Deducing Allophonic Rules
Part 2
Supplementary Readings

The following readings have been posted to the Moodle course site:

- Contemporary Linguistics: Chapter 3 (pp. 70-77, 84-86)
- Language Files: Chapter 3.5 (pp. 127-133)
Supplementary Readings

The following readings have been posted to the Moodle course site:

- Contemporary Linguistics: Chapter 3 (pp. 70-77, 84-86)
- Language Files: Chapter 3.5 (pp. 127-133)

The following reading (on Moodle) isn’t essential, but you might find it helpful:

- Language Instinct: Chapter 6 (153-189)
A Core Fact of Human Language

Fact of Central Interest:
Languages can differ over whether two phones are allophones of the same phoneme.

Example 1:

▶ In English, [t] / [tʰ] are allophones of the same phoneme (/t/).
▶ In Thai, [t] / [tʰ] are allophones of different phonemes.

Example 2:

▶ In English, long vowels (V:) and short vowels (V) are allophones of the same phoneme (short vowel).
▶ In Kikuyu, a long vowels (V:) and a short vowels (V) are allophones of different phonemes.
Solving the Analytic Problem

The Question This Raises:
How do you tell whether [X] and [Y] are allophones of the same phoneme?
Solving the Analytic Problem

The Question This Raises:
How do you tell whether [X] and [Y] are allophones of the same phoneme?

First Main Sub-Task:
Determine if there are minimal pairs for [X] and [Y].
  ▶ If there are, STOP!
    ▶ [X] and [Y] are allophones of different phonemes.
  ▶ If there aren’t, move on to Second Main Sub-Task.

Second Main Sub-Task:
Determine if there is a rule deriving [X] and [Y] from the same phoneme.
Solving the Analytic Problem

Subsequent Question:
But, how do we determine whether such a rule exists?
Solving the Analytic Problem

Subsequent Question:
But, how do we determine whether such a rule exists?

The Overarching Logic:
We want to determine which of the following is true:

1. There’s a rule that requires /X/ to be pronounced as [Y] in some environment Z.
2. There’s a rule which requires /Y/ to be pronounced as [X] in some environment Z.
Solving the Analytic Problem

Subsequent Question:
But, how do we determine whether such a rule exists?

The Overarching Logic:
We want to determine which of the following is true:

1. There’s a rule that requires /X/ to be pronounced as [Y] in some environment Z.
2. There’s a rule which requires /Y/ to be pronounced as [X] in some environment Z.

If (1) is true, then...
- There should be an environment Z where we only find [Y] (never [X])

If (2) is true, then...
- There should be an environment Z where we only find [X] (never [Y])
Solving the Analytic Problem

Subsequent Question:
But, how do we determine whether such a rule exists?

The Overarching Logic:
So, we now want to determine which of these is true:

1. There is an environment Z where we only find [Y] (and never [X])
2. There is an environment Z where we only find [X] (and never [Y])

Figuring this out can be broken down into four manageable steps...
Solving the Analytic Problem

Second Main Sub-Task:
Determine if there is a rule deriving [X] and [Y] from the same phoneme.
Solving the Analytic Problem

Second Main Sub-Task:
Determine if there is a rule deriving [X] and [Y] from the same phoneme.

▶ Step 1:
Determine the environments of [X] and [Y].
Solving the Analytic Problem

Second Main Sub-Task:
Determine if there is a rule deriving [X] and [Y] from the same phoneme.

▶ Step 1:
Determine the environments of [X] and [Y].

▶ Step 2:
For each environment, look for similarities between the sounds.
Solving the Analytic Problem

Second Main Sub-Task:
Determine if there is a rule deriving [X] and [Y] from the same phoneme.

- **Step 1:**
  Determine the environments of [X] and [Y].

- **Step 2:**
  For each environment, look for similarities between the sounds.

- **Step 3:**
  See if any environments are unique to [X] or [Y].
Solving the Analytic Problem

Second Main Sub-Task:
Determine if there is a rule deriving [X] and [Y] from the same phoneme.

▶ Step 1:
  Determine the environments of [X] and [Y].

▶ Step 2:
  For each environment, look for similarities between the sounds.

