Obstruent Voicing and Glottalic Obstruents in Gitksan

Bruce Rigsby
Department of Anthropology & Sociology
University of Queensland

John Ingram
Department of English
University of Queensland

1. The main argument of Hoard (1978), "Obstruent Voicing in Gitksan: Some Implications for Distinctive Feature Theory" (hereafter referred to as OVG), centers on the voicing of non-continuant obstruents in Gitksan. Hoard observes that Gitksan has a phonological rule that voices plain non-continuant obstruents. He claims that this rule also applies optionally to the glottalized non-continuant obstruents, which occur in three allophonic types: voiceless non-ejective preglottalized stops/affricates occur finally; voiceless ejective glottalized stops/affricates occur as first members of clusters; and voiced implosive stops/affricates occur before [+sonorant] segments. Hoard also proposes a revision of the features in Chomsky and Halle (1968) that distinguish amongst sound types differing in airstream and larynx features, and he says that some of these involve cooccurrence restrictions. One such restriction is that voiced segments are also characterized by glottal constriction. Thus, it follows that as glottalized stops/affricates become voiced, they also redundantly have glottal constriction, and as the closed larynx moves rapidly downward, so they are implosive.

Our paper is a critique of the substantive portion of OVG. It offers alternative formulations of the obstruent voicing and other phonological rules that are based on different articulatory-phonetic observations and on consideration of a wider range of forms, distributions and alternations. It also provides instrumental evidence that Gitksan does not have voiced implosive stops; rather, it has lax glottalized stops that display a croaky voice quality at the margin of voiceless nonglottalized stops/affricates. It also proposes a revision of the features in Chomsky and Halle (1968) that distinguish amongst sound types differing in airstream and larynx features, and he says that some of these involve cooccurrence restrictions. One such restriction is that voiced segments are also characterized by glottal constriction. Thus, it follows that as glottalized stops/affricates become voiced, they also redundantly have glottal constriction, and as the closed larynx moves rapidly downward, so they are implosive.

2. The first part of OVG identifies and locates the language and makes brief comments on Lonnie Hindle, who served as the consultant in Hoard's field methods course at the University of British Columbia in 1970-71. It was Mr. Hindle's speech on which Hoard based his instrumental analysis. He used an Electro-Voice 635A omni-directional microphone and a Marantz CP430 cassette recorder. Mrs. Sarah Hindle, who has lived in Hazelton for many years, is in her mid-sixties, and although she speaks more English in her daily life than Gitksan, she speaks both languages fluently and well. Lonnie Hindle, Mrs. Hindle's older son, is in his late thirties. He has lived in the Vancouver area for over fifteen years, and English is the language of his daily domestic and public life. He seldom has the opportunity to speak Gitksan now. Although his comprehension of Gitksan remains good, his speaking command of the language is less fluent than that of his mother and his knowledge of its vocabulary has lessened over the years. The Hindle family and I (BR) have had a close association for almost twenty years. Lonnie and I call Mrs. Hindle /ma·7/ Num in Gitksan, and we call one another /wak/ brother. Mrs. Hindle and I've done language work together since 1966. In 1970-71, Lonnie and I developed the Gitksan practical alphabet and prepared a short practical Gitksan dictionary (Hindle and Rigsby 1975).

3. The second section of OVG presents a provisional phonemic inventory of thirty consonants, three short vowels, and three long vowels. It notes that Rigsby (1967) reported two additional long vowels, but Hoard suggests some of these are positional variants of the long high vowels, while others are secondary developments resulting from intermorphemic phonological processes. Hoard also describes the phonetic variation he found in the two lateral consonants, /l/ and /r/.

We observe that the phoneme inventory of Gitksan does include thirty consonants, and these pattern phonetically and distributionally into three sets, as seen in:

Obstruents

<table>
<thead>
<tr>
<th>p</th>
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<th>k</th>
<th>ʔ</th>
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<tbody>
<tr>
<td>ŋ</td>
<td>ñ</td>
<td>k̑</td>
<td>q</td>
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</table>

Resonants

<table>
<thead>
<tr>
<th>m</th>
<th>n</th>
<th>l</th>
<th>y</th>
<th>w</th>
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</thead>
<tbody>
<tr>
<td>ŋ</td>
<td>ŋ</td>
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<td>ŋ</td>
<td>ŋ</td>
</tr>
</tbody>
</table>

