Ann. Rev. Anthropol. 1981. 10:253–73
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ATHAPASKAN LINGUISTICS: PROTO-ATHAPASKAN PHONOLOGY

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INTRODUCTION

A century has passed since the publication of the first Athapaskan[1] dictionary by Father Petitot (28) and the first Athapaskan grammar by Father Legoff (24). During this period, Athapaskan linguistics has made a steady progress with the increasing participation of able linguists, particularly Dene linguists who are playing more and more active roles in all aspects of linguistic study.

Edward Sapir, who is rightly considered the founder of Athapaskan linguistics, dominated the scene during the early decades of this century. The wealth of his field material and his ideas discussed in classrooms and personal correspondence are yet to be fully assessed and exploited. Following Sapir's death in 1939, Fuang-Kuei Li and Harry Hoijer, especially the latter, assumed the leadership, and the UCLA campus was the center of Athapaskan linguistics during the forties and fifties. The retirement of Hoijer in the sixties ended another era, and a new leadership has emerged in Alaska, the home of the Dene people, and where the greatest number of Na-Dene languages still survive.

Michael Krauss began his field research on Eyak and Alaskan Athapaskan in the early 1960s. Since the publication of his most significant work on comparative Athapaskan (15) in 1964, Krauss and his colleagues—

[1]Two other common spellings are *Athabaskan* and *Athapascan*. For the designation of the people (not so much of the language), *Dene* is now being used widely especially by the native people themselves. After all, *Dene* is not a new term as it is more familiar to the native people and was used by Petitot (Dènè-Dindjié) and Morice (Dene language) and Sapir (Na-Dene), among others.

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James Kari and Jeff Leer in particular—have amassed old and new material and made significant new progress, especially in comparative studies.

While the most active team research has been launched in Alaska, the language which has seen the most extensive publication in recent years is Navajo, now further enriched by the work of Young & Morgan (35). Given the limited time and space, I shall not attempt to review the entire field of Athapaskan linguistics; instead, I shall concentrate on Proto-Athapaskan phonology, which is more appealing to a larger audience and has always attracted the attention of most prominent Athapaskan students. Furthermore, Krauss has already authored three general reviews of Athapaskan linguistics in the past several years. His first and most extensive review (17) is a bibliographical and historical survey of the Na-Dene stock with emphasis on comparative phonology. His second review (18) is a sequel to the first article, covering the most recent research activities, especially new findings on Proto-Athapaskan phonology and morphology by his research team in Alaska. Krauss's most recent review article (19) is a historical and philological account of comparative Athapaskan, part of which had already been mentioned in his earlier articles.

Since Krauss was the only author of the two most extensive reviews in the two major anthologies (3, 31), and more recent work of his and his colleagues at the Alaska Native Language Center has hardly been reviewed critically, I shall attempt to make this present article as complementary as possible to Krauss's review articles by concentrating on the major issues they have dealt with recently in their study of Proto-Athapaskan (PA) phonology.

CONSONANT PHONEMES

Sapir's reconstruction of Proto-Athapaskan consonants and vowels (29, 30) had never been challenged until 1964, when Krauss (15) proposed the PA phonemic inventory as shown in Table 1. The most significant aspect of Krauss's PA inventory is the addition of a new obstruent set, the *k̯ʷ series.[2] Another remarkable feature of the new inventory is the treatment of the voiced fricatives as allophones that alternate with the voiceless counterparts. It should also be noted that Krauss in 1964 recognized only one nasal (i.e., *n), whereas Sapir recognized three nasals (i.e., *m, *n, *ŋ). Another consonant that Krauss found suspect in 1964 was *ʔʷ, which

[2]The series or set of consonants represented by one symbol include all the homorganic obstruents, e.g. the k̯ʷ series includes g̯ʷ, k̯ʷ, k̯ʼʷ, and x̯ʷ (and γ̯ʷ, if applicable) the ts series includes *dz, ts, ts'*, and *s* (and *z*, if applicable), etc.

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Table 1 Proto-Athapaskan phonemic inventory (Krauss 1964)

Proto-Ath	d	dl	dž	dz	g̑	g̑^{w}	G	G^{w}				(stress system?)
ʔ	t	tl	ts	tš	k̑	k̑^{w}	q	q^{w}	i		u	
										U^{b}		
	t'	tl'	ts'	tš'	k̑'^{a}	k̑^{w}'^{a}	q'	q^{w}'		ə		(vowel modifiers,
										A^{b}		as in Eyak?)
		ȴ	s	š	x̑	x̑^{w}	x̣	x̣^{w}	e		a	
h (= zero) w	n				y							

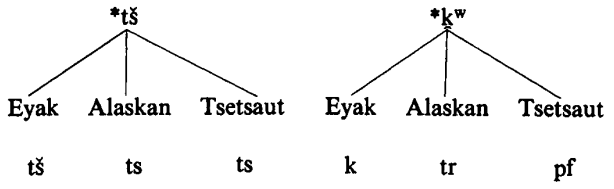
[a] Obvious typographical errors have been corrected.
[b] *U* and *A* represent *u* and *a* respectively.

he now believes, from his study of Sapir's unpublished material, to have been reconstructed by Sapir for PA.

As will be shown below, Sapir's two nasal phonemes (*m, *ŋ) have been almost reinstated recently by Krauss, and the independent status of the voiced fricatives appears to be recognized finally for PA. These recent developments have reduced the difference between Sapir's and Krauss's reconstructions, especially in the consonant inventory. In this section I shall be dealing with the phonetic properties and phonemic status of the *k̑^{w} series, the voicing of fricatives, and the most recent proposal for two sonorant phonemes, *w̃ and *ỹ.

