TLINGIT PHONOLOGY IN A GENERATIVE FRAMEWORK:
AN EXAMINATION OF PHONOLOGICAL PROCESSES
AND ABSTRACT REPRESENTATION

by

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ABSTRACT

The Saussurean Paradox described by Labov (1971), in which "the social aspect of language can be studied by the theorist asking himself questions, while the individual aspect can only be studied by a social survey", apparently mirrors a predicament occurring in the structuralist and generative models of linguistics.

For, while descriptive and structuralist linguistic models seek to mirror the reality of particular languages, a generative model of linguistics, in a search for universals, attempts to discover the underlying reality of all languages.

Since an accepted raison d'être of the current model of linguistic science is to provide an explanatory basis for real language, it seems self-evident that both kinds of theories of language models are necessary: the inductive decision procedures of the reality-based structuralism, and the deductive discovery hypotheses of the mentalistic generative phonology.

In the following Chapters, we shall attempt to explain the phonology of a particular language, which has been previously achieved through decision procedures, while investigating the natural and universal processes which have been hypothesized to occur.

Although we expect to make no decisions, or even discoveries, we hope to examine the fit of the phonology of a transformational generative model to a particular language. And, while testing the model, we hope to explicate the phonology of a particular North American Indian language, Tlingit.
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I.0 Tlingit: Language and Theory

I.1 THE TLINGIT LANGUAGE


Typologically, Tlingit phonology forms a part of the northwest coast linguistic diffusion area which, ranging from Alaska to Central California, includes the languages and superstocks of Athapaskan (Na-Dene phylum), Penutian, Salishan, Wakashan, Chemakuan, Ritwan (including Yurok and Wiyot), and Hokan (Haas 1969). Structurally, by Lehmann's (1972, 1973) typology (in which, according to principles of verb morphology, the object precedes the verb in simple declarative sentences), Tlingit, like Athapaskan, is a consistent OV language characterized by agglutination, postpositions, and the placement of restricting elements before restricted elements, occasionally by vowel harmony and tone (v. Greenberg 1963, Tai 1972).

Using Sapir's (1921) psycholinguistic terminology, Tlingit can be classified as polysynthetic in concept and of agglutinative-isolating technique. Of the six major grammatical processes listed
by Sapir (1921), which include word order, composition, affixation, internal modification and accentual differences, only reduplication, which is otherwise common in languages of the northern Northwest Coast diffusion area, is generally lacking in Tlingit. In terms of verb morphology, detailed by Story (1966), the Tlingit verb complex shows evident similarity to the verb composition of the Athapaskan languages (Swanton 1908, Sapir 1915, Hymes 1956, Pinnow 1964, 1965, Krauss 1965).

Interestingly, Tlingit forms part of the Pacific Rim isogloss which includes Chinese, Japanese, Korean, Ainu, Aleut, certain Northwestern Amerindian languages and Indonesian languages, and a number of Paleo-Siberian languages in possessing a phonemic system characterized by, at most, a single liquid (Jakobson 1968).

In addition to sections of the verb dictionary of Story and Naish (1973), the major grammatical studies of Tlingit include those of Boas (1917), Naish (1966) and Story (1966). According to Krauss (1973), in terms of comparative work including Velten (1939, 1944), Tlingit is a "relatively bright spot" in the Na-Dene language documentation.

I.1.1 Location and Population

Situated at the northern end of the rich, sea-oriented Northwest Coast cultural area and linguistic diffusion complex, Tlingit territory, which stretched for approximately 500 miles along the coast of Alaska from Yakutat at 60°N. latitude to Ketchikan at 54°40' latitude, was bounded immediately to the south by the Haida (language isolate) on Prince of Wales Island and the Queen Charlotte Islands, to the southeast by Tsimshian (Penutian phylum), to the east by Athapaskan (Na-Dene), and to the west by Eyak (Eyak-Athapaskan family, Na-Dene phylum), Chugach Eskimo and Aleut (Eskimo-Aleut) (Drucker 1955, 1965, Haas 1969, Oberg 1973).
Sixty years ago, the ethnographer and linguist Swanton (1911:163) observed of the expansionist Tlingit:

The Tlingit or Koluschan language is spoken throughout southeastern Alaska, from Dixon entrance and Portland canal to Copper river, with the exception of the south end of Prince of Wales island which is occupied by Haida. An interior tribe of British Columbia, the Tagish, are said to belong to the same linguistic stock, but it is by no means certain that they have not adopted the language from their Chilkat neighbors. Such a change is said, at any rate, to have taken place in the language of the Ugalakmiut, or Ugalantz, of Kayak Island and the neighboring mainland, who were formerly Eskimo and have now become thoroughly Tlingitized.

Pinnow (1976) has identified the Ugalakmiut or Ugalentz with Eyak (v. Krauss 1965). With regard to pre-contact location and population, the ethnographer Averkieva (1971:321) has recently stated:

At the time of the first European contacts, the Tlingit inhabited the southeastern coast of Alaska and the adjoining islands of Baranof, Chichagof, Admiralty, Kupreanof, among others. In addition, a small group of inland Tlingit lived around Lake Teslin. The Tlingit comprised the largest Indian tribe of Russian America, numbering around 12,000.

However, following the ravages of several disastrous post-contact smallpox epidemics in 1787, 1836, and 1862, and typhoid fever in 1819, 1848, and 1855 (U.S. Federal Field Committee 1968), the 1880 Census (reported by Krause 1885) revealed a number of Tlingit subdivisions with a total population of 6,763. Nevertheless, according to de Laguna (1960), the northern Tlingit population was evidently never as large as that of neighbouring areas (cf. Powell 1891/1966, Borden 1945).
1.1.2 Dialect Divisions

The 1880 Census of Petroff (Swanton 1908) listed the fourteen qwan, or major tribal subdivisions which formed the Tlingit federation, as Tongas (S), Sanya or Cape Fox (S), Henya (Klawak) (S), Kuiu (S), Kake (S), Sitka or Sumdum (N), Stikine (S), Taku (N), Auk (N), Hutsonwu or Killisnow (N), Huna (N), Chilkat (N), Yakutat (N), and Hehl (Wrangell) (S) (cf. Krause 1885, Pinnow 1966, 1970).

According to de Laguna (1960), a north and south cultural frontier and dialectal isogloss of the original tribal groups was formed naturally by the waters of Frederick Sound which separated the Kuius, Kakes and other central tribes from the central Hutsonwu or Angoon people, and the Sitka and other northern groups. The territory of the Angoon people, the most southerly of the northern Tlingit, adjoined that of the southern Kake, the northern Huna and Sitka to the north and west, and on the east and northeast the Taku and Auk (de Laguna 1960).

The inland Tlingit, considered to be Tlingitized Athapaskans, are divided into three dialect groups, the Tagish, Teslin and Atlin. According to McClellan (1953, in Landar 1967:70 n. 93):

Tagish Indians number about 120. The native language in general use now is a Tlingit dialect which sounds "crooked" to the people of Atlin and Teslin. The Tagish regard it as a recently learned language which supplanted an Athapaskan dialect still preferred by some. This old Tagish speech seems to be close to Southern Tutchone and also to Tahltan.

A recent U.S. government survey (Federal Field Committee 1968) has listed the present-day location of tribal groups with their
native (underlined) and non-native community distribution in Alaska: Yakutat (Yakutat), Chilkat (Klukwan, Haines), Huna (Hoonah), Auk (Juneau), Taku-Sumdum (Douglas), Hutsnuwu (Angoon), Sitka (Sitka), Kaku (Kake), Stikine (Wrangell), Henny (Klawak), Sanya (Ketchikan), Tongas (Saxman). The Kuiu evidently have no descendants and the present location of the Hehl is unknown. Drucker (1958) has discussed the viability of native Tlingit-language groups in the towns and cities in Alaska.

I.1.3 Present and Future Speakers

Various estimates have been given of native speakers of Tlingit. Chafe (1962, 1965) suggested a total of 2,000 speakers over the age of twenty in Alaska, British Columbia and the Yukon with all but two hundred living in Alaska, while Pinnow (1966) offered an estimate of 1,000 to 2,000. However, Krauss (1973) has offered a likely figure of more than one thousand, mostly over the age of twenty.

According to Naish (1966), monolingualism of children in English has replaced the bilingualism of young adults on the coast, although Drucker (1958) noted that in Indian-speaking communities like Angoon and Hoonah younger people will more generally speak Tlingit than in the predominantly white communities of Juneau, Sitka and Ketchikan. An informant in the Teslin lake area (Bob Fleming, interview, Toronto, 1971) has stated that most of the inland Tlingit now speak non-standard or "Indian" English.

Despite the fact that classes in the Tlingit language are common in Alaska native schools, with a programme of language learning and
native language teaching in effect, the future survival of Tlingit is doubtful, given the powerful and opposing forces of cultural assimilation and non-assimilation (Krauss 1973, v. Drucker 1958, 1976).

I.1.4 Linguistic and Ethnographic Studies

I.1.4.1 Historical Accounts and Ethnographic Data

Averkieva (1971), following Krause 1885, has noted that historical accounts of contact between Europeans and Tlingit began in the mid-eighteenth century. The Russian Bering-Chiricov expedition of 1741, which first contained reports of Tlingit activity, was followed by Spanish, English or French data-gathering expeditions of Perez 1774, Quadra 1775, Cook 1778, La Perouse 1786, Dixon and Portlock 1787, Marchand 1790, and Vancouver 1792-1794.

In the nineteenth century, the Russians Lisianski 1812, Davidov 1810-1812, Lutke 1834, Wrangell and Veniaminov 1840 published ethnographic materials, while Krause 1885, Niblack 1890, Petroff 1881 and Anatoli 1906 detailed later studies (v. Averkieva 1971). American accounts include anthropological and linguistic data of Boas (1917), Swanton (1908, 1909, 1911), and the cultural studies of Drucker (1955, 1965), Garfield 1947, McClellan 1964, de Laguna (1960, 1964), and the well-known work of the Canadians Barbeau and Jenness 1932? Theses references may be obtained in Averkieva (1971).

I.1.4.2 20th Century Linguistic Studies

Boas' (1917) Tlingit grammar, following the earlier but somewhat inconsistent work of Swanton (1911), has been the most substantial account until the recent grammatical studies of Naish (1966) and Story (1966), although Velten (1939, 1944) published two analyses of a southern dialect (v. Landar 1967). Naish and Story (1963) have also published a useful English-Tlingit Dictionary: Nouns, in addition to primers and religious materials, while the Alaska Native Language Center, University of Alaska, has recently made available Story and Naish's (1973) Tlingit Verb Dictionary. Naish (1968) has also introduced a set of beginner's lessons in Tlingit (Krauss 1973).
I.1.4.3 Comparative Controversy – the Na-Dene Hypothesis

The controversial issue of the relationship of Tlingit, Haida and Athapaskan was raised by Sapir (1915). Naming the projected phylum Na-Dene (Tl. na "people", Ath. dene "person, people"), Sapir concluded that "correspondences are of so intimate a character that mutual borrowing of words and morphological features seem out of the question".

However, Krauss (1973) has noted that the Na-Dene hypothesis was suggested by Europeans in the eighteenth century, much earlier than Sapir (1915). For example, early attempts (Resanov 1805) detailed in Krauss (1964) disclosed similarities among Eyak, Tlingit and Tanaina thought to be the result of borrowing, while Wrangell's editors considered Eyak, Tlingit and Athapaskan to be related through widely divergent. Radlov 1858 thought Eyak might be related to both Athapaskan and Tlingit and, with Buschmann, considered it a link between Haida and Tlingit, as did Boas 1894. Subsequently, Swanton (1908) tentatively suggested a very distant genetic relationship between Haida and Tlingit, perhaps descended from a common parent language such as Athapaskan, while the important paper of Sapir (1915) raised the issue of a genetic relationship based mainly on morphological rather than phonetic similarity, an approach which Goddard (1920) and Boas (1920, 1929) rejected (Hymes 1956).

Noting that

the existence of a Na-Dene relationship and the use of morphological criteria for genetic relationship are ... historically interrelated problems.

Hymes (1956) published an interesting paper on the positional analysis of categories occurring in verb stems in Athapaskan, Tlingit, Haida and Na-Dene which established systematic morphological similarities. Following the series of reasoned articles by both Pinnow and Krauss on the Na-Dene question, Pinnow (1970) concluded that

it follows beyond question from Krauss' (1970) discerning articles that Tlingit and Eyak-Athapaskan are related; the parallels which Krauss brings forth rule out any other conclusion.

Krauss, who is more involved in the field of Athapaskan languages generally, has taken longer to be convinced of any genetic relationship based on the striking typological similarities. Recently, though, Krauss (1975) has allowed for a distant relationship of Tlingit to Athapaskan-Eyak; although ruling out a relationship with Haida (cf. Levine, 1973) through lack of phonological correspondence or grammatical similarity. Broader relationships have been suggested for Tlingit or Na-Dene, including a postulated Sino-Tibetan-Na-Dene of Sapir and Morice (Shafer 1952, v. Swadesh 1952); the Vasco-Dene including Basque, Wakashan, Kutenai, Japanese and Indo-European of Swadesh; and the Athapaskan-Tlingit-Yuchi-Souian of Haas (Krauss 1973).
I.2 THEORIES, MODELS AND TRADITIONS

In discussing linguistic blinkers, which through rigidity may retard the growth of an entire discipline, Heiberg (1973) has noted that, in a hierarchy of models, the culminating root model provides an orientational framework for an entire discipline, while a theoretical model is merely description couched in meta-language which provides a critical method of examining existing explanation.

Kelly (1971), noting parallels of thought in the philosophical tradition of the mediaeval speculative grammarians with Chomsky's transformational grammar, has found that repeatedly "the needs and procedures of linguistics have oscillated between description and explanation". Tracing historical patterns in linguistic thought from the schoolmen to the present day, Kelly (1971: 250-251) has placed the model of generative grammar in a logical progression from structuralism in the context of growth or philosophical activity versus order or systematization:

After a period spent in developing historical linguistics, linguists followed de Saussure in developing a new type of descriptive linguistics which was based on observation of language behavior instead of analysis of written texts and literature. As this stream reached the height of its development, Chomsky brought to bear on the field his own training as a mathematician and philosopher.

In discussing the history of descriptive linguistics in America (1900-1950), Teeter (1964: 199-201) has commented on the logical fallacies evolving from the dogmatism of the post-Boasian and post-Bloomfieldian structuralist traditions. From implications of Boas' work explicit in Sapir has stemmed the tradition of field work in which practice
is divorced from theory in a view that "reality can be approached without perceptions", while from the anti-mentalist theories of Bloomfield arose the discreditation of theory per se on the rationale that mind itself is limited to input-output conditions.

From these biases, since no appeal could be made to general theory, "justification of a given analysis came to mean the specifying of the procedures used to arrive at a given result from the data", and theory was thus equated to practice. Chomsky (1966), however, has suggested that the present choice between a generative grammar and a descriptive grammar is not genuine, since the latter is simply "one aspect of the full generative grammar . . . it is not a choice between competing systems, but rather a choice between a whole and a part".

Though opposing views of mentalistic and anti-mentalistic thought may periodically rule linguistic procedures (v. Kelly 1970), in the present study we intend to use the framework of transformational generative grammar as a theoretical model to examine the phonology of Tlingit and, insofar as possible, to provide a description of certain phonological processes.

In Chapter II and throughout, we examine Tlingit phonology making use of data and materials from Boas (1917), Naish (1966), Story (1966), and Velten (1939, 1944). With the recently incorporated acceptance of surface phonetic constraints, the phonemic system of surface contrasts is explicated more simply within the framework of generative phonology. In Chapter III we investigate the simple
phonological processes detailed by Boas which, according to Stampe's theory of natural phonology (an outgrowth of transformational generative grammar), are universal and natural. In Chapter IV we consider the issue of abstract representation raised by Kiparsky for generative phonologists, and we investigate the level of morphophonemic representation using an interpretation of vowel harmony to examine the unresolved controversy. In Chapter V, we review briefly the work of preceding Chapters, having discussed, without conclusion, certain issues of theoretical interest in phonological theory.
II.0 DESCRIPTIVE PHONOLOGY

In this Chapter, a description of Tlingit phonology, using primary data from Boas (1917) and Naish (1966) and Story (1966) with additional examples drawn from Velten (1939, 1944), will be set out within the theoretical framework of generative phonology.

The phonology presented will first be discussed in articulatory and descriptive terminology to make plain on a purely phonemic level the number of surface contrasts occurring especially on a consonantal plane, for, as Schane (1971: 503) has suggested, certain linguistic effects may only be explained satisfactorily in phonemic terms:

The phoneme as a viable phonological unit for capturing relevant surface contrasts has been rejected within generative phonology ... The historical phenomena of denasalization in French, depalatalization in Rumanian, delabialization in Romance, palatalization and labialization in Nupe, and palatalization in Japanese are due to surface contrast rather than to statable morphophonemic or phonetic processes. From these observations I conclude that the phoneme must be recognized as a phonological entity.

Atchison (1974) also, in a diachronic study, has noted that certain sound changes in pre-classical Greek may be more adequately characterized at the explanatory level by recognizing surface phonetic constraints or "output conditions" in addition to symmetricality of arrangement or pattern congruity as part of a speaker's unconscious psychological reality.

Phonetic data used will be drawn mainly from Boas' remarkable pre-phonemic study in the Chilkat dialect, although supplemental
phonological materials will be based on the more recent work of Naish and Story who use an adapted Bendor-Samuel model in a tagmemic framework. While other references will be cited, any analysis of Tlingit within an adequate linguistic context obliges primary reliance upon these works.

Boas' data, the result of two months' work with his erratic but brilliant informant, Louis Shotridge (v. Duff's Foreword in Oberg 1973), unlike the data of John R. Swanton (1908, 1909, 1911), some of whose findings appear in the Handbook of American Indian Languages (1911), are phonetically secure. According to H.V. Velten (1939: 65):

For establishing dialectal differences only Boas' description of northern speech can be utilized with safety. Earlier material and Swanton's transcription, as well as his grammatical analysis, are often inaccurate. For example, he disregards pitch altogether; he fails to distinguish between the glottalized voiceless lateral spirant 渫' and the corresponding affricative t��'; and he uses a single symbol for the glottalized velar stop q', and the glottalized palatal and velar spirants x and ԑ, which are all clearly distinguished in southern as well as northern Tlingit. However, Boas includes in his Notes a good deal of Swanton's material in corrected form.

Until the recent work of Naish and Story, Boas' work in the field has offered the most complete and reliable material available (v. Landar 1967: 62 n.6). However, certain flaws in Boas, noted in Pinnnow (1968: 205), for example, the failure to establish the extensive root variation which occurs in the verb, have been corrected and extensively amplified in Story.

For Tlingit, the most recent, thorough-going and consistent work has been that of Naish and Story. Based on the Angoon or central dialect, their work represents the most comprehensive attempt to
construct a lexicon for Tlingit (1963, 1973), in addition to phonological and syntactic processes in the contemporary context. While their 1966 work remains unpublished, extensive notes for this paper have been made from the original manuscripts at the University of London.

II.1 CHARACTERISTICS OF TLINGIT PHONOLOGY

Briefly, according to Story, the Tlingit phonological system may be characterized as possessing some forty-two consonant phonemes (in some idiolects, forty-four), consisting of:

37 obstruents: stops, affricates and fricatives;
3 sonorants: a nasal and two semi-vowels; and
2 laryngeals: a glottal stop and fricative.

In some idiolects, depending on rounding, there are four laryngeals.

As Velten (1944: 168) has suggested:

The consonant system is rather intricate and unusual. There are no labial stops, spirants or nasals, but on the other hand there exist no less than ten rounded (or labialized) back consonants.

However, Velten (1944: 169) has noted:

1 Boas' (1917:9) chart indicates a total of 41 consonants. Although the glottal stop is not marked, a bracketed palatal sonant y occurs. According to Naish (1966:222):

"The glottal stop is phonemic in intervocalic position within a stem or in initial position in a stem whose first syllable is the tonic syllable of the tone group. In other environments the glottal stop is facultative."
If the number of Tlingit consonants seems, therefore, fairly high, it should be remembered that a comparison of the relative wealth or poverty of phonological systems is a matter of counting, not the phonemes, but the distinctive features. Actually, the Tlingit consonant system has only two more such features than has English. These are the glottalization and rounding, i.e. opposition of the type /k - k/ and /k - k\textsuperscript{u}/.

There are eight vowel phonemes which may be marked by high or low phonemic tone.

Typologically, the consonantal phonology is remarkable for the complete absence of labials, and for the lack of voiced spirants, a factor originally noted in Boas. In terms of Northwest Coast areal phonology, Mary Haas (1969: 85-9) has stated that the most striking features of the complex consonant system in Tlingit are the series of labiovelar, back-velar, glottalized stops, notably the occurrence of glottalized spirants, and the appearance of lateral affricates and spirants. In a recent paper, Kinkade (1976, Table II) found as a differentiating feature of the proposed "Na-Dene" from their neighbours immediately to the south the contrast of alveolar and palatal affricate-spirant positions in Tlingit, Eyak, Carrier and Chilcotin.

Shown in Chart I (adapted from Naish), the consonantal phonemic system is remarkable also for the number of stop and manner oppositions, the presence of fourteen glottalized phonemes including six strongly glottalized fricatives, an almost full set of laterals, and twenty back consonants, rounded and non-rounded. There is a single nasal which according to Troubetskoy (1957: 189) is noteworthy in that:
Parmi les langues que nous connaissons seul le tlingit présente un rapport oppositionnel isolé 'occlusive-nasale' (d-n), n étant ici la seule nasale et la classe de localisation labiale n'existant pas.²

According to data taken from Naish (1966: 19-21) and Story (1966: 14-19), phonemes have the following phonetic realizations:

The simple alveolar stops /d, t, t/ are somewhat fronted phonetically.

The apical affricates and fricatives /dz, c, ç, s, š/ are articulated with the tip of the tongue and have a grooved sibilant release.

The laminal affricates and fricatives /j, c, ç, s/, phonetically palato-alveolar, are articulated with the blade of the tongue. They have a grooved sibilant release.

The lateral affricates and fricatives /j, ɾ, ɾ, ɾ, ɾ/, with lateral release, are not 'noticeably' clear or dark.

Uvulârs, not far removed from back velar position, are articulated at the back of the soft palate. According to Velten (1939: 66) for the Klawak dialect: "The palatal spirant x is articulated slightly further back than the ch in German ich, the sibilant c a trifle further back than the English sh."

The simple velars and uvulârs are unrounded.

The labial velars and uvulârs are articulated with simultaneous rounding.

Nasal /n/ is alveolar in all positions.

The plain stops are frequently lightly voiced intervocally and elsewhere.

The glides are palatal /y/ and labiovelar /w/.

² However, Velten (1944: 169 n.8) suggests: "The opposition /n-d/ is not a correlation since it has no parallel in Tlingit."
### CHART I

<table>
<thead>
<tr>
<th>Position</th>
<th>Simple</th>
<th>Apical</th>
<th>Laminal</th>
<th>Lateral</th>
<th>Simple</th>
<th>Round</th>
<th>Simple</th>
<th>Round</th>
<th>Simple</th>
<th>Round</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alveolar</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stop</strong></td>
<td>d</td>
<td>dz</td>
<td>j</td>
<td>ʃ</td>
<td>g</td>
<td>w</td>
<td>g</td>
<td>w</td>
<td>?</td>
<td>(?)</td>
</tr>
<tr>
<td><strong>STOP Asp.</strong></td>
<td>t</td>
<td>c</td>
<td>ɔ</td>
<td>ʒ</td>
<td>k</td>
<td>w</td>
<td>q</td>
<td>w</td>
<td>&lt;hr&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Glott.</strong></td>
<td>t</td>
<td>c</td>
<td>ɔ</td>
<td>ʒ</td>
<td>k</td>
<td>w</td>
<td>q</td>
<td>w</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FRIC</strong></td>
<td>s</td>
<td>ʃ</td>
<td>ʒ</td>
<td>x</td>
<td>x[w]</td>
<td>x</td>
<td>x[w]</td>
<td></td>
<td>h</td>
<td>(h[w])</td>
</tr>
<tr>
<td><strong>Glott.</strong></td>
<td>ʃ</td>
<td>ʒ</td>
<td>x</td>
<td>x[w]</td>
<td>x</td>
<td>x[w]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nasal</strong></td>
<td>h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Semi</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vowel</strong></td>
<td></td>
<td></td>
<td>y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>w</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data taken from Naish (1966: 19-21) and Story (1966: 14-19).
Plain fricatives are voiceless and unglottalized. At syllable final, the contrast between plain and aspirated stops and affricates is neutralized. Stops and fricatives that are glottalized have almost simultaneous glottal closure. The simple uvular fricative has an uvular trill variant. The glottalized uvular stop may occasionally have affricate release. The plain fricatives are always voiceless and unglottalized; occasionally aspirated word-initially. In certain environments the plain alveolar fricatives, as noted later, may be syllabic.

II.2 CONSONANTS: FEATURES AND ARRANGEMENTS

Although there are several possible arrangements of consonants, the Chart adapted from Naish (1966) is particularly neat, showing the three series of phonemically opposed alveolar affricates and the manner range of back and alveolar consonants.

There are three pure stop positions, alveolar, velar and uvular, which Höckette (1955: 103) analyses:

<table>
<thead>
<tr>
<th>3 pure stops:</th>
<th>t</th>
<th>k</th>
<th>q</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 colour modified:</td>
<td>k(^w)</td>
<td>q(^w)</td>
<td></td>
</tr>
<tr>
<td>3 affricate positions:</td>
<td>c</td>
<td>č</td>
<td>ķ</td>
</tr>
</tbody>
</table>

A four-way modification of simple stop with three affricated stops, apical, laminal and lateral, occurs at the alveolar

---

3 Back consonants are termed velars and uvulars by Naish (1966) and Story (1966); palatals and velars by Boas (1917), Swanton (1911), Jacobs (1954), and Velten (1939, 1944). Whether this is a question of terminology or acoustic variation is not made clear in Jacobs, pp. 47-50. See also Kinkade (1976: 3, 9) whose terminology is pre- and post-velar. According to Kinkade, at the phonetic level only, Tlingit (like Haida) has a palatalized k series of pre-velar obstruents.
point. Using the markedness feature system of Chomsky and Halle (1968), this four-way modification may be distinguished as follows:

<table>
<thead>
<tr>
<th>Simple alveolar</th>
<th>Apical affric.</th>
<th>Laminal alveolar</th>
<th>Lateral alveolar</th>
<th>Lateral rel</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ant</td>
<td>+ant</td>
<td>-ant</td>
<td>+cor</td>
<td>+lat</td>
</tr>
</tbody>
</table>

It should be noted, however, that in distinguishing a similar series of coronal contrasting non-continuants in Nitinat, Klokeid (1975: 90) has used, besides coronal, the five features of [+ delayed release], [+ forward=anterior], [+ lateral], [+ high], and [+ distributed]. Lateral affricates and spirants are distinguished by the features [+ continuant], [+ forward], [+ stiff vocal cords], and [+ spread glottis]. At velar and uvular points, color modification (rounding) provides two extra positions of labialized velar and uvular.

4 Welsch (1976: 291) distinguishes lateral affricates and spirants in Hydaburg Haida by the use of the features [+ high], [+ back], and [+ continuant].

In the structuralist position, justification for treating labiovelars and affricates as simple phonemes is offered by Troubetskoy (1957: 61):

"Si dans ces langues des groupes phoniques comme ph, th, kh, ou pf, ts, kk, ou tw, kw, etc., peuvent se trouver à l'initiale, il est clair alors qu'ils doivent être considérés comme des réalisations de phonèmes simples (consonnes aspirées, affriquées, labialisées, etc.). Cela vaut par ex. pour les groupes ts, dz, tš, dž du tlingit . . . ."

