Reanalysis of Stem Prominence in Hän Athabascan: Evidence from Disyllabic Stems

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1. Introduction

Several studies (Kari 1990 for Ahtna, Bird 2004 for Lheidli, Tuttle 2005 for San Carlos Western Apache, Rice 2005 for Hare, Leer 2005, Manker 2012 for Hän) have indicated that the stem syllable is phonetically prominent in Athabascan languages, which often results in a longer initial consonant. Most stems in Athabascan languages consist of a single syllable and take the form CV(C) (Krauss & Golla, 1981:69). However, there also exist many disyllabic stems which consist of two syllables but whose morphology is no longer analyzable by current speakers. Thus, the question arises as to whether the stem initial consonant of the first syllable of a disyllabic stem would now display prominence, reflecting the morphological reanalysis, despite whatever morphological function this first syllable may have once been assigned. For example, following the previously described system of stem prominence, we might expect that the word /ǰə-žar/ ‘her own – son,’ a prefix plus a stem, would be pronounced differently from /ǰəžar/ ‘cow moose,’ a single stem with two syllables. Stem prominence should occur on the /ž/ in word /ǰə-žar/ ‘her own – son,’ but on the initial /ǰ/ in /ǰəžar/ ‘cow moose.’ The results of this study, however, indicate that these disyllabic stems are pronounced identically to polymorphemic prefix + stem combinations, which suggests that the language may have reanalyzed its historic morphological prosodic system, where now all final syllables receive this prominence rather than all stem syllables.

2. Background

2.1 Stems and Affixes in Athabascan and Hän

Athabascan languages are primarily prefixing in nature, and most have only a few suffixes (Hoijer 1971). Nouns and verbs all consist of at least one stem, but differ in their affixation patterns. Nouns may exist as bare stems or take a single prefix, while verbs must take at least one prefix and may take as many as seven or eight. Stems usually consist of a single syllable and generally take the form CV(C) (Krauss & Golla 1981).

Hän and a few of its neighboring languages are distinct from other Athabascan languages in that they no longer have any suffixes, instead having a light and heavy stem distinction (Leer 1996a). Heavy syllables are the result of desyllabification of suffix syllables, where phonetic vestiges of the suffixes surface as vowel length, voicing, and low tone if a glottal segment was present in the suffix (compare the light syllable /θaʔ/ ‘belt’ with the heavy /-ðaʔ/ ‘belt (possessed)’ from PA *-zəʔəʔ, containing the possessed form prefix /-əʔ/ (Leer 1996b)). This
fact is crucial in the analysis of prosodic patterns in Hän because it means the stem syllable is almost always the final syllable, usually making it ambiguous as to which is attracting prominence. The only possible exceptions to this stem or final syllable ambiguity are polysyllabic stems (this study focuses on just disyllabic stems), whose stem initial consonant would not coincide with the initial consonant of the final syllable.

2.2. *Stem Prominence in Athabascan*

As mentioned above, stem syllables have been described as being phonetically prominent, relative to prefix syllables, in a number of studies (Kari 1990 for Ahtna, Bird 2005 for Lheidli, Tuttle 2005 for San Carlos Western Apache, Rice 2005 for Hare, Leer 2005). Manker (2012) shows that duration is the most reliable distinction in indicating stem prominence in Hän Athabascan, particularly in stem initial consonants. All segment types measured displayed some sort of significant phonetic lengthening in stem initial position. For segments with prominent releases (affricates, aspirated stops), often only the release (either frication or aspiration) was significantly longer in duration, which is reflected in figure 1. Additional features of consonants, such as voicing in fricatives and voice quality following ejectives are also indicators of stem prominence in Hän, but are likely epiphenomenal effects that developed from duration differences according to morphological class (stem or prefix). Results from Manker (2012) are reproduced below, showing a variety of different consonant segments which are significantly shorter in prefixes.

![Figure 1: Percent Length of Prefix Initial Consonants Compared to Stem Initial Consonants](p < 0.05 for all)
2.3. Disyllabic Stems

Most stems take the form CV(C) (Krauss & Golla 1981). However, in modern Hän (and many other Athabascan languages), some stems contain more than one syllable, which in most cases evolved from combinations of prefixes, stems, suffixes, and particles. Table 1 below shows a few examples of how these stems were formed in proto-Athabascan. These words in Hän are now single, fossilized units and are no longer analyzed as having more than one morpheme (or may be partially analyzable “cranberry” morphs, such as /t'əgæ/ where speakers may agree that /gæ/ is related to the word for ‘small’ if pointed out to them, but they cannot analyze /t'ə/).