The k̑^{w} Series

Krauss reconstructed the *k̑^{w} series on the basis of ample data from Eyak and Tlingit, as well as from Alaskan dialects that had not been documented and old Tsetsaut material that Boas (2) recorded. Krauss observed two full sets of affricates, i.e., *ts* and *tr* (retroflex) series among such Alaskan Athapaskan languages as Central Tanana, Ingalic, Kutchin, and Han. Then he discovered that these two sets of consonants regularly correspond to Eyak *tš* and *k̑* on the one hand and to Tsetsaut *ts* and *pf* on the other. On the basis of these correspondences, Krauss concluded that PA, as well as Proto-Athapaskan-Eyak (PAE), had not only a **tš* series but also a **k̑^{w}* series, i.e.



The new set of obstruents, which Krauss postulated in 1964 as PA as well as PAE phonemes, have also been motivated on purely structural grounds. Although the exact nature of the phonetic properties was uncertain (see below), Krauss showed the phonemic contrast among the four sets of obstruents, including the new set but excluding the velar set, namely *ts, *tš, *k̑, *k̑^{w}, in terms of the following four-way opposition:

ts	k̑
tš	k̑^{w}

more abstractly

c	k̑
c^{w}	k̑^{w}

and still more abstractly

t^{y}	k^{y}
t^{yw}	k^{yw}

With this scheme, in which the newly established obstruents fit symmetrically, Krauss (17) showed how these four sets of obstruents merge in ways in which other obstruents, including the velars, do not. The y-feature (whatever phonetic characteristics it may represent), which is shared by the four sets of obstruents, suggests that the obstruents constitute a natural class. Tharp (32) first suggested that the *k̑^{w} series that Krauss postulated for PA is coronal, i.e. not a pre-velar, but dorsopalatal. Krauss now believes that *k̑^{w} was pre-velar in PAE, but changed to palatal (i.e. coronal) in PA. I shall return to this question shortly.

The interesting point is that the four sets of PA obstruents have maintained a remarkable structural relationship as shown by the pattern of historical developments. The coronality of the *k̑ series (and *k̑^{w} series) is also indicated by internal reconstruction. In 1978 I (6) postulated a voiced dorsopalatal fricative ($\gamma^{y} = \hat{\gamma}$) for Sarcee purely on the basis of internal phonological alternations. It has turned out that this dorsopalatal which derives from *$\hat{\gamma}$ (i.e., *k̑ series) triggers the sibilant assimilation in the same way the palatal sibilants do.

More recently, in a manuscript which is still being revised, Krauss (20) is more explicit about the phonetics of PAE *k̑^{w} and its PA counterpart, and he suggests that the interpretations of *ts, *tš, *k̑, and *k̑^{w} as t^{y}, t^{yw}, k^{y}, and k^{yw} respectively were once true for PAE, but were no longer true for PA. Viitso [as reported by Krauss (18)] and Tharp (32) observed the inadequacy of these interpretations primarily because it is *ts, but not *k̑^{w}, that has developed into *k^{w}* in Dogrib and *p(f)* or *k^{w}* in some Slavey dialects, all of which can be explained in terms of flattening or rounding (labialization). A more striking case for this type of development is seen in Chilcotin, in which alveolars and velars oppose phonemically in terms of sharp and flat (pharyngealized) features, *ts* vs *tŝ, k* vs *q* (see 4). Interestingly, flat alveolars develop from *ts, and its sharp counterparts develop from the merger of *k̑^{w} and *tš series, e.g.,

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*ts > tŝ	(flat):	*ts'ən > tŝ ən 'bone', *sadʔ > ẑí 'mouth'
		*tsiʔ > tŝí 'head'.
*tš > ts	(sharp):	*tšaʔ > tsæ 'beaver', *tšu > tsu 'grandmother'
*k̯ʷ > ts		*x̯ʷun > zun 'good' , *g̯ʷe-n > dzin 'day'
		*s̯ʷa > sæ 'sun'.

The above Chilcotin data provides some support for Viitso's interpretation of *ts, *tš, *k̯, and *k̯ʷ as t^{yw}, t^{y}, k^{yw}, and k^{y}, respectively,[3] where the w-feature is considered to be [+flat] in the Jakobsonian framework (13). Now the development of the flat alveolar sibilant in Chilcotin from *ts, that of the Tsetsaut labial consonant from *k̯ʷ, and that of the retroflex obstruents in Alaskan languages are all attributable to the w-feature, i.e. [+flat]. On the other hand, the merger of *tš and *k̯ʷ (t^{y} and k^{y} *à la* Viitso) is explainable in terms of the loss of opposition between two points of articulation.

Krauss, however, still prefers his own abstract interpretation of the four sets of obstruents to those of Viitso's, taking a more concrete approach to the development of labials from the *ts series. He believes the labials have been developed from *ts through an intermediate stage, namely an interdental, i.e. ts > tθ > pf. But a similar interpretation is unlikely for the development of k^{w} (Dogrib, Slavey) from *ts, i.e. there is no reason to believe that k^{w} has gone through an intermediate stage, *tš* or *k̯ʷ*. Nor does this "push-chain" type of interpretation make sense for the development of Chilcotin *tŝ* (flat sibilant series) from *ts.

While this problem remains unresolved, Krauss now transcribes PA reflex of PAE *k̯ʷ as [tṣ̌ʷ] or [tšʷ̥] which can be abstractly interpreted as t^{ywr}. This heavily "marked" segment is obviously intended to account for such a labialized alveolar palatal as Hupa *tšʷ* on the one hand and a retroflex alveopalatal as Kiowa-Apache *tšʳ* on the other. In terms of the Jakobsonian distinctive feature framework, both the w-feature and the r-feature are considered to be [+flat], hence these two phonetic features are mutually exclusive realizations of the same distinctive feature. While it is generally accepted that labialization (rounding) has to be independent of pharyngealization, since both may be phonemic in one language, i.e. labialization and pharyngealization are not mutually exclusive with respect to a given language, it has not been explicitly questioned, at least to my knowledge, whether or not these two features are mutually exclusive with respect to a given segment.

Chilcotin velars seem to suggest that these features are not mutually exclusive with respect to a given segment either: *q* (as in *-qən* 'husband')

[3]This interpretation is reported by Krauss (18), but I have not been able to see Viitso's article.

