REPLICATING GODDARD: A CONTEMPORARY AIRFLOW AND EGG STUDY OF DENE SŲŁINÉ

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1. Introduction

Over one hundred years ago, P. E. Goddard took a field trip up to a Dene Sųłiné (Chipewyan) community in Alberta and northern Saskatchewan to create a description and illustration of the sounds of those related Athabaskan (or Dene, as speakers prefer) languages. His work was motivated in part by an interest in making a comparison to the Pacific Dene languages, Hupa and Kato. In these Pacific Coast Dene communities where he had been working and studying, he had adopted instrumental techniques recently introduced by L'Abbé Rousselot, that he adapted for the field, collecting empirical data on Dene speech. In particular he used static palatography and the kymograph. By doing so, he became one of the first to bring laboratory techniques into the field. Goddard's body of work on Hupa and Kato communities, and his recordings of the northern Dene (Cold Lake, Bear Lake and TsuuT'ina) are among the earliest instrumental field phonetics performed in North America. Working with consultants and collaborators in the communities he visited, he recorded airflow and pressure data. He published the results of these field trips in a series of articles between 1906 and 1929 (Goddard 1904, 1905, 1907, 1912, 1929).

Of no small importance is the fact that Goddard's work represents a record of speech in these communities from 100 years ago. The data is an important historical document for both the indigenous communities and the academic linguists. This work represents a bridge between the present day and past communities as well as an historical ground to work from. In most respects, the Dene communities have undergone tremendous change since that time, and most are dealing with language endangerment and loss. The Dene Sųłiné retain a strong community memory of Goddard's visit and the descendants of his consultant, Jean-Baptiste Ennow. The community however was unaware of Goddard's published work. Interesting, this work of Goddard's has also been overlooked by the academic communities. This oversight may in part be due to the fact that the kymograph itself is no longer used in speech research.. However, data from airflow and air pressure, and static palatography are still collected in the field, though this data is supplementary to acoustic data, from which a more complete document can be constructed. As in today's phonetic fieldwork, Goddard was interested in illustrating the sound systems of these languages, providing an empirical base of comparison to other languages. Goddard used a kymograph. Today this is done with acoustic recordings supported with other instrumental techniques such as devices that collect airflow and pressure.

Another important factor comes into play when considering the relevance of the Goddard-Ennow data. Even in contemporary work, phonetic field data tends to be overlooked in language documentation practices. Its importance is often unjustifiably construed as incidental to the broader goal of documenting language and grammar, which may include a brief phonological description, but rarely includes systematic phonetic data. However, without this type documentation of the speech community, we are dependent exclusively on orthographic and IPA. These symbols and systems cannot fully represent or encode the unique details of the community's speech or capture the systematicity of factors that are not symbolic, such as differences in the production of a given segmental contrast or postlexical processes. This is a shortsightedness that is underlined by current laboratory approaches to phonology, in which phonological generalizations emerge from phonetic data and experimental phonetics, and provide the basis for phonological theory. The lack of systematic documentation and analysis of speech is almost painfully ironic because the communities in question are oral cultures. Speech and language are the principle infrastructure on which a community's cultural knowledge is built. The loss of language, which is equal to the spoken word in oral cultures, is equivalent to a devastating loss of knowledge and culture.

There are two purposes to the present paper. One is to provide a link between the past and the present Dene speech communities by revisitng Goddard's techniques using comparable contemporary means. Second, we wish to further establish the role and importance of phonetic field data in contemporary language documentation practices.

1.1 Cold Lake

Goddard worked with Dene Sųłiné Jean-Baptiste Ennow from the Cold Lake community in Lloyminster, Saskatchewan (recorded as Ennou by Goddard, Ennow is the spelling the family uses). Thus we refer to the data as the Goddard-Ennow data in accordance to the preferences of the Dene Sųłiné communities. Goddard and Ennow produced a series of texts that Goddard transcribed and published together with the kymographic and palatographic studies (Goddard, 1912). Our purpose in this study is to replicate the original kymographic study using contemporary techniques, and with generally similar goals: (1) to illustrate the sounds of the language, (2) as a point of comparison to other languages, but also particularly, (3) as a point of comparison to the current language as it is spoken today, one hundred years after the Goddard-Ennow study, providing a link between the present speech community and the Goddard-Ennow documentation.

1.2 The Kymograph

In the late 19th century, L'Abbé Rousselot introduced experimental techniques and methodology to the study of speech. His work, *Principes de Phonétique Expérimentale*, was published in two volumes, in 1897 and 1901. These extraordinary volumes lay out the parameters of speech research within which we still operate. Much in the style of contemporary laboratory phonetics, Rousselot borrowed the kymographic technique from medical research; the kymograph was invented in the mid 1800's as a medical device used to record variations in blood pressure. Rousselot adapted it to speech research using the reocrod of air pressure and flow to understand the timing and the mechanisms of speech production.

Goddard was obviously familiar with Rousselot's work. He was using techniques described by Rousselot, such as kymography and static palatography, within a couple of years of the publication of the Rousselot volumes. In 1905, Goddard noted that the Rousselot kymography apparatus, as illustrated in Figure 1, provides information about the timing and duration of speech gestures. He also observed that voicing in the speech sounds is recoverable from the device. Duration, timing and pitch information is considered a crucial part of the documentation of better studied languages and the theories that are built around them. Goddard used the kymograph in a series of studies on the Athabaskan language communities on the Pacific coast, and he took it into the field in southern Alberta in 1905, and this, within 4 years of the publication of the second volume of Rousselot's *Principes*.

The kymograph consists of a rotating cylinder, whose speed is determined by a mechanical clockwork. It has one or more tracing arms which consist of flexible tubing with a rubber diaphragm or tambour on one end and a reed pen on the other, as pictured on the right in Figure 1. The cylinder itself is covered with smoked paper, and tracings are scratched into the paper by the reed pen. The pen is moved by the changes in air pressure in the tube, caused by the movement of the diaphragm. Three types of data could be recorded with the kymograph: (1) oral airflow by placing the diaphragm against the mouth, (2) nasal airflow by inserting a nasal olive into a naris or nostril, (3) laryngeal activity by placing the rubber diaphragm against the larynx. An example of Goddard's kymograph recording is provided in Figure 2.

