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A REVISED APPROACH TO SOUTHERN PAIUTE PHONOLOGY¹

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Fifty years after Edward Sapir published his classic "La Réalité psychologique des phonèmes", the one enduring feature of Southern Paiute phonology is that it is still a problem despite the efforts of numerous linguists who have attempted to unravel the knot. Rather than discuss every contribution to a phonological description of Southern Paiute, I will limit myself to the three principle contributors, that is, the three works most consistently quoted and used in further analysis--Sapir's (1930) Southern Paiute, A Shoshonean Language; Harms' (1966) "Stress, Voice, and Length in Southern Paiute"; and Chomsky and Halle's (1968:344-9) The Sound Pattern of English. Each of the modern descriptions has made certain claims and proposals about and for the generative treatment of Southern Paiute phonology, but each has failed to capture the full nature of the problem, and, in some cases, serious errors have been made in utilizing the data.

Sapir's Description

Sapir's description (1930:6-70) of Southern Paiute phonetics and phonology is easily one of the most thorough and well-exemplified descriptions of any North American language; indeed, it is one of the best phonetic descriptions available for any language. Sapir describes the consonantal processes on pages 62 to 70. He states (62):

A word must begin with either a vowel . . . or one of the following nine consonants: p, t, q, qw, c, s, m, n, ʔ. When these consonants, by the processes of derivation and composition, take up a medial position and are immediately preceded by a vowel, voiced or unvoiced, they assume . . . one of three distinct forms.

He then provides the following table of the consonantal variations (62):

Initial	Spirantized	Geminated	Nasalized
p-	-v-	-pp-	-mp-
t-	-r-	-tt-	-nt-
q-	-g-	-qq-	-ŋq-
qw-	-gw-	-qqw-	-ŋqw-
c-	-c-, -nc-	-cc-	-nc-
s-		-ss-	
m-	-ŋw-	-mm-	(-mm-)
n-		-nn-	(-nn-)

Table 1. The consonantal variations

This chart illustrates what happens to a morpheme-initial consonant when it is preceded by another morpheme. Which change affects the consonant is determined by the preceding morpheme. Sapir states (63):

. . . the deciding factor is the nature of the preceding stem or suffix, which . . . must be credited, as part of its inner form, with an inherent spirantizing, geminating, or nasalizing power . . . Thus, for purposes of derivation and composition one needs to know always whether a given stem or suffix is one that spirantizes, geminates, or nasalizes.

Thus, a morpheme-initial q- will appear as -g- after a spirantizing stem, e.g., anqa-ga 'to be red' (anqa 'red'; -ga 'stative'); as -qq- after a geminating stem, qucca-qqa 'to be gray' (qucca 'gray', -ga 'stative'); and as -ŋq- after a nasalizing stem, paŋ-ŋqa 'to be smooth' (paŋ 'smooth', -ga 'stative'). Sapir indicated the "inner form" of a stem or affix by writing -S (spirantizing), -G (geminating), or -N (nasalizing). The stems just cited would therefore be written anqa-S 'red', qucca-G 'gray', and paŋ-N 'smooth'. Despite the changes which the initial consonant of -ga undergoes, the suffix itself is consistently spirantizing, as in the participial forms of each of the above forms--anqaga-ri- 'being red', quccaqqa-ri- 'being gray', and paŋqa-ri- 'being smooth'. The stative suffix is therefore -ga-S. The participial suffix -ti-N also undergoes the regular consonantal processes after geminating and nasalizing stems, for example, -ai-tti- 'not having' and nuggwi-nti- 'streaming'.

While -ga-S 'stative' and -ti-N 'participial' both show the expected and regular consonantal changes in their initial consonants, many suffixes are only found with a single type of initial consonant which is invariant no matter what type of stem it is attached to. These invariant consonants can be either spirantized, geminated, or nasalized. For example, the suffix

-vaa-N 'future' nearly always occurs with a spirantized initial consonant (the variant -mpaa-N generally occurs after a stem which contains a nasal rather than one that is nasalizing, although it is not always clearcut), thus we find guggwi-vaa- 'will shoot' from guggwi-G 'shoot' (compare ta-guggwi-ggarɿ- 'shoot with the foot (kick) while sitting' with the secondary verb -garɿ-S 'while sitting'), and yai-vaa- 'will hunt' from yai-N 'hunt' (compare yai-ngw'ai- 'go hunting' with the suffix -gw'ai-S 'go while -ing'); the suffix -qgw'ai-S 'go while -ing' always occurs with a geminated initial consonant (this is a variant of -gw'ai-S 'go while -ing' which does have a variable consonant), thus we find payɿ-qgw'ai- 'go back' from payɿ-S 'return (sg)' (compare payɿ-rɿ 'one who goes home' with the participial suffix -tɿ-N), and pagi-qgw'ai- 'walk off' from pagi-N (compare gaa-ppagi-nki- 'comes singing towards' with the suffix -qi-S 'come while -ing'); the suffix -ngɿ-G 'benefactive' always occurs with an initial prenasalized stop, as in gaa-ngɿ- 'sing for' from gaa-S 'sing' (compare gaa-rɿ- 'singing' with the participial suffix -tɿ-N), and sa'a-ngɿ- 'make mush for' from sa'a-G 'boil' (compare na-ssa'a-qqani 'sweat house' with the noun qanni-S 'house').

With the possibility of two types of initial consonant--the variable and the invariable--it is important to keep the forms distinct in the lexicon. Sapir did this by writing the invariant forms with the initial consonant which always occurred. The variable forms he wrote by indicating all three possibilities, for example, -ga, -qqa, -nqa 'stative'. On page 63, however, he uses the term "schematic form" and writes this suffix as -ga-S. This is the same as his "maximally correct" forms of 1933 (1949:50). If we drop the listing of all the variants, and write the "schematic form", there are four possibilities for the initial consonant of a morpheme. These four possibilities are (illustrated with the uvular stop series) g, q, qq, and ng, the first being the variable consonant and the remaining ones being the invariant consonants.

From the discussion in Sapir (1930), it is apparent that Sapir treated these processes as lexical rather than phonological, that is, the consonantal variations were due either to the type of stem to which a morpheme was attached or to an invariable initial consonant. Whenever a stem's "inner form" contradicted the initial consonant of the suffix, the suffix form took precedence. In the case of the variable suffixes, the variant appropriate to the stem was attached without regard to specific phonological rules. However, Sapir also states (45) that there are "only twelve, at most thirteen, primary [underlying, non-derived] consonants: p; t; q; gw; s; c; m; n; ŋ; w; ɣ; ʔ; possibly also initial h-. He also states (45-6) that:

The unaspirated stops and affricates occur as such only initially before a voiced vowel and medially after an unvoiced vowel . . .; otherwise they are either 'nasalized' . . . or 'geminated'.

Concerning spirantization, he writes (46) that "all spirants (except s; w; ɣ; h) are developed from stopped consonants".

From this discussion, it seems that Sapir considered the consonantal processes to be not just lexical rules, but also phonological rules and that he considered the voiceless stop series to underly the spirantized, geminated, and nasalized series. He does not, however, actively pursue the implications of these claims in his "phonemic" forms, although the only series that could be represented differently is the spirantized series. Throughout the grammar and lexicon, medial spirants are consistently written as underlying. McCawley (1967:110) discusses Sapir's "phonologic" representations, and states "if a morpheme always possesses a medial glottal stop, Sapir will write that segment in his phonologic representations even if there is a phonologic rule of the language which would insert it anyway". The medial, ungeminated, unnasalized stops of Southern Paiute are always spirantized, therefore, Sapir always writes spirants and not stops in morpheme internal positions. He does recognize, however, the underlying nature of the stop, hence his "schematic form" (63) is -ga-S 'stative' even though this morpheme never surfaces with an initial ungeminated g. McCawley also states (110) that "Sapir would . . . treat one single phenomenon as two if its effects were manifested both in the alternations of some morphemes and in the constant shapes of others". Thus, for Sapir, spirantization was both a lexical rule and a phonological rule, although, in 1930, he considered the phonological aspect of this rule to be a diachronic rather than a synchronic process (63-64).

The discussion of stress and vocalic devoicing revolves around the question and definition of moras. Sapir (38) states that:

Of greater phonologic importance than the division of a word into syllables is that into units of length, moras. Every organic [underlying, non-derived] short vowel . . . counts for one mora; every long vowel or diphthong . . . for two.

Stress placement in Southern Paiute is mora-counting, not syllable-counting. Sapir (39) called the stress placement rule the "law of alternating stresses" whereby "all odd moras are 'weak' or relatively unstressed, all even moras are 'strong' or relatively

stressed". Primary stress nearly always falls on the second mora, except in bisyllabic words which have primary stress on the first mora and words which begin with one of a few prefixes which have primary stress always associated with them, for example, ganínI 'my house', with stress on the second mora, qánI 'house', a bisyllabic word with stress on the first mora, and í-ivi- 'drink in vain', and í-ppínni- 'look in vain', with stress on the prefix í-G 'in vain'. The law of alternating stresses would therefore assign stress to the form taggiu-qgi-nqí-ppígai-aqqa-'mí 'they hit it so that it broke into pieces' to yield tagqíuqqíngqíppígalagqà'mí. Primary stress is on the usual second mora.