Table 1: Proto-Athabascan Reconstructions (Leer 1996b) of Hän Disyllabic Stems

<table>
<thead>
<tr>
<th>Gloss</th>
<th>PA reconstruction</th>
<th>Structure</th>
<th>Modern Hän</th>
</tr>
</thead>
<tbody>
<tr>
<td>man</td>
<td>*da-ne</td>
<td>prefix + enclitic</td>
<td>/jəje/</td>
</tr>
<tr>
<td>moose</td>
<td>*də-nig-i</td>
<td>prefix + stem (+ suffix)</td>
<td>/jəju/</td>
</tr>
<tr>
<td>girl</td>
<td>*-t'ed -caye</td>
<td>stem + particle / stem</td>
<td>/t'əgæ/</td>
</tr>
</tbody>
</table>

Some studies have found that some Athabascan languages may use stress or prominence as a clue to the listener as an indication of where the stem is in a word (Rice 2005, Hargus 2005a). Hargus (2005a) states that in Witsuwit’en “stress placement… allows us to infer that certain syllables in polysyllabic nouns are the stem” (pg. 401). Thus we might expect that stem prominence would work similarly in Hän, indicating the onsets of stem syllables.

2.4. The Current Study

According to the findings of previous studies (Kari 1990 for Ahtna, Bird 2004 for Lheidli, Tuttle 2005 for San Carlos Western Apache, Rice 2005 for Hare, Leer 2005, and particularly Manker 2012 for Hän) we would expect that stem initial consonants would display some sort of prominence, particularly longer duration. Thus, we would expect the pattern as seen below in (1)-(2), where bold underlined letters would indicate a prominent consonant.

(1) /jə-žar/ ‘her own son’  (2) /Ləžar/ ‘cow moose’

prefix + stem  stem

This is somewhat similar to how stress is applied in Witsuwit’en (Hargus 2005a), where stress might indicate the stem in a polysyllabic word. However, in Hän, the patterning of the vowel /a/ would seem to contradict this hypothesis. /a/ has a range of pronunciations spanning from central slightly rounded [ə] to back unrounded [ɛ] (de Reuse, p.c) which is generally the

1 The function of these morphemes varies cross-linguistically and thus their reconstructed functions in PA is unclear. For example, Hän /gæ/ ‘small’ can be used adjectively, unlike regular noun and verb stems, and /-ne/ may be cognate with an enclitic nominalizer *ne or from a verb stem *na-y ‘move’(Leer 1996b). In any case, such ambiguity may only strengthen the likelihood of eventual reanalysis.
pronunciation in stems, while it is pronounced in a range from [ə] to [l] in prefixes. For example, a word such as /ʃəčɑ/ meaning ‘his own — pillow,’ being a prefix followed by a stem, is pronounced as [ɛɾ-ɕʰə]. In disyllabic stems containing /ə/, this phoneme is always pronounced as the [ə] allophone in the first syllable and as the [o] allophone in the second (final) syllable. Compare then /naga/ > [nɑqʰə] ‘fox’ with /tʰagæ/ > [tʰɑqʰə] ‘girl’. This data may indicate that disyllabic stems are, at least phonetically, sequences of prefixes and stems. However, as they are not analyzed as such, this scenario could cast doubt on the analysis that stem initial consonants are prominent, and this prosodic system would need to be explained in other terms.

Because disyllabic stems represent a rare case in which either stems occur non-finally, or non-stems (historical suffixes, particles, etc.) occur finally, they allow us to test how stem prominence patterns synchronically. The current study therefore investigates whether prominence occurs in the consonants in the second syllable of disyllabic stems. In other words, is the /ʃ/ in /ʃə-ʒär/, ‘her own son’ more prominent than the /ʃ/ in /ʃəʒär/, ‘cow moose’ because it is in stem initial position, or are both equally prominent, indicating that syllable initial consonants in all final syllables are prominent?