And Velten (1944: 169):

"We have represented the affricatives as single phonemes. For if they were to be considered as di-phonematic, we should have to state that Tlingit possesses the phonemes */z/, /ž/ and /l/ (occurring only after /d/), a somewhat absurd assumption which would lead to unnecessary complications."
There is a five-way manner contrast of plain, aspirated and glottalized stop; plain and glottalized fricative at the apical, laminal and lateral alveolar affricate points, and at the velar and uvular (rounded and non-rounded) positions.\(^5\)

The three-way stop opposition at the six points of articulation is of plain (unmarked) unaspirated, unvoiced stop vs. aspirated; voiceless stop vs. glottalized voiceless stop. Although voicing is clearly non-distinctive and redundant (Naish 1966: 21), plain stops may occur lightly voiced in intervocalic position or occasionally at syllable onset. With regard to the feature voicing, Anderson (1974: 303) has suggested:

"The feature [+ voice] occurs in a large number of rules, and its interpretation varies from language to language. It provides a parameter distinguishing 'more voiced' from 'less voiced' sounds in any given language . . . Thus the voiceless series of one language may be essentially the same as the voiced series of another. Generally some combination of glottal width and vocal-cord stiffness is involved, and some configurations are certainly typical of voiced sounds while others are typical of voiceless sounds."

\(^5\) Hockett (1955: 105) has noted that five-way manner contrasts are of two types only:

(1) voiceless unaspirated stop (sometimes glottalized), aspirated stop, voiced stop, voiceless spirant, and voiced spirant; and

(2) unaspirated stop (sometimes voiced), aspirated stop, glottalized stop, voiceless spirant, and voiced spirant.

Tlingit would thus fit into a sub-type of (2) because of the stop opposition, forming a separate sub-type because of the voiceless vs. glottalized spirantal opposition.
In terms of distinctive features, however, the opposition could perhaps be captured by using the features aspiration and glottal closure, for example, unmarked /d/ would be:

$$/d/ \begin{bmatrix} - \text{asp} \\ - \text{glott clos} \end{bmatrix}, /t/ \begin{bmatrix} + \text{asp} \\ - \text{glott clos} \end{bmatrix}, /?/ \begin{bmatrix} - \text{asp} \\ + \text{glott clos} \end{bmatrix}.$$  

Features of [+] tense and [+] heightened sub-glottal pressure might be used instead, as suggested by Chomsky and Halle (1968), or the features of [+] stiff vocal cords, [+] slack vocal cords, [+] spread glottis, and [+] constricted glottis utilized by Klokeid for the Nitnat feature system. However, using laryngeal features of tenseness and aspiration introduced by Halle and Stevens (1971, in Anderson 1974: 301-2) instead of the features above, the three-way stop opposition could be depicted as:

$$/d/ \begin{bmatrix} - \text{spread glottis} \\ - \text{constr glottis} \\ - \text{stiff voc cords} \\ + \text{slack voc cords} \end{bmatrix}, /t/ \begin{bmatrix} + \text{spread glottis} \\ - \text{constr glottis} \\ + \text{stiff voc cords} \\ - \text{slack voc cords} \end{bmatrix}, /?/ \begin{bmatrix} - \text{spread glottis} \\ + \text{constr glottis} \\ + \text{stiff voc cords} \\ - \text{slack voc cords} \end{bmatrix}.$$  

Lacking from the symmetry of the Chart is glottalized /š/ at the laminal alveolar position. For this Chart, with the exception of the voiced lateral, a complete set of laterals occurs. Concerning lateral articulation as a contrastive point, Troubetskoy (1957: 157-8) has suggested:

*En effet du point de vue phonologique l'articulation latérale ne peut être considérée comme une particularité de localisation que si elle est propre à plusieurs phonèmes dont les autres marques distinctives sont semblables aux particularités de mode de franchissement.*
présentées par les phonèmes d'autres séries fondamentales (ou apparentées) appartenant au même système (comme c'est le cas par ex. en pédî, en sandavé, en tlingit, en chinook, en adyghé, en avar, etc.).

Only one nasal, alveolar /n/, occurs.⁶ Laryngeals /ʔ/ and /h/ are bracketed since these phonemes vary in occurrence with idiolect.⁷

There are two semi-vowels, palatal and labiovelar /y/ and /w/. A voiced post-palatal spirant has since disappeared and merged with /y/ (v. Pinnow 1976).

The problem of the merging and disappearance of the sole voiced spirant is an interesting one, noted by both Boas (1917) and Swanton (1908). This voiced spirant (for which we use the IPA symbol /y/) evidently occurred in the southern dialects but was in the process of being replaced by the glide /y/. In northern dialects, the merging of the voiced post-palatal spirant and the palatal glide had already occurred, not a trace appearing in the speech of Boas' Chilkat informant whereas Boas (1917: 9) reports "In 1886 I heard it distinctly and without any tendency to merge into y when taking down notes from a Stikine

---

⁶ A single nasal is not unknown in the phonology of American Indian languages. See Hockett (1955: 119) where:

"Tillamook, and most or all of the Iroquoian languages (Seneca, Oneida, Cherokee, Mohawk) have no labial consonants, and only one nasal /n/.

⁷ For laryngeals, see Naish (1966: 21) and Story (1966: 19). Rounded laryngeals, evidently first noted by Naish and Story, occur idiolectically in only a few words. According to Story: "In some idiolects labialized glottal stop and fricative occur in certain lexical items where the simple glottal phonemes occur in other idiolects."
However, according to Krauss (Kinkade, p.c.), this spirant still occurs in an unspecified Tlingit dialect.

As noted, no labials occur although, according to Krauss (Kinkade, p.c.), "for some speakers w is in certain positions m, and for some also n is l (not related to the obstruent laterals at all...)". The striking lack of labials has been widely noted in the literature, though Tlingit, as noted by Kinkade (p.c.), is not alone in this feature since Tillamook (Salish) and Iroquoian languages also lack labials.

8. Swanton (1908: 396) termed this voiced spirant 'vocalic-velar', while noting (1911: 165) in the pronunciation of younger people its exact similitude with the English palatal glide.

See also Boas's Tsimshian (1911: 288) wherein he has stated:

"It corresponds to the sound in Tlingit which Swanton... writes y, but which I have heard among the older generation of Tlingit distinctly as the same sound as the Tsimshian here discussed. With the assumption that it was originally the continued sonant corresponding to x of other Pacific Coast languages agrees its prevalent u'tinge."

Pinnow (1966: 21) has referred to [x] as a post-palatal, pre-velar spirant (v. n. 3 above). I. Brenzinger (p.c.) notes correctly that the symbol for the IPA voiced palatal fricative is [j] (v. Boas 1917: 9).

9 As Troubetskoy (1957: 135) has stated:

"Nous ne connaissons aucune langue sans apicales; les gutturales manquent par ex. dans quelques dialectes slovènes de Carinthie, les labiales en tlingit (Alaska), mais ce sont là des cas extrêmement rares: en général les trois séries de localisation nommées ci-dessus apparaissent dans toutes les langues du monde."

However, according to Jakobson (1939, in Troubetskoy 1957: 370):

"Tel est le manque des labiales dans le tlingit (et dans quelques parlers féminins de l'Afrique centrale), marque dû à la mutilation artificielle des lèvres, et même dans ces cas, la classe des labiales tend à être représentée dans le système phonologique par des substituts spécifiques."

Chomsky and Halle (1968) note also that Jakobson (1940: 357-58), in propounding his theory of implicational sound laws, stated that
II.3 VOWELS

Phonemically, there are eight vowels in Tlingit. Schematically, from data of Story (1966: 20-21), Naish (1966: 22), and Velten (1944: 168), they may be arranged as front vs. back, close vs. open, and long vs. short, although according to Story (1966: 20):

The short vowels, with the exception of the short member of the central pair, are more open than the corresponding long vowels. The short central vowel is closer than the long central vowel.

9 continued

Tlingit is one of the few languages in the world without labials, to which is attributed the use of labrets. (Labrets were the bone or wood (rarely stone) lip ornaments worn after puberty as a sign of wisdom by the aristocratic women of the tribe, v. de Laguna 1960). Chomsky and Halle (1968: 413) reiterate that:

"The absence of labials in the speech of women in a few Central Africal languages is caused by ritualistic mutilation of the lips, and such mutilation also occurs among the Tlingit, where both men and women wear labrets."

The above reasoning, however, is not valid on several grounds. Although evidently only high-caste Tlingit women wore labrets, their use was fairly widespread in the northern cultural area. For example, the neighbouring Tsimshian women used labrets (Tsimshian, of course, has a full set of labials), as well as some of the Alaskan Athapaskans, the Haida, and the Babine, a Carrier (Athapaskan) tribe (v. Krauss 1964: 131 n. 6). Krauss has stated that:

"The Na-Dene lack of labials, then, is far stronger evidence in favor of the unity of the consonant systems of Proto-Athapaskan, Eyak, Tlingit and Haida, than for any correlation between the use of labrets and the lack of labials."

10 It should be noted that Troubetskovy (1957: 115), using Swanton's (1911) data, has classified both Tlingit and Haida as having a triangular system of two degrees and two classes:

a
u
i

Unless Troubetskovy analysed /e,ɛ/ as schwa, the triangular description does not appear to be an apt fit.
While phonetic length duration in vowels only maintained in tonic syllables, long close vowels are more tense than the short close vowels. According to Naish (1966: 22) length distinction in vowels, which also indicates a change in quality, is significant gramatically in indicating the different inflections of the verb stem. Although Krauss (Kinkade, p.c.) is of the view that tense vs. lax is the best way to state the opposition, which is "definitely not a close-open opposition", Jones (1964: 40) has suggested:

It is generally advisable to apply the terms **tense** and **lax** only to the case of close vowels. It is extremely difficult to determine in the case of the opener vowels whether the sensation of 'tenseness' is present or not, and there is in regard to some vowels considerable difference of opinion on the subject.

In terms of distinctive features, however, since the feature

11 According to Kinkade (1976: 4) a contrast of three or more vowel positions is usual in Northwest Coast areal phonology.

12 Long vowels may occur with either high or low tone.

Velten (1944: 168) noted in the verb system the morphophonemic alteration of open and close vowels, as well as of /ʌ/ and /ɛ/,
length is evidently not a Chomsky and Halle preferred feature, the suggested long-short feature opposition for both high and low vowels is that of tense-lax. According to Chomsky and Halle (1968: 324):

The feature "tenseness" specifies the manner in which the entire articulatory gesture of a given sound is executed by the supraglottal musculature. Tense sounds are produced with a deliberate, accurate, maximally distinct gesture that involves considerable muscular effort; nontense sounds are produced rapidly and somewhat indistinctly. In tense sounds, both vowels and consonants, the period during which the articulatory organs maintain the appropriate configuration is relatively long, while in nontense sounds the entire gesture is executed in a somewhat superficial manner.

Tense vowels, marked by greater effort, distinctiveness and longer duration, are articulated with a greater deviation from neutral position than are lax vowels.

In an interesting discussion of the problem of feature opposition in low vowels, however, Halle (lecture, U.B.C., 1974) has stated that tense-lax distinctions in low vowels are physiologically impossible since low vowels always occur with the feature [+ constricted pharynx]. He has therefore suggested that low vowels such as /ə, ə, ʊ/ be distinguished by the feature [+ constricted pharynx], while high and mid lax, as well as low vowels, be distinguished by the use of the feature [- advanced tongue root]. For example, Tlingit long-short vowels using Halle's suggested feature approach could be characterized thus:
II.3.1 Vowel Realization

The vowels indicated in Chart II are realized as follows according to Naish (1966: 22):

- **i** is a close front unrounded vowel;
- **I** is a half-close to close front unrounded vowel;
- **e** is a half-open to half-close front unrounded vowel;
- **ε** is an open to half-open front unrounded vowel;

- **u** is a close back rounded vowel;
- **U** is a half-close to close back rounded vowel;
- **a** is an open central vowel;
- **∧** is a half-open central vowel.

Using secondary source material, Pinnow 1966:42 has suggested the following vowel realizations (v. 1966: 19-21) with some qualifications according to source:
CHART II

close

half-close

e

half-open

open
/i/ is realized as [i i:], /u/ as [u u:], [o o:].
/I/ is realized as [I], /U/ as [U] [o o].
/e/ is realized as [e e:], /ə/ as [ʌ ə], after /w/, /w/ as [o].
/ɛ/ is realized as [ɛ], /ɑ/ as [a a·], after /w/, /w/ as [o].

Although the back vowels /u, U/ generally tend to be lowered next to velars and especially to uvulars, there is apparently little sub-phonemic variation for the Angoon or central dialect. Naish (1966: 22) has noted, however, that U tends to be lowered to ɔ next to a uvular, while the degree of lowering may increase when U is between two uvulars. For the northern Chilkat dialect, Boas (1917: 11) has noted:

The quantitative value of vowels varies considerably. Unaccented syllables tend to have open vowels, which is due to the lack of intensity of movement. Where u and U are in contact with velars, they are apt to assume a less rounded character, and verge on ɔ, rarely on ɔ.

II.3.2 Phonemic Variation

On the basis of Boas' pre-phonemicized data of the northern dialect, Kinkade (personal communication) has raised the possibility of the occurrence of certain lax vowels as phonemic schwa within certain predictable consonantal environments. For example, where Boas' (1917: 17) orthography indicates the high lax back vowel U, contiguous to velars and uvulars, a 'coloured' schwa might be indicated:

---

13 According to Naish and Story (1963: viii), "sub-phonemic variations are at a minimum; the phonemic symbols may be taken as representative of the phonetic values also."
k U q'w λ ɪ λ s ɪ n
"I shall hide it"
/k ə q'w ə ɪ λ s ɪ n/

g U x'w λ I s I n
"I hid it for myself"
/g ə x λ I s I n/

In support of this possibility is Boas' (1917: 8) own testimony of his uncertain transcription with regard to the quality and quantity of some of the vowels:

There is a considerable amount of uncertainty in regard to the quality of some of the vowels recorded by me, particularly in regard to the use of Q[=/ʌ/], ε, and e, which is due to difference of pronunciation in rapid and slow speech. I discovered the significance of some of these differences in the course of my work, and had not the time to revise the whole material.

Further support of phonemic schwa may be its widespread appearance in the Northwest Coast phonology, particularly among the Salishan languages, e.g., Squamish, Upper Chehalis, Thompson and Shuswap, for which reference may be made to discussions in Kinkade (1963), Davis (1971), Kuipers (1967, 1974) and Grubb (1974). According to Kuipers (1967: 36):

The possible reduction of all unstressed vowels to schwa and the possible opening of schwa-type vowels to a, ɔ, etc., in the neighbourhood of uvulars, combined with the fact that reduced forms in many cases have become standardized, causes certain difficulties with regard to the phonemic interpretation of individual recordings.

II.4 THE SYLLABLE

The basic syllable structure of Tlingit is CV where, in a sample of running text, Story (1966: 14) found 70 per cent open syllables.

(In the adapted tagmemic framework used by Story, the syllable is
defined as the phonological unit above the phoneme and below the
tone group, while syllable division is defined as phonemic). Tlingit
syllable structure thus accords with Sapir's (1915: 534) findings for
the proposed Na-Dene:

The most typical and doubtless historically primary type
of stem form found in the Na-Dene languages is the
monosyllabic stem consisting of consonant plus vowel . . .

and with the universals of syllable structure discussed by Schane

According to Anderson (1974: 253) the syllable as a unit in
generative phonology has generally been ignored, and a re-examination
of its inclusion into the theory should be made, for:

The consistent attempt in generative phonology to ignore
the syllable as a structural unit has not been based
generally on a refusal to recognize the existence and
potential articulatory and psychological integrity of
such elements. A case against the inclusion of syllables
in phonological representations has never been made in
any detail in print, but it has generally been assumed
that the sort of facts associated with syllable structure
can in fact be attributed to the strictly segmental
representation, and do not require additional elements . . .
It would be of some importance if facts of syllable structure
were to turn out to be mechanical consequences of other
aspects of phonological representation. This does not,
however, appear to be the case . . .

Brown (1969: 5), also, has asserted that a striking feature of
generative phonology is the non-introduction of the syllable "to
account for the distribution of different phonetic realizations of
the same systematic phoneme...." Both Hooper (1972: 525-540) and
Brown (1969), however, have suggested ways of incorporating the
syllable as a unit.
Hooper would recognize the syllable as a phonological unit in order to gain simplicity, generality and explanatory power. Prosodic features such as stress and tone affect the syllable rather than the segment or morpheme, for example, in tone languages such as Chinese (and Tlingit) where the syllable is the tone-bearing unit. To Hooper, the syllable might be defined in two ways within the theory:

First, as segment sequences in the lexicon, underlying syllables might be postulated, with syllable boundaries referred to by marking conventions and morpheme-structure conditions.

Second (Hooper's choice), the syllable could be defined in terms of segment sequences with syllable boundaries inserted by a universal rather than a phonological rule. For example, a syllable boundary could be inserted by universal convention between a vowel and the following CV thus:

\[
\emptyset \rightarrow $ / [+\text{yll}] [-\text{yll}] [+\text{yll}]$
\]

Applied to Tlingit, Hooper's definition of the syllable might be very useful in the formation of phonological rules to account for the complex morphology of the verb word with its numerous morphophonemic changes and the shifting vowel deletion. Though sufficient data from Story's extensive work is not at hand, it is evident from Boas' comments and examples that a syllable explanation such as Hooper's might lead to greater clarity of explanation in prefixal morphophonemics. For example, Boas (1917: 61) has noted:

When a prefix ending in a vowel precedes the nominal subject and the modal element, the pronoun which stands between the modal element and the classifier loses its vowel, if the
classifier is vocalic. In this case the modal element retains its vowel. If the classifier is consonantal, the pronoun retains its vowel, while the modal element loses it.\textsuperscript{14}

In an alternative method to Hooper's, Brown (1969) using if-then sequence structure conditions would introduce the syllable into generative theory by having the redundancy rules assign syllabic status, as well as the distribution of allophones, to the phonetic realization. For example, Brown (1969: 5-6) has suggested as a morpheme structure condition:

The first of a sequence of two [- consonantal] segments will be assigned the value [- syllabic] (glide), and the second will be assigned the value [+ syllabic] (syllable nucleus).

\textbf{II.4.1 Syllable Types}

There are two syllable types in Tlingit: consonantal and vocalic. Vowels are the nucleus of a vocalic syllable. Consonantal syllables consist of a single consonant which may only be the apical, laminal or lateral non-glottalized fricatives /s, ʃ, ɬ/. According to Story (1966: 23):\textsuperscript{15}

Every vowel constitutes the nucleus of a vocalic syllable. Vocalic syllables are of the structure V, VC, CV, CVC, CVCC ... Consonantal syllables comprise a single consonant.

\textsuperscript{14} Dauenhauer (1976: 11) evidently concurs that "a series of three open syllables is unstable in Tlingit."

\textsuperscript{15} According to Naish (1966: 24), CV and CVC syllables occur in all environments. CVCC occurs almost always as a tonic syllable, while VC and V occur only in pre-tonic syllables.
Except in cases where the morphology is not known ... it can be stated that these syllables are congruent with (1) a total grammatical word which is not a clitic or ... (3) with an extensor when this extensor occurs between 2 consonants.

Congruent with a grammatical word, i.e., ſ"reflexive" or ["negative", or morphologically as an extensor form /s, ſ, Ž/, the plain alveolar fricatives may occur syllabically either an an independent word or interconsonantally in the verb word. Naish (1966: 24-25) has stated the environment as follows:

(1) between two consonants within a tone group preceding the tonic syllable - kəyiy•š•xldin - 'you (pl.) had written'
(2) initial to the tone group and preceding either a consonant or a vowel which may be potentially preceded by a glottal stop, that is initial to a grammatical word:

*qūštlini 'blind person', *ūškē 'evil'.

Exceptions to this rule occur under two conditions: if, as grammatical words, the alveolar fricatives /š, Ž/ are preceded by (1) a non-tonic bearing word, and (2) if /s, ſ, Ž/ are preceded by a non-tonic bearing word which is also vowel final, e.g. ya ſ• naḍʔēn - 'he is dressing'.

Only the independent words (š or Ž) or the extensor forms that are unglottalized alveolar fricatives undergo the following rule:

Consonant Syllabification
[+ cor] + cont [- glott clos] \[\] [\] \[\] CX syll
stem

Plain alveolar fricatives may syllabify within stated grammatical environments.
There is a general congruence between word and syllable boundaries with certain exceptions. For example (Naish 1966: 25), the first consonant in an initial consonant cluster of a head word will belong to the preceding syllable of a vowel-final modifier. Syllabicity of the apical alveolar fricatives in certain grammatical positions has already been noted. Within a word, a single consonant between vowels forms the onset of the following syllable. Two consonants word-medially are divided by syllable boundary. All consonants may occur as syllable onsets, although laryngeals (Story 1966: 27) may occur only in stem-initial syllable onsets.

II.5 PREFERRED SYLLABLE STRUCTURE

Schane (1973: 53-4) has defined a preferred syllable structure as:

Any process which takes a more complex syllabic structure and reduces it to the CV pattern leads to a preferred syllable structure. The effect of such processes is to break up clusters of consonants or sequences of vowels.

A preferred syllable structure, which is basically the reduction of a more complex syllabic pattern to the preferred CV, may be one result of certain phonological constraints, such as the surface phonetic

16 Aitchison (1974: 5), in arguing for the psychological reality of surface phonetic constraints, has suggested:

If all that is required is an apparatus for generating all and only the permissible sequences, then no such constraints are needed since the morpheme structure conditions (lexical redundancy rules) and the phonological rules can achieve this. But if one is interested in the kinds of mechanisms that a speaker is likely to have and which play a role in language change, then output conditions become relevant as a template against which all new forms are matched. Without them, the phonological rules seem essentially arbitrary and pointless.
constraints (Shibatani 1973: 87-106) which operate to produce a phonotactically patterned output of the P-rules.

According to Shibatani (1973: 87), while such constraints on distribution and combination expressed through allophonic rules and phonotactics were featured in the structuralist framework and phonetic theory, generative theory, does not, currently provide, provide a 

... direct means to capture phonetic constraints, and generative phonologists seem to be content with direct account by means of abstract morpheme-structure conditions together with the effects of phonological rules.

Within the context of generative theory, syllable structure processes may occur within and across morpheme boundaries. Morpheme structure conditions, which include statements of permissible sequence combinations, handle such constraints within a morpheme, while phonological rules may account for such processes across and within morphological boundaries. For example, Anderson (1974: 287) in cases of syllable restructuring has noted that:

... the morpheme structure condition and the phonological rule are clearly different aspects of the same fact, and should not be treated as completely separate. If they are simply stated, each in its own component of the grammar, this will not be expressed, however: it will appear as an accidental fact that some of the phonological rules have the effect of ensuring that constraints on underlying structures are also imposed on derived structures.

Although the standard theory of Chomsky and Halle (1968) has generally not recognized the need for some kind of surface constraints,
various suggestions, briefly reviewed below, such as the 'derivational constraints' and 'conspiracies' of Kisseberth (1970), the 'phonological targets' of Haiman (1972), the 'negative target' of Kiparsky (1972) and the 'surface phonetic constraints' of Shibatani (1973) have shown the necessity for incorporating some surface device into standard theory although, (as in the case of Shibatani's s.p.c.'s) surface phonetic constraints may overlap with morpheme-structure conditions).

Kisseberth's derivational constraint, to be examined briefly in Tlingit, is the effect of a set of rules operating together functionally to produce, by virtue of certain rule environment restrictions, a general constraint on the linguistic output. For example, concerning ouēpüt ōnditionstín Yawelmani, Kisseberth (1970: 293) has stated:

There are rather heavy constraints in Yawelmani phonetic representations on the clustering of consonants and of vowels. No vowel-vowel sequences are permitted. Words may neither end nor begin with consonant clusters. Nowhere in a word may more than two consonants occur in a sequence ... But in fact there are a variety of phonological processes which, it might be said, 'conspire' to yield phonetic representations which contain no word-final clusters and no triliteral clusters.

Kisseberth's conspiracy, then, is the result of a related morpheme structure condition and phonological rule which may, for example, have the effect of reducing a consonant cluster.

Haiman (1972: 376), has suggested that various languages, such as Papago and Yawelmani, may have CV(C) syllable-structure targets (CV is the maximally unmarked syllable) which are realized by means
of epenthesis and deletion rules, while Kiparsky (1972: 195) has argued that "the theory of derivational constraints and 'conspiracies' fails to provide an adequate explanatory account of these constraints on phonotactic structure" and that a notion of 'negative target' is needed instead. In borrowing from the theory of autonomous phonemics, Shibatani has suggested the notion of surface phonetic constraints to explain surface redundancies and phonotactic patterns in generative phonology.

In discussing the need for derivational constraints in Yawelmani phonology, Kisseberth (1970: 294) has noted that:

First of all, in the underlying representation of Yawelmani morphology, there are no triliteral clusters. If regularities of this sort are to be reflected in the grammar, there must be a language-specific morpheme structure condition which requires the segments on either side of a CC sequence to be vowels. The existence of this morpheme structure condition is not sufficient to account for the absence of triliteral clusters, for it blocks such clusters only inside the morpheme. Morphological processes of suffixation and special stem formation rules operate so that morphophonemic representations of words do contain triliteral clusters.

Specifically, in Tlingit, according to Naish (1966: 22), and Story, a similar process of consonant cluster reduction occurs for, while the basic syllable structure is CV, consonant clusters of three or more may be found across grammatical boundaries.

According to Boas' northern dialect data (1917: 12-13), consonant clusters are rare both initially and terminally in stems, although clusters may originate with certain consonant suffixes, e.g., the diminutive. Medial clusters which originate through word composition
are evidently unrestricted. In such environments, an epenthetic high vowel is inserted between consonants, breaking the cluster, thus leading to a preferred syllable structure.

It would appear, therefore, given the general lack of consonant clusters of three or more across morpheme boundaries, that a derivational constraint is operating in certain grammatically induced phonological environments where a high lax vowel is inserted automatically. This high lax vowel is inserted by rule under the following conditions:

(1) following a stem ending in a final double consonant cluster and before the preceding initial consonant of the modifier;

(2) between the final double consonant cluster of a modifier in an attributive clause and the following head noun beginning with a consonant in a noun phrase.

Story (1966: 24-6) has enumerated the grammatical environments as occurring in structures of:

(1) noun plus \{post-modifier\} clitic

(2) noun possessive plus locative

(3) verb attributive plus noun

(4) verb plus auxiliary, as well as across morpheme boundaries of tone-bearing stem plus suffix(es), e.g.

\[g\text{ùx}Ux \ (f\xi\xi m\ g\text{ùx}\xi) \ sI\i \ "He's a slave"\]

The epenthetic vowel agrees in roundness with the preceding consonant. A general rule for this epenthetic assimilation (which
Kinkade (p.c.) has suggested may be a quite general process in Tlingit might be stated:

\[
\text{EPENTHETIC ASSIMILATION} \quad V \quad [\alpha \text{ round}] / C \# \\
+ \text{high} \quad - \text{tense} \quad [\alpha \text{ round}]
\]

An inserted high lax vowel agrees in roundness with a preceding consonant over a word boundary. (since the derivational constraint operating will not allow inserted vowels to violate morpheme structure conditions which operate generally in preventing contiguity of palatal and labiovelar sonorant forms).

II.6 MORPHEME STRUCTURE CONDITIONS

Within standard theory, morpheme structure conditions have been established as a part of the readjustment component to account for a speaker's knowledge of the lexical structure of items in the lexicon, and to characterize formally a possible morpheme of a language. According to Chomsky and Halle's (1968: 171) definition, lexical redundancy rules apply "strictly within a single lexical entry and... simply fillin unspecified sequences of phonological matrices, without violating invariance. (Markedness theory has been an attempt to obviate the necessity for morpheme structure conditions. Universal marking rules would postulate the naturalness or unnaturalness of certain configurations in terms of features in a phonological matrix).