All final moras are devoiced in Southern Paiute and while this devoicing varies as to degree (Sapir 1930:27-33), I will treat it here as fairly regular in retaining the quality of the final vowel. This is a rather straightforward rule, and would seemingly require little comment, but for two considerations. First, Sapir explicitly states that non-final vocalic devoicing is bled by this rule (39) when he states that non-final devoicing affects all weak moras before a geminated stop or sibilant except "the next to the last mora, which is always preserved intact (owing to the unvoicing of the following mora)". Final vowel devoicing must therefore precede non-final devoicing in a derivation. Second, while Sapir makes no mention of the relative ordering of final vowel devoicing and the law of alternating stresses, I have ordered these as stress placement first and final devoicing second. Applying Sapir's rule formulations in either order can assign strong mora status to a final vowel, therefore, a word-final voiceless vowel could have relative stress. A slight modification to his law of alternating stresses would state that final vowels are always weak moras or a modification to the final vowel devoicing rule would state that final vowels lose their relative stress. Sapir would most likely have opted for the former modification as this leads to the simplest derivation with no false steps (viz., assigning stress to a syllable and then taking it away with a later rule).

Once stress is known, non-final vocalic devoicing can be described. While Sapir does not deal with ordered rules per se, such a notion seems implicit in his discussion. He explicitly states (39), following his description of the law of alternating stresses, that "we may now state the full law of non-final unvoicing". Indeed, his vocalic devoicing rule makes use of the 'weak' moras which he has defined by the stress rule above, thus, the law of alternating stresses affects non-final devoicing. His rule states (39):

Aside from the next to the last mora, which is always preserved intact (owing to the unvoicing of the following

mora), every weak mora standing before a geminated stop (pp; tt; cc; qq; ggw) or sibilant (ss; postvocalic sibilants are always to be understood as geminated) loses its voice. A diphthong or long vowel can be partly unvoiced only when its second mora is weak . . .

This rule would then devoice the vowels in taqqíuqqìngqíppìgàìagqà'mɛ̃ 'they hit it so that it broke into pieces' to yield the near-surface form tAqqíUqqìngqíppìgàìAqqà'mɛ̃. In his statement of the distribution of unaspirated stops (45), Sapir says that "the unaspirated stops occur as such only initially before a voiced vowel and medially after an unvoiced vowel". However, the rule of vocalic devoicing applies only to vowels before geminated stops. This is a rather clear case of Sapir's implied ordering as he states (46) that the unaspirated stops following voiceless vowels are geminated in origin. Sapir has thus implicitly ordered four rules: (1) the law of alternating stresses; (2) final vowel devoicing; (3) non-final vowel devoicing; and (4) degemination of stops after a voiceless vowel. The surface form of tAqqíUqqìngqíppìgàìAqqà'mɛ̃ is therefore tAqíUqìngqíppìgàìAqà'mɛ̃.

One final aspect of the devoicing of moras is the devoicing of voiced non-vowels in front of a voiceless vowel. Sapir (45) simply states that:

. . . most of the voiceless spirants . . .; the voiceless or partly voiceless nasals . . .; and the voiceless rolled R are all developed from the corresponding unaspirated or voiced forms . . . in connection with the unvoicing of moras.

The nasals do not seem to consistently devoice and n is never found voiceless in Sapir's data, but the spirants and glides devoice regularly. For example, tíva 'pine nut' becomes tífA, and píqqágwittà 'Sore Buttocks (acc.)' becomes píqáxwItàA.

In 1933, Sapir (1949:51) revised his treatment of intervocalic spirantization and, in a now (in)famous chart, showed both surface and underlying forms for a number of possible word shapes. The spirantized consonants were, naturally, treated as underlying simple stops, a marked departure from his 1930 treatment which treated spirantization as a lexical rule rather than a phonological rule. Sapir's "words" were composed of nonsense syllables, but Cairns (1978:215) has revised Sapir's chart to include real words of the specified shapes. The addition of the intervocalic spirantization rule to the previously described rules and the use of Cairns' list of words provides us with the following derivations:

[Abbreviations for rules are: SPI, SPIrantization; LAS, Law of Alternating Stress; FDV, Final vowel DeVoicing; DVO, vowel DeVoicing; DGM, DeGeMination; and SDV, Sonorant DeVoicing]

	/típa/	/típaá/	/qaípa/	/qaípaá/	/puqqwi/	/puqqwia/
SPI	tíva	tívaa	qaíva	qaívaa	---	---
LAS	tíva	tíváá	qaíva	qaívaa	púqqwi	puqqwía
FDV	tívA	tíváA	qaívA	qaívaa	púqqwI	puqqwía
DVO	---	---	---	---	---	pUqqwía
DGM	---	---	---	---	---	pUqwía
SDV	tífa	---	qaífa	---	púqqwI	---
	[tífa]	[tíváA]	[qaífa]	[qaívaa]	[púqqwI]	[pUqwía]

[Glosses are: 'pine nut', 'pine nut (accusative)', 'mountain', 'mountain (accusative)', 'bladder', 'bladder (accusative)']

	/paíppi/	/paíppia/	/nípapi/	/nípapia/	/naqaay±/
SPI	---	---	nívavi	nívavia	nagaay±
LAS	paíppi	paíppia	nívávi	nívávia	nagáay±
FDV	paíppI	paíppiA	nívávI	nívávIA	nagáay±
DVO	---	---	---	---	---
DGM	---	---	---	---	---
SDV	---	---	níváfI	---	nagáay±
	[paíppI]	[paíppiA]	[níváfI]	[nívávIA]	[nagáay±]

[Glosses are: 'blood', 'blood (accusative)', 'snow', 'snow (accusative)', 'puts on']

	/qavaagai/	/mupippi/	/mupippia/	/símqqa/	/símqqai/
SPI	qavaagai	muvippi	muvippia	---	---
LAS	qaváagài	muvíppi	muvíppia	símqqa	símqqài
FDV	qaváagàI	muvíppI	muvíppiA	símqqA	símqqàI
DVO	---	---	---	---	símqqàI
DGM	---	---	---	---	símqqàI
SDV	---	---	---	---	---
	[qaváagàI]	[muvíppI]	[muvíppiA]	[símqqA]	[símqqàI]

[Glosses are: 'is a horse', 'nose', 'nose (accusative)', 'let it go', 'let ... go']

	/tissapí/	/tissapía/	/mussuipi/	/mussuipia/
SPI	tissaví	tissavía	mussuivi	mussuivia
LAS	tissáví	tissávía	mussúivi	mussúivía
FDV	tissávɨ	tissávíA	mussúivI	mussúivíA
DVO	tɨssávɨ	tɨssávíA	mUssúivI	mUssúivíA
DGM	tɨsávɨ	tɨsávíA	mUsúivI	mUsúivíA
SDV	tɨsávɨ	---	MUsúifI	MUsúivíA
	[tɨsávɨ]	[tɨsávíA]	[MUsúifI]	[MUsúivíA]

[Glosses are: 'rope', 'rope (accusative)', 'mustache', 'mustache (accusative)']

	/muttaqqa/	/muttaqqa/	/appíiqqu/	/paccáiqqai/
SPI	---	---	---	---
LAS	muttáqqa	muttáqqa	appíiqqu	paccáiqqai
FDV	muttáqqa	muttáqqaA	appíiqqu	paccáiqqai
DVO	mUttáqqa	mUttáqqaA	Appíiqqu	pAccáiqqai
DGM	mUtáqqa	mUtáqqaA	Apíiqqu	pAcáiqqai
SDV	MUtáqqa	MUtáqqaA	---	---
	[MUtáqqa]	[MUtáqqaA]	[Apíiqqu]	[pAcáiqqai]

[Glosses are: 'forehead', 'forehead (accusative)', 'fall asleep', 'hang']

	/piqqagwittí/	/pattáqqittui/
SPI	piqqagwittí	---
LAS	piqqágwittí	pattáqqittui
FDV	piqqágwittíA	pattáqqittui
DVO	pIqqágwittíA	pAttáqqittui
DGM	pIqágwittíA	pAtáqqittui
SDV	pIqáxWittíA	---
	[pIqáxWittíA]	[pAtáqqittui]

[Glosses are: 'Sore Buttocks (accusative)', 'cause to burst']

While these rules and derivations work well for the vast majority of data, there is one specific instance in which Sapir's rule as stated will not derive the correct form. His law of alternating stresses as stated does not take into account the prefixes which are always stressed on the first mora. These prefixes disrupt the normal stress pattern by assigning strong syllables on odd moras rather than even moras. Sapir (42) tries to explain these on historical grounds, but is only partially successful. He is finally forced to mark initial stress in the lexicon on the two that cannot be explained--tí-G 'in vain', and tíra-S 'desert, open expanse, bare'. The effects of these on mora-counting can be seen in the forms tíRA_sín'ávígáiváantɨ 'destined to be a desert dog, coyote' (from tíra-ssinna'avi-gai-vaa-ntɨ), where the second mora is voiceless

before a geminate consonant; and tʃraʊggwivɪni 'my unfeathered arrow' (from tʃra-uggwi-vi-ni), where the third mora is strong and is not devoiced before the geminate consonant.