▶ Step 3:
  See if any environments are unique to [X] or [Y].

▶ Step 4:
  If there’s an environment unique to [X] or [Y], write the rule deriving that allophone in that environment.
Solving the Analytic Problem

Second Main Sub-Task:
Determine if there is a rule deriving [X] and [Y] from the same phoneme.

Rule of Thumb for Writing Rules:
If there are two allophones [X] and [Y], and only [X] appears in environment Z, the rule is: “/Y/ is pronounced as [X] in Z”

Notation for Writing Rules

▶ /X/ → [Y] / ___ A
  “/X/ is pronounced as [Y] when preceding A”.

▶ /X/ → [Y] / A ___
  “/X/ is pronounced as [Y] when following A”.

▶ /X/ → [Y] / A ___ B
  “/X/ is pronounced as [Y] when following A and preceding B.”
Fricatives in German

Key Fact:

German has two fricative phones that don’t exist in English.

- [ç]: voiceless oral palatal fricative
- [x]: voiceless oral velar fricative

Some Illustrative Words:

- [bux] ‘book’
- [mîç] ‘me’
- [kokxen] ‘to cook’
- [bax] ‘brook’
- [medçen] ‘girl’
- [kuxen] ‘cake’
- [mîlç] ‘milk’
- [feçer] ‘fan’
- [naxt] ‘night’
- [çemi] ‘chemist’
Fricatives in German

Key Fact:
German has two fricative phones that don’t exist in English.

▶ [\textipa{\textgreek{c}}] : voiceless oral palatal fricative
▶ [\textipa{\textgreek{x}}] : voiceless oral velar fricative

Some Illustrative Words:

| [bux] | ‘book’ | [kux\textipa{\textgreek{c}}n] | ‘cake’ |
| [mi\textipa{\textgreek{c}}] | ‘me’ | [mil\textipa{\textgreek{c}}] | ‘milk’ |
| [kox\textipa{\textgreek{c}}n] | ‘to cook’ | [fe\textipa{\textgreek{c}}\textipa{\textgreek{c}}r] | ‘fan’ |
| [bax] | ‘brook’ | [nax\textipa{\textgreek{c}}] | ‘night’ |
| [med\textipa{\textgreek{c}}\textipa{\textgreek{c}}n] | ‘girl’ | [\textipa{\textgreek{c}}emi] | ‘chemist’ |

Question:
In German, are [\textipa{\textgreek{x}}] and [\textipa{\textgreek{c}}] allophones of the same phoneme?
First Main Sub-Task: Minimal Pairs

Key Fact:
German has two fricative phones that don’t exist in English.
- [ç]: voiceless oral palatal fricative
- [x]: voiceless oral velar fricative

Some Illustrative Words:

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>bux</td>
<td>[bux]</td>
</tr>
<tr>
<td>mič</td>
<td>[mič]</td>
</tr>
<tr>
<td>koxən</td>
<td>[koxən]</td>
</tr>
<tr>
<td>bač</td>
<td>[bač]</td>
</tr>
<tr>
<td>medçən</td>
<td>[medçən]</td>
</tr>
<tr>
<td>kuxən</td>
<td>[kuxən]</td>
</tr>
<tr>
<td>milč</td>
<td>[milč]</td>
</tr>
<tr>
<td>feçər</td>
<td>[feçər]</td>
</tr>
<tr>
<td>naxt</td>
<td>[naxt]</td>
</tr>
<tr>
<td>čemi</td>
<td>[čemi]</td>
</tr>
</tbody>
</table>

First Main Sub-Task
Determine if there are minimal pairs for [x] and [ç].
First Main Sub-Task: Minimal Pairs

Key Fact:
German has two fricative phones that don’t exist in English.

