Acoustic Clues for Understanding the Morphological Structure of Disyllabic Stems in Hän Athabascan
The Hän Athabascan Language

- The traditional language of Eastern Alaska and Western Yukon.
- Spoken in the villages of Eagle, Alaska, and Dawson City, Yukon.
The youngest speakers are in their early 60s, so the language was last naturally transmitted in the 1950s and 60s.

Today there are between 8 and 15 speakers, depending on the definition of fluency.
But there are efforts to revive the language...
Athabascan morphemes can be divided into stems, prefixes, and suffixes, while words can be created by attaching any number of prefixes to a stem (or none at all). Stems usually consist of a single syllable and take the form CV(C) (Krauss & Golla, 1981:69).

Several studies (Kari 1990 for Ahtna, Tuttle 2005 for San Carlos Western Apache, Rice 2005 for Hare, Leer 2005) have indicated that the stem syllable is phonetically prominent in Athabascan languages.
Manker (2012) shows that duration is the most reliable distinction in indicating stem prominence in Hän Athabascan, particularly in stem initial consonants. Additional features of consonants, such as voicing in fricatives and voice quality following ejectives are also indicators of stem prominence in Hän.
Percent Length of Prefix Segments Compared to Stem Segments
(p < .05 for all)
Disyllabic Stems

- In the modern language, there are some “stems” with two syllables that cannot be analyzed by current speakers (synchronously). This study investigates the phonetic production of such disyllabic stems---do they display stem prominence, and if so, has the structure of the stem been reanalyzed? Does this occur in the first or second syllable?
Historically, disyllabic stems in the modern language may have consisted of a prefix plus a stem, two stems, or prefix plus a suffix, etc.

<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>*də-ne</td>
<td>prefix + suffix</td>
<td>/jəže/</td>
</tr>
<tr>
<td>moose</td>
<td>*də-nig'iy-i</td>
<td>prefix + stem (+ suffix)</td>
<td>/jəju/</td>
</tr>
<tr>
<td>girl</td>
<td>*t'ed -gaye</td>
<td>stem + particle</td>
<td>/t'əgæ/</td>
</tr>
</tbody>
</table>

In the modern language, such words are not analyzable, or are only partly analyzable (such as /t'əgæ/) and may be considered disyllabic stems.
Synchronic Structure of Disyllabic Stems

Some suspected disyllabic stems such as /jɛjɛ/ ‘man’ or /t’ɛɣæ/ ‘girl’ structurally appear as though they might represent combinations of prefixes and stems according to a synchronic interpretation, thus /jɛ-je/ and /t’ɛ-ɣæ/; this analysis is based on the fact that the phoneme /ɛ/ occurs phonetically as [ɛ] or [i] in both of these examples which is typical of the allophone found in prefixes (in stems, /ɛ/ is realized as [ø] (de Reuse, p.c.)).
So the first syllable of these disyllabic stems may be realized phonetically like a prefix, but is the second syllable realized like a stem? Some preliminary evidence indicated it might not be.

This example shows the monomorphemic /ǰəǰe/ ‘man’ compared to /ǰə-ǰà/ ‘his-friend.’ Is the prefix-stem boundary being marked with a longer /ǰ/ in ‘his-friend’?
This Study

- Specifically, this study tested the second syllables of disyllabic stems for prominence (it is difficult to add prefixes to most of these stems which could be a necessary method for measuring stop closure lengths within the word).

- Thus, would the words /jəžar/ ‘cow moose’ and /jə-žar/ ‘her-son’ be pronounced the same, or does only the /ž/ in ‘her-son’ display stem prominence due to the clear morpheme boundary?
101 example words were collected from one fluent speaker of Hän (RR) within complete sentences. These included disyllabic stems as well as analyzable prefix + stem combinations for comparison (with all examples being two syllable words with the consonant being in intervocalic position), thus:

- /nàgə/ ‘fox’ (disyllabic) vs. /a-gak/ (3rd sng / l-classifier – ‘runs’)

Six different phonemes were tested: /g/ / ɟ/ /ʒ/ /ɣ/ /b/ and /t’/ (Comparisons were not made across different phonemes).
For the stop /b/, only closure length was compared. For /j/ and /g/, closure and release length were both compared. Phonetically these phonemes are realized as [t̪ʒ] and [q̪ʁ] respectively.

The fricatives /ʒ/ and /ɣ/ were compared in duration and total voicing percent; Voiced fricative phonemes tend to display some semi-voicelessness in stem onsets (Holton 2000, Tanacross, Manker 2012, Hän).