Harms' Analysis

Harms (1966) did a great deal of reanalysis of Sapir's data and made several rather startling claims. Most of his conclusions, however, are based not on derivational or naturalness considerations, but on feature economy in the rules and lexicon. Rather than discuss all of Harms' rules, I will confine the following comments to those rules which deal with the questions of the consonantal variations, stress, and voiceless vowels and will deal with his rules in the order in which he gives them.

In discussing long and short segments, Harms analyzes long vowels as underlying geminate clusters of short vowels, and long intervocalic nasals as underlyingly short, to be lengthened by rule. These two solutions are fairly straightforward, but his discussion of geminate stops is where the analysis begins counting features. As can be seen from Sapir's description, voiceless vowels, stress, and geminate obstruents are quite interrelated. Sapir's solution uses stress and gemination to predict voiceless vowels (with subsequent degemination following a voiceless vowel). Harms' solution, on the other hand, uses stress and voiceless vowels to predict gemination. On the basis of number of features used in the rules and lexicon, Harms sets up voiceless vowels as underlying and all stop consonants as short and voiceless. This seems to be a highly unnatural solution and has generated a large amount of criticism both from specialists in the Numic languages and from theoreticians. Iannucci (1973:80-81), for example, writes:

One can not consider economy of description out of the context of other theoretical principles, especially that of the theory of 'markedness' . . . the existence of an underlying voiced/voiceless distinction for vowels [is]--at best--highly marked and thus quite damaging with respect to the economy of the system . . . This consideration of 'naturalness' in phonology leads us to view Harms' analysis as something of an exercise in 'hocus-pocus' linguistics.

Kelly (1978:95-96) goes further:

. . . Greenberf [sic] (1969) has shown that voiceless vowels are predictable in all languages, a fact which makes Harms's solution look highly unnatural, and no amount of feature saving can outweigh this unnaturalness.

This approach, which achieves economy but misses generalizations, ignores the original motivation for the simplicity metric . . .

The bulk of criticism of Harms' analysis has dealt with his setting up underlying voiceless vowels; however, the first rule which deals with the problems in this paper (2b) is equally unnatural. Harms, in describing the output of:

Rule 2b

$$\begin{bmatrix} -\text{cns} \\ +\text{voc} \end{bmatrix} \rightarrow [+stress]$$

simply says (231) "all vowels receive stress" without further discussion. The long arguments describing the rationale behind underlying voiceless vowels and the brevity of this statement have probably equally contributed to the lack of attention which this rule has received, but it is no less unnatural than underlying voiceless vowels. In addition to the unnaturalness of stressing all vowels, this rule also stresses the VOICELESS vowels.

Rule 5 is fairly straightforward:

Rule 5

$$[\quad] \rightarrow \begin{bmatrix} -\text{voice} \\ -\text{stress} \end{bmatrix} / \text{---} \neq$$

This rule devoices word final vowels and unstresses them.

Rule 6 then removes stress from odd syllables unless they are penultimate:

Rule 6

$$\begin{bmatrix} -\text{cns} \\ +\text{voc} \end{bmatrix} \rightarrow [-stress] / \left\{ \begin{bmatrix} -\text{cns} \\ +\text{voc} \\ -\text{stress} \end{bmatrix} \begin{matrix} \neq \\ C_0^2 \end{matrix} \begin{bmatrix} -\text{cns} \\ +\text{voc} \\ +\text{stress} \end{bmatrix} \right\} C_0^2 \text{---} C_0^2 \begin{bmatrix} -\text{cns} \\ +\text{voc} \\ +\text{stress} \end{bmatrix}$$

Rules 2b, 5, and 6 would "assign" stress by adding it to all vowels, deleting it word-finally, then deleting it on all odd non-penultimate vowels. This method of assigning stress to a word suffers not only from the sheer weight of being non-intuitive, but also from involving a rather complex false step in the derivation. Harms' rules may use features more economically, but his derivations

are far more complex. Sapir's one step law of alternating stresses has become three steps in Harms' solution. In addition, Harms' solution cannot account for invariance of first syllable stress on ɛ-G 'in vain' and tɛra-S 'desert, bare'.

Harms Rule 7 geminates consonants after a stressed voiceless vowel:

Rule 7

$$\begin{bmatrix} +cns \\ -voc \end{bmatrix} \rightarrow [+long] / \begin{bmatrix} -cns \\ +voc \\ -voice \\ +stress \end{bmatrix} \text{ ---}$$

Once again, the question of naturalness raises its head and asks why gemination is triggered only by a stressed voiceless vowel and not by a stressed voiced vowel also. Indeed, the voiceless vowels, in general, are merely abstract markers to indicate that the following consonant is geminated if it follows stress. Over half of the underlying voiceless vowels are voiced at some point in the derivation. This use of voicelessness as an abstract feature can be illustrated in the derivation of Aqɛssa'əppɪ 'sunflower mush'. The verb /sa'A/ 'boil' (Sapir's sa'a-G) is first nominalized with the passive participle suffix /-pi/ (Sapir's -ppi-; as discussed below, this invariably geminated consonant cannot be represented in Harms' system, but here, it is affixed to a geminating stem and the problem is not apparent), yielding /sa'Api/ 'mush (what is boiled)'. The noun /Aqɛn/ 'sunflower seeds' (Sapir's agqɛ-N) is then compounded with /sa'Api/ to yield /Aqɛnsa'Api/ 'sunflower mush'. A modification to Harms' nasal deletion rule will then delete the nasal before the s so the form /Aqɛsa'Api/ will go through the rules, but the incorrect *[Aqɛsa'əppɪ] will be generated. Harms has no rule for geminating a fricative other than Rule 7 despite the fact that Sapir specifically states (1930:39) that "postvocalic sibilants are always to be understood as geminated". Harms' rules will take care of geminated ss by always having it preceded by a voiceless vowel. Thus, in order to correctly derive Aqɛssa'əppɪ by Harms' rules, we must have /Aqɛn/ as the underlying form of 'sunflower seeds'. The voiceless ɛ will NEVER surface as such (except in final position), serving only to geminate a following s after the final nasal has been deleted. Compare, for example, the surface forms əqqɛ 'sunflower seeds', and Aqɛmpɛ 'sunflower plant'. Not only agqɛ-N, but every other one of Sapir's nasalizing stems would have to end in a voiceless vowel in Harms' forms in order to account for the behavior of s in a following morpheme; for example, NɛsɛmmɛA 'to let a person go' (from Sapir's nɛ-N 'person' and sɛmmɛa-G 'to let go'; Harms' /nɛn=sɛmɛA/), and ovɛssarɛɪɪ 'wooden

dog' (from ovi-N 'wood' and sarii-ci 'dog (absolute)'; Harms' /opIn=satii=ci/).

Rule 8 spirantizes (and voices) the stops after a voiced vowel:

Rule 8

$$\begin{bmatrix} +cns \\ -voc \\ -strid \end{bmatrix} \rightarrow \begin{bmatrix} +cns \\ +voice \end{bmatrix} / \begin{bmatrix} -cns \\ +voc \\ +voice \end{bmatrix} \text{ —}$$

Rule 9 voices stressed vowels:

Rule 9

$$\begin{bmatrix} -cns \\ +voc \\ +stress \end{bmatrix} \rightarrow [+voice]$$

Rule 11 voices vowels before a voiced segment:

Rule 11

$$\begin{bmatrix} -cns \\ +voc \end{bmatrix} \rightarrow [+voice] / \text{ — } [+voice]$$

As can be seen, Harms' rules may be simple, but where Sapir needed only one rule for non-final devoicing, Harms has two separate rules for vocalic voicing. These two rules cannot be collapsed and clearly illustrate a more complex derivation than Sapir's rules yield.

Rule 12 devoices consonants before a voiceless vowel:

Rule 12

$$[+cns] \rightarrow [-voice] / \text{ — } \begin{bmatrix} -cns \\ +voc \\ -voice \end{bmatrix}$$

According to Harms' approach, some of the forms used to illustrate Sapir's rules above would have the derivations found below.