(Non-resonant)

| G | ŋ | y | ŋ |

Glides:

| h | h |

The front dorsal series is underlyingly palatal, not velar. The palatal obstruents occur in a wide range of environments: pre-vocalic, postvocalic final, and pre- and post-consonantally - but they are not found before the coronal fricatives /s/ and /吸入/. Instead, velars found there, and we derive these by phonological rule. Note the following alternations:

1. CVC1 CV1C2
2.
developing by lowering, stress shift and elision (Tarpent 1983). The C1V, uvular: following exhaust my knowledge of the subset in short

The conventional form for mud in Mr. Hindle's speech and in the wider

blossom and few native forms. such as

hunchback versus

mid vowels arose historically from high vowels. However, there are so

Only the three long vowels /i/-/a/-/u/- occur in unstrressed positions, and pretonically, the contrast of unstrressed short vowels is neutralized. We represent that vowel phoneme as /a/, and in unstrressed final position, only non-low /a/ and low /a/- contrast.

Hoard is correct that the pairs, /i/-/e/-/a/-/o/-/u/- are in near complementary distribution, and this is evidence that some long mid vowels arose historically from high vowels. However, there are so many contrasts in native forms and loans that it seems best to enter many contrasts in native forms and loans that it seems best to enter

Only non-low /a/ and low /a/- contrast.

Hoard's proposed derivation of [l'sota'] mud-like from [l'w:txa'] is not correct, as there is no such customary form in the language. The conventional form for mud in Mr. Hindle's speech and in the wider

Hoard noted that [?] could be substituted for initial [h] in two

forms, but he also noted more forms in initial [?] where [h] could not be substituted. This led him to include [?] among the allophones of /h/ and to exclude [h] from the allophones of /f/?. With respect to the former two forms, I have never heard or recorded [hanad]/[wanan] with an initial glottal stop and Hoard's second form, given as hagnall 'I ran a little', was doubtless intended as a construction with the preverbal /bab-/al: slowly, gently, which never has an initial glottal stop. Thus, [?] is not really among the allophones of /h/, nor is [h] an allophone of /f/. However, Mrs. Hindle regularly pronounces the

reduplicated plural of be good (vi) as [ham*am], although [ham*am] is conventional among other speakers; her plural shows initial

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The third section of OVG first presents forms that provide evidence for the phonological rule that voices non-continuant obstruents, formulates the rule to operate before [+sonorant] segments, and notes four other consonant rules. These involve aspiration of plain stops, palatalization of the plain velar stop, preriglottalization of final glottalized segments, and the syllabification of final post-consonantal nasals (for the insertion of an epenthetic vowel before them). The remainder of the section focuses on the three allophonic types of glottalized obstruents: weakly ejective voiceless final preriglottalized obstruents, voiced implosive obstruents, and voiceless ejective glottalized obstruents. The second are said to display a downward movement of the larynx, while the third have the typical ejective upward movement of the larynx. Thus, the voiceless and voiceless ejectives glottalized stops have the same allophonic variation as do the plain obstruents, and Hoard comments that the obstruent voicing rule ought to include both plain and glottalized non-continuants in its domain of operation.

Gitksan does indeed have a rule that voices non-continuant obstruents, but contrary to Hoard's formulation, it applies only to the plain stops (including affricates) to the ejective ones. Focusing first on the plain stops, one notes that there are three major allophonic subtypes that are in complementary distribution. Voiced stops are found in prevoocalic position; voiceless stops with noticeable aspirate release are found in final position; and plain voiceless stops are found in the remaining preconsonantal positions. The following possessive paradigm of /n̪a-pi-/ maternal uncle displays the [b̪ - p̪ - p] alternations that are characteristic of the general plain stop and affricate allophony:

<table>
<thead>
<tr>
<th>[n̪b̪f̪p̪h]</th>
<th>maternal uncle</th>
<th>/n̪a-pi-/</th>
</tr>
</thead>
<tbody>
<tr>
<td>[n̪b̪biy]</td>
<td>my</td>
<td>/n̪a-pi-o-/</td>
</tr>
<tr>
<td>[n̪b̪b̪n̪]</td>
<td>your (sg)</td>
<td>/n̪a-pi-s-an/</td>
</tr>
<tr>
<td>[n̪b̪b̪t̪h]</td>
<td>his, her</td>
<td>/n̪a-pi-t̪/</td>
</tr>
<tr>
<td>[n̪b̪b̪t̪]</td>
<td>our</td>
<td>/n̪a-pi-o/#</td>
</tr>
<tr>
<td>[n̪b̪b̪p̪s̪t̪]</td>
<td>your (pl)</td>
<td>/n̪a-pi-sa#</td>
</tr>
<tr>
<td>[n̪b̪b̪d̪1-t̪h]</td>
<td>their</td>
<td>/n̪a-pi-t̪-t̪/</td>
</tr>
</tbody>
</table>

