

Korean Vowel Systems

A Study of Vowel Systems in Seoul and Pyongyang



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Summary

This is a study of the Korean vowel system. The traditional description is that of a quadrangular system with three levels of sonority and three to four classes of timbre, but none of my findings match it. Instead, unusual and exciting vowel systems emerge, with back vowels in both the Seoulites and older people in Pyongyang contrasting three degrees of timbre in addition to the front vowels, though they do it in different ways.

The vowel system of Seoul is found to be a triangular system where /ɛ/ has merged with /e/ and /o/ has been raised to the same degree of closeness as /u/, making a four-way distinction in timbre between what we should call /i, u, ʊ, u/. The medial level of sonority, then, consists of only two vowels: /e/ and /ʌ/. The most sonorous member is still /a/. The system is not only found in university students either; it is consistent in the KBS News announcers too. This system is shown in table 1, with the traditional symbols, but with my suggested alternatives in parentheses.

| <i>Front</i> | <i>Back</i> | | |
|------------------|------------------|----------------|-------|
| <i>Unrounded</i> | <i>Unrounded</i> | <i>Rounded</i> | |
| i | ʊ (i) | u (ʊ) | o (u) |
| e | ʌ | | |
| a | | | |

Table 1: Seoul Vowel System

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The Pyongyang vowel systems vary a bit more, with the oldest announcer displaying a triangular system with no distinction between /e/ and /ɛ/, but with four classes of timbre being contrasted at the medial level of sonority, consisting of /e, ə, ɣ, o/. This is shown in table 2, with my suggested alternative symbols in parentheses next to traditional ones.

| | | | |
|------------------|------------------|-------|----------------|
| <i>Front</i> | <i>Back</i> | | |
| <i>Unrounded</i> | <i>Unrounded</i> | | <i>Rounded</i> |
| i | u | | |
| e (ɛ) | ɯ (ə, ə) | ʌ (ɣ) | o (ɔ) |
| a | | | |

Table 2: Older Pyongyang Vowel System

The younger announcers distinguish /e/ and /ɛ/, but they do it in an unexpected way: the close /e/ sits between /ɛ/ and /i/, but /ɛ/ actually contrasts with /ə, ɣ, o/ purely in timbre, meaning /e/ sits between these two sonority levels. This is shown in table 3, with my suggested alternative symbols in parentheses next to the traditional symbols.

| | | | |
|------------------|------------------|-------|----------------|
| <i>Front</i> | <i>Back</i> | | |
| <i>Unrounded</i> | <i>Unrounded</i> | | <i>Rounded</i> |
| i | u | | |
| e | | | |
| ɛ | ɯ (ə, ə) | ʌ (ɣ) | o (ɔ) |
| a | | | |

Table 3: KCTV Vowel System

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Finally, the young leader of the Democratic People's Republic of Korea has a very symmetrical system that is a triangular, three-level, three-class one, contrasting /i, u, u/, /e, ʌ, o/, and /a/. This is shown in table 4, with my suggested alternative symbols in parentheses next to the traditional symbols.

| <i>Front</i> | <i>Back</i> | |
|------------------|------------------|----------------|
| <i>Unrounded</i> | <i>Unrounded</i> | <i>Rounded</i> |
| i | u | u |
| e (ɛ) | ʌ (ʌ) | o (ɔ) |
| a | | |

Table 4: Young Pyongyang Vowel System

Acknowledgements

This is the thesis I have written for the master's degree in linguistics at the University of Oslo, fall 2014. It explores Korean vowels from the two capital cities separated by the demilitarized zone, Seoul and Pyongyang. It not only looks at the acoustic measurements of each vowel, but also at how they fit in the overall vowel system according to traditional phoneme theory. The thesis was written by me, but I owe thanks to many others for helping me with it.

First, I would like to express my gratitude to my supervisor, Rolf Theil, for helping me with the thesis. He was also the one who inspired me to study linguistics in the first place, with his accounts of field work in Africa. His skepticism of sloppy terminology and willingness to disagree with consensus have helped me learn to read literature much more critically, and his knowledge of and experience in the field of linguistics, as well as his constructive comments along the way have both been invaluable. This thesis would probably never have been written without him.

In writing the thesis, I had a lot of support from friends and family, which I am very thankful for. I have to especially thank my patient and helpful Korean friends. Thanks to Ben Kim in Toronto for helping me with the data, and even sitting up all night helping me through the last couple of informants! His knowledge and patience drastically reduced the amount of time I spent on the laborious task of identifying vowels and words from which to extract the formants. Thanks to Yeon Ju Oh for not

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Berrjod, October 30th 2014

Victor Berrjod

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1. Introduction

Abstract

This introduction presents the reasons for why I decided to write about this topic. It also gives an account of romanization and transcription systems used, as well as a brief outline of what the thesis contains.

1.1 Motivation

1.1.1 Why Korean Vowels?

As someone who enjoys learning languages as a pastime, I have come to take interest in what is sometimes called the "sinosphere", meaning the area of East Asia traditionally influenced by Chinese language and culture. In the golden ages of Chinese civilization, many its neighbours borrowed not only scientific and legal vocabulary, but thousands upon thousands of vocabulary units and even the word formation system itself. The result is that knowledge of any Chinese variety aids a student of such otherwise diverse languages as Vietnamese and Japanese a great deal. Another such language is Korean, and I decided to learn more about the oft-forgotten language of the Korean peninsula, obscured by the People's Republic of China's economic growth and Japanese popular

culture.

Although learning the readings of Chinese characters in Korean is both useful and interesting, the native Korean alphabet is equally interesting, especially for those of us with warm feelings for phonetics. This featural alphabet has its consonants take the shape of the tongue pronouncing them and marks whether they are plosive or not, adding an extra line for aspiration... for the most part. Vowels are another story, though. Although they do have a certain logic to them, they are not (near) anatomical descriptions, like the consonant symbols. I learned the pronunciation described in textbooks and academic works alike, but something seemed off about the traditional description. When I showed a Korean friend how to make a vowel chart, I was surprised to find no difference in vowel height between the sounds traditionally described as [u] and [o]. They seemed to overlap quite a bit, in fact. I also kept hearing rumours about how differently some of the vowels sounded in north Korea, with one friend telling me that their /o/ sounded like the southern /ʌ/ and the other way around. When I tried to find literature about this, there appeared to be no thorough research on it, so I decided to write about it in my master's thesis in the hope of finding something interesting that could help not only me, but also anyone else wanting to improve their Korean pronunciation, and maybe even discover something new and exciting along the way.

1.1.2 North and South Korea

Before taking an interest in Korean language, I hardly knew anything about the Korean peninsula, aside from the names of the capital cities of the northern and southern parts of it, but the more I learned, the more fascinated I grew with the history of the Korean war, and the diverging cultures on each side of the 68th parallel. I tried to learn all I could about north Korea, and naturally that included what the language there was like. I wanted to analyze the vowels of speakers from both sides of the demilitarized zone in detail to spot any differences. I wanted to have 12 informants, representing both sexes in three generations from two capital cities read the same thing, but that would mean either going to Pyongyang myself or find Pyongyangers outside of the Democratic People's Republic of Korea. I contacted DPRK-affiliated organizations, but found that the price for travelling alone to Pyongyang for a few recordings would be far from worth it. Travelling with a group was much cheaper, but there was no guarantee of any recordings; especially good ones. Fortunately, media from the DPRK is available on the Internet, so when I returned from Pyongyang without any good recordings (though with many good memories), I decided to use online material instead.

1.2 Transcriptions and Spellings

In this thesis, I employ many different transcription systems and spelling conventions. I will explain them one by one.

1.2.1 Korean Spelling

Since Korea was split in two over 60 years ago, spelling reforms have been carried out in both the north and south, leading to some words being spelled differently. The easiest way to harmonize spellings, since most of them occur in Sino-Korean words, is to simply write these words in their original (and my preferred) spelling: Chinese characters. This "mixed script" style obscures the vast majority of spelling differences, so that e.g. **론문** (DPRK) and **논문** (ROK), respectively "ronmun" and "nonmun", meaning 'thesis', are both rendered 論文.

Although both the DPRK and the ROK officially use only Korean letters in their orthography, Chinese characters are commonly included in dictionaries in both north and south. However, since neither most Korean nor international readers can be assumed to be able to read Chinese characters easily, and the latter group cannot be assumed to be able to read Korean at all, the Korean spelling *and* its romanization or phonetic transcription will be included alongside any word. Section 1.2.2 deals with the romanization, and 1.2.3 deals with phonetic transcription.

Although both orthographies have their strengths and weaknesses, the official spelling used in the DPRK contains more etymological information and uses fewer spaces than that of ROK, and for these reasons, it is the one I will use alongside the Chinese characters. Fortunately, any differences are very minor and should be understandable to anyone familiar with just ROK spelling as well.

1.2.2 Romanization of Korean

Although several romanization schemes exist for Korean, I will follow a slightly modified McCune–Reischauer scheme, which aims to represent Korean words according to their pronunciation, rather than acting as a pure transliteration.

The McCune–Reischauer system distinguishes the voiceless and voiced variants of Korean 'lax' plosives: 붉은 is pulgŭn ('red'), and 아버지 is abŏji ('father'), so that voiced ㅂ is transliterated 'b' and voiceless is 'p'. Aspirated ㅍ as in 높이 is written with an apostrophe: nop'i ('height'). Figure 1.1 shows the romanization of Korean letters. Five letters or combinations of letters are romanized differently by me: ㅈ, ㅊ, ㅌ, ㅍ, and ㅍ. Standard McCune–Reischauer uses *ch/j/t*, *ch'/ch'/t*, *tch/tch/t*, *ae*, and *oe* for these. I must note that, although Ahn (2009: 21-22) lists ㅍ simply as "y" in McCune–Reischauer romanization, that is merely a typo; it should be *yŏ*.

| <i>Letter</i> | <i>Initial</i> | <i>Intervocalic</i> | <i>Final</i> | |
|---------------|----------------|---------------------|--------------|---|
| ㄱ | k | g | k | |
| ㅋ | k' | k' | | |
| ㄲ | kk | kk | | |
| ㅇ | (null) | ng' | ng | |
| ㅎ | h | h | t | |
| ㄷ | t | d | | |
| ㅌ | t' | t' | | |
| ㄸ | tt | tt | | |
| ㅅ | s | s | | |
| ㅆ | ss | ss | | |
| ㅈ | c | j | | |
| ㅊ | c' | c' | | |
| ㅉ | cc | cc | | |
| ㄹ | r | r | | l |
| ㄴ | n | n | | n |
| ㅍ | p | b | | p |
| ㅑ | p' | p' | | |
| ㅑ | pp | pp | | |
| ㅁ | m | m | m | |
| ㅣ | | i | | |
| ㅔ | | e | | |
| ㅚ | | ě | | |
| ㅓ | | a | | |
| ㅕ | | ö | | |
| ㅗ | | o | | |
| ㅜ | | u | | |
| ㅡ | | ü | | |
| ㅟ, ㅠ, ㅞ, etc. | | ya, yu, ye, etc. | | |

| | |
|------------|--------------|
| ㅏ, ㅑ, etc. | wa, wŏ, etc. |
|------------|--------------|

Table 1.1: Romanization

If actual pronunciation differs from spelling, then the pronunciation is given preference: e.g. 漢字 ('Chinese character') is spelled 한자, indicating "hanja", but its pronunciation is that of 한짜, so I romanize it "hancca".

1.2.3 The International Phonetic Alphabet

Although well known in phonetic and phonological circles, a note is in order. I will use slashes to indicate phonological transcriptions, and brackets to indicate phonetic transcriptions. The latter is intended to be as useful as possible in guiding the reader to correctly pronounce something, whereas the former is intended to represent the sounds with focus on their place in the overall sound system rather than their actual pronunciation. Any transcription is an idealized representation, especially those of abstract or "imagined" speech instances, which is necessarily what we are transcribing unless we have a concrete utterance in mind. For this reason, phonological concerns are of course also relevant for the abstract phonetic transcription, even though they are less relevant to concrete phonetic transcriptions.

Given that the symbols can represent quite different things depending on how they are used and how detailed the user wants or needs to be, I will detail my use of them here. For example, the sound represented by the Korean letter ㅑ in post-pausal position is

usually transcribed as [k] in IPA. This does make sense when considering that the sound written in Korean as ㅋ is usually transcribed as [k^h]; the difference between them is the degree of aspiration. However, ㆁ is noticeably more aspirated than ㄱ, which is variously transcribed as [kʰ], [kʰ̥], [kʰ̥̥], [ʔk], etc. It is clear that these are relevant considerations, since the limited symbols of the IPA serve to cover a practically innumerable amount of possible realizations. Although the thesis is about the vowels, I will introduce the consonants first.

Korean plosives and affricates come in three "sets" or "rows", where one member is usually described as "aspirated", one as "lax", and the last as "tense". My transcriptions aim to be as useful as possible at helping the reader pronounce the words accurately, and for this reason I will transcribe the "aspirated" row (ㅍ, ㅌ, ㅋ, ㆁ) as [ph, th, kh, t͡ʃh], the "lax" row (ㅂ, ㄷ, ㄱ, ㄷ͡ʒ) as [p^h, t^h, k^h, t͡ʃ^h] initially and [b, d, g, d͡ʒ] between voiced sounds, and all three as [p^ʰ, t^ʰ, k^ʰ] in final position ([t͡ʃ^ʰ] doesn't occur, but merges with [t^ʰ] in final position). To settle on a single transcription of the "tense" row (ㅃ, ㄸ, ㄲ, ㄴ), I have chosen to simply represent them as unaspirated plosives: [p, t, k, t͡ʃ], although other transcriptions are legitimate too. The sibilants ㅅ and ㅆ are also tricky to transcribe, but I will use [s^h, s] and [ç^h, ç], where the latter ones occur before close front vowels. The liquid will be transcribed as [r] initially and [l] finally.

In phonological transcriptions, I will stick to more traditional notations, where the "aspirated" row is simply marked with a normal aspiration mark: /p^h, t^h, t͡ʃ^h, k^h/, the

"lax" row with no special marks and no difference initially or intervocalically: /p, t, t̃, k/, and the "tense" row with an ejective mark: /p', t', t̃', k', s'/. The second sibilant will be written as /s/, and the liquid as /l/.

As for the vowels, I will use the symbols [i, e, ε, a, ʌ, o, u, ʊ] and /i, e, ε, a, ʌ, o, u, ʊ/ unless dealing with a specific utterance. Note that many authors use /i/ and [i] rather than /u/ and [u]. As we will see, there is a great deal of individual variation in the precise pronunciation. Indeed, even the same individual pronounces these sounds differently from one utterance to another – often very differently. The transcriptions are therefore rather idealized, as most transcriptions are. For consistency, I will stick to these symbols even when considering mergers, so that even if an informant doesn't distinguish /e/ and /ε/, I will consider them separately, since I have sampled them separately.

1.2.4 Names of Korea

The names of the "two Koreas" remain slightly controversial, since many Koreans still see Korea as one. A good illustration of this are the names they use about each other. Although the official name of the Democratic People's Republic of Korea is 朝鮮民主主義人民共和國 (조선민주주의인민공화국; cosŏnminjujuŭiinminkonghwaguk), or 朝鮮 (조선; cosŏn) for short, it is referred to as 北韓 (북한; pukhan) 'north Korea' in the Republic of Korea. The latter is officially called 大韓民國 (대한민국; tēhanminguk), or 韓國 for short (whence the 韓). In the DPRK, it is conversely known as 南朝鮮 (남조

선; namjosŏn) 'south Korea'. A more neutral name could be 高麗 (고려; koryŏ), which is where we get "Korea" from, but it is only used for the historical dynasty. Since the names are so politicized, and no viable neutral alternatives are available, I think the most neutral option is to use their respective names for themselves. Extending this to English is also the most fair way to go about this. I will also spell "north Korea" and "south Korea" without capitalizing the compass direction, but will prefer to refer more specifically to "Seoul" or "Pyongyang" where this is possible.

1.2.5 English Spelling

The English orthography standard will be Canadian English. However, there will be a major difference in punctuation, which is usually placed before apostrophes and quotation marks. I will place it before these marks where it is part of the sentence being quoted, and after it where it's not. I will also use guillemets («») for proper quotations, and common ASCII quotation marks (""") otherwise. Apostrophes are used instead of quotation marks when they occur between a set of quotation marks.

1.3 Structure of the Thesis

1.3.1 Historical Development of the Korean Vowel System

The thesis will be structured so that the historical development and contemporary descriptions of the Korean vowel system are presented first. This section presents the

development of the system from Middle Korean in the 15th century, when the invention of the Korean alphabet enabled the production of literature in Korean. The development is considered all the way up to Contemporary Korean.

Further, four working hypotheses are considered:

- In Seoul, /e/ and /ɛ/ have merged.
- Before palatals/sibilants, [y] and [ø] occur as allophones of /wi/ and /we/ respectively.
- The vowels /o/ and /u/ are distinguished by F2 value, rather than F1 value, in Seoul.
- The vowels /o/ and /ʌ/ have merged in Pyongyang.

1.3.2 Theory and Method

Next, I will discuss the problem of defining the object of study. Although I am interested in the vowel systems of Seoul and Pyongyang, it is problematic to talk about "the Seoul dialect" or "the Pyongyang dialect", since there is no objective boundary that defines these supposed entities. Similarly, "speech community" is a problematic term that might at first seem like a good workaround.

The main theory underlying the thesis is the traditional phoneme theory of the Prague school of phonology, which will be described next. I will introduce Трубецкой's formulation of the theory, and special focus will be reserved for how it applies to vowel systems. This phoneme theory also underlies the descriptions of the vowel systems presented in chapter 2.

Next, I will describe the method. The data was extracted from the acoustic analysis program Praat, which is introduced as well. The collection of the samples, especially of the young Seoulites, will also be described.

1.3.3 Data

Next, the data will be presented in the form of vowel charts. These have the advantage of being familiar to any student of phonetics and phonology, and make spotting patterns easy. The informants are introduced, and the charts are displayed and discussed one by one. The charts for the young Seoulites are compared and discussed.

1.3.4 Analysis

The analysis of the data is where it all comes together. The data is analyzed in light of the theory, and the evidence for and against the hypotheses is considered. The overall system is also considered for each of the informants, and they are compared to each other. My findings as they relate to the hypotheses are:

- The Seoul informants have all merged /e/ and /ɛ/. Two out of four in Pyongyang have also merged them.
- Both [y] and [ø] occurred so rarely that they couldn't be reliably sampled.
- The Seoul informants distinguished /u/ and /o/ by their F2 values, not F1. The Pyongyang informants distinguished them by F1.
- None of the informants showed signs of /o/ and /ʌ/ merging.

1.3.5 Summary and Conclusion

Finally, the thesis is summed up and a conclusion is drawn based on the analysis. This is also where the relevance of the study is considered, and suggestions are presented for future research.

2. Historical Development of the Korean Vowel System

Abstract

In this chapter, the historical development of the Korean vowel system is discussed, from Middle Korean to Contemporary Korean. Vowel harmony, tones, and diphthongs are also discussed. Finally, dialectal variation is considered, and hypotheses postulated.

2.1 The Periods of Development

Sohn (2001: 41) summarizes the development of Korean. Not unlike other periodizations, the starts and ends of periods are considered to coincide with historically significant events like the start of a dynasty. The advantage of doing this is that it is easier to talk about the different stages by knowing history, and not necessarily when an arbitrarily chosen linguistic feature appeared or disappeared, especially since that time can rarely be pinpointed anyway. We will consider the development from Middle Korean through Modern Korean to Contemporary Korean, but it is worth noting that Sohn's discussion goes even further back.

"Prehistoric Korean" is considered to have ended at the start of the Christian era. This is

probably based more on convenience than anything else. Sohn considers this period to be the successor of proto-Altaic, a very speculative stage that assumes Turkic, Mongolian, and Tungusic languages, among others, constitute a single language family. The evidence supporting this is sparse, and adding Korean and Japanese to the mix (the so-called "Macro-Altaic" hypothesis) is not necessarily a good idea. If our knowledge of Prehistoric Korean hinges on speculative proto-Altaic reconstructions, it is probably better to leave it at this.

Old Korean is less speculative, though not much is known about it. Sohn considers it to have started at the beginning of the Christian era and to have lasted throughout the Three Kingdoms period until the end of the Unified Silla (or Unified Sinla; 統一新羅, 통일신라 "t'ong'ilssilla", spelt "t'ong'ilsinla", is pronounced [thoŋilɕil:a]) in the early tenth century.

Middle Korean is considered to range through the Koryŏ dynasty (高麗王朝, 고려왕조 "koryŏwangjo") period in the tenth century, and the first 200 years of the Chosŏn dynasty (朝鮮王朝, 조선왕조 "cosŏnwangjo"), and its end is marked by the start of the Japanese Invasion in 1592. Modern Korean is then considered to last from the seventeenth century through the nineteenth, which is the period after the Japanese Invasion. Contemporary Korean is considered by Sohn to be that of the twentieth century, and presumably also the twentyfirst, since his book was published in 2001.

2.2 Developments in Middle Korean

Since Korean was not properly written down until the 15th century, there is not a lot of direct evidence to go by before that (Lee and Ramsey 2011: 1). There have been attempts at reconstructing the Early Middle Korean vowel system. Based on grammatical similarity and possible cognates, Korean is speculated to be related to Japanese, the Altaic language family, and even both (Sohn 2001: 18, 29-30).

2.2.1 Vowels

Thanks to the development of a featural alphabet in the Middle Korean period, the Late Middle Korean vowel system is fairly well documented. Sohn (2001: 46) presents the vowel system shown in table 2.1. Lee and Ramsey differ in the choice of symbols: /ʌ/ for /ɔ/, and possibly /a/ for /ɑ/, but with Sohn's font, it is possible that "ɑ" is simply a cursive "a". However, his cursive "æ" does not look like "œ".

| | Front | Central | Back |
|------|----------|----------|----------|
| HIGH | <i>i</i> | <i>ɨ</i> | <i>u</i> |
| MID | | <i>ə</i> | <i>o</i> |
| LOW | | <i>a</i> | <i>ɔ</i> |

Table 2.1: Middle Korean Vowels

The only difference besides /a/, which is probably a font issue anyway, is the symbol chosen to represent ㅓ . The exact pronunciation of this sound is unclear, but it is clear that it was relatively open and back. Since ㅓ in Contemporary (Central) Korean is

often transcribed /ʌ/, the transcription /ɔ/ for ㅓ is less likely to cause confusion, and so in the following, I will prefer Sohn's transcription of /ɔ/. A minor difference in my transcriptions will be the use of /u/ rather than /i/ for ㅡ.

2.2.2 Semivowels

In addition to the seven vowel sounds, it should be noted that LMK also had two semivowels, /j/ and /w/. Like in Contemporary Korean, both of them could function as onglides, but unlike in Contemporary Korean, /j/ also functioned as an offglide with other vowels than /u/. Aside from the expected /i/, two other vowels also did not appear with the onglide /j/ in the "national speech", which should probably be taken to mean that of the capital city (although they did appear in other dialects, and apparently in the speech of children), namely /ɔ/ and /u/. The four vowels with a /j/ onglide were written just like today. (Lee and Ramsey, 2011: 159-161)

The onglide /w/ occurred with /a/, /ə/, and /i/. These were written ㅘ, ㅙ, and ㅚ. This latter symbol, ㅚ, most of the time represented /uj/, but where Middle Korean /β/ lenited to /w/ by the end of the period, it almost certainly represented /wi/. (Lee and Ramsey, 2011: 160-161) The offglide /j/ could appear with six of the vowels to form /ɔj/, /aj/, /əj/, /oj/, /uj/, and /uj/ (written ㅓㅣ, ㅕㅣ, ㅖㅣ, ㅗㅣ, ㅛㅣ, ㅜㅣ). There were four possible triphthongs, according to Lee and Ramsey, but Sohn lists two more: /waj/, /wəj/, /jəj/, and (morphophonemically) /jaj/ (ㅘㅣ, ㅙㅣ, ㅚㅣ, ㅛㅣ) (Lee and Ramsey, 2011: 161). Note the extra ones, /joj/ and /juj/ and the lack of /wi/ as Sohn (2001: 47) puts it all into the

diagram shown in table 2.2.

| | | | | | | |
|----------------|------------|------------|------------|------------|-----------|-----------|
| Diphthongs | | | | | | |
| On-glides: | <i>ja</i> | <i>jə</i> | <i>jo</i> | <i>ju</i> | | |
| | <i>wa</i> | <i>wə</i> | | | | |
| Off-glides: | <i>aj</i> | <i>əj</i> | <i>oj</i> | <i>uj</i> | <i>ij</i> | <i>ɔj</i> |
| | | | | | | |
| Triphthongs | | | | | | |
| On-off glides: | <i>jaj</i> | <i>jəj</i> | <i>joj</i> | <i>juj</i> | | |
| | <i>waj</i> | <i>wəj</i> | | | | |

Table 2.2: Diphthongs and Triphthongs of Late Middle Korean

It should be noted here that although both Sohn and Lee and Ramsey call these "diphthongs" and "triphthongs", there are reasons one might want to simply consider them sequences of vowels and glides. The strongest argument for this is precisely the fact that (almost) every single vowel can feature in one way or another. Since /j/ and /i/ are both close front approximants and both /w/ and /u/ are close back rounded approximants, it is not surprising that the members of each pair do not feature together (though it would not be impossible, as Eastern Norwegian /ji/ 'give' and English /wu:/ 'woo' show). A reason for considering them diphthongs may be that the off glides would eventually go on to develop into monophthongs. However, analyzing them as glide sequences seems to be the most practical.

2.2.3 Tone and Vowel Length

Middle Korean had three tones that were described in documents written in this period, such as the 訓民正音諺解 (훈민정음언해, *hunminjǒng'ŭmǒnhae*), a translation of the original 訓民正音 (훈민정음, *hunminjǒng'ŭm*) from Classical Chinese into Middle Korean, probably from the early 15th century. (Lee and Ramsey 2011: 103, 163) The tones were marked with dots in the following way:

(no dot: low) 손 /sòn/ 'guest'

(one dot: high) ·손 /són/ 'hand'

(two dots: rising) :솔 /sǒ:l/ 'brush'

However, there is reason to believe that the rising tone was not distinctive, but rather a sequence of a low tone followed by a high tone. Analyzing the tones as L and H (low and high) and the mora as the tone bearing unit, we see that short vowels, which consist of one mora, are able to take one of the two, whereas long vowels, which consist of two morae, theoretically could take either LH, HL, HH, or LL. In Middle Korean, only LH occurred, however.

Sometimes, these were the result of historical changes, like in :개 'dog', which comes from 가·하 | /kàhí/. After the /h/ dropped from this word, it came to be written as a single syllable with a rising tone, /kǎ:j/ (or /kàáj/). Another example is :곰 /kǒ:m/ (or /kòóm/) 'bear', which comes from 고·마 | /kòmá/. An even more interesting change occurred when the nominative particle ·오 | /i/ (or the copula ·오·라, or the causative suffix ·오|) was

incorporated into a preceding low-pitch syllable (Lee and Ramsey, 2011: 163-164; Sohn 2001: 47-48):

그 + ·오| = > :그| /kù/ + /í/ = > /kũ:j/ 'that one.NOM'

부터 + ·오| = > :부:터| /pùt^hjə/ + /í/ = > /pùt^hjǒ:j/ 'Buddha.NOM'

누의 + ·오|·라 = > 누:의·라| /nùùj/ + /ílá/ = > /nùũ:jlá/ '(male's)-older-sister.COP'

보- + -·오|- = > :보|- /pò/ + /í/ = > /pǒ:j/ 'see.CAUS'

So, the number of tones may be only two, with vowel length being the distinguishing factor in the case of the rising-tone syllables, so that Late Middle Korean can be said to have had only two phonemically distinct tones, which is the view taken by Lee and Ramsey (2011: 163). However, Sohn (2001: 47-48) take the view that there were three tonemes, although he still describes the rising tone as a combination of a short and a high tone. Concerning vowel length, they all state that rising tones occurred in long vowels, but that also seems to be the only time they talk about long vowels in Middle Korean. It could be the case that there is no way to know if syllables of other tones could be both short and long. It is also possible that all long vowels in Middle Korean had rising tones, and as such were not distinguished by their length, but rather by their tones. The latter is likely the view of Sohn and the reason for his three-tone analysis, as he does seem to imply when he writes about the loss of tones in the sixteenth century that «[a]ll vowels that had a rising tone became (and still are) long, whereas vowels with a high or low tone remained short». (Sohn 2001: 48) Although it is difficult to say exactly which property was relevant for distinguishing the vowels, it may have been

either tone or vowel length, and there is a case to be made for either.

2.2.4 Vowel harmony

LMK had regular vowel harmony. So-called 'yang' or 'bright' (陽; 양 [jaŋ]) vowels only occurred with other yang vowels in the same word, while 'yin' or 'dark' (陰; 음 [um]) vowels occurred with other yin vowels. The vowel /i/ was considered a neutral vowel, and could occur with both yin and yang vowels. This is shown in table 2.3, taken from Lee and Ramsey (2011: 161-162), but with their strange romanization replaced with my transcription.

| | | | |
|-----------------|---------|---------|---------|
| <i>Yang:</i> | ㅑ (·) | ㅓ (ㅓ) | ㅕ (ㅓ) |
| <i>Yin:</i> | ㅗ (ㅓ) | ㅜ (ㅓ) | ㅛ (ㅓ) |
| <i>Neutral:</i> | ㅣ (ㅓ) | | |

Table 2.3: Vowel Harmony Categories

Endings attached to verbs also had yang and yin forms. For example, what Lee and Ramsey (2011: 162; Sohn 2001: 49) refer to as the "locative case" particle had two forms; -어| for yin stems, and -ㅓ| for yang stems. This is similar to vowel harmony in neighbouring languages that Korean is sometimes speculated to be related to, such as Mongolian.

2.3 Development to Early Modern Korean

2.3.1 Vowel changes

Based on these reconstructions, the number of sounds in the Korean vowel system seems to have gone down from Proto-Altaic, but stayed the same in Early Middle Korean as in Late Middle Korean. But going from Late Middle Korean to Early Modern Korean in the early seventeenth century, we see it growing again, even as /ɔ/ disappears from the dialects in the central areas, which include the ones I am looking at in Seoul and Pyongyang, which, although they are usually said to belong to different dialect groups (Sohn 2001: 12), differ very little. Usually, /ɔ/ became /u/, and sometimes /o/ in non-initial syllables, and then later, in the 18th century, /a/ in initial syllables, as evidenced by confusion in spelling: "to play (an instrument)" is variously spelled /tɔlɔjta/, /talujta/, or /talɔjta/ in the 1776 text 漢清文鑑 (한청문감, hanch'öngmun'gam) (Lee and Ramsey 2011: 262-263).

The sequence (or diphthong) /ɔj/ also turned into /aj/, as we would expect. However, the sequences (or diphthongs) /aj/ and /ej/ were also subsequently monophthongized to /ɛ/ and /e/, respectively, leaving the eight-vowel system shown in table 2.4 (Lee and Ramsey 2011: 262-265). Although Sohn (2001: 53) does not separate this development from that of the diphthongs /oj/ and /uj/ into /ø/ or /we/ and /y/ or /wi/, like Lee and Ramsey do, he does state that the monophthongization is not complete. To be fair, Sohn discusses the development less specifically than Lee and Ramsey, and treats Modern Korean and Contemporary Korean under the same title, whereas Lee and Ramsey

separate them under Early Modern Korean and Contemporary Korean.

| | | |
|-------|-------|-------|
| ㅣ [i] | ㅡ [ɨ] | ㅓ [u] |
| ㅓ [e] | ㅕ [ə] | ㅗ [o] |
| ㅗ [ɛ] | ㅛ [a] | |

Table 2.4: Early Modern Korean Vowels

2.3.2 Tone and Vowel length

In the early 16th century, confusion of the tones became apparent. 15th century text had very consistent marking of tones, which also held true for some writings even in the 16th century, but by the middle of the century, the tone marks started being incredibly confused or even dropped altogether. In the Seoul area, tonal distinctions were probably gone by the mid 16th century. However, the long rising-tone syllables did stay long (Lee and Ramsey 2011: 266; Sohn 2001: 47-48).

2.3.3 Vowel harmony

When /ɔ/, a yang vowel, merged with /u/, a yin vowel, in non-initial syllables in the 16th century, it represented the beginning decline of the Korean vowel harmony system. It made /u/ a partially neutral vowel. By contrast, when /ɔ/ occasionally merged with /o/, or when it merged with /a/ in initial syllables in the 18th century, it did not affect vowel harmony, since they were all yang vowels (Lee and Ramsey 2011: 265). Sohn (2001: 54) also mentions the shift from /ɔ/ to /u/ as a major cause of vowel

harmony breakdown. He also mentions the massive influx of Chinese words, where no vowel harmony was observed.

2.4 Development to Contemporary Korean

2.4.1 Vowel Changes

The main difference in the vowel system of Early Modern Korean and Contemporary Korean was that the sequences (or diphthongs) ㅟ and ㅢ went from /oi/ and /ui/ to /ø/ and /y/ some time after the 19th century. Lee and Ramsey (2011: 290, 294-295)

dedicate a paragraph to these vowels' place in the vowel system. They state that «many young Seoul speakers do not have these front rounded vowels, pronouncing them [we] and [wi] in all phonological environments». Sohn (1994: 433) agrees, but does not include age as a factor, and later, he states again that they are pronounced [wi] and [we] by many Central speakers (Sohn 2001: 156). Sohn (2001: 53) also states it somewhat differently, saying that the monophthongization of these diphthongs is not complete.

Sohn (2001: 54; 1994: 432) sets up the Contemporary Korean vowel system shown in table 2.5 (using cursive *a* in 2001 and non-cursive *a* in 1994). As before, the symbols of Lee and Ramsey (2011: 295) are included for reference, in non-italics (to the right of Sohn's symbols). Y.-b. Kim (1977: 33, 41, 92) uses the same symbols that Sohn uses for Standard Language for the Pyongan dialect zone, although he sets up two systems: one "不均衡" (불균형; pulgyunhyǒng) and one "均衡" (균형; kyunhyǒng), meaning

"uneven, disproportional" and "even, proportional", respectively. The latter is the same system as that of Sohn and Lee and Ramsey, whereas the former is the same system minus /y/ and /ø/. Y.-b. Kim uses the "disproportional" system for most of his book. However, it is worth mentioning that [y] and [ø] are used in the phonetic transcriptions in Y.-b. Kim (1997), including those from Pyongyang. This 10-vowel system is thus the same for all these authors, and also for Ahn (2009), although every single one of them acknowledge that the inclusion of /y/ and /ø/ is problematic.

| | | | | |
|------|----------|------------|------------|----------|
| High | <i>i</i> | <i>y ü</i> | <i>ɨ</i> | <i>u</i> |
| Mid | <i>e</i> | <i>ø ö</i> | <i>ɘ</i> | <i>o</i> |
| Low | <i>ɛ</i> | | <i>ɑ a</i> | |

Table 2.5: Contemporary Korean Vowels

Earlier, when discussing Middle Korean, the vowels were divided into three columns; front, central, and back. Now, although they do not explicitly mark it, it seems that both Sohn and Lee and Ramsey consider the system to have only front and back vowels, and that with the exception of the low vowels, they all have rounded and unrounded counterparts. In Sohn (1994: 432), all of this is explicitly marked. The IPA symbols they use are very fitting for making the historical three-way division symmetrical, but it makes the representation of the Contemporary Korean vowels less so. Consider that all the symbols they use for the front vowels are IPA front vowels symbols, both the rounded and unrounded ones. However, for the back vowels, they use back symbols for the rounded vowels, but central symbols for the unrounded ones. It would be more

symmetric to use the symbols shown in table 2.6 instead. Although some symbols are still mismatched in height, this reflects a phonetic difference if we go by the diagrams shown by Y.-b. Kim (1977: 38).

| | | | | |
|------|----------|----------|----------|----------|
| High | <i>i</i> | <i>y</i> | <i>ɯ</i> | <i>u</i> |
| Mid | <i>e</i> | <i>ø</i> | <i>ʌ</i> | <i>o</i> |
| Low | <i>ɛ</i> | | <i>a</i> | |

Table 2.6: Contemporary Korean Vowels

In discussing the Seoul standard, I will use the symbols in table 2.6. The phoneme /ʌ/ is supposed to have a long counterpart in this conservative/prescriptive variety, pronounced centrally, [æ:], with the short version being back [ʌ], but I will need only one, since I did not investigate vowel length, which seems to have disappeared as a distinctive feature in both Seoul and Pyongyang.

Maybe Sohn and Lee and Ramsey's symbol choices are motivated by a desire to keep the same symbols for the same vowels throughout history, which seems doubtful in light of Sohn's (1994: 432) earlier use of the same symbols in a strictly contemporary grammar. Maybe the symbols are intended to represent the relative second formant (F2) frequencies of the vowels, since rounded vowels have a lower F2 than their unrounded counterparts, and Sohn (1994: 437) himself states that /ɯ/ has the same tongue position as /u/. The further back a vowel is pronounced, the lower its F2 becomes, and rounding of the lips further reduces the F2 (Ladefoged 2001: 42-43; Трубецкой 1939: 87-89).

This is a possible explanation for why unrounded front vowels are much more common than rounded ones, and rounded back vowels are much more common than unrounded ones; the maximum possible contrast is achieved by having unrounded front vowels, achieving a high F2 frequency, and rounded back vowels, achieving a low F2 frequency. It is less common for low vowels to contrast in rounding, and this might be attributed to the fact that the lower in the mouth the back of the tongue gets, the smaller the possible range for manipulating F2 becomes. In any case, the relative frequency would be an inaccurate analysis at best, especially since they still use the rounded front vowel symbols, and not /ɶ/ and /ø/. It is likely that the symbols were simply chosen in accordance with tradition.

An important ongoing development is the merger of /e/ and /ɛ/ into /e/. Sohn (1994: 433) mentions this happening in southern dialects, but doesn't mention the central area. Lee and Ramsey (2011: 195) do mention Seoul, and speculate that this change could be fueled by the large-scale immigration into Seoul from Kyōngsang because the vowels have long since merged in that area. The merger of these makes the nominative form of two pronouns identical: 네가 /neka/ 'I' and 넌 /neka/ 'you' would both be pronounced [nega] by most Seoulites. This problem is also found in the genitive form of these pronouns: 내 /nɛ/ and 네 /ne/, respectively. To avoid misunderstandings, new forms of the second person pronoun emerged, pronounced 니가 /nika/ and 니 /ni/ (Lee and Ramsey 2011: 298-299).

Lee and Ramsey also mention the difference in vowel quality depending on length in the case of ㅏ. They give as examples the readings of 榮 영 [jʌŋ] and 永 :영 [jə:ŋ]. My data does not seem to support this for either Seoul or Pyongyang, both of which seem to have lost the length distinction. Although this was not investigated, even the Pyongyang interviewees denied any difference between short and long vowels, pronouncing 밤 (pam) 'hazelnut' and 밤 (pam) 'night' the same. To be fair, Lee and Ramsey are describing what they refer to as the "Seoul standard", and they then go on to claim that the distinction is only lost in non-initial syllables (Lee and Ramsey 2011: 296-297). Because the short form appears to be the dominant one, I will keep transcribing ㅏ as /ʌ/ in Contemporary Korean. Sohn (1994: 445-446, 452-453) also shows length distinction in examples, and says that the orthography not reflecting length distinction «is partly responsible for many speakers below approx. 40 years old (as of 1992) to be less sensitive to vowel length».

Another difference from Early Modern Korean is the diphthong ㅡㅣ, which is now pronounced /u/ in initial syllables and /i/ otherwise (by older natives in Seoul), but many younger people pronounce it /uj/ in initial syllables, which is probably a spelling pronunciation, but nevertheless one that is embraced by dictionaries like that of Naver (네이버 國語辭典 [neibŏ kugŏsajŏn], «의사의 결과» [ŭisaŭi kyŏlkkwa]. [2014]). In addition, the genitive particle 의 went from historical /uj/ to /e/ (Lee and Ramsey 2011: 295; Sohn 2001: 53; Sohn 1994: 450-451).

2.4.2 Vowel harmony

Although much of the Middle Korean vowel harmony system has been lost, there is still significant portions of it left, especially in onomatopoeia, where yin vowels generally have a more emphatic meaning than their yang counterparts, producing pairs like **졸졸** $/\widehat{t\check{c}o\widehat{l}t\check{c}o\widehat{l}}/$ 'trickling, murmuring' versus **줄줄** $/\widehat{t\check{c}u\widehat{l}t\check{c}u\widehat{l}}/$ 'flowing, streaming'. This is also supported by Sohn (2001: 14). In addition, the yang vowels /a/ and /o/ take the yang ending - ㅏ /a/ in what is often called the infinitive form, where all other vowels take - ㅓ /ʌ/. However, there are signs that this distinction is eroding, with - ㅓ taking over even in cases of yang vowel roots to produce constructions like **바-ㄷㅓ** instead of **바-ㅏ** 'receive-INF' (Lee and Ramsey 2011: 296).