	/tɪpa/	/tɪpaa/	/qaipa/	/qaipaa/	/pUqwi/	/pUqwia/
2b	tɪpá	tɪpáá	qáipá	qáipáá	pUqwí	pUqwíá
5	tɪpA	tɪpáA	qáipA	qáipáA	pUqwI	pUqwíA
6	---	tɪpáA	qáipA	qáipáA	---	pUqwíA
7	---	---	---	---	pUqqwI	---
8	tɪvA	tɪváA	qáivA	qáiváA	---	---
9	---	---	---	---	pUqqwI	---
12	tɪfA	---	qáifA	---	pUqqwI	---
	[tɪfA]	[tɪváA]	[qáifA]	*[qáiváA]	[pUqqwI]	[pUqwíA]

[Glosses are: 'pine nut', 'pine nut (accusative)', 'mountain', 'mountain (accusative)', 'bladder', 'bladder (accusative)']

	/paɪpi/	/paɪpia/	/naqaayɪ/	/mupɪpi/	/mupɪpia/
2b	páɪpí	páɪpíá	náqááyɪ	múɪpí	múɪpíá
5	páɪpI	páɪpíA	náqááyɪ	múɪpíI	múɪpíA
6	páɪpI	páɪpíA	naqááyɪ	mupɪpI	mupɪpíA
7	páɪppI	páɪppíA	---	mupɪppI	mupɪppíA
8	---	---	nagááyɪ	muvɪppI	muvɪppíA
9	páɪppI	páɪppíA	---	muvɪppI	muvɪppíA
12	---	---	nagááyɪ	---	---
	[páɪppI]*[páɪppíA]*[nagááyɪ]			[muvɪppI]*[muvɪppíA]	

[Glosses are: 'blood', 'blood (accusative)', 'puts on', 'nose', 'nose (accusative)']

	/mUtAqa/	/mUtAqaa/
2b	mÚtÁqá	mÚtÁqáá
5	mÚtÁqA	mÚtÁqáA
6	mUtÁqA	mUtÁqáA
7	mUtÁqqA	mUtÁqqáA
8	---	---
9	mUtáqqA	mUtáqqáA
12	MUtáqqA	MUtáqqáA
	[MÚtÁqqA]*[MÚtÁqqáA]	

[Glosses are: 'forehead', 'forehead (accusative)']

Examining the derivations reveals several serious problems with Harms' analysis. First, the starred forms reveal a serious weakness of his rules assigning stress to all vowels and then deleting it with the two rules which he has postulated. There is no rule to delete penultimate stress on an odd-numbered mora. It might seem to be possible to add a rule deleting specifically penultimate stress after another stressed vowel, but it must be ordered after Rule 7 has geminated the following consonant and Rule 9 has voiced it (in the case of the voiceless vowels). This rule would be rather unnatural as it would be separated from the other stress rules. In

deriving ApííqqU 'to fall asleep' from Harms' underlying /ApíIqu/ illustrates this misplaced stress rule:

/ApíIqu/ --> (2b) Ápííqú --> (5) ÁpííqU --> (6) ApííqU -->
 (7) ApííqqU --> (9) ApííqqU --> (new rule) ApííqqU -->
 [ApííqqU]

Second, the derivations are full of false steps, specifically with regards to stress. The majority of vowels stressed by Rule 2b are unstressed later in the derivation. For example, out of five vowels stressed by 2b in /pIqaqwItia/ 'Sore Buttocks (acc)', only two retain their stress in the final form [pIqáxWItia].

Finally, the derivations are much longer than Sapir's and more convoluted. For example, in Sapir's solution, the derivation of [simíaaqA] 'let it go (preterite)' requires only two steps while Harms' derivation requires five steps. It is clear that Harms' attempt to save features in the rules and lexicon fails if the total number of steps in a derivation is increased. In only eight of twenty-six derivations illustrated for Sapir's rules is Harms' derivation simpler than Sapir's, and in each of these, Sapir's derivation is only one step longer. Each of Sapir's longer derivations is shortened in Harms' derivation by assuming underlying voiceless vowels. This is not a significant savings.

One feature of Harms' reanalysis has, however, been widely accepted and has formed the basis of many subsequent discussions of not only Southern Paiute, but of other Numic languages as well. Sapir had discussed the consonantal variations in lexical terms, that is, the initial consonant of the variable suffixes was determined by the "inner form" of the preceding morpheme. During word formation, prior to any phonological rules, one of the three possible shapes of the morpheme was matched to the stem. Harms reanalyzed this not in lexical terms, but in phonological terms, that is, the initial consonant of a morpheme was invariable in underlying form, but was changed by regular phonological rules. Instead of stems having an "inner form", Harms analyzed spirantizing stems as ending in a voiced vowel subject to Rule 8 which spirantizes the following consonant; geminating stems were analyzed as ending in a voiceless vowel which (by the numerous rules of stressing, destressing, voicing, and lengthening) geminates the following consonant; and nasalizing stems were analyzed as ending in a nasal which was lost word-finally and before vowels and resonants, but was assimilated to the place of articulation of a following stop. Rules 4b and 17 describe the nasal deletion and assimilation:

Rule 4b

$$\begin{bmatrix} +cns \\ +voc \\ +nas \end{bmatrix} \rightarrow \text{null} / \text{---} \left\{ \begin{array}{l} = [+voc] \\ \neq \end{array} \right\}$$

Rule 17

$$[+nas] \rightarrow \begin{bmatrix} \alpha \text{ cmp} \\ \beta \text{ grv} \end{bmatrix} / \text{---} \begin{bmatrix} +cns \\ \alpha \text{ cmp} \\ \beta \text{ grv} \end{bmatrix}$$

It should be noted that Harms' nasal deletion rule (4b), as formulated, does not work, because it does not include s in the conditioning environment. As formulated, Rule 4b would derive from /Aqin/ 'sunflower seeds' (Sapir's agq̄i-N, compare Aq̄mp̄ 'sunflower plant') and /sa'Api/ 'mush' (Sapir's sa'appi) the incorrect *Aq̄insa'appI 'sunflower mush'. The correct form does not include the nasal--Aq̄ss'appI. Thus, what to Sapir was a lexical feature of the preceding stem, is to Harms a phonological feature. This was Harms' contribution to Southern Paiute phonology. Historically, there is evidence supporting the analysis of spirantizing stems ending in a vowel and nasalizing stems ending in an underlying nasal (see I. Miller 1982), but Harms' analysis of underlying voiceless vowels makes his solution for geminating stems counter-intuitive.

While Harms' solution for spirantizing and nasalizing stems seems to be a good one, there is one inherent flaw in treating consonantal variation strictly phonologically. The morphemes which begin with an invariant consonant are a serious problem in Harms' solution. Morphemes which always begin with a nasal pose no problem--the nasal is added to a vowel final stem, a voiceless vowel will voice in front of a voiced consonant (Rule 11), and, presumably, another rule will shorten a three consonant cluster (nasal, nasal, stop) by deleting the first nasal. The other two types of invariant morpheme, however, will not operate correctly under Harms' rules when affixed to a stem of a different type--that is, a spirant initial morpheme on either geminating or nasalizing stems, or a geminate initial morpheme on either spirantizing or nasalizing stems. The following derivations illustrate the problem.

	/qUqwI=paan/	/yain=paan/	/payi=qwai=yi/	/paqin=qwai=yi/
2b	qUqwIpaán	yáinpaán	páyíqwaíyɪ	páqinqwaíyɪ
4b	qUqwIqáá	yáinpaá	---	---
5	qUqwIpaA	yáinpaA	páyíqwaíyɪ	páqinqwaíyɪ
6	qUqwIpaA	yáinpaA	páyíqwaíyɪ	páqinqwaíyɪ
7	qUqwIppáA	---	---	---
8	---	---	páyíqwaíyɪ	páqinqwaíyɪ
9	qUqwIppáA	---	---	---
12	---	---	páyíqwaíYɪ	páqinqwaíYɪ
17	---	yáimpaA	---	páqinqwaíYɪ
	*[qUqwIppáA]	*[yáimpaA]	*[páyíqwaíYɪ]	*[páqinqwaíYɪ]
	[qUqwIvaA]	[yáivaA]	[páyíqwaíYɪ]	[páqinqwaíYɪ]

[Glosses are: 'will shoot', 'will hunt', 'goes back', 'walks off']

Both the spirantized stems and the geminated stems require, in Harms' analysis, that the final segment of the stem be modified in some way. The stems ending in a nasal must drop the nasal, the stems ending in voiceless vowels must have the vowels voiced, and the stems ending in voiced vowels must have the vowels devoiced. There is no mechanism in Harms' approach by which this can be accomplished. Any phonological solution (such as creating an abstract "preceding vowel devoicing/voicing" feature) will be completely ad hoc and non-intuitive. We are thus left once again on the doorstep of a lexical solution as the phonological statements of Harms are inadequate to describe the data.

Chomsky and Halle's Discussion

It should not be surprising to find that a language of Southern Paiute's theoretical interest and quality of description has a place in The Sound Pattern of English (Chomsky and Halle 1968:344-9). Chomsky and Halle reworked Harms' analysis of stem-final features determining the initial consonant of the following morpheme. They made several key changes to Harms' rules, however, and thereby established a phonological framework which numerous following phonologists have accepted. They made, however, a serious error in using Sapir's chart (1949:51) of phonological and phonetic shapes without checking the forms thoroughly in his grammar (1930). Kelly (1978:102) makes the following remark:

McCawley (1974) praises this analysis as "highly insightful . . . an elegant analysis of rather fearsome-looking data". What data? Chomsky and Halle produce not one single word of Southern Paiute as evidence . . .

In addition, for some reason unknown to me, Chomsky and

Halle reinterpreted Sapir's bilabial and velar fricatives as voiced and voiceless variants of glides; therefore, their Rule (54) for devoicing of consonants only works on sonorants, which excludes the devoicing of v, q, and gw.