Developed by Halle (1959), the original function of morpheme structure rules was to fill in the unspecified or blank features in
items in the dictionary representation. Stanley's (1967: 393) original summary of the function of morpheme structure rules was as follows:

Thus, a full set of morpheme structure rules for a language will do two things: it will state, in terms of features, all constraints on what sequences of phonemes are possible in morphemes, and it will allow each morpheme to have a representation in which redundant feature values are omitted.\[17\]

Stanley, pointing out that these blank features, along with positive and negative values, were acting as a third value, suggested the need for a fully specified phonological matrix as well as stated sequence structure conditions.

Schane (1973: 43) has described the function of morpheme structure conditions, including the definition of a conceivable morpheme, as follows:

The segment redundancies and the sequence redundancies jointly form a set of morpheme structure conditions. The former define the set of possible phonemes in a language and the latter a set of possible morphemes—that is, possible sequences of phonemes. A conceivable morpheme can now be defined as an arbitrary sequence of bundles of unspecified features which does not violate

\[17\] The difference in theory focus between autonomous and systematic phonemics with regard to the specification of morpheme structure has been pointed out by Anderson (1974: 282) who states:

"For the theories known collectively as 'taxonomic' phonemics, the primary focus of attention was not the relation between forms, but the autonomous structure of each individual form. Such theories were concerned to specify the regularities which obtain within the domain of the individual form, and to distinguish those aspects of the structure of forms that serve distinctively from those aspects of their structure that are due to regularities of language."
any of the morpheme structure conditions of that language.

II.6.1 Redundancy

Morpheme structure conditions thus reflect both segment redundancy, the marking of non-distinguishing features in a fully specified phonological matrix, and sequence redundancy, the same across segments. Segment redundancy will not be discussed here. However, there are some sequence structure constraints which can be discussed generally, as well as in terms of syllable structure, if-then, and negative conditions, as noted below.

In Boas' (1917: 12-13) data, consonant clusters are rare stem initially; rare finally in verb stems; and not common in noun stems. Because all stem-final consonants are devoiced naturally, the first member of a consonant cluster across a morpheme boundary will always be voiceless. Specifically, Story (1966: 14, 20) has noted that in spite of the large inventory of consonant phonemes, many occur rarely in affixes, while a limited number occur in function words. In terms of phoneme frequency in a lexical listing, the most common CV(C) verb stem-initial phonemes (25%) are listed as /ʔ, t, n, χ, d/; and the most common CV(C) noun stem-initial phonemes (25%) as /t, ʌ, k, χ/. Five phonemes /y, d, w, n, χ/ in a small text sample accounted for 50% of the consonants.

II.6.2 Constraints

Constraints restricting the pattern of distribution and the combinations of features are expressed by morpheme structure conditions.
In structuralist terms expressed allophonically and phonotactically, these constraints are expressed in current generative theory by three kinds of morpheme structure conditions which may be in the form of syllable structure, if-then, or negative conditions (v. Stanley 1967).

In Tlingit, an interesting phonological constraint on CVC verb roots is the non-occurrence of root initial lateral consonants with root final apical or laminal consonants, and of root initial apicals with root final laminals. Thus, according to Story (1966: 71):

When verb roots are of the shape CVC, a root initial lateral consonant has not been found to occur with a root final apical or laminal consonant; a root initial apical consonant has not been found to occur with a root final laminal consonant.

Interestingly, there is evidently in these roots a marked preference for the occurrence of root initial apical with root final apical, for root initial laminal with root final laminal, and for root initial lateral with root final lateral. A further interesting feature of these CVC roots, the combination of phonetic and semantic function, has also been noted by Story (1966: 71) in that pairs of monosyllabic verb roots are "identical in initial consonant, in close or open vowel, back or front vowel, contrast in feature of final consonant, and occur in forms of similar semantic function." Negative constraints may be expressed by the following negative morpheme structure conditions:

Negative Condition

(a) Lateral Root ~ + [+ lateral] [ . . . ] [+ coronal] +
    Initial (CVC Verb Root)
    ~ + coronal ~
    ~
    ~

(b) Apical Root ~ + [+ anterior] [ . . . ] [+ coronal] +
    Initial [+ coronal]
    ~ + anterior ~
    ~
    ~
Redundant features are not specified here. Dots indicate features that would ordinarily be specified, e.g., [+ syll].

In addition, laryngeals, the glottal stop and fricative, may occur only stem initially. A negative condition, a morpheme structure constraint which specifies a non-permitted sequence, will indicate that laryngeal glide segments are unacceptable stem-finally, e.g. in formal terms. 18

Negative Condition

Laryngeal $\sim [+ \text{cons}] [+ \text{syll}] [+ \text{cons}] [+ \text{son}] [+ \text{low}]

A further sequence structure constraint occurs in the extensor series, where an s-series extensor, for example, does not co-occur with a sibilant or lateral stem consonant. With two exceptions, an š-series extensor does not co-occur with sibilant stems. Story (1966: 85) has noted the co-occurrence restrictions occurring between the

---

18 In their definition of the three major class features as sonorance, vocality and consonance, Chomsky and Halle (1968: 301-3) have defined the laryngeals /h, ?/ on the basis of vocal tract shape as both sonorant and non-consonantal, and therefore to be classified as glides. However, Ladefoged (1971: 108-111), defining sonorance in auditory and acoustic terms, has argued that it is counterintuitive to classify voiceless sounds as sonorant, and that laryngeal stop and fricative ought to be classified as true consonants. (Aitchison (1974: 10) concurs with reference to the behavior of h in Classical Greek in that: "It seems more plausible to regard h (as it was regarded traditionally) as a true consonant rather than a glide."
extensor series and the stem consonants of a verb theme. A suggested negative condition for the non-occurrence of the s-series extensor with sibilant or lateral stem consonants is:

**Negative Condition**

\[
\begin{align*}
\text{S-series} & ~\sim + \begin{cases} 
\text{+ ant} \\
\text{+ cor} \\
\text{+ strid} \\
\text{+ exten}
\end{cases} \quad ([ + \text{syll}]) & + \begin{cases} 
\text{+ cor} \\
\text{+ strid} \\
\text{+ strid} \\
\text{+ strid} \\
\text{+ strid} \\
\text{+ strid}
\end{cases} \\
\text{Extensor:}
\end{align*}
\]

(Stidant sounds are marked by greater air turbulence than non-stidant sounds. The feature stidant is thus restricted to obstruents, continuants and affricates, and can be a feature of nonvocalic laterals, v. Chomsky and Halle 1968: 329.)

In addition (Story 1966: 14), no vowel clusters are permitted within a grammatical word. This could be indicated by a syllable structure condition of the stem. For example:

**Syllable Structure Condition**

\[
\begin{align*}
\text{Syllable} & \quad + ([- \text{syll}]) \quad [-\text{syll}] \quad [+ \text{syll}] \quad [- \text{syll}] \quad ([- \text{syll}]) \quad + \\
\text{Condition:}
\end{align*}
\]

To recapitulate:

Lexical entries, which include as part of their information fully specified matrices of underlying abstract representations of formatives, are stored in the lexicon of the syntactic component. Unordered morpheme structure conditions, applying before the phonological rules, state the language-specific constraints on sequence structure and segment formation within the morpheme. However, unlike Chomsky and Halle (1968: 382) who find the lexical redundancy rules seemingly
'like ordinary phonological rules, in form and function', Brown distinguishes between redundancy and phonological rules by their operations. \(^{19}\) As Brown (1969: 9) has pointed out:

Many examples can be found of regularities which operate both within morphemes and across morpheme boundaries: we have seen some examples in the Lugisu data. A theory which refuses to account for this very general phenomenon, and by its refusal allows redundant processes to proliferate, needs modification.\(^{20}\)

\(^{19}\) According to Brown (1969: 16):

"The redundancy rules are realization rules: they complete the phonetic specification of the output of the syntactic surface structure within the domain of the phonological word. The formal constraint on their function is that they can only add features. The phonological rules, on the other hand, are exclusively mutation rules. They are divided into two parts, the intra-word rules and the inter-word rules. The intra-word rules operate on the output from redundancy rules which is marked for entry to the phonological rules. They exist only to deal with complications in the phonology ... The inter-word rules, like the intra-word rules, are mutation rules. They specify the phonetic consequences of phonological words occurring in sequence. The formal distinction then between redundancy rules and phonological rules is that whereas redundancy rules add feature but perform no other operations, the phonological rules only perform operations other than simple adding transformations."

\(^{20}\) With regard to other theories, Brown (1969: 5) has stated:

"Non-generative analyses have accounted for data of this kind by allowing certain general rules to operate both within and between morpheme boundaries" (see, for example, Hockett (1958: 131), Whorf (1956: 223) and the implicit reasoning in Bloomfield (1933: 133)), and by invoking the concept of the syllable (see, for example, Jesperson [sic] (1909: 59), Bloomfield (1933: 121)), as apropos for phonologists have always done (papers in Bazell et al. 1966 exemplify this approach)."

then restrained from applying across morpheme
Brown has given examples of sequence rules which apply across and within morpheme boundaries, for example: "... we have only to look at the familiar English examples of voicing similarity in *apse, caps, adze and cads* and the constraints on the stop sequences that give us *act, apt, cracked, capped* but not *atk or atp.*"

II.6.3 **Idiolectal Variation**

Idiolectal variation, involving a y-idiolect and a w-idiolect, have been noted by Naish (1966) and Story (1966: 31-32). These idiolectal variations may involve syllables or morphemes in each of the two idiolects. There is, for example, a y-idiolect where the sequence /w + i/ or /w + 1/ is not permitted across a morpheme boundary, and a w-idiolect where a sequence /uy/ or /Uy/ (where /y/ is syllable onset) is not permitted.

In the y-idiolect, a negative condition will specify that /w + i/ or /w + 1/ may not occur across a morpheme boundary. In w-idiolects, syllable-initial /y/ will not appear following a rounded back vowel.

Examples:

<table>
<thead>
<tr>
<th>y-idiolect</th>
<th>w-idiolect</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>du yid</td>
<td>du wid</td>
<td>&quot;his son&quot;</td>
</tr>
<tr>
<td>qUyawaqà</td>
<td>quwawaqà</td>
<td>&quot;it was suggested&quot;</td>
</tr>
</tbody>
</table>

Except in pronounced y-idiolects, where the sequence /uy$/ may also occur across morpheme boundaries, certain constraints in both idiolects will not allow /w/ to occur before /i/, or /y/ to occur after /u/. Thus, according to Story:(1966: 31): "Within the syllable and
within the morpheme, in the absence of variant forms, the sequences
wi and uy are non-permitted in all idiolects."

Following Brown (1969, 1971) who, using both Lúgisu and English
examples, demonstrated the advantages of allowing the predicted
feature values established by redundancy rules to be carried over
morpheme boundaries (and who, unlike Chomsky and Halle, distinguishes
between redundancy and phonological rules by their functions), we
could therefore suggest valid morpheme structure conditions for both
y- and w-idiolects.

This idiolectal material could be handled in the lexicon in
several ways.

First, and probably psychologically real to the native speaker
of Tlingit, there would be, for each of the two idiolects, one set
each of lexical entries for the affected sequences, with perhaps a
general recognition of both sets to the speaker-hearer.

Alternatively, the underlying abstract forms might have two
phonetic realizations for the two idiolects, with a differing set of
morpheme structure conditions for each idiolect.

Third, as shown below in Condition 2B, the constraints could be
stated in general terms, with phonological rules handling feature
changes for each idiolect.

Condition I, Parts A and B, illustrates the suggested morpheme
structure constraints applying to two separate sets of lexical
entries in and across morpheme boundaries, while Condition II
shows the suggested constraints for an underlying abstract represent-
CONDITION I

A. Negative Condition

\begin{align*}
\text{Y-idiolect} & \Rightarrow [- \text{cons}] [+ \text{F.B.}] [+ \text{syll}] \Rightarrow [\sim \text{w} + \text{i}] \\
& \Rightarrow [+ \text{round}] [- \text{back}] \\
\text{The sequence of } /w + i/ \text{ or } /w + I/ \text{ is not permitted across a morpheme boundary.}
\end{align*}

B. Negative Condition

\begin{align*}
\text{W-idiolect} & \Rightarrow [+ \text{syll}] [+ \text{F.B.}] [- \text{cons}] \Rightarrow [\sim u + \text{y}] \\
& \Rightarrow [- \text{back}] [- \text{round}] \\
\text{The sequence } /u\text{y}/ \text{ or } /U\text{y}/ \text{ is not permitted across a morpheme boundary where } y \text{ is syllable onset.}
\end{align*}

CONDITION II

A. If-Then Condition

\begin{align*}
\text{Strong-Y-idiolect} & \Rightarrow [+ \text{syll}] [+ \text{cons}] \Rightarrow /u + y/ \\
& \Rightarrow [+ \text{back}] [- \text{round}] \\
\text{In a strong y-idiolect, a sequence of } /u + y$/ or /U + y/ \text{ may occur across a morpheme boundary.}
\end{align*}

B. If-Then Condition

\begin{align*}
\text{Both idiolects (except strong y-idiolect)} & \Rightarrow [+ \text{syll}] [- \text{cons}] \Rightarrow /u \ w/ \\
& \Rightarrow [+ \text{back}] [+ \text{round}] \\
\text{In both idiolects (with the exception of a strong y-idiolect), glides do not contrast before } /i/ \text{ or after } /u/.
\end{align*}
ation with two sets of morpheme structure constraints, which also apply within and across morpheme boundaries. The first constraints are realized as negative (non-permissible sequence) conditions and the second as if-then (cause-result) conditions.

It seems that these morpheme structure conditions, which apparently may cross morpheme boundaries, capture in a general way some of the structural limitations operating generally in Tlingit by illustrating underlying constraints which optimally prohibit certain sound sequences occurring in certain environments. The suggested Conditions are set out on the preceding page.

II.7 AUFHEBUNG OR NEUTRALIZATION

Traditionally regarded as the suspension of a bilateral phonemic opposition in certain environments, neutralization has been defined by Troubetskoy as the suspension of distinctive opposition in a correlated pair of phonemes that differ by one feature, the unmarked member (in Prague School usage) normally appearing in the neutralized position.

However, many linguists, including R.J. Gregg and Martinet, differentiate between neutralization, which results in an archiphoneme (of the representative of a neutralizable opposition, v. Troubetskoy 1969: 79), and Aufhebung which results in a suspension of distinctive opposition in certain environments. 21

21 'Archiphoneme' has been defined by Troubetskoy (1969: 79) as "the sum of distinctive properties that two phonemes have in common" and the representative of a neutralizable opposition.
In Tlingit, several examples of an environmentally determined suspension of opposition exist.

II.7.1 Neutralization in Generative Phonology

In generative phonology, neutralization has been discussed under several different headings. In a perceptive discussion of redundancy, Stanley (1969: 401@402) defined neutralization as occurring in an environment where "the value of the feature in the environment is determined by a sequential constraint." He has suggested somewhat inconclusively that aspects of redundancy pertaining to neutralization could be included in the morpheme structure rules.

However, Schane (1968: 715-716), following Chomsky and Halle, would use the universal notion of markedness to obviate the problem of phonological neutralization. Unmarked features would represent the underlying form. Where, for example, in the case of und in German, voicing may be undetermined in the underlying representation, Schane would choose the unmarked feature of voicing (i.e., minus voice) to represent the final segment, so that:

Just as the notion of archiphoneme was indispensable for dealing with phonetic realization, the concept of markedness is needed for handling phonemic realization.

On the other hand, Schane (1973: 59) would treat neutralization as one among several practical phonological processes, including those of assimilation, syllable structure (deletion, epenthesis and
coalescence), weakening (syncope, apocope) and strengthening (vowel shift, vowel reduction, diphthongization), and neutralization. In a phonological context, neutralization is thus defined by Schane as:

... a process whereby phonological distinctions are reduced in a particular environment. Hence, segments which contrast in one environment have the same representation in the environment of neutralization.

In this section, neutralization as a topic will be treated in the traditional manner as a part of the phonological description.

II.7.2 Aufhebung in Tlingit

In Tlingit, the archiphonemes represented in the phonology would appear to be typical of Troubetzkoy's (1969: 80) Case II in that:

The representative of the archiphoneme is identical with the realization of one of the opposition members, the choice of the archiphoneme being conditioned 'externally'. This is possible only in cases where the neutralization of a neutralizable opposition depends on the proximity of some particular phoneme. The opposition member that "bears a closer resemblance or relation" to such a neighbouring phoneme, or is even identical with it, becomes the representative of the archiphoneme.

This is illustrated in modification (colour-rounding), where there is a suspension of opposition between simple velars and uvulars and rounded velars and uvulars in three positions: next to rounded back vowels, before close front vowels, and following a rounded consonant in a double consonant cluster. Story (1966: 32) has noted that simple velars and uvulars do not contrast with rounded velars and uvulars "following either a labialized velar or uvular or labiovelar semi-vowel or a sequence of
or a sequence of /u/ and a velar or uvular." In glides, there is a general suspension of opposition before close front vowels, and after rounded close back vowels. In manner, opposition of plain and aspirated stops and affricates is suspended at syllable coda, a case of partial complementation (v. Naish 1966: 21, Story 1966: 15).

II.8 TONE

Tone in Tlingit is phonemic, and is marked on stem vowels which have a high or low tone, thus furnishing a total of sixteen distinctive syllables. According to Velten (1939: 66):

Tlingit syllables may have high, low, or indifferent pitch. The difference between high and low tone may have a semantic value, as in éq (high tone) 'beach' and éq (low tone) 'cooper', xát 'salmon' and xát 'root'. The distinction between low and indifferent pitch, however, is less essential.

Stress, though generally associated with high tone, is not

---

22 In Shuswap, an Interior Säl̓íl̓úsh language, Kuipers (1974: 34) distinguishes between 'automatic' and 'inherent' rounding of consonants. All consonants which are correlated for the rounding features are automatically rounded before and after u, as well as contiguous to rounded consonants (or separated only by schwa).

23 According to Naish (1966: 26), a tone group consists of the tonic syllable, always word final in a tone group, plus optional syllable(s). However, not all Tlingit dialects have tone. Historically, according to Krauss (Kinkade, p.c.):

"... Eyak and PCA [Pacific Coast Athapaskan], instead of developing tone like so much Ath, have instead kept glottal modification of the stem-vowel. Southernmost Tlingit (Ton-gass, under Tsimsian influence) has also done the same, the rest of Tlingit having developed tone instead."
phonemic. According to Velten (1944: 168), neither quantity nor stress is phonemic, while a non-distinctive difference in lower and neutral tones is apparently based on sentence rhythm. Story (1966: 29), who has identified four contrastive tone patterns, notes:

The tonic syllable is generally the stressed syllable though syllables are little differentiated by stress, and in tone patterns 1 and 2, the syllable immediately before the tonic syllable, when it contains a long vowel, may be equally stressed with the tonic syllable.

Stem tone is not absolutely stable, since high tone may be lost in certain compounds. Boas (1917: 12) has given the following examples:

xúts'- núwù: "bear's fort" xútsnúwú "Bear Fort" (place name)
?qál'w "little lake" qán "Little-Lake" (tribe)

Naish (1966: 29) suggests that a free-form stem with tonic syllable has a variant form with no tonic syllable as the first element of a compound. Velten (1939: 70) states, in reference to his word list, that nouns may change their pitch when entering into compounds. Velten (1944: 168) notes as well that the opposition of high and low tone is neutralized in certain suffixes, e.g., -dē, -yI, yIn.

According to Naish (1966: 28), certain function words have no associated tone. Tone distinction also differentiates members of a verbal paradigm. Story (1966: 63-5) has postulated a number of hitherto unmentioned patterns of the verbal paradigm. Variable verb stems, always of CV(C) shape, may be inflected by the opposition of high vs. low tone and of long vs. short stem vowel. For example, with stem-final consonant, Stem Type 2, probably the most common, is
postulated to occur with four inflected stem forms and the following opposition of tone:

\[
\begin{array}{cccc}
1 & 2 & 3 & 4 \\
C\check{\acute{\varepsilon}}:C & C\check{\acute{\varepsilon}}:C & C\check{\acute{\varepsilon}}:C & C\acute{\varepsilon}C \\
\end{array}
\]

Stem form 1 (with affixes) corresponds to the English pluperfect 2 to the future, 3 in part to a similitudinal clause "as" + perfect, and 4 to the imperative.

As identified by Story (1966: 29), there are four contrastive tone patterns in normal tone groups: three with high tone on the final, penult, or antepenult syllable; and one with low tone on the final syllable of the tone group. According to Story (1966: 29):

The pitch of the pre-contour to the tone group (that is, the pitch of those syllables, if any, preceding the tonic syllable), is on a low-mid level. The first syllable of the pre-contour is slightly higher than any following syllables in the pre-contour. The post-contour, if any, following a high tone falls to low if the vowel of the syllable following the tonic syllable is long; the pitch of the syllable following the tonic syllable is maintained at a high level if the vowel is short.

Tone is not inherent in all morphemes. For example, from Boas' data (1917: 17, 84, 87-91), two suffixes of a neutral tone, -yi with a variety of functions including nominal possession and verb nominalization, and -yin indicating past tense, when affixed to a stem, take the tone opposite the stem vowel.

Minimal pairs indicate the contrastive differences in high and low tones. High tone is marked by acute accent, low by grave accent. The following data, illustrating this tonal opposition, are taken from Boas (1917: 11-12).
In addition to his examples previously cited, Velten (1944: 168) also cites:

\[ \text{tú } "\text{inside, interior}" \quad \text{tù } "\text{mind, thought}". \]

II.9 BORROWING - PHONOLOGICAL INLOANS

As a means of tracing contact prehistory and establishing areas of linguistic diffusion, borrowing has been discussed in some detail by Haas (1969: 80) who has suggested that "...loan words are as important in tracing historical contacts as cognates are in tracing historical origins." In addition, lexical borrowing offers insights into phonological adaptation when a loanword is adopted from the donor language (DL) to the recipient language (RL).

Since Tlingit phonology lacks bilabials and labiodentals as well as the voiced alveolar frictionless continuant /r/ and the vocalic lateral /l/, certain changes are made in adaptation. Although as Swanton (1908: 472) noted, in studying the Sitka dialect with material from Wrangell and Yakutat, the use of \( m \) occurs "in a few words imitating natural sounds and in words introduced from other stocks such as Tsimshian; l, however, is usually transliterated as n."
More recently, Dauenhauer (1976: 10) has concurred:

The Tlingit language has no bilabials or labio-dentals, no p, b, f or v. M appears as a dialect variation of w. Also there is no r, and l only appears as a dialect variation of n.

There are, however, several examples in Tlingit of inloans from Tsimshian, Athapaskan, English, Russian and French, where loanword phonemes or features have been changed to conform with the existing phonological system. Examples below (Boas 1917: 10, 1-3; Dauenhauer 1976: 10, 4-6) show the adaptation of a foreign labial to a Tlingit labiovelar, since labials are noticeably lacking in Tlingit.

<table>
<thead>
<tr>
<th>Donor Language</th>
<th>Gloss</th>
<th>Original</th>
<th>Tlingit Borrowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsimshian</td>
<td>&quot;Tsimshian&quot;</td>
<td>čem-sián</td>
<td>čucxán</td>
</tr>
<tr>
<td>Northern Athapaskan</td>
<td>&quot;mountain sheep&quot;</td>
<td>tλme</td>
<td>tλwé</td>
</tr>
<tr>
<td>Northern Athapaskan</td>
<td>&quot;caribou&quot;</td>
<td>mλcI?</td>
<td>wλcIx</td>
</tr>
<tr>
<td>English</td>
<td>&quot;machine&quot;</td>
<td>mačheine</td>
<td>washéen</td>
</tr>
<tr>
<td>English</td>
<td>&quot;watchman&quot;</td>
<td>wačhaan</td>
<td>wáachwaan</td>
</tr>
<tr>
<td>English</td>
<td>&quot;commissioner&quot;</td>
<td>kommissioner</td>
<td>kawíshán</td>
</tr>
</tbody>
</table>

In terms of major class features, the change is perhaps best characterized as $\left[ + \text{son} \right] \rightarrow \left[ - \text{cons} \right]$. That class of consonantal sonorant segments marked for the feature coronal, i.e. nasal /m/, backs, rounds, and loses the feature of consonantality when borrowed.

Further examples from Dauenhauer (1976: 10) illustrate the adaptation of foreign bilabial sounds into Tlingit as velars (Dauen-
Hauer's orthography and tone markings are followed in his foreign examples where double letters indicate long vowels.

<table>
<thead>
<tr>
<th>Donor Language</th>
<th>Gloss</th>
<th>Original</th>
<th>Tlingit Borrowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Russian</td>
<td>&quot;beer&quot;</td>
<td>'pivo</td>
<td>gée waa</td>
</tr>
<tr>
<td>8. Russian</td>
<td>&quot;priest&quot;</td>
<td>batyushka</td>
<td>wadooshka</td>
</tr>
<tr>
<td>9. EEnglish</td>
<td>&quot;peanuts&quot;</td>
<td>'pi:nts</td>
<td>gwéelats</td>
</tr>
<tr>
<td>10. EEnglish</td>
<td>&quot;molasses&quot;</td>
<td>mo'læsæz</td>
<td>ganáashish</td>
</tr>
<tr>
<td>11. French</td>
<td>&quot;priest&quot;</td>
<td>la'pʃɛtʃ</td>
<td>nakwéít</td>
</tr>
<tr>
<td>12. French</td>
<td>&quot;table&quot;</td>
<td>la'tabl̊</td>
<td>nadáakw</td>
</tr>
</tbody>
</table>

According to Dauenhauer (1976: 10) also "...in English words spoken with a Tlingit accent, bilabials are commonly realized as velars. Thus 'tip' becomes 'tick' and 'helicopter' becomes 'helicockter'." Further borrowings (Dauenhauer 1976: 10, 12; Story 1966) illustrate the typical adaptation of foreign liquids to nasal or syllabic segment (tone indicated where given). However, I. Brenzinger (p.c.) notes that for orthographic consistency in Russian examples 8 and 16, the palatalized t of batyushka would be indicated as batushka.
Characterizing the change, it would appear that an adapted liquid retains the major class features of sonorance and consonance in the environment of a consonant, gaining a syllabic feature in the environment of a vowel (depending on the syllable placement). In addition, a further rule to do with tone may be deduced from the examples above.

<table>
<thead>
<tr>
<th>Donor Language</th>
<th>Gloss</th>
<th>Tlingit Borrowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. English</td>
<td>&quot;dollar&quot;</td>
<td>daanaa</td>
</tr>
<tr>
<td>14. English</td>
<td>&quot;gold&quot;</td>
<td>goon</td>
</tr>
<tr>
<td>15. English</td>
<td>&quot;rum&quot;</td>
<td>naaw</td>
</tr>
<tr>
<td>16. Russian</td>
<td>krest (&quot;cross&quot;)</td>
<td>kanéist</td>
</tr>
</tbody>
</table>

Illustrative of phonemic adaptation is the evidence of in-loan borrowing, from which a few general rules may be deduced:

<table>
<thead>
<tr>
<th>Donor Language</th>
<th>Adaptation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Athapaskan, English</td>
<td>(1) DL m --- Tl w</td>
<td>Boas (1917)</td>
</tr>
<tr>
<td>English</td>
<td>(2) DL {r} --- Tl {n}</td>
<td>Story (1966)</td>
</tr>
<tr>
<td>Russian</td>
<td>(3) DL Cr --- Tl Cn</td>
<td>Dauenhauer (1976)</td>
</tr>
<tr>
<td>French</td>
<td>(4) DL {p} --- Tl {kw}</td>
<td>Dauenhauer (1976)</td>
</tr>
</tbody>
</table>
II.10 DIALECTAL VARIATION

Outside of the idiolectal variation (mentioned in section II.6), minor differences in dialect also occur. For example, the ethnographer Swanton (1911: 163) noted, and classified geographically, certain dialectal differences observed:

Although each town appears to have had certain dialectic peculiarities, it would appear that the language nowhere varied very widely and that differences were mainly confined to the different arrangement and handling of particles; the lexical changes being very few and the structure practically uniform. The greatest divergence is said to exist between the Yakutat people on the one hand and the people of Wrangell and the other southern towns on the other hand - the speech at Sitka, Huna, Chilkat, Auk, Taku and Killisnoo being intermediate.

