

The Phonetics and Phonology of Mongolian

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1. Introduction

This paper is meant to provide a brief overview of the possible sounds and phonemes of Mongolian based on 5 weeks of word elicitation from a native speaker of Mongolian. Our consultant was born and raised in Ulaabaatar, the capital of Mongolia, and lived there until about five years ago. She uses Mongolian on a daily basis with her family and friends.

At a base level, the words were elicited in no particular systematic manner, the majority of the words being taken from the Swadesh list, a compilation basic concept words. However, follow up questions were often asked to the informant to see if similar sounding words (i.e. minimal pairs) existed. Furthermore, the consultant herself often offered such similar words without being asked. The elicitations were led by a designated person, who rotated from day to day, but the overall efforts of elicitation were performed as a group. While we occasionally shared our transcriptions of words uttered by the consultant, ultimately the final decision of how one would transcribe a word was the decision of each individual. Thus, the transcriptions to be provided are based on my own perception and are not necessarily correct.

This paper will first go over the phonetic and phonological characteristics of Mongolian in the following order: (1) consonants, (2) vowels, (3) suprasegmental features, and finally, (4) syllable structure.

2. Consonants

Below is a chart displaying the consonants of Mongolian.

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Glottal
Stops	p	t t ^h (d)						k	q	ʔ*
Affricates		ts ts ^h			tʃ tʃ ^h					
Nasals	m	n					ɲ	ŋ		
Trill		r								
Tap		(r)								
Fricative	(ɸ) β		s	ʃ			(ç)	x (ɣ)	(ʁ)	(h)
Lateral Fricative		ɬ (ɮ)								
Approximant	(β)						j			

Other sounds (ɥ)

Before getting into the explanations of the consonants of Mongolian, it should first be explained that characters in parentheses were not confirmed to be phonemes of the language. Rather, they were either found in a particular phonetic context or allophonically interchanged with phonemes from token to token, which I will explain in further detail when talking about each particular phoneme. Additionally,

while it is likely that the glottal stop occurs before every “word-initial” vowel, this characteristic shall be taken for granted as a phonetic phenomenon and the glottal stop shall not be considered as a phoneme.

2.1. Stops and Affricates

2.1.1 Bilabial Stop (/p/)

While at first it was tempting to transcribe the voiceless unaspirated bilabial stop [p] as a voiced bilabial stop [b], upon further listening and spectrogram analysis, it was determined that there is no voicing in the articulation of this sound. This can be seen below in Figure 1 which displays a spectrogram of the word [para:] “rain (noun).”

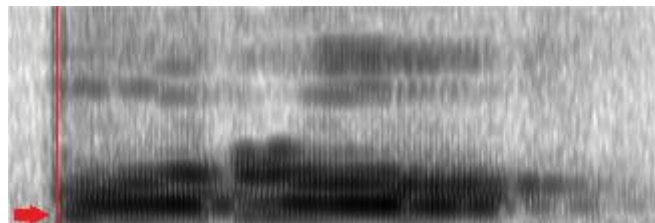


Figure 1. Spectrogram of [para:] “rain (noun)”

We can pay attention to the beginning of the word near the bottom left-hand corner and see that there is no energy at low frequencies where [p] is articulated. There was no variation found in terms of voicing or aspiration for bilabial stops, so there were no minimal pairs found.

2.1.2. Alveolar / Dental Stops (/t/, /tʰ/, and [d])

Similarly with [p], voiceless unaspirated stop [t] it was often mistaken to be voiced at the beginning of the elicitations, but was later clarified to be voiceless unaspirated based on the spectrogram data. However, this time, with the alveolar stops, there was one particular environment in which the voiced alveolar stop [d] occurred: post-nasally. This was found in words such as [ʊndʊk] “egg” and [xʊndi:] “valley.” Voicing can be seen clearly in the spectrogram of [xʊndi:] “valley.”