Ahn (2009: 44-45) mentions vowel harmony as an argument for counting /y/ and /ø/ among the other vowels, despite their common realization as /wi/ and /we/, sequences of glides and vowels (which Ahn and the other authors refer to as "diphthongs"). He gives examples of /y/ (dark) contrasting with /ø/ (light) in ideophones like **퀴퀴** (k'wik'wi 'stinking') and **꺨꺨** (k'wek'we 'smelling unpleasantly'). This follows the usual patterns of light and dark vowels, where the dark vowel in a pair is more emphatic than its light counterpart. If they are regarded as /wi/ and /we/, they do not follow the system, since both /i/ and /e/ are normally dark vowels.

2.4.3 Alternative Systems

So far, I have presented a somewhat simplified view of the Korean vowel system. Both

Lee and Ramsey and Sohn subscribe to the standard quadrangular, three-level and three/four-degree system, but there are linguists that have proposed different systems, and sometimes radically different. Ahn (2009: 46-48), who uses the same 10-vowel system (with /y/ and /ø/) as Sohn and Lee and Ramsey, nevertheless presents a good overview of these proposed alternative vowel systems, which are admittedly quite abstract.

2.4.3.1 9-Vowel Systems

The first of these systems, proposed by Choi (1937), takes a triangular shape and contains four levels of sonority. The two least sonorous levels distinguish three degrees of timbre, and the two medial levels distinguish two. Ahn (2009: 46) remarks that the position of [ɛ] in this system is further back than in many other languages. It is unclear if this is intended to be understood at an abstract level, or simply on an acoustic or articulatory one, but in this vowel system [ɛ] is placed only slightly more front than [ø]¹, so it may be an acoustic comment. Choi is cited as claiming that this represents the true nature of Korean vowels. Choi's vowel system is reproduced in figure 2.1.

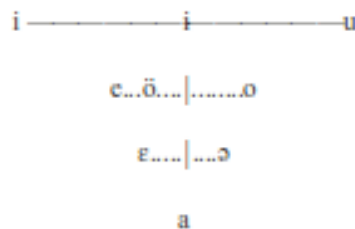


Figure 2.1: Choi's 9-Vowel System

¹ Ahn uses [ö] rather than [ø].

The second system comes from Martin (1954). While it contains the exact same vowels as Choi's system, Martin places them in a quadrangular system with three levels of sonority and, curiously, three degrees of timbre on the least sonorous level, but four degrees of timbre on the medial level. The most sonorous level still has only two members. Martin's system is shown in table 2.7.

| | | | |
|---|---|---|---|
| i | | ɨ | u |
| e | ö | ə | o |
| ɛ | | a | |

Table 2.7: Martin's 9-Vowel System

Neither one of these two systems include the close front rounded vowel, yet they curiously include a mid front rounded vowel as what Ahn (2009: 47) calls "surface forms", which prepares us for the next vowel system, based on assumptions in Chomsky & Halle's (1968) abstract generative formalisms.

2.4.3.2 Four-vowel System

C.-w. Kim's (1968) system contains only four vowels, of which none is front; all the other vowels are derived by rules of glide deletion. C.-w. Kim's system is presented in table 2.8.

| | |
|---|---|
| i | |
| ə | o |
| a | |

Table 2.8: C.-w. Kim's Four-Vowel system

There are four rules and one constraint, which are:

- a. Off-glide (i.e. followed by a formative boundary) j^2 is allowed, but not offglide w .
- b. Vowels are fronted by following off-glide j .
- c. Off-glide j is deleted after front vowels.
- d. After a glide, /i/ becomes [u].
- e. A glide is deleted when it occurs before a high vowel with the same backness.

This highly abstract system in practice would produce the same 9-vowel system as that of Martin, if it were not flawed. The difference lies in the supposed "underlying forms" proposed, but the "surface vowels" are all the same. Curiously, there is no way to derive [y] in this system, which Ahn (2009: 48) also remarks. He also notes that this system ignores the historical development of [y] and [ø] from original [uj] and [oj] and vowel harmony where [y] and [ø] alternate. It is also completely asymmetrical, which is unusual for a vowel system. Ahn also argues that it goes against speakers' intuition, and that its psychological reality (or plausibility) is questionable at best. He shows that it is not even consistent within its own theoretical framework, and would fail to produce words like **입** (ip 'mouth') and **민** (민; min 'people').

2 Ahn uses y .

2.5 Dialectal Variation

2.5.1 Standard vs. dialect

In discussing the historical development of Korean, the focus is typically on the standard language, which tends to be whatever is spoken in the capital city. However, the standard language is not necessarily the same as the dialect spoken in the capital, and that is true in both the Republic of Korea and the Democratic People's Republic of Korea. The standard speech of both are based on the speech of educated people in Seoul, called 標準語 (표준어 [phjodʒunʌ]; 'Standard language') in the ROK, although in the DPRK language use has gradually deviated from that notion of standard language, and since the capital of the DPRK was moved to Pyongyang (from Seoul) in 1966, it has used what is known as 文化語 (문화어 [munwaʌ]; 'Culture language'), which, according to Sohn (2001: 59-60), is based on the Pyongan dialect spoken in Pyongyang. Sohn (2001: 57-58, 76) lists seven dialect zones and goes on to describe the features of each. However, there is reason to believe that the descriptions are very general rather than absolute, especially when each zone covers a relatively large area. The term "dialect" (as well as "language", and even "variety") is problematic, as discussed by Richard Hudson (1996: 20-69) and Rolf Theil (Kristoffersen et al. 2005: 464-484). These are theoretical issues that are better left for the next chapter.

2.5.2 Central zone

Since my focus is on Seoul and Pyongyang, I will look at research into their respective dialect groups, starting with the oft-discussed Seoul dialect. Although the Seoul dialect is not necessarily the same thing as standard Korean, they are similar enough that they might as well go under the same name. The latter is based upon the former, and they are both considered part of the Central dialect zone.

Sohn (2001: 69-70) lists some defining characteristics of Central speech. He lists the four pronunciations of historical /uj/ as particular for this region, i.e. genitive /e/, word-initial /u/ with the reading pronunciation variant /uj/, and finally /i/. This is interesting, because it also seems to hold true for Pyongyang, which could suggest that Pyongyang speech may in fact be more accurately placed in the Central zone than in the Pyongan zone. The standard languages had the same source, and although they are not entirely the same, differences are harder to spot than similarities. Sohn continues by mentioning that /o/ is frequently raised to /u/ in final syllables of certain native morphemes, especially as part of a suffix. Among the examples is the very common word **그리고** /kʌligo/ 'and', raised to **그리구** /kʌligu/. Another relevant point is that historical /β/ has either disappeared completely or been weakened to /w/.

2.5.3 Pyongan zone

One of the most interesting features listed for the Pyongan dialects is retention of some historical diphthongs in certain words, like **오이** /oi/, **거이** /kʌi/ 'crab', and **가이** /kai/

'dog'. This is not supported in my data from Pyongyang. He also lists what he calls "umlaut and vowel fronting", to which he gives the example 메누리 /menuli/ (standard: 며느리 /mjʌnuɭi/) 'daughter-in-law'.

A fuller discussion of the Pyongan zone phonemic system by Y.-b. Kim (1977: 33, 41, 92) reveals that the traditional Pyongan system is the same quadrangular three-degree and three-class system as that of the Central zone, although the individual phonemes are not necessarily found in the same positions in words. For example, Y.-b. Kim describes a change from [u] to [i] following /s/, /tɕ/, and /tɕʰ/.

2.5.4 Cultured Language

Pyongyang is on the very edge of the Pyongan zone, and has been the seat of government almost continuously since the end of Japanese rule, both unofficially and officially. It is the best educated city in the DPRK, and as such, it would not be surprising to find a much more significant influence of Central elements than Pyongan elements on the vowel system of its residents. In addition, the standard language was based on educated Seoul speech – at least until 1964, when Cultured Language was promulgated by Premier 金日成 (김일성, Kim Il Sŏng) (Sohn 2001: 78).

Even Cultured Language contains Central elements that, according to Sohn (2001: 81) differ from Pyongyang speech, such as 天地 'heaven and earth', which would be 텨디 [thjʌndi], being written and pronounced 천지 [tɕʰʌndʒi], as in the south. However,

vowel harmony is more conservative in Cultured Language than in southern Standard Language (Sohn 2001: 80), so that stems ending in -p, which becomes -w before vowel-initial endings, are still subject to vowel harmony in all cases, unlike the south, where only monosyllabic stems of this kind observe vowel harmony: 아름답- [arumdap̚] 'beautiful' becomes 아름다와 [arumdawa] in Cultured Language, but 아름다워 [arumdawɔ] in Standard Language, but 돕- [tʰop̚] 'to help' becomes 도와 [tʰowa] in both. Note that, although spelled with the symbol for /o/, ㅜ, ㅜㅏ still represents /wa/, and ㅜㅓ /wɔ/. Both kinds take the -운 /un/ ending (as opposed to -은 /un/, which is the regular ending) when they modify nouns.

2.5.5 Vowels of Cultured Language

Although Sohn lists many differences, including in pronunciation, he does not bring up vowels much. He mentions vowel fronting and what he calls "umlaut" in discussing the Pyongan zone dialects, but he does not specify whether this applies to Cultured Language or not. Y.-b. Kim does not seem to mention Cultured Language at all, but from his description of the Pyongan zone phonemic system matching Sohn's (and Lee and Ramsey's) description of the Central zone system, we can extrapolate that the vowels of Cultured Language ought to be identical to those of Standard Language. This will make any differences in the phonemic systems all the more interesting.

2.6 Working Hypotheses

After considering the development of the Korean vowels, we have arrived at what is commonly accepted as the Contemporary Korean vowel system, which ought to be valid for both the Central and Pyongan dialects. Any data must be compared to this system, which is probably the traditional one in both areas. Any differences likely represent relatively recent changes.

From what we have discussed so far, we can postulate a few working hypotheses. First of all, as we have seen in the literature, there is an ongoing merger of /e/ and /ɛ/ in Seoul. My Pyongyang interviews suggest that this is not the case in the DPRK capital, so we should investigate whether or not this is the case. Since the possible phonemic status of /y/ and /ø/ (rather than considering them the sequences /wi/ and /we/) is mentioned by all the authors, it is possible that we should look at their realizations as well, and see where they stand in the system. A testable hypothesis could be that we will find this realization in sibilant/palatal environments.

As mentioned in the introduction, I showed a Korean friend how to make a vowel chart, but got strange results when plotting her vowels onto it: /o/ and /u/ kept overlapping. The more I listened to Korean, the more I had to admit that /o/ was likely articulated much closer than I had been led to believe, and we should investigate how /o/ differs from /u/ in both Seoul and Pyongyang. Also mentioned in the introduction is a south Korean friend's description of Pyongyang /o/ and /ʌ/ as sounding alike, which should

also be investigated – perhaps as another possible merger. It should be noted that my Pyongyang interviews indicate that they have not merged.

From Sohn's and Lee and Ramsey's descriptions of the Korean vowel system of Seoul, and Kim's matching one of Pyongan, as well as my previous experiences and interviews, we can postulate the following hypotheses:

- The distinction between /e/ and /ɛ/ is lost in Seoul, but preserved in Pyongyang.
- The front vowels [y] and [ø] occur as allophones of /wi/ and /we/ after sibilants/palatals (/s/, /sʰ/, /tɕ/, /tɕʰ/, and /tɕʰ/) in both Seoul and Pyongyang.
- The back vowels /u/ and /o/ are distinguished from each other by the F2, rather than F1, value in Seoul.
- The back mid vowels /o/ and /ʌ/ have merged in Pyongyang.

Additionally, we must consider any other differences we find in the material, whether consistent for each city or not, and consider why the differences are found.

3. Theory and Method

3.1 The Object of Study

As touched upon in the previous chapter, the object of study may be slightly difficult to pin down. According to Hudson (1996: 18-19), it may be impossible to say where the boundaries of a language go. In fact, he questions the assumption that languages are discrete, identifiable entities, consisting of dialects which can be subdivided further until we reach the individual and find the "smallest dialect". Hudson explores that and many other related questions.

3.1.1 Linguistic items

In order to distance ourselves from the concepts of *dialect* and *language*, Hudson (1996: 21-22) introduces the technical term «linguistic item». The definition of this depends on what view one has of language structure, but Hudson writes that everyone would accept that there are items of vocabulary, which we may call "lexical items" or "lexemes", and that there are also sound-patterns within these items of vocabulary, in addition to larger syntactic patterns that they are used in. He writes that, as far as sociolinguistics is concerned, there is no important difference between the three, even though "non-social" linguistic work tends to treat them quite separately in theories about how language

"works" (with a typical view being «that lexical items are listed (in a lexicon), but that sounds and constructions are defined ('generated') by general rules and principles»).

Hudson (1996: 43) considers that there may be a general difference between items of pronunciation and other linguistic items in terms of variation. He points out that standardization is closely associated with writing, so it would not be surprising to find that pronunciation is less liable to standardization than other items (morphology, syntax, vocabulary). It is possible, then, that items of pronunciation are generally used to indicate our point of origin, implying that we originate from a certain group, whether we actually did or not. The other items may then, in contrast, be used to identify our current status in society, showing for example how much education we have had. This is conjecture by Hudson at this point, but he points out that there is enough evidence for differences between pronunciation and other areas of language to make it worth looking for general explanations. If his hypothesis is any indication, we should expect to find very consistent results in the data from the Pyongyang and Seoul speakers, respectively.

3.1.2 Varieties of language

Another useful term that Hudson (1996: 22-24) introduces is 'variety'. He introduces it by asking us to think of "language" as a phenomenon including all the languages of the world, and says that the term *variety of language* (or simply *variety*) can be used to refer to different manifestations of it. He likens it to the way 'music' can be thought of as a general phenomenon even when we distinguish different varieties of music. What

makes one variety of language different from another is the linguistic items that it includes, and he defines it as «*a set of linguistic items with similar social distribution*». This definition then covers anything we would normally call 'languages', 'dialects', or 'registers', but there is still no consistent basis for distinguishing between the latter three or similar terms.

In considering whether a variety is a "language", Hudson (1996: 30-36) talks about what popular usage of "language" and "dialect" is in English. English speakers distinguish them in two ways: by size and by prestige, such that a language may be larger than a dialect, or it may be more prestigious. In the first case, a language may be made up of several dialects, with one of them being considered standard. In the second, the most prestigious variety is a language, and any other variety is a dialect. In the latter case, standard languages are possibly the only *true* languages. In the former case, his objection is that size is relative, and even attempts at making it less relative by means of *mutual intelligibility* are doomed to fail, for several reasons:

- Even popular usage does not follow this criterion consistently.
- Mutual intelligibility is a matter of degree. It ranges from total intelligibility (100%) to total unintelligibility (0%). Any number for how high up this scale two varieties need to be in order to count as members of the same language must be arbitrary.
- Varieties may be arranged in a *dialect continuum*, meaning a chain of adjacent varieties in which each pair of adjacent varieties are mutually intelligible, but pairs

taken from opposite ends of the chain are not. If varieties A and B are mutually intelligible, and varieties B and C are mutually intelligible, varieties C and A are not necessarily mutually intelligible.

- Mutual intelligibility is really a relation between people, since it is they, and not the varieties, that understand one another. The understanding depends on qualities like motivation (how much person A wants to understand person B) and experience (how much experience they have with the variety they are listening to). The biggest problem is also that these qualities do not necessarily need to be reciprocal: A and B do not necessarily have the same degree of motivation or the same amount of experience with each other's varieties.

This means there is no real distinction that we can draw between "language" and "dialect" in the "size" sense. An even more fundamental question is how clear the boundaries between varieties are, and according to Hudson (1996: 38-45), they are not. He explains it by considering the family tree model (Hudson 1996: 37-38) and showing that we cannot keep subdividing until we reach the individual level, because if that were the case, isoglosses drawn on a map would never intersect; yet they do. Explanations for this include wave theory, where changes in language are assumed to spread from centres of influence to nearby areas (like a stone dropped in a pool causes a wave to spread). Hudson (1996: 39-41) suggests the metaphor of different plant species in a field, rather than a rock dropped in water, because 'waves' of linguistic influence freeze when their point of origin is not strong enough to sustain them; i.e. people do not want

to identify themselves with the group that uses the item in question. Like geographical dialects and languages, Hudson (1996: 41-42) considers social dialects and accents to be problematic to delimit for similar reasons.

3.1.3 Speech Communities

Hudson (1996: 24-30) considers some differing definitions of 'speech community', perhaps most notably the common «all the people who use a given language (or dialect)», which does not help unless we can delimit the language or dialect, and number (6), which is an approach that «avoids the term 'speech community' altogether, but refers to groups in society which have distinctive speech characteristics as well as other social characteristics».

Supporters of the latter approach include Robert Le Page, who is quoted by Hudson (1996: 26):

«Each individual creates the systems for his verbal behaviour so that they shall resemble those of the group or groups with which from time to time he may wish to be identified, to the extent that

- a. he can identify the groups,
- b. he has opportunity and ability to observe and analyse their behavioural systems,
- c. his motivation is sufficiently strong to impel him to choose, and to adapt his behaviour accordingly,
- d. he is still able to adapt his behaviour.»

Hudson proposes that it is doubtful that the notion 'speech community' is helpful at all. He says that the term may in fact mislead us by implying the existence of "real" communities "out there", which we could discover if only we knew how. He gives some reasons for why this is not a good idea:

- Mismatch between subjective and objective reality.

We have a vague idea of the way people speak in distant places that we have little experience with, so the least we can say is that if there are objective communities, they are somewhat different from the communities that we recognize subjectively.

- Evidence against community grammars.

Behind all the definitions but number (6) lies the assumption that members of the community are linguistically "the same" in some sense, either in their use of language or in what they know and think about language. However, people do not even know the linguistic details of other people living in the same city, let alone hundreds of miles away. This is often the case even for members of the same family, especially if we consider differences between generations.

- Evidence for networks

The community that the definitions seek to leave us with has a boundary, however vague, yet social networks have no boundaries at all. Instead, they typically have a

small cluster of people near the centre, and several others "hanging on" more or less closely, while maybe hanging on to neighbouring networks at the same time.

- Small size of the most important communities

The most important communities are very small – family, friends, neighbours, colleagues at school or work, and any clubs or organizations. Communities like these are the ones that influence an individual's speech the most, especially as children, but they are far smaller than the "speech communities" that linguists usually talk about.

Hudson's (1996: 29) conclusion, then, is that our sociolinguistic world is not organized in terms of objective 'speech communities', although we may think subjectively in terms of communities or social types such as 'Londoner' and 'American'. He describes the search for a "true" definition of the speech community or the "true" boundaries thereof as «a wild goose chase».

He also answers the question of where language is; in the community or in the individual. Hudson's (1996: 29-30) view is that it is in the individual, because each individual is unique and because individuals use language so as to locate themselves in a multi-dimensional social space, among other reasons. He includes this quotation from Guy (1980): «...language, while existing to serve a social function (communication) is nevertheless seated in the minds of individuals.»

3.1.4 Relevance for Korean

All of this has implication for the varieties of Korean that are currently being investigated. We have seen that terms like "language", "dialect", "register", or "speech community" do not adequately delimit the object of study. It is nevertheless possible to analyze the pronunciation of individuals from Seoul and Pyongyang while attempting to cover some common variables, such as gender and age. We know from Sohn (2001: 59-60) that Standard Language (標準語; 표준어, p'yojun'ö), is the definite standard language in the Republic of Korea and Cultured Language (文化語; 문화어, munwha'ö) is that of the Democratic People's Republic of Korea. Sohn (2001: 79) also states that this goes for pronunciation.

However, both Sohn and Lee and Ramsey also describe the vowels of the so-called 'Seoul standard', which they do not appear to define clearly, but which might be taken to mean the prescribed pronunciation used by news anchors and other specially trained people. An indication of whether an individual from Seoul tries to follow this standardized pronunciation may be the distinction between ㅏ /e/ and ㅓ /ɛ/, which appears to have disappeared among young speakers in Seoul (Sohn 1994: 433; Lee and Ramsey 2011: 195). In the event that we do find a distinction between these two, it might be a good idea to consider that/those speaker(s) separately.

3.2 Phonological Theory

The phonological theory employed in this thesis is essentially classic phoneme theory of

the Prague school of phonology. It was well described by Prince Николай Сергеевич Трубецкой (Nikolai Sergeyevich Trubetzkoy) in his posthumously published *Grundzüge der Phonologie* (Трубецкой 1939), in which he made the case for establishing phonology as a science separate from phonetics, which was not common practice at the time (Трубецкой 1939: 9-10). Especially relevant to this thesis will be the notion of *phoneme*, particularly what concerns vowels.

3.2.1 Phonetics and Phonology

Трубецкой (1939: 7) writes that instead of a single "study of sound", there should be instituted two different studies; one directed toward the act of speech, and the other toward the language system. They would have to use different methods of investigation according to their subject matter. The study of sound pertaining to the act of speech, concerned with concrete physical phenomena, would have to use the methods of the natural sciences, while the study of sound pertaining to the system of language would only use the methods of linguistics, humanities, or the social sciences. Трубецкой calls the former *phonetics* and the latter *phonology*.

Although he mentions that the words are used differently in English, with "phonetics" (Трубецкой 1939: 12) or, in the 1969 translation into English, "phonemics" (Трубецкой 1969: 9) being used for "Phonologie", this is no longer the case, and the terms are used much the same in English and German.

3.2.2 Phoneme

Трубецкой (1939: 34) defines the phoneme as phonological units which cannot, from the standpoint of a given language, be further divided into smaller consecutive phonological units. This means that the phoneme is the smallest phonological unit of a given language.

He warns that the phonemes are not to be considered building blocks that words are made of. Rather, each word is a phonic entity of its own, a *Gestalt*, and is recognized by its entire appearance. Phonemes are the distinctive marks that make it possible to distinguish any word from all other words. A word can be analyzed completely into phonemes, and it consists of phonemes in the same way a tune composed in a major scale consists of the notes in that scale, although each tune will contain something that makes it a specific musical configuration (Трубецкой 1939: 34-35; 1969: 35).

Трубецкой (1939: 35) says that although the German *ich* sound and *ach* sounds are nondistinctive, they contrast with *k*, as in examples like *stechen-stecken, roch-Rock*. From this, we see that producing a complete closure (a plosive) or merely a stricture (a fricative) is what distinguishes meaning; not whether the constriction happens more in the back or in the front (or middle). The former is then *phonologically relevant*, and the latter *phonologically irrelevant*. The phoneme, then, is ««*the sum of the phonologically relevant properties of a sound (Lautgebilde)*»» (Трубецкой 1969: 36). He calls the various realizations of the phonemes *Varianten*, which are what we now call *allophones*.

The various realizations of the phoneme /x/ in German are thus [x] and [ç] (or [χ], since he describes the stricture as occurring in the centre of the palate), although Трубецкой does not seem to have a special convention for indicating phonological and phonetic transcriptions, and the phonetic symbols he uses are not the same as the IPA used today.

Трубецкой (1939: 37-38) warns that, although there have been attempts at defining the phoneme in psychological terms, and indeed this is the way it was first defined, linking it to vague terms like "psyche", "linguistic consciousness", and "empfinden"³ means you can never actually know what to consider a phoneme, and so the definition ought to be linked to the language system instead.

3.2.3 Rules for Designating the Phoneme

Трубецкой (1939: 42-47) explains four rules for deciding what is a phoneme and not. These should be laid out here.

I. If two sounds in the same language occur in exactly the same sound environment, and can be switched out for one another without that causing any changes to the lexical meaning of the word, then the two sounds are *Varianten* (allophones) of the same phoneme.

He goes on to mention that there may be distinguished different types of this, so that

3 "Sensory perception". (Трубецкой 1969: 39)

some of them may be considered regionalisms, and others pathological, etc.

II. When two sounds occur in the same position and cannot be interchanged without a change in the meaning of the word, or without rendering the word unrecognizable, then the two sounds are phonetic realizations of two different phonemes.

Of course, the degree of "Unkenntlichmachung"⁴ may vary, and it may or may not be possible to figure out what was meant.

III. If two acoustically or articulatorily related sounds of a language never occur in the same sound environment, then they should be considered combinatory variants of the same phoneme.

IV. Two sounds that otherwise meet the conditions of Rule III can still not be regarded as variants of the same phoneme if, in a given language, they can occur next to each other, meaning they are part of a sound sequence in those positions where one of the sounds also occurs in isolation. He illustrates this with the example of [ɹ] and [ə] in (non-rhotic) English. Although [ɹ] occurs only before vowels, and [ə] never does, they cannot be considered variants of the same phoneme, because they can also occur together, as in <profession> [p^h.ɹə¹fɛʃn], in the same position where [ə] can occur alone, as in <perfection> [p^hə¹fɛkʃn].

4 Meaning "made-unrecognizable-ness".

3.2.4 Distinctive Oppositions

Although the above is sufficient to decide what the phonemes of a language are, Трубецкой (1939: 59) also considers that we must determine what the distinctive features of each phoneme are. That is to say, all the phonologically relevant properties of a phoneme, particularly those which serve to distinguish it from phonemes with related properties. Трубецкой describes the German /k/ as a *tense nonnasalized dorsal occlusive*. He considers that the phonologically relevant features of this phoneme cannot include "velar", because it also has a palatal articulation in certain environments. Instead, the phonologically relevant features must include "dorsal", but this is of course not enough, since there are other dorsal phonemes too, /g, ŋ, x/. Of the four dorsal phonemes, only /x/ is not a *Verschlusslaut* (an occlusive). Only /ŋ/ is nasalized, and finally he describes /k/ as "tense" to distinguish it from the "lax" /g/.

Трубецкой (1939: 59-61) proceeds to talk about classifications of the oppositions. He says they should be classified on the basis of their relationship to the entire system of oppositions as *multilateral* and *bilateral*, *isolated* and *proportional* oppositions. It is not the phonemes that play the major role, but rather the distinctive oppositions that make up the phonemes by virtue of the definite order or structure in the system of distinctive oppositions.

An opposition is formed by two things simultaneously sharing a property and having certain properties that distinguish them from each other, as illustrated with German /k/

above. Two things that don't share a single property, such as German /g/ and /h/ (or, as Трубецкой says, an inkpot and free will), do not form an opposition with each other. He explains that in the case of bilateral oppositions, the properties shared by the opposition members are only common to these two members of the system, whereas those in multilateral oppositions can share properties with more than one other member of the system. For example, the opposition /t/-/d/ is bilateral (in German), because they are the only dental occlusives, but the opposition /b/-/d/ is multilateral, because there exists another member of the system that shares the property of what Трубецкой calls "*schwache Verschlussbildung*" (weak occlusion), namely /g/. Each phoneme must take part in multilateral oppositions, but participation in bilateral oppositions is not necessary.

Although Трубецкой (1939: 60-61) states that the distinction between bilateral and multilateral oppositions is extremely important for the general theory of oppositions, it seems to me that a bilateral opposition is simply one extreme of the logically possible number of oppositions (the lower one, since nothing can be in a distinctive opposition to itself), and not otherwise noteworthy.

Трубецкой (1939: 63) also stresses the importance of proportional and isolated oppositions. An opposition is proportional if the relation between its members is identical to the relation between the members of another or several oppositions in the same system. He gives as an example the relation in German between /p/ and /b/, which

is proportional because the relation between the two phonemes is identical to that between /t/ and /d/, as well as /k/ and /g/. The opposition /p/-/ʃ/ is isolated, on the other hand, because no other pair of phonemes that relate to each other in the same way that /p/ relates to /ʃ/ exists in German.

Трубецкой (1939: 69-70) goes on to discuss classification of oppositions on the basis of the extent of their distinctive force. Again he introduces a binary distinction: constant and neutralizable oppositions. He considers that in Danish, [æ] and [e] can occur in any position, whereas in Russian, [e] only occurs after /j/ and palatalized consonants, with [ɛ] occurring in all positions besides that one. So Danish /e/ and /æ/ are different phonemes, whereas Russian [e] and [ɛ] are variants of the same phoneme. However, in French, [e] and [ɛ] are only distinctive in final open syllables, and their distribution is otherwise predictable. That is to say that these two vowels must be considered phonemes only when they occur in final open syllables, and combinatory variants of a single phoneme in all other positions. This is what Трубецкой calls a *neutralized* opposition, and he names the positions where oppositions are neutralized *neutralization positions*, and positions where oppositions are relevant *relevance positions*. He notes that although it does not take phonetic training to take notice of constant oppositions, it is often difficult to indicate, of a pair in a neutralized opposition, which of the two has just been produced. Трубецкой (1939: 71-74) describes four main cases of realization of such neutralized oppositions: (1) those in which the archiphoneme is realized differently from either of the opposition members; (2) those in which it is realized like

one of the members; (3) those in which the choice of representative opposition member is conditioned internally; (4) those in which both opposition members represent the archiphoneme in different environment.

3.2.5 Distinctive Phonic Properties

Трубецкой (1939: 80-82) considers that the above oppositions are not specifically phonological ones, but are valid for any system of opposition, such as the Latin alphabet. They must be supplemented by specifically phonological principles of classification. A phonological opposition, he says, consists of a *distinktiver Schallgegensatz*⁵. "Distinctiveness" in the phonological sense is the capacity to differentiate meaning, and is something that requires no further classification. He notes that phonetic terminology is mostly sound-physiological rather than acoustic, but adds that this is not a problem, because only the unambiguous designation of phonic properties is important. Acoustic terminology is also much more sparse than its physiological counterpart.

Трубецкой (1939: 82-86) divides the distinctive phonic properties into three classes: vocalic, consonantal, and prosodic. He notes that while vowel phonemes and consonant phonemes consist of distinctive vocalic and consonantal properties, respectively, no phoneme consists exclusively of prosodic properties. In a given language, prosodic properties may combine with a single vowel or consonant phoneme, or even with an

5 «*Distinctive opposition of sound.*» (Трубецкой 1969: 90)

entire sequence of phonemes. Трубецкой says that what characterizes *consonants* is the production of an obstruction and the overcoming of such an obstruction, whereas *vowels* are characterized by the absence of any obstruction. The consonantal properties can thus be called *properties based on the manner of overcoming an obstruction*, and those of vowels *properties based on degree of aperture*.

However, there are other properties that are not specifically vocalic or consonantal. *Properties of localization* are properties that both consonants and vowels may have, in that it indicates *where* the obstruction or aperture occurs. Another such shared property is *properties of resonance*, which indicate the type of phonation. Трубецкой gives the example of French /o/, which has a specific property based on degree of aperture in opposition with /u/, a specific property of localization in opposition with /ø/, and a specific property of resonance in opposition with /õ/. However, these "three coordinates" need not be present in every phoneme, as illustrated with German /o/, which does indeed contrast with /u/ and /ø/, but distinctive oppositions between nasalized and nonnasalized vowels are not found at all in standard German. Nevertheless, each of the properties that make up a vowel or consonant phoneme must invariably belong to one of these "three coordinates".

3.2.6 Vocalic Properties

At this point, we leave Трубецкой's discussion of consonants and prosodic units entirely and concentrate on his discussion of vowels. He writes that among all speech

sounds, vowels can most easily be analyzed acoustically (Трубецкой 1939: 86-87). The degrees of aperture correspond acoustically to the degree of "saturation" or "sonority". He notes, however, that the same acoustic effects can be achieved with the articulating organs in a different position, so the parallelism between degree of saturation of the vowel and degree of lowering the jaw is not always complete. He suggests that since linguists are ultimately more interested in the acoustic effect, it might be a good idea to replace physiological terms pertaining to vocalic properties with acoustic ones.

The properties of localization correspond acoustically to various gaps in the series of *partial tones* (i.e. formants), so that front vowels show an increase of the higher and suppression of the lower partial tones, and in back vowels, the higher partial tones are suppressed. He does not seem to specifically mention lip rounding suppressing the higher partial tones, but he does mention the parallelism between tongue and lip movement. (Трубецкой 1939: 86)

Трубецкой (1939: 86-87) introduces the discussion of vowel systems by considering that a language with only one vowel would have to allow numerous consonant combinations, because otherwise, the vowel would not contrast with anything, and it could not be considered a phoneme. With consonant combinations, however, it could be considered a phoneme by being in opposition with a *Vokalnull* (null vowel). There are several known vowel systems – some more common than others. He introduces three basic types from the perspective of degrees of aperture and vocalic localization series:

a) *linear systems*, with vowel phonemes that have specific degrees of sonority (i.e. vowel height, or closeness), but no distinctively relevant properties of timbre (i.e. vowel backness and/or lip rounding); b) *quadrangular systems*, where all vowel phonemes have distinctive properties based on degree of both sonority *and* timbre; c) *triangular systems*, with distinctive properties of both sonority and timbre, with the exception that timbre is irrelevant for the maximally open vowel phoneme.

Трубецкой (1939: 87-89) explains that there are two possible oppositions of timbre, namely that between rounded and unrounded vowels and that between back and front vowels. They can also occur in combination, so that we can distinguish up to eight classes of timbre: rounded, unrounded, front, back, front rounded, back rounded, front unrounded, back unrounded. Although all eight do occur in different languages, a single language may only have up to four of these classes. Rounded vowels are acoustically "darker" than unrounded ones, and front vowels "clearer" than back vowels. It is therefore possible to say that any multiclass vowels system (i.e. excluding systems where timbre is not distinctive) has a *maximally dark* and *maximally clear* class of timbre (the extremes), which may have one or two medial classes between them. An objection to this is that a three-way distinction of lip rounding in close front vowels is found in large parts of Scandinavia. Although only four close vowels are distinguished and /i/ and /u/ predictably act as the extremes, the medial vowels, conventionally transcribed /y/ and /ɥ/, are both front vowels with different degrees of rounding, so that /i/ is unrounded, /y/ has "open" rounding, and /ɥ/ has "close" rounding and may

have slight retraction of the tongue. See Theil (1991: 88-89) for a discussion of this. Nevertheless, the system does end up with only two classes between the extremes, though not the way one would expect.

Трубецкой (1939: 96-99) mentions that all vowel systems distinguish vowels by sonority/aperture. Most commonly, three degrees of aperture are distinguished (as in e.g. Latin), but no less than two (as in e.g. Arabic). His examples even includes the vowel system of Gweabo (spoken in Liberia), which seems to have a *six-degree* (two-class) triangular vowel system (Трубецкой 1939: 101). He qualifies this by adding that one has to consider that the "bright" and "muffled" vowels are evaluated as an opposition based on the degree of sonority for this to be the case.

According to Трубецкой (1939: 102), in every vowel system the maximally dark and the maximally clear class of timbre always contains the same number of degrees of sonority. He does mention systems where the phonetic realization of the vowels is not symmetric, such as in Tonkawa, spoken in Texas, where a four-vowel quadrangular system is found (i-o, e-a) (Трубецкой 1939: 98). His statement still holds true, because the same number of degrees of sonority is distinguished. Further, they can be considered to belong to the same categories of close/nonclose or open/nonopen regardless of their phonetic realization.

Трубецкой's statement about a vowel system always containing the same number of

degrees of aperture in the maximally dark and clear classes of timbre lets us make certain predictions. In a given language with the most common five-vowel triangular system (/i/-/u/, /e/-/o/, /a/), if all vowels may occur in stressed syllables, but the distinction between /i/ and /e/ is neutralized in unstressed syllables, the distinction between /u/ and /o/ is expected to be neutralized as well, resulting in a three-vowel triangular system for unstressed syllables. This is indeed what we find in certain Greek dialects (Трубецкой 1939: 102). It is also a strong hypothesis that can easily be tested. If there were to be found a system that distinguishes three degrees of sonority in the maximally clear classes, but only two in the maximally dark classes, then it would have to be downgraded from a hypothesis to a common tendency at best.

Further, Трубецкой says that in three-class vowel systems, the medial class of timbre must contain as many or fewer degrees of aperture than the two extremes; never more. He says that quadrangular systems almost always distinguish fewer medial-class degrees of aperture, and that this is not rare for triangular systems either. Трубецкой gives an example of the Norwegian vowel system for this, but while it is doubtful that his description of the phenomenon itself is inaccurate, it must be pointed out that his representation of the Norwegian vowel system is inaccurate; cf. Theil (1991: 113). In fact, the main reason for his confusion is likely the fact that three close front vowels are distinguished, although the orthography (and he does use the orthographic symbols) does not help either: while <u> *does* represent /u/ in many words, it usually represents /ʉ/, and while <o> *does* represent /o/ in many words, it usually

represents /u/. The Norwegian vowel system may more accurately be presented as a three-class quadrangular system, as shown in figure 3.1 (with orthography in parentheses, and vowel system flipped to conform to conventional modern presentation), though /y/ and /ɥ/ do make this somewhat problematic. Трубецкой's prediction still holds true – the extreme classes still have the same number of distinct degrees of aperture.

| | |
|-----------|-------|
| iу (i-yu) | u (o) |
| eø (e-ø) | o (ä) |
| æ (æ) | a (a) |

*Figure 3.1: Norwegian
Vowel System*

Трубецкой (1939: 105) also does not neglect to mention that what he calls an *"unbestimmter Vokal"*⁶ (a mid central vowel, commonly referred to as a "schwa") appears in many systems. He considers that it often occurs in partial systems, but recognizes that it can enter into a special opposition with the maximally open vowel of triangular systems, such as in Bulgarian, which can be interpreted as a dual triangle system where one triangle consists of /i/-/u/-/ə/ and the other consists of /e/-/o/-/a/.

3.3 Method

The initial plan was to gather data from male and female informants from roughly three generations in both Seoul and Pyongyang. That proved impossible for several reasons:

6 «Indeterminate vowel» (Трубецкой 1969: 113)

- While young informants around 20 years of age were easy to find in Seoul, I could not find any middle aged or older volunteers. I had a contact in Seoul who was going to help me with this, but she canceled because of a death in the family.
- Traveling to Pyongyang outside a group would be much too expensive.
- I could not get in touch with any north Korean defectors living in south Korea, and while another contact in Seoul was going to help me with that, he disappeared.

With this in mind, I decided instead to combine the data I could get with the wealth of Korean material freely available online. This has some obvious drawbacks, in that it is more difficult to account for variables such as educational background and social class, however, this is intended to be a quick scan rather than an in-depth survey, and should be sufficient to lay the basis for potential future research.

3.3.1 Acoustic Analysis

The analysis was done with Praat, a program for analyzing audio files and provide detailed acoustic analyses including pitch, intensity, and most importantly in this case, formants. Pitch and intensity are not relevant for the data in this thesis. Vowel formants, on the other hand, are of paramount importance, as they form the bulk of the data this thesis is based on. The formants were extracted manually from Praat by loading up the audio files one by one, zooming in on each word or syllable, locating the most stable areas of each vowel, and instructing the program to output the F1 (formant number

one), F2 (formant number two), and F3 (formant number three) values at a given point in the stable section. The numbers were then put into a spreadsheet as shown in figure 3.2, with the word the sample is from, as well as a number indicating the syllable. This syllable count follows the written form, so that each Korean or Chinese character counts as a syllable, and if a syllable is not pronounced, it is still counted – though not sampled. The values were plotted onto a chart, ordered by their F1 and F2 values and arranged in the manner of the well-known vowel quadrilateral, with front vowels on the left and open vowels on the bottom.

| Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
|--------|-------|-----|------|------|-------|-------|-----|------|------|
| 온나라1 | /a/ | 363 | 925 | 2502 | 人民軍3 | /u/ | 322 | 1163 | 2376 |
| 民族2 | /a/ | 426 | 1315 | 2400 | 將軍2 | /u/ | 271 | 1304 | 2303 |
| 金日成同志4 | /a/ | 313 | 943 | 2553 | 여러분3 | /u/ | 319 | 1270 | 2367 |
| 金正日同志4 | /a/ | 350 | 810 | 2485 | 우리는1 | /u/ | 298 | 891 | 2209 |
| 하고2 | /a/ | 353 | 929 | 2183 | 人民軍3 | /u/ | 289 | 1170 | 2536 |
| 온나라1 | /a/ | 505 | 906 | 2482 | 主體1 | /u/ | 440 | 1304 | 2423 |
| 모든1 | /a/ | 522 | 891 | 2564 | 人民軍3 | /u/ | 290 | 1065 | 2540 |
| 幸福2 | /a/ | 373 | 829 | 2428 | 大元首님3 | /u/ | 332 | 1316 | 2453 |
| 으르2 | /a/ | 411 | 1023 | 2437 | 우리1 | /u/ | 300 | 978 | 2302 |

Figure 3.2: Spreadsheet Values

This makes it easy to spot anything unexpected. The charts will be presented in the next chapter. Although the charts only take into account F1 and F2, I sampled F3 as well, because if the F2 value is doubtful, a completely normal F3 value helps determine whether it is likely to be right anyway, since F2 has a tendency to merge with F1 or F3 in Praat, as shown in figure 3.3, where an F1 merges with an F2.