3. Methodology

This study collected 101 examples of two-syllable Hän words with medial consonants, split approximately evenly between one- (disyllabic stems) and two-morpheme (prefix + stem) words from a single fluent female speaker who is representative of the youngest generation of Hän speakers of the Eagle, Alaska dialect. Disyllabic stems included only nouns (no disyllabic verb stems exist), while the two-morpheme prefix + stem combinations included nouns and verbs. Nouns and verbs stems are expected to pattern the same, as prominence effects were found in both (Manker 2012) and the phonological patterns of nouns and verbs stems are the same (for example historical *y occurs as /ʃ/ in both noun and verbs stems, but as /j/ in prefixes). Only six different consonant phonemes were selected for analysis in this study: /g/, /ʃ/, /ʃʃ/, /ʃj/, /b/, and /t'/. Note that /ʃʃ/, /ʃj/ and /b/ are voiceless unaspirated stops, and are rarely if ever voiced in Hän (older speakers sometimes voice /b/, but the consultant in this study did not. See Appendix for a consonant chart for Eagle Hän as spoken by the consultant in this study). These were chosen for phonetic variability (a variety of plain stops, ejectives, fricatives), as well as for frequency in the language (particularly frequency in common disyllabic stems). Comparison of all measurements (such as duration) only occurred among like phonemes to avoid intrinsic duration differences for different phonemes. All the syllable initial consonants measured were in intervocalic position, with no preceding coda consonant. However, the quality, fullness, and tone of the surrounding vowels, as well the syllable type of the second syllable (open or closed), were not controlled for. These factors were shown to have no categorical effects on the consonant lengthening effects of stem prominence, which occurred in the onset of stem syllables (no disyllabic stems were investigated, so these were always the final syllables also) regardless of the surrounding environment (Manker 2012). While these factors may still have small effects on the duration of syllable initial consonants in addition to any stem prominence effects, minimal pairs or sets that would control for all or even most of these factors are extremely rare in Hän.
Additionally, comparison of the duration of segments in minimal or near minimal pairs could induce word frequency effects, where more common words tend to be pronounced with shorter duration. Nevertheless, §5 addresses this concern with a direct comparison of two words in a near minimal pair.

This study focused only on the medial consonants of these two-syllable words (CVCV(C)) in order to see if those in disyllabic stems act like stem initial consonants. The consonants in the first syllable were not tested because of word initial effects that can occur (in addition to the potential difficulty of measuring closure in word initial position). Most of the disyllabic stems in Hän happen to be non-possessable words, such as ‘man’ or ‘girl,’ so there was no grammatical way to elicit prefixed forms of those words in order to measure the duration of their initial segments in medial position.

For the phoneme /b/, only closure duration was measured. Closure was defined as the period of relative silence after the preceding vowel and before the onset of the following vowel. The phonemes /j/ and /g/ are phonetically affricates ([tʃ] and [qʃ] respectively), so both closure duration and release duration were measured separately. Release duration was defined as beginning after the silent period of the closure and ending when the following vowel formants became stable and well defined. A few examples of /j/ were removed because the speaker maintained a distinction between historical *d and *n, both of which are arguably voiceless unaspirated [ĉ], but with reflexes of *n being significantly shorter and sometimes voiced as [ʃ] (such as /ʃ ə j e/ ‘man’). The fricatives /ʃ/ and /ɣ/ were compared in both total duration and total voicing percentage. Total duration of fricatives was defined as the period of high frequency turbulence bounded by well-defined vowel formants. Total voicing percentage was calculated by dividing the duration of any voiced sections by the total duration of the segment. Voicing was determined by the presence of low frequency (below about 250 Hz) energy. Fricatives in stem onsets are often semi-voiced in Hän, thus having a lower total voice percentage than those in prefixes (Manker 2012). The closure duration of the ejective /t’/ was also measured in addition to the VOT (voice onset time). VOT was defined as beginning with the burst (following the closure) and ending with the presence of low frequency energy. Manker (2012) found that /t’/ in stems had a longer VOT than in prefixes (correlating with creaky voice quality commonly found in prefix ejectives).