- [ç]: voiceless oral palatal fricative
- [x]: voiceless oral velar fricative

Some Illustrative Words:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[mɪç]</td>
<td>‘me’</td>
<td>[mɪlç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bəx]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Result:

- There are no minimal pairs for [x] and [ç].
- So, on to Second Main Sub-Task...
Second Main Sub-Task: Find the Rule

Distribution of [x] and [ç] in German:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[mिंç]</td>
<td>‘me’</td>
<td>[mिंlç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Second Main Sub-Task:
Determine if there is a rule deriving [x] and [ç] from the same phoneme.
Second Main Sub-Task: Find the Rule

Distribution of [x] and [ç] in German:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[mîç]</td>
<td>‘me’</td>
<td>[mîlç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxɛn]</td>
<td>‘to cook’</td>
<td>[feçɛɾ]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçɛn]</td>
<td>‘girl’</td>
<td>[çɛmi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Second Main Sub-Task:
Determine if there is a rule deriving [x] and [ç] from the same phoneme.

▶ Step 1: Determine the environments of [x] and [ç].
Second Main Sub-Task: Find the Rule

Distribution of [x] and [ç] in German:

- [bux] ‘book’
- [mïç] ‘me’
- [koxən] ‘to cook’
- [bax] ‘brook’
- [medçən] ‘girl’
- [kuxən] ‘cake’
- [milç] ‘milk’
- [feçər] ‘fan’
- [naxt] ‘night’
- [çemi] ‘chemist’

Second Main Sub-Task:
Determine if there is a rule deriving [x] and [ç] from the same phoneme.

- **Step 1:** Determine the environments of [x] and [ç].
- **Step 2:**
  Look for similarities between the sounds in each environment.
Second Main Sub-Task: Find the Rule

Distribution of [x] and [ç] in German:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[miç]</td>
<td>‘me’</td>
<td>[milç]</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
</tr>
</tbody>
</table>

Second Main Sub-Task:
Determine if there is a rule deriving [x] and [ç] from the same phoneme.

▶ **Step 1:** Determine the environments of [x] and [ç].

▶ **Step 2:** Look for similarities between the sounds in each environment.

▶ **Step 3:** See if any environments are unique to [x] or [ç].
Second Main Sub-Task: Find the Rule

Distribution of [x] and [ç] in German:

- [bux] ‘book’
- [mïç] ‘me’
- [koxən] ‘to cook’
- [bæx] ‘brook’
- [medçən] ‘girl’
- [kuxən] ‘cake’
- [mïlç] ‘milk’
- [feçər] ‘fan’
- [næxt] ‘night’
- [çemi] ‘chemist’

Second Main Sub-Task:
Determine if there is a rule deriving [x] and [ç] from the same phoneme.

- **Step 1**: Determine the environments of [x] and [ç].
- **Step 2**: Look for similarities between the sounds in each environment.
- **Step 3**: See if any environments are unique to [x] or [ç].
- **Step 4**: If there’s an environment unique to one phone, write out the rule.
Step 1: Get the Environments

Distribution of [x] and [ç] in German:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[miç]</td>
<td>‘me’</td>
<td>[milç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koçən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çəmi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [x] and [ç].
Step 1: Get the Environments

Distribution of [χ] and [ç] in German:

<table>
<thead>
<tr>
<th>Word 1</th>
<th>Word 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>[bux]</td>
<td>‘book’</td>
</tr>
<tr>
<td>[mīç]</td>
<td>‘me’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
</tr>
<tr>
<td>[kuxən]</td>
<td>‘cake’</td>
</tr>
<tr>
<td>[mīlç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [χ] and [ç].

▶ The phones that precede [χ]:
Step 1: Get the Environments

Distribution of [x] and [ç] in German:

<table>
<thead>
<tr>
<th>Word</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>[bux]</td>
<td>‘book’</td>
</tr>
<tr>
<td>[mic]</td>
<td>‘me’</td>
</tr>
<tr>
<td>[koxen]</td>
<td>‘to cook’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
</tr>
<tr>
<td>[medcxen]</td>
<td>‘girl’</td>
</tr>
<tr>
<td>[kuxen]</td>
<td>‘cake’</td>
</tr>
<tr>
<td>[m1c]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[feccer]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[ceimi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [x] and [ç].