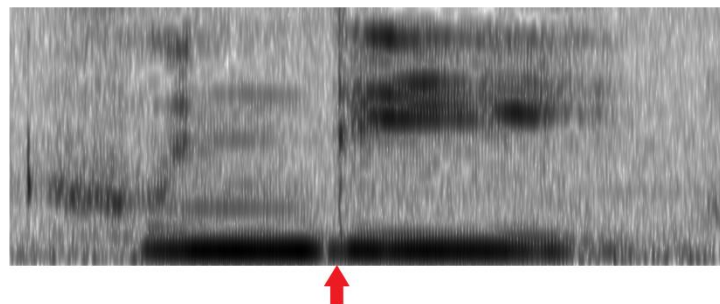


Figure 2. Spectrogram of [xʊndi:] “valley”

If we pay close attention to the area where the red arrow is pointing, we can see that there is a dark bar at the bottom of the spectrogram during the pronunciation of the alveolar stop which is the dark

vertical stripe at around the same location as the arrow. This seems to indicate that stop is voiced, which would seem logical to be a result of coarticulation with the alveolar nasal [n] due to its voiced quality. This would contrast with a word such as [ɔntʰax] “fall (verb)” which does not become voiced despite being preceded by an alveolar nasal. While this is indeed interesting, it does not seem possible to form a concrete phonological rule with such little data involving this particular environment (i.e. nasal + alveolar stop).

As the alveolar stop was one of the most frequent sounds to occur during the elicitations, numerous amounts of minimal pairs were found between voiceless aspirated and voiceless unaspirated stops, as seen in Table 1 below.

	Unaspirated	English Meaning	Aspirated	English Meaning
Word Final	ʊt*	“Feather”	ʊtʰ	”Bug”
	xat*	“Rock (in mountains)”	xatʰ	”Dry (verb) (imperative)”
	ɔrt*	“Front”	ɔrtʰ	”Long (adjective) ”
	aɬt*	“Unit of measurement”	aɬtʰ	”Gold”
Intervocalic	ʊtʊ:r	“Make with a feather”	ʊtʰʊ:r	”Make with a bug”
	xatax	“Nail (verb)”	xatʰax	”Dry (verb) (intransitive)”

Table 1. Chart showing minimal pairs between /t/ and /tʰ/

One thing that is important to mention is that word-final unaspirated alveolar stop phonemes are realized with a little bit of aspiration on its surface form. However, the aspiration is not nearly at the same level in terms of intensity as the aspirated counterpart. Furthermore, the reason why we can confirm that these said word-final unaspirated alveolar stops are indeed allophones of the /t/ phoneme is because for most of the words listed, there would be one or two tokens where the informant would add a shwa at the end of the word in order to emphasize the different between its aspirated counterpart. For example, while of course most tokens of /ʊt/ were realized as /ʊtʰ*/ such that there was a little bit of aspiration at the end, there were also tokens of /ʊt/ realized as [ʊtə] where the /t/ was clearly unaspirated. The fact that our consultant described both of these tokens as the English word “feather” implies that both

pronunciations are acceptable realizations of the word. This phenomenon was seen constantly throughout the elicitations.

2.1.3. Alveolar Affricates (/t͡s/ and /t͡sʰ/)

One again, unaspirated alveolar affricate /t͡s/ often sounded more like a voice affricate ([dz]), but was confirmed to be voiceless. Minimal pairs were found between /t/ and /t͡s/ as well as /t͡s/ and /t͡sʰ/ as seen below.

/t/, /t͡s/ : [xatax] “Nail (verb)” [xat͡sax] “Bite (verb)”

/t͡s/, /t͡sʰ/: [t͡sɪs] “Copper” [t͡sʰɪs] “Menu”

What is interesting, however, is the lack of minimal pair between /tʰ/ and /t͡sʰ/. In fact, often times it was difficult to differentiate between these two sounds. The closest thing to a minimal pair between these two sounds was [tʰa:s] “dust (noun)” and [t͡sʰa:s] “paper.” While the two vowels are somewhat similar, we will see later that they are different phonemes, therefore making these two words not a minimal pair. At this point, it seems we neither confirm nor deny whether [tʰ] and [t͡sʰ] are separate phonemes.

2.1.4. Palato–alveolar affricates (/t͡ʃ/ and /t͡ʃʰ/)

Unfortunately, there were not many minimal pairs found amongst the alveolo–palatal and palato–alveolar affricates. In fact, the only perfect minimal pair was one found between the palato–alveolar affricate and the palato–alveolar fricative, which we will look at in section 2.2. This minimal pair can be seen below.