Only the labial and plain dental stops occur in pretonic preconsonantal position; dorsal stops are lacking there. Some examples are:

| [p̪d̪l̪]    | rib            | /pt̪l̪/ |
| [p̪t̪̪a]   | sea otter      | /pt̪u/ |
| [t̪̪k̪̪ɪ̪k̪̪] | child          | /kt̪̪ɪ̪k̪̪/ |
| [t̪̪ radiation] | skin, hide    | /t̪̪w̪/ |

There is little to say of interest about our instrumental observations of the plain voiceless stops and the final voiceless aspirated stops, but the voiced stops bear some discussion. The principal acoustic correlate of the voicing feature of stops in prevoocalic position is voice onset time (VOT). We can identify two kinds of "voiced" stops in a broader perspective. Spanish-type fully voiced stops have a negative VOT, i.e., a short period of "prevoicing" prior to the oral release, and VOT values vary with place of articulation. English-type voiced stops have VOTs that may range from somewhat negative values (typically -20 msecs) to positive values (+20 msecs, in velars). The Gitksan prevoiced voiceless stops have VOTs that span the range from prevoiced to (weakly) voiced (which some phoneticians might label as "voiceless aspirate"), but they fall mainly within the English-type range. We observed only a few instances of prevoiced Spanish-type stops, all labial or alveolar and from both speakers.

There are a number of anomalous forms in which a fourth allophonic stop subtype - prevoiced voiceless aspirated stops - occurs. Some are loans from English (which contrasts lax voiced and tense voiceless stops in all positions except after /s/), while others are native Gitksan forms. Their situation bears consideration because of the possibility that structural pressure from English loans may have brought about the phonemic split of the formerly plain voiceless stops series into two new distinctive voiced and voiceless series. This does not seem to be the case, but there obvious advantages to be gained by distinguishing voiced and voiceless stops in the Gitksan practical orthography, which is designed for people literate also in English.

Loans from English with anomalous voiceless aspirated stops include:

...
It should also be remarked that English personal names predominate in vernacular speech, while Gitksan personal names are used mainly in ceremonial and traditional narrative contexts. Thus many English names, such as Peter (＊pʰ’tʰa) and Tom (＊th’a:m), have been nativized with initial voiceless aspirated stops. All these anomalous forms can be reasonably represented underlyingly as clusters of plain stop followed by /h/.

Native Gitksan forms with apparently anomalous initial and intervocalic voiceless aspirates are stops of three kinds, which are seen in the following groups:

{phayntʃw*} suddenly appear /pxanṭxw/ {
{thytʃw*} thunder /txaq’txw/
{arbyfw*} trade (vi) /sa=txw-x‘a-
{thun} this (one) /tx̂w‘in/
{dirphun} these (people) /t̂px‘in/
{thuθ̌} that (one) /tx̂w‘ist/ 
{dirphuʃt} those (people) /tpəx‘ist/
{thuθ̌} belonings, gear /θọ-st/ 
{strtʃθ̌} com, deceive, lead on (vt) /sa-thọ-q/ 

It is not desirable to represent the first group of forms with underlying /pʃ/ and /tʃ/ clusters because other distributional phonotactic evidence leads us to expect that intramorphemic stop-plus-resonant clusters are not permitted. All allophones of the labiovelar fricative /θ/ have been nativized, and thus there is no fossilized marginal unstructured reflex of earlier */kwiːn/ preserved in the Gitksan form [ɡYIbaykwi]. It has been suggested that allophones of the labiovelar fricative /θ/ in Gitksan are found in all phonetic environments except the pretonic intervocalic one. As well, we elsewhere need a rule to change [wi] - type sequences to [xu] ones, together with another gliding rule to characterize the [xw / ‘w] alternation in other (post-tonic intervocalic) environments. Thus it completes the parallelism with the /tx/ forms if we represent this second group of Gitksan forms with /θ/ clusters. I’ve also heard very old speakers pronounce these forms as /txun/, etc., which gives some confidence in this treatment.