- The phones that precede [x]: [u]
### Step 1: Get the Environments

#### Distribution of [x] and [ç] in German:

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>[miɕ]</td>
<td>‘me’</td>
<td>[mɪlɕ]</td>
</tr>
<tr>
<td>[kɔxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
</tr>
<tr>
<td>[bɑx]</td>
<td>‘brook’</td>
<td>[nɑxτ]</td>
</tr>
<tr>
<td>[medɕən]</td>
<td>‘girl’</td>
<td>[çɛmi]</td>
</tr>
</tbody>
</table>

#### Step 1: Determine the environments of [x] and [ç].

- The phones that precede [x]: [u] [o]
Step 1: Get the Environments

Distribution of [ʦ] and [ç] in German:

<table>
<thead>
<tr>
<th>Phoneme</th>
<th>Word</th>
<th>Phoneme</th>
<th>Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>[mιç]</td>
<td>‘me’</td>
<td>[mιlç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [ʦ] and [ç].

- The phones that precede [ʦ]: [u] [o] [a]
Step 1: Get the Environments

Distribution of [x] and [ç] in German:

| [mɪç] | ‘me’    | [milç]  | ‘milk’ |
| [koxən] | ‘to cook’ | [feçər] | ‘fan’ |
| [bax] | ‘brook’ | [naxt]  | ‘night’ |
| [medçən] | ‘girl’ | [çemi] | ‘chemist’ |

Step 1: Determine the environments of [x] and [ç].

- The phones that precede [x]: [u] [o] [a]
- The phones that follow [x]:
Step 1: Get the Environments

Distribution of [x] and [ç] in German:

- [bux] ‘book’
- [mίc] ‘me’
- [köxen] ‘to cook’
- [bax] ‘brook’
- [medçen] ‘girl’
- [kuxen] ‘cake’
- [milç] ‘milk’
- [feçer] ‘fan’
- [naxt] ‘night’
- [çemi] ‘chemist’

Step 1: Determine the environments of [x] and [ç].

- The phones that precede [x]: [u] [o] [a]
- The phones that follow [x]: #
Step 1: Get the Environments

**Distribution of [x] and [ç] in German:**

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[bux]</td>
<td>‘book’</td>
<td></td>
</tr>
<tr>
<td>[miç]</td>
<td>‘me’</td>
<td></td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td></td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td></td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td></td>
</tr>
<tr>
<td>[kuxən]</td>
<td>‘cake’</td>
<td></td>
</tr>
<tr>
<td>[milç]</td>
<td>‘milk’</td>
<td></td>
</tr>
<tr>
<td>[feçər]</td>
<td>‘fan’</td>
<td></td>
</tr>
<tr>
<td>[naxt]</td>
<td>‘night’</td>
<td></td>
</tr>
<tr>
<td>[çemi]</td>
<td>‘chemist’</td>
<td></td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [x] and [ç].

- The phones that precede [x]: [u] [o] [a]
- The phones that follow [x]: # [ə]
Deducing Allophonic Rules
Part 2

Supplementary Readings
Introduction and Review
Fricatives in German
Task 1: Minimal Pairs
Task 2: Find the Rule
Step 1: Environments
Step 2: Commonalities?
Step 3: Uniqueness?
Step 4: Write the Rule

Fricatives in Southern Congo
Step 1: Get the Environments

Distribution of [x] and [ç] in German:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[miç]</td>
<td>‘me’</td>
<td>[milç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxen]</td>
<td>‘to cook’</td>
<td>[feçer]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçen]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [x] and [ç].

- The phones that precede [x]: [u] [o] [a]
- The phones that follow [x]: # [e] [t]
Step 1: Get the Environments

Distribution of [ɣ] and [ç] in German:

- [bux] ‘book’
- [mίç] ‘me’
- [koxən] ‘to cook’
- [bαx] ‘brook’
- [medçən] ‘girl’
- [kuxən] ‘cake’
- [mιlç] ‘milk’
- [feçər] ‘fan’
- [nαxt] ‘night’
- [çemi] ‘chemist’

Step 1: Determine the environments of [ɣ] and [ç].