/ʃ/, /t͡ʃ/: [φʊkʃɪŋ] “Music” [φʊkt͡ʃɪŋ] “Old”

Furthermore, while it is not a perfect minimal pair, Mongolian also displays a near minimal pair between /t͡sʰ/ and /t͡ʃʰ/, as seen below.

/t͡sʰ/, /t͡ʃʰ/: [t͡ʃʰɪɕ] “Ear” [t͡sʰɪs] “Menu”

The important aspect about the above near minimal pair is that both affricates occur before the same vowel /ɪ/, which implies that there would not be a complementary distribution between these two sounds. While it does not necessarily prove that these affricates are separate phonemes, it certainly strongly hints so.

2.1.5. Velar and Uvular Stops (/k/ and /q/)

Similarly to the bilabial stop /p/, Mongolian showed no contrast in aspiration or voicing for the velar stop /k/ and uvular stop /q/. Below is a minimal pair between velar fricative /x/ and velar stop /k/, a minimal pair between /x/ and /q/, and a near minimal pair between /x/ and /q/.

/x/, /k/:	[kar] "Hand"	[xar] "Black"
/x/, /q/:	[xaɣ] "Far"	[qaɣ] "River"
/k/, /q/:	[kar] "Hand"	[qaɣ] "Fire (noun)"

2.2. Fricatives and approximants (

2.2.1. Alveolar and Palato-alveolar Fricatives (/s/ and /ʃ/)

We can infer that /s/ and /ʃ/ are separate phonemes due to the fact that both of them have minimal pairs with /x/ in which the fricative is followed by /a/.

/s/ , /x/:	[sar] "Moon"	[xar] "Black"
/ʃ/ , /x/:	[ʃatax] "Burn (intr.)"	[xatax] "Nail (verb)"

Furthermore, no signs of free variation between /s/ and /ʃ/ were observed, further hinting that they are separate phonemes.

2.2.2. Lateral Fricative (/ɬ/ and maybe [ɮ])

A common fricative found in Mongolian during the elicitations was the lateral fricative /ɬ/. A minimal pair can be seen below.

/r/ , /ɬ/:	[art] "Back (direction)"	[aɬt] Unit of measurement
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Furthermore, there were even more near minimal pairs.

/x/ , /ɤ/: [ox] “Drink” [o:ɤ] “Mountain”

/s/ , /ɤ/: [us] “Hair” [u:ɤ] “Cloud”

2.2.3. “[h]–like” fricatives (/x/, [ɕ], [ç], and maybe [h] itself)

During the first few elicitations, it was thought to be the case that Mongolian had [h] in its phonemic inventory. After getting used to the sounds uttered by our consultant, it was found that [h] in fact very rarely occurs, and if it does occur, it occurs in free variation as an allophone of the phoneme /x/. /x/ showed phonemic contrast with /s/, as seen below.

/x/ , /s/: [æmdrəx] “Live verb)” [æmdrəs] “Life”

What is believed to be the phoneme /x/ also had a few different realizations depending on the vowel to which it was adjacent. Namely, [ɕ] often occurred when adjacent to a high front vowel /i/ and /ɪ/, [ɸ] often occurred when adjacent to a high back vowel /u/ or /ʊ/, and [x] occurred elsewhere. This can be seen in Table 2 below, which includes near minimal pairs that exhibit allophonic contrasts between the three fricatives.

[ɕ]	[x]	[ɸ]
[ɕi:ɕ] “Do”	[xa:x] “Close (verb)”	
[ɕi:ɕ] “Do”	[xæ:x] “Look for”	
[ɕɪɤ] “Say (imperative)”	[xœɤ] “Mix (imperative)”	
[ɕɪɤɕ] “Say”	[xæ:ɤx] “Melt”	
	[xaɤtax] “Move away”	[ɸʊɤtuɸɤ] “Freeze”
[ɕɪɤ] “Say (imperative)”	[xaɤ] “Far”	[ɸʊɤ] “Foot”
[ɪɤsɪɕ] “Enroll”	[aɤxəx] “Walk”	[ʊɤsuɸ] “Starve”

Table 2. A chart displays the complementary distribution between [x], [ɕ], and [ɸ]

As seen in the case of [ɸʊɤtuɸɤ] “Freeze,” it often times sounded like both velar fricative and labial frication occurred when /x/ occurred next to a high back vowel, and was often difficult to differentiate [x] from [ɸ]. Nevertheless, there indeed seems to be somewhat of a complementary distribution between [x], [ɕ], and [ɸ], where [x] is the ‘default’ choice. Finally, as a last note, it is possible

that [h] occurred on some tokens of /x/, but it always seemed like there was more frication than what [h] would be based on the spectrogram data.