One important revision of Harms' analysis by Chomsky and Halle is to set up geminate consonants as underlying, thus doing away with Harms' voiceless vowels. To account for the geminating stems, they set up an underlying stop in stem final position which totally assimilates to a following consonant (here symbolized by C). They then generalize Harms' Rules 4b and 17 (which only dealt with nasals) to Rules (44) and (45):

Rule 44

$$[+cons] \rightarrow \emptyset / \text{---} \left\{ \begin{array}{l} \# \\ +v \end{array} \right\}$$

Rule 45

$$[+cons] \rightarrow \left[\begin{array}{l} \alpha \text{ ant} \\ \beta \text{ cor} \\ \gamma \text{ high} \\ \delta \text{ back} \end{array} \right] / \text{---} + \left[\begin{array}{l} +cons \\ \alpha \text{ ant} \\ \beta \text{ cor} \\ \gamma \text{ high} \\ \delta \text{ back} \end{array} \right]$$

These two rules, while looking straightforward enough, are unable to handle several things. First, as discussed under Harms' rules, Rule (44) will not delete a nasal or obstruent in front of s. If the stem-final obstruent stop is retained before s, then it does not assimilate correctly, but becomes t rather than forming a geminate ss. For example, /taC/ 'foot' (Sapir's ta-G) plus /siu + pi/ 'toe, finger (absolutive)' (Sapir's -ssiu-vi-) would yield /taC + siu + pi/ which would become tatsiupi after the application of rule (45); and tatiiuvi (ignoring the problems with Rule (46) for now) after the application of Rules (46), (47), and (51). This would presumably lead to a surface form such as *tAtifufI, although Chomsky and Halle's rules are poorly written after this point (due to their analysis of intervocalic voiced fricatives as glides). The correct surface form is tAsifufI 'toe'.

Rules (44) and (45) also do not correctly delete stem-final nasals and obstruents before morpheme-initial glides. For example, /aaqaC/ 'in hiding' (Sapir's aaga-G) and /waci-/ 'put' (Sapir's waci-) become /aaqawaci-/ 'put in hiding', but Chomsky and Halle's rules predict */aaqawaci-/. Also, geminating stems have the same effect on initial nasals as do nasalizing stems (Sapir 1930:63), but Chomsky and Halle's rules would derive */ayapmi/ instead of /ayammi/

'prairie dogs' from /ayaC/ 'prairie dog' (Sapir's aya-G) and /-mɨ/ 'plural'.

Rule (46) spirantizes postvocalic stops, although it supposedly produces non-strident voiced continuant glides for p, q, and gw. I do not know where they got the idea that these were glides rather than fricatives, but it was certainly not from Sapir (1930 or 1949). Sapir clearly distinguished between the glides or semivowels, w and y (1930:56), and the other consonants. Chomsky and Halle's rule therefore, does not produce the correct phonetic forms:

Rule 46

$$\begin{bmatrix} -\text{son} \\ -\text{strid} \\ \alpha\text{cor} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{cont} \\ +\text{voice} \\ +\text{son} \\ \alpha\text{cons} \\ \alpha\text{voc} \end{bmatrix} / \text{V} + \text{---}$$

This rule also contains one additional flaw. It only operates after a morpheme boundary. It will therefore be necessary, given this formulation, to set up voiced intervocalic fricatives which do not follow a morpheme boundary in the underlying forms. Thus, the underlying form of 'hair' must be /paigi/ as there is no rule in Chomsky and Halle which will spirantize a morpheme-internal stop. Their statement of the underlying consonants of Southern Paiute (346), however, does not include voiced fricatives.

Rule (47) assigns stress and is a formal version of Sapir's law of alternating stresses. It is a rather impressive formulation and handles the data 99% effectively. The only problem arises with the two intractable prefixes ɨ-G 'in vain' and tɨra-S 'desert, bare' which always have first syllable stress.

Rule 47

$$\text{V} \rightarrow [1 \text{ stress}] / \# \langle \text{C}_0 \text{V} (\text{C}_0 \text{VC}_0 \text{V})^* \rangle \text{C}_0 \text{---} \langle [+seg]_0 \rangle \text{C}_0 \text{V} \#$$

Rule (51) deletes the second of two obstruents in a cluster when followed by a stressed vowel. This rule necessarily applies after Rule (47) has assigned stress.

Rule 51

$$[-\text{son}] \rightarrow \emptyset / [-\text{son}] \text{---} \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{stress} \end{bmatrix}$$

Chomsky and Halle analyze geminates in Southern Paiute as clusters of two identical consonants; therefore, this rule is a degemination rule.

Rule (53) devoices a vowel before a word boundary or obstruent followed by a vowel.

Rule 53

$$V \rightarrow [-\text{voice}] / \text{---} \left\{ \begin{array}{l} \# \\ [-\text{son}] \quad V \end{array} \right\}$$

Stress is not important in the formulation of this rule because, at this point in a derivation, there will be no sequences of stressed vowel, obstruent, vowel. This is possible for Chomsky and Halle because they have changed the nongeminated stops into glides rather than fricatives. While this rule seems rather straightforward, there is an objection on the basis of naturalness. This rule misses the generalization that voiceless vowels both are always unstressed and always precede either a word boundary or a voiceless consonant. A more damaging aspect of this rule is that it does not take into account the difference between underlying /VccV/ and /VcV/ sequences. /c/ is [+strident], therefore is correctly unaffected by Rule (46) which spirantizes non-strident obstruents. Rule (51), however, then shortens /cc/ clusters to /c/, thus losing the distinction between /VcV/ and /VccV/ sequences. For example, /qwaccaqqi/ 'to make a splash' (Sapir's qwaccaqqi-) by Rule (47) would have the second vowel stressed and then by Rule (51) would become qwacáqqi. Rule (53) would then produce qwAcáqgi. However, /qwacaqayɨ/ 'splashes about' (Sapir's qwacaga-yɨ) would come out of Rule (47) with the form qwacáqayɨ, and Rule (53) would then produce *qwAcáqayɨ, the correct surface form being qwacáqayɨ (certain phonetic detail rules being ignored).

Rule (54) devoices sonorants in front of a voiceless vowel (treating voiced fricatives as sonorant).

Rule 54

$$\left[\begin{array}{l} +\text{son} \\ -\text{voc} \end{array} \right] \rightarrow [-\text{voice}] / \text{---} \left[\begin{array}{l} -\text{cons} \\ -\text{voice} \end{array} \right]$$

Chomsky and Halle's rules are in many ways simply formal versions of Sapir's prose rules, and thus are more intuitive and natural than Harms'. They suffer, however, from an extreme amount of carelessness in the formulations, allowing segments to leak through in great numbers. Their rules are even more curious because

of the fact that they only cite Sapir's 1933 (1949) chart, but then take morpheme boundaries into account in an inordinate number of their rules. Sapir's chart does not contain morpheme boundaries, yet Chomsky and Halle's Rule (46) is supposed to derive w and W [sic] from underlying p.

Chomsky and Halle's formulations of stem-final vowels, nasals, and stops looks adequate to account for the data presented, and they are an improvement over Harms' stem-final segments, but they still fail to account adequately for the morphemes which have invariable initial consonants. As with Harms' rules, morphemes with a nasalized consonant pose little problem, if a cluster reducing rule is in effect, but the invariable spirantized and geminated consonants pose severe problems. Adjusting Chomsky and Halle's rules for spirantization so that stops become fricatives, the following derivations illustrate what happens to the invariable consonants in Chomsky and Halle's system:

	/quqgwiC + paan/	/yain + paan/	/payi + qgwai + yi/
(44)	quqgwiC + paa	yain + paa	---
(45)	quqgwip + paa	yaim + paa	---
(46)	---	---	payi + qgwai + yi
(47)	quqgwippaa	ya'impaa	payi'qgwaiyi
(51)	quqgwippaa	---	payi'qgwaiyi
(53)	qUqgwippaA	ya'impaA	payi'qgwaiYi
(54)	---	---	payi'qgwaiYi
	*[qUqgwippaA]	*[ya'impaA]	*[payi'qgwaiYi]
	[qUqwi'vaA]	[ya'i'vaA]	[payi'qgwaiYi]

[Glosses are: 'will shoot', 'will hunt', 'goes back']

Chomsky and Halle's rules, aside from being poorly written, cannot account for the data in phonological terms alone. Their rules, strictly applied, produce linguistic forms, but they are not Southern Paiute.

A Reappraisal

There are certain pieces of data which any reformulation of Southern Paiute phonology must be able to handle. First, it must be able to deal with the standard consonant variations, stress placement, and vowel devoicing in a natural and intuitive way. Second, it must be able to deal with abnormal stress placement with adjusted mora counting. And third, it must be able to deal with the morphemes with invariable initial consonants. It has been shown above that both Harms' and Chomsky and Halle's approaches fail to account for the second and third pieces of data completely and that the first piece of data is either handled sloppily or in an

unnatural, non-intuitive way. Even Sapir's description fails to handle the second set completely.

The first question which needs to be asked is how much of the description is lexical and how much is phonological. The consonantal variations which Harms and Chomsky and Halle dealt with were the regular ones, that is, those cases where a single stem is always followed by the same type of consonant and a single morpheme always changes its initial consonant to suit the preceding stem. Their rules, however, have been shown to be inadequate to deal with morphemes which always begin with the same consonant. The rules could possibly be revised to handle the invariable consonants, but any formulation would be extremely messy, and would still have problems dealing with morphemes which always have an initial spirantized consonant. Somehow the rules would have to delete the stem-final stop or nasal on just these suffixes--in other words, a lexical solution, not a phonological one, is called for.