Though very little has been published, field workers appear to have covered the major areas of divergence. There are, evidently, two or three dialect areas. According to Story (1966: 11), who has described the speech of the Angoon, or central, dialect:

There are dialectal differences but these appear to affect extensor forms, close vowels and intonational features for the most part, and divergence between dialects is small. Two papers by Velten (1939, 1944) are descriptive of the southern dialect; Boas' work is in the northern dialect.

Interestingly, with regard to Swanton's skills as a Northwest Coast ethnographer, Levine (1973: 28) has noted:

"Research on the Haida language and non-linguistic culture was conducted in the first part of the twentieth century by John Swanton, whose skill as an ethnographer rivals that of Franz Boas, the founder of ethnographic methodology in North America. In addition to a monograph on Haida, which is without question the most detailed, accurate and objective work on Haida ever written, Swanton presented a collection of myths and a grammar, based on the texts of those myths."
However, it has not been ascertained definitely whether there are two or three, or more, dialect areas in existence. Swanton (1911) and Story (1966) evidently subscribe to three: northern, southern and central. The ethnographer de Laguna (1960) and Velten (1944: 168 n. 1), following Boas, mention two.

According to Pinnow (1970: 26-7), Buschmann (1855, 1857) and Swanton (1908, 1909, 1911) worked in Chilkat (N) and Sitka (N); Swanton also in Yakutat (N) and Stikine (S). Krause (1885) dealt mostly with Chilkat and Sitka. Dall (1877) touched upon Taku (N), Stikine, Sitka and Tongas (S). The most reliable work, however, is that of Boas (1917) in Chilkat, Velten (1939, 1944) in Klawak (which Velten asserts as the most southern of dialects), and that of Naish (1966) and Story (1966) in the Angoon or central dialect.

Velten (1939: 65) has perhaps noted most thoroughly the slight variation in the northern Chilkat and southern Klawak dialects:

The main peculiarities of the southern dialect consist in the transformation of certain verb classifiers and in the tendency to open closed vowels of high pitch and to close the open vowels a, e, i, u, especially when they have low pitch.

Thus, along with a few minor morphological and lexical changes, the major differences appear to be tonal and vocalic.

II.10.1 Vocalic and Tonal Variation

According to Velten (1939: 70 n. 1), dialects generally agree on pitch, though with many differences in vowel quality. Velten notes, however, that
...the rules concerning pitch after certain nouns and prefixes, as set forth by Boas (75-7), do not always seem to hold good in the southern dialect.

Although Velten provides no examples for these tonal differences, Boas' (1917: 75-7) northern dialect material shows that certain of the locative prefixes require an open vowel and low pitch, when occurring with the past tense form of the verb stem. In addition, some of Velten's (1939: 71-72) examples show a dialectal morphophonemic alternation of e^A (Boas 1917: 92, 104), e.g.:

\begin{verbatim}
<table>
<thead>
<tr>
<th>Velten</th>
<th>Boas (1917: 92, 104)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-yê</td>
<td>yê</td>
</tr>
<tr>
<td>yêx</td>
<td>&quot;likeness, in like manner&quot; yêx</td>
</tr>
<tr>
<td>kênen</td>
<td>&quot;to jump&quot; kân, kén</td>
</tr>
</tbody>
</table>
\end{verbatim}

Other sound change has been noted in Velten (1939: 72-73):

\begin{verbatim}
<table>
<thead>
<tr>
<th>southern</th>
<th>northern</th>
</tr>
</thead>
<tbody>
<tr>
<td>ʰxán</td>
<td>kán</td>
</tr>
<tr>
<td>kʰgwA-</td>
<td>gÜgA-</td>
</tr>
<tr>
<td>ʰtaq</td>
<td>dʰq</td>
</tr>
</tbody>
</table>
\end{verbatim}

Lexical variation other than sound change has not been noted in Velten's data.

Close vowels of low pitch occur more often in the southern dialect. In addition, as previously noted, there is a tendency, in contrast with the northern dialects, for the closed vowels of high pitch to open and for the open vowels, especially those with low pitch, to close. Examples from Velten (1939: 71, 72; 1944: 178) and
Boas (1917: 107, 123-125) showing vocalic and/or tonal change are:

<table>
<thead>
<tr>
<th>Velten</th>
<th>Boas</th>
</tr>
</thead>
<tbody>
<tr>
<td>yít</td>
<td>&quot;son&quot;</td>
</tr>
<tr>
<td>tē</td>
<td>&quot;stone, rock&quot;</td>
</tr>
<tr>
<td>tàq</td>
<td>&quot;inland&quot;</td>
</tr>
<tr>
<td>yàx</td>
<td>&quot;border, edge,</td>
</tr>
<tr>
<td></td>
<td>shore&quot;</td>
</tr>
</tbody>
</table>

Velten notes that the form /dàq/ may appear only without a prefix in southern speech.

Because features of tense vs. lax, or even those suggested by Halle (1974) of [+ advanced tongue root] and [+ constricted pharynx], do not adequately characterize the change from open to close in southern vowels, the suggested feature for reflecting this change is that of length, e.g.:

Southern Dialect: \[
\begin{array}{c}
V \\
\alpha \text{ high tone}
\end{array}
\] \[\rightarrow\] [-\alpha \text{ long}]

As a feature of the southern dialect, vowels with high tone become short; low-toned vowels lengthen. That this is the right feature characterization seems confirmed by Naish (1966: 22) who suggests that there is

...some contrast in phonetic duration between vowels... only maintained in tonic syllables.

II.10.2 Classifiers

As previously noted, an important difference in the extensor forms or classifiers is evidenced dialectally. 'Classifier' is the
traditional term used by Boas (1917), Swanton (1911), Sapir (1915), Velten (1939), Krauss (1969) and Pinnow (1970). Krauss (1969: 81 n.1), noting that the term 'classifier' is a "blatant misnomer", defines classifiers as a "set of morphological segments occurring in prefixal position immediately preceding the stem in the Athapaskan, Eyak and Tlingit verb." 'Extensor' is the term devised by Naish (1966) and Story (1966) to express the derivational and inflectional element which, when affixed to a verb stem, comprises the major component of the verb theme.

Of the four series of extensors, one of which will precede the verb stem, one series, in the northern and central dialects, is of the syllable structure CV, while in the southern dialects these forms are mainly consonantal. Velten (1939: 69-70) has described these changes in syllable structure. The northern classifiers ɐɪ-, ᵣɪ-, ʰᵣɪ-, ɾᵣɪ-, ɾɪ-, ɾzdɪ-, ɾji-
appear in southern speech as

ɨ-, ɾ-, ʰʔ-, t-, ɾ-, c-, č-.

In addition, there is an apparent loss of voicing in the southern stop and affricate forms.

As a result of these changes in syllable structure, Velten (1944: 70) notes that:

...the approximate distinction between definite and indefinite classifiers traceable in the northern dialects... has, to a great extent, broken down in southern speech. It must be remembered, however, that the original functions of the classifiers are largely effaced in the whole Tlingit language, and that in the consciousness of the native speaker verb stem and classifier form an indivisible unit.
Velten (1939: 69) cites the following verbs in the southern dialect (the northern equivalents are given in brackets):

- **wU-Ɂ-sāt** (wU-li-sāt) "he was carrying"
- **wU-s-hā** (wU-si-hā) "he missed him"
- **wU-s-ɡeq** (wU-si-ɡeq) "he was stingy"
- **wU-t-ɡāx** (wU-di-ɡāx) "it was grey"
- **wU-Ɂ-gUt** (wU-Ɂi-gUt) "he was going"
- **qiy-c-ti** (qiy-dzi-ti) "thou art born"
- **wU-Ɂ-xix** (wU-Ɂi-xix) "he ran"

II.10.3 **Idiolectal Variation as a Dialect Feature**

Idiolectal variation (v. II.6.3) has been noted by Story as a dialect feature. For example, Story (1966: 31) suggests:

In IPA terms it may be said that regressive palatalization and progressive labialization occur. When these conflict, which takes precedence, or the degree to which either is operative, depends on idiolect. Idiolects in which regressive palatalization is dominant are called y-idiolects (a y-idiolect is standard in the central area) and idiolects in which progressive labialization is dominant are called w-idiolects.

Thus, one of the more interesting dialect features is the alternation next to high vowels of semi-vowels which, depending on relative glide strength in an area, results in either regressive palatalization (y-idiolect), or progressive labialization (w-idiolect). The y-idiolect, standard in the central area, was also evidenced in the speech of Boas' (1917: 16) northern Chilkat informant.

In treating dialect variation as a phonological process, an
alternation in form, rather than as an inherent constraint (a much stronger view), idiolectal variation may be handled by two phonological rules. If these idiolectal variations are to be regarded as P-rules and thus handled under the heading of dialect variation, the suggested rule for palatalization and a further rule for labialization follow:

Rule: Y-idiolect
(Central and Northern Area)

Regressive Palatalization  

\[ \begin{array}{c}
\text{[- cons]} \\
\text{[- syll]}
\end{array} \rightarrow \begin{array}{c}
\text{[- round]} \\
\text{V}
\end{array} \begin{array}{c}
\text{[- round]}
\end{array} \]

Rule: W-idiolect

Progressive Labialization  

\[ \begin{array}{c}
\text{[- cons]} \\
\text{[- syll]}
\end{array} \rightarrow \begin{array}{c}
\text{[+ round]} \\
\text{V}
\end{array} \begin{array}{c}
\text{[+ round]}
\end{array} \]

II.10.4 Other Features

A further feature of the southern dialects cited by Velten (1939: 66 n. 1) is an apparent delabialization, which often occurs word-finally after vowels. For example, Velten (1939: 72, 74; Boas 1917: 126, 128) noted:

\begin{tabular}{lll}
\text{\footnotesize southern} & \text{\footnotesize "marten"} & \text{\footnotesize northern} \\
\text{\textquotesingle kux} & \text{\'kux\textsuperscript{w}} & \text{\textquotesingle naq} & \text{\'naq\textsuperscript{w}}
\end{tabular}

The suggested optional rule for delabialization in the southern dialect, applying to tone-bearing stems, is:

\begin{tabular}{l}
\text{DELABIALIZATION (optional)} \\
\text{\footnotesize SOUTHERN DIALECT}
\end{tabular}  

\[ C \rightarrow \begin{array}{c}
\text{[- round]} \\
\text{\#}
\end{array} \]

A consonant may unround optionally word-finally.
For the Angoon or Central dialect, Story (1966: 33), however, has suggested a general rule applying to stem-final consonants and consonantal suffixes where "stem-final velar or uvular, or velar or uvular constituting a suffix, [which are] labialized without a following suffix, are simple when preceding a suffix with initial vowel". Examples given by Story (1966: 34) are:

\[
\begin{align*}
\text{xuw} & \quad \text{"blanket"} & \quad \text{du xuwu} & \quad \text{"his blanket"} \\
\text{xuwk} & \quad \text{"blankets"} & \quad \text{du xuwku} & \quad \text{"his blankets"} \\
\text{yagw} & \quad \text{"boat"} & \quad \text{du yagu} & \quad \text{"his boat"} \\
\text{yagw’k} & \quad \text{"little boat"} & \quad \text{du yagwk’u} & \quad \text{"his little boat"}
\end{align*}
\]

However, as Kinkade (p.c.) has pointed out, this apparent neutralization (of consonant preceding a rounded vowel) may be a kind of orthographic self-deception since, phonetically speaking, the labialization of vowels will necessarily affect consonant articulation. As noted by Kuipers (1974: 34) for Shuswap, a back consonant contiguous to a rounded consonant or vowel will most commonly show some rounding whether or not indicated orthographically. As indicated by Kinkade (p.c.), neutralization of this kind may frequently and mistakenly be referred to as delabialization. However, in contrast, for the northern dialect, Boas' (1917: 17) example shows rounding of an affix following a rounded consonant:

\[
\begin{align*}
\text{guxw} & \quad \text{"slave"} & \quad \text{dufiš guxw’ku’} & \quad \text{"his father's slave"} \\
\text{(du-iš guxw’-x-yi)} & \quad & \quad & \quad
\end{align*}
\]
II.11 SUMMARY

Using transcribed material from Boas (1917), Velten (1939, 1944), and Naish (1966) and Story (1966), who used respectively pre-phonemic, phonemic and adapted tagmemic models, this Chapter has examined in some detail aspects of Tlingit phonology generally within the confines of transformational generative theory.

Under various section headings, we have dealt with Tlingit phonology using the methodology of generative phonology. At the level of observational adequacy we have found that generative theory accounts satisfactorily for the data, using the proposed phonemic modifications of Schane (1971), though perhaps certain questions are raised and not answered in examining morpheme structure conditions.

However, having examined the phonological structure in some detail, the next Chapter will proceed to a discussion of phonological processes.
III.0 PHONOLOGICAL PROCESSES

This Chapter, based exclusively on Boas' (1917) Chilkat data, will cover a few of the most simple and general phonological processes in Tlingit within a transformational generative framework considered to include a theory of natural phonology. (It should be noted that the rather extensive morphophonemic complexities of the inflectional aspects of the verb word, recently explained in Story (1966), will not be touched upon.) For, as Dinnsen (1974: 29) has described the goal of linguists:

The task of descriptive linguistics is to provide a correct characterization of natural language. We, as linguists, are therefore concerned with proposing a theoretical model which describes natural language and only natural language. Chomsky and Halle (1968) offered generative phonological theory as the most comprehensively defined model of natural language; and since that time much work has concerned itself with elaborating on that model.

The phonological processes described, such as final consonant devoicing, intervocalic voicing, and assimilation, will, as discussed by Schane (1973) and others, be simple and natural, and the rules will be unrestricted in application. Although the distinction will not be made here, natural processes, which are innate and universal, have been characterized by Vennemann (1972) as allophonic or phonemic in effect, while natural rules may be considered to be morphophonemic or morphological (cf. Rudes 1976).

Although according to Boas (1917: 14) no phonetic processes occur consistently in Tlingit because of definite sound combinations,
phonetic change results from contact of the stem with certain affixes or endings, as will be illustrated throughout in a number of simple and universal processes which occur.\(^1\)

While Schane (1972) has suggested that natural or context-free, or universal, rules will fall mainly into the three categories of assimilation, preferred syllable structure, and maximum differentiation, the phonological processes which have been especially noted in Tlingit are final consonant devoicing (a natural process, Stampe 1969), pre-vocalic stem voicing before suffixes (an assimilation process), yod deletion (a syllable structure process), and an assimilation process which includes labialization and a feature to be here interpreted under the heading of vowel harmony.\(^2\)

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1. Glottal insertion is apparently an example of an exceptionless low level phonetic process which occurs with the pre-glottalization of stem-initial vowels. See Boas (1917: 14) where: "Initial vowels open with a glottal closure".

Example:

\[\emptyset \rightarrow \ \text{?} / \ # \ \text{V} \ ?uk\] "to boil" wui?ugun "it has boiled"

See also Story and Naish (1973: 264) where: "... no Tlingit verb stem begins with just a vowel."

2. It should be noted that, although this analysis includes underlying yod deletion and vowel harmony assimilation processes, M. Dale Kinkade (personal communication) has pointed out that a simpler alternative, and perhaps more likely, hypothesis would be that of intervocalic glide insertion with vocalic assimilation. Kuipers (1967: 36) noted a kind of progressive vowel assimilation in Squamish, perhaps illustrative of the kind of process Kinkade suggests. Since this explanation of glide insertion and vowel assimilation is a highly plausible one, examples of this alternative analysis will be noted where appropriate in the data.
In order to clarify the basic assumptions of this paper, however, with respect to phonological theory, a brief recapitulation of the transformational generative model will be given first, along with recent modifications to the theory in the field of natural phonology.

III.1 STANDARD TRANSFORMATIONAL GENERATIVE THEORY

In the standard theory of the 1960's expounded prior to Chomsky and Halle (1968) in *The Sound Patterns of English*, the phonological component of the grammar was said to consist of morpheme structure rules and phonological rules, the latter accounting for morphophonemic alternations in form in the phonetic representations (v. Lightner 1971: 499-564, Anderson 1974).

In theory, the phonetic representations were considered to be segmentally discrete bundles of distinctive features, while the ordered or partially ordered phonological rules were given formal and precise status. Phonological descriptions were evaluated simply by counting the number of features in each, with the lowest in number being the most highly valued.

After Chomsky's (1965) *Aspects* model, the phonological component in a generative grammar, like the semantic component, was considered to be interpretive of the central syntactic component. Exceptions to phonological rules were marked in the lexicon, and the alpha convention to assist with problems of assimilation and dissimilation was recognized.
Further formal refinements to the theory in rule and in representation, though perhaps not widely welcomed, were suggested as the sixties progressed: Bach's (1968) neighbourhood convention, L. Anderson's (1967) left-to-right syllabic cycle, McCawley's (1969) iterative rules, and, most important theoretically, Kiparsky's (1968) investigation into the abstractness of underlying representations.

As suggested by Dinnsen (1974: 29):

Elaborations on the Chomsky-Halle theory of phonology (henceforth, the 'standard theory') have been of two types. On the one hand, it has been argued that a given descriptive device may be too powerful, in that it permits statements which cannot be supported by evidence from any natural language. In such cases, a more constrained descriptive device is offered. On the other hand, some elaborations on the standard theory have involved adding a descriptive device which increases descriptive power. In these cases, it is argued that there is some fact about natural language which must be accounted for, and which escapes a proper characterization in the standard theory.

natural phonology, Schane's (1968) non-uniqueness of phonological representations, and Vennemann's (1972) natural generative phonology based in part on the serious acceptance of Postal's (1968) Naturalness Condition. Therefore, based on constraints of, or extensions to, generative theory the major phonological issues of rule ordering and of underlying representation appeared to dominate linguistic discussion until the mid 1970's.

Although it has been suggested by Dinnsen that further major issues in innovations to the standard theory include phonological conspiracies (Kisseberth 1970), surface-phonetic constraints (Shibatani 1973), and cyclic segmental rules (Kisseberth 1972), it seems that stemming directly from the aforementioned issues of rule order and abstract versus concrete representation there has arisen a major theme of naturalness in phonology.

III.2 NATURALNESS IN PHONOLOGY

Arising partly from a recurring interest in the hierarchy of phonological development put forth in the implicational laws of Jakobson's (1940) Kindersprache and continued research in child language acquisition, as well as from an ongoing search for tighter phonological constraints in standard transformational generative theory, naturalness in phonology in the guise of natural segment, natural class, natural system, natural process or natural rules has been a recent goal of linguistic theory. According to Stampe (1969: 540), however, Jakobson's implicational laws, and the markedness
theory of Chomsky and Halle, unlike Stampe's (1969) theory of natural phonology, are merely a subset of context-free phonological processes.

Thus, according to Bach and Harms (1972: 5):

A number of linguists have begun to emphasize the serious limitations in this account of phonological [classical generative phonology] theory. The main criticism has been directed at the lack of substantive assumptions about the context of rules, the particular generalizations that are available for the human (as opposed to the dolphin) communicator and so on. Under the headings of "markedness", "naturalness" or "archetypal rules" linguists have begun to search for tighter constraints on phonological systems and rules.

Characterized by a linguistic criterion of simplicity, naturalness in phonology has been defined as a search for phonetic plausibility (v. Hyman 1975, Schane 1972), although Bach and Harms (1972) and Skousen (1972) have recently criticized naturalness conditions for being essentially diachronic, and subject to the process of denaturalization through time. While opponents to naturalness may raise interesting points, it seems important to allow proponents of naturalness an adequate synchronic forum, remembering as well the dictum of Saussure (1915/1959: 99) that

... each language in practice forms a unit of study, and we are induced by force of circumstances to consider it alternately from the historical and static viewpoints. Above all else, we must never forget that this unit is superficial in theory, whereas the diversity of idioms hides a profound unity. Whichever way we look at studying a language, we must put each fact in its own class and not confuse the two methods.

Archetypal rules (cf. Foley 1968) will not be discussed in this paper. Chomsky and Halle's (1968) markedness, Stampe's (1969) theory
of natural phonology, and Vennemann's (1972) natural generative phonology will be discussed briefly below.

III.2.1 Markedness

Markedness theory has been the recent proposal of Chomsky and Halle to incorporate within transformational generative phonology the intrinsic feature content of a universal sound inventory in a natural manner.

To rectify earlier attempts at capturing "naturalness" with the notion of natural class, Chomsky and Halle (1968: 400) noted that the entire discussion of phonology in this book suffers from a fundamental theoretical inadequacy. Although we do not know how to remedy it fully, we feel that the outlines of a solution can be sketched, at least in part. The problem is that our approach to features, to rules, and to evaluation has been overly formal.

They therefore posited the Praguian concept of a set of universal feature values in the form of 'marked' versus 'unmarked' segments.

According to Anderson (1974), these universal marking conventions, intended as a substitute for language-specific morpheme-structure conditions, are used to interpret lexical matrices to the desired 'natural' configurations, while the accompanying 'linking' rules applying to these derivations adjust feature values in an attempt to characterize naturalness within the generative framework.

Marking conventions have been criticized, however. While approving the move to universalize phonological theory by removing its "arbitrary and formal character", Anderson (1974: 29192) has
suggested that marking conventions are in relevant respects "simply a version of Stanley's, with universality posited", and that these conventions still do not capture naturally certain universal phonological processes that occur, such as voicing assimilation in consonant clusters.

Marking conventions have been used in this paper as a notational abbreviation characterizing features and rules throughout.

III.2.2 Natural Phonology

The theory of natural phonology, advanced by Stampe (1969) since 1965, is based on a postulated innate system of a complete set of phonological processes in which the residual left by linguistic experience is the result of a number of mergers of a "potential phonological opposition into that member of the opposition which least tries the restrictions of the human speech capacity."

As Stampe (1969: 444) has stated:

I assume, then, that in its language-innocent state, the innate phonological system expresses the full system of restrictions of speech: a full set of phonological processes, unlimited and unordered. The most extreme processes are usually observable only in infancy: unstressed syllables are deleted, clusters and coarticulations are simplified, obstruents become lax stops, linguals become coronals, vowels merge to a.

According to Stampe's theory, these contradictory and apparently binary phonetic restrictions impinging on the phonological processes may be limited in three ways: by suppression, by partial suppression, or by ordered rule application.
For example, the suppression of a natural process would ensure the appearance of voiced obstruents in all contexts though obstruents are, through oral constriction, by nature voiceless. Partial suppression, or limitation, of a process would allow voicing of obstruents in voiced contexts, for example intervocally through assimilation. Ordered application has reference to changes which result from a different ordering of phonological processes. For example, in the case of obstruents, the devoicing process may, through ordered application, either precede or follow intervocalic voicing.

Stampe's system of natural phonology may be compared with Vennemann's (1972) natural generative phonology in that no distinction is made between redundancy rules (morpheme-structure conditions) and phonological rules. Instead, a difference occurs between morphophonemic and phonological (phonemic) rules, termed respectively phonological rules and phonological processes as noted by Rudes (1976: 142 n. 1) where

... within the framework of natural phonology proposed by David Stampe (1973) [where] phonological process is used in the sense of our phonological rule or process and phonological rule is used in the sense of our morphophonemic rule....

III.2.3 Natural Generative Phonology

Natural generative grammar has been defined by Vennemann (1972: 110) as
...a generative theory of language which is characterized primarily by the absence of a provision for extrinsic rule ordering. The goal of this theory is to establish a system of universal constraints which is powerful enough to free the linguist analyzing a language to construct a grammar which directly models the mental representation of the generative and analytic capacity underlying that language.

Arising from efforts to constrain or limit the power of transformational generative phonology (TGP), a theory of natural generative phonology (NGP), based on intrinsic rule order (cf. Koutsoudas, Sanders and Noll 1974), the strong naturalness condition (Postal 1968), and the basic category principle, has been developed from Vennemann (1972), and the recent work of Hooper (1975).

Differences between transformational generative phonology and natural generative phonology have been discussed by Vennemann (1972: 110-11):

In morphology, the constraint that all rules are unordered (a term which I will use with 'random sequentially ordered' or 'applying whenever a rule's structure description is met') leads to a number of consequences which make this portion of a grammar look radically different from a TG phonology. For example, there is no difference between lexical redundancy rules and phonological rules (NG phonology shares this property with Stampe's 'natural phonology') ... Instead, there is a distinction between phonological rules (allophonic and phonemic rules) on the one hand and morphophonemic, morphological, and sandhi rules on the other.

Recent articles in Glossa of Hooper and Terrell (1976) and Rudes (1976) have discussed stress assignment, and lexical representation within this theory. According to Hooper and Terrell (1976: 65):
NGP differs from TGP in that NGP has stronger constraints on abstractness. In particular, the rules of the grammar are not extrinsically ordered, rather a rule applies each and every time its structural description is met...

In discussing natural processes we will, after some discussion, adhere to Vennemann's theory of natural generative phonology in the acceptance of unordered rules.

III.3 CONSONANT DEVOICING

In Tlingit, voiced obstruents are devoiced word finally or at morpheme boundary as shown below. Since there are no examples of consonants with word-terminal voicing, and because no underlying voiced consonants are posited word-finally, this appears to be an exceptionless rule—an example of one of Stampe's innate and, in this context, unsuppressed phonological processes in which obstruents are devoiced through the natural process of oral constriction (Stampe 1969: 443, 445).

The following noun and verb stems illustrate obstruent devoicing in word-final position, especially in these rare stems ending in consonant clusters. (Data from Boas 1917: 13, whose orthography is given a current Americanist transcription. Item 14, p. 81 via Swanton 1909, v. Boas 1917: 7).
Noun Stems

1. saxt  "devil's club"  9. cückw  "bird"
2. ?ixt  'shaman'  10. caòk  "gopher"
3. saqs  "a species of tree for making bows"  11. kIink  "stale salmon-head"
4. gánč  "leaf tobacco"  12. tInx  "Arctostaphylos uva ursi"
5. yàñć  "sea otter"  13. xč śxw  "bluejay, blue"
6. xIxč  "frog"  14. kwaíx  "green fern root"
7. ƛtk  "ground"  15. šátš  "elder sister"
8. nuskw  "wolverine"  16. taqł  "hammer"

Verb Stems

1. šuwq  "to laugh"  3. xIxč  "to be suspended"
2. naíx  "wealthy"  4. kIk  "to shake"

Rule 1


Obstruents are devoiced stem finally.

III.4 YOD-DROP

In Boas' (1917: 15) data, a palatal voiced continuant (y) appears in certain marked affixes where it is deleted following a consonant or glide. Examples given (Boas 1917: 15) show the loss of underlying /y/ in the suffixes {−yI} and {−yIł}. 
In the framework of generative phonology adopted here, there are two ways of representing this suffix-initial segment with regard to the underlying representation.

The first method would offer the underlying historical and etymological voiced post-palatal continuant as an abstract representation with rule-governed loss or assimilation.

The second, and more concrete, method would consider the glide as being morphologically marked for loss in certain environments, for assimilation in certain others.

Primarily because Boas' orthography is not always consistent with regard to a /y~y/ alternation in words or suffixes, the second method of morphological marking has been arbitrarily chosen.

Therefore, the suggested rule of yod drop (in which a necessary stipulation is that this rule must apply to underlying forms as the structural description is met, unless rule ordering is presumed) is:

Rule 2

\[
\text{YOD DROP} \quad \begin{cases} \text{syl} \quad \text{cons} \end{cases} \quad \rightarrow \quad \emptyset \quad /\quad \begin{cases} \text{cons} \end{cases} \quad \begin{cases} \text{syl} \quad \text{cons} \end{cases} \quad \begin{cases} \text{F.B.} \end{cases}
\]

The glide /y/ in certain morphologically marked suffixes is dropped following a consonant across a morpheme boundary.