2.2.4. Bilabial Fricative and Approximant (/β/ and [β̞])

The voiced bilabial fricative [β] and bilabial approximant [β̞] occurred in free variation with one another, as the consultant often pronounced different tokens of the same word using both of these sounds. The closest occasion to a minimal pair displaying that /β/ is a phoneme is seen below.

/β/ , /m/ [tʰaβ] “Five” [tʰam] “Big”

Furthermore, [β] and [β̞] were most often found word finally (e.g. [a:β] “father”; [arəβ] “ten”) or intervocalically (e.g. [aβɔq] “uncle”; [aβəx] “take”). Occasions where /β/ occurred word-initially were postulated to be loan words. For example, [βa:r] “vase” was believed to have possibly come from English “Vase” and [βəndy] “Peas” seems to have come from the Chinese word 豌豆 (Wāndòu) “peas.”

2.2.5. Velar and Uvular Fricatives ([χ] and [ʁ])

With few data to work with for these two sounds, it is hypothesized that [χ] and [ʁ] and allophones in free variation with the phonemes /k/ and /q/ respectively. There are a few reasons to believe this. The first and main reason is because on two occasions, the consultant freely interchanged between [k] and [χ] as well as [q] and [ʁ], such that she pronounced the voiced fricative counterpart when pronouncing words as a natural speed and the voiceless unaspirated counterpart when pronouncing slowly and separating the syllables to emphasize the sounds of that particular word. Examples of this can be seen below in Table 3.

English Meaning	Natural pronunciation	Slow pronunciation
“Six”	tsɔɾɣa:	tsɔɾ ka:
“White”	tsʰaɣaŋ	tsʰa kaŋ
“Head”	tʰaɬɐ	tʰaɬ qæ
Greeting (Plural, Formal)	sæŋ pætsʰɾan o:	sæŋ pætsʰ qan o:

Table 3. Chart displaying the free variation between velar/uvular fricatives and stops

This type of variation hints that (at least velar and uvular) stops become fricatives intervocalically.

2.2.6. Palatal Approximants (/j/ and [ɥ])

There were not very many occurrences of either of these approximants. Therefore, basically no minimal pairs occurred. The closest occurrence to a minimal pair involving the palatal approximant /j/ is seen below.

/i/ , /ij/: [pi] "I" [pij] "Body"

When we tried to pronounce [pij] as [pi:], our consultant corrected us and placed emphasis on the [j] sound, further hinting that it is a separate phoneme from /i/.

The voiced labial–palatal approximant /ɥ/ occurred even more infrequently than the voiced palatal approximant. It was found in words such as [kɥiç] "run" and [ɸɥitiŋ] "cold." Unlike the labial approximant, this was not found to be in free variation with the labial fricative /β/ and did not occur intervocally. This does not seem to be enough evidence to prove that [ɥ] is a phoneme of its own.

2.3 Trill and Tap (/r/ and [r])

It is hypothesized that /r/ is a phoneme while [r] is an allophone of /r/ in free variation. The reason for this is due to the fact that it was almost never full clear whether the tap [r] was actually a tap or just a shortened trill. With some words, sometimes one token would contain an [r] and another would contain a [r]. Because there were cases when obvious trills did occur, it seems to make more sense to think of taps as "shortened trills" rather than to think of trills as "elongated taps." That being said, here are some examples of minimal pairs with /r/.

/t/ , /r/: [itiɾç] "Eat" [iriɾç] "Come"

/r/ , /ɾ/: [art] "Back (direction)" [aɾt] Unit of measurement

2.4 Nasals (/m/, /n/, [ŋ], and [ɳ])

The nasals of Mongolian were one of the more difficult sounds to figure out. Very few, if any, minimal pairs were found amongst the nasals themselves, making it difficult to confirm if /n/, [ŋ], and [ɳ] were separate phonemes. At the very least, it seems we can confirm that /m/ and /n/ are separate

phonemes since both of them are found word initially, making their place of articulation characteristics more salient. Below are two near minimal pairs of /m/ and /n/.