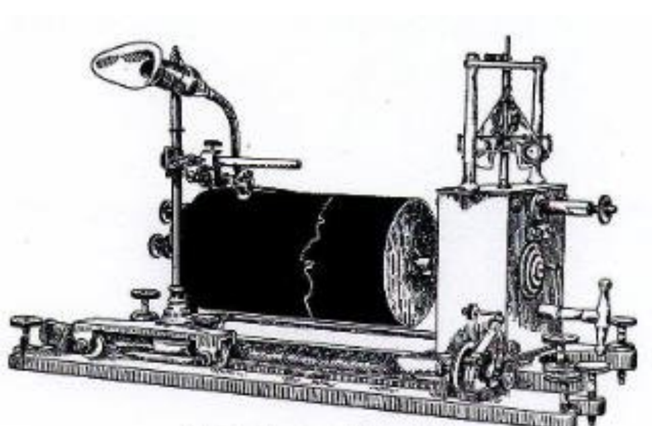

Fig. 1.—Kymograph (Rousselot).

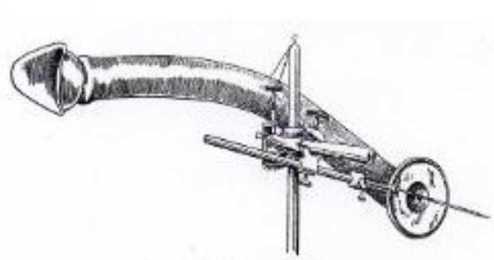

Fig. 2.—Vowel Tracer (Goddard).

Figure 1 The kymograph and tracing arm from Goddard's *Mechanical Aids to the Study and Recording of Language* (1905)

1.3 Current Study

In this study our goal was to replicate the earlier Goddard study as closely as might be possible. To this end, we worked with two contemporary speakers of Dene Sųłiné, recording airflow in conjunction with electroglottography (EGG). One of our speakers, Mrs. Val Wood (Cold Lake, Alberta), has worked extensively on the Goddard texts, heading, with Dr. Sally Rice, a retranscription and translation program of the Goddard-Ennow texts in contemporary orthography for use in community language revitalization efforts. Our second speaker, Mr. Horace Adams (Lac du Fond, Saskatchewan), had recently completed work towards his Community Linguistic Certificate (CLC) through the University of Alberta's CILLDI (Canadian Indigenous Language and Literacy Development Institute) program and is presently at work on a dictionary of Dene Sųłiné. Both were familiar with the airflow and EGG techniques that were used in the study.

2 Methods

2.1 Participants

In July 2009, the two speakers of Dene Sųłiné were recorded in the Department of Linguistics Phonetics Lab at the University of Alberta, using a SciCon RD airflow set-up with electroglottography. The word list from the original Goddard-Ennow study was used as a basis for this study. Mrs. Wood was familiar with Goddard's orthography and tended to use it as a reference for her productions. Mr. Adams was less familiar with Goddard's orthography, which differs considerably from the one in current use, thus he tended to use the English gloss as a reference point, producing a Dene Sųłiné word for the English gloss. As a result, there are differences in the performance of the words on the list between speakers.

2.2 Procedure

In this replication of the Goddard-Ennow kymographic recordings, a Scicon PCquirerX data acquisition system was used. This instrument allows the recording of up to five channels simultaneously, an audio signal, and three additional channels recording oral airflow, oral pressure and nasal airflow. A fifth channel was used to record laryngeal activity using an electroglottography signal. For this purpose we used the Glottal Enterprises EGG system. In the EGG set-up, the system records vocal fold movement by measuring the impedance across the vocal folds. This is done by placing two small probes on the throat on both sides of the larynx. As the vocal folds close and open the impedance across the glottis decreases and increases respectively. The impedance is recorded as a waveform and the signal is used to give a measure of vocal fold movement.

Participants were seated next to the equipment and we demonstrated the equipment. A nasal mask was secured over the nose and the two EGG probes were positioned so that the best possible signal was recorded. The oral pressure tube was adjusted so that it would not impede movement of the tongue during articulation. Two to three practice recordings were made, the gain on the individual channels was adjusted to satisfactory levels. When the participant was ready to begin the recording session, the participant produced as many words from Goddard's list as they were comfortable producing in a block which was then followed by a break. Participants were able to take the mask away from their mouth during the breaks. A new block was recorded after the break. The recording session took about 45 min on average, including setup time and recording. In this time, about 25% of Goddard's original list was reproduced.

2.3 The Kymograph and the EGG/Oral and Nasal Airflow

This section is written orient the reader to the data from the Goddard-Ennow and the current study.

Figure 2 is taken from Goddard's (1912) publication on Dene Sųłiné which contains the kymographic tracings under discussion. The kymograph tracings provide information on oral flow and laryngeal activity. From these tracings we can interpret broad details of the timing of the articulators and voicing. There are, of course, no audio signals in the Goddard record, nevertheless these data may provide valuable information about the speech patterns in the community from one hundred years ago.

The kymograph provides two channels (on two separate tambours) of information, which as noted are recorded on paper mounted on a rotating drum[1]. For tracings 1-26 in the Goddard-Ennow recordings, the breath tracing is the top tracing. In the original record, a second channel was held against the neck at the larynx. In the remainder of the tracings (26-143), a second channel was connected to the nose, but as Goddard reports: 'Tracings from the nose to show nasalization of the vowels were attempted but proper adjustment could not be secured in the time available.' The nasal channel does not provide interpretable data in this record.

An illustration Figure 2 is provided. The first channel is top tracing. This is the breath tracing. The lower tracing is the laryngeal movement. For some of the tracing, such as this one, Goddard segmented the word into discrete consonant and vowel sounds. In this figure, we have placed numbers under Goddard's segmentation, (1) is the stop closure of the /d/ and (2) is the duration of the vowel, including, it appears, the burst release of the consonant. We can also see the voicing of the vowel in this trace, which gives us information about the timing of the voicing. Goddard added a third interval in which the oral flow returns to near its start value, with little evidence of voicing.

[1] Duration can be calculated using the circumference of the drum and the rate of rotation. However, we did not calculate duration.

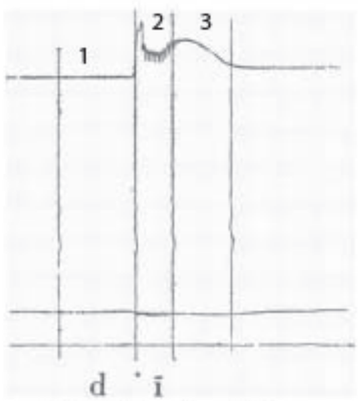

Fig. 13. dī, chicken.

Figure 2 Example kymographic tracing from Goddard's (1912) recordings of Dene Sų̨łiné including the original figure number and label.