However, although following Boas (1917) this analysis includes processes of yod deletion and vowel assimilation,
M. Dale Kinkade (personal communication) has suggested that a simpler, and perhaps more natural, hypothesis involving a commonly occurring phonetic process would be that of intervocalic glide insertion with vocalic assimilation. This appears to be the accepted analysis as well of Story and Naish (1973: 348) where: "... if a stem ends in a vowel, then the consonant y or w comes between the stem and the suffix, y if the suffix is -ee, w if the suffix is -oo."

For several reasons, however, including the etymological origin of the glide /y/, I have rejected this alternative. First, there are, in Tlingit, a number of morphophonemic alternations involving consonant change or vowel assimilation which, in a generative analysis, would require the positing of an underlying form to be changed in certain phonological contexts by rule, for a more linguistically general solution.

Second, other functional inflectional suffixes of the same type as {-yi} and {-yin}, such as {-iq} and {-it} show vowel loss, rather than glide insertion, after stem-final vowel, while stem-initial vowels, as previously noted, are automatically preceded by glottal stop (cf. Story and Naish 1973: 349).

Third, since Boas' data are the result of concentrated effort with his native Chilkat informant, Louis Shotridge, one would assume that Boas, like Sapir in Southern Paiute, would check with the informant for an innate intuition of his mother tongue. For an important, and often final, question in generative phonology is: "How would the intuition of a native speaker account for the data?"
III.5 PRE-VOCALIC STEM VOICING

A related, though opposing, process to consonant devoicing is the voicing of stem obstruents before vocalic suffixes. This process, according to Stampe's theory of natural phonology, shows the partial suppression of the devoicing process through limitation.

According to Stampe (1969: 443), phonological processes form opposing sets of conflicting phonetic restriction. In the case of obstruents which are voiceless by oral constriction, though voiced, for example, through voicing assimilation intervocalically, a conflict of processes arises, one of which must then be partially suppressed or limited.

Final stem voicing (noted also in entries in Story and Naish 1973, Part II), with the qualifications on voicing noted in Chapter I, is limited to occur only before vocalic suffixes. According to Boas (1917: 14-15), stem voicing does not occur before glides, nor before a phonemic glottal stop plus vowel.

Examples are:

1. `\xat` "root" \du\xadj\l\ "h\i\si\u{r}oot" du-\xat-yi
2. `\at` "to go"(pl) \adin "having gone" at-yin
3. yek "spirit" duyeg\l\ "his spirit" du-yek-yi
4. yakw "canoe" duyagu "his canoe" du-yakw-yi
5. `\ukw` "to boil" wu\#ug\un "it has boiled" wu-\#-\ukw-yin
6. `\aq` "eye" duwag\l\ "his eye" du-waq-yi
7. ke\x "dog" duke\l\ "his dog" du-ke\x-yi
8. xwa'n "tired" xwe'lin "he was tired" xwe'-yin
9. xi'a "to fish with rake" xila "herring rake" xila-a
10. yaq "to pull" kaya'ga "stern sheets" k a'-yaq-a

Rule 3

PRE-VOCALIC STEM VOICING [+ cons] \rightarrow [+ voice] / [+] F.B. [+ syll]

A consonant may be lightly voiced before a following vowel across a morpheme boundary.

As the examples show, consonants are voiced intervocically, a second natural process. However, a lexical exception to the foregoing rule noted by Boas (1917: 14) is ?it "place" which in composition with a vocalic suffix appears to be morphologically frozen, e.g.

'xan ?it'I "fireplace" <xan ?it-yi

III.6 ASSIMILATION: LABIALIZATION OR VOWEL HARMONY

Of some interest, perhaps, to linguists has been the suggestion by Boas (1917) of the occurrence of vowel harmony in Tlingit. Following Boas' analysis, we have chosen to consider the implications of certain of these harmonic processes within a generative framework and to discuss them in some detail.

Although Boas included labialization of glide and consonant as a vowel harmony process, we will find it somewhat simpler at the beginning to separate the two processes for discussion.
As the discussion will show, there is a problem, of course, as to whether to include glide assimilation under labialization or under vowel harmony. If glide assimilation occurs under labialization, the rule becomes somewhat awkward. If, however, glide assimilation occurs under vowel harmony, then cyclicity, simultaneity, or persistent rule application is required. These approaches will be considered in turn.

Kinkade (p.c.) has suggested that labialization may be a more general occurrence than suggested by Boas' data. For example, on reviewing verb roots in Story and Naish's Tlingit dictionary, Kinkade (p.c.) has perceptively commented:

I note that in the Tlingit dictionary, only a few roots are listed with final labialized consonants after \( i \) or \( e \) (there are many after \( a \), but if, as you say, that may derive [sometimes?] from \( o \), that can be explained). Their initial distribution is even more peculiar: there are only five roots with initial labialized consonants before \( i \) or \( e \); those before \( a \) are presumably from forms with earlier \( o \). The fact that they are not written before back vowels is misleading; it is unlikely that velars and uvulars are not rounded before back vowels, but the acoustic impression of rounding is masked by the rounded vowel. Note also that S and N do not write rounded consonants after rounded vowels and rounding (in a root) after a rounded vowel may be blocked by a following front vowel."

III.6.1 Labialization

Progressive labialization, or rounding of velar and uvular (Boas: palatal and velar) consonants as well as palatal glide, occurs in certain suffixes and prefixes after all labialized sounds—vowel, consonant or glide—and after certain words ending in phonetic
[a] which may be recognized as underlying /ɔ/. These cases will be discussed separately.

III.6.1.1 After Rounded Segments

The affixes marked for this process are the velar "k" suffixes, the first person pronominal prefix, suffixes {-yi} and {-yin}, and the prefix {ya-} which only labializes after the vowel /u/ (Boas 1917: 16-18). The vowels of suffixes {-yi} and {-yin}, like the vowels of other functional inflectional suffixes listed by Story and Naish (1973: 349), are also marked for vowel harmony.

However, in a stem, there is no rounding assimilation resulting from stem-affix composition, as the following examples show:

1. duyitk "her little son" du-yit-k
2. qukit' "to pick berries" qu-kit'
3. wUxix "it fell" wU-xix

although an exception to this rule occurs, an example of idiolectal variation (a further example (Boas 1917: 160) occurs in the compound: t'iy kUwAt' (<yAt' (v.)) "long-elbowed"):  

4. ?Akuwatî "its length" A-ku-yat'-I

A few general examples of labialization follow.

"k" suffixes

1. Ili inuguq" "do not be sick" Ili i-nuk'-iq
2. gux"x" "slaves" gux'-x
3. yAawk" "a little strap" yA-aw-k
Examples are from Boas (1917: 16). The optative verbal suffix /iq/ is subject to vowel harmony or rounding assimilation, as well as to vowel loss following a final stem vowel (Naish 1966: 31).

1st person pronoun

Although weak labialization of k-sounds after /u/ is found in 1st person pronoun combinations, in slow speech it tends to disappear:

1. kUq\-i\-sIn
   "I shall hide it myself"
2. gUx\-I-sIn
   "I hid it for myself"

The combinatorial changes of verbal prefixes are covered in detail in Story (1966 Ch. 7). (It has been noted by M. Dale Kinkade (personal communication) that the lax vowel (in examples 1 and 2 above) contiguous to velars might, in a phonemic treatment, be treated as schwa phonetically predictable in rounded environments.)

Incorporated noun \x "mouth"

1. yux\-\x\-t\-ank
   "I am talking" yu-\x-\x-t\-ank

Verbal prefix \ya-

The verbal prefix {\ya-} is labialized only after /u/ in the morphophonemic combination /uw\-/ from /wu-\ya/, and is thus restricted grammatically and lexically to labialization only after $\begin{bmatrix} + \text{ syll} \end{bmatrix} \begin{bmatrix} + \text{ round} \end{bmatrix} [\text{+ F.B.}]$

1. \xat ?uw\-d\-j\-q
   "he killed me" \xat ?u-\ya-\d\-j\-q
The nominal suffix {-ya} is not marked for labialization, and does not assimilate.

If glide and consonant labialization is treated as a single process, a suggested rule for labialization in these marked affixes, incorporated nouns, and in pronoun combinations is thus:

**Rule 4'**

CONSONANT AND GLIDE ROUNDING

\[ \text{[- syll]} \rightarrow [+ \text{round}] / [+ \text{round}] [+ \text{F.B.}] (V) \]

Consonants and glides are rounded following a rounded segment.

However, if labialization applies only to consonants, and the glide is treated more generally as part of vowel harmony or rounding assimilation, a more acceptable rule is this:

**Rule 4''**

CONSONANT ROUNDING

\[ [+ \text{cons}] \rightarrow [+ \text{round}] / [+ \text{round}] [+ \text{F.B.}] (V) \]

Consonants are rounded following a rounded segment.

Though less general, the rule of consonant rounding allows for the special behaviour of yod (etymologically y) in the yod-drop rule.

The bracketed vowel in the rule allows for an epenthetic vowel which also occurs in the Angoon or central dialect of Naish and Story. A further, though unlikely, possibility, other than anaptyxis before the diminutive suffix, is that this vowel may be an underlying stem-ending, deleted finally. (This optional vowel, inserted by rule, occurs automatically in certain stated environments, v. II.5).
III.6.1.2 After marked segment /a/

In some lexically marked cases, labialization of the affix follows nouns ending in phonetic [a], which in a transformational generative treatment may also be regarded as underlying /ɔ/. In these special cases, following the usage of Hyman (1970), morphemes marked [+ L.R.], i.e., plus lip rounding, indicate that rounding assimilation of the affix follows.

1'. q'a "man" qawu "its man" qa-yi [+ L.R.]

2'. nawun "having died" na-yin [+ L.R.]

The diminutive suffix /-k/ is also affected by this rounding. Even when epenthetic /ʌ/, which Boas relates to /a/, is inserted between two consonants across a morpheme boundary as noted by Boas (1917: 18, 86) in examples 4 and 5 below, labialization occurs.

1. ?akw "a small pond" ?a-k
2. ?akw "a small thing" ?a-k
3. t·akw "a small spring salmon" ta-k
4. hin?akw "a little water" hin-k
5. ?ex·akw "a little grease" ?ex-k
6. ?asakw "little tree" ?as-k
7. ?anakw "little town" ?an-k

Labialization caused by /a/ may be followed by vowel harmony or rounding assimilation. The rule for glide and consonant labialization follows.
Rule 4a

CONSONANT AND GLIDE LABIALIZATION

\[- \text{syll} \] \rightarrow [+ \text{back}] / [+ \text{L.R.}] [+ \text{F.B.}] 

Consonants and glides are rounded following marked /a/.

Because marked /a/ labializes glides directly, as in examples 1’ and 2’ above, no discussion re rule treatment is warranted since the need for two separate rules for glides and consonants cannot be justified.

III.6.2 Vowel Harmony - Rounding Assimilation

Vowel harmony is a process which occurs when certain of the features of a vowel in one syllable come to agree or assimilate with certain features of a vowel of another syllable as, for example, in Turkish where a high suffix vowel assimilates to the backness and roundness of the preceding stem vowel (v. Schane 1973: 52).

This type of progressive assimilation, or vowel harmony, where a high suffix vowel 'assimilates to a preceding morpheme-final high vowel', occurs in Yawelmani (Kisseberth 1969, 1970) as an underlying feature (Schane 1973: 78-80, Hyman 1975: 87), and in most idiolects of Wâlbiî, a language of Central Australia (Hale 1973: 405).

In Tlingit, vowel harmony, or progressive assimilation, occurs in certain contexts as automatic alternation. For example, the palatal vowel /i/ and the semi-vowel /y/ in certain affixes are velarized after rounded segments or certain nouns ending in /a/.

Application of a phonological rule to special morphemes is not unknown.
For example, accidental reference of a harmony rule to a single suffix occurs in Turkish (Zimmer 1970) where, according to Hyman (1975: 182), a single morpheme 'satisfies the conditions of a phonological rule.'

While no longer a productive process, the exception to harmony noted by Boas (1917: 18) of dutanu "its navel" from /du-tan-yi/, and the rounding assimilation caused by certain segments marked /a/ as well as by the inserted vowel /ʌ/, show that the process of distance assimilation or harmony has been a viable concept, perhaps similar to the process of progressive vowel assimilation noted by Kuipers (1967: 36) in Squamish.

III.6.2.1 After Rounded Segments

The most common assimilations in Tlingit are those of the suffixes /-yi/ and /-yin/ in which palatal phonemes are labialized after rounded segments, whether derived or original (Boas 1917: 17). For this reason, Boas (1917: 16-18, 85, 88) has treated labialization as part of the vowel harmony process for, as the sampling below indicates, the two processes seem inseparable. Further examples of vowel harmony and rounding assimilation, to which the rule of consonant and glide labialization has already applied, illustrate the process relationship.

1. `nu "fort"  `dunuwu "his fort"  `du-nu-yi
2. `iu "nose"  `du'uwu "his nose"  `du-.lu-yi
3. `i'ukw "king salmon"  `du'ugu "his king salmon"  `du-`i'ukw-yi
III.6.2.2 After Segment /a/

1. duaku
   "his little pond"
   du-a-kw-yi

2. dutanu
   "its navel"
   du-tan-yi
   [+ L.R.]

As previously noted, this second example, which must be accounted
for in the lexicon, is quite exceptional with vowel harmony applying
through a nasal segment, and would therefore have to be marked [+ L.R.]
in the lexicon.

Vocalic rounding assimilation, however, which occurs in the
above examples, must be accounted for by rule. Therefore, a vowel
harmony rule for marked affixes applying after the rule of glide and
consonant rounding (Rule 4') is indicated:

Rule 5'

PALATAL VOWEL ROUNCING  
[ + syll ]  
[ - back ]  

[ + back ] / [ + round ] [+ F.B.]

A high front vowel in marked affixes is backed and rounded
following a rounded segment across a morpheme boundary.
However, for a vowel harmony rule applying both to palatal vowel and glide after the application of Rule 4", the rule of consonant labialization, the rule would be:

**Rule 5"**

\[
\text{PALATAL VOWEL AND GLIDE ROUNADING} \quad \begin{array}{c}
[- \text{cons}] \\
[+ \text{high}]
\end{array} \quad \rightarrow \quad \left[ + \text{back} \right] / \left[ + \text{back} \right] / \left[ + \text{round} \right] / [+\text{F.B.}]
\]

In certain affixes, the high front vowel and palatal glide back and round following a rounded segment across a morpheme boundary.

Nevertheless, it seems possible and plausible that these Rules 4', 4" and 4^a, respectively for consonant and glide rounding, consonant rounding, and consonant and glide rounding following marked a, in addition to the above Rules 4f and 4g, for palatal vowel rounding and palatal vowel and glide rounding, can be collapsed together into one natural and phonetically plausible assimilation rule that will apply cyclically or persistently as the structural description is met. We shall designate this collapsed or reduced rule as Rule 4*.

**Rule 4**

\[
\text{ROUNDING ASSIMILATION} \quad \begin{array}{c}
[+ \text{cons}] \\
[+ \text{high}]
\end{array} \quad \rightarrow \quad \left[ + \text{back} \right] / \left\{ 
\begin{array}{c}
[+ \text{round}] \\
[+ \text{seg}]
\end{array}
\right\} / [+\text{F.B.}] (V)
\]

In certain affixes, a high consonant, glide or vowel backs and rounds after rounded or marked round segment across a morpheme boundary.

An interesting feature of the above rule, of course, is the
addition of the distinctive feature of height, which relates the palatal and velar consonants to the high vowels and glides, correlating in this way with features of backness and rounding, characteristic of types of vowel harmony as in Turkish (Schane 1973: 52) where "the high vowels of a suffix agree in backness and rounding with the stem vowel".

As can be seen, the rules and processes discussed above have been phonetically plausible, inherently natural assimilation rules which, to some degree, illustrate the remarks of Schane (1972: 207):

Rules of assimilation provide some of the clearest examples of natural rules. In all such rules the values for one or more features of a segment are changed so as to agree with the values for the same features in some other segment.

Following from the discussion above, it will be seen that some comments on rule ordering and/or rule restriction are necessary in order to achieve the desired forms of a phonetic representation.

III.7 TONE DISSIMILATION

The vowels of a number of suffixes, including {-yi} and {-yin}, have a neutral pitch. When added to a stem with high tone, the suffix takes a low tone; when added to a stem with a low tone, the suffix has a high tone.

While tonal processes were not discussed by Stampe (1969) as a natural process, tone dissimilation would qualify under the category of rules for maximum differentiation (Schane 1972: 207). As noted,
the acute accent indicates high tone, while the grave indicates low tone. Examples from Boas (1917: 11) are given below.

1. dutayl "his king salmon" du-ta-yl
2. dutayl "his board" du-ta-yl
3. duxadl "his root" du-xat-yl
4. duxadl "his salmon" du-xat-yl
5. duti̲l "his scar" du-ti̲̅-yl
6. duti̲l "his shoe" du-ti̲̅-yl
7. nugun "having been sick" nukʷ-yIn
8. xāśin "having cut" xaš-yIn

The tone dissimilation rule for these neutrally marked suffixes is the following:

Rule 6

\[
\text{TONE DISSIMILATION} \quad V \rightarrow \begin{cases} \text{[high]} & V \text{[high]} \text{stem + (G)} \\ \text{[low]} & \text{stem + (G)} \end{cases}
\]

The neutral-toned vowel of a suffix will have the opposite tone to the stem vowel.

III.8 RULE ORDERING

In the standard theory of transformational generative grammar put forth by Chomsky (1965) and Chomsky and Halle (1968), the phonological component, ancillary to the syntactic component of the
grammar, must operate on the syntactic strings or surface structures generated during the operation of the transformational cycle. This phonological component has been defined by Chomsky and Halle (1968: 9) as

the system of rules that applies to a surface structure and assigns to it a certain phonetic representation drawn from the universal class provided by general linguistic theory.

However, since the output of the syntactic component, the syntactic surface structures, may not exactly coincide with the input to the phonological component, the readjustment rules (or morpheme structure conditions) may need to reanalyze the underlying lexical representations of the base into the appropriate phonological representations.

The function of the phonological component is, then, to convert the underlying abstract phonological representations of the phonological surface structure to concrete phonetic representations by means of a series of ordered and organized phonological rules which can apply to words, or to strings of formatives which include phrases, words or morphemes.

III.8.1 **Linear Ordering**

These principles of rule order have been enunciated by Chomsky and Halle (1968: 18):

It is always possible to order the rules in a sequence and to adhere strictly to this ordering in constructing derivations without any loss of generality as compared to an unordered set of rules or a set ordered on a
different principle. Such linear ordering makes it possible to formulate grammatical processes that would not otherwise be expressible with comparable generality.

Because principles underlying theories of natural language are assumed to be divided into two categories of linguistic universals, formal and substantive, the formal universals are considered the organizational or rule component of a transformational generative grammar, while substantive universals deal with the categories, features, and linguistic units. According to Chomsky and Halle (1968: 4):

the theory of transformational generative grammar proposes certain formal universals regarding the kinds of rules that can appear in a grammar, the kinds of structures on which they may operate, and the ordering conditions under which these rules may apply.

With regard to rule application in a transformational generative grammar, the underlying principle of rule order in the phonological component (Chomsky and Halle 1968: 341) is the convention that all rules apply extrinsically in a linear order, with each rule operating on a string modified by "all earlier applicable rules".

However, because Rule A must apply before Rule B in some examples, while Rule B must apply before Rule A in others, the convention of the phonological transformational cycle (Chomsky and Halle 1968: 349), which applies mainly to prosodic or closely related segmental phenomena, has been introduced.
III.8.2 Refinements to Rule Ordering

The convention of the phonological transformational cycle for other than prosodic phenomena at, above, or below word-level, though not a significant factor in recent generative phonology (and rejected by White (1972) and Brame 1972) has been noted in treatments of several Amerindian languages (v. Zwicky 1976: 267-8).

However, instead of the transformational cycle convention, iterative-rule application, through the device of infinite schema which would allow a rule to apply to its own output, has been the suggested modus operandi of Chomsky and Halle (1968). Anderson (1974: 124-133), in dismissing this solution, has noted that this formal device, by reducing linguistic generality, creates more problems than it solves.

Further modifications to a strict linear rule ordering have been suggested by Kiparsky (1968, 1971), Chafe (1968), and Anderson (1969). For example, Kiparsky (1968) has created the notion of feeding and bleeding relationships in rules where the unmarked or natural order is a feeding relationship and where, in a bleeding relationship, the other order is the unmarked. If there is no rule relationship, rules are then neutral with respect to each other. A feeding relationship has been defined by Kiparsky (1968: 196) as: "one way in which two rules, A and B, can be functionally related is that the application of A creates representations to which B is applicable."
A further principle enunciated by Kiparsky (1971: 623) with regard to rule ordering is the dictum: "Rules tend to be ordered so as to become maximally transparent." The converse of transparency, opacity, is defined by Kiparsky as follows:

A rule \( A \rightarrow B / C \_ D \) is opaque to the extent that there are surface representations of the form

(i) A in environment C \_ D

or (ii) B in environment other than C \_ D.

Chafe (1968), using examples from Caddo, an American Indian language, proposed that the rules of grammar be organized in several depths, with rules of the greatest depth to be applied simultaneously to underlying forms. A persistent rule would be one that would apply at any depth as the structural description was met, an "anywhere" rule. His additive and subtractive interference are the equivalent of Kiparsky's feeding and bleeding relationships.

As Anderson (1974: 202) has stated, however, in criticism of Chafe's theory:

We see, therefore, that the theory of persistent rules including the most liberal view of the possibility of simultaneous ordering cannot accommodate an example like that of Icelandic u-Umlaut. The reason, of course, is the fact that u-Umlaut behaves differently in its relation to different rules...A theory such as Chafe's, which divides rules into fully linear and fully 'anywhere', cannot accommodate these facts; even the use of simultaneity does not help, if the rule with respect to which a putatively persistent rule is restricted cannot be ordered last among the linear rules.
Anderson (1969) has put forth a theory of local ordering in which rules may be related naturally, as discussed by Kiparsky (1968), or explicitly. Only explicit linear ordering will be stated in the grammar, since natural ordering is predictable by universal principles.

Even so, as Norman (1972: 491-2) has suggested with respect to the local ordering hypothesis (LOH):

An alternative to the LOH is the complete elimination of extrinsic ordering, with all ordering being absolutely determined by a set of universal principles, as proposed by Koutsoudas, Sanders and Noll...The principle that a rule must apply whenever its structural description is met is sufficient to account for all feeding and counter-bleeding orders and to eliminate the possibility of natural language: rules in the orders of bleeding and counter-feeding.

III.8.3 No Ordering Hypothesis

Recently, however, in phonological theory, a distinction between extrinsic rule order, that imposed by the data of a specific language, and intrinsic rule order, that governed by the formal properties of the rules, has been discussed. According to Dinnsen (1974: 29):

Rule ordering, for example, has been an issue of current concern. The standard theory provides for the proper sequencing of most phonological rules by statements of extrinsic rule ordering, i.e. language-specific conditions in a grammar which assign one linear order to the rules. However, Koutsoudas, Sanders and Noll 1974 claim that such rule ordering provides greater descriptive power than can be shown to be necessary. As a more constrained alternative to language-specific conditions on rule application, they propose universal principles which determine applicational precedence relations between rules.
Like Vennemann's No-Ordering Principle, the effect of Koutsoudas, Sanders and Noll's Proper Inclusion Precedence, which accounts as well for Kiparsky's feeding and bleeding relationships, is that a rule must apply whenever its structural description is met in random sequential ordering.

According to Koutsoudas, Sanders and Noll (1974: 13) with regard to the elimination of extrinsic rule ordering:

First, arguments suggesting the necessity of extrinsic ordering based on a very limited range of facts often fail completely as soon as additional facts about the language are brought into consideration. Second and more important, in a theory that excludes the possibility of extrinsic ordering, the linguist is forced at the outset to look for general explanatory principles which there would otherwise be little reason to look for. Theories of grammar which prohibit language-specific restrictions on the application of phonological rules thus provide a degree of stimulation and direction in the search for significant linguistic generalizations which is lacking in those theories which permit such restrictions.

Recently, however, Cathey and Demers (1976) have, using Old Icelandic examples, maintained that Koutsoudas, Sanders and Noll's universal principles are insufficient and that extrinsic ordering should not be eliminated from a grammar.

However, as formally argued by Levine (1976: 115) with respect to the current debate of extrinsic versus intrinsic ordering in syntax, "unless a concept of naturalness of transformations can be incorporated into grammatical theory, the debate seems to be one of conflicting methodology, taste and terminology."
III.8.4 Application of Rules

Questions of application in rule ordering have formed an issue in linguistic discussions recently. According to Anderson (1974: 221):

Problems of a substantive nature begin to arise, however, when we consider the application of a rule to a string which contains several instances of substrings satisfying the rule's structural description. When several potential applications of a rule exist in a single string, how is the change specified by the rule to be carried out? Numerous alternatives can be imagined: apply the rule simultaneously everywhere; apply the rule in one place at a time, in random sequence; apply the rule in only one place, making the choice either randomly or on some universal or language particular basis; etc.

Thus, a review of the simple processes of voicing, yod-drop and labialization including vowel harmony assimilation indicates that a few comments are necessary. For example, how or how often does the rounding assimilation rule apply to an underlying form? When does yod-drop apply?

For convenience, the rules are summarized and ordered in Table I, with categories designated according to Chafe (1968). Derivations including the underlying representations will be discussed on the accompanying data sheet.

Briefly, in reference to the data sheets, examples #1 - 5 indicate derivations resulting from a simultaneous application to one string at a time of linearly ordered rules (Table I).

In examples #2 and #4, however, rule 4 must apply to its own output in order to obtain the desired representation, thus violating
**TABLE I**

Table of Tlingit Phonological Processes

<table>
<thead>
<tr>
<th>No.</th>
<th>Label</th>
<th>Rule</th>
<th>Category/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>Rule</td>
<td>Boas Reference</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>UR du-gas-yi &quot;his post&quot;</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>du-gas-i</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>du-gas-i</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>UR na-yin &quot;having died&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>na-win</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>na-wun</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>UR du-gux-w-yi &quot;his slave&quot;</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>du-gux-w-i</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>du-gux-w-u</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4a.</td>
<td>2. du-yak-w-i &quot;his canoe&quot;</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>du-yag-w-i</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>du-yag-w-u</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>du-yag-u</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4b.</td>
<td>UR du-yakw-yi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>du-yakw-i</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>du-yakw-u</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>du-yagw-u</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>du-yag-u</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5a.</td>
<td>UR du-a-k-yi &quot;his little pond&quot;</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>du-a-k-i</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>du-a-kw-i</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>du-a-kw-u</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>du-a-k-u</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In example 5b, rules must first apply within square brackets.

A labialization rule has not been offered following Kinkade's perception (v. II.10.4) of indicated labialization following rounded consonants as an orthographic artifact.
the convention that a rule may not apply to its own output except through an extra principle such as the transformational cycle or a costly device such as infinite schema. However, the use of the transformational cycle in example #2 would still necessitate the reapplication of rule 4.

Example 5b illustrates the effect of the transformational cycle with linearly ordered rules applying first to the innermost constituents of a syntactic bracketing, then reapplying after erasure of the innermost brackets. Although the principle of the transformational cycle has been used in a few treatments of segmental phonology in American Indian languages with some success, the cycle does not appear workable in example 2, unless some extra syntactic bracketing is warranted.

The remaining examples will illustrate the application of rules applying in random sequential order as the structural description is met, with the result that rule 4 may apply to its own output in order to achieve the desired phonetic representation.

It should be noted that rule 2, yod-drop, is in a feeding relationship to rule 3, pre-vocalic stem-voicing, and thus, according to principle, occurs before rule 3 in a natural, unmarked order.

Thus, in the few simple processes we have described in Tlingit, (as evidenced in the application of the rules in the examples), rules are best applied when the structural description is met. No rule ordering, although rules could be ordered as in Chomsky and Halle (1968), or local ordering (Anderson 1972), or even unmarked
ordering, appears to be necessary, although given a full set of grammatical processes and a full structural description of Tlingit some theoretical amendments might be required.