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is distinguished from *k* (as in *-kən* 'vagina') by pharyngealization (called "flattening"), and from *q*ʷ (as in *q*ʷ*ən* 'fire') by labialization; while *q*ʷ is distinguished from *q* by labialization *and* from *k*ʷ (as in *-k*ʷ*əl* 'mother') by pharyngealization. In other words, both labialization and pharyngealization are phonemic for *q*ʷ *and q*ˤʷ (see *dəlqw'æ̀* 'a kind of bird'). This Chilcotin data provides a measure of support for the co-existence of the w-feature and r-feature in PA [tšʷʳ], *although it is still not clear if both features were phonemic in PA.*

Leer's notation of *DŽʷ in his PA phonemic inventory (23) seems to indicate that only one of the two, probably the w-feature, was phonemic in PA, but there is no explicit discussion on this matter. There are a number of other questions with respect to Leer's inventory of PA phonemes to which I shall return shortly.

Fricatives

The analysis of Athapaskan fricatives, both synchronic and diachronic, has revealed a number of interesting but puzzling questions. Diachronically, was voicing phonemic with respect to fricatives in PA? Sapir seems to have suggested it was. Krauss's 1964 PA phonemic inventory does not include voiced fricatives. In a recent manuscript (20), Krauss maintains that voiced fricatives in PA were intervocalic allophones, but he includes both voiceless and voiced fricatives in his phonemic notation of PA forms. Leer's inventory of PA phonemes includes voiced fricatives. If voiced fricatives were not phonemic in PA, as they are not in Eyak and Tlingit, at what stage did they become phonemic?

Another diachronic problem is the incongruent correspondences among daughter languages, unlike stops and affricates which show systematic correspondences. Still working on this problem, Krauss (20) states that the fricative correspondences raise more questions than answers. The incongruent development of fricatives has also left an inconsistent synchronic phonological alternation. In what is known as light/heavy syllable alternation (see 5), the homorganic voiceless and voiced fricatives pair off in stem-final position marking the imperfective and perfective aspects, e.g. *s* pairs off with *z*, *ɬ* with *l*, *x* with *γ*, etc. In some languages, however, including Chipewyan and Chilcotin, *š* pairs off with *y* where *ž* does not exist. This inconsistency is apparently due to the change of *x̯ to *š* like other obstruents in the set, and to the unexpected merger of *γ (voiced counterpart of *x̯) with *y*. This incongruent pair is *phonetically* even more incongruent because *š* is [š] in syllable initial position, but still [x̯] in syllable final position. Phonetically speaking, the change of *x̯ is partial since it remains unchanged in final position. Incidentally, this final [x̯] has been incorrectly identified as *ih* in Chipewyan and Carrier (see 5). In any case, this incongru-

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ent diachronic change provides an explanation for the inconsistent synchronic alternation.

Returning now to the voicing of fricatives in PA, Krauss is most explicit on this matter in his two manuscripts, one of which he co-authored with Leer (22). The salient points can be summarized as follows: (*a*) in PA voiced fricatives were allophones occurring between voiced segments, and (*b*) in stem-initial position fricatives were always voiced. The first, he maintains, is due to a "natural phonologically motivated" process and the second to a "morphologically motivated" process or a special juncture. What is not clear here is the status of voicing, which is motivated either by a certain morphological phenomenon or a boundary. The morphologically motivated voiced fricative is certainly not an allophone in terms of the autonomous phoneme. The process is typically a morphophonemic alternation rather than a phonetic alternation. One can, on the other hand, argue that the stem-initial voiced fricative is a *systematic phonetic* representation of a *systematic phoneme* which is voiceless. This theoretical distinction is essential for the correct interpretation of the voiceless and voiced fricatives that appear in the reconstruction of PA forms, especially by Krauss. In any case, it is reasonable to assume that voicing was not phonemic in Pre-Proto-Athapaskan (PPA), but it must have become phonemic (in a taxonomic sense) at a later stage.

The voiced fricatives in Leer's phonemic inventory of PA may have been based on this interpretation of historical development. As pointed out earlier, Leer's PA refers to a later stage in time than Krauss's PA (of 1964). This difference is understandable, but there is no explicit discussion of the voiced fricatives as to when and how they emerged as phonemes. In my view, their phonemic status was established when the fricatives became voiced in stem-initial position, or when the syllable weight was marked by the alternation of the voiceless and voiced fricatives. It is yet to be determined when and how these phonological phenomena came into being.

Sonorants

*ỹ and *w̃ are two sonorant phonemes that have been newly reconstructed for the inventory of PA as well as PAE by Krauss and Leer (22). Their proposal for these new phonemes was first made in 1976 in a manuscript which is still being revised. My comments are based on this 1976 version, and I cannot speculate to what extent they may change their stand on the status of these new sonorants by the time their revised version becomes available.

Of these two sonorants, evidence for *ỹ is much stronger and better motivated by both internal and external evidence. By internal evidence, I mean apparently irregular morphophonemic alternations observed in many contemporary Athapaskan languages. As early as 1969, Krauss (16) ob-

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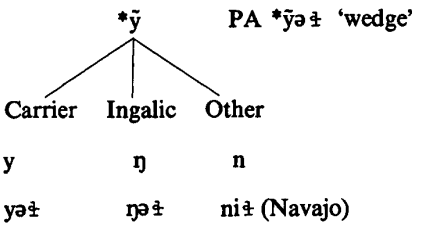
served that in Eyak classifiers *də-* and *ɬə-* alternate with *di-* and *ɬi-* respectively, and the alternating vowel *i* was identified as "y-component," which is now reconstructed as *ỹ. In a number of Athapaskan languages, it is observed that *n-* and *i-* alternate as a perfective prefix, and the same alternation in Athapaskan (and *yi-/i*-alternation in Eyak) also marks the second person singular subject in the verb. Combining the nasality and the y(i)-component, *ỹ has been suggested as representing the sonorant in question, although its phonetic and phonemic status has not been fully explored (see below).