/m/ , /n/ [mɪtɪç] “Know” [nɪsɪç] “fly” and [ɪme:] “Grandmother” [une:] “Cow”

Out of the other two nasals that occurred, [ŋ] occurred word-finally or before /k/ and [ɲ] occurred only word-finally. There appears to be a possible minimal triplet between /n/, [ŋ], and [ɲ] word-finally, but it is somewhat unclear.

[n], [ŋ], [ɲ]: [xən] “Sleep over” [xəŋ] Adjective suffix (e.g. pəɣɪn xəŋ “short) [xəɲ] “Sheep”

There are few reasons why it is unclear that this is an example of a minimal triplet. First, it is possible that the vowels are proximal but not the same. Second, our consultant often added a shwa after word-final nasals, making it unclear whether the shwa was an actual segment of the word or simply just a release of the nasal. Finally, it is possible that [xəɲ] “sheep” does not actually contain the palatal nasal [ɲ], and rather contains a short palatal approximant in between the [ə] and the nasal and therefore influencing how the nasal sounds.

3. Vowels

	Front	Central	Back
High	i (i:) (y) y: ɪ	(ɨ) (ʉ)	u u: ʊ ʊ:
Close-Mid	(e) e: (ø) ø:	(ə)	o o:
Open-Mid	(ɛ)	ə	ɔ ɔ:
	æ æ:		
Low		a a: ɶ ɶ:	ɑ ɑ:

One remark to begin with are that while I did not transcribe any words to have the high central vowel [ɨ], I believe that it is possible that there were some words where [ɪ] could have been [ɨ], but was unable to confirm this. Similarly, [ə] and [ʊ] were also often very difficult to differentiate and seem to be likely the same phoneme. However, since [ʊ] was heard more often based on my perception, it was chosen as the phoneme in which minimal pairs were found.

3.1. Vowels with Frontness/backness contrast

In the following sections I will list minimal pairs which contrast in terms of their frontness / backness, providing commentary only when something is worth special mention.

3.1.1. High vowels

/ʊ/, /ɪ/:	[ᠲᠤᠰᠤ] “Bile”	[ᠲᠤᠰᠤ] “Menu”
/u:/, /y:/:	[ᠤᠴᠤ] “Cloud”	[ᠶᠤᠴᠤ] “Doing religious practice (noun)”

3.1.2. Mid vowels

/o:/, /ø:/	[ᠣᠴᠤ] “Mountain”	[ᠥᠴᠤ] “Cry”	(Roundness contrast also present)
/æ/, /ə/:	[ᠬᠠᠭᠢ] “Wife”	[ᠬᠠᠭᠢ] “Sheep”	

3.1.3. Low vowels

/ɑ:/, /æ:/:	[ᠠᠭᠤ] “Forest”	[ᠠᠴᠤ] “Toothpaste (short)”	(Roundness contrast also present)
/ɑ/, /æ/:	[ᠬᠠᠭᠤ] “Far”	[ᠬᠠᠭᠤ] “Mix (imperative)”	(Roundness contrast also present)
/a/, /a/:	[ᠬᠠᠭᠤ] “River”	[ᠬᠠᠭᠤ] “Fire (noun)”	

3.1.4. Summary

As can be seen above, there is at least one perfect minimal pair that contrasts in terms of frontness backness for each level of height. However, two vowels that are missing is /e/ and /e:/, which actually occurred quite often during the elicitations (the long counterpart in particular). One example of a near minimal pair involving /e:/ is [ᠬᠠᠭᠤ] “to fear” and [ᠤᠴᠤᠭᠤ] “to blow.” Although there are no minimal pairs found in the elicited data, it was a quite easily distinguishable vowel in Mongolian and seems logical to hypothesize as a phoneme.

3.2. Vowels with height contrast

In the following sections, I will provide minimal pairs which contrast in terms of their height.