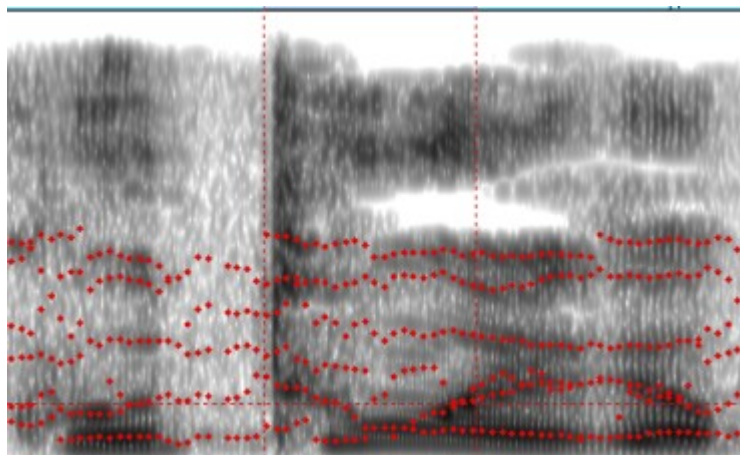


Figure 3.3: Formant Merger

3.3.2 Problems with the Data Analysis

Most of the problems with the data analysis are minor, and closely tied to Praat. As accurate as it is, Praat does occasionally analyze incorrectly. In those cases, it is usually easy to spot, and comes down to the quality (or lack of quality, if you will) of the recording. Following are the most common mistakes.

3.3.2.1 Extra Formants

Occasionally, background noise is strong enough that Praat interprets it as a formant, as shown in figure 3.4. If F1 is interpreted correctly, but background noise is interpreted as a formant in between F1 and F2, that means the actual F2 will be labeled F3 instead, and the actual F3 will be labeled F4, and so on, because Praat always assigns numbers from the bottom up. It is possible to increase and decrease the sensitivity with which Praat interprets formants, but usually it is easy to see where the actual formants are, so I have kept the sensitivity at 6 formants as much as possible.

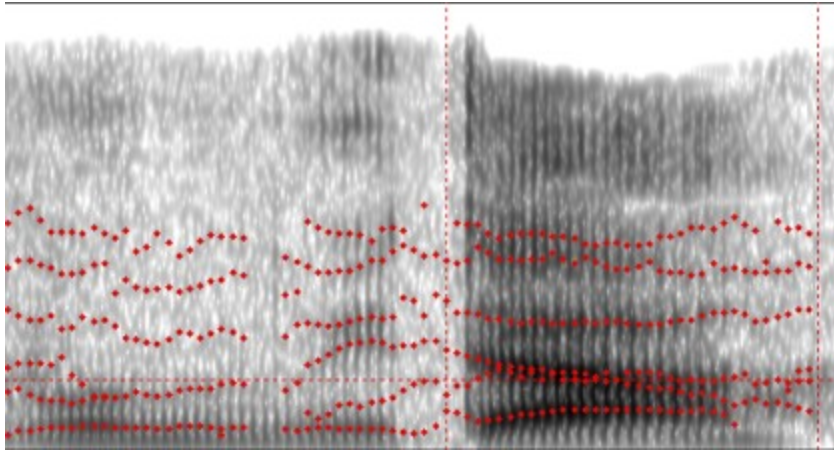


Figure 3.4: Extra Formant

Occasionally, the false formants occur very close to the actual ones, making it difficult to tell whether they are interfering or not. In such cases, it was usually enough to position the cursor near the line of the actual formant and compare Praat's interpretation to see if it matched the actual or false formant more closely. If that did not help, I skipped that vowel.

3.3.2.2 Merged Formants

When two formants have values that lie very close together, Praat often interprets them as one formant, as can be seen in figure 3.3. In cases where this occurred, I increased the sensitivity, but if they were still merged into one, as sometimes happens, I skipped that vowel. It was more difficult to tell whether formants had merged when they were both high, but I compared the formants with others of the same phoneme to make sure.

3.3.3 Advantages

An advantage with using this method of entering the values into a spreadsheet to display them in the shape of a vowel quadrilateral is that it makes it easy to locate anomalies, but it also makes it easy to see the general areas of each vowel, and thus the vowel system itself. The more an area is covered in points, the more we can be sure the area is a good representation of the range of possible pronunciations for the vowel in question. This makes comparing the phonetic realizations of vowel systems somewhat comparable, but it is important to keep in mind that people have differently shaped speech organs, so we cannot simply map them on top of each other. In general, men have bigger throats, resulting in lower formants and thus a smaller range, whereas women generally have smaller larynges, giving them higher formants and a larger range of possible realizations (Ladefoged 2001: 40, 45).

3.3.4 Seoul Data

Although I could only get two young informants from Seoul – one man and one woman – I will detail the collection process here. I first decided to try eliciting three rough levels of formality, inspired by similar approaches by Hognestad (2012: 40). I did the recordings in one sitting with three phases; each with a task for the informants. In the first, the informants read a list of words, available in appendix B. In the second, they were asked to read a paragraph, available in appendix C. In the third and last phase, they were asked questions that they had to answer, available in appendix D. The two

other informants are announcers for KBS News (KBS 뉴스 [k'eibiesŭ nyusŭ]) and were found on YouTube.

3.3.4.1 The Word List

I prepared the list of words and made sure to include every vowel phoneme several times. I also made sure to include every modern vowel grapheme of the Korean orthography at least once. All but one of the words, 0ㅓ /jɛ/ (a nonsense syllable), were relatively common lexical words that the informants were assumed to understand. The list was initially planned to be kept as ideologically neutral as possible, in order to avoid potential offense to any of the informants, but when it was clear that I could not use the same method in Pyongyang, I decided to include the word 民主主義 (민주주의 /mintɕutɕui/) 'democracy' because it has two instances of /u/ following sibilants, and the final syllable is written 으, which represents three different phonemes (prescriptively /i/ in this case, but can also represent /u/ and /e/, as well as the reading pronunciation /uɿ/). I made a slideshow that I manually flipped through once the informant had read the previous word while recording.

3.3.4.2 The Paragraph

I had a Korean native speaker write a paragraph that included all the vowel phonemes (though not necessarily all vowel graphemes), including /wi/ and /we/. I specifically asked that both ㅓ /ɛ/ and ㅕ /e/ be included, and for the vowels /u/, /o/, /ʌ/, and /u/ to be well represented. The informants were asked to read the text and not to worry about

making mistakes; in the event that they did make a mistake, they were to simply correct it and keep reading.

3.3.4.3 The Interview

Initially the interview was planned to work like an interview; that is, with me as the interviewer asking the informants questions that they would respond to. In order to save time (and face) I had the interviewees read the questions and then answering them out loud. In retrospect, that might have been a bad idea, in that it is less like an interaction, and thus may feel more formal.

3.3.4.4 Expected Results

The expected result would be that the first task, reading a list of words, would elicit the most formal pronunciation. If there were any distinction made between /e/ and /ɛ/, this is where it would be expected to show up. In the second task, reading a paragraph, we might also expect it to show up, but that exercise would hopefully be perceived as less formal. The final exercise would hopefully elicit the least formal pronunciation, although that goal might have been better achieved if I as the interviewer asked the questions, rather than having the interviewees read them.

3.3.5 Pyongyang Data

The data from Pyongyang was collected from YouTube, and ultimately comes from

Korean Central Television. The occasion is formal throughout the material. This is somewhat fortunate, because it is difficult to know where the YouTube informants are from, and so even if they are not from Pyongyang, they will likely pay attention to their pronunciation in such situations, especially as news anchors, and we can compare their pronunciation to that of the known Pyongyangers. Some of the material analyzed is from a speech by Marshall Kim Jǒng Ŭn, the young leader of the DPRK himself. The ages of the informant are not precisely known, but the young leader is likely in his early thirties, the retired announcer likely in her seventies, and the two other announcers are aged somewhere in between. The links to the videos are in the bibliography.

3.3.5.1 Interviews

In the Democratic People's Republic of Korea, I had the opportunity to ask the guides many questions about Korean language, culture, and history. They seemed happy to answer, and were very informative. Although they were not linguists, they were educated and appeared to speak a standardized variety, with an accent that one of the guides also suggested would be best for a learner to adopt as well. The questions were necessarily spaced out because of limited time, and the fact that I was not the only person who wanted to talk to them. Many of them occurred spontaneously within conversations, but I noted down the answers and have collected my notes in appendix A. The interviewees were both men and women, although the precise ages of the guides are unknown. Most of the interviews were in English, but a few in Korean as well. The interviewees' names are not disclosed.

The interviews are not meant to be properly regarded as data, but they were a way to scan for information so I could propose hypotheses. Some of those hypotheses seemed worth pursuing in this thesis, including whether the phonemes /e/ and /ɛ/ have merged in Pyongyang or not.

3.3.5.2 Quality of the Material

Much of the material considered was rejected because the recordings were not good enough. Nevertheless, there was enough good material that I got 30 instances of every vowel for all but three informants. A few of the instances looked clear enough in Praat, but after extracting them and plotting them onto a chart, there are a few that appear in quite obviously wrong positions. These are not numerous, and do not become problematic for the analysis.

4. Data

Abstract

In this chapter, I will consider the data that will be analyzed. It is divided into two groups: Seoul and Pyongyang. The Seoul group also has a sub-group for the young informants, where samples were collected in three stages. The data is presented in the form of vowel charts.

4.1 Collected Data

The data is qualitative rather than quantitative, but is intended to reveal tendencies that could later be researched quantitatively. For example, aside from differences depending on where the informants are from, there might also be a difference that seems to depend on age, or maybe gender.

Instances of the vowels are conveniently presented in the form of vowel charts where the value of the x-axis is the F2 value and the y-axis is the F1 value. The chart has then been turned, so that it better matches the traditional orientation of the vowel quadrilateral, which has the roof of the mouth on top and the front of the mouth on the left (Ladefoged 2005: 42-43).

4.1.1 Sources

Aside from my own recordings in Seoul, I have used material from speeches and news found on YouTube (KBS News 2014a, 2014b; MissReporter China 2014; NORTH KOREA TODAY (DPRK NEWS CHANNEL) - rodrigo1 2010, 2014; Williams 2013). Everything has been analyzed in Praat, set to a sensitivity of 6 formants. This was occasionally lowered to 5 to make sure the estimate was reasonable, for example in cases where one formant registers as two in Praat at a sensitivity of 6.

4.1.2 Size of the Selection

Initially, there was going to be 12 informants tested by the same material, but this proved difficult to realize monetarily. Because of this, the number was reduced to 4 informants per city; two men and two women. Most of them are television announcers, for whom it is easy to find enough material; newscasts from Korean Central Television (KCTV) and Korean Broadcasting System (KBS) are abundant on the Internet, so even if a single video does not have enough material, there is always another video with the same announcer with a difference of only a few days. In practice, another video was only needed for the last few vowels of one informant.

I only included vowels of words I could understand myself. The target was 30 instances of each vowel per informant. 30 instances should be enough to see how the vowel spreads out, but not so much that diminishing returns become a big problem.

I initially planned on looking at both diphthongs and monophthongs to see if there were any consistent differences when the vowels appeared after a semivowel, but realized that it would have meant almost doubling the size of the data collection for a very minor and unlikely difference, and so I avoided diphthongs as much as possible. A few of the words in the collection contain diphthongs when written in Korean orthography, but are pronounced as monophthongs. These include words such as 繼續하다 (계속하다; kyesokhada) 'to continue', which is pronounced [k^hesokhada] even in prescribed pronunciation. Although I tried to avoid sequences where vowels occur either before or after another vowels or a glide as much as possible, because of my suspicion that those sequences might have "reduced" vowel articulations where the vowel is close to the glide or vowel following it, I made an exception to this in the Pyongyang data and included some cases of the dative particle 에 /e/, even though it is often pronounced /je/ in Pyongyang. There has not turned out to be any noticeable difference from the other instances of the vowel.

For the young Seoulites, the selection was divided in three, so ten vowels were from a word list, ten from a paragraph, and ten from an interview. It turned out that there was very little discrepancy between the three, aside from a "laxing" that is likely due to the speed at which the words were spoken. Unfortunately the limited material made it impossible to reach the sampling target for some of the vowels. These will be discussed below.

4.1.3 Quality of the Vowels

I have tried to use mainly vowels in roots, though that was not always possible.

Especially the vowels /e/ and /u/ tend to occur much more often in endings than in roots, since 에 and 으, both pronounced /e/, a locative particle and a possessive particle, as well as 은 /u/, a topic particle, occur very frequently.

Most of the time, if a vowel was somewhat unclear in the recording, it was skipped. I made some exceptions when hunting for some of the less frequent vowels, but never if the recording was so unclear that I could not tell whether it was reasonable or not.

Nevertheless, there are a few cases where an otherwise clear vowel has a strange value and ends up far from its "vowel blob" on the chart. The reason for this may be that there was background noise in the recording, that Praat interpreted it strangely, or simply that the speaker pronounced an instance of the vowel strangely. The strange vowels have little bearing on the average, and I have left them in there for transparency's sake.

4.2 Data from Seoul

The data from Seoul comes from two informants who are 22-23 years old, one male and one female (the 'young' informants), and from KBS News (KBS 뉴스 [kheibies(u) njʌs(u)]) announcers, one male and one female. The announcers are 40 and 30 years

old, respectively.

4.2.1 Young Informants

The data from the younger Seoulites is presented here. It is presented in the form of vowel charts (the files containing the formant values are available as appendices). Each chart contains the average sample values of all the vowels and all the points of the single vowel samples. Since all of the target vowels seem to be around the outer edges of the possible range, it was expected that rapid speech would produce more mid-centralized instances of the vowels.

4.2.1.1 Seoul1

These are the vowel charts for Seoul1, the younger female Seoulite. They are presented starting with the wordlist, then the paragraph, and finally the interview. The vowels /e/, /ɛ/, and /u/ were difficult to sample enough of, especially in the interview, but they do appear where they are expected to.

Most of the vowels in fig. 4.1 are as expected. There is no difference between /e/ and /ɛ/, which seem to have merged into /e/. There is little overlap in these samples, but a few instances of /e/ and /ɛ/ do go very high, overlapping with some instances of /i/. We see that /u/ covers both the areas for [i] and [u]. The vowels /i/ and /a/ are exactly where we would expect, but /ʌ/ seems to vary in both rounding and closeness (ranging from the common [ʌ~ɔ] to [o] on some occasions, which could mean we might find it as

[ɣ] as well), though everything but [ʌ~ɔ] is probably marginal.

The most unexpected occurrence here is the almost consistent overlap of /u/ and /o/. That is not to say they have merged, though; they clearly sound distinct. The second formant, which determines the values for the x-axis, is primarily affected by both tongue position and lip rounding (Ladefoged 2005: 42-43). The reason for this overlap could well be a systematic difference in lip configuration rather than tongue position. This merits further discussion in section 5.1.

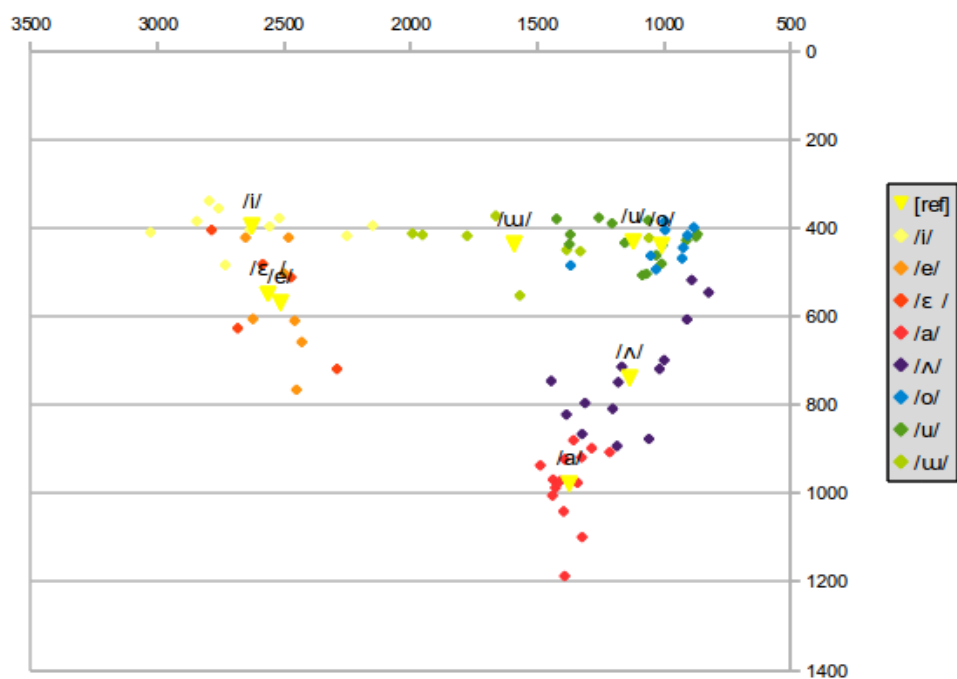


Figure 4.1: Seoul1 Wordlist

As can be seen from fig. 4.2, the pattern continues. The vowels /i/ and /a/ are still as predictable as ever, /e/ and /ɛ/ are still close enough to have a bit of overlap with /i/, /ɯ/

still ranges from back to central, and /ʌ/ still varies a lot in both roundedness and closeness (this time even overlapping a bit with /a/). As can be seen, the overlap of /o/ and /u/ is less complete here, and they both have more and less close instances, with some of them registering as open as /a/ and /ʌ/, which is almost certainly due to disturbances in the sound file. Nevertheless, there is a clear pattern here.

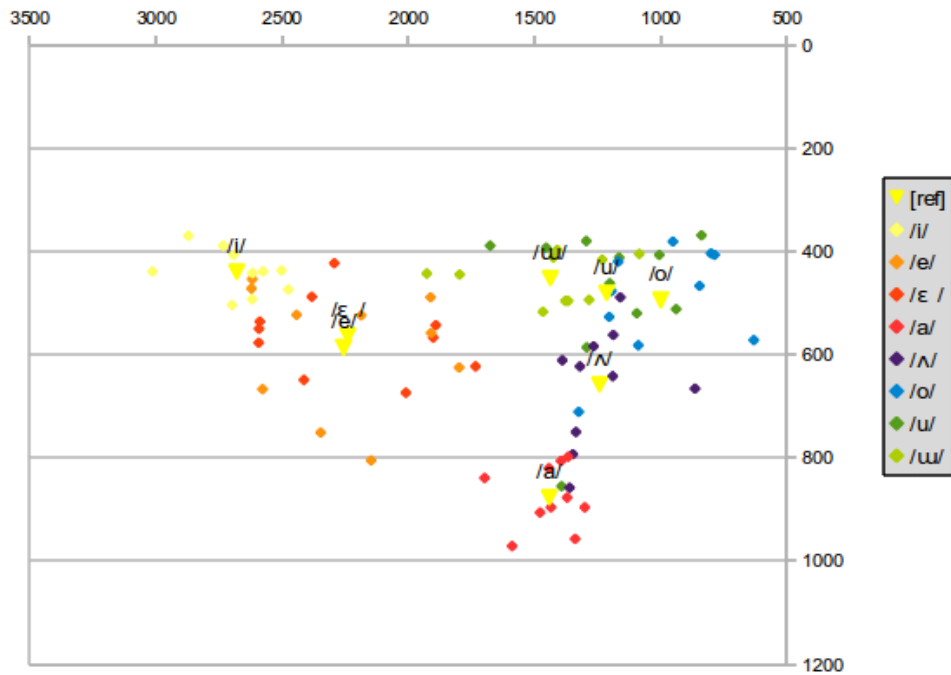


Figure 4.2: Seoul1 Paragraph

With the interview (fig. 4.3), we see the same pattern, even though the number of instances leaves something to be desired. The quality of this recording is also not as good, which leads to some instances of e.g. /e/ and /ɛ/ varying too widely to be likely. We see some overlap between /a/ and /ʌ/ as well, which might be due to the same problem. /ɯ/ ends up very centralized here, but there were only four analyzable

instances of it. Interestingly, /u/ and /o/ overlap *less* here than in the previous two charts.

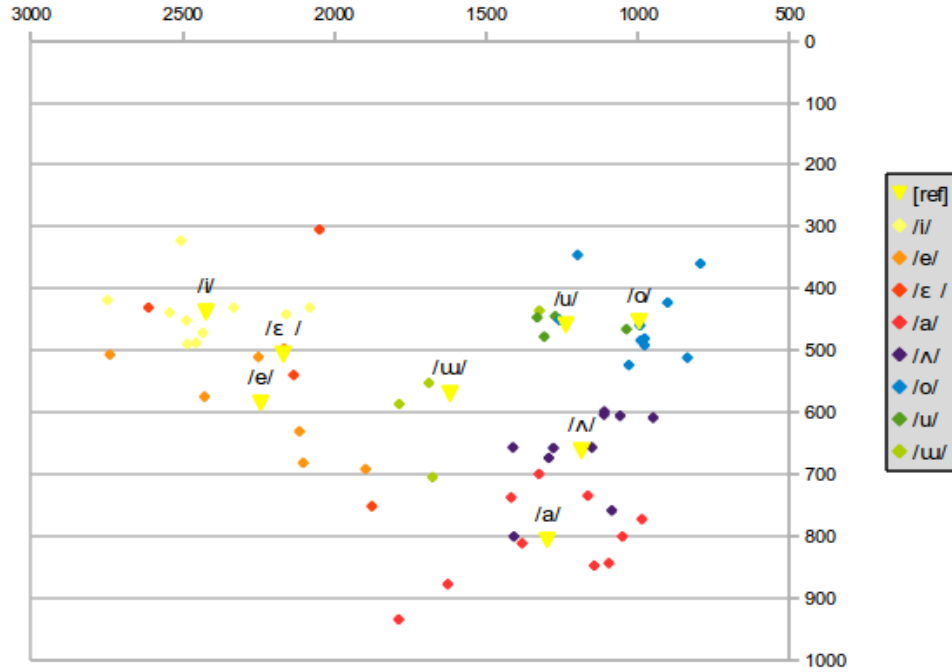


Figure 4.3: Seoul1 Interview

Figure 4.4 shows the vowel averages of the three stages, as well as the cumulative average. The general assumption of the wordlist vowels being least centralized seems to hold true, and there is a certain *tendency* for the interview vowels to be the most centralized as well, but surprisingly nothing too significant, with the exception of /e/ and /ɛ/, as well as /a/ and possibly /ʌ/.

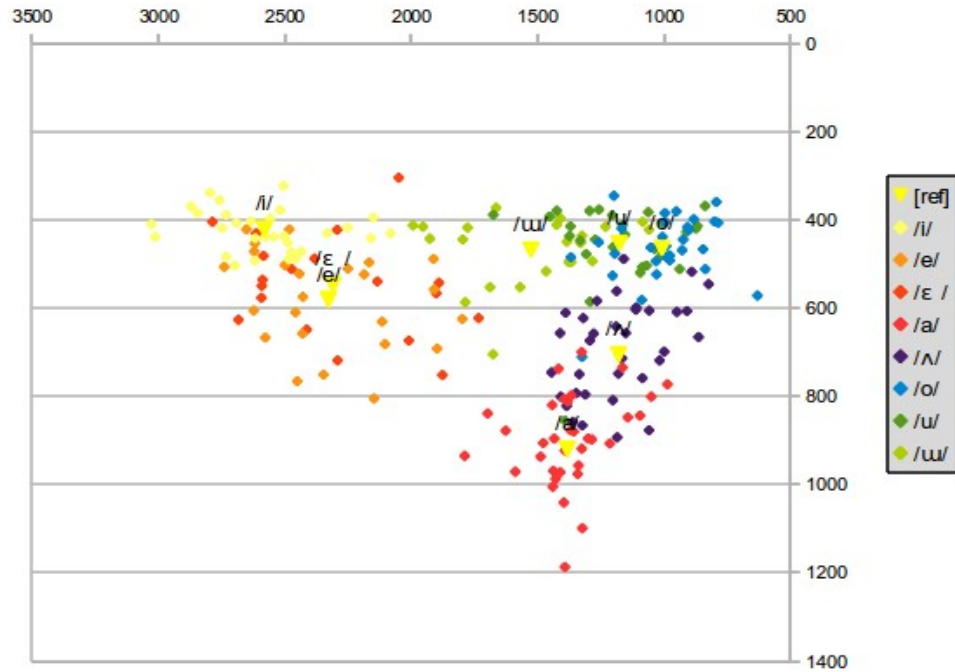


Figure 4.5: Seoul1 Complete

4.2.1.2 Seoul2

These are the vowel charts for Seoul2, the younger male Seoulite. They are presented starting with the wordlist, then the paragraph, and finally the interview. As with Seoul1, the vowels /e/, /ɛ/, and /ɯ/ were difficult to sample enough of, but for the most part, they appear where we would expect them to.

As can be seen from figure 4.6, there is some overlap between /e/, /ɛ/, and /ɯ/ in their centralized instances, and between /ɯ/, /u/, and /o/. However, the overlap between /u/ and /o/ is much smaller than it was in the material for Seoul1. In addition, /o/ averages lower in closeness than /u/, though not much. As for the second formant, /u/ rarely gets as far back as /o/.

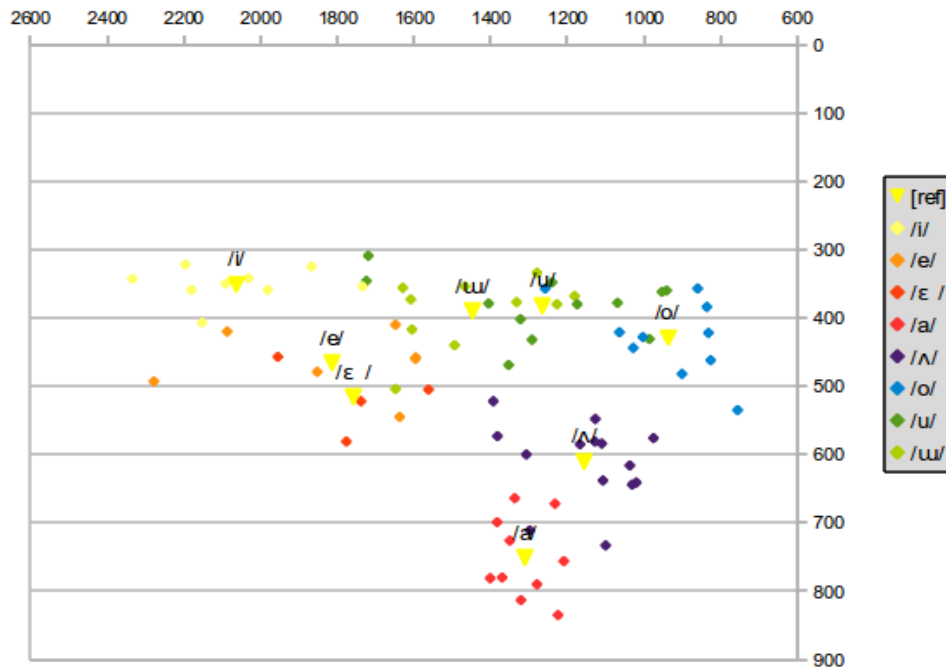


Figure 4.6: Seoul2 Wordlist

Figure 4.7 shows the vowels of the paragraph as read by Seoul2. The vowels /e/, /ε/, and /ʊ/ are very prone to centralization, and there are four instances of centralized /ʌ/ as well. They are not (historically) long vowels either – in fact, only one of them occurred in an initial syllable. We see a much greater overlap between /u/ and /o/ this time, and a greater spread overall. This could be due to less careful pronunciation, which is what the wordlist was intended to elicit.

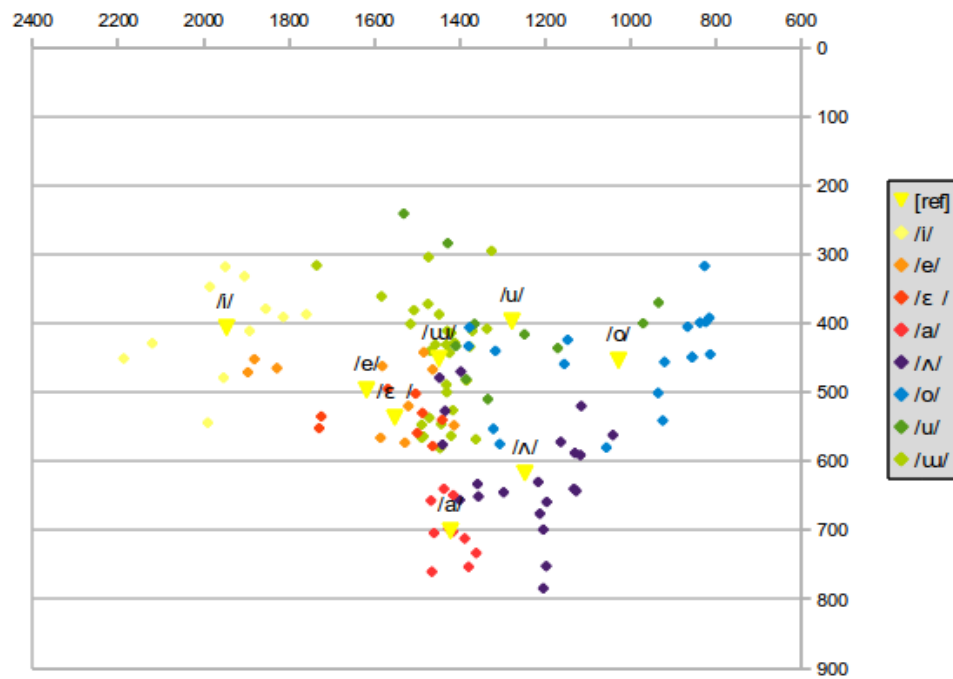


Figure 4.7: Seoul2 Paragraph

In figure 4.8, the vowels from the interview are shown. It is difficult to say much about it, beyond the overlap we see between /i/, /e/, /ɛ/, and /ɯ/. Although /u/ and /o/ look entirely distinct on this chart, there were only two instances of /u/ that were possible to analyze, meaning that this chart is probably not very representable.

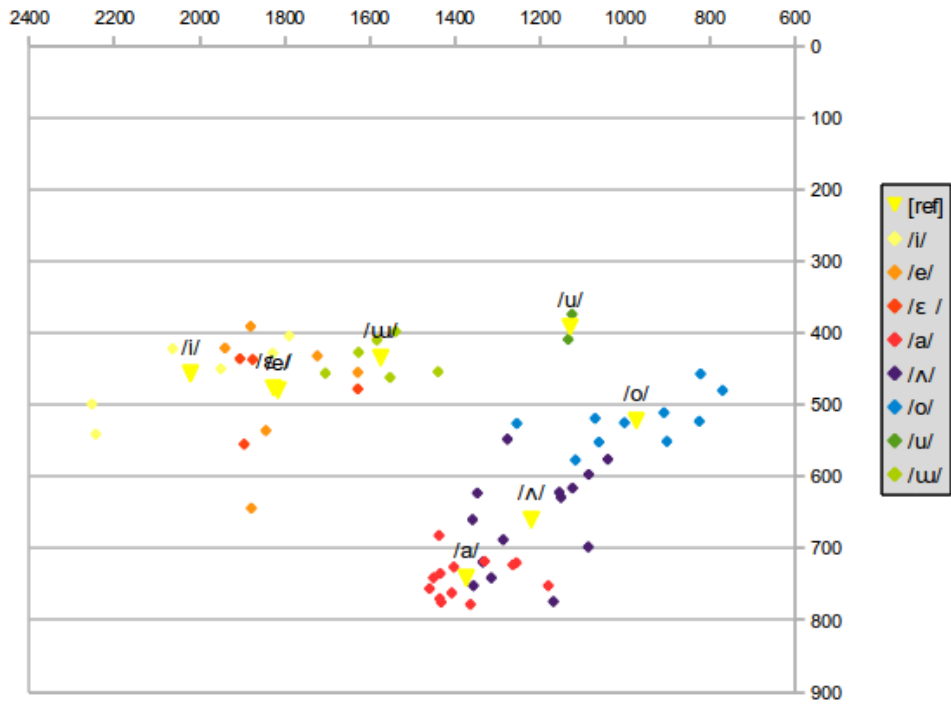


Figure 4.8: Seoul2 Interview

Figure 4.9 shows the average values of the three previous charts, as well as the average values between them. The lack of great variation here may indicate that the target pronunciation remains the same, even though rapid speech reduces the likelihood of reaching the target.

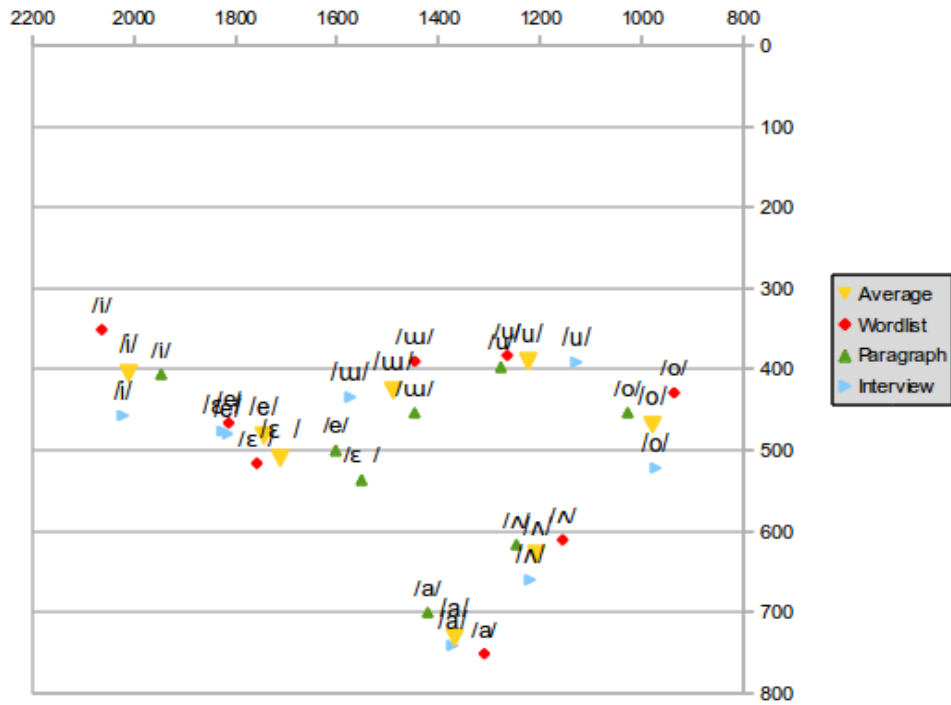


Figure 4.9: Seoul2 Averages

In figure 4.10 we see all the vowels sampled from Seoul2. Compared to Seoul1, there is very little overlap between /u/ and /o/, but they do seem to differ primarily in their F2 values. There also appears to be no doubt whatsoever that /e/ and /ɛ/ have completely merged.

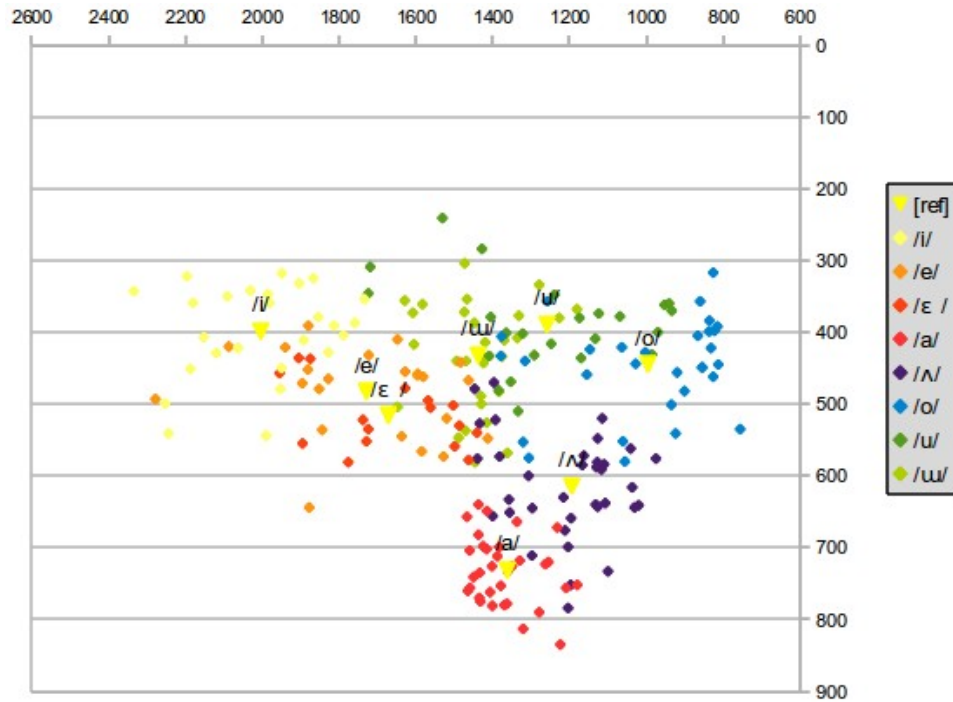


Figure 4.10: Seoul2 Complete

4.2.2 Announcers

The data from the announcers were collected from two videos on the YouTube channel of KBS news (KBS 뉴스). The vowels were pronounced by one male and one female announcer, respectively codenamed Seoul3 and Seoul4, and are mainly from the same video. Only a few of the last vowels had to be collected from a second video in order to get 30 instances of /ɛ/ and /ɯ/, and they were filmed only five days apart anyway. Since only the young informants went through a test, there is only one vowel chart for each of the other informants, including the KBS announcers.

4.2.2.1 Seoul3

Figure 4.11 shows the vowel chart for Seoul3. It is a very familiar pattern, quite like the one seen in Seoul1, in that /u/ and /o/ overlap a lot. Although the average values vary a bit, the "vowel blobs" show that the borders are similar, so we see some overlap between /i/ and /e/ and /ɛ/, for example.

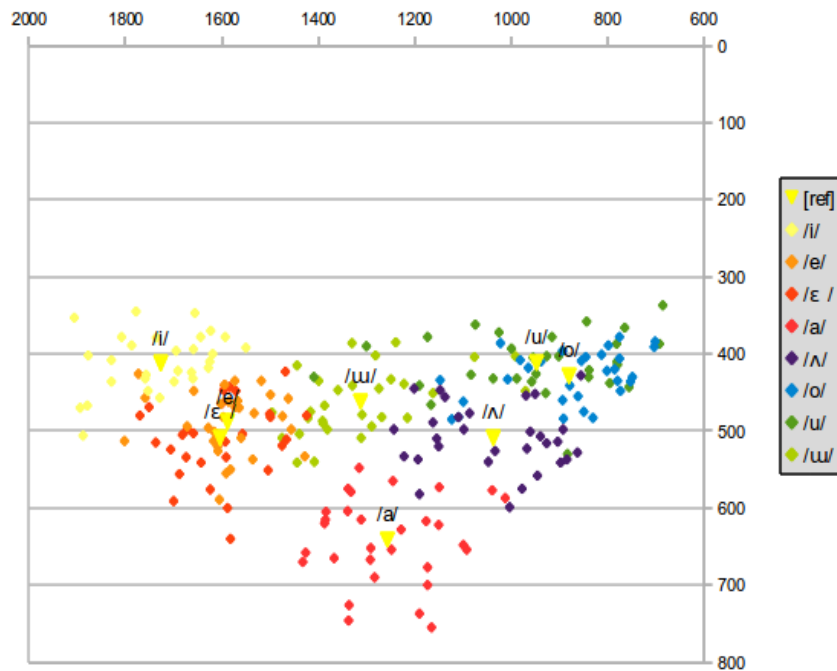


Figure 4.11: Seoul3

4.2.2.2 Seoul4

Figure 4.12 shows the vowels of Seoul4. Again there is a familiar overlap of /u/ and /o/, although we see quite a few fronted /u/ instances pulling the average F2 value up and making it overlap a great deal with /ʊ/. There is some overlap between /a/ and /ʌ/ as

well as /i/ and /e/ and /ɛ/. Also, /ʌ/ has some overlap with /o/.

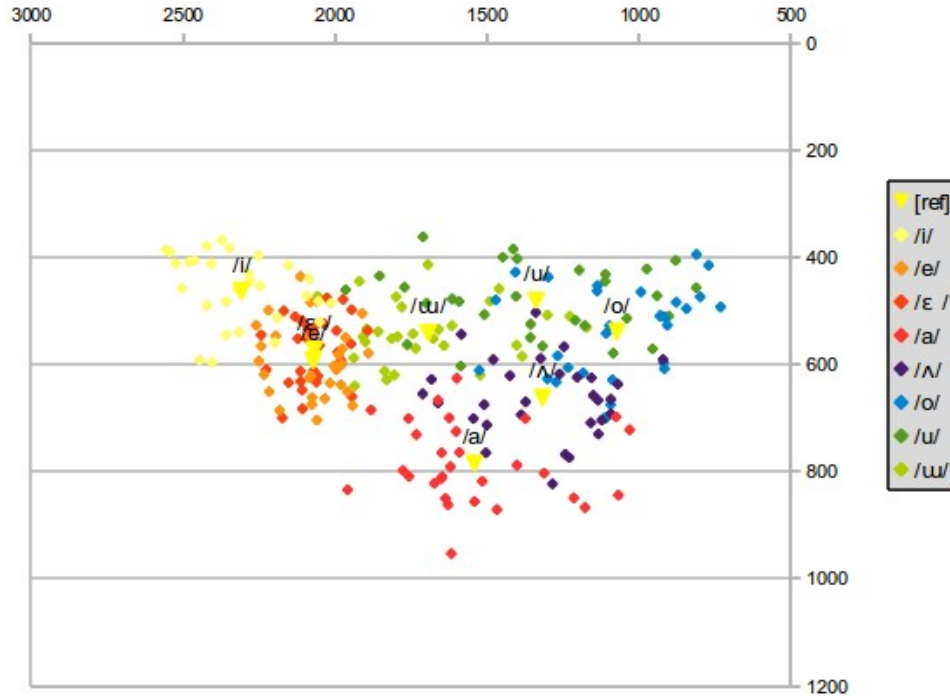


Figure 4.12: Seoul4

4.2.3 Observations

An interesting observation here is that neither of the announcers make a distinction between /e/ and /ɛ/. These two (historical) vowels overlap completely, even though they are prescriptively contrasted (Sohn 1994: 432). The fact that not even the announcers at KBS contrast them could mean that they have merged completely. This is not really a big surprise, but it is good to have evidence of it anyway.