More convincing evidence for an extra sonorant in PA comes from comparative data. Krauss and Leer demonstrated that the three sonorants *y, ŋ,* and *n* almost regularly correspond in stem-initial position as well as in stem-final position. Where Carrier has *y* and Ingalic *ŋ,* the rest of the Athapaskan languages have *n,* i.e.,



The y:ŋ:n correspondence is different from the n:n:n and y:y:y correspondences which develop from *n and *y respectively, clearly suggesting that there was an extra sonorant in PA which contrasted with *n on the one hand and with *y on the other, hence *ỹ.

Krauss and Leer therefore attempted to show how *ỹ contrasted with *n and *y in stem-initial, stem-final, and prefix positions. While their argument and evidence for *ỹ are quite convincing (aside from the phonetic and phonemic status; see below), their evidence for *w̃ is not so convincing. The evidence for this extra PA sonorant is not based on systematic correspondences but on what I consider circumstantial evidence, e.g. structural symmetry and distinctive features involved.

It is easier to argue for *ỹ in contradistinction to both *y and *n, because the latter two sonorants are well established PA phonemes, than to argue for *w̃ in the absence of *m. In other words, the structural relationship expressed by Equation 1 holds, but that in Equation 2 does not:

1. $y : \tilde{y} = w : \tilde{w}$
2. $y : n \neq w : m$.

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It is difficult to motivate *w̃ without motivating *m. If *w̃ is a notational variation of *m (a possibility Krauss and Leer alluded to but did not pursue), *ỹ must be a notational variation for *ñ. I shall present two arguments that *ñ and *m are more probable than *ỹ and *w̃, granted that these are not notational variations, but imply substantial phonetic difference and structural relationship.

It is important to note what Krauss & Leer (22, p.3) had to say on this matter:

> Throughout this paper the symbols ỹ and w̃ will be used, rather than ñ and m. The phonetic difference implied is that for the former pair oral occlusion is not complete. It is possible that especially for *PA ñ and m may be more accurate,* but we have chosen here not to make the distinction explicitly (emphasis added).

Since they chose "not to make the distinction explicitly," I interpreted the two sets of symbols as notational variations. On the other hand, they suspect that *m and *ñ are more likely for PA (not PAE), for reasons not presented.

In order to choose between two sets of nasal sonorants as PA phonemes, it is necessary to scrutinize the whole sonorant system, including vowels, with particular attention to the role of nasality. First of all, it seems unnatural, if not impossible, for a language to have contrast between *w* and *w̃* rather than between *w* and *m*. Second, if nasality is phonemic for nonsyllabic sonorants, it is only natural to expect that nasality is phonemic for syllabic sonorants, i.e. vowels. There is, however, no conclusive evidence to determine the phonemic status of nasal vowels in PA. From Leer's discussion of nasalization, one can only conclude that all PA nasal vowels are derivable from underlying sequences of a vowel followed by *n* (Vn) before a consonant or word boundary. In the absence of conclusive evidence for phonemic nasal vowels in PA, there is no convincing *structural* evidence to suggest that the sonorants in question were *ỹ and *w̃ rather than *ñ and *m.

Krauss and Leer also note the difficulty in explaining the apparently irregular development of stem-initial *ny* in Carrier (e.g., *nyən* 'you') and stem-final *ŋ* (e.g. *'ətsəŋ* 'meat'), for both of which one would expect *y*. The careful reexamination of my Central Carrier notes, however, presents at least a partial solution to the problem Krauss and Leer have had. Furthermore, it suggests that what Krauss and Leer reconstructed as *ỹ is probably *ñ or *ŋ.

During 1975–76 I recorded a considerable amount of Carrier data from three speakers who identified themselves as speakers of Central Carrier. I reported (4) that their speech form is somewhat different from what is reported by Walker (34) and the sources that Krauss and Leer refers to. But the difference is not directly relevant to the problem at hand. The nasal segments that I recorded phonetically include syllabic [m̩, n̩, ñ̩, ŋ̩] (e.g.,

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[n̩ba·] 'who,' [n̩zekʷ] 'your saliva,' [n̩tsi·] 'your head,' [n̩do·] 'up,' [ñye·] 'there,' [n̩ke·] 'your foot'), nonsyllabic [ñ] (e.g., [ñən] 'you,' [ñətistə́ɬ] 'I'll kick you,' [ñəɬ] 'with you,' [ñəbət] 'your stomach,') and nonsyllabic [ŋ] (e.g., [ˀətsəŋ/ˀətsəŋk] 'meat,' [xʷətsotsəŋ/xʷətsotsəŋk] 'spider'). Observing that the syllabic nasals assimilate to the following consonant in terms of point of articulation and the morphophonemic alternation between a syllabic nasal and *ñə-*, I analyzed the syllabic nasals as allophones of phoneme *n* (which alternates morphophonemically with *nyə*). On the other hand, I interpreted the nonsyllabic [ñ] as a consonant cluster of *ny,* having observed that there were other word-initial clusters, and no palatal nasal phoneme had been postulated for any other Carrier dialects. Where the syllabic nasal is interpreted as *n,* it is assumed that *n* becomes automatically syllabic before a consonant. This redundancy rule, however, produces an incorrect phonetic form for *nyən* 'you' as [n̩yən]. An important fact is that [ñ] as in [ñən] 'you' and [ñəɬ] 'with you' clearly contrasts with [ñ] as in [ñye] 'there,' [ñyo] 'down,' i.e. [ñən] is /ñən/, not /nyən/. In other words, the nonsyllabic palatal nasal is phonemic on the taxonomic level. Historically, the Carrier reflex of PA *ỹ or its equivalent is *y,* as Krauss and Leer maintain, in stem-initial and stem-final positions, but apparently this correspondence does not hold regularly. As shown in the above Carrier data, the second person singular pronoun has *ñ* as its initial consonant both in the free form and bound form (i.e., prefix).