Kelly (1978) has mustered several arguments and a fair amount of data supporting a strictly lexical solution to the consonant variations (although she seems to have thrown the baby out with the bathwater in trying to argue against ANY phonological input, especially in dealing with spirantization). Her best argument (129-34) shows several examples of morphemes which have dual marking of features, that is, stems which can be either spirantizing or geminating, geminating or nasalizing, etc. These cannot be handled in a strictly phonological framework. In Chomsky and Halle's analysis, a stem which varied in its final feature would have to be listed twice in the lexicon with the same meaning--for example, once with a final vowel, and once with a final stop. Compare anqagwissA 'to flash red' (anqa-S 'red'; qwissA 'flash') with anqaggoro- 'paint the face' (anqa-G 'red'; goro 'paint'), where anqa 'red' has both spirantizing and geminating force. A strictly phonological treatment would require two entries in the lexicon--anqa and anqaC. Such variations in use, however, are to be expected when dealing not with phonological classes, but with lexical classes where the processes of analogy and reanalysis are constantly at work levelling class distinctions.

Historically, the basis of the consonantal variations is phonological. I. Miller (1982) has demonstrated several ways in which the spirantizing, geminating, and nasalizing stems could have developed in Proto-Numic. Shoshoni, a language of the Central Numic group (Southern Paiute being in the Southern Numic group), preserves the stem-final nasals in more environments in nouns than does Southern Paiute (W. Miller 1975:5). When the accusative suffix -a is affixed to a nasalizing stem, the underlying stem-final nasal surfaces. For example, /tsoon/ [tsoo] 'beads' becomes /tsoona/

[tsoona] 'beads (accusative)'. Also, for some speakers, the final nasal can nasalize the preceding vowel--[tsɔ̃] 'beads'. Nasalization can also proceed forward in a word if the final syllable begins with a semivowel to yield all the following surface forms of /piyɨn/ 'duck': [piyɨ], [piyɨ̃], [piyɨ̃n]. These changes are in addition to the usual environments for a stem-final nasal, that is, in front of a following stop as in /piyɨmpən/ [piyɨmba] 'on the duck'.

It is unreasonable to assume, however, that what was once a phonological process must remain a phonological process. It is quite natural for phonological processes such as those found in the Numic languages to develop into lexical processes. That is, the variation in morpheme-initial consonants may no longer be due to phonological conditioning (Is there a final consonant on the stem?), but to lexical conditioning (What class does this stem belong to?). The question is a difficult one. One consideration is whether or not the irregularities in a phonological treatment of consonantal variation are great enough to constitute a serious threat. While there is no objective measure of the amount of acceptable irregularity, it seems quite clear that the irregularities in Southern Paiute are quite numerous. Including the stems which have two possible processes and the morphemes which have invariable initial consonants alone, we find a significant number of problems with a strictly phonological approach to Southern Paiute consonants.

If, on the other hand, we assume a lexical solution to the consonant mutations, many of the problems are cleared up. Class membership, is, naturally, often flexible and somewhat variable, due to the natural tendency to standardize all stems into one class. Most stems are spirantizing; therefore, most of the stems with multiple class membership are members of the spirantizing class and either the geminating or nasalizing class. However, the set of stems which have multiple class membership in the geminating and nasalizing class, but not the spirantizing class, is quite small (only one of Kelly's examples is clearcut--to'o-G,N 'hole'; compare to'ɔ̃ppɨ 'hole' and movɨtt'ɔ̃mpɨ 'nostril', both of which have the absolute suffix -pɨ). In Shoshoni, verbs have been completely levelled in terms of class membership so that only the spirantizing class remains (a different class division has developed, however, from a stress shift in Pre-Proto-Central Numic (W. Miller 1980)).

On the basis of Shoshoni and Southern Paiute, it seems apparent that a phonological process, with respect to verbs, was morphologized at a very early date, but the morphemes with invariable initial consonants are also quite old, as many of the same morphemes are found with the same initial consonant in at least Central and Southern Numic, if not throughout Numic as a whole. For

example, the directional **-kwa* 'thither' has an invariable geminated consonant for motion simultaneous with action in both Southern Paiute *-q̄q̄wai*, and Comanche (Central Numic) *-h/kkwan* (*-hkwan* and *-kkwan* in Central Numic are both derived from Proto-Numic **-kkwan*). The forms with invariable spirantized consonant mean motion prior to action and are Southern Paiute *-gwai* and Comanche *-kwan* (McLaughlin 1982). The benefactive suffix **-ṅk̄* is also identical in Southern Paiute and Shoshoni. The fact that all three branches of Numic use a "spirantized" consonant on the morpheme meaning "come in order to" (Comanche *-kin*, Southern Paiute *-gi*, Mono (Western Numic) *-ki'*), points to a lexical analysis as historically sound, as no strictly phonological treatment can deal with this particular type of consonant-initial morpheme without relying on some type of lexical marking or ad hoc phonological blocking feature.

Kelly (1978:162-3), on the basis of a lexical analysis of Southern Paiute and comparison with Irish, sets up underlying simple stops in word-initial position (only), voiced fricatives (never word-initial), geminate stops (never word-initial), and nasal-stop cluster (never word-initial). The nasal-stop clusters are fine and geminate stops can either be analyzed as clusters of identical stops or as a [+long] stop without problem (I have opted for the latter here on the basis of feature economy), but the voiced fricatives can be very easily derived by rule. Throughout her work, Kelly complains that Sapir, Harms, and Chomsky and Halle have treated spirantization as a morpheme boundary phenomenon, and thus, in a lexical framework, a phonological rule of spirantization can be discarded along with phonological rules of gemination and nasalization as morpheme boundary rules. Voiced fricatives and simple voiceless stops are in complementary distribution, however, and when a morpheme which begins with a stop in isolation, such as *q̄anni* 'house', follows a spirantizing stem, the stop is spirantized, as in *avaganI* 'summer house'. There is no need to increase the number of underlying phonemes in order to accommodate a strictly lexical treatment of Southern Paiute. Morphemes which always begin with a spirantized consonant can be set up in underlying form with a simple stop with a rule in the grammar making it a voiced fricative between vowels. Morphemes which have a variable initial consonant depending on the class of the preceding morpheme would have three underlying forms--one with a simple stop, one with a geminate stop, and one with a nasal-stop cluster. The phonological rules would then apply to the output of the lexical rules and spirantize the intervocalic simple stops. This is a more natural solution that does not rely on either morpheme boundaries or underlying voiced fricatives. It is also a fairly common rule among the world's languages.

There is one serious objection to a completely lexical

analysis of Southern Paiute, however (assuming that underlying simple stops are spirantized by a phonological rule). In compounds, the stem class of the preceding element determines the initial consonant of the following one. This is no problem when one of the elements is a derivational or inflectional affix, which is naturally subject to the variations inherent in a lexical analysis, but when both words are noun or verb stems, it is unexpected. Inflectional or derivational suffixes are to be expected to vary according to the class of stem to which they are affixed, and prefixes might carry some marking on a following stem, although this is a little more uncommon, but full noun and verb stems should have no effect on another noun or verb stem. This is not the case, however, in Southern Paiute. The variations in derivational and inflectional suffixes have already been amply illustrated and are not surprising. Prefixes, however, always affect the initial consonant of a following stem. The spirantizing prefixes, of course, do nothing, but allow the spirantization rule to operate--navarigi- 'wash oneself' (from na-S 'reflexive' and parigi 'wash'). The nasalizing prefixes add a nasal--tɨntogogqWIPigaI 'ran well' (from tɨ-N 'well' and togogqi 'run'). The geminating prefixes geminate the following consonant--iitIga- 'eat beforehand' (from ii-G 'beforehand, readily' and tigga- 'eat'). In actuality, the prefixes work far more regularly in affecting the first consonant of a following stem than do the stems on following suffixes. Chomsky and Halle's rules (with certain important revisions) work quite adequately in describing the phonological effects of prefixes on following stems.

The consonantal variations also appear to operate between stems in the processes of compounding, although it is not as regular as between prefixes and stems, nor as irregular as between stems and suffixes. For example, note avaganI 'summer hut' (ava-S 'shade'; qanni 'house'); toagqanI 'partuition hut' (tua-G 'child, give birth'; qanni); and tinqanI 'cave' (ti-N (from timpi 'rock'); qanni) where the initial consonant of qanni 'house' has regularly spirantized, geminated, and nasalized. Compare, however, the verb tigga-S which Sapir lists as spirantizing (tɨqarɨ 'eating' with the participial suffix -tɨ which is subject to change), but which rather consistently geminates a following verb stem, as in tIqagqari- 'to eat while sitting, keep eating' (qari 'sit'), tIqappini- 'to look for something to eat' (pinni 'see, look'), and tIqagqaa 'eat while singing' (qaa 'sing'). It would be incorrect, however, to assume that all verbs in compounds have the initial consonant geminated. For example, qwicagarɨ- 'to sit down and defecate' (qwica 'defecate'), and Usugqigaa- 'to whistle a tune' (ussugqi 'to whistle'). However, a large majority of verbs as second members of verbal compounds have the initial consonant geminated. Even qari and qaa generally have the initial consonant geminated in most

verbal compounds. In compounds with nouns, however, the consonants vary, as in maágaríRí 'timbered knoll' (maa-S 'brush'; garí 'sit'; -tí 'participle' (garírí 'sitter, hill')), and ogónqaríríA 'fir island (accusative)' (ogo-N 'fir') when the noun is first. With incorporated nouns, the consonants also vary, as in waráRíqá- 'eat grass seeds' (wara-S 'grass seed'; tíqqa 'eat'), qo'áttíqá- 'smoke (tobacco-eat)' (qwo'a-G 'tobacco'), and qwiimuúrantíqgamíá- 'go in order to eat people up' (qwiimuura-N (?); míá 'go'). When the noun follows the verb, however, the verb seems to occasionally geminate the following noun, although the compound type verb+noun is rare. For example, yaíqgavàA 'hunting horse' (yai-N 'hunt'; qaváa 'horse'), but also caásigànI 'menstrual hut' (caassi-S 'to menstruate'; qanni 'house'). Adjectives in initial position in a compound vary more than do active verbs in their effect on a following consonant, as in angágwissA 'to flash red' (anqa 'red') and angággoro- 'paint the face'. The following generalizations tend to hold for compounds: (1) verbs generally geminate a following consonant; (2) nouns, either incorporated or in compounds, cause normal consonant variations on a following consonant; (3) common second element verbs may show consonant mutation in their first consonant; and (4) adjectives behave ambiguously between nouns and verbs as to their effect on a following consonant.