The ejective /t’/ was compared for closure duration and VOT; VOT of /t’/ was found to be longer in stem onsets and creaky voiced followed /t’/ in prefix onsets (Manker 2012)
Results

- Initial results were a bit mixed but mostly indicated that second syllable onsets of disyllabic stems were realized just like those in other stems, unlike the preliminary results.
- Most p values were very insignificant, some were around 0.1, and the results for /j/ actually yielded a significant p value initially.
Comparison of Duration of Intervocalic /g/ in words with 1 or 2 morphemes

For example, /nàɡə/ ‘fox’ vs. /a-ɡaːk/ ‘s/he-is running’
Comparison of Duration of Intervocalic /j/ in words with 1 or 2 morphemes

- For example, /jəje/ ‘man’ vs. /jə-jà/ ‘his-friend’
Comparison of Duration of Intervocalic /b/ in words with 1 or 2 morphemes

- For example, /ǰəbe/ ‘sheep’ vs. /ǰə-bà/ ‘his-sleeve’
Comparison of Duration of Intervocalic /t'/ in words with 1 or 2 morphemes

- For example /haːt'ɔr/ ‘birch’ vs. /nə-t'aw/ ‘it-is flying’

<table>
<thead>
<tr>
<th>Duration Type</th>
<th>Group 1</th>
<th>Group 2</th>
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<tbody>
<tr>
<td>Closure</td>
<td>161.1</td>
<td>213.8</td>
</tr>
<tr>
<td>Release</td>
<td>131.3</td>
<td>152.2</td>
</tr>
<tr>
<td>Total</td>
<td>292.4</td>
<td>366.0</td>
</tr>
</tbody>
</table>

- p = 0.09 for closure and release duration
- p = 0.054 for total duration
Comparison of Duration of Intervocalic /ž/ in words with 1 or 2 morphemes

- For example, /jəžar/ ‘cow moose’ vs. /jə-žar/ ‘her-son’
Comparison of Total Voicing Percentage of Intervocalic /ž/ in words with 1 or 2 morphemes

1 morpheme: 41.23%
2 morpheme: 34.52%

p = 0.38
Comparison of Duration of Intervocalic /ɣ/ in words with 1 or 2 morphemes

For example, /nàɣay/ ‘frog’ vs. /a-ɣew/ ‘s/he-carries’
Comparison of Total Voicing Percentage of Intervocalic /ɣ/ in words with 1 or 2 morphemes

![Bar chart showing total voicing percentage comparison between 1 morpheme (disyllabic) and 2 morphemes. The percentages are 34.55% for 1 morpheme and 32.45% for 2 morphemes. The p-value is 0.6.]
After reviewing this data, which yielded mixed but mostly insignificant results, two additional factors were discovered that could have an effect on the length of the intervocalic consonant.
First of all, a preceding schwa / reduced vowel /ə/ caused the following consonant to be significantly shorter.

Comparison of consonant duration following a reduced or full vowels for all segments

*duration (ms) p < 0.001*
Comparison of consonant duration following a reduced or full vowels for /g/
Thus, this explains why comparing /t’əɡæ/ and /a-gak/ appeared to yield a significant difference in the preliminary results. When this environment is controlled for, there is still no significant difference (for example between /nagə/ ‘fox’ and /a-gak/ ‘he is running’ or /t’əɡæ/ ‘girl’ and /jə-gæ/ ‘her young’).
Secondly, two forms containing a /ȷ/ actually maintained a contrast with a historically distinct /j/. These originated from *n and *d separately; thus:

- *dəne < /ȷəje/ ‘man’
- *dənig-i < /ȷəju/ ‘moose’
For some Hän speakers, *n remains as a fully voiced /d/ or /ɲ/ which contrasts with a voiceless unaspirated /d/ and /ɲ/.

This speaker’s reflexes of *n varied freely in voicing, but were always significantly shorter than reflexes of *d. This made it appear as though a word such as /ɲə-ɲà/ was marking a morpheme boundary with a longer /ɲ/ than in /ɲəɲe/ when in fact these were different phonemes.
When these examples (/ǰəǰe/ and /ǰəǰu/) were removed, there was no significant difference.

(p values listed are between 1 and 2 morpheme examples (gray and green) and not *n, which were significantly different)
Analysis

- Overall, the onsets of the second syllables of disyllabic stems were in fact realized identically to stems, despite whatever they may have been historically.
- For example, the /ʒ/ in the word /ǰəžar/ ‘cow moose’ was no shorter than the /ʒ/ in /ǰə.žar/ ‘her own son.’
- Words like /t’əɡæ/ ‘girl’ or /ǰəje/ ‘man’ are produced phonetically as if they are sequences of a prefix plus a stem, despite their analyzability in the modern language.
In Hän, it appears that prominence is assigned to the second syllable of “disyllabic stems,” and such prominence does not necessarily reflect the historical picture, for example /t’əgæ/ ‘girl,’ or /ǰəǰe/ ‘man.’

Furthermore, suffixes in Hän are only vestigial, meaning stems are almost always the final syllable of a word. Thus, is prominence actually just assigned to the final syllable of a word, or have these categories just been redefined (-gæ and –je are now stems)?
References

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