Table 2: Examples of Disyllabic Stems Compared to Two-Morpheme Prefix + Stem Words

<table>
<thead>
<tr>
<th>Disyllabic Stem</th>
<th>Prefix + Stem</th>
</tr>
</thead>
<tbody>
<tr>
<td>/n̥aːɡa/ ‘fox’</td>
<td>/aːɡak/ ‘s/he is running’</td>
</tr>
<tr>
<td>/j aːbə/ ‘sheep’</td>
<td>/j aːbəɾ/ ‘his/her sleeve’</td>
</tr>
<tr>
<td>/hætˈər/ ‘birch’</td>
<td>/na-t’aw/ ‘it is flying’</td>
</tr>
<tr>
<td>/ʃ aːʃə/ ‘cow moose’</td>
<td>/ʃ aːʃəɾ/ ‘her own son’</td>
</tr>
<tr>
<td>/nəwəj/ ‘frog’</td>
<td>/a-ʃew/ ‘s/he is carrying’</td>
</tr>
<tr>
<td>/ʃrej ə/ ‘grayling’</td>
<td>/ni-j əew/ ‘our sister’</td>
</tr>
</tbody>
</table>
Recordings were made with a Zoom H4n Handy Recorder with an internal microphone at a sampling rate of 44.1 KHz and a bit-depth of 16 bits. Praat version 5.2.13. (Boersma & Weenick 2009) was used for all acoustic analysis. Two-tailed t-tests were used for analysis. A $p$ value of 0.05 or lower was considered to indicate significance.

4. Results

The results of this study show that medial consonants in two-morpheme words were pronounced no differently from those in one-morpheme, disyllabic stems. Figures (2) – (9) show these comparisons for each of the six consonants, with vertical bars representing the mean values rounding to the nearest millisecond (duration) or percent (total voicing percentage). Error bars indicate standard deviation. For stops and affricates, as shown in figures (2) – (4) release, closure, and total duration of the segments were not significantly different in the two sets of words.

Figure 2: Comparison of Intervocalic /ɡ/ Duration (ms) in Disyllabic Stems and Prefix + Stem Words

Figure 3: Comparison of Intervocalic /ʃ/ Duration (ms) in Disyllabic Stems and Prefix + Stem Words

Figure 4: Comparison of Intervocalic /b/ Duration (ms) in Disyllabic Stems and Prefix + Stem Words
As shown in figure (5), there were also no significant differences in the closure or VOT for the ejective /t'/.

![Figure 5: Comparison of Intervocalic /t'/ Duration (ms) in Disyllabic Stems and Prefix + Stem Words](image)

Lastly, as shown in figures (6)-(9), there were also no significant differences in duration (figures 6 and 8) or total voicing percentage (figures 7 and 9) for fricatives.

![Figure 6: Comparison of Intervocalic /ž/ Duration (ms) in Disyllabic Stems and Prefix + Stem Words](image)

![Figure 7: Comparison of Intervocalic /ž/ Total Voicing Percentage in Disyllabic Stems and Prefix + Stem Words](image)
These results suggest that disyllabic stems displayed prominence in medial consonants that are no longer stem initial, which suggests that what may have been an older system of “stem prominence” has been reanalyzed.

One additional comparison will be shown between near minimal pairs, to show that the surrounding vowel environment is not skewing the data. Figure 10 below shows compares the duration of the release and closure of the segment /g/ in the words /tʻəgæ/ ‘girl’ and /j ə-gæ/ ‘its own young,’ where the surrounding vowels, syllable type (open or closed) and tone of both syllables are controlled for. In general, such near minimal pairs are difficult to find, and comparing single tokens could actually induce frequency effects whereby more frequent words are pronounced slightly shorter, even among homophones (Gahl 2008). Nevertheless, this data, with that presented above, yields a uniform result showing that disyllabic stems are pronounced no differently from prefix + stem combinations.
5. Discussion

The results show that there is no significant difference in the pronunciation of the onset consonants of the second syllables in disyllabic stems and those in two morpheme prefix + stem combinations. This provides a clear example of prominence being applied to a non-stem initial consonant (as has also been noted as occurring in the history of Athabascan languages (Leer 2005). While this study did not measure the duration and other acoustic effects of consonants in the first syllables of disyllabic stems (CVCV), my impressions indicate that they are pronounced much like they are in prefixes. For example, the initial /t/' in /tʼəgæ/ ‘girl,’ is usually pronounced with no audible gap between the burst of the ejective and the onset of the schwa, and the ejective is mostly cued by the presence of laryngealization of the following vowel (see Manker (2012)). This seemingly aberrant short VOT ejective in stem initial position is shown below in figure 12, compared to an expected short VOT ejective in prefix initial position in figure 11. These can be compared to a long VOT type ejective that is usually found in stem initial position, as shown in figure 13. This observation would fit elegantly with the fact that /ə/ in /tʼəgæ/ is pronounced as [ə] and not [ø], thus making the syllable /tʼə/ more prefix-like. Future research may provide quantitative evidence to address this question.