The rules needed to map all these underlying forms onto phonetic representations are:

Rule 3 xw /x̂w/ ---> ph, th [θ] / # _

The two forms of the final group present another problem for the phonological representation of their anomalous voiceless aspirate stops because their Nisg̱a forms have voiceless stops, i.e. [ḋʷθ̌] and [síḋθ̌], respectively /to-st/ and /ə-w/to-q/. Also similar is the anomalous intervocalic [ph] found in the intransitive verb pair [gYIpyaykwi] and [li-pθ̌aykwi] (with alternant in [li-p̤hθ̌aykwi]) (vi mk sa-pl). The corresponding Nisg̱a forms are [gYIpyantθ̌i] and [li-bY̌θ̌aykwi]. I propose that the Gitksan forms should be represented with clusters of stop plus /h/, as in /k̤phθ̌aykwi/ and /liθ̌aykwi/. The rule that operates on these forms is:

Rule 5 [h] ---> [θ̌]

The prevocalic voiceless aspirates were found to have a positive VOT of 20 msecs or more (the values varying with place of articulation), and they are clearly distinct from the prevocalic voiced stops in this respect. Perceptually, they strike us as laxer than their English counterparts, but they are clearly aspirated.

The glottalized stops of Gitksan (and Nisg̱a, see Boas 1911a:76-77, 1911b:287-88; Sapir 1915:29-30; and my own Nisg̱a fieldnotes and recordings), when compared to those of other Pacific Northwest languages such as Sahaptin and Kiksht (Upper Chinookan), have a definite lenis character. Sapir (1949:225) lists a large number of Amerindian languages that have glottalized stops and affricates, and he
notes that in most languages, they are "fortes" (Chinookan and Athabaskan), but "lenes" in others (Chitimacha and Taos). Aoki (1970) also discusses the occurrence of glottalized stops in some languages, and his instrumental findings indicate that Nez Perce has fortis-type glottalized stops. Montler (1986:8) says that the glottalization of the obstruents of Squamish, a Coast Salish language in Vancouver Island "areective but weakly so. It is often difficult, especially in the anterior consonants, to perceive the contrast." Price (n.d.; 1906), a missionary at Kitwanga village on the Skeena for several decades from the 1890s who knew the language well, generally wrote the glottalized stops as voiceless ones. Wickstrom (1974), who made an instrumental study of the glottalized obstruents and resonants in Gitksan, found (p. 63) in the spectrograms of glottalized stops produced by an older speaker (Mrs. Sarah Marshall) that, "There is a definite tendency to have voicing as evidenced by a light voicing bar. This is probably due to some vibration of the vocal cords during the glottal release", Hoard, as we have seen, described some of the glottalized stops in Lonnie Hindle's speech as "voiceless implosives", and he commented (p. 115) that he mistakenly recorded voiceless stops when he failed to hear their glottalization on first hearing, as I myself tend to do. On the other hand, Wickstrom (1974) and Powell (1974), Eastern and Western pedagogical materials frequently represent the glottalized stops and affricates as voiceless ones. Clearly, we feel that it is called for instrumental work to complement impressionistic articulatory observations in order to ascertain and clarify the description of the phonatory mechanism of the Gitksan (and Nisg̱a'a) glottalized stops. There may also be interindividual variability in the production of these glottalized obstruents.

Our articulatory observations of the glottal stop allophones in Gitksan differ significantly from those of Rigsby, although confirmed by instrumental measurements. We discuss in this order the magnitude of the differences in our observations.

Hoard says (p. 115) that the final glottalized allophones "are only weakly ejective (i.e. there is little or no laryngeal straining), although glottal closure is clearly audible before the onset of a glottalized stop or affricate and glottal closure extends through the articulation of these stops and affricates". We agree that they are preglottalized, that the glottal closure precedes the oral closure, but we observe no ejection. Instead, the oral release is accompanied with distinctly noticeable aspiration, except that the final preglottalized allophone of /k/ lacks such aspiration. Acoustically, the glottalization of these final obstruents is manifested in a way very similar to the that of the initial lenis glottalized obstruents, i.e., a gradual voice quality change at the margin of the vowel. The period of the glottal cycle changes as the last glottal pulse prior to oral closure is approached, and there is a sharp fall in pitch over the last five or six cycles as compared to the negligible fall for final plain obstruents. No observable differences in the closure period or the oral release gesture between the final glottalized and plain obstruents were found.

