛ	owenə	héne:?	ti?now
98	woman	wahine	kwe	ɪskweo	hisei	wenčokʷs
99	yellow	melemele	zaw	osaw-	ní:ho:	ti?npel-
100	you (sg.)	?oe	gin	kiyə	nin	ke?l

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