Figure 11: Prefix initial “weak” ejective: /yət’aðəžæ/ ‘he caught up with her’
Figure 12: Stem initial “weak” ejective: /tʼəgæ/ ‘girl’
Thus, this data suggest that prominence in disyllabic stems occurs in the onset of the final syllable, and not in the onset of the stem syllable. This causes a set of exceptions if we continue to claim that only stem syllables receive prominence. However, there is a simpler way to describe the pattern of prominence in Hän. In all other words besides disyllabic stems, the stem is always the final syllable in the word. This is not the case in all Athabaskan languages, since most retain the historic suffixes as distinct syllables. Hän, on the contrary, has merged its suffixes with the preceding syllables, causing a light versus heavy stem distinction (for example /θāy/ ‘belt’ ~ /-ðày/ ‘belt’ (possessed) where a shorter voiceless /y/ alternates with the longer, voiced /y/ which has absorbed the possessive suffix). Thus, in all words except for disyllabic stems, it is ambiguous whether prominence is assigned to the final syllable or the stem syllable, since both usually occur as the same syllable. The rule for prominence was then reanalyzed as applying to final syllables, and this new pattern was adopted for disyllabic stems, despite what each morpheme was (stem, prefix, or otherwise historically). Thus, /tʼəgæ/, being a stem plus another stem (or particle), is pronounced like a prefix plus stem combination, but only because prominence is now assigned to final syllables and not stem syllables.

5.1. Alternative Analyses

Table 3 below shows several possible analyses of these data and their predictive abilities. First of all, we could assume that the historical morpheme categories remain as they were, or that they have been reassigned in one or two possible ways. Secondly, what may have been the historical rule of stem prominence may remain the same, or a new rule, such as final morpheme or final syllable prominence may be applied.

Scenario (1) assumes that historical morpheme categories remain the same, and the word /tʼəgæ/ is still analyzed as a stem + stem / particle. If prominence occurs on stem syllables, this
would predict prominence on the first and possibly second syllable, but this scenario incorrectly predicts based on the results of this study. In scenario (2), the same historical categories still exist (morphemes are marked with a category although they may not be semantically analyzable). Thus, it is possible /tʰægæ/ is considered two morphemes, in which case a “final morpheme” prominence rule would correctly predict. However, it seems unlikely that all disyllabic stems (such as /j əɹ e/ ‘man,’ /nætˈor/ ‘birch’) are still analyzed as being two morphemes, even if they are unanalyzable formatives (such as morphemes like con-ceive, de-ceive, etc., in English). In scenario (3) the final syllable is always analyzed as a stem and all preceded syllables as prefixes, so /tʰə/ would be reanalyzed as a prefix and /gæ/ as a stem. This is the only possibility in which a stem prominence rule would correctly predict; however, it would be unlikely that that all disyllabic stems were reanalyzed as prefix + stem combinations, unless it was a reverse analysis occurring after final syllable prominence was applied (that is, “the final syllable is prominent so thus it must be the stem”). Scenario (4) is precisely what was hypothesized in this study, but was proven false. If reanalysis of morpheme categories has occurred whereby a word like /tʰægæ/ is a single stem, we would expect prominence to occur only on the stem onset (/tʰ/). Scenario (5) seems most likely and is what is suggested by the result. While disyllabic stems are interpreted as single morpheme stems, prominence occurs on the final syllable of all words. This correctly predicts the outcome and is the most elegant description. This would require a reanalysis of an older rule of stem prominence, but is plausible because of the particular situation that occurred in Hän, in which all suffixes were lost, making most stem syllables also final syllables. In the handful of exceptions (disyllabic stems in particular), the rule was reapplied. In the case of widespread ambiguity, a final syllable prominence rule would be simpler and more salient to speakers (especially if morphological categories become ambiguous or blurred), and might be expected to dominate an older stem prominence rule.