This analysis of Carrier data also provides an answer to final *ŋ.* In the dialect in which *ŋ* occurs followed by a homorganic stop, *ŋ* is simply treated as an allophone of *n.* In the dialects where *ŋ* occurs finally without any following consonant, *ŋ* is in complementary distribution with *ñ.* In other words, *ñ* and *ŋ* represent a single phoneme. This observation along with Story's (forthcoming) interpretation of Morice's (27) data, as well as Krauss and Leer's study of Harmon's word list (22), suggests that there was a final velar or palatal nasal which corresponds to the PA sonorant in question.

The question which has not been raised is why the sonorant in question is *y instead of *ñ or *ŋ. Krauss and Leer suggested (in a footnote) that Carrier ŋ and *y* have developed from *ỹˀ and *ỹ, respectively. But this suggestion is worth considering only if *ỹ is independently motivated, because it is equally possible, if not easier, to argue that Carrier *ŋ* and *y* have developed from *ñ or *ŋ.

The above discussion of Carrier data is intended primarily to propose that the two PA sonorant phonemes postulated by Krauss and Leer may be better represented by *m and *ñ (or *ŋ). The existence of *ñ* as a phoneme in Carrier (at least in one, if not all, dialects) may be vestigial evidence for PA *ñ (which, incidentally, takes us back to Sapir!). In any case, it is important to determine whether the sonorants in question were *ỹ and *w̃

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or *ñ and *m respectively, in order to better understand not only the PA phonemic system, but also the phonological system in general.

As mentioned above, Krauss and Leer are noncomittal as regards the phonetic properties of the two nasalized resonants. They are also noncomittal as to the *phonemic* status of these PA segments as indicated by their concluding sentence: "In sum *ỹ and *w̃ may contrast only marginally with *y and *w, but they were certainly *phonetically* present in PA(E)" (emphasis mine).

Phonemic Inventory

The preceding discussion on the PA consonant system is in a way summarized by Table 2, copied from Leer (23). As pointed out earlier, Table 1 represents an earlier stage that Leer calls PPA from which the system in Table 2 developed.

Comparing the obstruents in Table 1 and Table 2, one may easily notice differences in two sets: what Krauss called the *k̂ʷ series is represented by the *DŽʷ series. This is consistent with the view that *k̂ʷ has become coronal in PA. The labialized velar obstruents are not present in Table 2. The phonemicity of labialization in PPA is believed to have been lost (as described by Leer) in PA as the labialization was transferred from the consonant to the vowel (e.g. qʷə > qu). A third set of obstruents to be noted here is the voiced fricatives in Table 2. This confirms the view that voiced fricatives emerged as phonemes at a later stage. Another consonant that Krauss might add to Table 2 is *ˀʷ (which Sapir also reconstructed, as indicated in his unpublished material).

Notice also that *y is now listed under sonorants along with *w and *n as well as *ỹ and *w̃. This leaves *l as an exceptional segment among the obstruents. If *ỹ and *w̃ are replaced by *ñ and *m respectively, as suggested above, *n, *y, *ŋ, and *w may be arranged under D, DŽ, Ĝ, and Ġ respectively, leaving *m alone out of the core system as the only bilabial segment.

SYLLABLE PHONEMES

It is reasonably well established that PA had four full (long) vowels and three reduced (short) vowels. But the phonemic status of the so-called constriction (laryngealization) and nasalization has not been established satisfactorily, although Krauss and Leer might claim to the contrary. Their position on the status of these features is uncertain, partly because of unconventional and inconsistent terminology. For example, Krauss & Leer (22) have claimed that PA had "constricted vowels" which are represented by V̀'s in reconstructed PA forms. One wonders, however, why such vowel

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Table 2 Proto-Athapaskan phonemic inventory (Leer 1979)

Obstruents (X)	alveolar	affricate series				front velar	back velar (uvular)
	(*D*)	(*DL*)	(*DZ*)	(*DŽ*)	(*DŽ*^{w})	(*Ĝ*)	(*Ġ*)
plain stops (D)	d	dl	dz	dž	dž^{w}	ĝ	G
aspirated stops (T)	t	tɬ	ts	tš	tš^{w}	k̂	q
glottalized stops (T′)	ˋt'	tɬ'	ts'	tš'	tš'^{w}	k̂'	q'
voiceless fricatives (S)		ɬ	s	š	š^{w}	x̂	ẋ
voiced fricatives (Z)		l	z	ž	ž^{w}	γ̂	γ̇
Sonorants (R)	front						back
oral	y				–		w
nasal (N)	ỹ				n		w̃
Vowels (*V*)							
full (V)	i			e[a]		a[a]	u
reduced (v)			e			*a*	*ʊ*

[a]*e phonetically [ae], *a phonetically [ɔ].

phonemes are not included in the phonemic inventory (Table 2). To take just another example, consider the status of nasal vowels. In 1964, Krauss suspected that all vowels except *e* may be "modified" by nasalization, and Leer (23) presented an extensive discussion of nasalization from PPA to PA. But it is never clear whether the nasalization was a phonetic process which did not change the vowel inventory, or whether it ended up causing restructuring (i.e., phonologization) in PA. I shall discuss these and other related questions as I concentrate on two major problems: the relationship between the full vowels and reduced vowels and the phonemic status of the constricted vowels.

Full Vowels vs Reduced Vowels

The alternation between the full vowels (V) and the reduced vowels (v) is fairly well established: *i* and *e* alternate with *ə*, *u* with ʊ, and a with *ɑ*. But it has not been clear whether the alternation was purely phonetic and

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morphophonemic (i.e., nonfunctional) or inflectional (i.e., functional). Krauss (15, p. 124) called the alternation "morphophonemic alternations," which was probably intended to mean "inflectional" (paradigmatic) alternations.

Leer's recent monograph (23) is the most extensive study of comparative Athapaskan stem phonology. Leer deals not only with the development from PPA to PA, but also with root vowel alternations and consonantal suffixes that marked in the PA verb system what have been inadequately and inconsistently known as "mode" and/or "aspect."[4] This work contains a wealth of material and stimulating observations, if only the reader can clarify the unconventional terminology, distinguish the diachronic rule from the synchronic rule or the functional rule from the nonfunctional rule, and understand what stage (PPA or PA) a given reconstruction represents.