Similarly, in the limited number of examples given, no notion of cyclicity appears to be needed and, given the nature of the rules, even seems warranted. Nor need a strict linear or even local ordering apply, were cyclicity a pre-requisite in longer derivations.

These language-general rules thus appear well satisfied to apply either in conjunction with Chomsky and Halle's universal markedness conditions, or Stanley's language-specific morpheme structure conditions, or within the theory of natural phonology which includes the Basic Category Principle (v. Rudes 1976). Although a lexical marking is necessary on certain morphemes, e.g., nouns ending in /-a/, in order to stimulate a rule to apply, the un- or non-ordering of the rules given here is entirely consistent with Koutsoudas' (1973) (and with Koutsoudas, Sanders and Noll 1974) enunciated principle:

All restrictions on the relative order of grammatical rules are determined by universal rather than by language-specific principles.

III.9 SUMMARY

In this chapter, having briefly discussed the standard theory and recent modifications or constraints in the field of natural phonology, we have examined a few of the simple language-general phonological processes of Tlingit which, while serving to illustrate
the theory, provide as well a minor description of language data in
the theory of transformational generative grammar.

Thus, with regard to rule ordering of the simple phonological
processes in Tlingit, we have arranged our system of rules in accord­
ance with the no-ordering hypothesis put forward by Koutsoudas,
Sanders and Noll (1974), not only as a matter of "methodology, taste
and terminology" as suggested by Levine (1976), but in accordance
with the search for universal principles in linguistic theory, which
in Chomsky's view, according to Cole (1976: 564)

should play a crucial role in the analysis of specific
languages. It should provide criteria to determine
the relative inadequacy of a number of apparently
adequate descriptions. A theory of this sort would
be in a symbiotic rather than a parasitic relationship
to description: linguistic theory would assist in
the refinement of linguistic description by ruling
out unacceptable analyses, just as description assists
in the refinement of theory by falsifying incorrect
theoretical hypotheses.

In the following chapter, we will examine morphophonemic
representation by using various treatments of vowel harmony
assimilation in Tlingit in order to discuss current issues in
abstractness.
IV.0 APPLICATION AND APPROACH IN PHONOLOGY

Abstractness in phonology is thought to account for deeper, underlying patterned regularities in a language. Concerning abstractness, Hyman (1970:58) has raised two questions for generative phonologists:

(1) "To what extent do the underlying forms of the most highly valued phonological system of a language differ from those forms in surface phonetics?

(2) "Does a phonology that 'explains' certain processes at an abstract level necessarily coincide with the one explanatorily adequate (that is, the most highly valued) form of phonology?"

In this Chapter, using a preferred interpretation of vowel harmony in Tlingit phonology as examplar (and Lyons' (1962) motto that "the actual cannot be properly described (or recognized) except in the framework of what has been previously envisaged as possible"), possible solutions to the problem of abstractness in generative phonology raised by Kiparsky (1968) and others are set out.

In this context, Lyons' (1962:127) rationale is worth noting, for in all social sciences in recent decades, in a formulative process in which linguistics and its particular fields of enquiry have not been immune, methodological questions of the most fundamental nature have arisen:

To those of you who, having heard these views, might feel inclined to say that they are of "only theoretical
interest" and that the linguist's job is to describe what actually occurs in particular languages without troubling himself about what might occur (for I have heard this said), I would suggest that the history of science is full of examples to support the opinion that the actual cannot be properly described, perhaps not even be recognized, except in the framework of what has previously been envisaged as possible. At the same time, of course, the sphere of what is thought of as possible is being constantly revised under the impact of discoveries made in the description of actual languages. Such is the relation between the theoretical and the applied. And, as a consequence of this, linguistic typologies should be built of a judicious mixture of induction and deduction.

This statement of Lyons is particularly relevant as it anticipates and conforms to the propositions advanced by Kuhn (1970) and Popper (1972) as applied to the spectrum of pure science and social science. Following Kuhn, linguistics is susceptible to the process of established, competing and ultimately replacement 'world views'. Adapting Popper, all theories in linguistics are provisional (are 'conjectures') until refuted by a superior (or more complete, or general) theory which is itself of provisional status.

These processes asserted by Kuhn and Popper have been indicated in Chapter III in terms of their application to linguistic theory over the past decade. Of perhaps less fundamental concern, but a source of continuing methodological controversy, is Lyons' distinction between the 'theoretical' and the 'applied' (descriptive, or the empirical testing of hypotheses). Thus, in this Chapter, Lyons' statement is taken more as a caution than as a touchstone or guide.
IV.1 ABSTRACTNESS IN PHONOLOGY

The issue of abstractness in the relationship of levels, phonological and phonetic, was first raised for generative phonologists by Kiparsky (1968) at the beginning of a brilliant and productive essay:

What is the form of morphophonemic representations? How far removed are they from the phonetic and phonemic surface? The whole gamut of possible answers to this question has been given in modern linguistics.

Characterized as a distinguishing feature of generative phonology over more traditional theories, abstractness is the result of absolute neutralization: the appearance in the underlying phonological representation of a non-alternating segment, unrealized phonetically and set up solely to classify and distinguish that segment in order to meet the structural description of a rule.

Interestingly, and in this context historically, McCawley (1967) has compared the mentalistic representations of Sapir with the underlying phonological representations of generative phonology, in that only two levels are considered of relevant significance: an underlying representation representing "the speaker's 'mental image' of the various morphemes and a phonetic representation which corresponds to the actual articulation made by the vocal organs in producing utterances".

According to McCawley (1967:106):

No systematic significance is attached to any intermediate representation in the sense of e.g. Bloch and Trager's Outline of Linguistic Analysis, although in both Sapir and transformational grammar, 'underlying' phonological representations are converted into phonetic representations through several intermediate stages, since some 'rules'
apply to the output of other "rules". That the representations which Sapir called 'phonemic' or 'phonological' were not 'phonemic' as the term is used in the 'Neo-Bloomfieldian' tradition of Bloch and Trager op. cit. is apparent from a perusal of almost any of Sapir's grammars; to cite an example, in his Takelma grammar, Sapir gives four forms of the verb to shoot which he observes are all pronounced \([s\acute{a}k]\) but have different phonological representations.

Although Gregg (p.c.) has referred to D. Jones' (1957, 1964, 1967:6-7, 204) discussions of abstract vs. concrete sounds, abstractness was apparently not an issue in phonemic theory to the dominant post-Bloomfieldian structuralists who were bound, according to Chomsky (1964), by constraints of bi-uniqueness, linearity, invariance, and local determinancy. However, abstractness has remained a concern in recent theory of transformational grammar. According to Harms (1973:439) one important unresolved issue "concerns the abstract relationship between the phonological shape of morphemes in the lexicon and their phonetic manifestations".

IV.2 MORPHOPHONEMIC REPRESENTATION

Traditionally, morphophonemic representation has been regarded as a third, though generally undefined, level in the stratified hierarchy consisting of phonetic, phonemic and morphophonemic levels of structuralist phonemic theory.

Anderson (1974), in a highly lucid exposition of morphophonemic representation in both phonemic theory and generative phonology, has argued that the structuralists made no attempt to relate the morphophonemic level to the concrete phonetic basis. According to Anderson (1974:33):

Morphophonemes, however, could not be given the kind of operationalist definition that appealed to the positivism
of the period. It is not possible to recover morphophonemic information directly and unambiguously from the speech event itself. Accordingly, the morphophoneme was never regarded as a legitimate or 'real' entity within taxonomic theory, but rather as a pure descriptive artifact, a convenient fiction devised by the linguist to shorten his description. Thus, no effect was made to impose any sort of condition of naturalness on the elements of a morphophonemic representation: these could be literally anything at all, with any arbitrary set of rules to specify the correspondence between morphophonemic and phonemic entities.

Within transformational generative theory, however, the level of morphophonemic representation, here used interchangeably with the terms phonological or systematic phonemic representation following the usage of Chomsky (1964), Kiparsky (1968) and Schane (1968), (but not of Chomsky and Halle (1968), has been defined by Chomsky (1964) and Chomsky and Halle (1968) as the representational level which results from the effect of the readjustment rules or morpheme structure conditions on formative strings generated by the syntactic component; and the level which forms the input to the phonological component of a transformational grammar from which the output — the systematic phonetic level or derived surface representation — then results.

And although Schane (1968), in defining a phonological representation as one more abstract than a narrow phonetic one, though related to phonetic representation by a set of interpretive rules, has argued (1971) that the output of generative phonology in most cases is not the detailed phonetic specification it purports to be, but rather is akin to a Smith-Trager phonemic representation (in other words, the output of the p-rules on the morphophonemic
representation is phonemic in nature); within transformational generative theory morphophonemic (systematic phonemic, or phonological) and systematic or universal phonetic levels are separated and related only by a system of phonological rules (or p-rules) which form the phonological component of a transformational generative grammar.

Since this system of relation leaves a tremendous amount of leeway as to interpretation within generative theory, various constraints and conditions, previously reviewed, have been proposed to allow for a unique phonological representation, including that of Schane, Postal's naturalness condition, Kiparsky's alternation condition, Stampe's natural phonology, and Vennemann's natural generative phonology.

IV.3 APPROACH

Within, and without, transformational generative theory various viewpoints have been entertained with regard to the reality of the morphophonemic level. For example, Chafe (1968:115) has suggested:

In some fashion virtually all serious linguists, both now and in the past, have recognized the validity of phonological structures which are more abstract than phonetic—less directly related to physical sound—and it has usually been held that phonetic structures are in some sense derived from these more abstract forms. Bloomfieldian linguists, because of their unwillingness to stray very far from observable data, admitted only the validity of 'phonemes', units which differed from the phonetic only by virtue of the avoidance of complete phonetic redundancy. Both before and after the Bloomfieldian period, however, bolder abstractions were and have been posited, many of them far removed from the phonetic realm.
In his 1968 essay on abstractness, Kiparsky defined three schools of thought regarding the approach to an accepted morphophonemic representation in linguistic phonology—those of abstract, concrete, and process theory. According to Kiparsky, in the abstract view, morphophonemes are purely classificatory ideal elements with no phonic function. Abstractionists Lambraaistratificalist, and Householder, a post-structuralist, as well as Fudge of the London school, and a glossematist Hjelmslev, a Saussurian disciple of the Copenhagen school, exemplify this viewpoint. As described by Fudge (1970:89):

The parallel between an 'abstract' view of the phoneme and modern approaches in the philosophy of science is brought out by Shaumjan (1968): while allophones and distinctive features are entities with a physical basis, phonemes and 'differentors' (the abstract entities corresponding to distinctive features, cf. cenemes) are purely abstract and have the status of 'constructs' within the phonological theory—their purpose is to account for the complexities of the observed physical data (utterances by speakers of the language), and not directly to describe them. Furthermore, this insistence on a strict distinction between the (abstract) phonemic elements and the (at least partially concrete) phonetic elements would appear to be well suited to a psychologically real theory of speech production.

On the other hand, linguists favouring a concrete or 'reality' view expected that a morphophonemic representation would furnish all the realized forms of a particular morphemic alternation. This stand, by Kiparsky's definition, was that of the post-Bloomfieldian item-and-arrangement structuralists of the 1940's (though not of
Bloomfield himself) and of the early Prague school of linguists, including Troubetzkoy.¹

The third view, called process morphophonemics, of Sapir, Jakobson 1948, Kiparsky (1968), and Chomsky and Halle (1968), presumably derives its title from the item-and-process structuralist school typified by Zellig S. Harris (1951). Process morphophonemics combines the ideas of both 'ideal' and 'real' in that morphophonemes are considered as abstract entities realized on a concrete phonetic level. As Kiparsky (1968:1-2) states:

Like fully abstract morphophonemics, it recognizes that there is an underlying phonological pattern which is not necessarily identical with the phonetic pattern (e.g., superficial [ŋ] may function like /ng/), which fully concrete morphophonemics is forced to deny. On the other hand, it recognizes that this pattern, while abstract, is not arbitrary, but in general is related to the phonetic level ([ŋ] is hardly likely to function as /ð/ or /p/ or /l/), a relationship which fully abstract morphophonemics, with inexplicable joy, throws overboard.

In adhering to Postal's naturalness condition (i.e., a natural relationship exists between concrete phonetic and abstract phonological structures), morphophonemes are largely "but not wholly" determined by their surface phonetic realization. As Postal (1968: 56 n. 3) has noted in comparing the three approaches – abstract,  

¹ In contrast to this view, it has been noted that one of the defining criteria of generative phonology is the acceptance of absolute neutralization: the setting up of phonetically unrealized phonological distinctions in a morphemic lexical representation – v. Kiparsky (1968:9). Later Prague school linguists inclined to an abstract, functionalist view though with a more or less concrete phonetic realization of contrast and opposition: v. Crystal (1971:179).
concrete, and process — as exemplified in three theoretical models:

It is thus proper to look upon the theory of systematic phonemics as intermediate between autonomous phonemics, which assumes in effect that phonological structure is mechanically determinable from phonetic information plus contrast, and a theory, like that in part approximated by stratificational grammar, in which phonological structure would be an arbitrary code. Systematic phonemics is intermediate in the sense that it recognizes phonetic structure as providing a substantial, but far from complete, portion of the information relevant for the determination of phonological structure, the rest being provided by grammatical information, i.e. information about word boundaries, syntactic and morphological categorizations, morphophonemic alternations, etc.

IV.4 APPROACHES VS APPLICATIONS

As delineator, however, Kiparsky has not clearly distinguished between approach or school of thought and application or method in the use of abstract, concrete and process terminology. For example, while prosodists of the London school regard morphophonemes as abstract entities, their methodology as illustrated by Fudge also tends toward complete abstraction with a strict separation of morphophonemic and phonetic levels, and with the usage of non-phonetic symbols in both mutation (sound-change) and realization (phonetic level) rules. Approach and method may therefore be called synonymous.

Thus, Fudge, (1967:23, 1969) (rebutted in part by Kiparsky 1968), has offered rather stern criticism of the failure of Chomsky (1964, 1967) and Chomsky and Halle (1968) to maintain a "consistent and rational distinction" between levels which appear to be "rooted in actual imprecisions of thought...and lead in turn (as often happens) to further confusion". For example, in Fudge's (1969:24) opinion:
Obviously the fact that the symbol B within the slant lines is the same as the symbol B within the square brackets (bundles of distinctive features in each case) counts for very much more than the fact that the slant lines are distinct from the square brackets. In other words there is not really stratification - the alleged distinction between systematic phonemics and systematic phonetics is not really drawn. I would suggest (cf. Fudge, 1967:6-7) that this is empirically unsound: thus it is not (or at least not only) Lamb who is arguing on 'conceptual' grounds (Chomsky 1967:107) - Chomsky and Halle's insistence on using distinctive features at both phonemic and phonetic levels is equally aprioristic.

And although Aoki (1966), Lightner (1965), Bach (1968), and Chomsky and Halle (1968) and other generativists of the process school, tend also to make use of abstract methods, e.g. root marker or initial vowel or absolute neutralization, in their solutions to certain phonological problems, Kiparsky (1968:11) has stated that within present generative theory the decision among the three alternatives is arbitrary "because the evaluation measure assigns no relative weight to rule features vs phonological features". However, in the newer natural generative phonology, where greater constraints are placed upon abstractness, a concrete or "surface" solution is preferred.

Thus, clearly, at the outset, a distinction of approach or school versus application or method in terms of abstract, concrete and process terminology has been necessary. Therefore, using, where possible, examples of vowel harmony in various languages possessing this feature, a theoretical review of methods in generative phonology with solutions, criticisms and discussions according to the three categories of application is now commenced.
IV.5 ABSTRACTNESS IN METHODOLOGY

An abstract methodology using absolute neutralization will permit the use of non-alternating underlying phonological segments which do not appear on the phonetic surface (Hyman 1970). Within current abstractness theory various solutions have been devised using archiphonemes, neutralized segments unmarked for certain matched features; the diacritic use of phonological features, e.g., the use of schwa as an underlying phonetically unrealized feature; and the phonological use of diacritic features, e.g., the use of the feature {a GRAVE} to specify roots (v. Kiparsky 1968).

Three solutions will be investigated: the root marker, a prosodic method which regards vowel harmony as a property of the morpheme; the initial vowel method, which regards vowel harmony as an assimilation process; and absolute neutralization, which is thought to account for the deeper underlying regularities in the specific grammar of a language (Hyman 1970). These three solutions are now examined in their contexts.

IV.5.1 Root Marker

The root marker, a morphological solution involving archiphonemes and the phonological use of diacritic features, was introduced by Lightner as a solution to vowel and velar consonant harmony in Classical Mongolian. Evidently inspired by Z. Harris' (1951) "Phonemic Long Component" (v. Lightner 1965:247 n.8), the intention
of the root marker, prosodic, non-assimilating and non-directional, is to capture formally the intuitive notion of harmony (Lightner, 1965:249).

By vowel harmony rule, roots are furnished with abstract markers which specify simultaneously every vowel in the root, plus attached affixes, with a harmonizing feature. According to Lightner (1965:247), the rationale for root marker method in vowel harmony is thus specified:

With each root we shall associate an abstract marker specified for the binary feature GRAVE. Each root will thus carry either the marker \(+\) GRAVE or the marker \(-\) GRAVE. This marker is not to be confused with the binary feature grave. The distinctive feature grave is a phonological feature like vocalic, diffuse, and so forth; distinctive features are properties of sound segments. The marker GRAVE is an abstract idiosyncratic property of roots analogous to the markers ANIMATE, TRANSITIVE and others; the markers ANIMATE, TRANSITIVE have primarily syntactic reflexes, the marker GRAVE primarily phonological reflexes.

Two examples of vowel harmony prosody in Finnish and in Classical Mongolian illustrate the specified representation and the vowel harmony rule.

A. Vowel Harmony - Finnish

An example of Finnish vowel harmony from Kiparsky (1968), using the root marker method suggested by Lightner, shows the lexical listing using unmarked vowel archiphonemes and the morphological feature \{GRAVE\} from Halle (1962).

\[
\begin{align*}
\text{/ } & \text{pOUtA } / \\
+ & \text{GRAVE } \\
\text{/ } & \text{pOUtA } / \\
- & \text{GRAVE }
\end{align*}
\]
A prosodic rule from Bach (1968) assigns features to each unspecified vowel of the root, marking the vowel for backness as indicated by the morpheme-sized feature.

Rule

$$\text{VOWEL HARMONY} \quad [+ \text{syll}] \rightarrow [\alpha \text{grave}] / [\alpha \text{GRAVE}]$$

A syllable agrees in backness according to the assigned morpheme-feature marking. A further assimilation rule fills in the missing features of the vowel archiphonemes with the resultant phonological words:

/ pöytä / and / pouta /.

B. Vowel and Consonant Harmony - Classical Mongolian

A second example using root marker illustrates the application of root marker morphemes in describing vowel and consonant harmony in pre-sixteenth century Classical Mongolian. In Classical Mongolian, all vowels in a word are either all acute (front) or all grave (back), except for i which may occur with either type. Velar consonants also agree in graveness with vowels, becoming pre- or post-velar (v. Lightner 1965:245) as marked below.

$$\text{UGUtA} \quad "\text{bag}" \quad \text{KObAGUn} \quad "\text{son, boy}"$$

{+ GRAVE} \quad \{- \text{GRAVE}\}

A suggested rule for vowel and velar consonant harmony in Classical
Mongolian has been given by Bach (1968):

Rule

\[
\begin{align*}
& \text{VOWEL AND} \\
& \text{CONSONANT} \\
& \text{HARMONY} \\
& \{ [+ \text{syll}] \} \\
& \{ [+ \text{obs} ] \\
& \quad - \text{strid} \\
& \quad + \text{high} \} \\
& \quad \quad \rightarrow [\alpha \text{grave}] / [\alpha \text{GRAVE}]
\end{align*}
\]

According to this rule, vowels and velar consonants within a morpheme boundary are specified by the morpheme feature [GRAVE] to agree in backness with the phonological feature [grave]. Assimilation rules fill in the missing features and the phonological words / uyuta / and / kőbegün / appear.

Because the traditional solution to vowel and velar consonant harmony in Classical Mongolian requires an arbitrary decision as to progressive or regressive assimilation, the root marker method, applicable to other vowel harmonic languages, has been suggested.

Discussion

Zimmer (1967) suggested a possible use for root-marker in languages where both prefixes and suffixes have pre-determined vowels, thus requiring progressive and regressive assimilation rules.

Citing Igbo, an African language, and Nez Perce, an American Indian language, Zimmer admitted that an essentially prosodic statement would successfully handle the data in each. A further argument cited is the general economy of statement, with the need not to account for intervening consonants in root marker. However,
a decision involving simplicity would be arbitrary in view of the difficulty in equating morphological with phonological features.

Noting that directional assimilation rules are more efficient in handling cases such as labial harmony in Turkish, Zimmer (1967: 171), giving qualified support to root marker, has suggested:

But if, as has been suggested above, root-marker rules are in some general sense simpler, then it is rules of this kind that would be chosen for languages like Mongolian. Such rules could be considered as unmarked; it would be the directional assimilation type of rules that would require some language-specific reason for adoption. One might therefore after all agree with Lightner that a root-marker does in some sense capture the notion of harmony more adequately and is to be considered as the basic format for the description of vowel harmony.

Arguing against root marker, Bach suggested the obvious advantage for Classical Mongolian of the neighbourhood convention, an abbreviating rule device both capturing and generalizing the order of environment in assimilation processes, which would obviate the need for a decision as to progressive or regressive assimilation, should velar consonant harmony not, indeed, be a universal phonetic rule.

However, the main objection to root marker is in the use of the ad hoc morpheme marker which is only spuriously related to the phonological features. According to Bach (1968: 144), the morphological feature {GRAVE}

bears no more relation to the phonological feature of gravity than would, say, the NOUN or ANIMATE. Moreover, unlike the latter features it plays no role in the language outside of just this rule.
The main thrust of Kiparsky was to restrict the power of generative theory gained through abstractness by the use of the alternation condition which would end the use of devices such as archiphonemes and morphological markers. In criticizing root marker as a quasi-phonological solution, similar in approach to fully abstract phonology, Kiparsky, while concurring with Zimmer and Bach, specifically noted that the method overgeneralized by recognizing only neutral vowels, thus cutting the total number of vowels in half.

IV.5.2 Initial Vowel Method

The initial vowel method, with a specified first vowel in a morpheme occurring with vowel archiphonemes, and a rule of progressive assimilation, is the traditional way of treating vowel harmony (v. Lightner 1965: 245 n.4). Preferred by Troubetskoy (1958) and others in describing vowel harmony in Finnish, Hungarian, Turkish and Mongolian and related languages, the initial vowel method has been adopted as well by Zimmer and Bach.

Examples

A. Vowel Harmony - Finnish

An example in Finnish illustrates the listing in the lexicon with the fully specified first vowel and the neutralized, unspecified archiphonemes:

\( / \text{p}8\text{UtA} / \)   \( / \text{poUtA} / \)
Using the neighbourhood convention, the suggested assimilation rule (adapted from Bach 1968) would specify the gravity feature of the first vowel to following vowels:

\[
\text{ASSIMILATION RULE} \quad [+ \text{ syll}] \rightarrow [\text{a grave}] / [\text{a grave}]^X
\]

A syllable agrees in backness with the preceding (and following) syllable.

Under the neighbourhood convention, the fully expanded rule applies regressively and vacuously. A lower-level rule would assign specific values to the archiphonemes involved with the same forms resulting as with the root marker method.

B. Vowel Harmony - Turkish

A second example (Bach 1968: 140) utilizing the initial vowel method is furnished in Turkish where both gravity vowel harmony and rounding assimilation of high vowels in certain contexts occur. Two forms show the lexical listing with a differing specified initial vowel:

/gedikler/> "their having come" /güldikler/> "their having laughed"
A syllable agrees in backness with a preceding syllable.

Another rule is necessary to determine rounding, which occurs with an immediately preceding high vowel, giving the resulting forms:

/geldikleri/ /gülükleri/

Discussion

Lightner, while setting forth the root marker method, criticized the initial vowel method as being arbitrary in a choice of progressive assimilation. Zimmer, noting that progressive assimilation was a natural process, commented that such assimilation could account equally well for consonant harmony in Classical Mongolian and Turkish, while being a more convenient and satisfactory device for Turkish labial harmony. However, in terms of simplicity and economy of statement, the initial vowel method might be less successful than root marker.

Bach was highly prejudiced in favour of assimilation rules in vowel harmony with the use of the proposed neighbourhood convention to account for both back and front assimilation. While acknowledging the possible existence of languages in which either the first, or the last, vowel might be independently specified, Bach (1968: 147) suggested that:

The use of the neighbourhood convention for situations like vowel harmony, in short, expresses the view that (at least in situations like vowel-harmony) the direction is predominantly progressive, possibly progressive and regressive (when one value is dominant like in Fogny or
apparently, Nez Perce, Aoki:1966: or when other lexical elements determine affix elements as in Igbo, Ijo, etc.) but never purely regressive.

Cognizant of the difficulty in standard generative theory in having identical constraints in both morpheme structure and phonological rules, Bach (1968:142) noted that "within current phonological theory it is impossible to use one rule both to fill in redundant specifications and switch features as in Diola-Fogny."

The initial vowel method, like the root marker method, was criticized by Kiparsky for violating the alternation condition, and for being unworkable under markedness theory where vowels must be fully specified in the lexicon (v. Stanley 1967), and where lexical representations must not violate Chomsky and Halle's well-formedness conditions.

Moreover, arguing for the necessity of morpheme structure conditions and phonological rules in Finnish, Turkish and Hungarian, where root and affix harmony have different sets of exceptions, Kiparsky (1968:31) has stated that "it is impossible to derive both root harmony and affix harmony by a single rule", thus rendering root marker and initial vowel methods invalid.

Specifically, the initial vowel method in Finnish, for example, would require odd morpheme structure conditions where vowels underlying neutral /ɪ/ and /e/, i.e., /ɪ/ and /e/ (vowels of absolute neutralization), would be required to appear with at least one occurrence of archiphonemes A, O, U so that morphemes such as */kɪvɪ/ and */kəll/ would not occur.
IV.5.3 Absolute Neutralization

A third method, which has been termed concrete (v. Kiparsky 1968), and which certainly is less 'abstract' than the two previous solutions, but which, following the definition and usage of Hyman, we term abstract, uses phonological features such as diacritic markers to set up underlying, phonetically unrealized, representations.

Examples

A. Vowel Harmony - Nez Perce

An example of the absolute neutralization method is furnished by Kiparsky's 'concrete' solution of dominant versus recessive vowel harmony in Nez Perce where an underlying, [+ dominant] /a/, later neutralized phonetically to /i/, is established to distinguish between the asymmetric vowel harmony function of the two kinds of /i/. In this system of dominant versus recessive vowel harmony in morphemes, an underlying six-vowel system, considered historically accurate, of dominant vowels /a,o,ɛ/ paired with corresponding recessive vowels /æ, u, i/ is distinguished. Two rules, a vowel harmony rule changing feature values of recessive vowels when occurring with a dominant vowel in a morpheme, and a later neutralization rule, account for the change to dominant feature values in Nez Perce.

ASSIMILATION RULE

\[ V \rightarrow \left[ \begin{array}{c} + \text{back} \\ - \text{high} \end{array} \right], \quad / * \ {} / x \left[ \begin{array}{c} + \text{back} \\ - \text{high} \end{array} \right] \ Y \rightarrow \]

A vowel in a morpheme corresponds in dominance to its paired dominant
vowel when a dominant vowel occurs.

```
ABSOLUTE NEUTRALIZATION RULE
      [ - low ]  --->  [ - back ]
      [ - round ]
```

A low-level surface rule changes /a/ to /i/.