Our data collection is broadly comparable to the Goddard-Ennow data. Figure (3) illustrates the data collected in the current study. From the top channel to bottom in Figure (3), the audio signal is shown on the first channel, the oral flow which is similar to the breath tracing is in the second channel, oral pressure is recorded on the third channel, nasal flow is shown on the forth channel and the EGG or vocal fold movement is on the fifth channel.

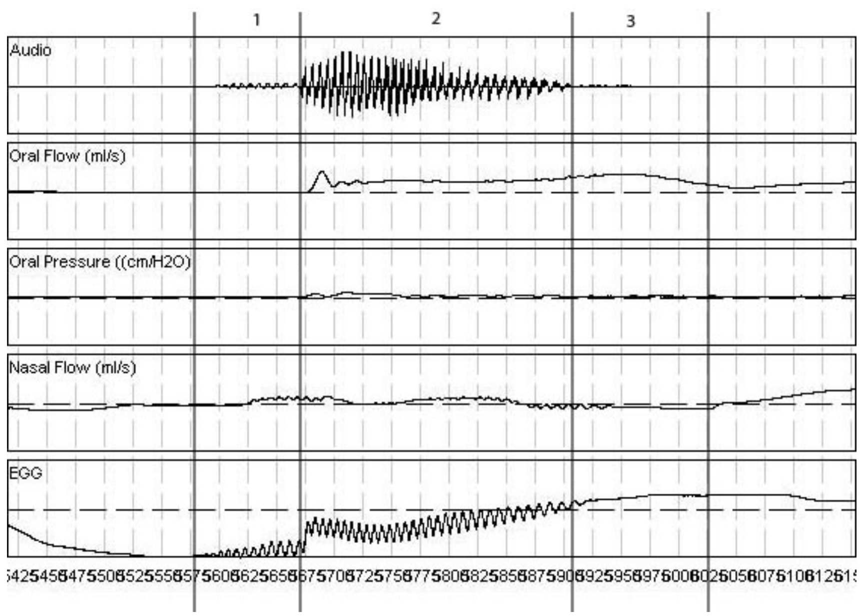

Figure 3 Recording of /di:/ 'chicken' by Mr. Adams.

Figure 3 is an illustration of Mr. Adams producing /di:/ 'chicken', the same item as we find in the Goddard-Ennow study in Figure 2. Numbers have been inserted above the figure to orient the reader to the segment intervals we are discussing. In this token, in contrast to the Goddard-Ennow data for the same item, the /d/ segment is clearly voiced, which can be seen in both the audio and the EGG channels. Interval (2) begins with a slight burst of air, following the release of the /d/, after which the vowel begins. As in Goddard's tracing, a third segment has been marked at the cessation of voicing in Figure 3. In both tokens, the Goddard-Ennow example and Mr. Adam's example, show an increase of airflow over the initial state after the cessation of voicing of the vowel at (3).

3. Data and Results

For this study, nine example tokens were selected from the items recorded. These exemplify the timing patterns and segmental patterns of the data gathered. We present the Goddard-Ennow data first and then the production by Mr. Adams. Words produced by Mrs. Wood were only shown if they were useful in illustrating differences between the two speakers and the Goddard-Ennow data. EGG recordings did not successfully record voicing for Mrs.Wood.

The example of [di:] discussed briefly above (Figures 2 & 3) illustrates a token of a fully voiced consonant, the closure starts (1), the vowel (2) with a slight burst of air at the onset of the oral flow. Notice the vowel begins at this point, indicating that the segment is an unaspirated stop. In this item for Mr. Adams there is obvious laryngeal movement in the EGG signal in channel four well before the release of the /d/. Goddard observes that the initial stop is often voiced in Dene Sųłiné (Goddard, 1912); however in Figure 2, from Goddard, there is little obvious voicing during the closure period of the /d/ segment. This may be due to low amplitude voicing not registered in the kymographic tracing, or to variation in the production of voicing in the closure period of stops.

Goddard's recording of /deł/ [dəɬ] 'crane', Figure 4, illustrates an alveolar stop in initial position and a voiceless lateral fricative in coda; the segmentation is Goddard's. In this figure, the top tracing indicates oral flow and the bottom tracing, nasal flow. Note the sharp onset of flow immediately after the release of the stop, indicative of an unaspirated stop. The airflow gradually drops off during the articulation of the vowel and then increases slightly during the lateral fricative. There is no indication of voicing during the /d/ closure or during the lateral fricative, which Goddard transcribes as the voiceless lateral fricative ('L').

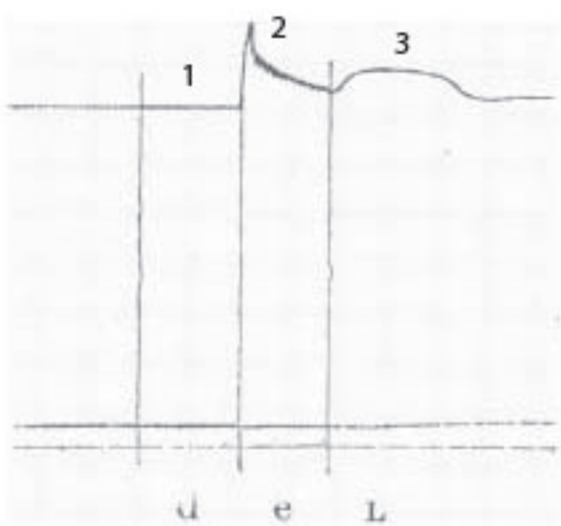

Fig. 14. deʟ, crane.

Figure 4 Goddard's (1912) kymographic tracing of /deɬ/ 'crane'.

Figure 5 is a token of Mr. Adams producing the same word: /deɬ/ [təɬ] 'crane'. As in Goddard, there is no voicing during the stop closure. The air flow visible in the vowel (channel 2) begins gradually and increases in amplitude as it moves into the fricative, as befitting fricative airflow. The EGG (channel 4) indicates that the fricative is voiced through most of its articulation. The sharp increase in airflow (channel 2) indicates that this is a likely instance of a lateral fricative. Although it is hard to determine the quality of the voicing in the Goddard-Ennow tokens, the two tokens are quite comparable otherwise.