What Leer calls "ablaut" is essentially a nonfunctional process of contraction, whereas the alternation between the full vowel and the reduced vowel, that Leer calls "lengthening," is a functional synchronic process. Here, Leer clearly observes the grammatical function of the V/v alternation in the PA verb paradigm. This functional alternation, which was apparently quite regular in PA, has become obfuscated, at least on the phonetic surface, in most of the contemporary Athapaskan languages, due in part to the nonfunctional diachronic process of contraction which Leer calls "ablaut."

The paradigmatic function of the V/v alternation should be distinguished from shortening or laxing. Leer describes this shortening as a synchronic rule (23, p. 5): "Full vowels are long except immediately preceding glottal stop or the enclitic *+he· ."[5] The same rule is now viewed as a diachronic process (p. 67): "The negative enclitic +he· . . . deletes length from preceding full vowel in PA; PPA *CV·+he· > PA *CVhe· . . ." From this statement, along with the statement on page 5, I gather that PPA V· became PA V in the stated environment (which is a diachronic process), and further that PA V is realized by v in the same environment (which is a synchronic rule). In other words, the shortening rule neutralizes the phonemic distinction between V and v before ' or *h,* a synchronic rule that existed in PA and still exists in some modern Athapaskan languages. This shortening or laxing rule should be clearly distinguished from the lengthening or tensing rule which marks paradigmatic distinctions in verb paradigms.

[4]In a recent paper (7), I showed why the current practices in the use of these terms are often incorrect and inconsistent, and I emphasized the need for some sort of agreement and standardization.

[5]This rule is obviously a phonologically conditioned (by *h* or ') rather than a morphologically conditioned rule. Vestiges of this rule are found in Chipewyan and Chilcotin, among others.

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Constricted Vowels and Tone

In another manuscript, Krauss (21) presented an extensive study of pitch accent in Athaspaskan from a comparative and historical point of view. This work, followed by Leer's study (23), firmly established, in my view, that tone or pitch accent has developed from postvocalic glottalization (either glottal stop or glottalized consonant) in stems. Whether or not PA had tone was apparently a vexing question for Sapir and his students (see 19). The recent studies by Krauss and Leer provide ample Athapaskan and Na-Dene data to demonstrate that PA was not a tone language and that the postvocalic glottalization has developed consistently to high tone (i.e., "high-marked") in some languages or to low tone (i.e., "low-marked") in others. This discovery adds an interesting new dimension to Athapaskan dialectology.

The assertion that PA did not have tone and that postvocalic glottalization has given rise to the high-marked system or low-marked system raises a number of important questions that have not been properly addressed (or never addressed at all). An obvious question is why the same phonetic feature (glottalization) has become high tone in some languages (e.g., Chipewyan, Slavey) and low tone in others (e.g., Dogrib, Sarcee). Krauss (21) raises this question and finds an explanation in terms of tonal flip-flop unacceptable. He believes that there is "a far better explanation" first suggested by Leer in terms of "constricted vowels." According to this hypothesis, the postvocalic glottal feature became "suprasegmentalized" (i.e., tautosegmental to the preceding vowel) in PA, and then this suprasegmentalized glottal feature (i.e. constriction) has become high-toned or low-toned in contemporary Athaspakan. This hypothesis, which is essentially adding an intermediate stage between a stage where there was no constricted vowel or tone and a stage where tone is developed, still does not explain why the same feature, either as a postvocalic segmental feature or a suprasegmental constriction (i.e. tautosegmental or not), has given rise to the opposite pitch levels. Furthermore, this hypothesis makes another claim which is difficult to defend. While the phonetic transition from segmental glottal feature to suprasegmental glottal feature (constriction) is not an unreasonable one, the phonemic status of the "constricted vowel" cannot be taken for granted. Although the constricted vowels are not listed in the PA phonemic inventory (Table 2), the discussion of PA forms which include *V̀'s by Krauss and Leer clearly indicate that such vowels are treated as *phonemic* in PA. Since the question regarding the phonemic status is very important, I shall examine this question in some detail.

There is no evidence that constricted vowels exist in any contemporary Athapaskan languages. The only source that Krauss and Leer refer to is a statement on Carrier by Morice (26, p. 528) that the vowel in such words

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as *k^{h}on'* 'fire,' *nehn'* 'land,' and *tzé* 'gum' is pronounced with raised voice and "constrained effort." This observation may very well suggest that the constricted vowel existed in Carrier. But clearly it did not exist independent of either postvocalic glottal stop as in 'fire' and 'land,' or accent as in 'gum,' i.e., there is no indication that the phonetic feature "constriction" was independent.

It is extremely interesting, however, to note that Tsimshian, a close neighbor, has constricted or "creaky" vowels as reported by Dunn & Hays (8). Before examining the characteristics and status of the Tsimshian creaky vowel, it is important to review the salient aspects of the view developed by Krauss and Leer on the PA constricted vowels.

Putting minor details aside,[6] it is maintained that the PPA vowel immediately followed by a glottal stop or glottalized consonant (C') became constricted in PA, e.g., PPA CV^{ʔ} > PA CV̀^{ʔ}, PPA CVC' > PA CV̀C'. This rule applies also where the PPA vowel and the glottalized segment is intervened by a sonorant (R), e.g. PPA CV·R^{ʔ} > PA CV̀R^{ʔ}, PPA CVR^{ʔ} >PA CV̀R^{ʔ}. But this rule is blocked if the PPA long vowel is followed by a glottalized stop, unless the stop became spirantized, i.e., PPA CV·C' > PA CV̀S (where S is a homorganic fricative).