Table 3: Other Possible Morphological Analyses of Disyllabic Stems

<table>
<thead>
<tr>
<th>Morpheme and Prominence Situation</th>
<th>Analysis</th>
<th>Prominence Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. same historical morpheme categories, same historical prominence rule</td>
<td>/tʰæ-gæ/ stem – stem / particle</td>
<td>[incorrectly predicts]</td>
</tr>
<tr>
<td>2. same historical morpheme categories (despite analyzability), new prominence rule</td>
<td>/tʰə-gæ/ stem – stem / particle</td>
<td>prominence on final morpheme</td>
</tr>
<tr>
<td>3. reanalysis of historical morpheme categories (2), same historical prominence rule</td>
<td>/tʰə-gæ/ prefix - stem</td>
<td>prominence on stem syllable</td>
</tr>
</tbody>
</table>
5.2. Final Syllable Prominence and Other Attractors of Prominence

Several studies (Kari 1990 for Ahtna, Tuttle 1998, 2003 for Lower Tanana, Hargus 2005a and 2007 for Witsuwit’en and 2005b for Deg Xinag and Sekani,) have stated that full vowels also receive some sort of stress. Hargus (2005a) identifies stems (morphological category), vowel quality, vowel quantity, position of syllable in word, and syllable type (closed or open) as parameters of stress in Witsuwit’en. A parameter such as vowel fullness, however, may outweigh the placement of stress on a stem, and thus a Witsuwit’en verb such as /negeʔ/ ‘it healed,’ (Hargus 2005a:401) consisting of a prefix with a full vowel followed by a stem with a reduced vowel will display primary stress on the prefix, not the stem. A similar result is found in sequences of high toned prefixes plus low tone stems (both containing full vowels) in Sekani, where the tone attracts stress more than the stem (Hargus 2005b:41). This data forces us to consider whether full vowels and / or tone might interact with final syllable prominence, and whether or not we can say words always display final prominence.

Though the sample of disyllabic stems in this study is too incomplete to compare those with different tone and vowel types, previous observations in Manker (2012) suggest there may be in fact two separate systems of stress or prominence at work in Hän. The current study has only investigated consonant lengthening (and its correlated effects) but not vowel duration. Manker (2012) found that consonant lengthening effects in stem initial position did not seem to be affected by the tone or vowel fullness, but full vowels in prefixes could often be as long as those in stems (pg. 98). A quick review of this data finds no significant difference in the length of prefix consonants whether they are before full or reduced vowels (/ð/ in medial, prefix initial position [CVðV-CV] averages 0.107 ms before full vowels and 0.119 ms before reduced vowels, p = 0.35). This suggests that, while a full vowel may attract stress in the form of a longer vowel, it does not increase the length of the syllable initial consonant in the way that stem prominence does. This presence of two prosodic systems in Hän, one that assigns prominence to consonants and vowels in all final syllables and another that assigns stress or prominence to full vowels and possibly high or low tone is an intriguing hypothesis but requires further investigation.

6. Conclusion

Evidence from the prosodic patterns of disyllabic stems indicates that the proto-Athabascan system of stem prominence has likely been reanalyzed in Hän. Disyllabic stems, which historically were formed from combinations of prefixes, stems, particles, and suffixes, are now unanalyzable and represent single stem morphemes. However, prominence occurs on the
final syllable of these stems, despite whatever the historical morphological category may have been. It is most likely, therefore, that stem prominence is now reinterpreted as final syllable prominence. Future study may provide quantitative descriptions of first syllable consonants and vowels in disyllabic stems to corroborate these findings. Additionally, the relationship between final syllable prominence and stress, which may be attracted by vowel quality and tone, should be further investigated.

7. References


Appendix

Eagle Hän Consonant Chart

<table>
<thead>
<tr>
<th></th>
<th>LABIAL</th>
<th>CORONAL</th>
<th>DORSAL</th>
<th>GLOTTAL</th>
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<tbody>
<tr>
<td>plain</td>
<td>lab.</td>
<td>plain</td>
<td>dent.</td>
<td>lat.</td>
</tr>
<tr>
<td></td>
<td>/b/</td>
<td>/d/</td>
<td>/dð/</td>
<td>/t/</td>
</tr>
<tr>
<td>aspirated</td>
<td>/t/</td>
<td>/tθ/</td>
<td>/tʃ/</td>
<td>/ts/</td>
</tr>
<tr>
<td>ejectives</td>
<td>/t'/</td>
<td>/tθ'</td>
<td>/tʃ'</td>
<td>/ts'/</td>
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<td>/ɬ/</td>
<td>/s/</td>
<td>/sr/</td>
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<td>/ɬ/</td>
<td>/z/</td>
<td>/zr/</td>
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<td>voiced sonorants</td>
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<td>/l/</td>
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<td>------------------</td>
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<tr>
<td>voiceless sonorants</td>
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<td>/ŋ/</td>
<td></td>
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</table>