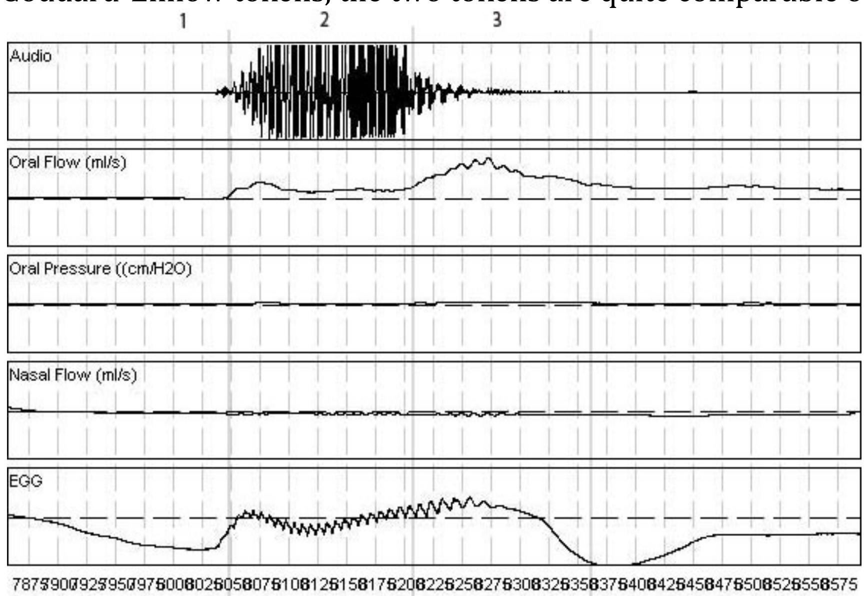

Figure 5 Recording of /deɬ/ 'crane' by Mr. Adams.

Figure 6 is an instance of the production of /ɬu:we/ 'fish' from Goddard-Ennow. The voiceless lateral fricative [ɬ] is in initial position (1). As with /deɬ/, in Figure 4, high oral airflow occurs during the frication period (1), which drops off into a period of voicing (2). After the vowel we note a period of low amplitude (3), which we associate with the labio-velar approximant [w] followed by voicing of the final vowel (4).

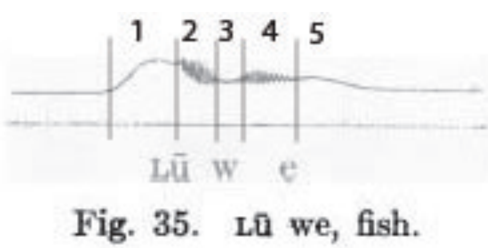

Figure 6 Goddard's (1912) kymographic tracing of /ɬu:we/ 'fish'.

Compare this to Mr. Adams' production of [ɬue] in Figure 7. In this production no intervocalic glide is present to break up the two vowels. A gradual onset of oral flow precedes the first interval (1), which we have annotated as the voiceless lateral fricative /ɬ/. Interval (2) is the vowel sequence [ue]. The interval is voiced throughout, as we can see in both channels 1 and 4, which we expect. Note that airflow increases during the production of this vowel as its amplitude decreases. Near the end of the interval (2) where the offset of voicing occurs, as indicated by the EGG signal (4), there is a sharp increase of nasal flow in channel 3. This release of a small amount of nasal flow often occurs at the end of utterances produces by this speaker and is likely due to breathing.

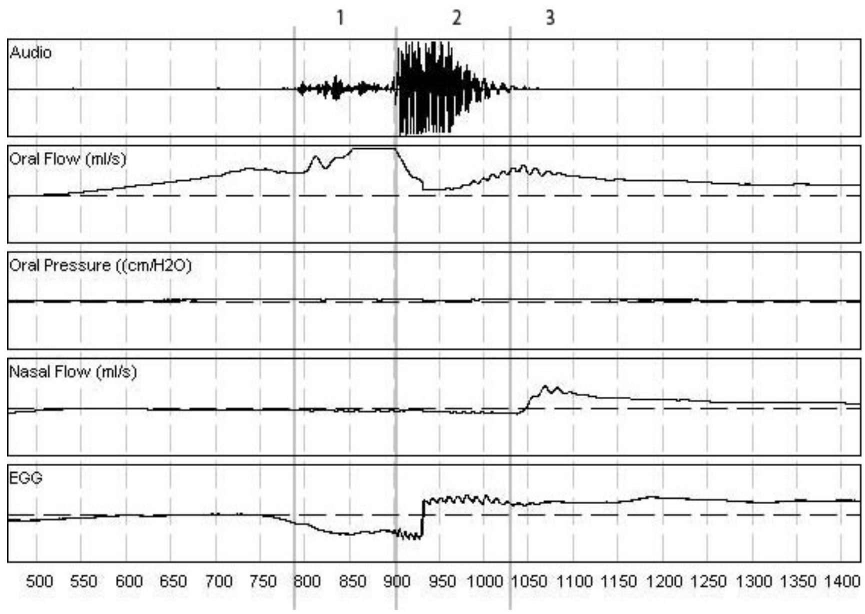

Figure 7 Recording of [ɬue] ‘fish’ by Mr. Adams.

The next series of productions illustrate the token [tɬ’i:ze] ‘a fly’, which begins with the lateral affricate ejective [tɬ’]. In Figure 8 is Ennow’s production. In this tracing (#18 in the Goodard-Ennow dataset) only the airflow trace is present. However this is a very nice example of ejective airflow. A canonical ejective described by Ladefoged (1993) begins with a simultaneous oral and glottal closure, followed by an oral, then glottal release. Air is expressed at the oral release by raising the larynx during the closure period, which compressed the air captured in the vocal track. We take the sharp rise in the airflow to indicate this release of the oral closure (1). Note that the glottis is still closed at this point, and the ejective airflow is confined to what is trapped above the larynx. Thus in the Ennow-Goddard trace we see a sharp release and a longish drop off in the airflow. This is a characteristic pattern among the ejectives across the Dene languages (Hogan 1976, Wright et al. 2002, McDonough 2003, McDonough and Wood, 2008). A second rise in airflow is associated with the remainder of the word, VCV sequence consisting of voicing striations interrupted by a short flat section. We associate the flat section with the voiced alveolar fricative /z/ segment.

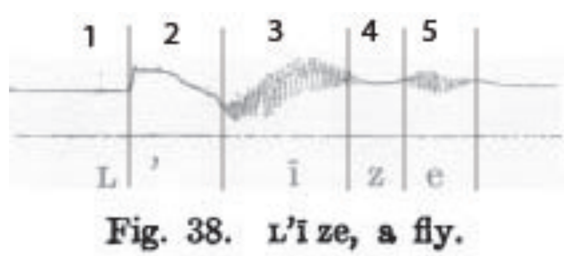

Figure 8 Goddard’s (1912) kymographic tracing of [tɬ’i:ze] ‘a fly’.