3.2.1. Front Vowels

/ø:/, /y:/: [ø:ɧ] “Cry” [y:ɧ] “Doing religious practice (noun)”

/a:/, /æ:/: [xa:x] Close (verb) [xæ:x] “Look for”

3.2.2. Central Vowels

/a/, /ə/: [xan] “Wall” [xən] “Sleep over”

3.2.3. Back Vowels

/ɔ/, /ʊ/: [tsʰɔs] “Blood” [tsʰʊs] “Bile”

/ɔ/, /u/: [ɔs] “Water” [us] “Hair”

/o:/, /u:/: [o:ɧ] “Mountain” [u:ɧ] “Cloud”

/a/, /ʊ/: [at] “Star” [ʊt] “Feather” (Roundness contrast also present)

/a/, /u/: [at] “Star” [ut] “Noon” (Roundness contrast also present)

/ɑ:/, /u:/: [ɑ:] “Toothpaste” [u:] “Wart”

3.2.4. Summary

There are clearly more minimal pairs for the back vowels, which is likely due to the fact that there are many short words that contain back vowels.

3.3. Vowels with tenseness contrast

I classify the next set of minimal pair in terms of contrast in tenseness, but they can also be considered as contrasting in terms of both frontness/backness and height.

/i/, /ɪ/: [iriɕ] “Come” [ɪriɕ] “Seak” [ir] “Knife tip” [ɪr] “Male” ”

/u/, /ʊ/: [ut] “Noon” [ʊt] “Feather”

3.4. Vowels with length contrast

As has been seen thus far, Mongolian verbs can contrast in their length. Short–long minimal pairs are seen below.

/a/, /a:/: [ʃatax] “Burn (intr)” [ʃata:x] “Burn (transitive)” [tsʰas] “Snow” [tsʰa:s] “Paper”

/a/, /a:/: [xɑ:ʈ] “Food” [xɑʈ] “Far”
 /ʊ/, /u:/: [ʊtʊr] “Day” [ʊtʊ:r] “Make with a feather”

3.5. Other vowel minimal pairs

Not all vowels had a minimal pair that contrasted in terms of one characteristic (frontness, height, tenseness, etc.). These minimal pairs can be shown below.

/ɔ:/, /i/: [ɔ:r] “Different” [ir] “Knife tip”
 /æ:/, /u:/: [æ:x] “Fear (verb)” [u:x] “Fat (noun)”
 /o/, /a:/: [ox] “Drink” [ax] “Older brother”
 /æ:/, /i:/: [xæ:x] “look for” [çi:ç] (/xi:x/) “Do”

It seems now we are only missing minimal pairs for [y], [e], [ɛ], and [ø]. While they are not the strongest arguments for phonemic contrast, somewhat near minimal pairs can be seen below for these vowels.

/y/, /i:/: [βəndy] “Peas” [xundi:] “Valley”
 /e/, /æ:/: [tʰɛxæ] “Chicken” [qaxæ:] “Pig”
 /ɛ/, /æ:/: [çjɛmtʰxãŋ] “Cheap” [æmtʰãŋ] “Animal”
 /ø/, /ɔ:/: [mørø] “hourse” [nɔɔ:] “back”

4. Suprasegmental qualities

4.1. Special vowel qualities (breathiness and nasalization)

As just seen in the example data above, words such as [tʰɛxæ] “Chicken” with breathiness and [æmtʰãŋ] “Animal” with nasalization on the vowel occurred. Nasalization seems to always occur in the context of /aŋ/. There was no apparent pattern in terms of breathiness. This breathiness quality almost came off as “extra expiration,” but when reviewing the spectrogram data, we can see that the vowel formant is not nearly as prominent as normal, as seen in Figure 3 below.

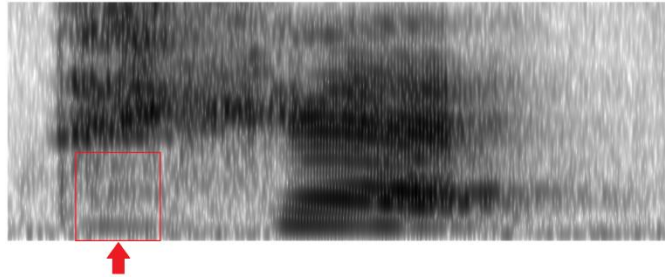


Figure 3. Spectrogram of [tʰɛxæ] "Chicken"

The front-mid vowel [e] can be heard in the recording that correlates with this spectrogram and sounds as if the consultant was whispering. This is consistent with the fact that we cannot prominence at where the formant frequencies would normally be.