Leer presented an interesting argument to the effect that the rise of the constricted vowel from PPA to PA is part of a more general process of "suprasegmentalization" which involves not only constriction but also nasalization and what he calls "ablaut" (which is an unfortunate misnomer). One can see the analogy between constriction and nasalization, since ^{ʔ} and *n* are viewed to have become suprasegmental features tautosegmental to the syllable nucleus. The so-called "ablaut," however, does not involve "transfer" of a particular feature, nor does it relate to a paradigmatic function, as the term would otherwise imply. "Ablaut" is defined by Leer (23, p. 28) as "the process by which PPA sonorants are absorbed into the stem vowel without causing nasalization." Since nasals and glides are categorized as sonorants, and the former undergoes nasalization and the latter contraction, Leer sees the two processes to be in complementary distribution, hence two different manifestations of one and the same process! The important difference, however, is that *n* (as well as ^{ʔ}), which is co-articulated with the syllable nucleus, is still functional, whereas the glide which is absorbed by the syllable nucleus is not. In other words, what Leer calls "ablaut" is a simple case of contraction or monophthongization by which a segment does not become a suprasegmental feature but becomes lost (although it may change the vowel quality).

[6]PPA had contrast between V· and V (long vs short), whereas PA had contrast between V and v (full and reduced).

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There is no question in my mind that the phonetic process involved in constricted vowels is analogous to that involved in nasalization. There are, however, important questions regarding the theoretical interpretation of the process. Both Krauss and Leer have made it clear that the PA constricted vowels are phonemic, to speak strictly in taxonomic terms. The balance of this section will be devoted to a challenge of this view.

Just like the nasal vowel, which is representable phonemically as *Vn* where [V̨] does not contrast with [Vn] or [V̨n], the constricted vowel is representable as *V'* (which should also be interpreted as VR' or VC'). There is no evidence that [V̊] is contrasted with [V'] or [V̊']. Interestingly enough, Leer (23, p. 5) states that "constriction is not distinguishable before an overt stem-final glottal stop" (i.e., CV' = CV̊', CVR' = CV̊R'), and Krauss writes V' for V̊'. In other words, constriction is predictable from the glottalization that follows the vowel. The only apparent counterexample is the case where there is no "overt stem-final glottal stop," as is implied by Leer, e.g., PA syllable type CV̊S (where S represents a fricative) which is supposed to have derived from PPA syllable type CVT' (where T' represents a glottalized stop). This, however, does not create any problem, since CV̊S can be represented as either CV'S or CVS'. The latter interpretation recognizes glottalized fricatives in PA, and in the absence of an independent evidence for PA glottalized fricatives, it may not be an attractive interpretation. On the other hand, CV'S is a well-motivated interpretation, since CV'C is a recognized PPA syllable type.

This implies that the PPA syllable type CVT' became PA CV'S (rather than CV̊S) by the process of spirantization. Incidentally, this view is consistent with the statement by Leer (23, p. 9) that "PA stem-final glottalized stops are phonetically preglottalized." I shall return to this point shortly.

The phonemicity of the PA constricted vowel cannot be supported from a typological point of view either. From the PA phonemic inventory and other discussions, it is clear that no glottalized fricatives or sonorants are postulated for PA. It is unlikely, if not impossible, on the taxonomic level that vowels may be modified by a secondary articulation of glottalization where fricatives and nonsyllabic sonorants are not. From an areal point of view, on the other hand, it is more likely that glottalized fricatives, rather than glottalized (i.e., constricted) vowels, existed in PA.

I shall now turn to the Tsimshian material analyzed by Dunn & Hays (8), which bears significantly upon the interpretation of the so-called PA constricted vowels. They (8, p. 138) observed in Tsimshian that "Vowels preceding glottalized segments . . often assimilate laryngeal constriction and become creaky." They also observed, as did Boas (1), that the laryngealized vowels (i.e., constricted vowels) are not just creaky but also rearticulated with a "parasite vowel" (Boas). If what Dunn and Hays call "laryngealiza-

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tion" is phonetically identical with constriction or glottalization in PA, this phenomenon adds, in a sense, more problems than solutions in that the apparently same phonetic feature is now responsible for constriction/laryngealization in both Athapaskan and Tsimshian, on the one hand, and for pitch accent in Athapaskan and rearticulation in Tsimshian on the other. What is particularly interesting, however, is phonetic variation of the following sort in Tsimshian:

hȧx ~ haʾx ~ haq̇ 'goose'[7]

sȯeq^h ~ sȯax ~ soHq̇ 'robin' (H = centralizing offglide)

Observing the regressive movement of the laryngeal feature, Dunn and Hays explain the variations in terms of "gamma bonding" following Foley (9). For 'goose' the final consonant *q̇* is a bonding of *x* and ʾ, as in *haʾx*, and the laryngealized vowel is a bonding of V and ʾ, as in *hȧx*. For 'robin' the final stop is unbonded to *ʾx* , and *x* in turn is unbonded to *q^h* where *sȯeq^h* and *sȯax* are representable in taxonomic terms as /soʾeq^h/ and /soʾax/ respectively. The phonetic process involved here is comparable to what is assumed to have taken place between PPA and PA, which has been explained in terms of spirantization and constriction. If a similar bonding and unbonding relationship holds between PPA and PA, the PPA syllable type CVT' must have changed to CVʾS by unbonding. As Dunn and Hays observed, the laryngealization or the rearticulation of the vowel in Tsimshian is attributable to tbe laryngeal feature, and the creaky or constricted vowel has no independent phonemic status where the laryngeal feature is a postvocalic segment (i.e., ʾ or C') or a prosodic feature. Similarly, there is no reason to motivate PA constricted vowels as phonemes.

The question of whether or not the PA constricted vowel was phonemic does not explain why the constriction gave rise to high tone in one language and low tone in another. To the question of why tone has not been developed in some languages, however, the assumption that constricted vowels were phonemic has to assume an extra stage of restructuring or phonologization. Obviously, the burden of proof lies on those who postulate an extra mechanism to account for the same phenomenon.