In Figures 9 and 10 are the tracings of Mr. Adams and Mrs. Wood's productions of [tɬ'i:ze] 'a fly', showing all four channels. In the waveform of both (channel 1), the word begins with an ejective, showing the characteristic Dene ejective pattern –simultaneous closure trapping air in the vocal track, oral release, glottal release. It includes a period of no activity, what Hogan (1976) termed 'a period of silence', after the oral release. This is caused by a delay in the release of the glottal closure. Observe in channel 2 of both utterances, there is a small rise at (2) which we associate with the oral release in the waveform. In a study of the cross-Dene stop and affricate releases, McDonough and Wood (2008) classified this timing pattern as representative of a distinct type of ejective in which the release period is a principle part of the main portion of the segment, contrasting with other types in which the glottal release follows more directly after the oral release as part of the transition of the onset into the vowel, such as those ejectives found in the Bantu languages (Lindau, 1984) and in some Dene languages (Wright et al. 2002; Bird 2002). The oral releases in the ejectives in Figures 10 and 11 show up as a small period of low amplitude in the waveform; it is followed by another period of closure before the amplitude of the vowel begins.

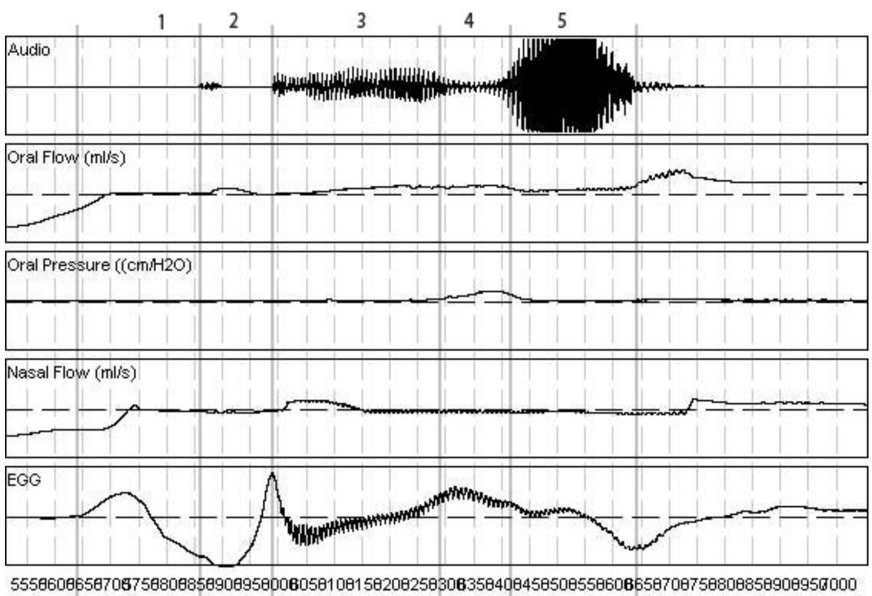

Figure 9 Recording of HA producing the word [tɬ'i:ze] 'a fly'.

We also note that in channel 4, the EGG channel which measures laryngeal activity, very strong vertical changes occurring in the signal (intervals 1 and 2) associated with the ejective articulation. However, the timing and alignment of the changes are quite different in each speaker and across individual utterances, precluding a clear association of this gesture to the ejective articulation.

In both Figures 9 and 10, the period after the ejective consists of two distinct periods of high amplitude we associate to the vowels, broken by a period of very low amplitude. In Mr. Adam's token the amplitude of the second vowel (5) is much larger than the first (3), though this appears to be a loudness factor, as the airflow signal (channel 2) drops off at this point. Note also in Mr. Adam's production, a small rise in air pressure (channel 3) during the production of the fricative /z/, which is voiced throughout. For Mrs.

Wood, the intervocalic consonant (5) is longer than Mr. Adams’ and shows little evidence of voicing; the length distinction is in keeping with the difference between a voiced and voiceless fricative. In both, there is a rise in oral airflow after the articulation of the vowel, likely a release of sub-glottal air before inhaling.

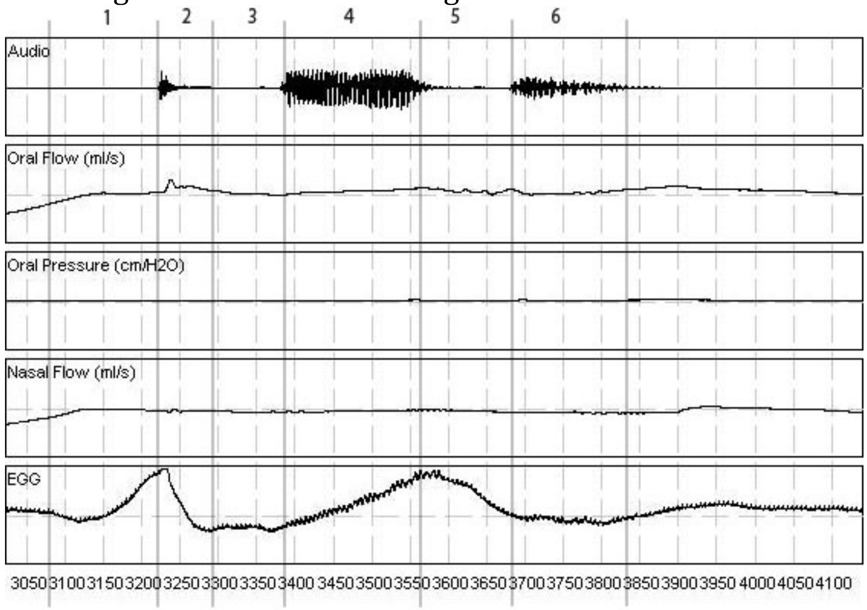

Figure 10 Recording of [tɬ’i:ze] ‘a fly’ by Mrs. Wood.

There are strong similarities between the current speakers’ and the Goddard-Ennow tokens of [tɬi:ze] ‘a fly’, in the distinct timing profile of the ejective and in the shape of the VCV sequences that makes up the rest of the word. Insofar as this is the case, this indicates that the particular articulation of the ejective in Dene Sųłiné is consistent over the past 100 years.