Another observation is the great overlap between /u/ and /o/ in most of the informants.

There is a lot of /u/ fronting in Korean, particularly after sibilants, but even in its

"normal" back position, it shows up with an F2 value that is usually higher (meaning "more front" or "less rounded") than that of /o/.

4.3 Data from Pyongyang

The data from Pyongyang is exclusively from YouTube. The first informant is the current supreme leader of the DPRK, Marshall Kim Jǒng Ŭn (金正恩; 김정은), codenamed Pyongyang1. The three other informants, codenamed Pyongyang2-4, are announcers for KCTV, among whom 李春姬 (리춘희; Ri Chun Hŭi) is the most famous for the dramatic gusto in her voice. These are also presented in one vowel chart each. Ideally, I would have included only two announcers here as well, but there is a scarcity of materials with females from Pyongyang other than in song and announcing, so I decided that an extra announcer would be better than having to deal with the possible disturbance that music would add.

4.3.1 Pyongyang1

Being one of the youngest current world leaders, Marshall Kim Jǒng Ŭn could be expected to show a somewhat different vowel system from the announcers, although he was recorded in a formal setting, specifically his New Year speech. In figure 4.13, we see immediately that /e/ and /ɛ/ overlap completely, and that they have a certain overlap with /i/. There is a relatively modest overlap between /u/ and /o/; nothing like the almost complete overlap we saw in some of the Seoul informants. On the other hand, there is a

greater overlap between /o/ and /ʌ/. They are clearly distinct, but rather than differing primarily in F1 values (i.e. closeness), what separates them is the F2 value, meaning it is a difference in rounding, backness, or both. However, given that /ʌ/ and /a/ both have the same degree of backness (with a few instances of /ʌ/ going further back), it is likely that the tongue position is the same, and that /o/ is the rounded counterpart of /ʌ/. In fact, /ɔ/ is probably a better symbol than /ʌ/ in this case, and /a/ would then be more accurate than /a/, but I will keep /ʌ/ and /a/ for consistency.

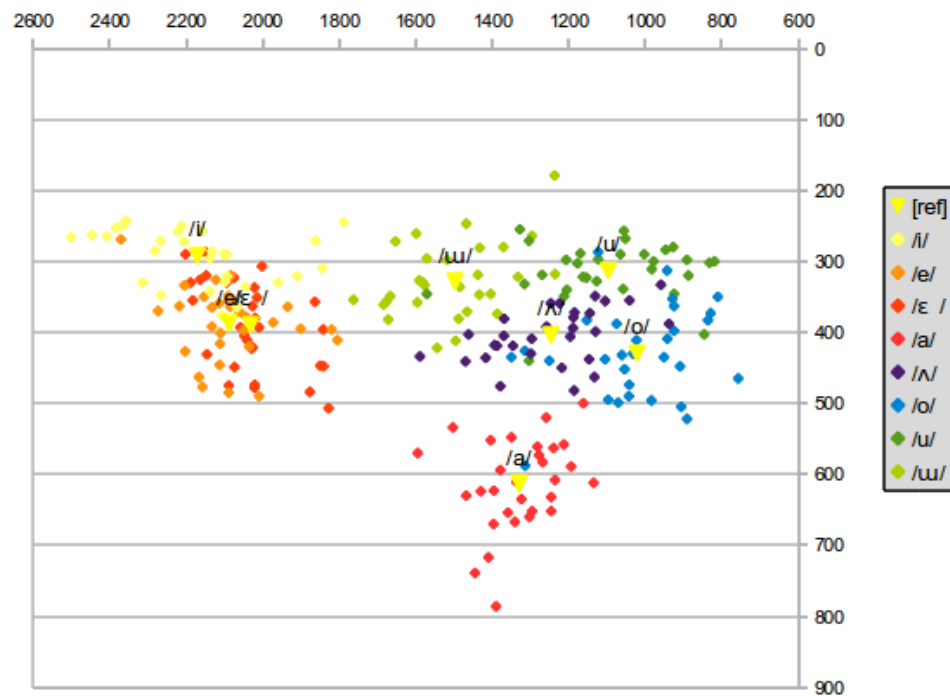


Figure 4.13: Pyongyang1

4.3.2 Pyongyang2

Pyongyang2 is the oldest of these announcers, and the recording was not always easy to analyze, with "extra formants" being very common, particularly in /e/ and /ɛ/ instances,

which might have led to a slightly lowered recorded F2 value in these. She is retired now, and may be expected to represent the speech of the older generation. Her dramatic tone sometimes gives plosives so much aspiration that the following vowels are impossible to analyze, such as 金 (김) [kʰim] being pronounced [kʰim̥] instead. Interestingly, as shown in figure 4.14, her /e/ and /ɛ/ also display a complete overlap, and they have some minor overlap with /i/. Her vowels tend to be very reduced, so /u/ is realized as [ə] and [ɐ] most of the time; it is even realized as [ɜ], but not even one instance of it is a clear [u]. It also overlaps considerably with /e/ and /ɛ/, though this could be a result of the difficulty in extracting these vowels' F2 value. There is considerable overlap between /ʌ/ and /a/, as well as /o/ and /ʌ/, with some overlap between /u/ and /o/ as well. Some instances of /ʌ/ also overlap with /u/. The darkest instances of /u/ and /o/ also display a lowered sonority.

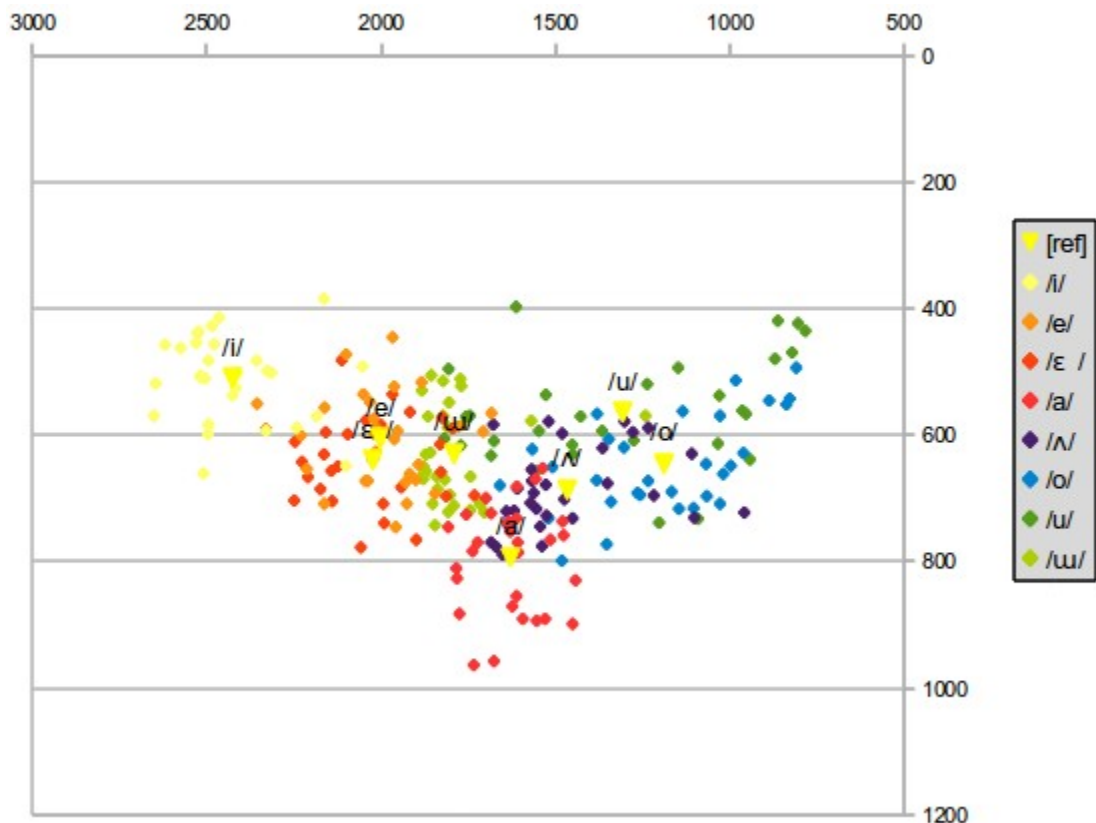


Figure 4.14: Pyongyang2

4.3.3 Pyongyang3

This second announcer for KCTV is male. His voice, while slightly dramatic, is much more natural than that of Pyongyang2. Even so, we see in figure 4.15 the same distribution of /ʊ/ – reduced and concentrated around the mid-central point. There is considerable overlap between /e/ and /ɛ/, especially considering that these vowels, together with /a/, vary the least with this informant. They also have some overlap with /i/. Pyongyang3 at first glance actually does seem to distinguish /e/ and /ɛ/, though not consistently. Whether it is because he is trained to do it or not is unknown, but it may be likely.

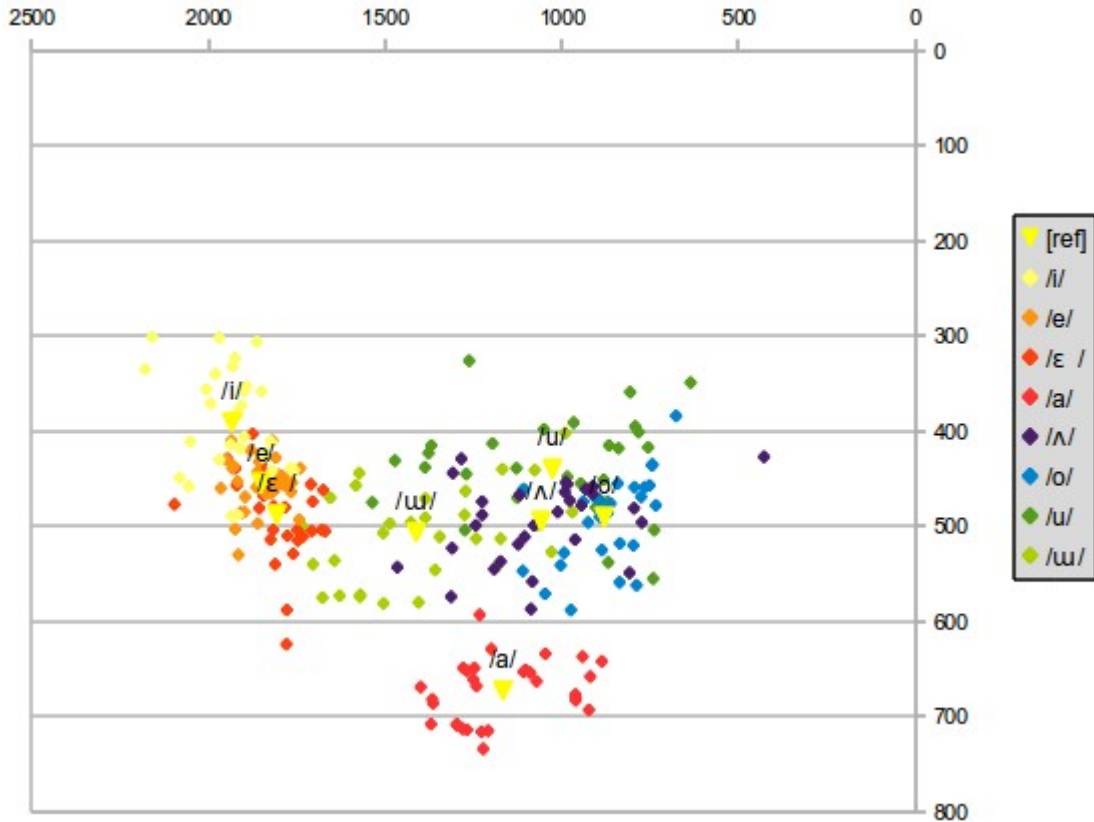


Figure 4.15: Pyongyang3

4.3.4 Pyongyang4

Figure 4.16 shows the vowel chart for Pyongyang4. For this informant, I could not get the full 30 instances of /e/, /ɛ/, and /ʊ/, but all of them have more than half, and we do see a familiar system. There seems to be a complete overlap of /e/ and /ɛ/, although a cluster of /ɛ/ instances near the bottom of the /e/ "vowel blob" could indicate that she tries to distinguish them. There is also the familiar slight overlap between /i/ and /e/ and /ɛ/. The open vowel /a/ is surprisingly distinct in this chart. No other vowel is nearly as open. Most instances of it also seem more central than in the other informants,

especially relative to /u/ and /ʌ/. That could also mean that /u/ and /ʌ/ are prone to rounding, and as can be seen, /o/ and /ʌ/ do overlap quite a bit. In fact, from this material, it may look like /o/, /ʌ/, and /u/ form a "rounding continuum" similar to the one we may have observed with /o/, /u/, and /ʊ/ in Seoul. The more open a vowel is, the less likely it is to contrast by rounding (Theil 1991: 91), and while these vowels are more open than /i/ and /u/, they seem to cover roughly the area of [ɤ~o], which is still relatively close.

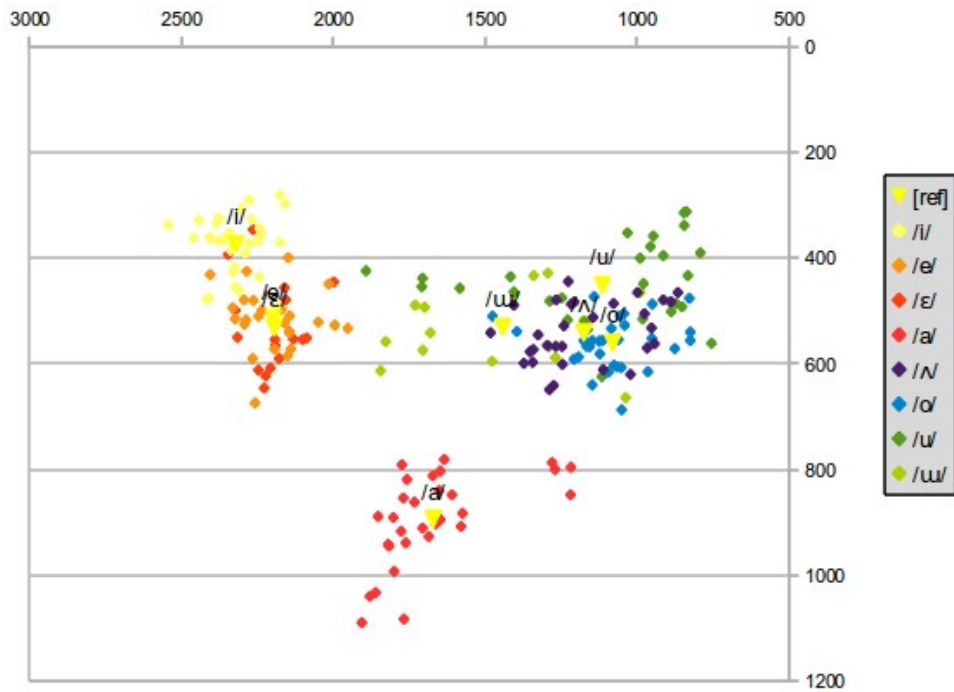


Figure 4.16: Pyongyang4

5. Analysis

Abstract

In this chapter I will analyze the data according to traditional phoneme theory. First, the hypotheses are considered in view of the data. Next, the overall system of each informant is considered, and generalizations are made for each city.

5.1 Hypotheses

Having presented the data, we can look at how it matches the working hypotheses . I will go through the hypotheses one at a time, adjusting the traditional vowel system as described by Sohn (2001: 54) and others, shown in table 5.1, along the way. It is a quadrangular system with three degrees of sonority, where the two least sonorous degrees also distinguish four degrees of timbre.

| <i>Front</i> | | <i>Back</i> | |
|------------------|----------------|------------------|----------------|
| <i>Unrounded</i> | <i>Rounded</i> | <i>Unrounded</i> | <i>Rounded</i> |
| i | y | ɯ | u |
| e | ø | ʌ | o |
| ɛ | | a | |

Table 5.1: Traditional Korean Vowel System

5.1.1 Merger of /e/ and /ɛ/

I hypothesized that this distinction was lost in Seoul, but preserved in Pyongyang.

However, none of the informants from either Seoul or Pyongyang, with two possible exceptions, seemed to distinguish these sounds, even the news anchors. This merger has consequences for the structure of the system. We must remove /ɛ/ from the equation, meaning that the system is no longer quadrangular, but triangular, as shown in table 5.2.

| <i>Front</i> | | <i>Back</i> | |
|------------------|----------------|------------------|----------------|
| <i>Unrounded</i> | <i>Rounded</i> | <i>Unrounded</i> | <i>Rounded</i> |
| i | y | ɯ | u |
| e | ø | ʌ | o |
| a | | | |

Table 5.2: Merger of /e/ and /ɛ/

The possible exceptions are Pyongyang3, and to a lesser degree Pyongyang4, who did have many instances of /ɛ/ with high F1 values, suggesting more aperture in the articulation, as shown in figure 5.1. Not counting the instance of /ɛ/ with the highest F1 value, 530 Hz, almost half of the of the /ɛ/ instances, specifically 13, have higher F1 values than any instances of /e/. The rest overlap as with the other informants. Although the difference in sonority between /ɛ/ and /a/ is striking, they could still be counted as members of the same sonority level (assuming the inclusion of /ɛ/ in the system), by merit of being the most sonorous of three vowels in the same class of timbre, though as

we will see, that is problematic.

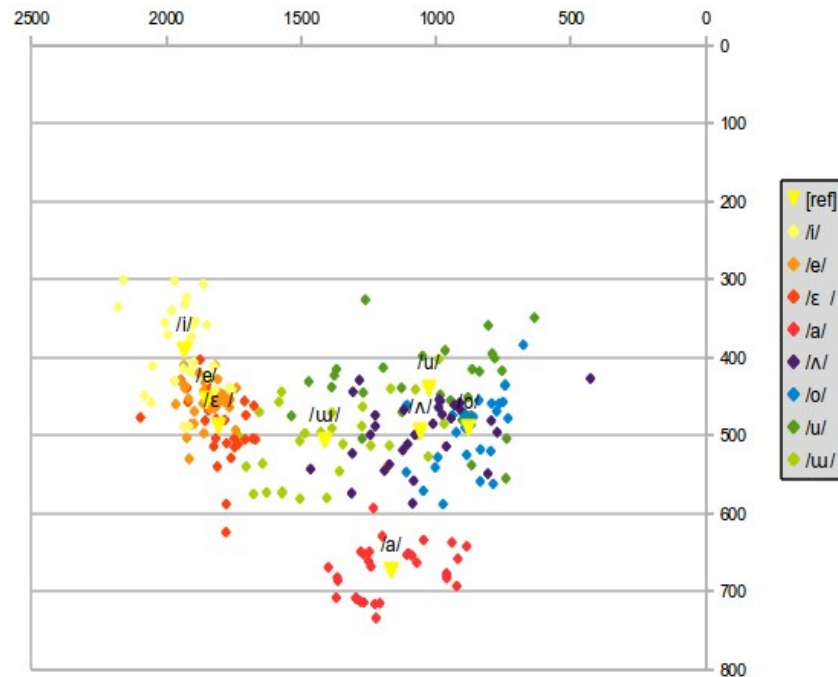


Figure 5.1: *Pyongyang3* (all thirty samples)

This is seen even better if we reduce the samples, since many of them overlap. Figure 5.2 shows *Pyongyang3* with only the twenty first samples. Although there are some instances with very low and one instance with very high sonority, the majority of /ε/ instances are quite sonorous compared to /e/, though they are still nowhere close to as sonorous as /a/. In fact, /ε/ seems to be located in the same range as /o/, /ʌ/, and /ʊ/, with /e/ sitting closer to /i/.

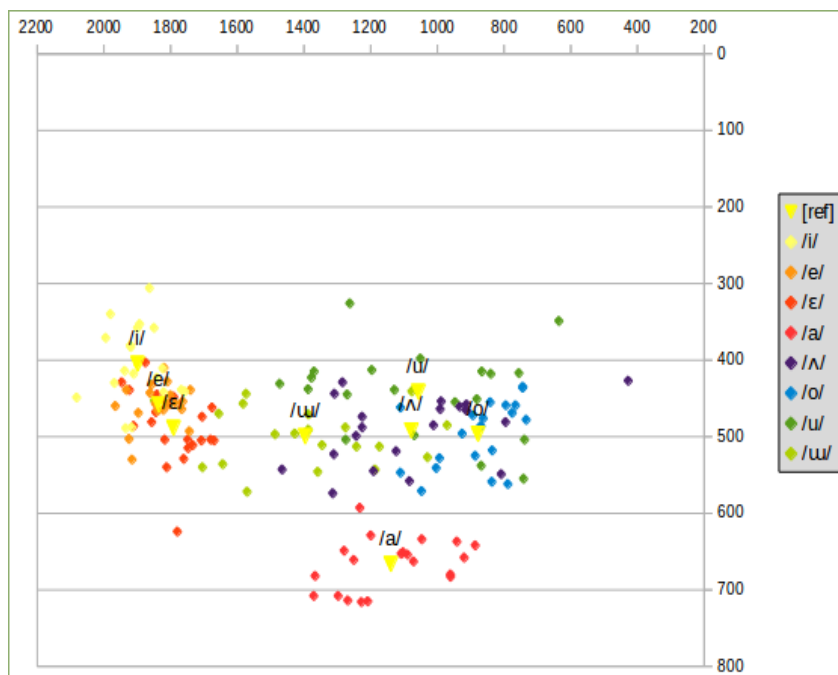


Figure 5.2: Pyongyang3 (20 first samples)

5.1.2 Realizations of /wi/ and /we/

I speculated that the front vowels [y] and [ø] would occur as allophones of /wi/ and /we/ after sibilants/palatals (/s/, /sʰ/, /tɕ/, /tɕʰ/, and /tɕʰ/) in both Seoul and Pyonyang.

Although there were cases of [y] in the predicted context, and indeed palatalization of /s/ and /sʰ/, there were no cases of [ø]. The cases where [y] was found were so few that I decided against sampling them. More commonly, the realization was simply a fronted [wi], i.e. [ɥi]. This is strange in light of Ahn's (2009: 45) comment that the realization [we] is less common than that of [wi], by extension making [ø] more common than [y] as realizations of their respective phonemes. I view this as further evidence against /y/ and /ø/ in favour of /wi/ and /we/.

These observations hold true for all eight informants. Because /w/ occurs with several vowels, it does not seem necessary to consider /wi/ and /we/ any differently, especially when their realization is almost always [wi] and [we]. In table 5.3, I therefore remove /y/ and /ø/ from the equation, and we are left with a triangular system with three degrees of sonority, but where only three degrees of timbre are distinguished.

| <i>Front</i> | <i>Back</i> | |
|------------------|------------------|----------------|
| <i>Unrounded</i> | <i>Unrounded</i> | <i>Rounded</i> |
| i | ɯ | u |
| e | ʌ | o |
| | a | |

Table 5.3: Removal of /y/ and /ø/

5.1.3 Distinction Between /u/ and /o/ in Seoul

I postulated the hypothesis that although the back vowels /u/ and /o/ are typically described as differing in F1 value (sonority), they are actually distinguished from each other by the F2 value (timbre). Although the Pyongyang informants stay true to the traditional description of /u/ vs. /o/, so that we do not need to amend table 5.3 for them, the Seoul informants do not, and the vowels differ in F2 value instead. The F1 value of /u/ and /o/ remains remarkably consistent for the Seoul informants, and although there are cases of more sonority as well, they are few and far between. A possible exception is Seoul2, as shown in figure 5.3. Seoul2's /o/ does appear to be relatively more back, as we have come to expect at this point. However, there also seems to be a

tendency towards more sonority, though counterexamples are unquestionably also numerous in this informant.

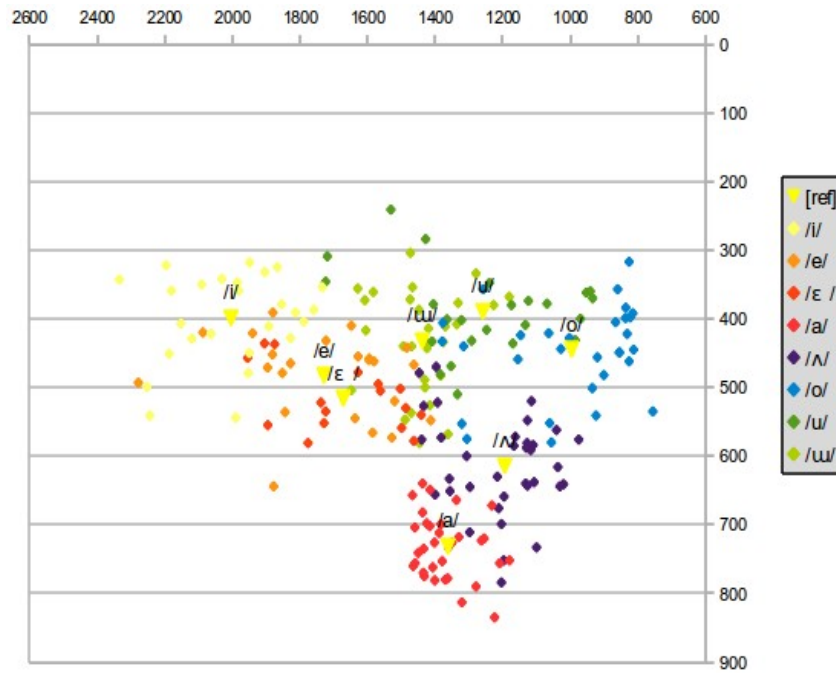


Figure 5.3: Seoul2

The fact that /u/ and /o/ have different F2 values is not new anymore. Although /o/ is relatively stable, /u/ is very prone to fronting, seemingly in all environments (though not necessarily equally often). Many of the backmost instances of /u/ do overlap considerably with /o/ for some of the informants. Sohn (2001: 69-70) mentions "raising" of /o/ to /u/ in certain positions, such as emphatic final position. However, as the data shows, it is the less sonorous /o/ that is more common, with more sonorous ones occurring much less often. When both /u/ and /o/ have the same degree of sonority, it is impossible for /o/ to be "raised" in order to merge with /u/. In addition, /o/ has a

different degree of timbre. It would be more reasonable to assume that /o/ merged with /u/ in timbre where they are neutralized. However, /u/ varies over a much larger area than /o/, so the overlap we can observe here is likely not related to the neutralization Sohn discusses.

Amending the table to account for the sonority of /o/ in Seoul, we get a triangular system with three degrees of sonority, and four degrees of timbre, but then only in the least sonorous vowels, shown in table 5.4. At the moment, I am only using the traditional symbols for the phonemes, but since /o/ covers the area for [u], it would be more accurate to transcribe it [ɯ] or [ʊ]. The first if we consider the lip configuration to be the important distinction, and the second if we consider tongue position to be important. We could even transcribe it with both, by placing the rounding diacritic above: [ɯ̠]. Conversely, /u/ in its dark realizations also covers the [u] area, so we could transcribe it as [ɯ̠], [ɯ̠], or even [ɯ̠] to distinguish them from each other.

| <i>Front</i> | <i>Back</i> | | |
|------------------|------------------|----------------|---|
| <i>Unrounded</i> | <i>Unrounded</i> | <i>Rounded</i> | |
| i | ɯ | u | o |
| e | ʌ | | |
| a | | | |

Table 5.4: Raising of /o/ (Seoul)

This is similar to the system common across Scandinavia, where four degrees of timbre

are distinguished in the least sonorous vowels, but three of the degrees are distinguished by lip configuration. Perhaps this is also the case in the Seoul system, but for back vowels, so that /u/ is unrounded, /u/ is rounded, but /o/ is more rounded than /u/. It is also possible that the tongue position is different, and rounding is the same for both. If the latter is true, the overlap we see could mean there is an ongoing neutralization, and then perhaps only in certain positions.

5.1.4 Merger of /o/ and /ʌ/

One of the most interesting hypotheses postulated in chapter 2.6 was that of a possible merger between /o/ and /ʌ/ in Pyongyang. It was based on my Korean friend's impression of Pyongyang /o/ as sounding like /ʌ/, and /ʌ/ as sounding like /o/. My Pyongyang interviews indicated that they had not merged, but as we saw in the case of /e/ and /ɛ/, the interviews are not necessarily reliable, and should only be used as a basis for asking questions that we can then find answers to.

If these sounds had merged, it would mean one out of three things. Either, they differed only in F2 value (timbre), with the F1 being irrelevant. Alternatively, they differed only in F1 value, with the F2 being irrelevant. Or, less credibly, they differed in both of these values and merged in spite of that.

The first scenario would make the most sense, considering the traditional description of both /o/ and /ʌ/ as mid vowels differing in timbre. The second scenario, however, could

also make sense if, instead of the traditional description, postulated a triangular system with four levels of sonority and three degrees of timbre distinguished only on the closest level, as shown in table 5.5. If we had a merger of /ɛ/ with /e/ and /ʌ/ with /o/, then it would simply be a case of a system no longer distinguishing four levels of sonority, reducing them to three.

| <i>Front</i> | <i>Back</i> | |
|------------------|------------------|----------------|
| <i>Unrounded</i> | <i>Unrounded</i> | <i>Rounded</i> |
| i | ɯ | u |
| e | o | |
| ɛ | ʌ | |
| a | | |

Table 5.5: Hypothetical Pyongyang Vowel System

Nevertheless, neither interpretation is actually valid, because not a single informant shows a merger between /o/ and /ʌ/. It *is* interesting to note that /o/ and /ʌ/ occur with approximately the same F1 value, as opposed to being counted as mid vowels despite occurring with a larger difference between themselves than between /u/ and /o/ as Y.-b. Kim (1977: 38) would suggest. This could also explain why my south Korean friend felt that they were so similar; in the Seoul informants, the distance between /o/ and /ʌ/ is very large, especially in F1 value, whereas in the Pyongyang informants, they are very close together, and with more or less the same F1 value.

5.2 Analysis of Vowel Systems

5.2.1 Overall Vowel Systems

Overall vowel systems can reasonably be said to exist for each speaker. There may be reason to generalize to some degree, but we should first look at the system for each informant and determine how all the vowels contrast with each other. We assume that the two relevant properties are sonority and timbre; properties of resonance are irrelevant, meaning that the two-dimensional representation is adequate. It is important not to consider the averages, which are included only as a reference, but rather the whole vowel range, with emphasis on areas with many instances. "Light" or "bright" and "dark" in this discussion are to be understood as in the sense of timbre; i.e. "back" or "rounded" rather than a reference to vowel harmony classes. The traditional system, as described by e.g. Sohn (2001: 54), is presented again for reference in table 5.6.

| <i>Front</i> | | <i>Back</i> | |
|------------------|----------------|------------------|----------------|
| <i>Unrounded</i> | <i>Rounded</i> | <i>Unrounded</i> | <i>Rounded</i> |
| i | y | ɯ | u |
| e | ø | ʌ | o |
| ɛ | | a | |

Table 5.6: Traditional Korean Vowel System

5.2.1.1 Seoul1

Figure 5.4 shows the vowel instances of Seoul1's vowels. It is clear that we must eliminate /ɛ/ by counting it as an extension of /e/, since they do not contrast at all, but

all the other vowels need to be considered.

We see that /i/ stands out as the brightest vowel in timbre and the least sonorous of the system. Its structural "neighbours" must be said to be /e/ and /ɯ/. While /e/ necessarily tends to be less bright, it must still be considered part of the same class of timbre as /i/, since they both represent the brightest areas of their respective degrees of sonority.

Although it is likely safe to consider /i/ and /ɯ/ as belonging to the same level of sonority, with /ɯ/ being in a distinctive opposition based on its degree of timbre, it is clear that /ɯ/ spans quite a large area. Most of its realizations are quite dark, but the brighter ones are numerous enough that they cannot be dismissed as errors.

/a/ is easily the most sonorous vowel of the system, with no neighbours in timbre. It overlaps quite a bit in the less sonorous instances with the most sonorous instances of /ʌ/, its neighbour in sonority, however.

The relationship between /e/ and /ʌ/ is slightly tricky because of /ʌ/'s tendency towards more sonorous realizations and /e/'s tendency towards less sonorous realizations, but in the end, considering them as being on the same level of sonority is not problematic.

/u/ and /o/ overlap a whole lot, similarly to what we saw for /e/ and /ɛ/ in Pyongyang³, but in timbre this time. There is a clear tendency towards darker realizations for /o/ and lighter realizations for /u/. In section 5.2.1.5, the transcriptions of these vowels will be

reconsidered.

On these grounds, I think it is reasonable to analyze Seoul's vowel system as a triangular, three-level, with a four-degree distinction in timbre at the least sonorous level, a two-degree distinction at the medial level, and naturally no distinctions at the most sonorous level.

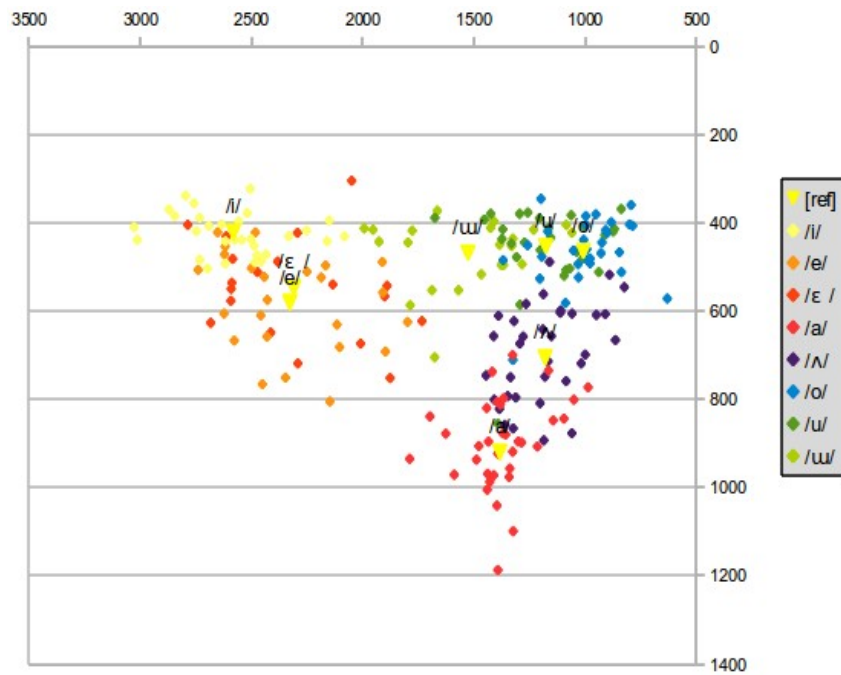


Figure 5.4: Seoul

5.2.1.2 Seoul2

Figure 5.5 shows the vowels of Seoul2. Once again, we must consider the instances of /ɛ/ to belong to /e/. This chart is less tidy than that of Seoul1, but the pattern is mostly the same. The exception, however, is /o/. In Seoul1, all instances of /o/ have very little sonority, with /ʌ/ essentially covering the entire area between /u/ and /a/. In Seoul2, although /o/ does have most of its concentration in the least sonorous and darkest areas, its entire distribution spans a much larger area, cutting /ʌ/ off from /u/ altogether by "lining the lower boundary" of /u/ with a small set of instances. While this could tempt us to conclude that /o/ differs from /u/ in sonority, it is important to note that instances of many vowels, including /u/ and /ʊ/, approach a mid central position, which might be explained by the quality of the recording or a tendency on the part of the informant to reduce vowels in less prominent positions.

Another difference is the sonority of /e/ and /ʌ/, which hardly overlap this time around. Nevertheless, it seems reasonable to consider them on the same (however wide) level of sonority. Maybe it would be reasonable to assume that the most sonorous and least sonorous levels have higher thresholds for being "considered a member", in that they represent the two extremes of the sonority range, with the medial level being more generous with "admission".

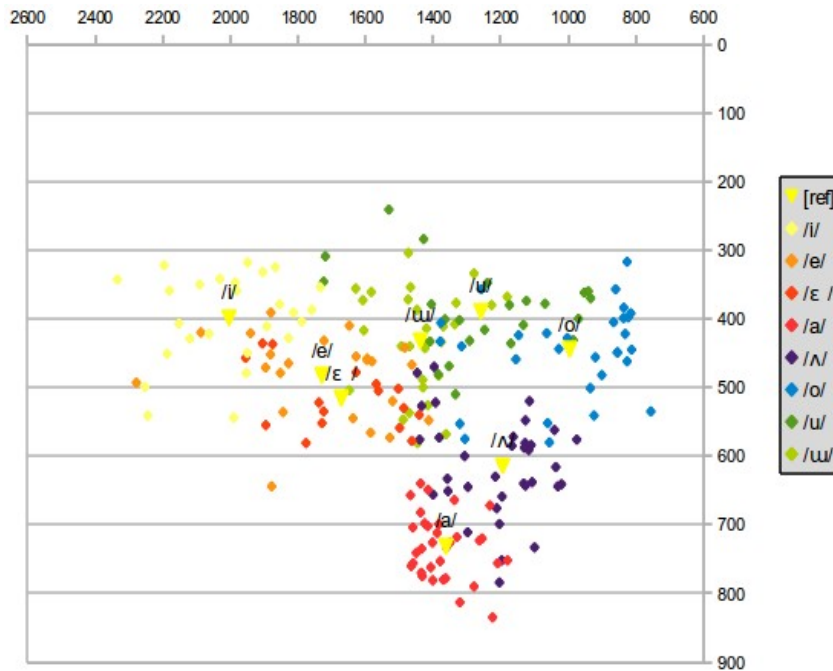


Figure 5.5: Seoul2

5.2.1.3 Seoul3

Figure 5.6 shows the vowels of Seoul3. Although /ɛ/ has merged with /e/ again, we see that most of the spectrum is actually covered quite nicely. The exception to this is the (at this point not-so-curious) overlap between /u/ and /o/, where the majority of /u/ instances are brighter and the majority of /o/ instances are darker. Although /o/ appears to have a slightly more lenient relationship to its sonority, it is clear that it is a member of the least sonorous level, as its darkest member. In this informant, /e/ and /ʌ/ are actually on almost exactly the same levels, beautifully paralleling each other. The strange thing about this map is the distribution of /ɯ/. It is very central, and stretches between the least sonorous level and the medial one. Even so, it is probably reasonable to consider it a close vowel.

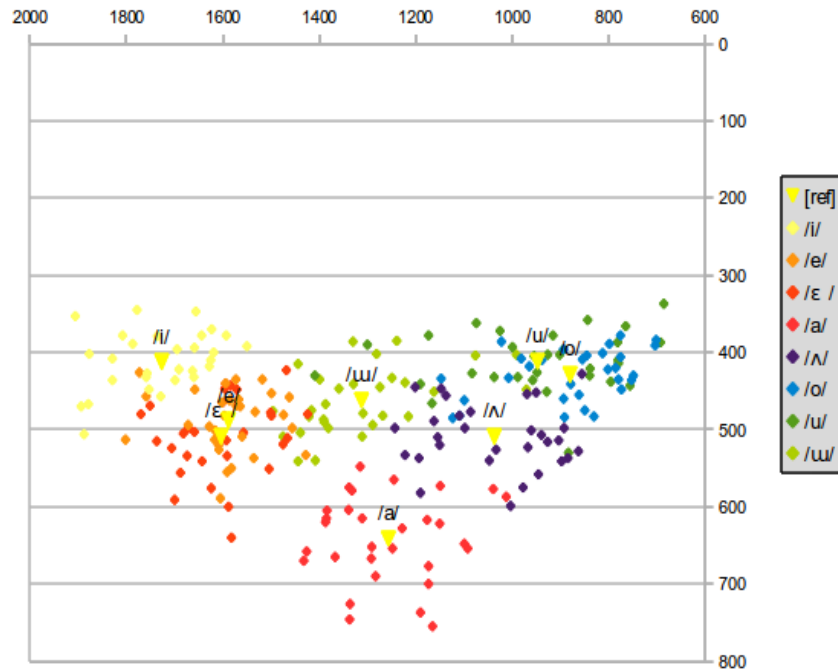


Figure 5.6: Seoul3

5.2.1.4 Seoul4

Figure 5.7 shows the vowels for Seoul4. The distribution is very similar to that of Seoul3, and /ɛ/ has notably merged with /e/ and must of course be considered part of it in this analysis. There is less overlap between /u/ and /o/ for Seoul4, and instead there is some overlap in the boundaries between /o/ and /ʌ/. Nevertheless, occurrences of /o/ are concentrated in the least sonorous and darkest regions of the chart, with instances of /u/ ranging from very dark to moderately dark – even only slightly dark in a few instances of fronting, where it overlaps with /ʊ/ – and covering a slightly less sonorous range. /ʊ/ is concentrated in the space between all the other vowels, at about the same sonority as /e/. Interestingly, /ʌ/ is concentrated in the darker areas, but its range covers

some quite light ones too. This may be because there is no rounding contrast on this level of sonority, since /o/ belongs to the least sonorous level, though /o/ admittedly has a significant number of more open occurrences as well. /ʌ/ also has a few very sonorous realizations, intersecting with /a/, but they are not very numerous.