Later in OVD, Hoard (p. 118) says that the Gitksan final glottalized stops are the same type of sounds as the preglottalized allophones found in English and stop. We disagree. In English's speech (basically, a Midland variety of American English), such words may either be voiceless stops with aspirate release or with unreleased preglottalized stops. The latter definitely differ from the Gitksan final type that has perceptually audible glottal closure and aspirate release.

Hoard describes the second glottalized allophonic type - the voiceless implosive stops - as having an upward movement of the larynx (p. 115), and he illustrates these with four forms, which are /da/, /da/, and [~ga], phonemicized as //taa/, /ta/, /taa/ and /ta/, respectively. However, we agree that the glottalized allophones found in these positions, e.g. /~g'ä/, /~g'ä/, /~g'ä/, are voiceless inharmonics, followed by a plain voiceless alveolar stop in the first case and by a glottalized uvular stop in the second - refer back to earlier section of our paper. And the two reduplicated forms have "weakened" plain voiced stops: /~g'ä/ sit (vi sg) /~g'ä/ (durative)

/dtä/ lise /to-tä/ (See Nigbsy 1970:213 and 1986:96-103 for further description of initial reduplication in Gitksan, which displays phenomena similar to Grassmann's Law in Indo-European). Lice, by the way, does not have a customary plural form in older people's speech, and Mrs. Hindle does not accept it. Thus, we have no evidence for the existence of Hoard's second, preconsonantal allophonic type.

Elsewhere, according to Hoard, one finds voice implosives, which have a significant downward movement of the larynx. Again, our articulatory and instrumental observations are quite at variance, but we agree that the glottalized allophones found in some other Pacific Northwest languages, e.g. initial pretonic, etc., are perceptually quite different from the fortis obstruents found in some other Pacific Northwest languages. They have an overall lenis articulatory set, and they do strike the casual observer as having a "voiced" character.

Acoustic analysis of the time-series waveforms confirms our impressionistic phonetic judgment that these Gitksan glottalized obstruents are quite lenis in character. They are only weakly ejective and their distinguishing features lie primarily in the nature of the vowel. Although the oral release burst is higher than expected for ejectives, its amplitude relative to the peak amplitude of the final glottalized obstruents is manifested in a way very similar to that of the initial lenis glottalized obstruents, i.e. the amplitude relative to the peak amplitude of the last glottalized obstruent. Variability in VOT may arise as a consequence of the glottal configuration at the vowel onset. Unlike the prototypical fortis ejective, where the vowel begins with a sharp glottal release, many Gitksan glottalized obstruents have a gradual release rather than abrupt vowel onset accompanied by several cycles of laryngealized or creaky voice. The gradual release may be observed in the amplitude envelope of the vowel. The creaky voice quality may be observed in the amount of jitter (pitch period perturbation) and in period by period frequency changes in the first
few glottal pulses. In other words, there is a lax glottal configuration. Details of our analysis are found in Ingram and Rigsby (1987).

There also also other allophones of the glottalized obstruents that Rigsby has identified. Preglottalized voiceless allophones also occur preconsonantically following stress, and these are not aspirated. In Rigsby's earlier work, he derived all the preglottalized allophones by a rule that segmentalizes the preconsonantal and the final glottalized obstruents into /ʔ/ followed by the relevant homorganic plain voiceless stop or affricate. The latter segment in final position then undergoes the aspiration rule as formulated in Rule 2 above. Examples are:

- [fu·c·al] black (vi sg) /fu·ĉ·a·l/
- [fu·c·al] metal, knife /fu·ĉ·a/

In the past, Rigsby has also tended to hear slightly preglottalized voiced allophones in intervocalic position following primary stress especially, as in:

- [fu·c·al] pupil (of eye) /fu·ĉ·a/

and he derived these by the same segmentalization rule, letting the obstruent voicing rule catch the second, voiceless obstruent segment before a vowel. This point of view is similar to Hoard's proposal, although it yields egressive pulmonic voiced stops. We have not had the opportunity yet to study these other allophones instrumentally, and so we can say nothing further about them.

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