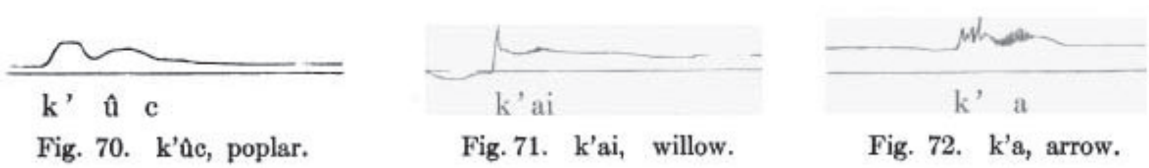

Figure 11 Goddard’s (1912) kymographic tracing of [k’u] ‘poplar’ [k’ai] ‘willow’ [k’a] ‘arrow’.

Figures 11–13 illustrate three velar ejectives from the words [k’u] ‘poplar’, [k’ai] ‘willow’ and [k’a] ‘arrow’. Figure 11 is the Ennow-Goodard token, Figures 12 and 13 are Mr. Adam’s and Mrs. Wood’s tokens respectively. As with the ejectives in Figures 9 and 10, following the burst release of the ejective is a period of silence before the onset of the vowel in each word. The vertical movement found for the lateral affricate ejective also occurs for the velar ejective as seen in Figures 12 & 13. In fact this vertical movement in the EGG signal is consistent in the data for all ejectives. However, the relationship of this movement to the signal in channel 1 is not consistent, either within or across the two speakers. We simply note its presence, and comment that it is possibly a reflection of the vertical movement of the larynx that is argued to be part of the articulation of the ejective, though we have no clear way of testing that the vertical movement in the EGG signal reflects laryngeal movement. Also, it may be the case that the differences we are seeing in the EGG signal between speakers are reflections of actual differences in the glottal-oral closure-release timing for the two speakers. Unfortunately, Mrs. Wood's EGG signal is not a dependable signal, so we can make no observations.

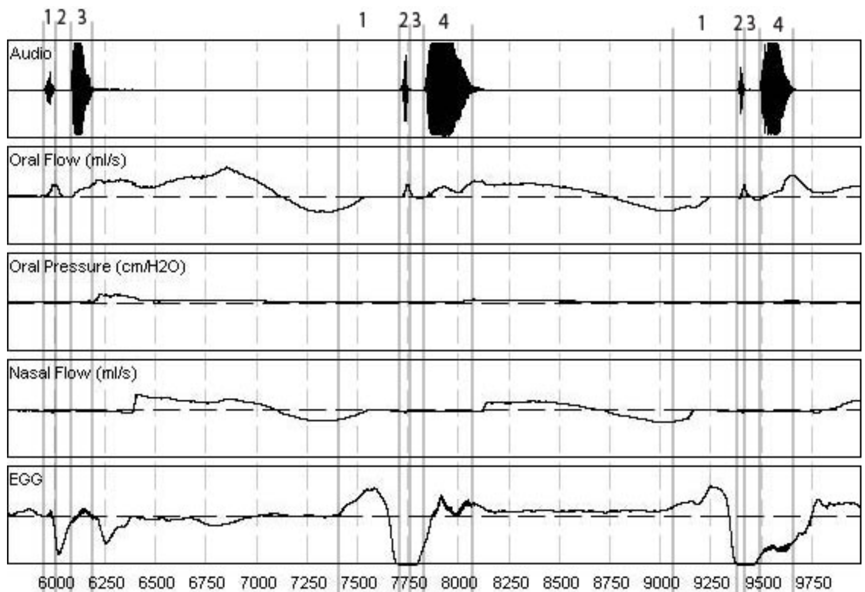

Figure 12 Recording of [k'u] 'poplar' [k'ai] 'willow' [k'a] 'arrow' by Mr. Adams.

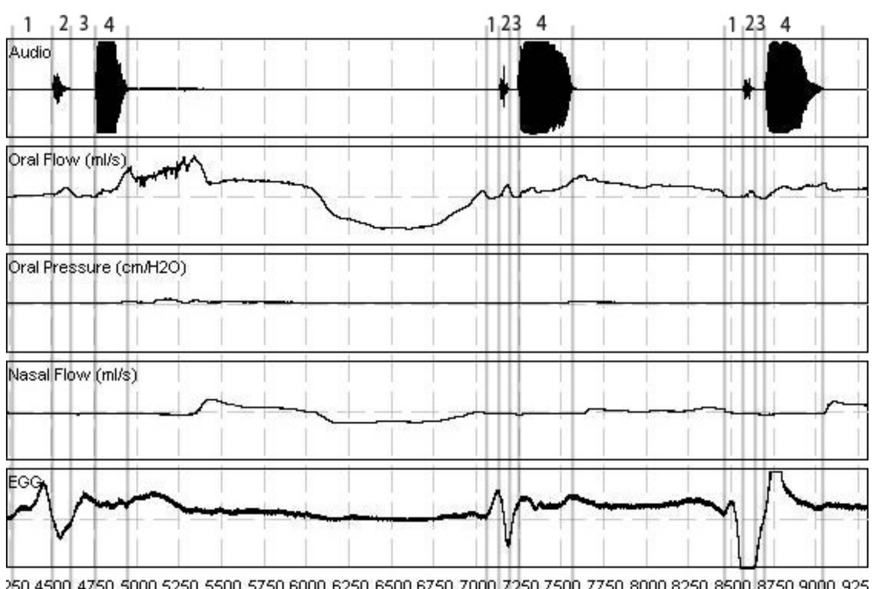

Figure 13 Recording of [k'u] 'poplar' [k'ai] 'willow' [k'a] 'arrow' by Mrs. Wood.

Figure 13 below shows a closer view of Mr. Adams' production for the word 'poplar'. It should be noted that this example shows the least amount of movement in the EGG signal during the ejective. This example shows a period of almost 100ms following the burst release of the ejective, which is in keeping with the acoustic measures for this release period in the McDonough and Wood (2008) study.