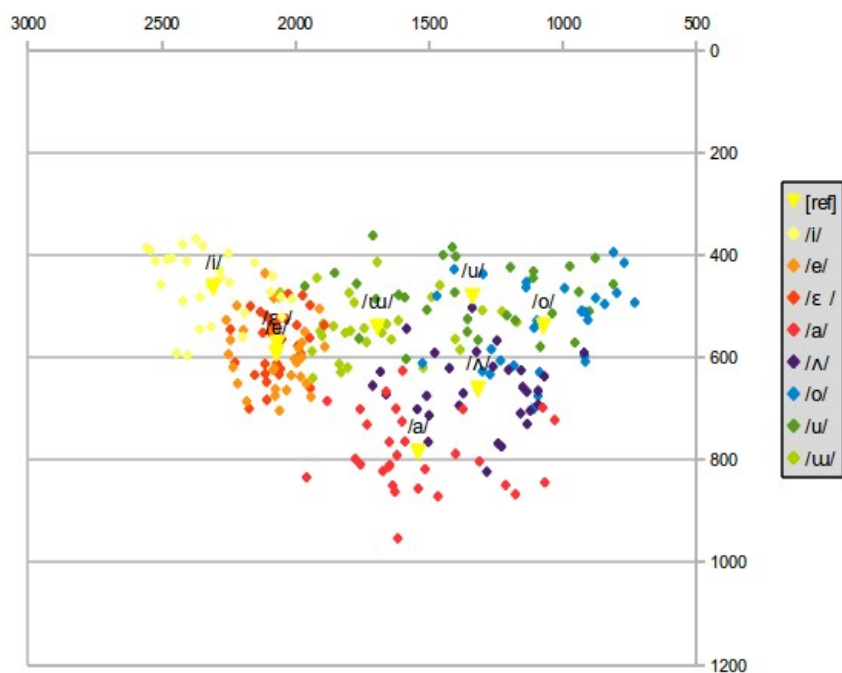


Figure 5.7: Seoul4

5.2.1.5 Seoul Generalizations

- Since all four of the Seoul informants have merged /ɛ/ with /e/, we must exclude /ɛ/ from the Seoul vowel system altogether.
- Although /e/ and /ʌ/ tend to cover somewhat different sonority ranges, they are the only two medial vowels, and must be considered to belong to the same structural level of sonority.

- /ɯ/ tends to cover the approximate area that we might label [i~ɯ], but also the same sonority as /e/, i.e. [ə], on occasions numerous enough that they must be considered.

The matter is clear-cut in Seoul1, and in Seoul2 and Seoul4, the darkest instances of /ɯ/ are less sonorous than /ʌ/, indicating that /ɯ/ belongs to the less sonorous level. For Seoul3, on the other hand, we may have to consider that /ɯ/ could belong to either of the two sonority levels, with its timbre being the distinguishing feature. With that noted, we can assign it to the least sonorous level to match the other informants.

- The Seoul informants realize both /u/ and /o/ as close vowels. The darkest in timbre, /o/ which we might transcribe [ɯ], [u], or [ù], should thus be given another symbol for future transcriptions, because even phonological transcriptions ought to use transparent symbols whenever this is possible. Since /u/ is already in use for its brighter neighbour, which we might transcribe [ɨ], [ʊ], or [ù], it might be best to change the symbols for both of these. In fact, we could go so far as to adopt the traditional central vowel symbol for /ɯ/, writing the equally appropriate /ɨ/ instead, and simply use its rounded counterpart /ɯ/ instead of /u/, and then use the freed-up /u/ symbol instead of /o/. Alternatively, /ɯ/ for /u/ and /ʊ/ for /o/ are also adequate, if we consider tongue position to be less important than lip configuration.

All of this makes the vowel system of Seoul, if we generalize from this data, the triangular one with three levels of sonority and three degrees of timbre shown in table 5.7. In parentheses, my suggestions for new symbols for the phonemes are shown where they differ from the ones we've used so far.

| <i>Front</i> | <i>Back</i> | | |
|------------------|------------------|----------------|-------|
| <i>Unrounded</i> | <i>Unrounded</i> | <i>Rounded</i> | |
| i | ɯ (i) | u (ɯ) | o (u) |
| e | ʌ | | |
| a | | | |

Table 5.7: Vowel System (Seoul)

5.2.1.6 Pyongyang1

Figure 5.8 shows the vowels of Pyongyang1, the youngest of the Pyongyang informants, whose /ɛ/ has also merged with /e/. We see a very low sonority in the realizations of /ɯ/, just like the young Seoulites; especially Seoul1. The whole system, other than the merged /e/ and /ɛ/ (and the disregarded /y/ and /ø/), fits the traditional description of the Korean vowel system. There is something to say about the degree of timbre, however. Although we count both /u/ and /o/ as back rounded vowels and /ɯ/ and /ʌ/ as their unrounded counterparts, the timbre of /u/ and /o/ is about the same, whereas the same cannot be said of /ɯ/ and /ʌ/. The former can safely be said to cover the areas of both [ɨ] and [ɯ], even approaching [ə] in a few instances, but /ʌ/ hovers around [ɤ]. It may be a difference in rounding or tongue position, but they are still the medial timbre members of their respective sonority levels.

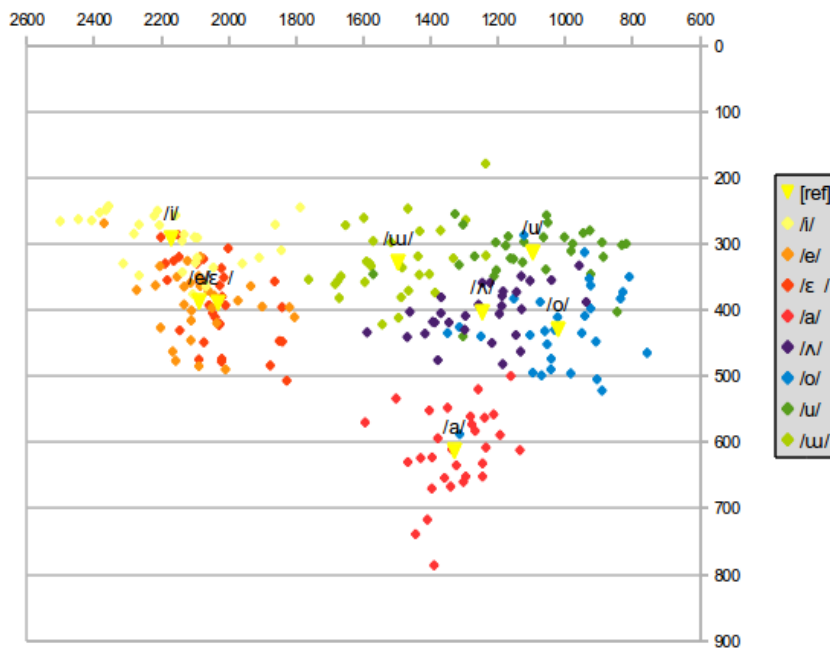


Figure 5.8: Pyongyang1

5.2.1.7 Pyongyang2

Figure 5.9 shows the vowels of Pyongyang2, and again the /ɛ/ has merged with /e/. The biggest difference from Pyongyang1 is /ɯ/. Only a few instances are as high as [i] would be expected to be, and none as far back as [u]. Instead, the timbre is consistently central, and the sonority varies from close/near-close to mid/open-mid, overlapping more than in any other informant with /e/ (and the merged /ɛ/), rather than /u/. This realization of [i~ɜ] suggests that it belongs to the medial level of sonority, and is not actually on the same level as /u/. We must also consider that many /u/ instances appear very sonorously as well, though not quite like /ɯ/.

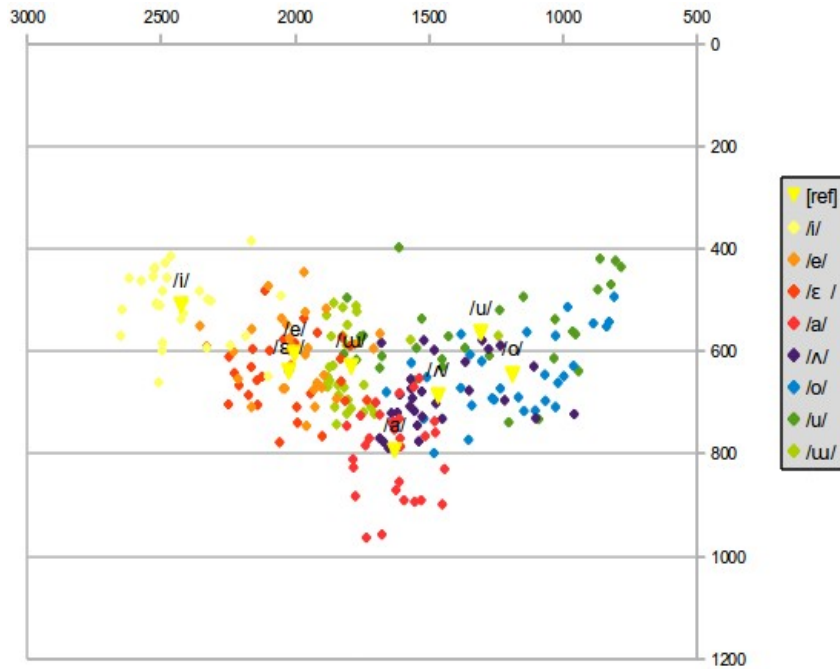


Figure 5.9: Pyongyang2

5.2.1.8 Pyongyang3

Figure 5.10 shows Pyongyang3's vowel realizations. The /e/ instances do not overlap completely with the /ɛ/ ones, so /e/ lies between the less sonorous vowels and the mid ones. The /u/ instances, as with those of Pyongyang2, are also in the approximate range [i~ɜ] or [ə~ɜ], though the majority is very mid, occupying the same sonority space as /e/ and /ɛ/, /ʌ/, and /o/. There is much more variation in timbre, with some instances going very far back and others going very far to the front, and here as well there is a bit of overlap with /ɛ/. In short, this vowel is much more sonorous than expected, and must be considered to differ from the other mid vowels by degree of timbre. The question of /e/ remains, though. It is clear that /ɛ/ and /u/ contrast in timbre, and /u/ even covers a greater and more sonorous range than /ɛ/. We must therefore consider /ɛ/ part

of the mid degree of timbre; we cannot pretend that it contrasts in timbre with /a/. Although it is typologically strange, there seems to be no other way of looking at it than to admit that /i/ and /e/ contrast in sonority, /e/ and /ɛ/ also contrast in sonority, and as we have seen, /ɛ/ is the brightest of the mid vowels. /e/ must thus be considered between /i/ and /ɛ/ on its own, or we must consider /i/ to be the most sonorous vowel on its own. The latter interpretation may actually be the most accurate, because most instances of /u/ are actually on the level of /e/, but the best approach may be to simply count it as contrasting with both /i/ and /e/ in timbre, since there is no evidence of an extra sonority level in the back vowels.

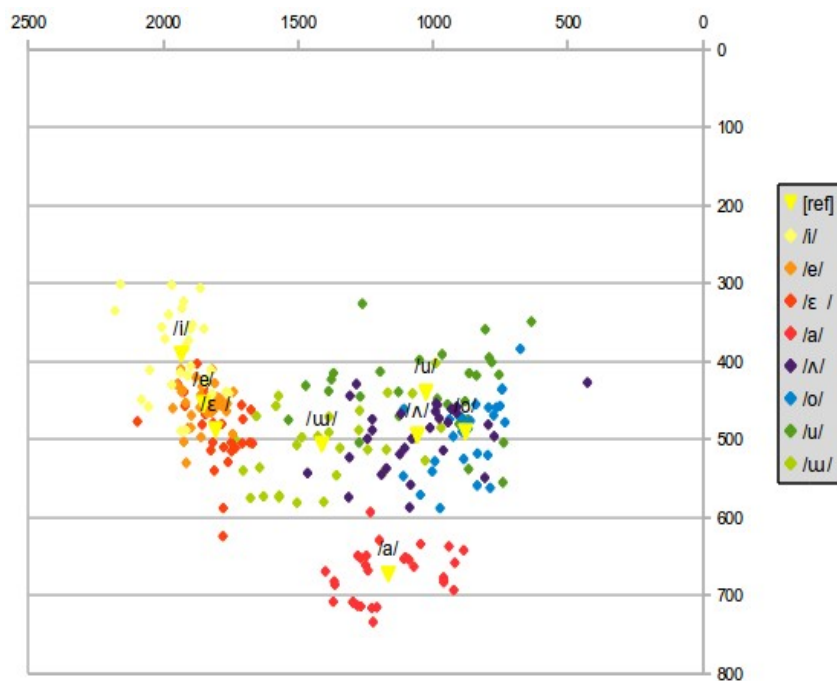


Figure 5.10: Pyongyang3

5.2.1.9 Pyongyang4

Figure 5.11 shows Pyongyang4's vowels. As with Pyongyang3, most of the realizations

of /ɛ/ were more open than most of those of /e/, suggesting that a distinction is made in the same way as in Pyongyang3. There were fewer instances of each vowel recorded for Pyongyang3, but the samples do match those of Pyongyang3 more closely than they match Pyongyang1 and Pyongyang2. Many instances of /u/ are also relatively sonorous, so if we consider /e/ to be on its own level of sonority, between /i/ and /ɛ/, we could consider /u/ as contrasting with both /i/ and /e/ in timbre. As for /ɯ/, although there were fewer samples of it, the variation lies in timbre, rather than sonority, as would be expected, but its sonority is rarely as low as that of /u/, so it falls in the mid range, between /e/ and /ɛ/, /o/ and /ʌ/. Interestingly, there is a lot of overlap between /o/ and /ʌ/, with the majority of /o/ instances in the darker area and the majority of /ʌ/ instances in the lighter area.

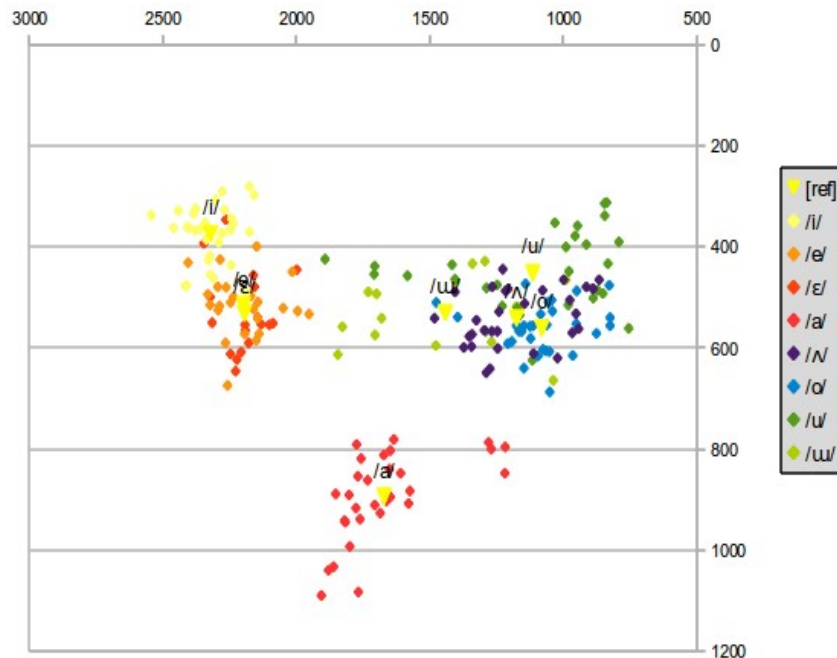


Figure 5.11: Pyongyang4

5.2.1.10 Pyongyang Generalizations

- Since both the youngest and oldest of the Pyongyang informants, the latter of whom was an experienced announcer at the time of recording, have merged /e/ and /ɛ/, there is reason to believe that these vowels have merged in Pyongyang as well. The other two announcers do tend to distinguish them, or at least produce /e/ with less sonority than the average /ɛ/, but it could be done on purpose for the job. This is assumed in table 5.7, but discussed further below.
- The two non-retired announcers' pronunciation of /o/ and /ʌ/ overlap more often than those of Pyongyang1-2. Nevertheless, the distinction lies in timbre.
- With the exception of Pyongyang1, all three informants have relatively sonorous /u/ instances, which could mean that it would be a good idea to consider it part of the medial level of sonority for the older speakers.

The Pyongyang vowel system for the older speakers could thus be interpreted as a triangular system with three levels of sonority, where three degrees of timbre are distinguished at the *second* level, rather than the first. This is illustrated in table 5.8. The system of the younger Pyongyang1 is shown in table 5.9. Both tables have my suggested alternatives for future transcriptions in parentheses. Because the mid level varies a great deal in sonority, the most important has been to select symbols from approximately the same level of sonority in the IPA without employing diacritics, so they might be more accurately transcribed /ʌ/ or /ʏ/, /ɔ/ or /ɔ̄/, but using the pair /o/-/ʌ/

implies a certain difference in sonority that is not found. The mid central vowel could be transcribed either /ə/ or /ɘ/ or even /ɘ̯/ with diacritics, in which case /ɘ̯/ should also be used. For the latter, /ɛ/ or /ɛ̯/ should be used if open symbols are selected. It is probably best to select either only the close-mid or only the open-mid IPA symbols without diacritics for simplicity. Using the close-mid symbols /e, ə, ʏ, o/ gives the least number of special symbols.

| <i>Front</i> | <i>Back</i> | | |
|------------------|------------------|-------|----------------|
| <i>Unrounded</i> | <i>Unrounded</i> | | <i>Rounded</i> |
| i | u | | |
| e (ɛ) | ʉ (ə, ə) | ʌ (ʏ) | o (ɔ) |
| a | | | |

Table 5.8: Vowel System (Pyongyang, older)

| <i>Front</i> | <i>Back</i> | | |
|------------------|------------------|--|----------------|
| <i>Unrounded</i> | <i>Unrounded</i> | | <i>Rounded</i> |
| i | ʉ | | u |
| e (ɛ) | ʌ (ʏ) | | o (ɔ) |
| a | | | |

Table 5.9: Vowel System (Pyongyang, younger)

Whether we consider it to be done on purpose or not, the system found in Pyongyang3-4 should be laid out as well, and it is shown in table 5.10, again with suggested alternatives in parentheses. In this case, it may be advisable to select the open-mid symbols, since /e/ is taken, although it is possible to use /ɪ/ or /i̯/ for /e/ to free

up that symbol; otherwise, the recommendations are the same as before. It is doubtful that it can be generalized to the average Pyongyanger, but it may well be a common one for KCTV announcers.

| <i>Front</i> | <i>Back</i> | | |
|------------------|------------------|----------------|-------|
| <i>Unrounded</i> | <i>Unrounded</i> | <i>Rounded</i> | |
| i | u | | |
| e | | | |
| ɛ | ɯ (ə, ə) | ʌ (ʏ) | o (ɔ) |
| a | | | |

Table 5.10: Vowel System (Pyongyang, older)

5.2.1.11 Final Comparison

If we assume that the traditional system was in general use among Korean adults in both Seoul and Pyongyang at the time of the Korean War, both cities have seen a vowel shift since then. Not one of the informants conformed to the traditional description in every regard. Interestingly, both systems have developed a three-way distinction in back vowels, but whereas the Seoulites have their three-way distinction in the close vowels, the older Pyongyangers have it in their mid vowels. The youngest Pyongyanger not displaying this three-way distinction is maybe an indication that it is disappearing in favour of a more symmetrical system. The vowel system of Pyongyang1 is indeed the most symmetric one of the eight we have looked at.

6. Summary and Conclusion

Abstract

In this chapter I summarize the previous chapters and make conclusions based on the data analysis. I also make some suggestions regarding future research.

6.1 Historical Development

6.1.1 Development of the Contemporary Vowel System

From the advent of the Korean alphabet in the 15th century, material for researching Korean phonology has grown increasingly abundant. It made it possible to see its development over time, for example by noticing around what time variant spellings occur.

The contemporary vowel system of the dialects in the Central and Pyongan zones, and by extension Standard Language and Cultured Language, are traditionally described as roughly the same: a quadrangular system with three levels of sonority and three to four degrees of timbre distinguished in the two lowest levels of sonority. However, since the division of Korea after World War II, the current capital cities of Seoul and Pyongyang have effectively been isolated from each other, which leads to my suspicion that their

vowel systems have diverged over the last 60 years.

6.1.2 Hypotheses

On the basis of my experiences leading up to this thesis, as well as phenomena described by the authors, I postulated four hypotheses to test in chapter 5:

- That /e/ and /ɛ/ had merged in Seoul, but not Pyongyang.
- That [y] and [ø] were allophones of /we/ and /wi/ following sibilants/palatals.
- That /o/ and /u/ were distinguished by F2 value rather than F1 in Seoul.
- That /o/ and /ʌ/ had merged in Pyongyang.

6.2 Theory and Method

6.2.1 The Problem with "Variety"

The notion that there exists clearly delimited "varieties", whether one wishes to call them "languages", "dialects", "registers", or something else entirely, does not hold water. Instead of assuming that people who live in Seoul speak the same identical "Seoul dialect", we must recognize that there are bound to be individual variations. However, we can and should expect two people of the same age who grew up in the same city and social class to sound similar, especially if they are also of the same sex, since men's and women's vocal tracts tend to be of different sizes, and although any definitive delimitation must be arbitrary, the conventional labels of "language" and "dialect", used informally, are still very useful, as long as we do not pretend that they

are more precise than they really are.

6.2.2 Phoneme Theory

Although our speech organs are capable of making a practically infinite number of noises differing in microscopic configurations of the tongue, slight variations in pitch, and so on, we do not have to be caught up in this to say something meaningful about the *sound system* of a language. Of all the innumerable possible variations, only a few are *phonologically relevant*, meaning that they contribute to the sound system of the language, and, ultimately, to the meaning of what is said. We can use the phonologically relevant features to find systems of oppositions, which we can then organize into *phonemes*, which are "the sum of the phonologically relevant properties of a sound". For a vowel system, the relevant properties are the degree of sonority and timbre, or aperture/closeness and backness in articulatory terms, though some systems have additional phonologically relevant properties, like nasality.

When considering a vowel system where vowels are distinguished by their degree of sonority and timbre, we can observe a pattern where the more sonorous members of the system contrast in timbre with as many or fewer than the less sonorous members, but rarely more. Many systems tend not to distinguish *any* degrees of timbre at all at the most sonorous level, leading the system to have a triangular shape, rather than a quadrangular one.

6.2.3 Method

Originally, the plan was to have three generations of informants, one male and one female in each, from both Seoul and Pyongyang go through a test battery. This was carried out with two young volunteers from Seoul, but the rest of the data had to be collected from the Internet. In the end, I settled on four informants from each city; two male and two female. The sound files were analyzed in Praat, and I extracted the first, second, and third formant of up to thirty instances of each traditional vowel phoneme for each informant. The first and second formant values were then used to plot the vowels onto a chart, and the third formant served as quality control.

6.3 Data

The data from the young Seoul informants was extracted in three stages, but that of all the other informants was not. The difference between the three stages was very small, and seemed to reflect the speed of the informants' speech slightly. There was great uniformity in the Seoul data, and both the two young informants and the two middle-aged announcers had roughly the same distribution of vowels. The Pyongyang data was also very uniform, but different from the Seoul data in certain ways.

6.4 Analysis and Conclusion

Both data sets indicated a merger of /e/ and /ɛ/, with two of the Pyongyang announcers seemingly trying to distinguish them. Neither data set had more than a few instances of

[y], and there were no instances of [ø] at all, so these were not sampled. The Seoul data seems to show that /u/ and /o/ do differ in F2 value rather than F1. The Pyongyang data, on the other hand, shows /o/ and /ʌ/ with the same F1 value instead. In addition, /ʉ/ appears to be very mid-centralized in most of the Pyongyang informants, although its pronunciation varies.

Table 6.1 shows the vowel system that I think we must conclude with for Seoul. My suggestions for alternative symbols are in parentheses where they differ from the symbols we have used so far. Most notable is of course the three-way distinction of timbre in close back vowels. It should be mentioned that although /ʉ/ (or /i/) was a little mid in the announcers, it was much closer than what we saw in the Pyongyang informants.

| <i>Front</i> | <i>Back</i> | | |
|------------------|------------------|----------------|-------|
| <i>Unrounded</i> | <i>Unrounded</i> | <i>Rounded</i> | |
| i | ʉ (i) | u (ʉ) | o (u) |
| e | ʌ | | |
| a | | | |

Table 6.1: Vowel System (Seoul)

Table 6.2 shows the system of the older Pyongyangers with /ɛ/ merged into /e/, and table 6.3 shows the same system, without a merger of /e/ and /ɛ/. My suggestions for alternative symbols are in parentheses, and are discussed in section 5.2.1.10. It is

interesting to note the three-way distinction in mid back vowels here, which parallels the close back vowels of Seoul. In the case where /e/ and /ɛ/ are not merged, which could stem from KCTV announcer training, /e/ peculiarly appear between /i/ and /ɛ/, while /ɛ/ is differentiated from /ʉ/ (or /ə/, /ə/) purely by timbre.

| <i>Front</i> | <i>Back</i> | | |
|------------------|------------------|-------|----------------|
| <i>Unrounded</i> | <i>Unrounded</i> | | <i>Rounded</i> |
| i | u | | |
| e (ɛ) | ʉ (ə, ə) | ʌ (ʏ) | o (ɔ) |
| a | | | |

Table 6.2: Vowel System (Pyongyang, older)

| <i>Front</i> | <i>Back</i> | | |
|------------------|------------------|-------|----------------|
| <i>Unrounded</i> | <i>Unrounded</i> | | <i>Rounded</i> |
| i | u | | |
| e | | | |
| ɛ | ʉ (ə, ə) | ʌ (ʏ) | o (ɔ) |
| a | | | |

Table 6.3: Vowel System (Pyongyang, older)

Table 6.4 shows the very symmetrical system of Pyongyang1. It is a clearly triangular system distinguishing three levels of sonority, with the two least sonorous levels distinguishing three degrees of timbre. It could be an indication that the typologically strange system with three degrees of timbre distinguished in mid back vowels is disappearing, and that the younger generation has a more symmetrical one.

| <i>Front</i> | <i>Back</i> | |
|------------------|------------------|----------------|
| <i>Unrounded</i> | <i>Unrounded</i> | <i>Rounded</i> |
| i | ɯ | u |
| e (ɛ) | ʌ (ɤ) | o (ɔ) |
| a | | |

Table 6.4: Vowel System (Pyongyang, younger)

In conclusion, despite the Korean vowel system traditionally being described as a quadrangular system with three levels of sonority and three to four degrees of timbre, it is clear from the data that this description does not fit any of the informants, who instead display a triangular system with three levels of sonority and four degrees of timbre only at the least sonorous level in Seoul and at the mid level of sonority in Pyongyang, both of which are typologically rare, but the typology must follow from the analysis; not the other way around! Pyongyang1 shows a very symmetric triangular three-level system with three degrees of timbre on all but the most sonorous level, which could indicate that this is the direction that current development is taking in Pyongyang.

6.5 Future Research

6.5.1 Extent of this Study

This only serves as a qualitative survey of eight Korean speakers, which means they may not be accurate to generalize from. Though we can reasonably assume that people

living in the same environment to sound similar to each other, it is important to stress that "the same environment", like "speech community", is not a very meaningful term, since no two people live in the exact same environment, and especially not all the time. Nevertheless, considering that we have covered some of the most obvious reasonable criteria such as age and sex, the patterns are likely to be found in other speakers as well.

Since Seoul and Pyongyang are very big cities, it may be reasonable to suspect that people from different parts of the cities may have certain differences in their vowel system. This study has not taken into account precise geography, social class, occupation besides making sure television announcers were present, or more precise age ranges, to name a few possible criteria for selecting informants.

6.5.2 Suggestions for Future Research

A future study should cover more informants and criteria alike. If possible, it should cover at least three generations, both sexes, and ideally take into account occupation. A smaller sample size per vowel is probably also a good idea. Twenty, or even just ten, vowel instances should reveal the general target pronunciation of the vowels, and any unexpected patterns could then be investigated closer.

In particular, the possible difference between /e/ and /ɛ/ in Pyongyang and the nature of /o/ and /u/ in Seoul both merit further study. It might be a good idea to conduct similar studies with more informants, and possibly also from many different places in

the Korean peninsula. It is of course also possible to use the same methods to document the vowel systems of other languages too, and this should probably be done. It seems especially advisable considering the discrepancy between the traditional description of the Korean vowel system and the one found in the Seoul data. This could indicate that similar findings could be made elsewhere as well, and especially in languages that are not yet well-described.

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Appendix A: Interviews from Pyongyang

PyongyangGuide1

me: Is 文化語 the same as Pyongyang dialect?

PG1: Yes. Well, 文化語 is without... what do you call it? Slang? That's the difference.

me: In that case I want to try to speak with a Pyongyang accent.

PG1: Oh, yes! A standard accent.

me: What do you call 'wool' in Korean? You know, like the sheep has?

PG1: You can say 털. Or you can say 羊毛. Both of them mean 'wool'.

me: Is the first one written □ ⊥ ≐?

PG1: No, ≐ † ≐.

me: Oh, OK. I think † and ⊥ sound very similar; I have trouble hearing the difference sometimes.

PG1: Yes, they are very similar.

me: Do you ever mix them up in writing?

PG1: No, they are distinct, so nobody will mix them up.

me: Even children?

PG1: Yes. It's easy to distinguish for Koreans. For me, two sounds in English are

difficult. Like the sound in 'cup' and 'bird'.

me: It's hard for you to hear the difference?

PG1: Yes.

me: Do children mix up ㅈ and ㅉ sometimes? They are also difficult for me to distinguish.

PG1: They are also similar, but they are not the same, so children can also distinguish them.

me: Is there anything that kids find difficult when they learn how to write?

PG1: Yes, sometimes the letters at the end are difficult. Children sometimes misspell 막다 with ㄹㄱ as 막다 with only ㄱ.

me: And 祝賀 as ㄷㅏㅑㅏ, right?

PG1: Oh, yes. That is also difficult.

me: What do you call the Korean alphabet in Korean?

PG1: What do you mean? 朝鮮글字?

me: OK, 글字 means "letter", right?

PG1: Yes.

PyongyangGuide2

me: Do children even mix up ㅈ and ㅉ? They are so similar to me.

PG2: No, we can hear the difference.

me: How about ㅈ and ㅉ? I have trouble with these.

PG2: No, they are different.

me: What do you call 'dog' in Korean?

PG2: 'Dog' is 개.

me: How about 'crab'?

PG2: Hehe, 'dog' is 개 and 'crab' is 게. Do you hear the difference?

me: 개 and 게? ([k^hɛ] and [k^he])

PG2: 개 and 게. ([k^ɾɛ] and [k^ɾe])

me: 개 and 게? ([k^hɛ] and [k^he])

PG2: 깨 and 껌. ([k^ɾɛ] and [k^ɾe])

me: How about 'snow' and 'eye'?

PG2: Both are 눈.

me: No difference?

PG2: Hehe, no. Both 눈.

me: How about 'night' and 'chestnut'? Are they both 밤?

PG2: Yes. 밤 and 밤, hehe.

me: Not even a difference in length?

PG2: No. They are pronounced exactly the same.

Appendix B: Word List

살다
이민가다
집에서
계속하다
의심
순간
개천절
민주주의
국가
금색
야망
황소
우유
은색
추운
과학
사랑니
사악
운명이
원숭이
소식
근육
하늘
왕위
테이블보
새
머리
공격
애
노르웨이어
세상
장군
육월
세상의 해양
오세요
데이터
일
여유
가득하다
물
월
교육
왼쪽
오른쪽
신성하다

트랙터
밭꿈치
결과
여기서
쉴
세우다
쉽다
먹으면서
팔꿈치
위업
언어
광복절

Appendix C: Paragraph

Mixed Script

外할아버지, 外할머니와 함께 우리 家族은 이번 여름 스웨덴으로 旅行을 갔다. 遠距離 海外旅行이 처음이신 外할아버지, 外할머니를 為해 父母님께서는 旅行準備를 徹底히 하셨다. 外換銀行에 들러 스웨덴 크로네로 換錢을 하시고, 或是 모를 事故에 對備하여 旅行者保險에도 加入하셨다. 나는 空港에서 무거운 짐을 들며 짐꾼노릇을 自處했다. 飛行中 飛行機體가 甚하게 흔들려 할머니께서 괴로워하셨다. 그래서 乘務員이 멀미藥을 할머니께 歡했다. 스톡홀름에 到着한 後, 우리 家旅은 스칸디나비아 傳統飲食을 맛보기 為해 한 레스토랑에 갔다. 貴한 馴鹿고기로 만든 미트볼을 注文했는데, 어른들께서는 입맛에 맞지 않은지 歡해도 드시지 않으셨다. 德分에 나는 圓없이 미트볼을 먹을 수 있었지만, 할아버지께서는 첫食事때 부터 韓國飲食을 무척 그리워하셨다.

South Korean Orthography

외할아버지, 외할머니와 함께 우리 가족은 이번 여름 스웨덴으로 여행을 갔다. 원거리 해외 여행이 처음이신 외할아버지, 외할머니를 위해 부모님께서는 여행 준비를 철저히 하셨다. 외환은행에 들러 스웨덴 크로네로 환전을 하시고, 혹시 모를 사고에 대비하여 여행자 보험에도 가입하셨다. 나는 공항에서 무거운 짐을 들며 짐꾼 노릇을 자처했다. 비행 중 비행 기체가 심하게 흔들려 할머니께서 괴로워하셨다. 그래서 승무원이 멀미약을 할머니께 권했다. 스톡홀름에 도착한 후,

우리 가족은 스칸디나비아 전통음식을 맛보기 위해 한 레스토랑에 갔다. 귀한 순록 고기로 만든 미트볼을 주문했는데, 어른들께서는 입맛에 맞지 않은지 권해도 드시지 않으셨다. 덕분에 나는 원없이 미트볼을 먹을 수 있었지만, 할아버지께서는 첫 식사때 부터 한국 음식을 무척 그리워하셨다.

Appendix D: Interviews from Seoul

Mixed Script

오늘은 어떻게 여기에 왔어요?

當身の 家族에는 戰爭에서 싸운 사람이 있어요?

統一에 對해 어떻게 생각해요?

South Korean Orthography

오늘은 어떻게 여기에 왔어요?

당신의 가족에는 전쟁에서 싸운 사람이 있어요?

통일에 대해 어떻게생각해요?

Appendix E: Lists of Formant Values

The following pages list the formant values extracted from Praat and used to create the vowel charts.