To sum up: Krauss has documented proof that Athapaskan tone has developed from a syllable final glottal stop or a glottalized occlusive which must have caused the constriction or laryngealization of the syllable nucleus in the languages in which pitch has become phonemic. There is, however,

[7]Compare: Chilcotin *xəx*, Carrier *xoh* 'goose'; Chilcotin *ŝux^w*, Carrier *s̯oh*, Eyak *ši·q·*, Tlingit *šùx̣* 'robin.' Leer (23, p. 25) reconstructs PA **šu̇·x̣* 'robin.'

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no evidence that any constricted vowel was phonemic in PA, nor that the PPA syllable final glottal feature was the only source for the development of tone in subsequent stages. The lexical pairs in Chipewyan like *ɬu* 'fish' vs *ɬú* 'whitefish,' *kuę* 'house' vs *kuę́* 'town,' and *bǫlay* 'button' vs *bǫ́lay* 'Frenchman,' and similar data in other languages suggest that the regular pattern of development has been obscured by subsequent processes other than constriction, including assimilation and neutralization which Krauss discussed.

The development of tone triggered by a certain class of consonants is well documented, particularly for Southeast Asian languages as reported by Matisoff (25) among others. Particularly interesting is the development of Vietnamese tones which were originated by high-marking ʼ and low-marking *h* as reported by Haudricourt (10). The tonal effects of postvocalic laryngeals (ʼ for high and *h* for low) have also been demonstrated by phonetic experiments as reported by Hombert (12). It is, therefore, not surprising that the high-marked Athapaskan tone is caused by postvocalic ʼ. It *is* surprising, however, that the low-marked tone is also caused by ʼ, not by *h* in Athapaskan. There is no plausible explanation of why both tones should have been caused by the same phonetic feature, contrary to what has happened historically in Southeast Asian languages and what has been demonstrated by experimental phonetics. The constricted vowel, whether phonemic or not, does not offer any explanation for the particular development in Athapaskan.

SUMMARY AND CONCLUSION

I have attempted to clarify the phonetic characteristics and phonemic status of PA segments, particularly those proposed by Krauss and Leer in recent years. While the PAE $*\underset{\frown}{k}^{w}$ > PA $*dž^{w}$ series is well motivated phonemically, the historical development of this obstruent series in contradistinction to other obstruent series, particularly coronals, is not fully understood.

The most questionable PA consonants are *ỹ and *w̃. I have suggested that *ñ and *m are more likely phonemes in PA. Just as *w̃ is less well motivated than *ỹ, so is *m compared to *ñ. The process of nasalization probably holds a major clue to the understanding of nasal sonorants.

The PA vocalic system is not very different from that of most contemporary Athapaskan languages. There is no evidence that nasality was phonemic with respect to vowels in PA. Nor is there any evidence that the so-called constricted vowel was phonemic at any stage from PPA to post-PA period. Just as there is no intermediate phonemic stage between Vn and V̨, there is no intermediate phonemic stage between Vʼ and V̀/V̀.

Aside from the questions regarding phonetic properties and phonemic status of some individual segments of the PA phonemic inventory, there

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remains another very difficult question. What does the system really represent? The reconstructed system is probably more symmetrical than any of the daughter languages and has the largest inventory of segments. Was there actually a *uniform* PA speech form from which all of the daughter languages have derived?

Just as one has to assume, in synchronic analysis, the uniformity of "competence" which varies in "performance," it is methodologically essential to assume the uniformity of the parent speech form. But it is equally essential to recognize variations that have existed at whatever level the reconstructed speech may represent. Just as Trager & Smith's (33) overall vowel system of American English is intended to account for all dialect variations, although no single dialect has all 27 syllable nuclei (represented by 9 simple vowels and 3 glides), so may the reconstructed system account for all the variations that must have existed in PA, but no variant may have had all the segments in the reconstructed inventory, nor all the phonetic features reconstructed for a particular segment (see [tš$^{w}_{r}$]). The variations must have been particularly true in the case of laryngealization and nasalization, which have caused the restructuring of the vocalic system (i.e., tone and nasal vowels) in some, but not all, daughter languages.

Another question that continues to be a focal point of interest is: how systematically has the PA system developed into daughter languages, and to what extent do the systematic correspondences reflect subgroupings, genetic or otherwise? Certain systematic sound correspondences are often used to define dialects and genetic subdivisions, e.g. the *c*entum languages vs the *s*atem languages in Indo-European, the *D*akota, *L*akota, and *N*akota languages of Siouan, and the Y-dialect, N-dialect, L-dialect, R-dialect, and Đ-dialect of Cree. Needless to say, a typical sound correspondence does not necessarily reflect a unique (genetic) development viewed from the family tree model, let alone the realities of network of relationship viewed from the wave theory. For this reason, Krauss is rigorously opposed to attempts, most notably by Hoijer (11), at classifying Athapaskan languages on the basis of stem-initial consonant developments. Krauss (17) demonstrated how wrong such a "taxonomic" approach is by extending Hoijer's approach to the extreme.

Despite this shortcoming, the development of stem-initial consonants has been a major research interest in comparative Athapaskan because consonants in that position are the most stable and best preserved. With the progress of research in other areas and growing new material, other isoglosses, both phonological and grammatical, will help to better understand the historical development. Krauss's survey of pitch accent has added another dimension to Athapaskan dialectology. There are a number of well-known phonological processes, including nasalization, sibilant assimilation, and spirantization, to name only a few, which need further scrutiny.

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Furthermore, comparative morphology, particularly those involving the so-called "mode" and "aspect" categories (see 14) and the pronominal system, should enlighten the field of comparative Athapaskan and dialectology.

ACKNOWLEDGMENTS

I am grateful to M. E. Krauss, J. Kari, J. Dunn, and J. Leer for providing me with unpublished manuscripts as well as published monographs, and to B. H. Smeaton and Kathy Officer for assisting me in the preparation of the manuscript. This work has been supported financially in part by Northern Social Research Division, Department of Indian and Northern Affairs, and Social Sciences and Humanities Research Council of Canada.

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