B. Vowel Harmony - Nupe

Another abstract solution is illustrated in Nupe (Hyman 1970) where, in order to explain nativization of foreign words, reduplication of certain forms, and certain distributional restrictions, underlying /ɔ/ and /ɛ/ from /a/ are posited. For example, distributionally in Nupe, the consonant clusters /Cw/ and /Cy/ occur only before /a/ and /ā/; so that the forms

```
/ēgwā/₁ "hand" and /twā/₁ "to him"
/egyā/₂ "blood"      /tyā/₂ "to be mild"
/ēgā/₃ "stranger"    /tā/₃ "to tell"
```

occur. If, as Hyman has reasoned, there are three kinds of /a/: one which causes labialization, e.g., underlying /ɔ/, one which causes palatalization, e.g., /ɛ/, and one which causes no effect, then the surface clusters are explained by a later rule of absolute neutralization which account for the surface appearance of the neutralized segments.

Thus, according to Hyman, with the underlying forms /ēgɔ/, /ēgɛ/, and /ēgā/, surface forms can be accounted for by three rules,
a labialization rule, a palatalization rule, and a rule of absolute neutralization.

ABSOLUTE NEUTRALIZATION RULE

\[ \begin{align*}
V & \quad + \text{low} \\
\rightarrow & \quad + \text{back}
\end{align*} \]

Underlying low vowels are realized as a low back surface vowel, i.e.

\[ \left\{ \varepsilon, \varepsilon^{'}, \right\} \rightarrow a \]

Discussion

The method using absolute neutralization was criticized by Kiparsky on the basis of markedness (vowels must be fully specified and thus predictable in the lexicon) and the strong alternation condition. However, absolute neutralization might be acceptable to a weak version of the alternation condition, were rule features not available, and were the linguistic cost not too great.

Absolute neutralization in Nez Perce (Kiparsky's 'concrete'), simple and historic by rule, less simple than the process solution, does not satisfy the basic alternation condition.

In regarding an abstract solution of absolute neutralization in Nupe as being more explanatory with regard to "the limitations on surface distributions of the bi-unique phonemes", Hyman intended with manipulation of Nupe data, to demonstrate that abstractness and absolute neutralization were more productive and psychologically real.

Harms (1973), in rejecting both the notion of morpheme structure and absolute neutralization in Nupe, while positing the underlying
vowel clusters /ia/ and /ua/ to account for Hyman's neutralization, suggested the recognition of surface-structure constraints to illustrate skewness of consonant palatalization and labialization before [a].

For those supporting the existence of morpheme structure, however, there is evidently no "non-arbitrary basis" for deciding between the generality of morpheme structure conditions (consonant and glide clusters) over absolute neutralization of /ɔ/ and /ɛ/ in the phonology. Harms also rejected a supposed nativization as offering support for absolute neutralization, while suggesting that Hyman's stated palatalization rules are not correct.

In responding to criticisms of his analysis of Nupe, Hyman (1973) suggested that

The challenge of Harms 1973 to my abstract Nupe solution (Hyman 1970) is not so much a principled account of how Nupe must be analysed as it is a negative demonstration of our frequent inability to provide sound empirical evidence concerning the nature of phonological systems.

Hyman further reiterated that loan words might indeed provide strong empirical support for absolute neutralization and that economy and naturalness were not satisfactory substitutes for badly needed psychological evidence.

IV.6 CONCRETE PHONOLOGY

Reviewing the basis of a concrete phonology which, for Nupe, Hyman (1970) defined as phonemic, we seek the roots in phonemic theory.
In an approach similar to Kiparsky, Fudge (1970) has suggested four main classes of various approaches to the phoneme, including the mentalistic or psychological views of Baudouin de Courtenay and Sapir; the physical approach of Daniel Jones; the functional view of Bloomfield; and the abstract view, again of Sapir, Hjelmslev, and Fudge.

According to Stankiewicz (1976:33), in Baudouin de Courtenay's psychological viewpoint a speaker aims phonemically at an ideal acoustic image composed of acoustic and articulatory elements "divorced from the actual speech-sounds". Idiolectal variations, in Fudge's opinion, cannot be accounted for. In the words of Baudouin de Courtenay:

The phonemes consist of ultimate psychological (articulatory and acoustic) elements ... [1910, 267] which "are not like separate notes, but like chords composed of several elements [1910, 271] ... (Stankiewicz 1976:32).

In the physical view, the phoneme is regarded as a family of sounds (v. Jones 1950) phonetically similar, and in complementary distribution. Minimal pairs differentiate meanings as a corollary of the definition, while similarly pronounced words must be phonemically similar or bi-unique, e.g., German Bund "federation", and bunt "coloured" (phonemically /bunt/).

The functional viewpoint, converse of the physical (Fudge 1970), defines the phoneme as a minimal meaningful sound unit composed of distinctive features (Bloomfield 1933). Distinctive opposition is the basis of phonological structure in the work of Troubetskoy (1939)
and Jakobson (1956). The distinctive feature of voicing, for example, may differentiate meaning in the minimal pair /latter/, /ladder/.

In the abstract view (cf. Kiparsky 1968), the phoneme is regarded as independent of physical properties, able to account for idiolectal variation by the use of non-phonetic criteria, e.g., the grouping together of alveolar 1 and velarized ("dark") 4, on the basis of morphological alternation. Bi-uniqueness is not a requirement of the abstract view.

However, stemming from difficulties in the physical viewpoint of utilizing grammatical information, a separate, and higher, level of morphophonemic representation (unrelated to the morphophonemic representation of generative phonology) was established, though mostly undefined. For example, to the physicalists (v. Fudge 1970:90), German Bund would be morphophonemically /bunD/, where D is /t/ word-finally, and /d/ elsewhere.

And from the early distinctive feature work of Jakobson (Jakobson and Halle 1956, Jakobson, Fant and Halle 1952) has arisen the modified set of distinctive features and phonological representations, currently in vogue, of Chomsky and Halle.

Although the phonemic and generative phonological theories, having their bases in opposing philosophical biases with methods, respectively, of induction (or discovery) vs deduction (or validation or decision) procedures, are not to be construed as similar, a similarity in viewpoint towards abstract, concrete and process has been noted (e.g. Kiparsky 1968, Fudge 1970) and reviewed. For, according to Gregg (1975: 139):
whatever our views on the matter of the phoneme - whether we regard it as a concrete, practical unit, useful in the description of languages and dialects known or hitherto unknown, or whether we consider it an abstract Platonic idea whose translation to the real world involves a series of Protean adaptations or adjustments to the phonological environment - in either case, the most important factor to be considered is distribution.

Following Hyman we take note of the concreteness, which Hyman has not defined, of a phonemic solution to the problem in Nupe, suggesting that a concrete method tends towards a physical basis (v. Crystal 1971:179).

IV.7 PROCESS SOLUTIONS

The process method, according to Kiparsky (1968), recognizes the abstractness of morphophonemic representation while ascribing 'an intrinsic representation on the phonetic level'. In treating vowel harmony, Kiparsky is bound by the alternation condition which in its strong form forbids absolute neutralization.

Adhering to Postal's naturalness condition in which a phonemic representation must be as like as possible the phonetic representation, process morphophonemics, in conjunction with markedness and the use of rule features where an asymmetric functioning of segments to rule may occur, treats the level of morphophonemic representation as being fully specified, yet as appearing in its maximally unmarked form, that is, in terms of universal phonetic specification, in its most neutral form.
Examples

A. Vowel Harmony - Hungarian

Using Hungarian vowel harmony as an example, Kiparsky gives a lexical listing, using minus rule features, of two identical vowels in morphemes in which one vowel undergoes vowel harmony, while the other does not.

(1) héj  "rind"  (2) kés  "knife"

[- Vowel Harmony]

The vowel harmony rule affecting suffixes with basic back vowels would thus apply only to form (2) and the following forms would result:

(1) héj-am  "my rind"  (2) kés-em  "my knife"

B. Vowel Harmony - Nez Perce

An example of a process solution is given by Kiparsky's treatment of Nez Perce. With a five vowel system of /i, æ, a, o, u/ and the dominant vowels /a, o, i/, the rule changes a vowel in which the features backness and height agree to a plus back, minus high vowel, that is in morphemes with dominant vowels:

```
RULE  Vowel Harmony
Vowel       [ V  ]  →   [ + back ]  →   [ - high ]
Harmony     [ α back ]          [ - α high ]
```


A vowel which agrees (plus or minus) in backness and height becomes back and minus high in the environment of a vowel that is of the same backness, and an opposite degree of height.

Discussion

For Nupe, Hyman offered a process-type solution, using rule-exception features, to the problem of labialization and palatalization before /a/. Positing two rule-exception features [-LR] (labialization rule) and [-PR] (palatalization rule), Hyman suggested that a single phoneme /a/ might have the variants /a/ [-LR], /a/ [-PR], and /a/ [-LR -PR]. However, the consonant labialization and palatalization rules would imply that a back vowel implies [+LR] and an unround vowel implies [+PR], which, without rule-exception features on each occurrence of /a/, would mean that a consonant would be both palatalized and labialized (an impossibility in Nupe) before /a/, According to Hyman (1970: 71) "the rule-exception feature forces us into an odd constraint, where every occurrence of post-consonantal /a/ in Nupe is an exception".

Hyman also, in discussing implications of the alternation condition (one of the supports of process morphophonemics), decided for the greater explanatory power of the abstract view. Recently, theories of natural phonology and natural generative phonology have been discussed which would obviate the use of markedness theory - a further support of the process approach. At the level of descriptive adequacy, process morphophonemics according to Hyman (1970, 1973) apparently does not account satisfactorily for data agreeing with a native speaker's
intuitions. Sufficient discussion of process morphophonemics is yet to be forthcoming in the literature, although Ingram (1976), in discussing child language acquisition, has recently equated the level of descriptive adequacy or concern for significant generalization with Chomsky and Halle's investigations into markedness, with Kisseberth's functional rules, and the search for conspiracies; and the level of explanatory adequacy with the natural rules and processes suggested by Stampe (1977 forthcoming).

IV.8 PROSODY

The previous solutions have been within the framework of transformational generative phonology. However, Lyons (1962) has discussed J.R. Firth's London school prosodic approach to vowel harmony. Briefly, in describing data, the prosodist distinguishes a multilevel design of system vs structure, with items described in terms of contrastive phonematic units, and prosodies which are akin to phonetic long components (cf. Lyons 1962).

In Turkish vowel harmony, for example, binary prosodic contrasts of front vs back and round vs non-round effect the phonematic units of high /i/ and low /a/. In an eight-vowel, two-height system (where /i/ = high vowel and /a/ = low vowel), with phonemic vowels /i, e, ü, ö, ü, a, u, o/, the contrasts are realized prosodically (where F=Front, B=Back, R=Round, and N=Non-Round) as follows:
The prosody, except for R which affects only the first syllable when low, covers the whole word, which is independently defined by stress.

Lyons suggested the advantage of a prosodic approach to avoid redundancy of statement, and to capture generally the front-back, round-non-round opposition of vowel harmony in the native lexicon. Although the prosodic statement cannot be judged in generative terms, prosody offers a simple, economical and abstract description of Turkish vowel harmony at the level of observational adequacy.

IV.9 EVALUATION CRITERIA

Within generative theory, according to Kiparsky, a choice of an abstract, concrete or process solution is entirely arbitrary lacking an adequate evaluation measure. Where, in evaluating phonemic descriptions, the criteria of contrast and complementation, phonetic similarity, pattern congruity, and economy (cf. Hockett 1958) were fundamental, in early generative phonology notions of simplicity, economy and generality were valued.

For example, Halle (1959) suggested that phonological rules should be less complicated than morpheme structure conditions, with a consequent cost to the grammar should the opposite be necessary. In recent
years, however, generative phonologists have shifted away from feature-counting and the simplicity metric to the newer concept of naturalness.

According to Anderson (1974: 79):

It has often been argued (e.g. Halle 1962; Chomsky and Halle 1965; Chomsky 1967) that linguistic theory must provide not only a framework in which all possible processes that might be found in a natural language can be expressed, but also some way to decide, given two or more distinct accounts of some linguistic fact or process, which is the most natural, in the sense of embodying the most linguistically significant generalizations.

And as Hyman (1970: 59) suggested in discussing an increasing non-uniqueness of solution:

We obviously cannot tolerate such a variety of solutions in a theory that claims explanatory adequacy as its goal, since we have assumed that there is only ONE correct grammar. It is this one grammar that we shall call 'psychologically real'. Therefore, we must find some appropriate means to tell us which one of these solutions is the most highly valued in a given set of circumstances.

Though Hyman (1970, 1973) has reiterated that psychological reality and psycholinguistic evidence are central in deciding among alternate descriptions, criteria in phonological description of simplicity, economy and naturalness will be briefly outlined.

IV.9.1 Simplicity

The simplicity metric (cf. Halle 1961) discussed in Bach (1968: 128; Zimmer 1969) is intended to "reflect generality of statement in
shortness of rules", while predicting a maximally simple phonology to the language acquisition device in child language acquisition. However, using English, Bach pointed out that the simplicity metric, a measurement of the predictability of rule correctness by the element of natural class and feature counting, may not always account for the most significant generalization or the most natural rule.

The simplicity metric, as such, has recently been discounted in favour of newer proposals: of markedness theory where universal conventions state the most likely feature change to occur on the basis of universal phonetic mapping; of natural processes (Stampe 1972); of natural generative grammar (Vennemann 1972); and of psychological reality and productivity (Hyman 1973).

IV.9.2 Economy

Economy in generative phonology (cf. Halle 1962) refers to the frugal counting of features in a rule so that the most highly valued solution is that rule most economic in feature use. However, according to Harms (1966: 602):

In evaluating possible analyses of phonemic systems within a distinctive feature framework, the average number of bits per phoneme is often taken as a measure of economy... That such a scale of economy cannot serve to evaluate phonological systems which are integrated into the total grammar of a language has been recognized in principle (Halle 1959: 29-30, 45) but is not always considered in practice.

Although Halle (v. Bach 1968: 610) considered that economy of phonological rule must take precedence over economy of lexical representation
without great cost to the grammar, Stanley (p.c. reported by Zimmer 1969) suggested that logically, in this view, it would be most economic to forego phonological rules entirely and to list all the morphemic variants in the lexicon.

However, as Harms pointed out, in generative phonology lexical features cannot be rated on the same scale as morphophonemic rule features. According to his interpretation of Halle's proposal it would appear that neither lexical economy nor morpheme structure economy should be considered at all. According to Harms (1966: 610):

A reliable answer — and an effective evaluation procedure — can be found only after our present meagre knowledge of individual languages in these respects has been substantially bolstered.

Therefore, because of the difficulty in evaluating simplicity and economy effectively (though these are lip-service criteria which linguists may still pay), newer forms of evaluation have been suggested. For example, Hyman (1973) rejected economy and naturalness in favour of psychological evidence, while Zimmer (1969: 97) has pointed out that:

An evaluation measure for grammars that relies exclusively on feature counting would have made what is clearly the wrong choice ... primarily because it would have had no way of recognizing the oddness of the rule ... 

Thus, these newer criteria stress naturalness in rules, processes, or even in the whole generative grammar.
IV.9.3 Naturalness

Naturalness has been a concern of generative phonologists following a shift away from the earlier evaluation measures of simplicity and economy. The naturalness condition, stated by Postal (1968) in a tirade against autonomous phonemics, contains the notion of a natural relationship between phonological and phonetic levels.

Anderson (1974: 50), in adhering to the naturalness condition, has noted that a morphophonemic representation occurs in a fully specified and maximally natural form, which deviates from the occurring phonetic forms only insofar as such is dictated by the need to optimize predictability of variation and to capture generalizations about phonological structure.

Markedness theory, with the use of marking conventions and linking rules, has been an attempt to capture naturalness by positing universal values. However, major criticisms of linking rules in application and evaluation have been voiced by Bach and Harms (1969), who suggest (p. 6) that "what we are concerned with is the suggestion that plausibility constraints should be reflected directly in the evaluation metric." Marking conventions, while apparently capturing phonetic naturalness, can not provide an adequate evaluation of simplicity in acquisition.

Phonetic plausibility is often taken as a measurement of naturalness. For example, Hyman (1975: 97–8), in discussing phonetic plausibility hypothetically, notes that it is entirely plausible in a language for alveolar [s] to palatalize to [ʂ] before front vowels.
[i, e], far less likely in an alternate solution for [ʃ] to become [s] following back vowels [u, ə, a]. Rule plausibility therefore refers to phonetic naturalness, including ease of articulation and usually unidirectional assimilation. According to Hyman (1975: 161):

While the study of rule naturalness is in its infancy, it is clear that naturalness is not a binary property. Rules are more or less natural or more or less unnatural.

IV.9.4 Alternation

Applying to absolute rather than contextual neutralization, Kiparsky's alternation condition has raised yet unresolved issues on abstractness which seemingly hearken back to similar disputes on phonemic realization among the post-Bloomfieldian structuralists. The alternation condition may be strong, the total exclusion in generative theory of absolute neutralization, or weak. The weak alternation condition suggests that not all cases of absolute neutralization will be excluded: Two conditions, that phonetically identical morphemes must have the same underlying representation (to avoid the method of absolute neutralization); and the converse, that phonetically distinct morphemes must have different underlying representations (to avoid root marker methods), are included. The weak alternation condition may well be, according to Kiparsky (1968: 23), the clause of an evaluation measure which says among other things that absolute neutralization is linguistically complex. In that form the alternation condition would, in any given case, balance out the generalizations gained by absolute neutralization against some
fixed cost assigned to it in phonological theory. The relation of absolute neutralization between underlying and phonetic representations would still be excluded in cases such as those analyzed above, where rule features do just as well, but it would be allowed where this is not the case.

IV.10 VOWEL HARMONY METHODOLOGY

Because of the alternating patterns of roots and affixes in vowel harmony languages, vowel harmony offers an interesting way of testing abstractness. As Kiparsky (1968: 46) has suggested:

Vowel harmony systems are of special interest, because many of their apparently quite strange features can be explained by the complex interaction of several rich and detailed phonological universals. Neither markedness, nor the alternation condition, were set up with vowel harmony in mind. Yet they jointly lead to just the right solution in many different kinds of cases.

As far as methodology in treating vowel harmony in generative phonology is concerned, it has been generally considered that the same rule which determines vowel harmony in alternating suffixes is also responsible for accord in the root, with vowels unspecified in the lexicon for the alternating feature. A problem has been the categorizing of roots, whether by a completely abstract marker or by vowel assimilation (v. Kiparsky 1968: 28).

In discussing vowel harmony methodology in Tlingit in accordance with abstract, concrete and process theory, we will examine each approach in turn. These methods will be described with references, illustrated with examples, and finally criticized as to economy, simplicity, and predictability within generative theory. Under
abstractness, the most detailed, three methods of application will be discussed: the root marker, the initial vowel, and absolute neutralization. Under concrete, the previously discussed Tlingit labial harmony will be featured, while under a process heading the use of rule features and markedness will be discussed. Initially, however (following Aoki 1968), vowel harmony typology will be briefly reviewed.

IV.11 VOWEL HARMONY TYPOLOGY

In a tentative typological classification of vowel harmony to be used in conjunction with markedness, Aoki (1968) suggested criteria of opposing features of total versus partial harmony, symmetry versus asymmetry, alternating versus non-alternating systems, while rejecting criteria of neutral vowels and directionality.

According to Aoki's typology, in total harmony a vowel is specified only for the feature plus vocalic (fully abstract), while in partial harmony the features are partly specified. Unspecified features are provided by p-rules that are either of the root-marker (prosodic) or assimilation type.

Sub-types of partial harmony are labial, horizontal and palatal harmony. Labial harmony refers to rounding assimilation, which generally occurs secondarily in Aoki's typology with either horizontal or palatal harmony. Palatal harmony refers to vowels unspecified with regard to backness. In Tlingit, this feature depends on the analysis
preferred, e.g., archiphoneme or root marker would need the gravity feature specified. Horizontal harmony refers to height, tension, and tongue root position.

Symmetry implies that the harmonizing vowels (e.g., i, u) are of equal power with no system dominant, as in Nez Perce or Koryak.

Alternating refers to the number of features which are left unspecified in the lexicon, an example of a non-alternating system being internal harmony in Turkish.

Using Aoki’s typology of vowel harmony, Tlingit may be characterized as evincing partial, symmetric (with idiolectal restrictions previously noted), labial and palatal harmony with respect to certain lexically-marked morphemes. As previously discussed, the effect of this vowel harmony, as described by Boas (1917), is to round and back palatal affix segments following rounded, back segments across a morpheme boundary. Nouns ending in /a/ also may cause rounding of certain suffixes. The following affixes listed by Boas (1917) are affected:

/-yi\-wu/ "possession" /y\-wu/ verbal prefix (this labialized only after /u/)

/-yin\-wun/ "past" /-k\-k\w/ "little" (diminutive attached to nouns)

The prefix /ya-/ of complex morphological conditioning, will not be discussed. The problem is to discover whether any of the theoretical solutions—abstract, concrete or process—outlined in this chapter presents a satisfactory, or even a unique, solution to the problem of vowel harmony in Tlingit.
IV.12: ABSTRACT TREATMENT

IV.12.1 Root Marker

In a root marker solution of Tlingit vowel harmony, the affix rather than the root must be marked for harmony. By convention, each segment of the affix will thus be marked for the morpheme-sized feature grave where, in terms of the grammar, lexical items will be termed [-Affix], the rest [+ Affix], an unmarked universally predictable feature (v. Bach 1968). There are several variants of root marker method: that of Lightner, reworked by Zimmer; and that of Chomsky and Halle. Their suggestions have here been adapted for Tlingit.

<table>
<thead>
<tr>
<th>Rule</th>
<th>Data Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightner (1965)</td>
<td></td>
</tr>
</tbody>
</table>
| \[ - cons \] + high \[ a grave \] \rightarrow [a grave] \{ when affix is specified \{ a GRAVE \} | du-t'á -yI
|               |                       | du-l'uk^{w} -yI + GRAVE
| Zimmer (1967)  |                       |
| \[ - cons \] + high \[ a grave \] \rightarrow [a grave] / [a GRAVE] Affix | ?áx^{w} -yIn + GRAVE
| where \[ a grave \] = [a GRAVE] |

These similar rules state that a glide or vowel or marked segment /a/ in an affix is marked to agree in backness with the morpheme marker.
Discussion

Lightner's rule distributes the feature of the ad hoc morpheme marker {GRAVE} to the affix marking each segment [a grave], e.g., Yn]i(n) [a grave].

With only one nasal, grave feature specification of /n/ is redundant, and variation is allophonic. In terms of data marking:

\[
\begin{align*}
\text{du-t'âì-YI} & \quad \text{du-ì'âk'-YI} \\
[- \text{grave}] & \quad [+ \text{grave}]
\end{align*}
\]

A later rule applying to all solutions (1), (2), and (3) would specify the

\[
\begin{align*}
[+ \text{grave}] & \quad \text{archiphonemes} & \quad Y \text{ as } [w] \\
[- \text{grave}] & \quad & \quad Y \text{ as } [y] \\
[+ \text{grave}] & \quad & \quad I \text{ as } [u] \\
[- \text{grave}] & \quad & \quad I \text{ as } [i].
\end{align*}
\]

Zimmer's improvement formalizes Lightner's convention that each phonological segment specified is associated with the abstract marker (of the affix) and thus would simplify Lightner's rule.

Chomsky and Halle (1968)

In their treatment of Nez Perce with its three dominant vowels, Chomsky and Halle offer a readjustment rule which distributes a [+ dominant] feature to all segments of a word occurring with a [+ dominant] morpheme. Using gravity as the distributed feature, and
archiphonemes, e.g., YI, a morpheme structure condition would specify round segments to agree in backness with the feature round, and thus mark the feature of the affix (v. Kiparsky 1968: 39), e.g.:

\[
\begin{align*}
&\text{q}U\text{x}^W \& \text{a-YIn} \\
&[+ \text{round}] \\
&\text{q}U\text{x}^W \& \text{Agn-et-YIn} \\
&[- \text{round}]
\end{align*}
\]

**Morpheme Structure Condition - Affix Marker**

\[
[ \alpha \text{ round} ] \rightarrow [\alpha \text{ grave}] / # \text{ X [ } \alpha \text{ round} ] + \]
Affix

A phonological rule states that gravity and backness agree in high vowels and glides:

**Rule— Vowel Harmony**

\[
[ - \text{ cons} ] \rightarrow [\alpha \text{ back}] / [\alpha \text{ grave}]
\]

A third rule is needed to stipulate the realization of the archiphonemes YI.

**Comment**

A Lightner-and-Zimmer kind of solution apparently may be applied to Tlingit with some success if one is willing to overlook the use of what previously has been termed an ad hoc and unrelated morpheme feature (v. Kiparsky 1968). Problems with root marker have been discussed in detail in the preceding section. A root marker solution in Tlingit captures a certain generality in glide and vowel harmony.
Chomsky and Halle's suggested solution, actually a morphological marker, entails two or three rules and a certain intricacy in rule-writing which suggests that the rules are none too natural. In addition, the first rule is actually a morpheme structure condition which marks the affix for the specified feature. No significant generalization is captured by the rules.

The problem with applying a root marker solution to Tlingit is that the affected affixes are most certainly the result of progressive assimilation, and this can not be formally shown by a prosodic solution. However, in the style of Lightner and Zimmer, a root marker type with harmonic affixes specified in the lexicon would appear to be a workable, and perhaps even psychologically real, solution.

IV.12.2 Initial Vowel

An initial vowel solution which acts in terms of a progressive assimilation would cause problems in Tlingit vowel harmony in those cases where /y/ is not removed directly following a consonant, although one could, in the spirit of terminological quibbling, choose to change the theory to Initial Glide and Vowel, in which case (rule 3), a simple assimilation 'rule', would suffice. A persistent rule is also necessary, e.g., $Y \rightarrow \emptyset / C^+$. 

Rule 1

\[
\text{INITIAL VOWEL} \quad [+ \text{syll}] \rightarrow [\text{a back}] / [\text{a round}]^+ 
\]
This rule accounts only for vowel agreement in backness and rounding across a morpheme boundary.

Rule 2

GLIDE AGREEMENT

\[ [- \text{ syll}] \rightarrow [\text{a round}] / [\text{a round}] + \_ \]

Where the glide is not omitted, rule 2 must apply, then rule 1. A glide is rounded following a rounded segment across a morpheme boundary.

Rule 3

GLIDE OR VOWEL AGREEMENT

\[ [- \text{ cons} \, (+ \text{ high})] \rightarrow [\text{a back}] / [\text{a round}] + \_ \]

A glide or vowel agrees in backness and rounding across a morpheme boundary. Rule 3 applied persistently would obviate the need of Rules 1 and 2 and would provide a satisfactory solution:

Data

\begin{align*}
\text{du-} & \text{gux-} \rightarrow \text{"his slave"} & Y \rightarrow \emptyset / C + \_ \\
\text{du-} & \text{gh} \rightarrow \text{"his nose"} \\
\text{du-} & \text{gh} \rightarrow \text{"his lake"}
\end{align*}

A later rule would specify the realization in backness of the archiphonemes.

A rule 3 solution in Tlingit is certainly plausible and natural. However, plausibility of this method would have to be determined in
terms of productivity, since there might be a more explanatory or even more descriptive solution.

Alternatively, an initial vowel solution could also have been approached in terms of both progressive and regressive assimilation when the glide is not deleted. Example:

Rule 4  [+ syll] ————> [a back] / [a round/ + ___
Rule 5  [- syll] ————> [a back] / + ___ [a back]

This solution is obviously less economical than Rule 3 above.

IV.12.3 Absolute Neutralization

From the Boas data, it is evident that the voiced post-palatal continuant /γ/ and the voiced palatal glide /y/ have but lately merged in southern Tlingit. Indeed, Boas gives the affixes /yi/ and /yin/ as [γi] and [γin], orthographically <yi> and <yin>. Thus the continuant may be assumed to be the underlying form of the glide /y/ in certain marked affixes, although the continuant [γ] is, of course, not the underlying form of all palatal glides, nor do all affixes with initial [γ] automatically undergo vowel harmony. The glide /w/ is tentatively marked as a labialized palatal continuant in Boas' chart.