Sheet1

| Seoul1 | | | | | Seoul4 | | | | | Pyongyang3 | | | | |
|---------|-------|-----|------|------|--------|-------|-----|------|------|------------|-------|-----|------|------|
| Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
| 집에서1 | /i/ | 418 | 2252 | 3267 | 三日2 | /i/ | 545 | 2358 | 2831 | 十二月1 | /i/ | 340 | 1980 | 2758 |
| 移民가다1 | /i/ | 339 | 2796 | 3583 | KBS2 | /i/ | 560 | 2197 | 2197 | 十二月2 | /i/ | 306 | 1863 | 2569 |
| 移民가다2 | /i/ | 484 | 2732 | 3237 | 서비스2 | /i/ | 482 | 2054 | 2677 | 秘書1 | /i/ | 414 | 1937 | 2775 |
| 疑心2 | /i/ | 378 | 2519 | 3333 | 職場1 | /i/ | 472 | 2093 | 2936 | 이신1 | /i/ | 439 | 1767 | 2629 |
| 民主主義4 | /i/ | 410 | 3027 | 3522 | 李 | /i/ | 409 | 2480 | 3709 | 이신2 | /i/ | 442 | 1820 | 2613 |
| 小食2 | /i/ | 395 | 2150 | 3191 | 必要한1 | /i/ | 415 | 2153 | 2805 | 우리2 | /i/ | 430 | 1968 | 2650 |
| 테이블복2 | /i/ | 404 | 2634 | 2861 | 確定日字3 | /i/ | 521 | 2051 | 2644 | 人民軍1 | /i/ | 381 | 1920 | 2702 |
| 노르웨이語4 | /i/ | 356 | 2758 | 3555 | 인터넷1 | /i/ | 430 | 2284 | 3135 | 人民軍2 | /i/ | 489 | 1934 | 2649 |
| 머리2 | /i/ | 385 | 2845 | 3568 | 이밖에1 | /i/ | 390 | 2543 | 3265 | 人民들은2 | /i/ | 418 | 1910 | 2589 |
| 일 | /i/ | 397 | 2557 | 3186 | 인터넷1 | /i/ | 412 | 2524 | 3156 | 同志2 | /i/ | 353 | 1892 | 2726 |
| | | | | | 處理2 | /i/ | 483 | 2357 | 2824 | 時期1 | /i/ | 358 | 1849 | 2695 |
| 外할아버지5 | /i/ | 504 | 2698 | 3191 | 있는1 | /i/ | 460 | 2321 | 2625 | 時期2 | /i/ | 358 | 1899 | 2680 |
| 外할머니4 | /i/ | 439 | 3013 | 3476 | 李 | /i/ | 379 | 2422 | 3093 | 黨이2 | /i/ | 449 | 2081 | 2737 |
| 우리2 | /i/ | 407 | 2692 | 3094 | 記者1 | /i/ | 383 | 2347 | 3005 | 우리2 | /i/ | 371 | 1994 | 2758 |
| 이番1 | /i/ | 370 | 2871 | 3167 | 입니다2 | /i/ | 397 | 2251 | 3224 | 金正日3 | /i/ | 441 | 1757 | 2499 |
| 遠距離3 | /i/ | 493 | 2618 | 3202 | 두명이3 | /i/ | 540 | 2316 | 2914 | 同志2 | /i/ | 488 | 1916 | 2773 |
| 旅行이3 | /i/ | 442 | 2617 | 3389 | 숨지고2 | /i/ | 486 | 2013 | 2753 | 것이2 | /i/ | 423 | 1840 | 2752 |
| 外할머니4 | /i/ | 389 | 2733 | 3569 | 한명이3 | /i/ | 592 | 2445 | 2786 | 全民2 | /i/ | 383 | 1919 | 2468 |
| 飛行1 | /i/ | 437 | 2502 | 3220 | 進行1 | /i/ | 406 | 2462 | 3563 | 同志2 | /i/ | 406 | 1898 | 2520 |
| 飛行1 | /i/ | 474 | 2475 | 3290 | 하기2 | /i/ | 458 | 2504 | 4066 | 一心1 | /i/ | 411 | 1823 | 2476 |
| 우리2 | /i/ | 439 | 2575 | 3280 | 이番1 | /i/ | 444 | 2279 | 3265 | 一心2 | /i/ | 323 | 1925 | 2885 |
| | | | | | 대단히3 | /i/ | 596 | 2404 | 3012 | 一黨1 | /i/ | 332 | 1931 | 2534 |
| 여기2 | /i/ | 419 | 2748 | 3370 | 無理2 | /i/ | 386 | 2556 | 4162 | 人民1 | /i/ | 301 | 2159 | 2912 |
| 地下鐵1 | /i/ | 442 | 2159 | 3270 | 導入2 | /i/ | 454 | 2247 | 2722 | 人民2 | /i/ | 458 | 2055 | 2706 |
| 入口1 | /i/ | 488 | 2456 | 3226 | 李 | /i/ | 412 | 2407 | 3038 | 生活이3 | /i/ | 427 | 1847 | 2378 |
| 當身2 | /i/ | 431 | 2081 | 3299 | 食口1 | /i/ | 441 | 2086 | 2537 | 將軍님3 | /i/ | 411 | 2051 | 2761 |
| 할머니3 | /i/ | 472 | 2434 | 3309 | 避할수1 | /i/ | 513 | 2189 | 3097 | 우리2 | /i/ | 302 | 1969 | 2687 |
| 日本1 | /i/ | 452 | 2488 | 3250 | 金 | /i/ | 368 | 2373 | 3174 | 信心1 | /i/ | 356 | 2006 | 2827 |
| 避身1 | /i/ | 323 | 2506 | 3222 | 아직도2 | /i/ | 590 | 2067 | 2713 | 信心2 | /i/ | 373 | 1906 | 2869 |
| 統一2 | /i/ | 431 | 2332 | 3085 | 加入2 | /i/ | 490 | 2421 | 2995 | 人民軍1 | /i/ | 335 | 2179 | 2721 |
| 같이 | /i/ | 439 | 2543 | 3278 | | | | | | | | | | |
| 이나1 | /i/ | 490 | 2484 | 3203 | | | | | | | | | | |
| Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
| 繼續하다1 | /e/ | 503 | 2500 | 3179 | 規制2 | /e/ | 625 | 2083 | 2798 | 에서1 | /e/ | 460 | 1965 | 2510 |
| 테이블복1 | /e/ | 606 | 2623 | 3208 | 傳眞契約2 | /e/ | 662 | 2075 | 2856 | 第一1 | /e/ | 455 | 1815 | 2508 |
| 世上1 | /e/ | 658 | 2430 | 3304 | 傳眞契約3 | /e/ | 499 | 2219 | 2758 | 께서1 | /e/ | 439 | 1932 | 2425 |
| 世上의 海洋1 | /e/ | 610 | 2458 | 3303 | 인터넷3 | /e/ | 651 | 1959 | 2912 | 우리의3 | /e/ | 410 | 1819 | 2587 |
| 世上의 海洋3 | /e/ | 766 | 2451 | 3282 | 이밖에3 | /e/ | 527 | 2259 | 2638 | 民族의3 | /e/ | 458 | 1805 | 2463 |
| 오세요2 | /e/ | 422 | 2482 | 3292 | 인터넷3 | /e/ | 635 | 2016 | 2884 | 깨 | /e/ | 428 | 1909 | 2520 |
| 데이터1 | /e/ | 422 | 2652 | 3234 | 繼續1 | /e/ | 436 | 2114 | 2674 | 에 | /e/ | 457 | 1784 | 2576 |
| | | | | | 하계2 | /e/ | 547 | 2195 | 2594 | 同志의3 | /e/ | 432 | 1857 | 2487 |
| 함께2 | /e/ | 454 | 2618 | 3073 | 한계2 | /e/ | 579 | 1890 | 2439 | 그런데3 | /e/ | 454 | 1763 | 2457 |
| 에 | /e/ | 667 | 2577 | 3185 | 에서1 | /e/ | 483 | 2060 | 2647 | 主體2 | /e/ | 439 | 1740 | 2576 |
| 께서1 | /e/ | 489 | 1911 | 3246 | 만든건데4 | /e/ | 610 | 1995 | 2866 | 時期의3 | /e/ | 443 | 1861 | 2584 |
| 깨 | /e/ | 472 | 2621 | 3289 | 訓練에3 | /e/ | 571 | 1976 | 2907 | 黨의2 | /e/ | 503 | 1924 | 2531 |
| 스톡홀름에5 | /e/ | 625 | 1798 | 3466 | 에 | /e/ | 664 | 2033 | 2606 | 黨의2 | /e/ | 530 | 1915 | 2297 |
| 레스토랑에1 | /e/ | 558 | 1909 | 3244 | 放送의3 | /e/ | 686 | 2182 | 2729 | 張成澤의4 | /e/ | 465 | 1821 | 2517 |
| 레스토랑에5 | /e/ | 751 | 2347 | 3378 | 오늘의3 | /e/ | 594 | 2250 | 2835 | 精製2 | /e/ | 493 | 1743 | 2236 |
| 했는데3 | /e/ | 523 | 2442 | 3338 | 放送의3 | /e/ | 619 | 2233 | 2727 | 에서1 | /e/ | 466 | 1838 | 2343 |
| 께서는1 | /e/ | 524 | 2186 | 3219 | 放送에3 | /e/ | 651 | 2216 | 2671 | 張成澤의4 | /e/ | 469 | 1896 | 2616 |
| 德分에3 | /e/ | 805 | 2147 | 3377 | 네 | /e/ | 547 | 2082 | 2619 | 하나의3 | /e/ | 464 | 1766 | 2494 |
| | | | | | 그런데3 | /e/ | 677 | 1942 | 2752 | 하나의3 | /e/ | 446 | 1800 | 2500 |
| 어떻게3 | /e/ | 507 | 2740 | 3347 | 保稅2 | /e/ | 582 | 1988 | 2568 | 中心의3 | /e/ | 457 | 1845 | 2674 |
| 에 | /e/ | 575 | 2428 | 3060 | 健物の3 | /e/ | 603 | 2003 | 2643 | 黨의2 | /e/ | 453 | 1917 | 2454 |
| 當身에3 | /e/ | 631 | 2115 | 3329 | 에서1 | /e/ | 484 | 2081 | 2546 | 께서는1 | /e/ | 485 | 1898 | 2343 |
| 에서는1 | /e/ | 497 | 2166 | 3045 | 工事中에4 | /e/ | 550 | 1965 | 2599 | 同志의3 | /e/ | 449 | 1787 | 2510 |
| 에서1 | /e/ | 692 | 1897 | 3215 | 때문에3 | /e/ | 675 | 2076 | 2765 | 主體2 | /e/ | 459 | 1864 | 2746 |
| 에 | /e/ | 682 | 2103 | 3183 | 에서1 | /e/ | 566 | 2243 | 2683 | 同志의3 | /e/ | 430 | 1949 | 2691 |
| 어떻게3 | /e/ | 511 | 2250 | 3160 | 하는데3 | /e/ | 621 | 2078 | 2759 | 革命의3 | /e/ | 437 | 1928 | 2685 |
| | | | | | 檢察의3 | /e/ | 505 | 1910 | 2650 | 오늘에3 | /e/ | 410 | 1935 | 2624 |
| 開天節1 | /e/ | 512 | 2473 | 3191 | 經濟2 | /e/ | 600 | 1977 | 2663 | 黨의2 | /e/ | 420 | 1880 | 2580 |
| 金色2 | /e/ | 627 | 2683 | 3155 | 베란다1 | /e/ | 638 | 1980 | 2820 | 黨의2 | /e/ | 497 | 1860 | 2446 |
| 銀色2 | /e/ | 719 | 2291 | 3300 | 에 | /e/ | 704 | 2059 | 3028 | 黨의2 | /e/ | 451 | 1800 | 2473 |
| 새 | /e/ | 482 | 2584 | 3390 | | | | | | | | | | |
| 世上의 海洋4 | /e/ | 405 | 2786 | 3436 | Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
| | | | | | 大統領1 | /e/ | 632 | 2113 | 2771 | 大國1 | /e/ | 505 | 1707 | 2538 |
| 旅行2 | /e/ | 488 | 2382 | 3118 | 解消1 | /e/ | 564 | 2051 | 2772 | 偉大한2 | /e/ | 448 | 1790 | 2662 |
| 海外1 | /e/ | 577 | 2592 | 3293 | 對象1 | /e/ | 498 | 1945 | 2577 | 重大2 | /e/ | 429 | 1946 | 2739 |
| 旅行이3 | /e/ | 536 | 2588 | 3158 | 할때2 | /e/ | 551 | 2093 | 2794 | 張成澤3 | /e/ | 462 | 1675 | 2517 |
| 為해2 | /e/ | 649 | 2413 | 3222 | 通해2 | /e/ | 700 | 2173 | 2714 | 張成澤3 | /e/ | 474 | 1705 | 2488 |
| 旅行2 | /e/ | 550 | 2591 | 3450 | 때 | /e/ | 562 | 1947 | 2779 | 毒害性1 | /e/ | 540 | 1811 | 2496 |
| 銀行2 | /e/ | 674 | 2009 | 3340 | 隊員1 | /e/ | 622 | 2056 | 2775 | 偉大한2 | /e/ | 504 | 1817 | 2508 |
| | | | | | 進行2 | /e/ | 648 | 2108 | 2961 | 張成澤3 | /e/ | 504 | 1679 | 2408 |
| | | | | | 했습니다1 | /e/ | 546 | 2072 | 2786 | 行為1 | /e/ | 624 | 1779 | 2473 |
| | | | | | 대단히1 | /e/ | 520 | 2106 | 2766 | 鬭爭2 | /e/ | 481 | 1856 | 2340 |

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| | | | | | | | | | | | | | | |
|-------------|--------------|-----------|-----------|-----------|-------------|--------------|-----------|-----------|-----------|-------------|--------------|-----------|-----------|-----------|
| 그래서2 | /ɛ/ | 543 | 1890 | 3272 | 部隊2 | /ɛ/ | 552 | 2122 | 2697 | 해도1 | /ɛ/ | 486 | 1910 | 2370 |
| 했는데1 | /ɛ/ | 423 | 2293 | 3541 | 施行2 | /ɛ/ | 613 | 2114 | 2815 | 行為1 | /ɛ/ | 529 | 1760 | 2556 |
| 勸해도2 | /ɛ/ | 567 | 1901 | 3245 | 對해1 | /ɛ/ | 537 | 1995 | 2742 | 張成澤3 | /ɛ/ | 515 | 1747 | 2560 |
| 때 | /ɛ/ | 623 | 1733 | 3265 | 對해2 | /ɛ/ | 526 | 2062 | 2752 | 行為1 | /ɛ/ | 439 | 1923 | 2327 |
| 弘大2 | /ɛ/ | 540 | 2134 | 3255 | 加入해3 | /ɛ/ | 634 | 2152 | 2771 | 張成澤3 | /ɛ/ | 511 | 1733 | 2526 |
| 戰爭2 | /ɛ/ | 752 | 1876 | 3318 | 생각1 | /ɛ/ | 577 | 1990 | 2835 | 偉大한2 | /ɛ/ | 403 | 1875 | 2758 |
| 생각해요1 | /ɛ/ | 305 | 2049 | 3145 | 百圓1 | /ɛ/ | 612 | 2070 | 2786 | 行為1 | /ɛ/ | 468 | 1844 | 2354 |
| 생각해요3 | /ɛ/ | 431 | 2613 | 3215 | 管理實態4 | /ɛ/ | 683 | 2107 | 2716 | 張成澤3 | /ɛ/ | 504 | 1748 | 2493 |
| Word | Vowel | F1 | F2 | F3 | 생긴1 | /ɛ/ | 511 | 2131 | 2763 | 張成澤3 | /ɛ/ | 445 | 1840 | 2432 |
| 살다1 | /a/ | ### | 1323 | 2772 | 때문에1 | /ɛ/ | 476 | 2026 | 2758 | 張成澤3 | /ɛ/ | 505 | 1669 | 2262 |
| 살다2 | /a/ | 976 | 1341 | 3007 | 學生2 | /ɛ/ | 660 | 1944 | 2855 | 執行2 | /ɛ/ | 456 | 1710 | 2305 |
| 移民가다3 | /a/ | 898 | 1285 | 2934 | 學生2 | /ɛ/ | 633 | 2061 | 2785 | 行為1 | /ɛ/ | 588 | 1778 | 2494 |
| 移民가다4 | /a/ | 907 | 1214 | 2273 | 同生2 | /ɛ/ | 610 | 2226 | 2652 | 張成澤3 | /ɛ/ | 479 | 1815 | 2450 |
| 繼續하다3 | /a/ | 880 | 1357 | 2897 | 背任嫌疑1 | /ɛ/ | 545 | 2243 | 2792 | 行為1 | /ɛ/ | 514 | 1824 | 2429 |
| 繼續하다4 | /a/ | 969 | 1438 | 3094 | 發生2 | /ɛ/ | 524 | 2036 | 2882 | 行為1 | /ɛ/ | 510 | 1776 | 2452 |
| 瞬間2 | /a/ | 923 | 1392 | 3251 | 뎌 | /ɛ/ | 534 | 2089 | 2763 | 張成澤3 | /ɛ/ | 480 | 1783 | 2241 |
| 國家2 | /a/ | 919 | 1325 | 2967 | 對한1 | /ɛ/ | 500 | 2168 | 2809 | 張成澤3 | /ɛ/ | 463 | 1816 | 2451 |
| 野蠻1 | /a/ | 972 | 1410 | 3555 | 大統領1 | /ɛ/ | 537 | 1892 | 2767 | 行為1 | /ɛ/ | 477 | 2096 | 2635 |
| 野蠻2 | /a/ | ### | 1392 | 3464 | 大統領1 | /ɛ/ | 479 | 1973 | 2771 | 張成澤3 | /ɛ/ | 435 | 1850 | 2523 |
| 科學2 | /a/ | 987 | 1428 | 3093 | 大統領1 | /ɛ/ | 593 | 1979 | 2778 | 生活1 | /ɛ/ | 457 | 1920 | 2177 |
| 사람나1 | /a/ | 937 | 1488 | 3030 | Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
| 邪惡1 | /a/ | ### | 1396 | 2915 | 三日1 | /a/ | 849 | 1214 | 1718 | 勞動黨3 | /a/ | 715 | 1208 | 2556 |
| 邪惡2 | /a/ | ### | 1440 | 2934 | 朴大統領1 | /a/ | 844 | 1067 | 1641 | 敬愛하는3 | /a/ | 682 | 1366 | 2404 |
| 外할아버지2 | /a/ | 971 | 1588 | 3181 | 三 | /a/ | 867 | 1177 | 1626 | 하였다1 | /a/ | 663 | 1071 | 2601 |
| 함께1 | /a/ | 957 | 1338 | 3244 | 對象1 | /a/ | 698 | 1075 | 1630 | 參加1 | /a/ | 658 | 919 | 2927 |
| 家族1 | /a/ | 806 | 1394 | 3023 | 할때1 | /a/ | 722 | 1030 | 1900 | 參加2 | /a/ | 651 | 1102 | 2653 |
| 갓다2 | /a/ | 896 | 1300 | 3185 | 必要한3 | /a/ | 810 | 1647 | 2822 | 하였다3 | /a/ | 708 | 1297 | 2616 |
| 外할아버지2 | /a/ | 877 | 1370 | 2601 | 確定日字4 | /a/ | 626 | 1599 | 2887 | 黨員들1 | /a/ | 653 | 1108 | 2493 |
| 外할아버지3 | /a/ | 896 | 1434 | 3101 | 받을수1 | /a/ | 701 | 1373 | 2792 | 하고1 | /a/ | 661 | 1250 | 2335 |
| 外할머니2 | /a/ | 906 | 1477 | 3047 | 이밖예2 | /a/ | 788 | 1401 | 2535 | 偉大한3 | /a/ | 629 | 1199 | 2482 |
| 하시고1 | /a/ | 820 | 1442 | 3183 | 不動產3 | /a/ | 818 | 1515 | 3002 | 歷史的2 | /a/ | 593 | 1232 | 2477 |
| 事故1 | /a/ | 798 | 1366 | 3271 | 方案2 | /a/ | 953 | 1617 | 2847 | 黨의1 | /a/ | 680 | 960 | 2735 |
| 為하여2 | /a/ | 839 | 1697 | 3084 | 方案2 | /a/ | 798 | 1776 | 2780 | 하고1 | /a/ | 649 | 1279 | 2474 |
| 갓어요1 | /a/ | 878 | 1626 | 2788 | 다음1 | /a/ | 856 | 1541 | 2861 | 黨의1 | /a/ | 637 | 941 | 2503 |
| 地下鐵2 | /a/ | 812 | 1381 | 1810 | 잡혀1 | /a/ | 803 | 1312 | 2540 | 千萬2 | /a/ | 716 | 1227 | 2467 |
| 타고1 | /a/ | 773 | 986 | 1418 | 받던1 | /a/ | 667 | 1661 | 2685 | 反黨1 | /a/ | 683 | 960 | 2794 |
| 타고1 | /a/ | 844 | 1095 | 1412 | 特戰司3 | /a/ | 764 | 1590 | 2921 | 反黨2 | /a/ | 714 | 1268 | 2573 |
| 大學 | /a/ | 735 | 1164 | 1680 | 다쳤습니다1 | /a/ | 834 | 1958 | 2742 | 張成澤1 | /a/ | 642 | 886 | 2557 |
| 까지1 | /a/ | 700 | 1325 | 1630 | 만 | /a/ | 791 | 1620 | 2829 | 反黨1 | /a/ | 654 | 1089 | 2723 |
| 當身1 | /a/ | 935 | 1788 | 3440 | 하기1 | /a/ | 700 | 1624 | 2425 | 反黨2 | /a/ | 708 | 1370 | 2591 |
| 家族1 | /a/ | 848 | 1143 | 1845 | 만 | /a/ | 701 | 1758 | 2658 | 張成澤1 | /a/ | 634 | 1046 | 2507 |
| 싸운 | /a/ | 738 | 1417 | 1722 | 事故1 | /a/ | 862 | 1628 | 2672 | 反黨1 | /a/ | 693 | 923 | 2661 |
| 사람2 | /a/ | 801 | 1050 | 1722 | 대단히2 | /a/ | 685 | 1881 | 2793 | 反黨2 | /a/ | 734 | 1222 | 2561 |
| Word | Vowel | F1 | F2 | F3 | 危險한3 | /a/ | 725 | 1601 | 2993 | 하나2 | /a/ | 686 | 1364 | 2456 |
| 집에서3 | /a/ | 809 | 1202 | 2831 | 하계1 | /a/ | 850 | 1636 | 2858 | 思想1 | /a/ | 677 | 961 | 2698 |
| 開天節2 | /a/ | 866 | 1323 | 3576 | 한계1 | /a/ | 765 | 1649 | 2692 | 思想2 | /a/ | 652 | 1268 | 2513 |
| 開天節3 | /a/ | 822 | 1385 | 3158 | 하는1 | /a/ | 731 | 1732 | 2817 | 하나1 | /a/ | 713 | 1280 | 2448 |
| 머리1 | /a/ | 518 | 890 | 3168 | 만든1 | /a/ | 822 | 1673 | 2714 | 하나2 | /a/ | 669 | 1399 | 2498 |
| 데이터3 | /a/ | 719 | 1017 | 2634 | 습니다3 | /a/ | 809 | 1756 | 2718 | 黨 | /a/ | 668 | 1241 | 2551 |
| 神聖하다2 | /a/ | 877 | 1059 | 3341 | 防彈1 | /a/ | 871 | 1467 | 3225 | 歷史的2 | /a/ | 649 | 1247 | 2661 |
| 트랙터3 | /a/ | 699 | 999 | 2258 | 防彈2 | /a/ | 813 | 1650 | 2701 | 나갈수1 | /a/ | 709 | 1297 | 2367 |
| 여기서3 | /a/ | 893 | 1185 | 3243 | Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
| 먹으면서1 | /a/ | 607 | 909 | 3113 | 서비스1 | /a/ | 768 | 1242 | 2658 | 朝鮮2 | /a/ | 458 | 912 | 2500 |
| 먹으면서4 | /a/ | 749 | 1180 | 3147 | 庶民1 | /a/ | 618 | 1261 | 3116 | 朝鮮2 | /a/ | 466 | 912 | 2423 |
| 偉業2 | /a/ | 714 | 1166 | 2405 | 贈呈2 | /a/ | 621 | 1424 | 2880 | 에서2 | /a/ | 481 | 795 | 2519 |
| 言語1 | /a/ | 546 | 823 | 2411 | 傳貫契約1 | /a/ | 658 | 1150 | 2907 | 朝鮮2 | /a/ | 464 | 991 | 2372 |
| 言語2 | /a/ | 796 | 1311 | 3173 | 確定日字2 | /a/ | 730 | 1133 | 2960 | 秘書2 | /a/ | 454 | 988 | 2318 |
| 光復節3 | /a/ | 746 | 1445 | 2680 | 인터넷2 | /a/ | 694 | 1387 | 3180 | 金正恩2 | /a/ | 558 | 1083 | 2376 |
| 할머니2 | /a/ | 562 | 1187 | 3219 | 業務1 | /a/ | 625 | 1156 | 3146 | 께서2 | /a/ | 549 | 808 | 2772 |
| 番 | /a/ | 584 | 1265 | 3188 | 인터넷2 | /a/ | 670 | 1372 | 3137 | 全的1 | /a/ | 429 | 1284 | 2474 |
| 遠距離2 | /a/ | 642 | 1189 | 3113 | 處理1 | /a/ | 701 | 1544 | 2770 | 全的2 | /a/ | 545 | 1191 | 2182 |
| 처음1 | /a/ | 858 | 1360 | 3235 | 받던2 | /a/ | 591 | 1479 | 2853 | 金正日2 | /a/ | 523 | 1310 | 2146 |
| 外할아버지4 | /a/ | 489 | 1159 | 3118 | 特戰司2 | /a/ | 713 | 1500 | 3029 | 그런데2 | /a/ | 543 | 1465 | 2407 |
| 께서2 | /a/ | 666 | 863 | 3343 | 이番2 | /a/ | 624 | 1203 | 2954 | 歷史的3 | /a/ | 444 | 1308 | 2206 |
| 徹底1 | /a/ | 623 | 1319 | 3333 | 危險2 | /a/ | 823 | 1284 | 3103 | 千萬1 | /a/ | 499 | 1243 | 2506 |
| 들리2 | /a/ | 793 | 1347 | 3204 | 에서2 | /a/ | 667 | 1134 | 2830 | 張成澤2 | /a/ | 461 | 932 | 2430 |
| 그래서3 | /a/ | 750 | 1335 | 3440 | 건 | /a/ | 567 | 1246 | 2940 | 精製1 | /a/ | 427 | 427 | 2493 |
| 멀미藥1 | /a/ | 611 | 1389 | 2400 | 그런데2 | /a/ | 589 | 1323 | 2920 | 에서2 | /a/ | 474 | 1225 | 2316 |
| 어떻게1 | /a/ | 606 | 1058 | 2037 | 三干2 | /a/ | 765 | 1503 | 3162 | 張成澤2 | /a/ | 485 | 1011 | 2390 |
| 어떻게2 | /a/ | 657 | 1151 | 2278 | 먹통1 | /a/ | 591 | 920 | 2951 | 害毒性3 | /a/ | 488 | 1225 | 2590 |
| | | | | | 安全2 | /a/ | 672 | 1661 | 3042 | 歷史的3 | /a/ | 519 | 1123 | 2279 |
| | | | | | 點檢1 | /a/ | 675 | 1509 | 3004 | 것은1 | /a/ | 574 | 1313 | 2352 |
| | | | | | 點檢2 | /a/ | 774 | 1229 | 3107 | 金正日2 | /a/ | 478 | 944 | 2292 |
| | | | | | 健物1 | /a/ | 637 | 1069 | 2897 | 께서는2 | /a/ | 511 | 1105 | 2408 |
| | | | | | 天障1 | /a/ | 628 | 1682 | 3110 | 金正恩2 | /a/ | 587 | 1087 | 2398 |

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|-------------|--------------|-----------|-----------|-----------|-------------|--------------|-----------|-----------|-----------|-------------|--------------|-----------|-----------|-----------|
| 에서2 | /N | 759 | 1085 | 1993 | 天障1 | /N | 544 | 1584 | 3119 | 에서2 | /N | 456 | 984 | 2535 |
| 에서2 | /N | 801 | 1408 | 2868 | 設置1 | /N | 655 | 1711 | 2657 | 것이1 | /N | 496 | 773 | 2515 |
| 戰爭1 | /N | 658 | 1278 | 1677 | 되어서3 | /N | 665 | 1092 | 2826 | 全黨1 | /N | 467 | 1119 | 2392 |
| 없어1 | /N | 609 | 949 | 2597 | 어려운1 | /N | 503 | 1339 | 2716 | 全軍1 | /N | 473 | 977 | 2421 |
| 없어2 | /N | 657 | 1411 | 3214 | 에서2 | /N | 704 | 1122 | 2818 | 全民1 | /N | 537 | 1173 | 2434 |
| 할머니2 | /N | 599 | 1110 | 1690 | 健物1 | /N | 692 | 1092 | 3009 | 金正恩2 | /N | 514 | 962 | 2282 |
| 어떻게1 | /N | 674 | 1293 | 2182 | 에서2 | /N | 709 | 1158 | 2934 | 強盛2 | /N | 499 | 1078 | 2316 |
| 너무1 | /N | 604 | 1111 | 1529 | | | | | | | | | | |
| Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
| 繼續하다2 | /o/ | 469 | 928 | 2318 | 大統領2 | /o/ | 627 | 1301 | 2803 | 朝鮮1 | /o/ | 436 | 744 | 2839 |
| 黃소2 | /o/ | 405 | 995 | 1981 | 또 | /o/ | 608 | 916 | 1859 | 勞動黨1 | /o/ | 528 | 993 | 2579 |
| 小食1 | /o/ | 463 | 1052 | 2463 | 勞動1 | /o/ | 453 | 1136 | 1848 | 勞動黨2 | /o/ | 525 | 886 | 2549 |
| 테이블복4 | /o/ | 445 | 924 | 2499 | 勞動2 | /o/ | 597 | 918 | 2130 | 朝鮮1 | /o/ | 459 | 794 | 2727 |
| 노르웨이語1 | /o/ | 417 | 907 | 2841 | 해서2 | /o/ | 463 | 1137 | 1598 | 勞動黨1 | /o/ | 541 | 1003 | 2453 |
| 오세요1 | /o/ | 399 | 882 | 2354 | 으로2 | /o/ | 542 | 1107 | 2634 | 勞動黨2 | /o/ | 562 | 788 | 2586 |
| 왼쪽2 | /o/ | 494 | 1031 | 2864 | 確定日字도5 | /o/ | 512 | 915 | 2840 | 朝鮮1 | /o/ | 469 | 775 | 2786 |
| 오른쪽1 | /o/ | 385 | 996 | 2402 | 도 | /o/ | 510 | 930 | 2966 | 勞動黨1 | /o/ | 571 | 1047 | 2500 |
| 오른쪽3 | /o/ | 485 | 1368 | 3097 | 通해1 | /o/ | 465 | 993 | 2912 | 勞動黨2 | /o/ | 559 | 836 | 2622 |
| 光復節2 | /o/ | 439 | 1006 | 2523 | 不動産2 | /o/ | 616 | 1183 | 2798 | 同志1 | /o/ | 476 | 862 | 2465 |
| | | | | | 業務도3 | /o/ | 509 | 928 | 2961 | 모든1 | /o/ | 478 | 733 | 2542 |
| | | | | | 繼續2 | /o/ | 428 | 1406 | 1654 | 으로2 | /o/ | 486 | 869 | 2596 |
| 父母님2 | /o/ | 711 | 1324 | 2473 | 消息1 | /o/ | 480 | 1471 | 2897 | 하고2 | /o/ | 435 | 743 | 2546 |
| 그로니2 | /o/ | 582 | 1088 | 1416 | 捕虜로1 | /o/ | 700 | 1113 | 2894 | 同志1 | /o/ | 472 | 893 | 2457 |
| 하시고3 | /o/ | 404 | 800 | 2172 | 捕虜로2 | /o/ | 701 | 1110 | 2937 | 하고2 | /o/ | 459 | 765 | 2553 |
| 或是1 | /o/ | 381 | 951 | 2462 | 捕虜로3 | /o/ | 675 | 1093 | 2892 | 害毒性 | /o/ | 455 | 841 | 2515 |
| 모름1 | /o/ | 467 | 845 | 2086 | 숨지고3 | /o/ | 496 | 843 | 1677 | 反動2 | /o/ | 518 | 835 | 2510 |
| 事故2 | /o/ | 527 | 1203 | 1550 | 事故2 | /o/ | 484 | 877 | 2817 | 領導2 | /o/ | 547 | 1110 | 2486 |
| 保險1 | /o/ | 407 | 786 | 1734 | 導入1 | /o/ | 437 | 1298 | 2585 | 領導2 | /o/ | 462 | 1110 | 2469 |
| 空港1 | /o/ | 572 | 630 | 1528 | 보고1 | /o/ | 415 | 770 | 2762 | 同志1 | /o/ | 496 | 925 | 2456 |
| 노릇1 | /o/ | 420 | 1167 | 1837 | 보고2 | /o/ | 493 | 731 | 2895 | 하고2 | /o/ | 471 | 902 | 2669 |
| 傳統2 | /o/ | 477 | 1194 | 1992 | 放送2 | /o/ | 633 | 1272 | 2745 | 하고2 | /o/ | 483 | 874 | 2634 |
| | | | | | 오늘1 | /o/ | 395 | 810 | 2757 | 또 | /o/ | 520 | 797 | 2552 |
| 오늘1 | /o/ | 460 | 992 | 2398 | 放送2 | /o/ | 584 | 1267 | 2838 | 同志1 | /o/ | 474 | 939 | 2531 |
| 타고2 | /o/ | 492 | 977 | 1971 | 아직도3 | /o/ | 611 | 1525 | 2838 | 라고2 | /o/ | 461 | 1107 | 2291 |
| 弘大1 | /o/ | 346 | 1198 | 2418 | 放送2 | /o/ | 629 | 1087 | 2377 | 오늘1 | /o/ | 457 | 751 | 2508 |
| 타고2 | /o/ | 512 | 836 | 2120 | 있다고3 | /o/ | 474 | 798 | 2817 | 同志1 | /o/ | 490 | 892 | 2491 |
| 家族2 | /o/ | 481 | 977 | 1810 | 無料로3 | /o/ | 606 | 1233 | 2786 | 으로2 | /o/ | 588 | 974 | 2570 |
| 日本2 | /o/ | 484 | 990 | 2219 | 좋아1 | /o/ | 528 | 1096 | 2772 | 은社會1 | /o/ | 384 | 676 | 2635 |
| 으로2 | /o/ | 451 | 1258 | 2177 | 保稅1 | /o/ | 527 | 906 | 2984 | 하고2 | /o/ | 460 | 917 | 2196 |
| 統一1 | /o/ | 423 | 901 | 2118 | | | | | | | | | | |
| 고 | /o/ | 524 | 1029 | 2383 | Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
| 統一1 | /o/ | 360 | 793 | 2221 | 九月1 | /u/ | 457 | 811 | 2113 | 우리1 | /u/ | 413 | 1196 | 2270 |
| | | | | | 不便1 | /u/ | 518 | 1209 | 2581 | 人民軍3 | /u/ | 439 | 1128 | 2465 |
| Word | Vowel | F1 | F2 | F3 | 不動産2 | /u/ | 424 | 1196 | 2178 | 主體1 | /u/ | 431 | 1472 | 2434 |
| 瞬間1 | /u/ | 415 | 1370 | 2992 | 業務2 | /u/ | 528 | 1178 | 2438 | 重大1 | /u/ | 415 | 866 | 2418 |
| 民主主義2 | /u/ | 437 | 1373 | 3227 | 特殊2 | /u/ | 473 | 1404 | 2773 | 主體1 | /u/ | 423 | 1377 | 2264 |
| 民主主義3 | /u/ | 380 | 1424 | 2949 | 訓練1 | /u/ | 403 | 1400 | 2558 | 全軍2 | /u/ | 504 | 1274 | 2447 |
| 國家1 | /u/ | 414 | 868 | 2341 | 두명1 | /u/ | 422 | 974 | 3790 | 國家1 | /u/ | 504 | 738 | 2238 |
| 牛乳1 | /u/ | 428 | 911 | 2108 | 숨지고1 | /u/ | 566 | 1317 | 2594 | 反國家的2 | /u/ | 417 | 755 | 2263 |
| 물 | /u/ | 390 | 1205 | 2635 | 訓練1 | /u/ | 461 | 1965 | 2624 | 國家1 | /u/ | 455 | 946 | 2308 |
| 추운1 | /u/ | 383 | 1062 | 2731 | 訓練1 | /u/ | 456 | 1771 | 2536 | 將軍님2 | /u/ | 415 | 1369 | 2230 |
| 추운2 | /u/ | 507 | 1085 | 2819 | 訓練1 | /u/ | 603 | 1586 | 2364 | 人民軍3 | /u/ | 538 | 868 | 2378 |
| 원숭이2 | /u/ | 434 | 1154 | 3466 | 無理1 | /u/ | 406 | 878 | 2446 | 國家1 | /u/ | 418 | 839 | 2302 |
| 발꿈치 | /u/ | 377 | 1257 | 2526 | 外國2 | /u/ | 510 | 901 | 2274 | 貴重2 | /u/ | 555 | 741 | 2449 |
| 將軍2 | /u/ | 462 | 1030 | 2340 | 特殊2 | /u/ | 483 | 1591 | 2724 | 國 | /u/ | 451 | 881 | 2416 |
| 팔꿈치 | /u/ | 420 | 873 | 2226 | 部隊1 | /u/ | 472 | 940 | 2842 | 主體1 | /u/ | 445 | 1270 | 2313 |
| 세우다2 | /u/ | 504 | 1069 | 2177 | 訓練1 | /u/ | 362 | 1710 | 2478 | 主體1 | /u/ | 438 | 1387 | 2402 |
| 팔꿈치2 | /u/ | 481 | 1009 | 1885 | 訓練1 | /u/ | 435 | 1853 | 3080 | 主體1 | /u/ | 398 | 1050 | 2288 |
| | | | | | 國會1 | /u/ | 579 | 1084 | 2586 | 將軍님2 | /u/ | 498 | 1069 | 2381 |
| 우리1 | /u/ | 512 | 938 | 2765 | 無料1 | /u/ | 432 | 1110 | 2143 | 로부터2 | /u/ | 326 | 1262 | 2338 |
| 父母님1 | /u/ | 369 | 837 | 2416 | 불꽃1 | /u/ | 385 | 1413 | 2392 | 우리1 | /u/ | 349 | 635 | 2571 |
| 準備1 | /u/ | 389 | 1675 | 3118 | 健物2 | /u/ | 445 | 1111 | 2784 | 人民軍3 | /u/ | 470 | 1126 | 2371 |
| 무거운1 | /u/ | 412 | 1164 | 2184 | 어려운 | /u/ | 486 | 1698 | 2919 | 대문에2 | /u/ | 448 | 984 | 2406 |
| 집권2 | /u/ | 462 | 1201 | 1756 | 中學校1 | /u/ | 525 | 1356 | 2465 | 할수2 | /u/ | 480 | 903 | 2511 |
| 乘務員2 | /u/ | 855 | 1392 | 2219 | 工事中3 | /u/ | 563 | 1762 | 2597 | 우리1 | /u/ | 391 | 966 | 2315 |
| 後 | /u/ | 586 | 1292 | 3359 | 대문에2 | /u/ | 550 | 1357 | 2582 | 國家1 | /u/ | 401 | 782 | 2256 |
| 우리1 | /u/ | 407 | 1005 | 2086 | 朴三求3 | /u/ | 571 | 955 | 2784 | 分子1 | /u/ | 475 | 886 | 2438 |
| 馴鹿1 | /u/ | 393 | 1453 | 3336 | 그름2 | /u/ | 400 | 1448 | 2403 | 人民軍3 | /u/ | 474 | 871 | 2459 |
| 注文1 | /u/ | 380 | 1294 | 2334 | 朴贊求3 | /u/ | 514 | 1039 | 2599 | 우리1 | /u/ | 395 | 792 | 2403 |
| 韓國2 | /u/ | 520 | 1094 | 2714 | 부터1 | /u/ | 478 | 1614 | 2685 | 우리1 | /u/ | 359 | 806 | 2458 |
| | | | | | 秋夕1 | /u/ | 507 | 1508 | 3020 | 主體1 | /u/ | 475 | 1536 | 2251 |
| 入口2 | /u/ | 447 | 1331 | 2425 | | | | | | | | | | |
| 싸운2 | /u/ | 445 | 1272 | 1661 | Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
| 너무2 | /u/ | 478 | 1308 | 3016 | KBS3 | /u/ | 585 | 1384 | 1826 | 金正恩3 | /u/ | 513 | 1173 | 2528 |
| 너무2 | /u/ | 466 | 1037 | 1825 | 서비스3 | /u/ | 620 | 1522 | 2896 | 오늘2 | /u/ | 470 | 1655 | 2213 |
| | | | | | 으로1 | /u/ | 510 | 1227 | 1757 | 黨員들3 | /u/ | 511 | 1345 | 2395 |
| Word | Vowel | F1 | F2 | F3 | 인터넷을4 | /u/ | 564 | 1402 | 1943 | 들 | /u/ | 491 | 1386 | 2331 |

Sheet1

| | | | | | | | | | | | | | | |
|--------|-----|-----|------|------|---------|-----|-----|------|------|-------|-----|-----|------|------|
| 金色1 | /w/ | 416 | 1953 | 3070 | 인터넷을4 | /w/ | 552 | 1676 | 2863 | 사람들은2 | /w/ | 497 | 1486 | 2437 |
| 筋肉1 | /w/ | 413 | 1993 | 2866 | 訓練을3 | /w/ | 531 | 1171 | 1879 | 金正恩3 | /w/ | 488 | 1275 | 2455 |
| 하늘2 | /w/ | 553 | 1569 | 3390 | 進行은3 | /w/ | 543 | 1743 | 2790 | 모든2 | /w/ | 441 | 1076 | 2300 |
| 테이블복3 | /w/ | 450 | 1384 | 2781 | 事故는3 | /w/ | 539 | 1858 | 2840 | 으로1 | /w/ | 485 | 970 | 2365 |
| 노르웨이語2 | /w/ | 453 | 1330 | 2869 | 訓練을3 | /w/ | 552 | 1813 | 2911 | 그런데1 | /w/ | 471 | 1386 | 2199 |
| 가득하다2 | /w/ | 418 | 1777 | 3225 | 禍根2 | /w/ | 535 | 1659 | 2892 | 에서는3 | /w/ | 540 | 1704 | 2392 |
| 오른쪽2 | /w/ | 373 | 1664 | 2903 | 特殊1 | /w/ | 414 | 1694 | 2907 | 큰 | /w/ | 513 | 1242 | 2413 |
| 먹으면서2 | /w/ | 423 | 1059 | 3017 | 하는2 | /w/ | 548 | 1794 | 2855 | 께서는3 | /w/ | 496 | 1427 | 2432 |
| 가족은3 | /w/ | 494 | 1283 | 3214 | 訓練을3 | /w/ | 613 | 1836 | 3029 | 金正恩3 | /w/ | 543 | 1186 | 2385 |
| 여름2 | /w/ | 496 | 1377 | 3171 | 만든건데2 | /w/ | 534 | 1896 | 2772 | 金正恩3 | /w/ | 527 | 1029 | 2456 |
| 으로1 | /w/ | 517 | 1466 | 3263 | 들 | /w/ | 640 | 1935 | 2866 | 있는2 | /w/ | 546 | 1358 | 2426 |
| 를 | /w/ | 443 | 1926 | 3208 | 오늘2 | /w/ | 549 | 1908 | 2698 | 오늘2 | /w/ | 457 | 1582 | 2382 |
| 銀行1 | /w/ | 416 | 1231 | 3340 | 그런데1 | /w/ | 482 | 1490 | 2608 | 同志를 | /w/ | 453 | 1848 | 2510 |
| 들러1 | /w/ | 397 | 1409 | 2193 | 오늘2 | /w/ | 474 | 1799 | 2727 | 一黨은3 | /w/ | 536 | 1643 | 2428 |
| 그로네1 | /w/ | 496 | 1366 | 3225 | 오늘은3 | /w/ | 570 | 1734 | 2733 | 張成澤은4 | /w/ | 572 | 1570 | 2413 |
| 그래서1 | /w/ | 445 | 1796 | 3124 | 天障을3 | /w/ | 620 | 1805 | 2643 | 앞에서는4 | /w/ | 444 | 1573 | 2457 |
| 乘務員1 | /w/ | 412 | 1425 | 3141 | 되는2 | /w/ | 588 | 1938 | 2700 | 張成澤은4 | /w/ | 573 | 1628 | 2429 |
| 飲食1 | /w/ | 405 | 1084 | 1960 | 苦痛을3 | /w/ | 528 | 1615 | 2578 | 張成澤은4 | /w/ | 507 | 1505 | 2429 |
| 오늘2 | /w/ | 553 | 1688 | 3344 | 學生들3 | /w/ | 558 | 1900 | 2742 | 行為는3 | /w/ | 501 | 1731 | 2524 |
| 오늘은3 | /w/ | 587 | 1786 | 3279 | 錦湖亞細亞나1 | /w/ | 508 | 1301 | 2558 | 張成澤은4 | /w/ | 575 | 1677 | 2473 |
| 에서요3 | /w/ | 705 | 1676 | 3546 | 會長側3 | /w/ | 493 | 1780 | 2535 | 만들었다2 | /w/ | 463 | 1272 | 2393 |
| 으로1 | /w/ | 436 | 1324 | 3242 | 으로1 | /w/ | 459 | 1460 | 2405 | 張成澤은4 | /w/ | 574 | 1571 | 2413 |
| | | | | | 葛藤2 | /w/ | 473 | 2057 | 2641 | 張成澤은4 | /w/ | 581 | 1504 | 2420 |
| | | | | | 을 | /w/ | 629 | 1830 | 2721 | 다른2 | /w/ | 580 | 1405 | 2306 |
| | | | | | 만큼2 | /w/ | 565 | 1641 | 2742 | 勝利1 | /w/ | 402 | 990 | 2481 |
| | | | | | 일을2 | /w/ | 445 | 1920 | 2606 | 勝利1 | /w/ | 440 | 1168 | 2372 |