It is therefore possible to set up a ranking for regularity of consonantal mutation at three places (in order of most regular to least): (1) after a prefix; (2) after a noun stem; and (3) after a verb stem (there are a few invariant noun suffixes and a confused noun stem or two, otherwise, the nouns are as regular as the prefixes). It seems possible, indeed, in the light of the overwhelming evidence, quite probable, that the prefixes and noun stems are operating under phonological rules of consonant variation, while the verb stems are operating under lexical rules of consonant variation. It seems rather odd to say that the generativists, in striving to describe the variations as phonological, and Kelly, in striving to describe the variations as lexical, are both right, depending on which set of morpheme boundaries one is looking at.

Are the Southern Paiute consonant mutations a phonological or a lexical process? Yes. The problem is that we are dealing with a language as a point in time, and as such, it is but a point in a continuum of ongoing change. Past treatments of Southern Paiute have invariably tried to deal with the consonantal variations as either regular phonological processes or as completely lexical processes, that is, as one of two endpoints. The real situation, however, is that Southern Paiute is somewhere in the middle of reanalyzing a phonological process as a lexical process. Therefore, the greater the distance from the front of the word and the greater the average morphological complexity in a word class (verbs are

highly inflected and nouns much less so), the greater the amount of morphologization that has occurred. In addition, as morphologization proceeds, so does morphological levelling to produce ever larger numbers of spirantizing stems. Southern Paiute verbs have outdistanced nouns on the road to morphologization, but not as greatly as they have in Central Numic. In Shoshoni, for example, the verbs have all been completely levelled to "spirantizing" stems, but the nouns retain more evidence of the final consonants that produced geminating and nasalizing stems, actually having more phonetic reality than just the effect on a following consonant. Shoshoni nouns, therefore, show where Southern Paiute has been while the verbs show where Southern Paiute is going. Shoshoni verb prefixes, just as in Southern Paiute, also show some of the most regular effects of consonant mutation.

Having cleared the way for both a phonological and lexical treatment of the Southern Paiute consonants, it is now necessary to clarify the segmental phonemes to be used in the rules which follow. The consonant phonemes of Southern Paiute are ([-syll]):

	p	t	c	q	qw	s	m	n	ŋ	ŋw	'	w	y
cons	+	+	+	+	+	+	+	+	+	+	-	-	-
son	-	-	-	-	-	-	+	+	+	+	-	+	+
ant	+	+	-	-	-	-	+	+	-	-			
cor	-	+	+	-	-	+	-	+	-	-			
cont			-			+							
round				-	+				-	+		+	-

In addition, each of the [+cons] stops--p, t, c, q, qw--can either be [+long] or [-long] in underlying form and s is always [+long] (to be shortened in word-initial position by rule). Two additional features are also needed for rule economy--c is [+del rel] and m, n, ŋ, and ŋw are [+nasal].

The vowel phonemes are ([-cons], [+syll], [+son]):

	a	i	ɨ	o	u
high	-	+	+	-	+
back	+	-	+	+	+
round	-		-	+	+

Long vowels and diphthongs are treated as sequences of short vowels. The two prefixes that always have initial stress have the vowels marked [+stress] in underlying form. For both vowels and consonants the feature [voice] is also marked appropriately, although it does not serve to differentiate between any two underlying segments.

The lexicon will be set up in this analysis with two stem

classes--nouns and verbs. Verbs fall into three categories: spirantizing, geminating, and nasalizing. Nouns end in either a vowel, an undifferentiated stop (C), or an undifferentiated nasal (N). Affixes are of two types--prefixes and suffixes. Prefixes end with either a vowel, an undifferentiated stop (C), or an undifferentiated nasal (N). Suffixes may begin with an invariable consonant and are either spirantizing, geminating, or nasalizing. One noun suffix---ci-N 'diminutive'--must be specifically marked to prevent its initial consonant from geminating or nasalizing after nouns which end in C or N. Some suffixes also undergo a special rule of nasalization after a nasal in the preceding syllable (Rule I), so these suffixes must also be marked in the lexicon.

The rules by which words are assembled will now put together a word which includes roughly a noun or verb stem plus affixes. If the word is a verb, the suffixes selected will already have the appropriate type of initial consonant (if there is a choice). Otherwise, the stem-final consonants precede the stem or affix initial consonants and the phonological rules will proceed. Thus, a verb such as tAq̄iUḡiŋq̄p̄iŋḡaI 'they hit it so that it went to pieces' will have the underlying form of /taq̄iu + q̄qi + ŋq̄i + pp̄iŋq̄ai + aq̄qa + m̄i/. The verb tAt̄aŋq̄q̄Uḡw̄iŋq̄q̄ar̄Ȳ 'keeps kicking out (his) feet while sitting' will have the underlying form /taC + taC + quq̄q̄wi + q̄q̄at̄i + ȳi/. The form t̄iR̄As̄ina'āv̄iḡaiv̄aant̄i 'destined to be a desert dog' will have the underlying form /t̄iŋ + ss̄ina'api + q̄ai + p̄aa + nt̄i/. The form t̄iŋtoŋq̄q̄I 'was on a dead run' will be from underlying /t̄iŋ + toŋq̄ + q̄qi + pp̄iŋq̄ai/. The noun aḡoŋgaamp̄iC̄I 'fir grouse' will be from /aq̄oN + q̄aaN + p̄iC̄i/. The verb p̄Aq̄aŋUḡw̄aiv̄ump̄aA 'will kill as he passes along' will be derived from /paq̄qa + ŋu + q̄q̄wai + ŋu + p̄aa/. Finally, the verbal uip̄p̄inc̄ump̄aaniA 'will make a canyon' will be from /uiC + pi + ntu (t --> c / i C₀ ___) + paania/.

The first rule (I) affects those suffixes subject to nasalization after a nasal:

Rule I

$$\emptyset \rightarrow \left[\begin{array}{c} +\text{cons} \\ +\text{nasal} \end{array} \right] / \left[\begin{array}{c} +\text{cons} \\ +\text{nasal} \end{array} \right] C_0 V_1 + \text{---} \left[\begin{array}{c} +\text{cons} \\ -\text{son} \\ -\text{cont} \end{array} \right]$$

(Only applies to suffixes marked [+Rule I])

For example: paq̄qa + ŋu + q̄q̄wai + ŋu + p̄aa 'will kill as he passes along' --> paq̄qa + ŋu + q̄q̄wai + ŋu + Np̄aa; uiC + pi + ntu + paania 'will make a canyon' --> uiC + pi + ntu + Npaania. This rule seems to be rightward iterative, as in paq̄qa + ŋu + p̄aa + p̄iŋ + aŋa 'maybe

(he) will kill him' --> pagga + nu + Npaa + Npi + ana.

Rule II reduces unacceptable clusters derived by the word formation rules:

Rule II

$$[+cons] \rightarrow \emptyset / \text{---} \left\{ \begin{array}{l} \# \\ + \left\{ \begin{array}{l} [-cons] \\ [+long] \\ [+cons] [+cons] \end{array} \right\} \end{array} \right\}$$

For example: (before a word boundary) aggN 'sunflower seeds' --> agg; (before a glide or vowel after a morpheme boundary) moonN + ani + pi 'mosquito' --> moonipi, opiN + yaa + pay + ppiqai '(he) brought back a stick' --> opiyaapayppiqai; (before ss) wa'aC + ssiaC + pi 'cedar sapling' --> wa'assiaCpi; (before a consonant cluster) wa'aC + mpi + a 'cedar berries (acc)' --> wa'ampia. (A glottal stop is often inserted between a prefix and a vowel initial stem, as in tiiN + appii + yi 'sleeps well' --> tii'appiiy, but does not, at this time, seem predictable.)

Rule III is the rule of assimilation of a stem-final consonant to a stem-initial consonant. At this point, there are four possible combinations--N + stop, C + stop, N + nasal, and C + nasal. In all but the N + stop combination, the assimilation is total--both the place and manner of articulation. With the N + stop combination, the nasal assimilates only to the place of articulation.