Because the segment /a/ in certain nouns also causes rounding of the diminutive suffix /-k/, an underlying /ɔ/, i.e., [+ syll + low + round ] may be posited for these forms.

Rule 1(a)

CONTINUANT [+ voiced] + cont
BACKING - syll ————> [a round] / [a round] + ___
A voiced continuant is rounded following a rounded segment across a morpheme boundary.

\[
\text{Rule 1(b)}\quad \begin{array}{c}
\text{ABSOLUTE} \\
\text{NEUTRALIZATION}
\end{array} \quad \begin{array}{l}
+\text{voiced} \\
+\text{cont} \\
-\text{syll}
\end{array} \quad \rightarrow \quad \begin{array}{l}
-\text{cons}
\end{array}
\]

The underlying palatal continuant loses its consonance.

\[
\text{Rule 2(a)}\quad \begin{array}{c}
\text{DIMINUTIVE}
\end{array} \quad \begin{array}{l}
+\text{cons} \\
+\text{dim}
\end{array} \quad \rightarrow \quad \begin{array}{l}
+\text{round} \\
+\text{syll} \\
+\text{low} \\
+\text{round}
\end{array}
\]

The /-k/ suffix rounds following /ɔ/.

\[
\text{Rule 2(b)}\quad \begin{array}{c}
\text{ABSOLUTE} \\
\text{NEUTRALIZATION}
\end{array} \quad \begin{array}{l}
+\text{syll} \\
+\text{low} \\
+\text{round}
\end{array} \quad \rightarrow \quad \begin{array}{l}
-\text{round}
\end{array}
\]

i.e. ɔ \rightarrow a

As far as a Tlingit solution is concerned, the absolute neutralization of [γ] and of /y/ provides a neat explanatory device for rounding of the affected affixes although, since other affixes may also be postulated to have initial [γ] (as shown orthographically) and do not round, a phonological explanation is not the complete answer. The answer possibly is to be found in the particular kind of syntax involved.

Though Kiparsky's criticism of the diacritic use of features perhaps may be justified, in Tlingit, until the recent past, a surface representation of the abstract feature [γ] occurred which is now
posited for rounding for certain probably grammatically marked forms.

With regard to /o/ in Tlingit phonology, there are only two back vowels, with tense and lax manifestations, and it is entirely possible that an o-type of vowel may previously have been neutralized. Though diachronically the positing of such underlying forms may be correct and well motivated, the assimilation rules, while plausible, are neither economic nor particularly simple, while natural solutions are available.

IV.13 CONCRETE TREATMENT

A concrete solution to the problem of vowel harmony in Tlingit within the confines of generative phonology, would demand that no underlying forms are posited that are not phonetically realized, and that all features be fully specified in the dictionary representation.

With the aid of minor rules (v. Lightner 1968) to account for those affixes which do not undergo vowel harmony, a possible solution is offered. Lightner (1968: 70) has described the use of minor rules:

The convention for application of a minor rule is that no form is subject to application of a minor rule unless the form is specifically marked as undergoing a certain rule.

In the case of minor rules, redundancy rules would have to specify that certain groups of morphemes are exceptions in that they undergo minor rules. The use of minor rules (i.e. + rule features) in a concrete solution is suggested by Kiparsky's strong alternation condition which allows for the categorization of elements into regular and exceptional classes with respect to phonological rules.
The following rules would account for the data in a concrete solution where the affix is specified as undergoing vowel harmony [+ V.H.]. Minor rules would account for these exceptional cases without the need of postulating underlying forms.

**Rule**

PROGRESSIVE ASSIMILATION <br> [+ cons] → [+ back] / { [+ round] } + [+ high] [+ V.H.]

High segments back and round across a morpheme boundary following a rounded segment or a segment marked for vowel harmony. In addition, nouns ending in /a/ which cause labialization would have to be marked in the lexicon as [+ V.H.].

**Underlying Forms**

<table>
<thead>
<tr>
<th>Underlying Forms</th>
<th>Root</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>yən'áigén-yin</td>
<td>+ V.H.</td>
<td>&quot;he was getting big&quot;</td>
</tr>
<tr>
<td>qUX'á'ú-yin</td>
<td>+ V.H.</td>
<td>&quot;I was dwelling&quot;</td>
</tr>
<tr>
<td>hit' t'áq' -yi</td>
<td>+ V.H.</td>
<td>&quot;house timber&quot;</td>
</tr>
</tbody>
</table>

"a small pond" [ + VH ][ + VH ]
"its man" [ + VH ][ + VH ]
"having died" [ + VH ][ + VH ]

The concrete method provides a neat and economical solution to the problem of vowel harmony in Tlingit. The use of minor rules to mark exceptional forms is economical in Tlingit where only a few forms are so marked. This solution provides naturalness and simplicity, as well as sufficient motivation and generalization, although it lacks psycholinguistic insights of a native speaker.
IV.14 PROCESS TREATMENTS

A process treatment of Tlingit vowel harmony requires that every stem vowel and consonant be specified in the lexicon, while the variable vowel and glide 'archiphonemes' are represented in their "fully specified maximally unmarked" forms according to the theory of markedness, the alternation condition, and naturalness (v. Kiparsky 1968: 39).

Rule features of the suggested \([-\text{-rule feature}\)] type would account for sound change of the unmarked features. The systematic phonemic level is related to universal phonetic features, first according to universal principles, and second by means of language specific p-rules which may shift one or more mapped features (Postal 1968: 60-2). There is no unmarked high vowel. The use of /i/ is arbitrary.

\[ \text{Rule} \]

\[
\begin{align*}
\text{VOWEL} & \quad + \text{cons} \\
\text{HARMONY} & \quad + \text{high} \\
\end{align*}
\]

\[\rightarrow [\alpha \text{ round}] / \left\{ \begin{array}{c}
\{ \alpha \text{ round} \} \\
\{ + \text{seg} \} \\
\{ - \text{V.H.} \} \\
\end{array} \right\} + \_\_ \]

A high segment rounds following a rounded segment or a minus V.H. rule segment across a morpheme boundary.

\[ \text{Data} \]

(1) \text{hit } \text{tåq }^{w}-\text{yi} \quad "\text{house timber}" \\
(2) \text{xúc ha}\text{ minX}-\text{yi} \quad "\text{grizzly bear's dung}" \\
(3) \text{à-k} \quad "\text{a small thing}"
(4) xát hín-yi  "salmon creek"
(5) t'á-k  "a small spring salmon"

As seen from the data, in order for the rule to apply to diminutive forms in nouns following /a/, a [- rule feature] would not be satisfactory or even workable, and a [+ rule feature] or minor rule must be involved instead e.g.,

qá-yi  "its man"
[+ V.H.][+ V.H.]

Minus rule features are not satisfactory in Tlingit in any case since so many features would have to be marked as [- rule feature], and it is the exception in this analysis that must undergo the rule. In order to have the rule account for all forms, the rule must then be amended as follows:

Rule

(1) \[ \begin{array}{c}
\begin{cases}
+ \text{cons} \\
+ \text{high}
\end{cases}
\end{array} \rightarrow [\alpha \text{ round}] / \begin{cases}
[\alpha \text{ round}] \\
+ \text{seg} \\
+ \text{V.H.}
\end{cases} \right. [+ \text{F.B.}] \]

A process treatment is satisfactory in adhering to naturalness and alternation, although all treatments so far have utilized markedness marking conventions as an abbreviatory device. However, although /y/ is the maximally unmarked glide under markedness, there is no one maximally unmarked high vowel, according to Chomsky and Halle, and one must arbitrarily assign /i/ as the unmarked high vowel if one rule is to apply. Outside of this requirement, the rule is simple and economical,
though the use of [+ rule feature] as a device rather than [- rule feature] is entailed.

If the goal of the theory as set out by Kiparsky (1968:41) for phonemics to handle sound change

in the directest possible way, without either setting up either diacritic features where an equivalent phonetic contrast exists, or setting up underlying phonological distinctions which have to be undone where there is no phonetic contrast

then both concrete and process solutions handle the problem equally well. The concrete solution, however, does not violate the assigned values of markedness.

IV.15 METATHEORY - AN ADDENDUM

Basing his theories on a number of attested language-general assimilation rules, Schachter (1970: 342) suggested that the incorporation of his universals "into the general phonological model can simplify the description of particular phonological systems and can explain otherwise idiosyncratic features of these systems" by extending the notion of naturalness to the p-rules themselves, defining a metatheoretical model of assimilation universals which might be applied to vowel harmony. Schachter argued that the general theory, using the simplicity metric, fails to give explanatory adequacy by not predicting normal or natural rules with the same number of features as less natural, or universal, rules. For example, in rules of intervocalic consonant voicing and inter-consonantal vocalic devoicing, the former is not predicted as being a natural process. Schachter (1970: 343) defined
assimilatory p-rules as those "in which the values of some feature (or set of features) of one segment is changed to agree with the value of that feature (those features) in a neighbouring segment, or in neighbouring segments". This adheres to Postal's naturalness condition as well as to the idea of process morphonemics set forth by Kiparsky.

Schachter postulated that the criterion of naturalness should thus be extended to certain p-rules and that in particular "a meta-theoretical distinction should be made between natural and unnatural assimilation rules". Two of these universals may be adapted to Tlingit vowel harmony (v. Schachter 1970: 344-9).

First:

"Feature values of non-vowels assimilate to those of adjacent vowels, rather than conversely."

For example:

(1) [- cont] → [+ cont] / [+ syll] (+ cont) → [+ syll] (+ cont)

A non-continuant becomes a continuant intervocalically. A rule of this type characterizes labialization and palatalization as normal assimilation types, following labial or palatal vowels.

Second:

"Unmarked feature values assimilate to adjacent marked feature values, rather than conversely."

For example, a minus nasal feature assimilates to a marked nasal feature in the environment of a nasal:

(2) [- nas] → [+ nas] / [+ nas]
However, according to Schachter, because universal (1) (v. below) does not account for all cases of assimilation, universal (2) must be considered within the scope of (1), and as taking precedence over although not superceding (1).

Using data from Tlingit and markedness, we can see readily how these generalizations would apply. With -yi, -yin as base forms, natural assimilation rule (1) correctly predicts rounding for the marked affixes following the feature [+ back]. However, it does not predict rounding of affix vowels following a [+ round] segment, nor the rounding of base affixes after a [+ round] consonant, although universal (2) will. To allow for the full application of universal (1) in this case, it is necessary to forego the naturalness condition in order to account for labializing /a/ as underlying /ɔ/.

Universal assimilation rule (2) suggests that unmarked features assimilate to adjacent marked features rather than conversely. This is true for Tlingit in the case of [+ round] consonants, which are marked, and which cause consequent rounding (and backing) of following sounds.

Data

"his nose" du-ľb-yi důľb-wů
"his fort" du-nů-yi dů-nů-wů
Schacter's universals are certainly workable in Tlingit, although universal (1) must be extended in some way to account for the assimilation of the affix vowels /i/ ~ /u/, since in markedness theory neither /u/ nor /i/ is more, or less, marked than the other. Rather than tampering with markedness theory it would probably be wiser to specify that, as a morpheme structure condition or as a surface phonetic constraint, \( + \) cons must agree in backness in certain specified affixes. The application of Schachter's metatheoretical model to Tlingit vowel harmony suggests, however, that analysis of /a/ as underlying /o/ might be a natural solution in which, as a result of the bleaching process (Stampe 1972), a restrained form of neutralization which depalatalizes and delabializes, vowels such as /o/ have been neutralized to /a/ by a completely natural and normal process of sound change. This apparently has happened phonologically in Tlingit.

As previously discussed, Tlingit phonology manifests a number of natural processes suggested by Stampe (1969), e.g., final devoicing, intervocalic voicing, limited clusters, lack of linguals, (undefined by Stampe, linguals refer to dentals, alveolars, palatals and velars in traditional terminology or to the distinctive features [+ coronal], [+ high] (v. Chomsky and Halle 1968: 304-305)), and in
the back vowel series the merging (one assumes for a symmetric chart)
of [- high] vowels to /a/.

Although recent developments in opposition to markedness,
expressed by Vennemann (1971), Hyman (1973) and Stampe (1969), have
brought within the scope of generative phonology some of the impli-
cations of Schachter's assumptions of assimilation universals,
Schachter's naturalness conventions, informally expressed above as
universals, would, in the case of Tlingit vowel harmony at least,
offer the basis of a more explanatorily adequate treatment and a
better basis for judgement and problem solving.

IV.16 THEORETICAL VALIDITY

While offering no replacing world-view, the sociolinguist Labov
just as impressionistic phonetics should be calibrated
against the readings of various instruments, so the
intuitions of the theorists should be matched against
observations of the unreflecting speech or ordinary men.

In noting the rejection of validity, (the independent judgement of
right or wrong according to a measurable, observable basis outside
of any theory), by Chao 1934, Harris 1965 and Chomsky (1965), Labov has
suggested that the competence-performance distinction blurs the
reality that theories ought to be tested against real language. Noting
that a generative grammar according to an internal evaluation is only
one model of many that are descriptively adequate, Labov, on the basis
of recent studies, has questioned the validity of certain convincing
linguistic analyses. Skousen (1972: 567) also, in disputing theoretical, versus the actual, regularities captured by a native speaker, has confirmed the methodological problems involved in choosing a single solution or a single theory to a linguistic problem:

In general, there is no single way to account for a set of linguistic data. And given a set of static data, there is no a priori method to determine in what ways speakers might account for the data. A simple analysis might be better than a complex analysis, but only if it is true that speakers would account for the data by means of the simple analysis. By just looking at static data, there is no way at present for a linguist to determine what regularities speakers will capture. A reasonable goal of phonology would be, in fact, to develop such a theory, one that will predict from a given set of data which regularities speakers would account for.

Within generative theory, Hyman (1970), in assuming a single, correct and psychologically real grammar at the level of explanatory adequacy to be the end result of a transformational generative model, has demanded that means be provided to distinguish the most highly valued grammar in "a given set of circumstances". However, Lightner (1971), in an excellent theoretical review of generative phonology, has suggested that the effect of a phonetic representation on the underlying representation is difficult to formulate explicitly in generative theory and that under present theory the abstractness issue is apparently deadlocked. In advancing the notion of linguistic indeterminancy, Lightner has suggested that one may have to accept the idea of an abstract theoretical grammar which will account for a native speaker's presumed rather than actual competence, with yet undefined limits on the abstractness of grammar.
IV.17 SUMMARY

Although Kiparsky raised the current controversy on the inclusion of abstractness of morphophonemic representation in the grammar, Hyman (1970) questioned the basis of whether explanatory phonological solutions may indeed coincide with a level of explanatory adequacy. In reviewing theoretical viewpoints or approaches to the issue, along with practical methods, applications, and solutions, we have also explored some of the possible solutions to the problem of vowel harmony in Tlingit, using Kiparsky as mentor and Hyman as touchstone. In discussing theoretical approaches to the issue of abstractness, given the present evaluation criteria, we have been able to perceive, like phonemicists decades earlier, no one right perception in the present framework of generative grammar.

Although Roberts (1976) has termed the abstractness controversy the result of ideological limits in linguistics, until, or unless, the constraints and conditions of natural generative grammar and of natural processes more widely replace the current standard generative model, the issue may remain at a standoff.

Practically, in applying various theoretical methods to a solution of vowel harmony in Tlingit (the acceptance of which in itself has been arguable), we have discerned under the present criteria of economy, simplicity and naturalness that certain solutions are perhaps more appealing, natural, normal, economic or productive than others. However, lacking the measure of explanatory adequacy which must be the unique solution to the acquisition of grammar in a
child, in this case of those rare Tlingit-speaking children, while possessing the intuitive insight of Boas' native speaker with regard to our interpretation of /-yi^-wu/, /-yin^-wun/ alternations, we can offer no preferred solution except methodologically in terms of the previously discussed evaluations of economy, simplicity and naturalness. Therefore, factually and theoretically, what we can offer is in terms of our own analysis of data, our own interpretation of theory, our own determination of observational adequacy. Like the Saussurean paradox (v. Labov 1971), where the individual 'parole' must realize the social and ideal 'langue', because we are unique as individuals, we seek our unique solutions, while adhering to the ideal that there must be, of course, only one.
V.1 SUMMARY

Methodologically, using pre-phonemicized data from Boas (1917), phonemic data from Velten (1939, 1944), and material from the tagmemic grammars of Naish (1966) and Story (1966), we commenced our analysis by investigating in the second Chapter the descriptive phonology of Tlingit in the framework of a transformational grammar. In this process, we noted and discussed certain problems arising from the application of derivational constraints and morpheme structure conditions to the yi-wu alternation in Tlingit phonology.

In the third Chapter, we examined some of the simpler phonological processes of Tlingit according to a framework of natural phonology and natural processes advanced by Stampe (1969), an analytical approach we perceived to be particularly appropriate. We found that, unlike the undiscussed morphological complexities of verbal compositions (for which, v. Story and Naish 1973), the phonological processes cited in Tlingit are indeed simple and language-universal.

In the fourth Chapter, while using the theoretical issue of abstractness to discuss approaches to morphophonemic representation according to abstract, concrete and process theory, we applied these various models to the problematical interpretation of vowel harmony in Tlingit, using formal criteria of economy, simplicity, and naturalness.

In this context, we discovered certain problems applicable to linguistic science as a whole. With present evaluation measures,
and lacking the psychological reality and validated hypotheses of language acquisition deemed necessary, a non-unique solution oriented to the investigator's own interpretation of available data (no matter what the specific language at issue) and based on the constraints of the current grammatical model, as discussed, remains the inevitable option. To expand the range of discussion vis-à-vis this more general problem, we incorporated brief treatments of prosodic and metatheoretical approaches in order to give these issues further point.

Theoretically, we discovered in the second Chapter that, while a phonemic framework featuring surface phonetic constraints provides a good descriptive fit for the phonology, certain distinctive features described yield analytical insights into the opposition of features, while offering the necessary basis for the operation of the feature-changing phonological rules.

In the third Chapter, we determined that Tlingit conforms to a natural framework of natural processes which in reality describes the language-universal processes involved. No claim to explanatory or even descriptive adequacy has been put forward at this stage, lacking any basis respecting a native speaker's insights into Tlingit, a matter clearly requiring specific and previously unattempted field research.

In the fourth Chapter, we discussed theoretical problems of morphophonemic representation in generative theory with internal evaluation criteria. In applying various theoretical approaches to methodological solutions we have found satisfactory, or better,
solutions, though by present theory no notion of validity has been incorporated. Here, we raised what might be termed for linguistics the validation problem to which (unlike certain companion social sciences) insufficient attention, in our derivations, has yet been addressed.

V.2 CONCLUSIONS

More than forty years have passed since Chao 1934 first raised the problem of non-uniqueness in phonemic theory. Not only has this problem been unresolved, but the problem of non-uniqueness in generative grammar, still lacking in psychological evaluation criteria, remains to perplex. As discussed in some detail, a number of theoretical constraints and conditions have been proposed in recent years to deal with specific cases of non-applicability and thus indeterminancy. Thus, practical problems of workability and non-uniqueness frequently are jointly associated. The problem is, of course, that given the limitations of the current, and generally established and accepted theory, no unique solution has been presented, or may even be possible, within the theory; for it has appeared evident, given the options in the range of approaches, that certain solutions are more to be preferred than others in terms of the criteria examined.

In this context, Skousen (1972) has argued that "nearly all of the arguments for the theoretical machinery of generative phonology" have been based on the assumption that speakers capture natural, phonetically statable rules. Skousen (1972) asserts further:
Yet all of the particular arguments for these notions crucially depend upon the assumption that speakers are actually capturing the regularities that linguists claim they are. If speakers are not really capturing these regularities, then any argument for a particular theoretical notion that is based on such regularities is without foundation . . . A proper theory of phonology can only be based on rules that speakers actually capture.

Skousen's injunction notwithstanding, matters cannot adequately be left merely with some perhaps clearer definition of the problem of indeterminancy, for it is entirely possible (though, intuitively, we would tend to doubt this would be the case) that the incorporation of psychological reality more firmly and consistently into the treatments we have discussed would still leave gaps to be closed in linguistic analysis, or create further areas which are resultanty opened up.

While these matters have been indicated perhaps only implicitly, it has been clear in the discussion throughout that linguistics (at least in the context we have elaborated) is in the process of fundamental, perhaps reformative, attempts at synthesis. For this reason, we conclude this summary discussion with a suggestion of Lyons (1962: 131 n. 16) with respect to certain implications for linguistics generally which the analysis in Chapter 4 has perhaps indicated:

Prosodists seem generally to prefer the 'hocus-pocus' philosophy of language . . . It seems clear, however, that on this question (as on so many theoretical questions of linguistics) it is possible to adopt an intermediate position. Where the structure of the language is clearly determinate and all linguists can reach agreement on the 'facts', one might claim to be dealing with 'God's truth', but where the language is indeterminate and does not compel one analysis rather than another, the linguist may choose arbitrarily one of the alternative solutions, providing that he makes it clear what he is doing.
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ZIMMER, KARL E.


ZWICKY, ARNOLD M.

APPENDIX

Data and Charts
CHART I  Tlingit Vowel Chart

<table>
<thead>
<tr>
<th>Tlingit Vowels</th>
<th>- back</th>
<th>+ back</th>
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<tbody>
<tr>
<td></td>
<td>+ tense</td>
<td>- tense</td>
</tr>
<tr>
<td>+ high</td>
<td>(i)</td>
<td>(I)</td>
</tr>
<tr>
<td>- high</td>
<td>(e)</td>
<td>(\varepsilon)</td>
</tr>
</tbody>
</table>

CHART II  Distinctive Features Chart

<table>
<thead>
<tr>
<th>Feature</th>
<th>Concrete Representation</th>
<th>Underlying Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(i) (I) (u) (U) (e) (\varepsilon) (a) (\hat{a})</td>
<td>(o) (\circ)</td>
</tr>
<tr>
<td>syll</td>
<td>+ + + + + + + + + +</td>
<td>+ +</td>
</tr>
<tr>
<td>high</td>
<td>+ + + + - - - - - -</td>
<td>- -</td>
</tr>
<tr>
<td>back</td>
<td>- - + + - - + + + +</td>
<td>+ +</td>
</tr>
<tr>
<td>tense</td>
<td>+ - + - + - + - + -</td>
<td>+ -</td>
</tr>
<tr>
<td>round</td>
<td>- - + + - - - - - -</td>
<td>+ +</td>
</tr>
</tbody>
</table>

CHART III  
Tlingit Vowel Markedness  
(after Chomsky and Halle 1968)

<table>
<thead>
<tr>
<th>Feature Value</th>
<th>1</th>
<th>I</th>
<th>u</th>
<th>U</th>
<th>e</th>
<th>ε</th>
<th>a</th>
<th>A</th>
<th>o</th>
<th>0</th>
<th>C</th>
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</thead>
<tbody>
<tr>
<td>low</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
</tr>
<tr>
<td>high</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>m</td>
<td>m</td>
<td>m</td>
<td>m</td>
<td>u</td>
<td>m</td>
<td>m</td>
</tr>
<tr>
<td>back</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>u</td>
<td>+</td>
<td>+</td>
<td>u</td>
<td></td>
</tr>
<tr>
<td>tense</td>
<td>u</td>
<td>m</td>
<td>u</td>
<td>m</td>
<td>u</td>
<td>m</td>
<td>u</td>
<td>m</td>
<td>u</td>
<td>m</td>
<td>m</td>
</tr>
<tr>
<td>round</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>u</td>
<td>m</td>
<td>m</td>
</tr>
<tr>
<td>complexity</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
DATA APPENDIX

<table>
<thead>
<tr>
<th>Surface Manifestation</th>
<th>Gloss</th>
<th>Underlying Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. <strong>-yin Verbal Forms</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. ?uxun</td>
<td>&quot;having blown&quot;</td>
<td>?uxw-yin</td>
</tr>
<tr>
<td>2. šùwqún</td>
<td>&quot;having laughed&quot;</td>
<td>šùwq-w-yin</td>
</tr>
<tr>
<td>3. ?ädín</td>
<td>&quot;having gone&quot;</td>
<td>ât-yin</td>
</tr>
<tr>
<td>4. wùx?ùqún</td>
<td>&quot;it has boiled&quot;</td>
<td>wùx?ùk-w-yin</td>
</tr>
<tr>
<td>5. xwèlín</td>
<td>&quot;he was tired&quot;</td>
<td>xwèl-yin</td>
</tr>
<tr>
<td>6. yÀaâgènín</td>
<td>&quot;he was getting big&quot;</td>
<td>yÀaâgèn-yin</td>
</tr>
<tr>
<td>7. xât ìàcinín</td>
<td>&quot;I used to be strong&quot;</td>
<td>xât ìàcin-yin</td>
</tr>
<tr>
<td>8. ìé ì wuduskúwun</td>
<td>&quot;he was never known&quot;</td>
<td>ìé wuduskú-yin</td>
</tr>
<tr>
<td>9. qùxwàwuwun</td>
<td>&quot;I was dwelling&quot;</td>
<td>qùxwàwu-yin</td>
</tr>
<tr>
<td>10. qùxwàkitin</td>
<td>&quot;I used to pick berries&quot;</td>
<td>qùxwàkit-yin</td>
</tr>
</tbody>
</table>

II. **-yi Pronominal Possession**

<table>
<thead>
<tr>
<th>Surface Manifestation</th>
<th>Gloss</th>
<th>Underlying Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. dùxadí</td>
<td>&quot;his root&quot;</td>
<td>du-xât-yi</td>
</tr>
<tr>
<td>2. dùyègi</td>
<td>&quot;his spirit&quot;</td>
<td>du-yèk-yi</td>
</tr>
<tr>
<td>3. dùyàgú</td>
<td>&quot;his canoe&quot;</td>
<td>du-yàk-w-yi</td>
</tr>
<tr>
<td>4. dùwàgí</td>
<td>&quot;his eye&quot;</td>
<td>du-wàq-yi</td>
</tr>
<tr>
<td>5. dükèli</td>
<td>&quot;his dog&quot;</td>
<td>du-keì-yi</td>
</tr>
<tr>
<td>6. dùtàyì</td>
<td>&quot;his king salmon&quot;</td>
<td>du-tà-yi</td>
</tr>
<tr>
<td>7. dùtàyì</td>
<td>&quot;his board&quot;</td>
<td>du-tà-yi</td>
</tr>
<tr>
<td>8. dù?àyi</td>
<td>&quot;his lake&quot;</td>
<td>du-à-yi</td>
</tr>
<tr>
<td>9. dùnuwu</td>
<td>&quot;his fort&quot;</td>
<td>du-nu-yi</td>
</tr>
<tr>
<td>10. dùluwu</td>
<td>&quot;his nose&quot;</td>
<td>du-lu-yi</td>
</tr>
</tbody>
</table>
11.  đu่เก้ "his king salmon"  đu-ลุก-yi
12.  ดุติลิ "his scar"  ดุ-ติล-yi
13.  ดุติลิ "his shoe"  ดุ-ติล-yi
14.  ดุสะาสะวุ "his hair"  ดุ-สะสะวย-yi
15.  ดุกกุธ "his slave"  ดุ-กุธ-yi
16.  ดุยำกิ "his mussel"  ดุ-ยำก-yi
17.  ดุ?กษ์กิ "his paddle"  ดุ-กษ์-yi

III. Nominal Possession
1.  ทีตี้ก "house timber"  ที-ตี้ย-yi
2.  ขุนขาลิ "grizzly bear's dung"  ขุนขาล-yi
3.  ขะตินิ "salmon creek"  ขะติน-yi

IVa. Nouns ending in /a/ - with diminutive ending
1.  ทักว "a little pond"  ทัก-yi
2.  ดุอากุ "his little pond"  ดุ-อาก-yi
3.  ทักคว "a small thing"  ทักคว-yi
4.  ดุกึติ "his little thing"  ดุ-กึตย-yi
5.  ทักคว "a small spring salmon"  ทักคว-yi

IVb. Exceptions - labialization without diminutive
6.  กาวุ "its man"  กาว-ยย
7.  นาวุน "having died"  นาว-ยย