Seoul2

| Word | Vowel | F1 | F2 | F3 |
|--------|-------|-----|------|------|
| 移民가다1 | /i/ | 322 | 2196 | 2988 |
| 移民가다2 | /i/ | 359 | 2180 | 2970 |
| 집에서1 | /i/ | 359 | 1981 | 2770 |
| 疑心2 | /i/ | 407 | 2152 | 2829 |
| 民主主義1 | /i/ | 342 | 2031 | 2851 |
| 民主主義4 | /i/ | 354 | 1734 | 2504 |
| 小食2 | /i/ | 350 | 2091 | 2772 |
| 일 | /i/ | 343 | 2334 | 2968 |
| 발꿈치3 | /i/ | 325 | 1867 | 2740 |
| 外할아버지5 | /i/ | 411 | 1892 | 2736 |
| 外할머니4 | /i/ | 479 | 1953 | 2783 |
| 우리2 | /i/ | 347 | 1985 | 2849 |
| 이番1 | /i/ | 332 | 1904 | 2879 |
| 旅行이3 | /i/ | 451 | 2187 | 2862 |
| 飛行1 | /i/ | 429 | 2120 | 2878 |
| 乘務員이4 | /i/ | 544 | 1990 | 3001 |
| 우리2 | /i/ | 379 | 1854 | 2731 |
| 없이2 | /i/ | 387 | 1759 | 2786 |
| 미트볼1 | /i/ | 318 | 1949 | 2824 |
| 食事1 | /i/ | 391 | 1813 | 2724 |
| 地下鐵1 | /i/ | 428 | 1828 | 2373 |
| 아니오2 | /i/ | 422 | 2063 | 2903 |
| 이랑1 | /i/ | 450 | 1950 | 2355 |
| 統一2 | /i/ | 499 | 2253 | 2671 |
| 지만1 | /i/ | 404 | 1789 | 2616 |
| 統一2 | /i/ | 541 | 2244 | 2362 |

| Word | Vowel | F1 | F2 | F3 |
|---------|-------|-----|------|------|
| 집에서2 | /e/ | 545 | 1637 | 2548 |
| 世上1 | /e/ | 458 | 1595 | 2456 |
| 世上의 海洋1 | /e/ | 460 | 1596 | 2477 |
| 世上의 海洋3 | /e/ | 493 | 2278 | 2864 |
| 오세요2 | /e/ | 410 | 1648 | 2520 |
| 데이터1 | /e/ | 420 | 2087 | 2867 |
| 세우다1 | /e/ | 479 | 1852 | 2465 |
| 함께2 | /e/ | 471 | 1896 | 2635 |
| 그로네3 | /e/ | 573 | 1528 | 2682 |
| 하계2 | /e/ | 465 | 1828 | 2645 |
| 깨 | /e/ | 452 | 1881 | 2910 |
| 스톡홀름에5 | /e/ | 566 | 1585 | 2645 |
| 는데2 | /e/ | 520 | 1520 | 2697 |
| 레스토랑1 | /e/ | 462 | 1581 | 2722 |
| 께서는1 | /e/ | 442 | 1484 | 2585 |
| 德分예3 | /e/ | 548 | 1413 | 2745 |
| 께서는1 | /e/ | 467 | 1463 | 2488 |
| 어떻게3 | /e/ | 391 | 1880 | 2233 |

Pyongyang1

| Word | Vowel | F1 | F2 | F3 |
|---------|-------|-----|------|------|
| 親愛하는1 | /i/ | 343 | 2138 | 2577 |
| 人民軍2 | /i/ | 376 | 2107 | 2567 |
| 人民들1 | /i/ | 286 | 2133 | 2916 |
| 人民들2 | /i/ | 365 | 2068 | 2623 |
| 우리는2 | /i/ | 290 | 2102 | 2558 |
| 人民軍2 | /i/ | 257 | 2158 | 2600 |
| 人民들이2 | /i/ | 271 | 2267 | 2673 |
| 人民들이4 | /i/ | 336 | 2046 | 2625 |
| 民族1 | /i/ | 249 | 2365 | 3052 |
| 金日成同志1 | /i/ | 271 | 1862 | 2427 |
| 金日成同志2 | /i/ | 245 | 1788 | 2447 |
| 金日成同志5 | /i/ | 330 | 1960 | 2330 |
| 金正日同志1 | /i/ | 330 | 2314 | 3419 |
| 金正日同志3 | /i/ | 321 | 1910 | 2413 |
| 드립니다2 | /i/ | 329 | 2099 | 2744 |
| 人民軍1 | /i/ | 253 | 2384 | 3148 |
| 人民軍2 | /i/ | 243 | 2357 | 3086 |
| 人民들1 | /i/ | 266 | 2501 | 3267 |
| 人民들2 | /i/ | 250 | 2212 | 2722 |
| 幸福이3 | /i/ | 285 | 2282 | 2888 |
| 真心1 | /i/ | 348 | 2267 | 2835 |
| 真心2 | /i/ | 296 | 2139 | 2736 |
| 그리고2 | /i/ | 291 | 2093 | 2492 |
| 進歩的1 | /i/ | 258 | 2222 | 2549 |
| 人民들1 | /i/ | 263 | 2447 | 3185 |
| 大元首님4 | /i/ | 321 | 2094 | 2538 |
| 빛나게1 | /i/ | 265 | 2408 | 2589 |
| 나갈수 있는4 | /i/ | 310 | 1844 | 2498 |
| 金日成同志1 | /i/ | 272 | 2206 | 2652 |
| 金日成同志2 | /i/ | 245 | 2361 | 2787 |

Word

| Word | Vowel | F1 | F2 | F3 |
|-------|-------|-----|------|------|
| 主體2 | /e/ | 371 | 2061 | 2610 |
| 깨 | /e/ | 378 | 2044 | 2570 |
| 에게1 | /e/ | 386 | 1973 | 2603 |
| 에게2 | /e/ | 416 | 2112 | 2704 |
| 世界1 | /e/ | 401 | 2111 | 2401 |
| 世界2 | /e/ | 365 | 2133 | 2675 |
| 親愛한1 | /e/ | 359 | 2075 | 2850 |
| 主體2 | /e/ | 326 | 2123 | 2549 |
| 빛나게3 | /e/ | 420 | 2036 | 2444 |
| 永遠예3 | /e/ | 477 | 2158 | 2581 |
| 主體2 | /e/ | 395 | 1901 | 2588 |
| 朝鮮의3 | /e/ | 490 | 2010 | 2591 |
| 主體2 | /e/ | 364 | 1935 | 2455 |
| 함께2 | /e/ | 334 | 2205 | 2658 |
| 계신다는1 | /e/ | 269 | 2371 | 2615 |
| 主體2 | /e/ | 359 | 2114 | 2614 |

Pyongyang4

| Word | Vowel | F1 | F2 | F3 |
|-------|-------|-----|------|------|
| 우리2 | /i/ | 370 | 2176 | 2744 |
| 人民1 | /i/ | 352 | 2343 | 3505 |
| 人民2 | /i/ | 362 | 2461 | 3177 |
| 이말리아1 | /i/ | 334 | 2385 | 3379 |
| 이말리아1 | /i/ | 337 | 2544 | 3686 |
| 人民1 | /i/ | 418 | 2325 | 2960 |
| 人民2 | /i/ | 391 | 2291 | 3134 |
| 民主主義1 | /i/ | 344 | 2243 | 3224 |
| 人民1 | /i/ | 478 | 2417 | 3335 |
| 二十日1 | /i/ | 361 | 2409 | 3241 |
| 二十日1 | /i/ | 328 | 2443 | 3430 |
| 九日2 | /i/ | 307 | 2304 | 3316 |
| 期間1 | /i/ | 324 | 2378 | 3197 |
| 金日成2 | /i/ | 490 | 2188 | 2928 |
| 同志2 | /i/ | 426 | 2331 | 2889 |
| 同志2 | /i/ | 462 | 2311 | 3354 |
| 人民1 | /i/ | 365 | 2360 | 3004 |
| 人民2 | /i/ | 367 | 2379 | 3231 |
| 金日成2 | /i/ | 436 | 2245 | 2964 |
| 民主主義1 | /i/ | 354 | 2237 | 2955 |
| 人民2 | /i/ | 455 | 2323 | 3156 |
| 二十五日1 | /i/ | 290 | 2278 | 3627 |
| 二十五日4 | /i/ | 367 | 2248 | 3357 |
| 勝利2 | /i/ | 476 | 2411 | 3245 |
| 이番1 | /i/ | 297 | 2159 | 3436 |
| 競技大會2 | /i/ | 327 | 2269 | 3123 |
| 民族1 | /i/ | 362 | 2402 | 3137 |
| 이番1 | /i/ | 280 | 2177 | 3449 |
| 民族1 | /i/ | 373 | 2279 | 3293 |
| 競技大會2 | /i/ | 385 | 2338 | 3179 |

Word

| Word | Vowel | F1 | F2 | F3 |
|-------|-------|-----|------|------|
| 人民의3 | /e/ | 674 | 2258 | 3211 |
| 同志개3 | /e/ | 431 | 2406 | 3223 |
| 同志개3 | /e/ | 510 | 2247 | 3109 |
| 期間예3 | /e/ | 525 | 2293 | 3090 |
| 白頭山에4 | /e/ | 572 | 2140 | 3110 |
| 께서1 | /e/ | 541 | 2145 | 3098 |
| 祖國의3 | /e/ | 479 | 2295 | 3030 |
| 同志의3 | /e/ | 494 | 2332 | 3092 |
| 金江산의4 | /e/ | 425 | 2286 | 3169 |
| 祖國의3 | /e/ | 515 | 2324 | 2994 |
| 께서1 | /e/ | 521 | 2050 | 3008 |
| 에서1 | /e/ | 533 | 1953 | 2856 |
| 國際2 | /e/ | 585 | 2151 | 2640 |
| 에서1 | /e/ | 480 | 2264 | 3090 |
| 에는1 | /e/ | 499 | 2236 | 2952 |
| 國際2 | /e/ | 590 | 2266 | 3303 |

Sheet1

| | | | | | | | | | | | | | | |
|---------------|--------------|-----------|-----------|-----------|-------------|--------------|-----------|-----------|-----------|-------------|--------------|-----------|-----------|-----------|
| 에서1 | /e/ | 455 | 1628 | 2296 | 에 | /e/ | 463 | 2167 | 2733 | 國際2 | /e/ | 572 | 2194 | 3028 |
| 當身외3 | /e/ | 644 | 1878 | 1988 | 연제나2 | /e/ | 396 | 1820 | 2625 | 여기에3 | /e/ | 497 | 2171 | 3313 |
| 에서1 | /e/ | 432 | 1723 | 2229 | 함께2 | /e/ | 397 | 2050 | 2527 | 에게1 | /e/ | 399 | 2149 | 3192 |
| 에서1 | /e/ | 536 | 1844 | 2268 | 지난에3 | /e/ | 485 | 2089 | 2129 | 에게2 | /e/ | 517 | 2288 | 3273 |
| 어떻게3 | /e/ | 421 | 1940 | 2497 | 지난에3 | /e/ | 392 | 2133 | 2692 | 第十次1 | /e/ | 523 | 2161 | 3151 |
| Word | Vowel | F1 | F2 | F3 | 將軍님의4 | /e/ | 427 | 2203 | 2734 | 第四十次1 | /e/ | 527 | 1996 | 3295 |
| 金色2 | /e/ | 522 | 1738 | 2475 | 빛나게3 | /e/ | 350 | 2154 | 2466 | 에게1 | /e/ | 509 | 2144 | 2914 |
| 銀色2 | /e/ | 457 | 1955 | 2393 | 에게1 | /e/ | 320 | 2084 | 2519 | 第四十次1 | /e/ | 449 | 2016 | 3213 |
| 世上의 海洋4 | /e/ | 581 | 1776 | 2572 | 에게2 | /e/ | 349 | 2090 | 2628 | Word | Vowel | F1 | F2 | F3 |
| 트랙터2 | /e/ | 505 | 1562 | 2334 | 結心하게4 | /e/ | 411 | 1805 | 2378 | 白頭山1 | /e/ | 612 | 2247 | 3131 |
| 旅行2 | /e/ | 540 | 1441 | 2006 | 單숨에3 | /e/ | 363 | 2218 | 2773 | 偉大한2 | /e/ | 554 | 2193 | 2560 |
| 海外1 | /e/ | 495 | 1568 | 1932 | 人民의3 | /e/ | 446 | 2113 | 2585 | 白頭山1 | /e/ | 590 | 2179 | 3004 |
| 為해2 | /e/ | 535 | 1724 | 2730 | 人民의3 | /e/ | 370 | 2274 | 2909 | 偉大한2 | /e/ | 623 | 2223 | 2864 |
| 旅行2 | /e/ | 559 | 1499 | 2369 | 지난에3 | /e/ | 364 | 2085 | 2735 | 大元首님1 | /e/ | 553 | 2132 | 3010 |
| 그래서2 | /e/ | 530 | 1487 | 2673 | Word | Vowel | F1 | F2 | F3 | 偉大한2 | /e/ | 550 | 2316 | 2634 |
| 為해2 | /e/ | 552 | 1729 | 2816 | 親愛하는2 | /e/ | 423 | 2029 | 2461 | 偉大한2 | /e/ | 565 | 2192 | 2795 |
| 勸해도2 | /e/ | 578 | 1463 | 2801 | 偉大한2 | /e/ | 330 | 2095 | 2487 | 노래2 | /e/ | 456 | 2161 | 2409 |
| 때 | /e/ | 502 | 1503 | 2726 | 幸福1 | /e/ | 337 | 2022 | 2487 | 偉大한2 | /e/ | 499 | 2323 | 3044 |
| 戰爭2 | /e/ | 478 | 1628 | 2329 | 大元首님1 | /e/ | 396 | 1842 | 2360 | 萬壽臺3 | /e/ | 445 | 1999 | 2655 |
| 對해1 | /e/ | 437 | 1875 | 2650 | 對해1 | /e/ | 393 | 2059 | 2610 | 競技大會3 | /e/ | 540 | 2145 | 3094 |
| 생각해요1 | /e/ | 555 | 1895 | 2563 | 白頭山1 | /e/ | 474 | 2021 | 2628 | 했습니다1 | /e/ | 346 | 2265 | 3400 |
| 생각해요3 | /e/ | 436 | 1905 | 2532 | 새로운1 | /e/ | 484 | 1877 | 2553 | 競技大會3 | /e/ | 554 | 2102 | 3096 |
| Word | Vowel | F1 | F2 | F3 | 軍隊2 | /e/ | 357 | 1864 | 2453 | 競技大會3 | /e/ | 551 | 2088 | 2925 |
| 살다1 | /a/ | 726 | 1350 | 2842 | 偉大한2 | /e/ | 323 | 2075 | 2705 | 跆拳道1 | /e/ | 646 | 2228 | 3132 |
| 살다2 | /a/ | 813 | 1321 | 2853 | 大元首님1 | /e/ | 449 | 2074 | 2497 | 萬壽臺3 | /e/ | 608 | 2207 | 2493 |
| 移民가다3 | /a/ | 664 | 1337 | 2793 | 軍隊2 | /e/ | 380 | 2020 | 2522 | 競技大會3 | /e/ | 479 | 2157 | 3103 |
| 移民가다4 | /a/ | 672 | 1232 | 2848 | 偉大한2 | /e/ | 411 | 2041 | 2557 | 했습니다1 | /e/ | 393 | 2347 | 3338 |
| 繼續하다3 | /a/ | 699 | 1383 | 2876 | 偉大한2 | /e/ | 290 | 2202 | 2500 | Word | Vowel | F1 | F2 | F3 |
| 繼續하다4 | /a/ | 780 | 1370 | 2858 | 白頭山1 | /e/ | 405 | 2048 | 2556 | 黨 | /a/ | 840 | 1652 | 2450 |
| 瞬間2 | /a/ | 781 | 1401 | 2616 | 軍隊2 | /e/ | 421 | 2027 | 2549 | 領導者3 | /a/ | 803 | 1648 | 2602 |
| 國家2 | /a/ | 790 | 1279 | 2568 | 不敗2 | /e/ | 363 | 2027 | 2385 | 敬愛하는3 | /a/ | 889 | 1853 | 2950 |
| 野蠻2 | /a/ | 835 | 1224 | 2919 | 現代2 | /e/ | 393 | 2010 | 2511 | 나라1 | /a/ | 819 | 1758 | 2901 |
| 科學2 | /a/ | 756 | 1209 | 2848 | 現代2 | /e/ | 447 | 1850 | 2536 | 訪問1 | /a/ | 903 | 1663 | 2724 |
| 外할아버지2 | /a/ | 704 | 1460 | 2002 | 새로운1 | /e/ | 351 | 2015 | 2586 | 하고1 | /a/ | 796 | 1218 | 1659 |
| 外할아버지3 | /a/ | 698 | 1425 | 2368 | 새로운1 | /e/ | 507 | 1828 | 2459 | 이탈리아2 | /a/ | 848 | 1219 | 1674 |
| 家族1 | /a/ | 649 | 1415 | 2320 | 對한1 | /e/ | 448 | 1841 | 2502 | 이탈리아2 | /a/ | 812 | 1673 | 2866 |
| 갔다1 | /a/ | 753 | 1379 | 2208 | 偉大한2 | /e/ | 307 | 2002 | 2625 | 까지1 | /a/ | 848 | 1610 | 2759 |
| 갔다2 | /a/ | 733 | 1361 | 1897 | 偉大한2 | /e/ | 320 | 2148 | 2544 | 期間2 | /a/ | 791 | 1775 | 2715 |
| 했다2 | /a/ | 712 | 1388 | 1581 | 오래2 | /e/ | 330 | 2189 | 2682 | 白頭山3 | /a/ | 911 | 1707 | 3007 |
| 外할머니2 | /a/ | 702 | 1416 | 2498 | 偉大한2 | /e/ | 478 | 2022 | 2634 | 偉大한3 | /a/ | 993 | 1800 | 2751 |
| 하사고1 | /a/ | 640 | 1437 | 2764 | 大元首님1 | /e/ | 287 | 2150 | 2638 | 白頭山3 | /a/ | 917 | 1777 | 2945 |
| 事故1 | /a/ | 760 | 1465 | 2857 | 偉大한2 | /e/ | 431 | 2146 | 2347 | 나라1 | /a/ | 895 | 1648 | 2833 |
| 하여1 | /a/ | 657 | 1467 | 2653 | 偉大한2 | /e/ | 355 | 2183 | 2692 | 偉大한3 | /a/ | ### | 1907 | 2979 |
| 타고1 | /a/ | 720 | 1255 | 2633 | 對한1 | /e/ | 475 | 2089 | 2609 | 敬愛하는3 | /a/ | 891 | 1803 | 2812 |
| 나오서1 | /a/ | 723 | 1263 | 1434 | 偉大한2 | /e/ | 326 | 2164 | 2704 | 戰士2 | /a/ | ### | 1880 | 2842 |
| 갈아갔어요1 | /a/ | 778 | 1363 | 1575 | 親愛하는3 | /a/ | 624 | 1430 | 2351 | 偉大한3 | /a/ | 862 | 1733 | 2767 |
| 갈아갔어요1 | /a/ | 762 | 1407 | 2633 | 將軍1 | /a/ | 563 | 1240 | 2074 | 金江山3 | /a/ | 927 | 1686 | 2506 |
| 當身1 | /a/ | 741 | 1450 | 1528 | 사랑하는1 | /a/ | 660 | 1303 | 2533 | 金江山2 | /a/ | 883 | 1575 | 2890 |
| 家族1 | /a/ | 735 | 1434 | 2421 | 사랑하는2 | /a/ | 573 | 1278 | 1987 | 金江山3 | /a/ | 939 | 1762 | 2186 |
| 싸운1 | /a/ | 752 | 1180 | 2209 | 사랑하는3 | /a/ | 558 | 1213 | 2231 | 社會主義1 | /a/ | ### | 1768 | 2615 |
| 사람1 | /a/ | 756 | 1459 | 2946 | 온나라2 | /a/ | 561 | 1282 | 2416 | 偉大한3 | /a/ | 945 | 1817 | 2908 |
| 사람2 | /a/ | 775 | 1432 | 2699 | 온나라3 | /a/ | 589 | 1194 | 2147 | 領導者3 | /a/ | 787 | 1280 | 1795 |
| 아니오1 | /a/ | 770 | 1435 | 2282 | 偉大한3 | /a/ | 570 | 1595 | 2497 | 金江山2 | /a/ | 781 | 1635 | 2531 |
| 한名1 | /a/ | 718 | 1330 | 1469 | 가장1 | /a/ | 786 | 1390 | 2602 | 偉大한3 | /a/ | ### | 1861 | 2799 |
| 家族1 | /a/ | 726 | 1402 | 2329 | 가장2 | /a/ | 667 | 1341 | 2335 | 말 | /a/ | 800 | 1270 | 2742 |
| 생각해요2 | /a/ | 682 | 1437 | 2417 | 黨 | /a/ | 623 | 1396 | 2283 | 나라1 | /a/ | 854 | 1770 | 2589 |
| Word | Vowel | F1 | F2 | F3 | 하고1 | /a/ | 500 | 1162 | 2462 | 나라2 | /a/ | 908 | 1580 | 2455 |
| 偉業2 | /a/ | 585 | 1167 | 2515 | 온나라2 | /a/ | 635 | 1324 | 2446 | Word | Vowel | F1 | F2 | F3 |
| 言語1 | /a/ | 733 | 1100 | 2793 | 온나라3 | /a/ | 632 | 1246 | 2435 | 金正恩2 | /a/ | 545 | 1326 | 2757 |
| 言語2 | /a/ | 616 | 1037 | 2920 | 사랑하는3 | /a/ | 652 | 1296 | 2348 | 膳物1 | /a/ | 487 | 1217 | 3181 |
| 光復節3 | /a/ | 573 | 1382 | 2521 | 빛나게2 | /a/ | 594 | 1379 | 2440 | 金正恩2 | /a/ | 577 | 1353 | 2140 |
| 집에서3 | /a/ | 638 | 1107 | 2548 | 나갈수 있는1 | /a/ | 739 | 1445 | 2350 | 膳物1 | /a/ | 465 | 999 | 1235 |
| 開天節2 | /a/ | 600 | 1307 | 2818 | 나갈수 있는2 | /a/ | 520 | 1259 | 2164 | 朝鮮2 | /a/ | 505 | 976 | 1635 |
| 開天節3 | /a/ | 522 | 1393 | 2598 | 歷史2 | /a/ | 534 | 1503 | 2435 | 朝鮮2 | /a/ | 567 | 1247 | 1803 |
| 머리1 | /a/ | 576 | 975 | 2790 | 親한2 | /a/ | 670 | 1397 | 2434 | 부터2 | /a/ | 483 | 888 | 3016 |
| 데이터3 | /a/ | 548 | 1127 | 2710 | 黨 | /a/ | 552 | 1404 | 2405 | 金正日2 | /a/ | 597 | 1344 | 2040 |
| 神聖하다2 | /a/ | 711 | 1298 | 2843 | 따라1 | /a/ | 548 | 1350 | 2383 | 朝鮮2 | /a/ | 444 | 1227 | 1651 |
| 트랙터3 | /a/ | 581 | 1128 | 2569 | 따라2 | /a/ | 654 | 1359 | 2459 | 戰士1 | /a/ | 489 | 1406 | 2657 |
| 여기서3 | /a/ | 584 | 1110 | 2643 | 黨 | /a/ | 652 | 1246 | 2262 | 金正恩2 | /a/ | 599 | 1373 | 1959 |
| 먹으면서1 | /a/ | 641 | 1020 | 2487 | 받들었습니다1 | /a/ | 608 | 1236 | 2426 | 金日成3 | /a/ | 641 | 1275 | 2832 |
| | | | | | 다 | /a/ | 612 | 1135 | 2344 | 께서2 | /a/ | 570 | 967 | 3042 |
| | | | | | 黨 | /a/ | 630 | 1468 | 2368 | 에서2 | /a/ | 479 | 1267 | 2408 |
| | | | | | 연제나3 | /a/ | 583 | 1268 | 2327 | 金正日2 | /a/ | 601 | 1246 | 2687 |
| | | | | | 온나라2 | /a/ | 611 | 1337 | 2359 | | | | | |

Sheet1

| | | | | | | | | | | | | | | |
|-------------|--------------|-----------|-----------|-----------|-------------|--------------|-----------|-----------|-----------|-------------|--------------|-----------|-----------|-----------|
| 먹으면서4 | /N | 644 | 1031 | 2491 | 지난2 | /a/ | 717 | 1410 | 2364 | 金日成3 | /N | 620 | 1022 | 1803 |
| 이番2 | /N | 784 | 1204 | 2903 | Word | Vowel | F1 | F2 | F3 | 개서2 | /N | 565 | 1296 | 2719 |
| 遼距離2 | /N | 572 | 1163 | 2716 | 여러分2 | /N | 430 | 1299 | 2229 | 朝鮮2 | /N | 567 | 1268 | 2946 |
| 처음1 | /N | 752 | 1197 | 2750 | 金日成同志3 | /N | 463 | 1133 | 2371 | 에서2 | /N | 541 | 1483 | 2782 |
| 徹底1 | /N | 656 | 1400 | 2071 | 進歩的3 | /N | 372 | 1185 | 2517 | 만나서3 | /N | 483 | 1207 | 2963 |
| 徹底2 | /N | 479 | 1447 | 2818 | 金日成同志3 | /N | 359 | 1247 | 2293 | 에서2 | /N | 486 | 1078 | 3082 |
| 들러2 | /N | 640 | 1132 | 2201 | 金正日同志2 | /N | 359 | 1224 | 2412 | 先軍節1 | /N | 479 | 914 | 3348 |
| 換錢2 | /N | 527 | 1434 | 2812 | 에서2 | /N | 418 | 1394 | 2631 | 先軍節3 | /N | 649 | 1289 | 2922 |
| 에서2 | /N | 562 | 1041 | 2000 | 朝鮮2 | /N | 381 | 1369 | 2545 | 選手1 | /N | 465 | 866 | 1937 |
| 개서2 | /N | 588 | 1130 | 2855 | 金日成3 | /N | 388 | 938 | 2471 | 選手1 | /N | 512 | 1145 | 2278 |
| 그라서3 | /N | 643 | 1127 | 1174 | 처럼2 | /N | 419 | 1388 | 2337 | 이番2 | /N | 562 | 943 | 2673 |
| 덜미藥1 | /N | 630 | 1216 | 2195 | 너무1 | /N | 333 | 959 | 2497 | 에서는2 | /N | 532 | 953 | 1562 |
| 할머니2 | /N | 520 | 1115 | 1874 | 받들었습니다3 | /N | 399 | 1130 | 2443 | 健設1 | /N | 611 | 1112 | 2971 |
| 어른들1 | /N | 659 | 1196 | 3105 | 여러2 | /N | 409 | 1297 | 2212 | 健設2 | /N | 573 | 1342 | 2979 |
| 개서2 | /N | 576 | 1440 | 2784 | 언제나1 | /N | 349 | 1131 | 2673 | 選手1 | /N | 528 | 1241 | 2917 |
| 徳分1 | /N | 676 | 1212 | 1222 | 歴史的3 | /N | 419 | 1346 | 2617 | Word | Vowel | F1 | F2 | F3 |
| 먹을수1 | /N | 591 | 1117 | 1712 | 貴덕운2 | /N | 392 | 1258 | 2610 | 最高2 | /o/ | 687 | 1051 | 2818 |
| 할아버지4 | /N | 470 | 1397 | 2946 | 貫徹2 | /N | 441 | 1470 | 2427 | 領導者2 | /o/ | 556 | 1114 | 2819 |
| 개서2 | /N | 651 | 1356 | 2569 | 朝鮮2 | /N | 403 | 1462 | 2469 | 하고2 | /o/ | 505 | 1044 | 2719 |
| 첫1 | /N | 633 | 1358 | 2994 | 千萬1 | /N | 434 | 1589 | 2727 | 同志1 | /o/ | 640 | 1148 | 2696 |
| 부터2 | /N | 699 | 1204 | 2855 | 朝鮮2 | /N | 482 | 1186 | 2503 | 共和國1 | /o/ | 615 | 965 | 2923 |
| 무척 | /N | 645 | 1297 | 2816 | 것을1 | /N | 405 | 1370 | 2507 | 안또니오2 | /o/ | 533 | 1085 | 2969 |
| | | | | | 强盛2 | /N | 355 | 1041 | 2463 | 안또니오4 | /o/ | 556 | 1176 | 2841 |
| 어떻게1 | /N | 698 | 1086 | 1864 | 에서2 | /N | 436 | 1417 | 2507 | 最高2 | /o/ | 591 | 1208 | 2620 |
| 저 | /N | 752 | 1356 | 2854 | 强盛2 | /N | 356 | 1105 | 2543 | 同志1 | /o/ | 616 | 1095 | 2433 |
| 빠스1 | /N | 597 | 1085 | 1662 | 健設1 | /N | 373 | 1145 | 2656 | 朝鮮1 | /o/ | 606 | 1065 | 2890 |
| 나오서3 | /N | 616 | 1123 | 2475 | 健設2 | /N | 476 | 1379 | 2376 | 共和國1 | /o/ | 571 | 876 | 2292 |
| 靑丘驛2 | /N | 774 | 1168 | 2669 | 에서2 | /N | 394 | 1189 | 2572 | 으로2 | /o/ | 487 | 950 | 2920 |
| 에서2 | /N | 622 | 1154 | 2160 | 것을1 | /N | 438 | 1147 | 2481 | 同志1 | /o/ | 607 | 1052 | 2107 |
| 에서2 | /N | 576 | 1040 | 1796 | 全國1 | /N | 379 | 1188 | 2730 | 同志1 | /o/ | 603 | 1076 | 2968 |
| 地下鐵3 | /N | 623 | 1347 | 2516 | 에서2 | /N | 450 | 1218 | 2573 | 모습1 | /o/ | 540 | 825 | 2132 |
| 에서2 | /N | 629 | 1150 | 2345 | 개서2 | /N | 406 | 1196 | 2652 | 勞動1 | /o/ | 552 | 952 | 2887 |
| 戰爭1 | /N | 660 | 1358 | 1678 | Word | Vowel | F1 | F2 | F3 | 勞動2 | /o/ | 557 | 1125 | 2207 |
| 에서2 | /N | 548 | 1276 | 2374 | 온나라1 | /o/ | 363 | 925 | 2502 | 온 | /o/ | 556 | 825 | 3141 |
| 저 | /N | 688 | 1286 | 1664 | 民族2 | /o/ | 426 | 1315 | 2400 | 모습1 | /o/ | 476 | 828 | 1905 |
| 戰爭1 | /N | 719 | 1334 | 2744 | 金日成同志4 | /o/ | 313 | 943 | 2553 | 朝鮮1 | /o/ | 510 | 1476 | 3049 |
| 그前2 | /N | 741 | 1314 | 2593 | 金正日同志4 | /o/ | 350 | 810 | 2485 | 領導者2 | /o/ | 473 | 1142 | 1754 |
| | | | | | 하고2 | /o/ | 353 | 929 | 2183 | 틀고2 | /o/ | 554 | 1062 | 2742 |
| Word | Vowel | F1 | F2 | F3 | 하교2 | /o/ | 505 | 906 | 2482 | 同志1 | /o/ | 567 | 1166 | 2795 |
| 繼續하다2 | /o/ | 444 | 1028 | 2711 | 온나라1 | /o/ | 522 | 891 | 2564 | 또 | /o/ | 581 | 1123 | 2621 |
| 黃소2 | /o/ | 462 | 826 | 2821 | 모든1 | /o/ | 373 | 829 | 2428 | 祖國1 | /o/ | 509 | 1056 | 2692 |
| 小食1 | /o/ | 421 | 1064 | 2763 | 幸福2 | /o/ | 411 | 1023 | 2437 | 하고2 | /o/ | 527 | 1041 | 2199 |
| 테이블복4 | /o/ | 422 | 832 | 2326 | 으로2 | /o/ | 440 | 1251 | 2478 | 領導者2 | /o/ | 556 | 1148 | 2349 |
| 노르웨이語1 | /o/ | 357 | 1258 | 2382 | 民族2 | /o/ | 388 | 1075 | 2510 | 同志1 | /o/ | 567 | 1156 | 1860 |
| 오세요1 | /o/ | 357 | 860 | 2448 | 그리고3 | /o/ | 430 | 1032 | 2557 | 노래1 | /o/ | 587 | 1193 | 1751 |
| 왼쪽2 | /o/ | 482 | 901 | 2566 | 進歩的2 | /o/ | 383 | 836 | 2435 | 家族2 | /o/ | 539 | 1396 | 1733 |
| 오른쪽1 | /o/ | 384 | 836 | 2655 | 金日成同志4 | /o/ | 432 | 1061 | 2469 | Word | Vowel | F1 | F2 | F3 |
| 오른쪽3 | /o/ | 428 | 1003 | 2383 | 金正日同志4 | /o/ | 588 | 1314 | 2431 | 우리1 | /u/ | 390 | 792 | 1735 |
| 光復節2 | /o/ | 535 | 756 | 2532 | 하고2 | /o/ | 435 | 951 | 2302 | 우리1 | /u/ | 433 | 833 | 1681 |
| | | | | | 높이1 | /o/ | 409 | 942 | 2565 | 訪問2 | /u/ | 561 | 755 | 1501 |
| 家族2 | /o/ | 433 | 1379 | 2328 | 이시고3 | /o/ | 465 | 757 | 2506 | 膳物2 | /u/ | 521 | 1173 | 1449 |
| 父母님2 | /o/ | 575 | 1306 | 2584 | 모든1 | /o/ | 383 | 1153 | 2452 | 膳物2 | /u/ | 475 | 1248 | 2882 |
| 그로네 2 | /o/ | 553 | 1321 | 2806 | 民族2 | /o/ | 490 | 1043 | 2383 | 共和國3 | /u/ | 395 | 914 | 2750 |
| 그로네로4 | /o/ | 580 | 1056 | 2447 | 하고2 | /o/ | 438 | 1105 | 2451 | 國會1 | /u/ | 358 | 947 | 2060 |
| 하시고3 | /o/ | 398 | 823 | 2478 | 同志를1 | /o/ | 287 | 1123 | 2507 | 民主主義2 | /u/ | 438 | 1707 | 2971 |
| 或是1 | /o/ | 317 | 826 | 2369 | 높이1 | /o/ | 474 | 1042 | 2420 | 共和國3 | /u/ | 482 | 891 | 2106 |
| 모를1 | /o/ | 456 | 920 | 2341 | 새로운2 | /o/ | 495 | 1097 | 2476 | 將軍2 | /u/ | 624 | 1116 | 2931 |
| 事故2 | /o/ | 449 | 855 | 2097 | 同志1 | /o/ | 448 | 909 | 2390 | 부터1 | /u/ | 481 | 1288 | 2141 |
| 도 | /o/ | 541 | 924 | 1967 | 뜻으로3 | /o/ | 452 | 1054 | 2423 | 九月1 | /u/ | 312 | 838 | 2548 |
| 노릇을1 | /o/ | 459 | 1155 | 2820 | 하고2 | /o/ | 398 | 925 | 2128 | 九日1 | /u/ | 314 | 846 | 2376 |
| 괴로워하셨다2 | /o/ | 449 | 855 | 1776 | 있고2 | /o/ | 499 | 1071 | 2374 | 白頭山2 | /u/ | 457 | 1584 | 2744 |
| 스톡홀름2 | /o/ | 424 | 1147 | 1460 | 온나라1 | /o/ | 496 | 984 | 2474 | 白頭山2 | /u/ | 567 | 1291 | 2900 |
| 到着1 | /o/ | 406 | 1377 | 2415 | 하고2 | /o/ | 435 | 1350 | 2508 | 藝術2 | /u/ | 464 | 1406 | 2394 |
| 하교2 | /o/ | 501 | 935 | 2290 | 朝鮮1 | /o/ | | | | 藝術2 | /u/ | 454 | 1709 | 2628 |
| 보기1 | /o/ | 445 | 813 | 2349 | Word | Vowel | F1 | F2 | F3 | 社會主義3 | /u/ | 424 | 1893 | 2662 |
| 레스토랑3 | /o/ | 440 | 1316 | 2236 | 人民軍3 | /u/ | 322 | 1163 | 2376 | 祖國2 | /u/ | 492 | 852 | 2766 |
| 고기1 | /o/ | 392 | 815 | 2181 | 將軍2 | /u/ | 271 | 1304 | 2303 | 祖國2 | /u/ | 515 | 982 | 1643 |
| 미트볼3 | /o/ | 399 | 837 | 2419 | 여러分3 | /u/ | 319 | 1270 | 2367 | 우리1 | /u/ | 448 | 979 | 1923 |
| 미트볼3 | /o/ | 405 | 866 | 2264 | 우리는1 | /u/ | 298 | 891 | 2209 | 民主主義3 | /u/ | 517 | 1229 | 2184 |
| 오늘1 | /o/ | 552 | 1061 | 2459 | 人民軍3 | /u/ | 289 | 1170 | 2536 | 共和國3 | /u/ | 501 | 888 | 1819 |
| 타고2 | /o/ | 525 | 1001 | 2609 | 主體1 | /u/ | 440 | 1304 | 2423 | 萬壽臺2 | /u/ | 352 | 1032 | 1801 |
| 地下鐵로4 | /o/ | 511 | 908 | 2499 | 人民軍3 | /u/ | 290 | 1065 | 2540 | 國際1 | /u/ | 400 | 990 | 2034 |
| 도 | /o/ | 519 | 1070 | 2452 | 大元首님3 | /u/ | 332 | 1316 | 2453 | 國際1 | /u/ | 378 | 956 | 2167 |
| 必要하다교5 | /o/ | 526 | 1254 | 2633 | 우리1 | /u/ | 300 | 978 | 2302 | 國際1 | /u/ | 338 | 845 | 2002 |
| 統一1 | /o/ | 551 | 901 | 1322 | 우리1 | /u/ | 284 | 947 | 2381 | 先軍節2 | /u/ | 535 | 1164 | 2771 |