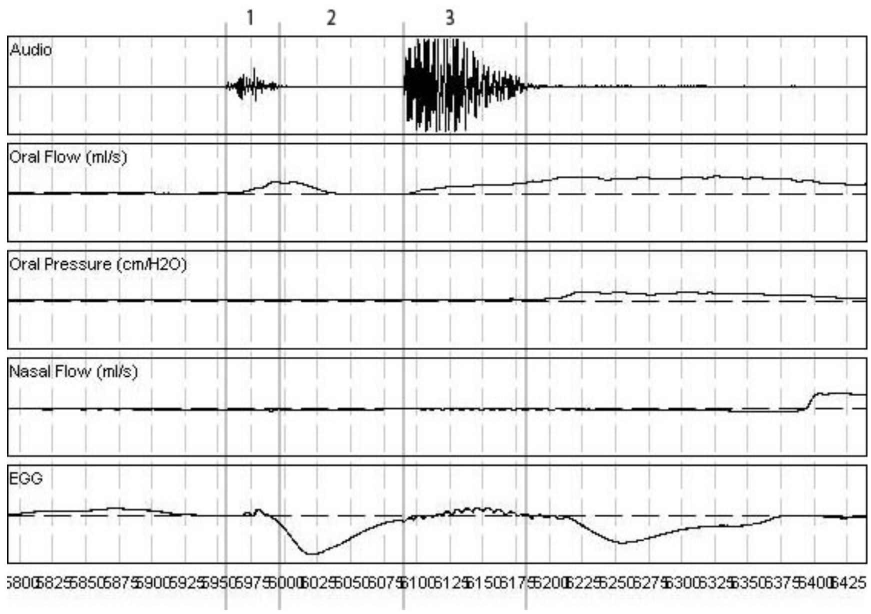

Figure 14 Recording of [k'u] 'poplar' by Mr. Adams.

The next example is a production of the voiced lateral affricate in the word [dɬi:e] 'squirrel' from Ennow (Figure 15) and by comparison, Mr. Adams (Figure 16). In Figure 15 the production shows the onset of voicing during the lateral fricative (2) followed by the sharp increased amplitude in the voicing of the vowel sequence (3). This lateral fricative voicing pattern is also shown in Mr. Adams' production (Figure 17) of the same word. Figure 16 also shows the burst release of the /d/ followed by a period of voicelessness (1) before the onset of voicing (2). In both productions of [dɬi:e], the lateral fricative is voiced throughout, moreover Mr. Adams is producing a lateral with clear approximant (rather than fricative) properties.

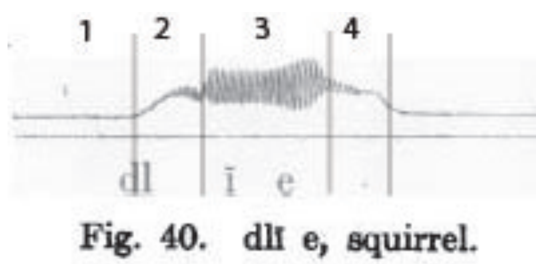

Figure 15 Goddard's (1912) kymographic tracing of [dɬi:e] 'squirrel'. The segmentation is the authors'.

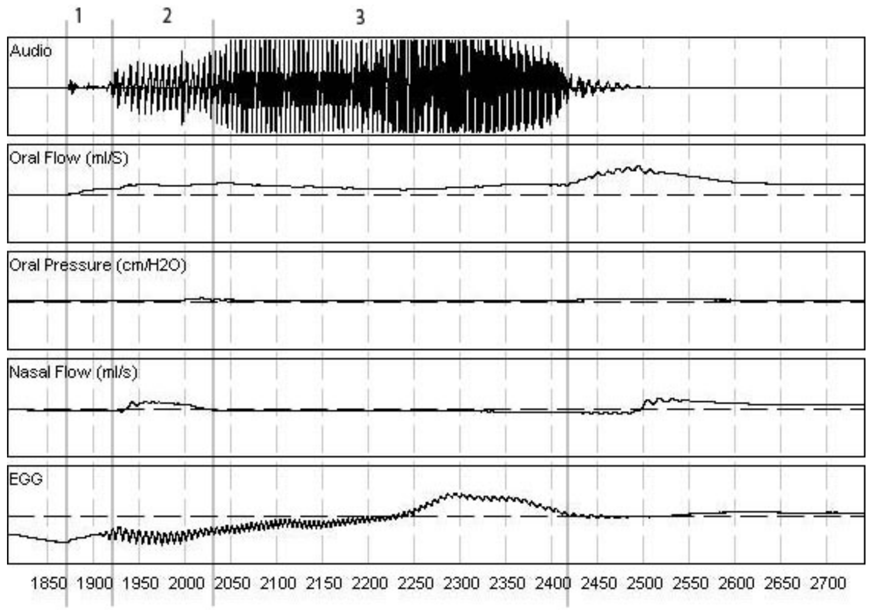

Figure 16 Recording of [dɬi:e] 'squirrel' by Mr. Adams, with segmentation.

The final examples are productions of the word /iɬtĩ/ 'bow' (Figures 17-19). This word also shows the lateral fricative which in this case is followed by a stop. The first syllable in the word ends with a voiceless lateral fricative [ɬ]; this is present in all three tokens as a rise in the airflow towards the end of the vowel (interval 2 in Goddard-Ennow and 1 in the present data). In all three tokens immediately following the lateral fricative is a stop closure (interval 4 in Goddard-Ennow and 3 in the present data) indicated by a drop off in airflow. The Goddard-Ennow token (Figure 17), it is less clear if the drop from the plateau in the trace is part of the fricative or indicates the stop closure. We have chosen, somewhat arbitrarily, to mark it as part of the stop closure. A somewhat similar drop off from the fricative portion is present in Mrs. Wood's token (2 and 3), though her closure period is quite a bit longer than the one indicated in the Goddard-Ennow token.

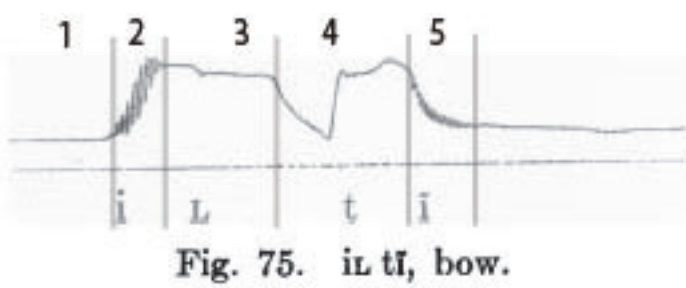

Figure 17 Goddard's (1912) kymographic tracing of [iɬtĩ] 'bow'.

This word also illustrates nasalization of the final vowel. However, Mr. Adams is the only speaker that shows evidence of nasal airflow during the vowel. For the Goddard-Ennow tracing in Figure 17, nasal airflow was not recorded or if it was nothing was registered on the tracing. Goddard makes a point of saying that the nasal flow of the recording did not seem to be working. Mrs. Wood also shows no nasal flow in her production of 'bow' this may be a result of dialect difference or language attrition.