Rule III

$$\left[\begin{array}{l} +cons \\ <-nasal> \end{array} \right] \rightarrow \left[\begin{array}{l} \alpha ant \\ \beta cor \\ \gamma round \\ <+son \\ <+nasal> \end{array} \right] / \text{---} \left[\begin{array}{l} +cons \\ \alpha ant \\ \beta cor \\ \gamma round \\ <+nasal> \end{array} \right]$$

For example: (N + stop) tiiNqani 'rock house' --> tiingani; (C + stop) cunuCpagu 'suckerfish' --> cunuppagu; (N + nasal) tiiNnaiqayi 'has a good copulation' --> tiinnaiqayi; (C + nasal) ayaCmi 'prairie dogs' --> ayammi.

Rule IV is a housekeeping rule to convert the geminate clusters produced by Rule III into [+long] consonants for simplicity in writing later rules. Miner (1976) has proposed a universal "equivalence rule" which applies "perpetually" converting geminate clusters into [+long] segments and vice versa:

$$[+seg]_i [+seg]_i \Leftrightarrow \begin{bmatrix} +seg \\ +long \end{bmatrix}_i$$

This universal rule would eliminate the need for housekeeping Rule IV.

Rule IV

$$\begin{array}{ccc} C_1 C_2 & \rightarrow & 1 \quad 2 \\ l_1 l_2 & & [+long] \quad \emptyset \end{array}$$

The next rule (V) is the rule of intervocalic spirantization:

Rule V

$$\begin{bmatrix} -son \\ -long \\ -del \text{ rel} \\ <+cor> \end{bmatrix} \rightarrow \begin{bmatrix} +cont \\ +voice \\ <+son> \end{bmatrix} / v \text{ _ } v$$

Basically, this rule says: $p, t, q, gw \rightarrow v, r, g, gw$. For example: gutapi 'neck' \rightarrow guravi; apagani 'summer house' \rightarrow avagani; puaqw~~ii~~y~~i~~ 'takes out (disease) with supernatural power' \rightarrow puaqw~~ii~~y~~i~~; but pacuqqu 'beaver' \rightarrow pacuqqu.

Rule VI assigns stress to even-numbered vowels. It has one significant difference from Chomsky and Halle's rule in that it is an iterative rule, determining the status of each vowel in turn in a rightward direction. The conditioning factors are either a word boundary or the last stress placed. Using this rule, it is possible to predict stress correctly following the prefixes with first syllable stress. Franklin and Bunte (1980:345) list several modern Southern Paiute morphemes which also alter the stress pattern following an invariably placed stress on one of the syllables of the suffix (for example, modern -pixai 'narrative past'). The following rule will correctly predict the modern Southern Paiute stress in addition to the stress in Sapir's data:

Rule VI

$$v \rightarrow [+stress] / \left\{ \begin{array}{l} \#C_0 \text{ _ } C_0V\# \\ \left\{ \begin{array}{l} \# \\ [v] \\ [+stress] \end{array} \right\} C_0 \left[\begin{array}{l} v \\ -stress \end{array} \right] C_0 \text{ _ } [+seg] \end{array} \right\}$$

(RIGHTWARD ITERATIVE)

For example: taqqiugginqi+ppi+gaiaggami 'they hit it so that it went to pieces' --> taqqiugginqi+ppi+gaiaggami; tfrassina'avigaiivaanti 'destined to be a desert dog' --> tfrassina'avigaiivaanti; tiva 'pine nut' --> tiva. (Primary stress will be assigned to the first stressed vowel by a later rule.)

Rule VII then devoices unstressed vowels in front of a [+long] consonant and word-finally. In addition it devoices [+voice] consonants in front of a voiceless vowel. This rule, therefore, captures the generalization that it is whole syllables which devoice in front of geminate consonants and word-finally. It is right to left iterative and devoices a segment in front of a voiceless segment with an opposite value for the feature [syllabic] (a voiceless consonant must also be [+long]).

Rule VII

$$[+seg] \rightarrow [-voice] / \left[\begin{array}{c} \text{---} \\ -stress \\ \alpha syll \\ \langle +syll \rangle \end{array} \right] \left\{ \begin{array}{c} \# \\ [-voice \\ -\alpha syll \\ \langle +long \rangle \end{array} \right\} \langle [+voice] \rangle$$

(LEFTWARD ITERATIVE)

For example: pacuqqu 'beaver' --> pacuqqU; taqqiugginqi+ppi+gaiaggami 'they hit it so that it went to pieces' --> tAqqiUgginqi+ppi+gaiAggaMi; tifi'appiyi 'sleeps well' --> tifi'AppiiYi; tfrassina'avigaiivaanti 'destined to be a desert dog' --> tFRassina'avigaiivaanti; tiva 'pine nut' --> tifa; agqissa'appi 'sunflower mush' --> Agqissa'appI. the feature [long] must be used rather than [voice] in determining vowel devoicing because c does not spirantize and only a [+long] cc will cause devoicing, as in quccáqqar 'gray' --> quccáqqarE, but pacuqqu 'beaver' --> pacuqqU.

Rule VIII is the rule which degeminates a stop after a voiceless vowel. It seems more natural, however, to link degemination with stress.

Rule VIII

$$C \rightarrow [-long] / \left[\begin{array}{c} v \\ -stress \end{array} \right] - \left[\begin{array}{c} v \\ +stress \end{array} \right]$$

For example: tAqqiUgginqi+ppi+gaiAggaMi 'they hit it so that it broke into pieces' --> tAqiUginqi+ppi+gaiAggaMi; Agqissa'appi 'sunflower mush' --> Aqissa'appI.

This paper has presented a natural set of rules to deal with several features of Southern Paiute phonology, although it cannot be said to constitute a complete survey. Several aspects, such as the strange occurrences of glottalization and the apparently random activity of glottal stops in general, have not even been touched upon here. There yet remains a great deal of work to be done before the full picture of Southern Paiute phonology can be seen.

NOTES

1 In the examples throughout this paper, I have generally modified Sapir's transcription to conform to modern practice; thus, Sapir's c for an alveopalatal fricative is here s (since the alveopalatal and alveolar affricates and fricatives are in complementary distribution, I have used s for the fricative and c for the affricate throughout, even though the surface forms are, more often than not, alveopalatal). His i with dieresis is here written ï. I have retained his use of capital letters to indicate voiceless segments. I have also used f and v to represent bilabial fricatives and g to represent the voiced velar and uvular fricatives (which are in complementary distribution). In addition, I have used -S, -G, and -N to indicate spirantizing, geminating, and nasalizing stems rather than Sapir's raised letters because of the size of the particular typeface I am using to print this paper.

Other author's transcriptions have also been modified to conform to the norms adapted for transcribing Sapir's forms. I have also consistently used q and qw for the velar and uvular stops (which are in complementary distribution--[k] and [kw] before or after an i and [q] and [qw] elsewhere).

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REFERENCES

- Cairns, Charles E. 1978. Universal rules and vocalic devoicing in Southern Paiute, Linguistic and Literary Studies in Honor of Archibald A. Hill, II: Descriptive Linguistics. The Hague: Mouton. Pages 213-26.
- Chomsky, Noam, and Morris Halle. 1968. The Sound Pattern of English. New York: Harper and Row.
- Franklin, Robert, and Pamela Bunte. 1980. Southern Paiute stress and related phenomena, The Seventh LACUS Forum 1980. Pages 339-47.
- Greenberg, Joseph. 1969. Some methods of dynamic comparison in linguistics, Substance and Structure of Language. Ed. Jaan Puhvel. Berkeley: University of California Press. Pages 147-203.
- Harms, Robert T. 1966. Stress, voice, and length in Southern Paiute, International Journal of American Linguistics 32:228-35.
- Iannucci, David Edmund. 1973. Numic historical phonology. Cornell University PhD dissertation.
- Kelly, Deirdre Mary. 1978. Morphologization in Irish and Southern Paiute. University of Texas at Austin PhD dissertation.
- McCawley, James D. 1967. Sapir's phonologic representation, International Journal of American Linguistics 33:106-11.
- . 1974. Review of The Sound Pattern of English, International Journal of American Linguistics 40:50-88.
- McLaughlin, John E. 1982. Two or three (or four) points about adverbs and aspect in Central Numic (Uto-Aztecan), Studies in Native American Languages. Kansas Working Papers in Linguistics Volume 7. Pages 64-89.
- Miller, Irving W. 1982. Southern Paiute and Numic final features, International Journal of American Linguistics 48:444-9.
- Miller, Wick R. 1975. A sketch of Shoshoni grammar (Gosiute dialect). ms.

- . 1980. Preaspirated consonants in Central Numic, American Indian and Indoeuropean Studies: Papers in Honor of Madison S. Beeler. Ed. Kathryn Klar, Margaret Langdon, and Shirley Silver. The Hague: Mouton. Pages 151-7.
- Miner, Kenneth L. 1976. Equivalence rules in generative phonology. University of Kansas Linguistics Department Colloquy.
- Sapir, Edward. 1930. Southern Paiute, A Shoshonean Language. Proceedings of the American Academy of Arts and Sciences 65. Pages 1-296.
- . 1931. Southern Paiute Dictionary. Proceedings of the American Academy of Arts and Sciences 65. Pages 536-730.
- . 1949. The psychological reality of phonemes, Selected Writings of Edward Sapir in Language, Culture, and Personality. Ed. D.G. Mandelbaum. Berkeley: University of California Press. Pages 46-60.