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|-------------|--------------|-----------|-----------|-----------|-------------------|--------------|-----------|-----------|-----------|-------------|--------------|-----------|-----------|-----------|
| 統一1 | /o/ | 577 | 1116 | 2676 | 우리1 | /u/ | 311 | 983 | 2199 | 選手2 | /u/ | 435 | 1417 | 2236 |
| 統一1 | /o/ | 457 | 822 | 1661 | 새로운3 | /u/ | 403 | 846 | 2492 | 首都1 | /u/ | 486 | 871 | 1560 |
| 보 | /o/ | 480 | 770 | 2152 | 主體1 | /u/ | 346 | 1571 | 2480 | | | | | |
| 라고2 | /o/ | 523 | 825 | 1972 | 우리1 | /u/ | 302 | 832 | 2320 | Word | Vowel | F1 | F2 | F3 |
| | | | | | 軍隊1 | /u/ | 298 | 1207 | 2446 | 金正恩3 | /u/ | 433 | 1341 | 1689 |
| Word | Vowel | F1 | F2 | F3 | 將軍님2 | /u/ | 339 | 1058 | 2487 | 나라를3 | /u/ | 574 | 1706 | 1960 |
| 瞬間1 | /u/ | 469 | 1353 | 2876 | 너무2 | /u/ | 257 | 1056 | 2538 | 있는2 | /u/ | 558 | 1828 | 2546 |
| 牛乳1 | /u/ | 362 | 953 | 2370 | 우리1 | /u/ | 280 | 927 | 2468 | 膳物을3 | /u/ | 489 | 1731 | 2640 |
| 牛乳2.5 | /u/ | 348 | 1240 | 2255 | 人民軍3 | /u/ | 290 | 1003 | 2485 | 金正恩3 | /u/ | 588 | 1269 | 1331 |
| 民主主義2 | /u/ | 309 | 1719 | 2551 | 將軍2 | /u/ | 255 | 1328 | 2418 | 膳物을3 | /u/ | 493 | 1700 | 2473 |
| 民主主義3 | /u/ | 346 | 1724 | 2354 | 우리1 | /u/ | 297 | 1123 | 2249 | 은 | /u/ | 595 | 1478 | 1752 |
| 國家1 | /u/ | 402 | 1322 | 2843 | 軍隊1 | /u/ | 303 | 1177 | 2547 | 敬愛하는4 | /u/ | 664 | 1038 | 1902 |
| 추운1 | /u/ | 431 | 986 | 2760 | 將軍님2 | /u/ | 349 | 1212 | 2519 | 金正恩3 | /u/ | 465 | 990 | 1994 |
| 運命1 | /u/ | 380 | 1174 | 2438 | 미더운3 | /u/ | 346 | 925 | 2558 | 따뜻2 | /u/ | 613 | 1845 | 2066 |
| 원승이2 | /u/ | 379 | 1405 | 2397 | 將軍님1 | /u/ | 328 | 1127 | 2545 | 에는2 | /u/ | 519 | 1159 | 2003 |
| 將軍2 | /u/ | 378 | 1069 | 2469 | 우리1 | /u/ | 320 | 887 | 2473 | 勝利1 | /u/ | 428 | 1294 | 2162 |
| 물 | /u/ | 360 | 941 | 2485 | 技術2 | /u/ | 323 | 1154 | 2185 | 에서는3 | /u/ | 518 | 1176 | 1734 |
| 세우다2 | /u/ | 432 | 1292 | 2390 | 技術2 | /u/ | 340 | 1205 | 2435 | 決勝2 | /u/ | 541 | 1681 | 2756 |
| | | | | | 國民1 | /u/ | 268 | 1052 | 2424 | 選手들3 | /u/ | 468 | 1403 | 2521 |
| 우리1 | /u/ | 436 | 1170 | 2232 | 우리1 | /u/ | 300 | 819 | 2254 | | | | | |
| 準備2 | /u/ | 241 | 1531 | 2218 | | | | | | | | | | |
| 집꾼2 | /u/ | 400 | 970 | 2168 | Word | Vowel | F1 | F2 | F3 | | | | | |
| 飛行中3 | /u/ | 510 | 1334 | 2437 | 親愛하는4 | /u/ | 374 | 1387 | 2219 | | | | | |
| 우리1 | /u/ | 284 | 1428 | 2253 | 同志들3 | /u/ | 412 | 1496 | 2484 | | | | | |
| 馴鹿1 | /u/ | 433 | 1409 | 2378 | 將軍들3 | /u/ | 322 | 1333 | 2182 | | | | | |
| 注文1 | /u/ | 401 | 1365 | 2926 | 人民들3 | /u/ | 358 | 1596 | 2520 | | | | | |
| 注文2 | /u/ | 481 | 1385 | 1799 | 우리는3 | /u/ | 327 | 1591 | 2445 | | | | | |
| 德分2 | /u/ | 416 | 1248 | 2909 | 모든2 | /u/ | 422 | 1544 | 2564 | | | | | |
| 韓國2 | /u/ | 370 | 934 | 2162 | 그리고1 | /u/ | 349 | 1667 | 2565 | | | | | |
| | | | | | 人民들3 | /u/ | 356 | 1676 | 2545 | | | | | |
| 靑丘驛2 | /u/ | 374 | 1124 | 2001 | 나갈수 있는5 | /u/ | 354 | 1763 | 2555 | | | | | |
| 두나라1 | /u/ | 409 | 1133 | 2404 | 同志는3 | /u/ | 347 | 1434 | 2505 | | | | | |
| | | | | | 모든2 | /u/ | 319 | 1438 | 2599 | | | | | |
| Word | Vowel | F1 | F2 | F3 | 勝利1 | /u/ | 318 | 1236 | 2525 | | | | | |
| 金色1 | /u/ | 354 | 1467 | 2305 | 同志를3 | /u/ | 346 | 1404 | 2462 | | | | | |
| 銀色1 | /u/ | 356 | 1629 | 2452 | 勝利1 | /u/ | 272 | 1653 | 2554 | | | | | |
| 筋肉1 | /u/ | 373 | 1608 | 2433 | 同志는3 | /u/ | 371 | 1466 | 2394 | | | | | |
| 하늘2 | /u/ | 504 | 1648 | 2756 | 뜻 | /u/ | 281 | 1433 | 2488 | | | | | |
| 테이블복3 | /u/ | 334 | 1279 | 2283 | 받들었습니다2 | /u/ | 382 | 1672 | 2422 | | | | | |
| 노르웨이語2 | /u/ | 368 | 1181 | 2406 | 받들었습니다4 | /u/ | 179 | 1237 | 2378 | | | | | |
| 가득하다2 | /u/ | 417 | 1605 | 2490 | 人民들은3 | /u/ | 361 | 1684 | 2475 | | | | | |
| 오른쪽2 | /u/ | 377 | 1332 | 2544 | 人民들은4 | /u/ | 334 | 1577 | 2558 | | | | | |
| 트랙터1 | /u/ | 440 | 1494 | 2747 | 將軍들3 | /u/ | 296 | 1571 | 2407 | | | | | |
| 먹으면서2 | /u/ | 380 | 1227 | 2333 | 人民들은3 | /u/ | 261 | 1599 | 2625 | | | | | |
| | | | | | 人民들은4 | /u/ | 298 | 1518 | 2678 | | | | | |
| 家旅은3 | /u/ | 568 | 1362 | 2931 | 黨을2 | /u/ | 381 | 1488 | 2491 | | | | | |
| 여름2 | /u/ | 443 | 1424 | 1878 | 들 | /u/ | 330 | 1581 | 2569 | | | | | |
| 外할머니는5 | /u/ | 581 | 1446 | 2311 | 勝利1 | /u/ | 247 | 1468 | 2589 | | | | | |
| 外할머니를5 | /u/ | 387 | 1448 | 2226 | 勝利을3 | /u/ | 280 | 1371 | 2574 | | | | | |
| 깨서는3 | /u/ | 483 | 1384 | 2771 | 朝鮮은3 | /u/ | 397 | 1252 | 2456 | | | | | |
| 들러1 | /u/ | 304 | 1473 | 2446 | 것을2 | /u/ | 336 | 1485 | 2443 | | | | | |
| 換錢을3 | /u/ | 526 | 1416 | 2777 | 믿음2 | /u/ | 264 | 1296 | 2461 | | | | | |
| 모를2 | /u/ | 408 | 1336 | 2754 | | | | | | | | | | |
| 保險을3 | /u/ | 547 | 1489 | 2323 | Pyongyang2 | | | | | | | | | |
| 나는2 | /u/ | 537 | 1471 | 2766 | Word | Vowel | F1 | F2 | F3 | | | | | |
| 집을2 | /u/ | 489 | 1431 | 2189 | 秘書1 | /i/ | 509 | 2519 | 3514 | | | | | |
| 들며1 | /u/ | 361 | 1583 | 2377 | 이시며1 | /i/ | 502 | 2413 | 3457 | | | | | |
| 집꾼노릇4 | /u/ | 411 | 1370 | 1608 | 이신1 | /i/ | 594 | 2330 | 3474 | | | | | |
| 노릇을3 | /u/ | 440 | 1469 | 2830 | 金正日3 | /i/ | 483 | 2357 | 3300 | | | | | |
| 흔들러2 | /u/ | 414 | 1420 | 2367 | 人民1 | /i/ | 599 | 2497 | 3298 | | | | | |
| 그래서1 | /u/ | 372 | 1474 | 1960 | 秘書1 | /i/ | 455 | 2531 | 3555 | | | | | |
| 乘務員1 | /u/ | 434 | 1376 | 2782 | 이시며1 | /i/ | 519 | 2647 | 3339 | | | | | |
| 멀미藥을4 | /u/ | 431 | 1431 | 2605 | 民主主義4 | /i/ | 584 | 2495 | 2897 | | | | | |
| 스톡홀름4 | /u/ | 500 | 1430 | 2772 | 우리2 | /i/ | 385 | 2164 | 2802 | | | | | |
| 家旅은3 | /u/ | 563 | 1420 | 2910 | 우리2 | /i/ | 415 | 2465 | 3247 | | | | | |
| 飲食1 | /u/ | 295 | 1325 | 2339 | 人民2 | /i/ | 571 | 2185 | 2684 | | | | | |
| 飲食을3 | /u/ | 428 | 1412 | 2557 | 金正日3 | /i/ | 511 | 2505 | 3493 | | | | | |
| 만든2 | /u/ | 431 | 1457 | 2893 | 同志2 | /i/ | 499 | 2327 | 2668 | | | | | |
| 미트볼2 | /u/ | 316 | 1735 | 2656 | 人民2 | /i/ | 649 | 2101 | 2489 | | | | | |
| 했는데2 | /u/ | 401 | 1515 | 2627 | 同志2 | /i/ | 492 | 2053 | 2481 | | | | | |
| 어른들2 | /u/ | 566 | 1489 | 2885 | 人民2 | /i/ | 661 | 2510 | 3318 | | | | | |
| 어른들3 | /u/ | 411 | 1429 | 2800 | 同志2 | /i/ | 507 | 2517 | 3471 | | | | | |
| 깨서는3 | /u/ | 546 | 1443 | 2806 | 第一2 | /i/ | 506 | 2417 | 3416 | | | | | |
| 나는2 | /u/ | 564 | 1485 | 2795 | 同志2 | /i/ | 428 | 2486 | 3454 | | | | | |
| 미트볼2 | /u/ | 381 | 1507 | 2646 | 同志2 | /i/ | 441 | 2527 | 3381 | | | | | |
| 깨서는3 | /u/ | 624 | 1487 | 2801 | 同志2 | /i/ | 463 | 2575 | 3495 | | | | | |
| 飲食을3 | /u/ | 441 | 1425 | 2738 | 同志2 | /i/ | 483 | 2495 | 3592 | | | | | |

Sheet1

| | | | | | | | | | |
|---------|-----|-----|------|------|-------|-----|-----|------|------|
| 그리워하셨다1 | /w/ | 380 | 1391 | 2434 | 民主主義4 | /i/ | 570 | 2652 | 3326 |
| | | | | | 同志2 | /i/ | 437 | 2524 | 3503 |
| 오늘2 | /w/ | 456 | 1704 | 2591 | 同志2 | /i/ | 457 | 2479 | 3440 |
| 오늘2 | /w/ | 398 | 1539 | 2550 | 同志2 | /i/ | 526 | 2417 | 3300 |
| 가족은3 | /w/ | 454 | 1439 | 2176 | 秘書1 | /i/ | 502 | 2315 | 3272 |
| 그前1 | /w/ | 410 | 1583 | 2501 | 同志2 | /i/ | 458 | 2620 | 3511 |
| 들은1 | /w/ | 427 | 1626 | 2565 | 人民2 | /i/ | 589 | 2242 | 2966 |
| 은 | /w/ | 462 | 1552 | 2423 | 金正日3 | /i/ | 538 | 2426 | 3441 |

Seoul3

| Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
|-------|-------|-----|------|------|-------|-------|-----|------|------|
| 視聽者1 | /i/ | 436 | 1699 | 2511 | 깨서1 | /e/ | 709 | 2163 | 2181 |
| 지난1 | /i/ | 483 | 1588 | 2458 | 人民의 3 | /e/ | 662 | 1918 | 2361 |
| 이 | /i/ | 353 | 1906 | 3012 | 깨서1 | /e/ | 675 | 1930 | 2465 |
| 아직도2 | /i/ | 379 | 1736 | 2155 | 第一1 | /e/ | 551 | 2356 | 2580 |
| 直接1 | /i/ | 378 | 1808 | 2181 | 中國의3 | /e/ | 591 | 2331 | 2918 |
| 叱責1 | /i/ | 392 | 1550 | 2197 | 깨서1 | /e/ | 601 | 2230 | 2874 |
| 까지2 | /i/ | 378 | 1593 | 2524 | 깨서1 | /e/ | 647 | 1892 | 2383 |
| 그린벨트2 | /i/ | 448 | 1753 | 2337 | 中國의3 | /e/ | 536 | 2051 | 2380 |
| 간접2 | /i/ | 436 | 1829 | 2265 | 깨서1 | /e/ | 627 | 2015 | 2271 |
| 치여서1 | /i/ | 410 | 1625 | 2359 | 世紀의1 | /e/ | 595 | 1707 | 2210 |
| 非理1 | /i/ | 424 | 1663 | 2072 | 世紀의3 | /e/ | 524 | 1962 | 2353 |
| 非理2 | /i/ | 422 | 1691 | 2440 | 깨서1 | /e/ | 587 | 1778 | 2303 |
| 있는1 | /i/ | 457 | 1729 | 2154 | 同志의3 | /e/ | 517 | 1884 | 2299 |
| 基礎1 | /i/ | 389 | 1787 | 2815 | 에서1 | /e/ | 671 | 1900 | 2273 |
| 費用1 | /i/ | 345 | 1778 | 2863 | 두나라의4 | /e/ | 654 | 2213 | 2410 |
| 導入2 | /i/ | 400 | 1619 | 1860 | 깨서1 | /e/ | 693 | 1845 | 2423 |
| 基礎1 | /i/ | 432 | 1759 | 2377 | 에서1 | /e/ | 566 | 1683 | 2259 |
| 導入2 | /i/ | 396 | 1695 | 1886 | 깨서1 | /e/ | 673 | 2045 | 2624 |
| 基礎1 | /i/ | 427 | 1757 | 2385 | 깨서1 | /e/ | 575 | 2021 | 2246 |
| 七兆圓1 | /i/ | 432 | 1660 | 2381 | 에서1 | /e/ | 607 | 1962 | 2322 |
| 돈이2 | /i/ | 467 | 1879 | 2763 | 世界1 | /e/ | 473 | 2100 | 2426 |
| 이 | /i/ | 402 | 1877 | 2924 | 世界2 | /e/ | 446 | 1967 | 2379 |
| 費用1 | /i/ | 408 | 1829 | 2926 | 同志의3 | /e/ | 590 | 2014 | 2342 |
| 있는1 | /i/ | 418 | 1628 | 2004 | 깨 | /e/ | 557 | 2162 | 3044 |
| 地自體1 | /i/ | 370 | 1623 | 2450 | 깨서는1 | /e/ | 548 | 2032 | 2293 |
| 老人2 | /i/ | 470 | 1894 | 2419 | 에서1 | /e/ | 598 | 2021 | 2437 |
| 人口1 | /i/ | 506 | 1888 | 2721 | 깨서는1 | /e/ | 594 | 1953 | 2263 |
| 基礎1 | /i/ | 347 | 1656 | 2621 | 깨서는1 | /e/ | 746 | 1958 | 2397 |
| 施行1 | /i/ | 378 | 1644 | 2462 | 깨서1 | /e/ | 709 | 1926 | 2260 |
| 視聽1 | /i/ | 394 | 1659 | 2405 | 人民의 3 | /e/ | 673 | 2038 | 2404 |

| Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
|----------|-------|-----|------|------|-------|-------|-----|------|------|
| 規制2 | /e/ | 470 | 1564 | 2087 | 偉大한2 | /e/ | 573 | 1824 | 2331 |
| 네 | /e/ | 555 | 1591 | 2198 | 偉大한2 | /e/ | 659 | 1828 | 2335 |
| 規制2 | /e/ | 477 | 1533 | 2288 | 했습니다1 | /e/ | 577 | 2043 | 2415 |
| 에게1 | /e/ | 435 | 1573 | 2011 | 對해1 | /e/ | 584 | 2001 | 2321 |
| 에게2 | /e/ | 494 | 1672 | 2254 | 했습니다1 | /e/ | 596 | 2159 | 2519 |
| 規制2 | /e/ | 440 | 1594 | 2288 | 새 | /e/ | 686 | 2174 | 2834 |
| 그린벨트3 | /e/ | 481 | 1474 | 2227 | 그대로2 | /e/ | 704 | 2249 | 2786 |
| 에서1 | /e/ | 461 | 1567 | 2147 | 對해1 | /e/ | 536 | 1967 | 2387 |
| 있도록했습니다4 | /e/ | 448 | 1658 | 2193 | 對해2 | /e/ | 591 | 1996 | 2363 |
| 偶然에3 | /e/ | 482 | 1597 | 2260 | 했습니다1 | /e/ | 592 | 2007 | 2552 |
| 逮捕1 | /e/ | 513 | 1617 | 2373 | 大國1 | /e/ | 697 | 1813 | 2236 |
| 問題2 | /e/ | 509 | 1560 | 2184 | 해 | /e/ | 705 | 2140 | 2148 |
| 後年에도3 | /e/ | 520 | 1609 | 2211 | 해서1 | /e/ | 615 | 1830 | 2284 |
| 地自體3 | /e/ | 465 | 1602 | 2318 | 생각1 | /e/ | 683 | 1942 | 2114 |
| 함께2 | /e/ | 457 | 1759 | 2366 | 現代2 | /e/ | 696 | 1732 | 2131 |
| 맞게2 | /e/ | 462 | 1586 | 1969 | 대단히1 | /e/ | 766 | 1899 | 2410 |
| 地自體3 | /e/ | 498 | 1456 | 2251 | 생각1 | /e/ | 740 | 1991 | 2412 |
| 政府의3 | /e/ | 526 | 1608 | 2231 | 새로1 | /e/ | 564 | 1917 | 2324 |
| 特段에3 | /e/ | 589 | 1605 | 2043 | 偉大한2 | /e/ | 482 | 2113 | 2391 |
| 以後에3 | /e/ | 453 | 1499 | 2104 | 敬愛하는2 | /e/ | 643 | 2227 | 2940 |
| 執行에3 | /e/ | 513 | 1802 | 2256 | 對해1 | /e/ | 650 | 2124 | 2386 |
| 그런데3 | /e/ | 426 | 1773 | 2291 | 對해2 | /e/ | 667 | 2210 | 2296 |
| 열네곳2 | /e/ | 501 | 1616 | 2333 | 對物1 | /e/ | 631 | 2164 | 2597 |
| 가운데3 | /e/ | 537 | 1536 | 2236 | 鬭爭2 | /e/ | 657 | 2143 | 2395 |
| 에서1 | /e/ | 458 | 1462 | 2267 | 紹介2 | /e/ | 611 | 2247 | 2593 |
| 에서1 | /e/ | 496 | 1628 | 2353 | 對해1 | /e/ | 599 | 2096 | 2321 |
| 에블라1 | /e/ | 550 | 1582 | 2223 | 偉大한2 | /e/ | 590 | 1794 | 2237 |
| 센터1 | /e/ | 533 | 1428 | 2326 | 對하여1 | /e/ | 709 | 1994 | 2414 |
| 한가운데4 | /e/ | 435 | 1518 | 2235 | 偉大한2 | /e/ | 639 | 2024 | 2291 |
| 있는데요3 | /e/ | 469 | 1572 | 2339 | 새로운1 | /e/ | 778 | 2058 | 2683 |

| Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
|-------|-------|-----|------|------|---------|-------|-----|------|------|
| 나라고1 | /e/ | 514 | 1593 | 2233 | 領導者1 | /a/ | 766 | 1514 | 2352 |
| 했습니다1 | /e/ | 465 | 1601 | 2314 | 訪問1 | /a/ | 899 | 1450 | 2208 |
| | | | | | 하지였습니다1 | /a/ | 964 | 1734 | 2377 |

Sheet1

| | | | | | | | | | |
|-------|-----|-----|------|------|----------|-----|-----|------|------|
| 叱責2 | /ɛ/ | 448 | 1571 | 1958 | 하시였습니다다6 | /a/ | 784 | 1737 | 2447 |
| 大統領1 | /ɛ/ | 441 | 1594 | 2087 | 黨 | /a/ | 737 | 1479 | 2096 |
| 캠핑場1 | /ɛ/ | 591 | 1700 | 2272 | 領導者1 | /a/ | 891 | 1593 | 2387 |
| 새누리黨1 | /ɛ/ | 504 | 1557 | 2199 | 共產黨2 | /a/ | 726 | 1755 | 2403 |
| 對한1 | /ɛ/ | 447 | 1596 | 2354 | 共產黨3 | /a/ | 700 | 1699 | 2369 |
| 깨고1 | /ɛ/ | 505 | 1682 | 2283 | 하여1 | /a/ | 827 | 1782 | 2279 |
| 보내2 | /ɛ/ | 469 | 1751 | 2251 | 訪問1 | /a/ | 891 | 1529 | 2319 |
| 為해2 | /ɛ/ | 576 | 1624 | 2145 | 하시였습니다다1 | /a/ | 958 | 1676 | 2218 |
| 오래2 | /ɛ/ | 541 | 1643 | 2190 | 하시였습니다다6 | /a/ | 770 | 1723 | 2591 |
| 來年1 | /ɛ/ | 480 | 1770 | 2068 | 勞動黨3 | /a/ | 653 | 1536 | 2244 |
| 施行2 | /ɛ/ | 498 | 1672 | 2043 | 勞動黨3 | /a/ | 786 | 1606 | 2188 |
| 百億圓1 | /ɛ/ | 640 | 1582 | 2367 | 勞動黨3 | /a/ | 670 | 1557 | 2252 |
| 為해2 | /ɛ/ | 534 | 1674 | 2274 | 黨 | /a/ | 855 | 1611 | 2547 |
| 行政1 | /ɛ/ | 524 | 1706 | 2205 | 領導者1 | /a/ | 724 | 1684 | 2086 |
| 執行2 | /ɛ/ | 534 | 1591 | 2189 | 為하여2 | /a/ | 883 | 1775 | 2553 |
| 지내2 | /ɛ/ | 556 | 1688 | 2261 | 또다시2 | /a/ | 682 | 1610 | 2067 |
| 새 | /ɛ/ | 511 | 1466 | 2349 | 訪問1 | /a/ | 770 | 1608 | 2446 |
| 배 | /ɛ/ | 600 | 1588 | 2363 | 하고1 | /a/ | 871 | 1623 | 2227 |
| 脫出해3 | /ɛ/ | 551 | 1504 | 2242 | 다하여1 | /a/ | 830 | 1442 | 2190 |
| 했다는1 | /ɛ/ | 482 | 1499 | 2223 | 共產黨2 | /a/ | 746 | 1807 | 1935 |
| 接待2 | /ɛ/ | 478 | 1501 | 2255 | 共產黨3 | /a/ | 732 | 1611 | 2125 |
| 했습니다1 | /ɛ/ | 423 | 1468 | 2268 | 共產黨2 | /a/ | 738 | 1636 | 2132 |
| 지내고2 | /ɛ/ | 519 | 1475 | 2335 | 共產黨3 | /a/ | 753 | 1629 | 2175 |
| 보내2 | /ɛ/ | 443 | 1584 | 2129 | 나라1 | /a/ | 738 | 1633 | 2281 |
| 幸福1 | /ɛ/ | 506 | 1608 | 2244 | 만나시고1 | /a/ | 894 | 1553 | 2245 |
| 行事1 | /ɛ/ | 503 | 1659 | 2152 | 訪問1 | /a/ | 759 | 1476 | 2190 |
| 行列1 | /ɛ/ | 515 | 1737 | 2095 | 하여1 | /a/ | 811 | 1784 | 2164 |
| 새벽1 | /ɛ/ | 480 | 1424 | 2308 | | | | | |

| Word | Vowel | F1 | F2 | F3 |
|-------|-------|-----|------|------|
| 安寧1 | /a/ | 746 | 1337 | 2409 |
| 하십니까4 | /a/ | 677 | 1173 | 2570 |
| 지난2 | /a/ | 575 | 1338 | 2336 |
| 合同1 | /a/ | 587 | 1012 | 2701 |
| 내라고1 | /a/ | 628 | 1228 | 2384 |
| 아직도1 | /a/ | 737 | 1190 | 2411 |
| 規制가3 | /a/ | 652 | 1291 | 2440 |
| 많다는1 | /a/ | 755 | 1165 | 2550 |
| 많다는1 | /a/ | 605 | 1384 | 2376 |
| 不滿2 | /a/ | 654 | 1248 | 2627 |
| 앞서1 | /a/ | 648 | 1099 | 2523 |
| 까지1 | /a/ | 548 | 1315 | 2334 |
| 朴大統領1 | /a/ | 654 | 1092 | 2459 |
| 캠핑場3 | /a/ | 579 | 1332 | 2376 |
| 이나2 | /a/ | 665 | 1367 | 2373 |
| 野球場3 | /a/ | 615 | 1385 | 2296 |
| 할수1 | /a/ | 670 | 1432 | 2342 |
| 새누리黨4 | /a/ | 565 | 1245 | 2349 |
| 對한2 | /a/ | 726 | 1336 | 2388 |
| 動議案3 | /a/ | 604 | 1339 | 2341 |
| 豫想2 | /a/ | 615 | 1311 | 2415 |
| 날로1 | /a/ | 690 | 1283 | 2312 |
| 이나2 | /a/ | 573 | 1149 | 2866 |
| 합니다1 | /a/ | 622 | 1150 | 2136 |
| 하고1 | /a/ | 700 | 1173 | 2593 |
| 地目體2 | /a/ | 620 | 1387 | 2436 |
| 負擔2 | /a/ | 617 | 1176 | 2379 |
| 함께1 | /a/ | 658 | 1426 | 2310 |
| 맞게1 | /a/ | 577 | 1039 | 2382 |
| 人口가3 | /a/ | 667 | 1292 | 2364 |

| Word | Vowel | F1 | F2 | F3 |
|-------|-------|-----|------|------|
| 視聽者2 | /a/ | 498 | 1098 | 2196 |
| 여러分2 | /a/ | 456 | 1137 | 2158 |
| 더 | /a/ | 537 | 884 | 2797 |
| 直接2 | /a/ | 447 | 1147 | 2224 |
| 들어보2 | /a/ | 454 | 969 | 2187 |
| 앞서2 | /a/ | 445 | 1201 | 2311 |
| 서 | /a/ | 558 | 945 | 2574 |
| 에서2 | /a/ | 477 | 1086 | 2459 |
| 치여서3 | /a/ | 516 | 926 | 2664 |
| 鐵道1 | /a/ | 582 | 1190 | 2324 |
| 부터2 | /a/ | 482 | 1109 | 2413 |
| 없는1 | /a/ | 501 | 960 | 2811 |
| 없습니다1 | /a/ | 507 | 939 | 2268 |
| 百億圓2 | /a/ | 428 | 855 | 2175 |
| 없는1 | /a/ | 452 | 950 | 2270 |

| Word | Vowel | F1 | F2 | F3 |
|------|-------|-----|------|------|
| 朝鮮2 | /a/ | 584 | 1678 | 2386 |
| 秘書2 | /a/ | 732 | 1450 | 2502 |
| 朝鮮2 | /a/ | 728 | 1525 | 2495 |
| 金正日2 | /a/ | 589 | 1233 | 2358 |
| 께서2 | /a/ | 731 | 1101 | 2292 |
| 朝鮮2 | /a/ | 744 | 1633 | 2512 |
| 秘書2 | /a/ | 777 | 1670 | 2657 |
| 朝鮮2 | /a/ | 579 | 1519 | 2622 |
| 金正日2 | /a/ | 596 | 1277 | 2588 |
| 께서2 | /a/ | 789 | 1651 | 2794 |
| 부터2 | /a/ | 723 | 957 | 2289 |
| 朝鮮2 | /a/ | 717 | 1554 | 2446 |
| 朝鮮2 | /a/ | 692 | 1562 | 2400 |
| 秘書2 | /a/ | 776 | 1538 | 2052 |
| 朝鮮2 | /a/ | 655 | 1568 | 2399 |
| 朝鮮2 | /a/ | 708 | 1571 | 2364 |
| 朝鮮2 | /a/ | 685 | 1609 | 2465 |
| 秘書2 | /a/ | 621 | 1364 | 2288 |
| 朝鮮2 | /a/ | 677 | 1350 | 2030 |
| 秘書2 | /a/ | 696 | 1217 | 2056 |
| 金正日2 | /a/ | 579 | 1301 | 2279 |
| 金正日2 | /a/ | 702 | 1474 | 2243 |
| 金正日2 | /a/ | 679 | 1527 | 2461 |
| 께서2 | /a/ | 770 | 1684 | 2636 |
| 金正日2 | /a/ | 745 | 1543 | 2333 |
| 金正日2 | /a/ | 673 | 1567 | 2517 |
| 金正日2 | /a/ | 598 | 1480 | 2333 |
| 秘書2 | /a/ | 721 | 1640 | 2613 |
| 께서2 | /a/ | 630 | 1108 | 2217 |
| 것은1 | /a/ | 720 | 1618 | 2496 |

| Word | Vowel | F1 | F2 | F3 |
|------|-------|-----|------|------|
| 勞動黨1 | /o/ | 799 | 1481 | 2416 |
| 勞動黨2 | /o/ | 717 | 1145 | 2153 |
| 좋은1 | /o/ | 546 | 886 | 2095 |
| 共和國1 | /o/ | 690 | 1166 | 1909 |
| 領導者2 | /o/ | 607 | 1346 | 2421 |
| 同志1 | /o/ | 570 | 1027 | 2295 |
| 朝鮮1 | /o/ | 709 | 1027 | 2681 |
| 勞動黨1 | /o/ | 773 | 1352 | 2309 |
| 勞動黨2 | /o/ | 697 | 1065 | 2136 |
| 좋은1 | /o/ | 543 | 827 | 2307 |
| 領導者2 | /o/ | 623 | 1566 | 2751 |
| 同志1 | /o/ | 706 | 1340 | 2370 |
| 共產黨1 | /o/ | 494 | 808 | 2357 |
| 共和國1 | /o/ | 629 | 960 | 2607 |
| 同志1 | /o/ | 567 | 1380 | 2239 |
| 共和國1 | /o/ | 662 | 1018 | 2306 |

Sheet1

| | | | | | | | | | |
|------|-----|-----|------|------|------|-----|-----|------|------|
| 政府1 | /N/ | 537 | 1193 | 2244 | 共和國1 | /o/ | 649 | 996 | 2276 |
| 法 | /N/ | 528 | 862 | 2698 | 同志1 | /o/ | 563 | 1134 | 2217 |
| 行政2 | /N/ | 533 | 1222 | 2354 | 朝鮮1 | /o/ | 552 | 836 | 2363 |
| 先驅1 | /N/ | 575 | 977 | 2753 | 勞動黨1 | /o/ | 732 | 1519 | 2197 |
| 直接2 | /N/ | 510 | 1154 | 2478 | 勞動黨2 | /o/ | 680 | 1659 | 2109 |
| 서울1 | /N/ | 599 | 1003 | 2543 | 同志1 | /o/ | 651 | 1508 | 2164 |
| 그런데2 | /N/ | 520 | 1150 | 2273 | 同志1 | /o/ | 692 | 1264 | 2250 |
| 여덟2 | /N/ | 489 | 1162 | 2317 | 朝鮮1 | /o/ | 514 | 982 | 2137 |
| 에서2 | /N/ | 498 | 892 | 2664 | 勞動黨1 | /o/ | 716 | 1103 | 2192 |
| 指定2 | /N/ | 498 | 1243 | 2297 | 勞動黨2 | /o/ | 673 | 1233 | 1727 |
| 에서2 | /N/ | 523 | 967 | 2623 | 同志1 | /o/ | 695 | 1256 | 1932 |
| 너무1 | /N/ | 541 | 897 | 2671 | 同志1 | /o/ | 646 | 1067 | 2138 |
| 檢疫1 | /N/ | 514 | 903 | 2562 | 同志1 | /o/ | 672 | 1381 | 2097 |
| 女性2 | /N/ | 540 | 1047 | 2384 | 同志1 | /o/ | 620 | 1303 | 2271 |
| 視聽2 | /N/ | 526 | 1033 | 2185 | | | | | |

| Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
|-------|-------|-----|------|------|-------|-------|-----|------|------|
| 共和國3 | /u/ | 562 | 963 | 2318 | 共和國3 | /u/ | 739 | 1202 | 2242 |
| 共和國3 | /u/ | 739 | 1202 | 2242 | 訪問2 | /u/ | 658 | 1555 | 2425 |
| 訪問2 | /u/ | 658 | 1555 | 2425 | 民主主義2 | /u/ | 571 | 1755 | 2471 |
| 民主主義2 | /u/ | 571 | 1755 | 2471 | 民主主義3 | /u/ | 606 | 1818 | 2675 |
| 民主主義3 | /u/ | 606 | 1818 | 2675 | 中國2 | /u/ | 470 | 820 | 2138 |
| 中國2 | /u/ | 470 | 820 | 2138 | 共和國3 | /u/ | 609 | 1275 | 2533 |
| 共和國3 | /u/ | 609 | 1275 | 2533 | 共和國3 | /u/ | 614 | 1033 | 2150 |
| 共和國3 | /u/ | 614 | 1033 | 2150 | 訪問2 | /u/ | 633 | 1684 | 2496 |
| 訪問2 | /u/ | 633 | 1684 | 2496 | 共和國3 | /u/ | 610 | 1676 | 2552 |
| 共和國3 | /u/ | 610 | 1676 | 2552 | 民主主義2 | /u/ | 570 | 1745 | 2519 |
| 民主主義2 | /u/ | 570 | 1745 | 2519 | 民主主義3 | /u/ | 617 | 1771 | 2328 |
| 民主主義3 | /u/ | 617 | 1771 | 2328 | 共和國3 | /u/ | 594 | 1365 | 2407 |
| 共和國3 | /u/ | 594 | 1365 | 2407 | 中國2 | /u/ | 631 | 1450 | 2666 |
| 中國2 | /u/ | 631 | 1450 | 2666 | 中國2 | /u/ | 436 | 782 | 2069 |
| 中國2 | /u/ | 436 | 782 | 2069 | 中國2 | /u/ | 420 | 861 | 2085 |
| 中國2 | /u/ | 420 | 861 | 2085 | 共和國3 | /u/ | 520 | 1236 | 2699 |
| 共和國3 | /u/ | 520 | 1236 | 2699 | 中國1 | /u/ | 537 | 1527 | 2420 |
| 中國1 | /u/ | 537 | 1527 | 2420 | 中國2 | /u/ | 571 | 1427 | 2353 |
| 中國2 | /u/ | 571 | 1427 | 2353 | 中國2 | /u/ | 424 | 803 | 2138 |
| 中國2 | /u/ | 424 | 803 | 2138 | 中國1 | /u/ | 398 | 1612 | 2587 |
| 中國1 | /u/ | 398 | 1612 | 2587 | 中國2 | /u/ | 480 | 869 | 2238 |
| 中國2 | /u/ | 480 | 869 | 2238 | 訪問2 | /u/ | 594 | 1547 | 2061 |
| 訪問2 | /u/ | 594 | 1547 | 2061 | 두나라1 | /u/ | 567 | 952 | 2293 |
| 두나라1 | /u/ | 567 | 952 | 2293 | 추신1 | /u/ | 496 | 1806 | 2503 |
| 추신1 | /u/ | 496 | 1806 | 2503 | 貴重2 | /u/ | 616 | 1451 | 2244 |
| 貴重2 | /u/ | 616 | 1451 | 2244 | 大國2 | /u/ | 639 | 941 | 2495 |
| 大國2 | /u/ | 639 | 941 | 2495 | 祖國2 | /u/ | 538 | 1029 | 2591 |
| 祖國2 | /u/ | 538 | 1029 | 2591 | 中國2 | /u/ | 733 | 1090 | 2538 |
| 中國2 | /u/ | 733 | 1090 | 2538 | 두나라1 | /u/ | 494 | 1147 | 2415 |
| 두나라1 | /u/ | 494 | 1147 | 2415 | | | | | |

| Word | Vowel | F1 | F2 | F3 | Word | Vowel | F1 | F2 | F3 |
|---------|-------|-----|------|------|---------|-------|-----|------|------|
| 계서는3 | /u/ | 666 | 1743 | 2431 | 계서는3 | /u/ | 666 | 1743 | 2431 |
| 여러분3 | /u/ | 403 | 926 | 2218 | 을 | /u/ | 658 | 1871 | 2492 |
| 을 | /u/ | 658 | 1871 | 2492 | 領導者들4 | /u/ | 530 | 1883 | 2391 |
| 注文1 | /u/ | 405 | 954 | 2065 | 人民들은4 | /u/ | 628 | 1858 | 2458 |
| 注文2 | /u/ | 426 | 948 | 2235 | 中國을3 | /u/ | 584 | 1765 | 2451 |
| 不滿1 | /u/ | 362 | 1074 | 2038 | 同志를3 | /u/ | 666 | 1840 | 2244 |
| 中國을3 | /u/ | 584 | 1765 | 2451 | 同志를3 | /u/ | 651 | 1877 | 2660 |
| 野球場2 | /u/ | 372 | 1025 | 2167 | 계서는3 | /u/ | 670 | 1879 | 2578 |
| 同志를3 | /u/ | 666 | 1840 | 2244 | 同志를3 | /u/ | 570 | 1822 | 2342 |
| 運營1 | /u/ | 387 | 692 | 2277 | 同志는3 | /u/ | 712 | 1791 | 2396 |
| 同志를3 | /u/ | 651 | 1877 | 2660 | 同志를3 | /u/ | 571 | 1865 | 2685 |
| 새누리黨2 | /u/ | 390 | 1300 | 1921 | 同志는3 | /u/ | 661 | 1877 | 2270 |
| 계서는3 | /u/ | 670 | 1879 | 2578 | 들어와1 | /u/ | 523 | 1770 | 2428 |
| 偶然1 | /u/ | 378 | 915 | 2109 | 계서는3 | /u/ | 723 | 1703 | 2483 |
| 同志를3 | /u/ | 570 | 1822 | 2342 | 그대로1 | /u/ | 506 | 1856 | 2341 |
| 國會1 | /u/ | 387 | 781 | 2186 | 人民은3 | /u/ | 722 | 1807 | 2285 |
| 同志는3 | /u/ | 712 | 1791 | 2396 | 同志는3 | /u/ | 588 | 1809 | 2439 |
| 同志를3 | /u/ | 571 | 1865 | 2685 | 는 | /u/ | 719 | 1744 | 2330 |
| 同志는3 | /u/ | 661 | 1877 | 2270 | 계서는3 | /u/ | 695 | 1802 | 2334 |
| 들어와1 | /u/ | 523 | 1770 | 2428 | 으로1 | /u/ | 570 | 1241 | 2170 |
| 계서는3 | /u/ | 723 | 1703 | 2483 | 있는2 | /u/ | 743 | 1845 | 2078 |
| 그대로1 | /u/ | 506 | 1856 | 2341 | 것을2 | /u/ | 671 | 1817 | 2614 |
| 人民은3 | /u/ | 722 | 1807 | 2285 | 同志를3 | /u/ | 631 | 1872 | 2309 |
| 同志는3 | /u/ | 588 | 1809 | 2439 | 同志는3 | /u/ | 686 | 1838 | 2361 |
| 는 | /u/ | 719 | 1744 | 2330 | 에서는3 | /u/ | 710 | 1715 | 2360 |
| 계서는3 | /u/ | 695 | 1802 | 2334 | 들어왔습니다1 | /u/ | 578 | 1569 | 2334 |
| 으로1 | /u/ | 570 | 1241 | 2170 | 있는2 | /u/ | 709 | 1852 | 2073 |
| 있는2 | /u/ | 743 | 1845 | 2078 | 들어였습니다1 | /u/ | 549 | 1805 | 2386 |
| 것을2 | /u/ | 671 | 1817 | 2614 | 들어였습니다1 | /u/ | 512 | 1772 | 2573 |
| 同志를3 | /u/ | 631 | 1872 | 2309 | | | | | |
| 同志는3 | /u/ | 686 | 1838 | 2361 | | | | | |
| 에서는3 | /u/ | 710 | 1715 | 2360 | | | | | |
| 들어왔습니다1 | /u/ | 578 | 1569 | 2334 | | | | | |
| 있는2 | /u/ | 709 | 1852 | 2073 | | | | | |
| 들어였습니다1 | /u/ | 549 | 1805 | 2386 | | | | | |
| 들어였습니다1 | /u/ | 512 | 1772 | 2573 | | | | | |

Sheet1

| | | | | | | | | | |
|-------|-----|-----|------|------|------|-----|-----|------|------|
| 脱出2 | /w/ | 430 | 1409 | 2176 | 따뜻한2 | /w/ | 515 | 1822 | 2134 |
| 한가운데3 | /w/ | 427 | 1083 | 2456 | | | | | |

| Word | Vowel | F1 | F2 | F3 |
|-------|-------|-----|------|------|
| 오늘2 | /w/ | 451 | 1162 | 2110 |
| 은 | /w/ | 448 | 970 | 2202 |
| 오늘2 | /w/ | 433 | 1249 | 2301 |
| 많다는3 | /w/ | 487 | 1391 | 2308 |
| 들어보1 | /w/ | 439 | 1222 | 2195 |
| 大統領은4 | /w/ | 494 | 1289 | 2178 |
| 들 | /w/ | 467 | 1387 | 2339 |
| 있는2 | /w/ | 509 | 1475 | 2199 |
| 豫想을3 | /w/ | 509 | 1311 | 2205 |
| 年金2 | /w/ | 402 | 1281 | 2054 |
| 年金2 | /w/ | 404 | 1076 | 2002 |
| 年金을3 | /w/ | 445 | 1274 | 2098 |
| 없는2 | /w/ | 415 | 1444 | 2113 |
| 費用을3 | /w/ | 483 | 1421 | 2102 |
| 있는2 | /w/ | 476 | 1496 | 2102 |
| 많은2 | /w/ | 541 | 1444 | 2185 |
| 는 | /w/ | 540 | 1408 | 2271 |
| 年金2 | /w/ | 385 | 1239 | 2000 |
| 으로1 | /w/ | 403 | 991 | 2088 |
| 없는2 | /w/ | 504 | 1439 | 2204 |
| 福祉費를4 | /w/ | 447 | 1359 | 2080 |
| 福祉費를4 | /w/ | 475 | 1416 | 2230 |
| 特段1 | /w/ | 386 | 1330 | 1865 |
| 을 | /w/ | 490 | 1390 | 2120 |
| 않은2 | /w/ | 498 | 1381 | 2299 |
| 을 | /w/ | 435 | 1399 | 2209 |
| 그런데1 | /w/ | 441 | 1329 | 2014 |
| 밖은2 | /w/ | 479 | 1309 | 2117 |
| 오늘2 | /w/ | 482 | 1268 | 2201 |
| 작은2 | /w/ | 483 | 1215 | 2228 |