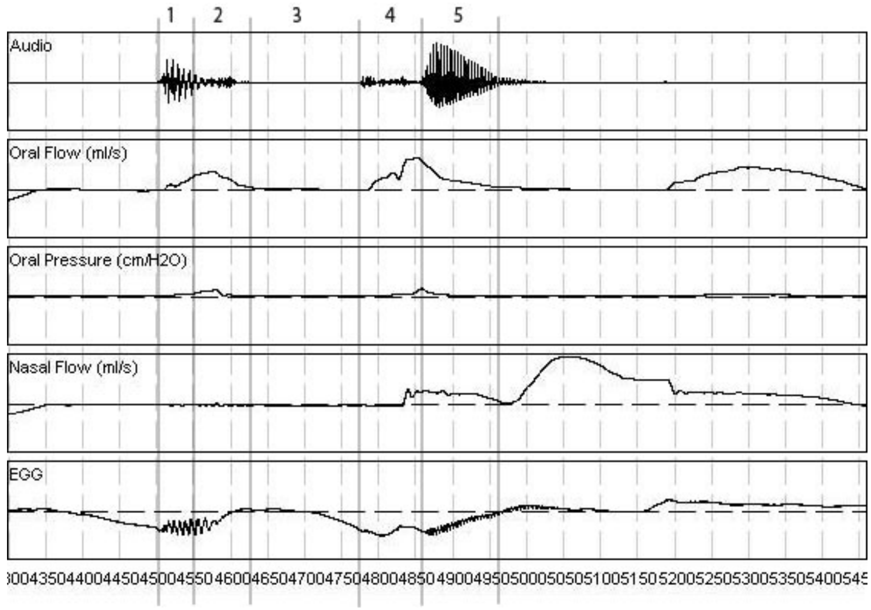

Figure 18 Recording of [iɬtĩ] 'bow' by Mr. Adams. The segmentation is the authors'.

All three show a pattern of high flow during the fricative and high flow following the burst release of the stop. For Mrs. Wood the period of flow after the burst release holds for almost 200ms before the onset of the vowel. In the Goddard-Ennow traces and in Mrs. Wood's token, the release period is longer than the stop closure. This is a characteristic property of the articulation of the Dene stop /t/ produced as [tx], as described in an acoustic study of this segment in McDonough (2003) for Navajo and McDonough and Wood (2008) for several Mackenzie Basin languages. Insofar as we are finding a similar profile in the Goddard-Ennow tracing, this indicates that the articulation of this segment in Dene Sų̨łiné is consistent over the past 100 years.

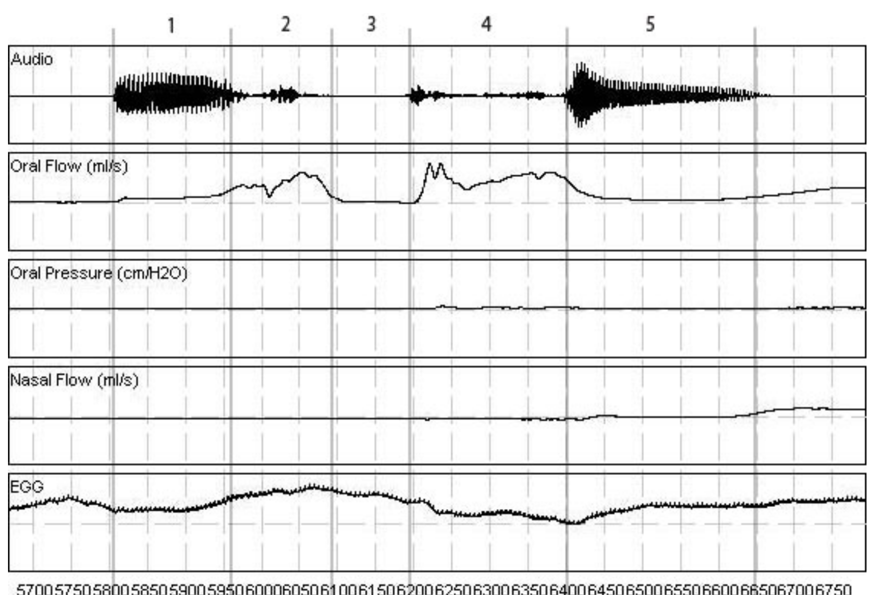

Figure 19 Recording of [iɬtĩ] 'bow' by Mrs. Wood. The segmentation is the authors'.

4. Discussion

The original data gathered by Goddard and Ennow is an important record of the Dene Sułinę́ language and speech community. The purpose of this study was to provide a base of comparison and to test the viability of interpreting the Goddard-Ennow data in light of contemporary Dene Sųłiné speakers. We were especially interested in aspects of the speech that were characteristic of the language such as the lateral fricative series, the ejectives and the articulation of the so called 'aspirated stop' /t/ as an affricate [tx], which has been reported on these languages over a century of scholarship (Haas 1968; Hogan 1976; Young and Morgan 1980, 1987; McDonough 2003; Wright et al., 2002; Bird 2002; McDonough and Wood 2008). In view of this goal we found evidence for a consistency in the temporal aspects of the articulation of these sounds over the 100 years between the Goddard-Ennow study and the present day speakers.

Several differences are found in the current data as compared to Goddard-Ennow data. For example, Mr. Adams' production of /łue/ 'fish' lacks an approximant that occurs in Ennow's original production /łuwe/. It is possible that this difference is due to simple speaker variation, or dialect variation. Mrs. Wood produces the missing approximant. One of Goddard's claims based on this kymographic data was that Dene Sųłiné had truly voiced stops, as opposed to the voiceless stops found in many of the Dene languages. The more recent data collected as part of this paper supports Goddard's claim and provides additional evidence for the voicing of stops in Dene Sułiné, and their variability.

We have also seen that the all speakers produce a classic Dene ejective, which contains a longish period between the release of the oral gesture and the glottal gesture, resulting in a characteristic profile. We have also seen in the data of all three speakers the tendency for lateral fricatives to become approximates when voiced (Maddieson & Emmory, 1984).

One finding of this paper is that Dene Sųłiné shows surprising consistency in phonetic and phonological characteristics between speakers more than 100 apart, notwithstanding normal language change and the effects of language attrition due to the loss of speakers and the increasing dominance of English in these areas. This aspect of the language recalls Sapir's observation that the Dene languages are very stable phonetically and are resistant to 'exotic influence' (Sapir, 1945).

5. **Summary**

This paper illustrates three points: (1) the value of a lasting record of a speech community, which provides continuity by linking work on the language community to the speech community and the researchers, establishing ownership of the research and results. (2) the role of this type of work in reaching across time and connecting speakers in an oral culture across generations. (3) The importance of phonetic documentation in language documentation in general.

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