4.2. Stress, Pitch, Tone?

One thing that was noticed is that there is often a fall in pitch on the last syllable of the word, but not every word. Other words showed a more flat pitch throughout the length of the word. There were no minimal pairs that contrasted in terms of pitch pattern of the word. Rather, the pitch pattern of the word seemed to be a set pattern from which cannot be deviated. This is based on the observation that if a group member repeated a word to the consultant with incorrect pitch, she would correct him or her with a consistent pitch pattern.

In words with long vowels, it was often perceived by the group that the stress fell on this vowel, but I hypothesize that this might be due to English influence, since elongation of vowels is one way to place stress on a word. As a matter of fact, most of the time this particular vowel has a completely flat pitch, as seen in Figure 4.

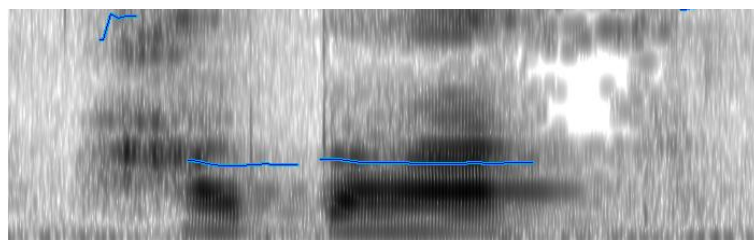


Figure 4. Spectrogram of [xata:s] "Nail (noun)"

It is quite unclear to me what type of prosodic system Mongolian implements due to the fact that words can contrast in terms of vowel length, which means that it would be difficult to say that elongating vowels would emphasize a particular syllable.

5. Syllable structure.

Table 4 shows the different possible syllable patterns observed in the elicited data using one syllable words only. Multiple-syllable words will be examined thereafter.

Pattern	Example	English meaning
CV	[pi]	1 sg
VC	[at]	“Star”
VV	[a:]	“Toothpaste (short)”
CVV	[tu:]	“Younger sibling”
CVC	[mɔt]	“Tree”
VVC	[a:β]	“Father”
VCC	[ɪktʰ]	“Older sister”
CVVC	[çi:ç]	“Do”
CVCC	[tʃɪβx]	“Diaper”

Table 4. Syllable patterns of Mongolian and examples

One interesting characteristic of Mongolian syllable structure is that it seems to prefer syllable without an onset. This is based on not on the fact that many of the words themselves start with vowels, but also based on how the consultant split up the syllables of a word when pronouncing a word slowly. One example of this is [sæŋ pæn o:], a greeting in Mongolian. When pronounced at a normal speed it sounds like the syllables are parsed as sæŋ-pæ-no:, but when our consultant split them herself when pronouncing it slowly, she clearly parsed the word as sæŋ-pæn-o:. This particular example may have to do with morphological factors as well ([o:] is some sort of marker according to the consultant). However, this phenomenon was noticed numerous times throughout the elicitations (although I cannot recall which particular words this occurred on). Overall, Mongolian seems to have a pretty robust and flexible syllable structure, with many interesting consonant clusters such as [βx], [ktʰ], and [ɸtʰ], as well as four-mora syllables.

6. Other Phonological rules

We have already seen a couple potential phonological rules thus far such as the voicing of unaspirated stops when preceded by a nasal and aspiration of unaspirated stops word finally. One other interesting phonological rule that was noticed was vowel harmony in verbs. It was noted that vowels always end with a V + the /x/ phoneme. What is interesting is that this V seemed to harmonize with the vowel found in the root of the verb. Multiple examples are shown below in Table 5.

Phonemic representation	English Meaning
/iɪx/	"Come"
/ɪɪx/	"Seak"
/sansax/	"Listen"
/t ^h at ^h ax/	"Pull"
/t ^h u ⁺ ux/	"Banish"
/xat ^h a:x/	"Dry (transitive)"
/xatsax/	"Bite"
/xɪɪtɪx/	"Argue"
/xu ⁺ tux/	"Freeze"
/xuβux/	"Float"

Table 5. Example words displaying vowel harmony

While this phenomenon was not perfect harmonization on every occasion, harmony definitely seems to be present in the language. We will most likely see more of this when moving on to the morpho-syntax of the Mongolian.