▶ The phones that precede [ɣ]: [u] [o] [a]
▶ The phones that follow [ɣ]: # [ə] [t]
▶ The phones that precede [ç]:
### Step 1: Get the Environments

#### Distribution of [x] and [ç] in German:

<table>
<thead>
<tr>
<th></th>
<th>Translation</th>
<th></th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>[mɪç]</td>
<td>‘me’</td>
<td>[mɪlç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

### Step 1: Determine the environments of [x] and [ç].

- The phones that precede [x]: [u] [o] [ɑ]?
- The phones that follow [x]: # [ə] [t]?
- The phones that precede [ç]: [i]?
### Step 1: Get the Environments

**Distribution of [x] and [ç] in German:**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[mɪc]</td>
<td>‘me’</td>
<td>[mɪlc]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

**Step 1:** Determine the environments of [x] and [ç].

- **The phones that precede [x]:** [u] [o] [a]
- **The phones that follow [x]:** # [ə] [t]
- **The phones that precede [ç]:** [ɪ] [d]
### Step 1: Get the Environments

**Distribution of [x] and [ç] in German:**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[mɪç]</td>
<td>‘me’</td>
<td>[mɪłç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

**Step 1: Determine the environments of [x] and [ç].**

- **The phones that precede [x]:** [u] [o] [a]
- **The phones that follow [x]:** # [ə] [t]
- **The phones that precede [ç]:** [i] [d] [l]
### Deducing Allophonic Rules

**Part 2**

**Supplementary Readings**

**Introduction and Review**

**Fricatives in German**

**Task 1: Minimal Pairs**

**Task 2: Find the Rule**

**Step 1: Environments**

**Step 2: Commonalities?**

**Step 3: Uniqueness?**

**Step 4: Write the Rule**

---

### Fricatives in Southern Congo

**Step 1:** Determine the environments of [χ] and [ç].

- The phones that precede [χ]: [u] [o] [a]
- The phones that follow [χ]: # [ə] [t]
- The phones that precede [ç]: [ɪ] [d] [l] [e]
Step 1: Get the Environments

Distribution of [x] and [ç] in German:

| [mιç] | ‘me’    | [mιlç] | ‘milk’  |
| [koxən] | ‘to cook’ | [feçər] | ‘fan’ |
| [bαx] | ‘brook’ | [nαxt] | ‘night’ |
| [medçən] | ‘girl’ | [çemi] | ‘chemist’ |

Step 1: Determine the environments of [x] and [ç].

- The phones that precede [x]: [u] [o] [a]
- The phones that follow [x]: # [ə] [t]
- The phones that precede [ç]: [i] [d] [l] [e] #
Step 1: Get the Environments

Distribution of [x] and [ç] in German:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[mǐç]</td>
<td>‘me’</td>
<td>[mǐlç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [x] and [ç].

- The phones that precede [x]: [u] [o] [a]
- The phones that follow [x]: # [ə] [t]
- The phones that precede [ç]: [l] [d] [l] [e] #
- The phones that follow [ç]:

Deducing Allophonic Rules
Part 2

Supplementary Readings
Introduction and Review
Fricatives in German
Task 1: Minimal Pairs
Task 2: Find the Rule
Step 1: Environments
Step 2: Commonalities?
Step 3: Uniqueness?
Step 4: Write the Rule
Fricatives in Southern Congo
Deducing Allophonic Rules
Part 2
Supplementary Readings
Introduction and Review
Fricatives in German

Task 1: Minimal Pairs
Task 2: Find the Rule

Step 1: Environments
Step 2: Commonalities?
Step 3: Uniqueness?
Step 4: Write the Rule

Fricatives in Southern Congo

---

**Step 1: Get the Environments**

**Distribution of [x] and [ç] in German:**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[miç]</td>
<td>‘me’</td>
<td>[mılç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxəŋ]</td>
<td>‘to cook’</td>
<td>[feçəɾ]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçəŋ]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

**Step 1: Determine the environments of [x] and [ç].**

- The phones that precede [x]: [u] [o] [a]
- The phones that follow [x]: # [ə] [t]
- The phones that precede [ç]: [i] [d] [l] [e] #
- The phones that follow [ç]: #
### Step 1: Get the Environments

**Distribution of [x] and [ç] in German:**

<table>
<thead>
<tr>
<th>Sound</th>
<th>Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>[bux]</td>
<td>‘book’</td>
</tr>
<tr>
<td>[mici]</td>
<td>‘me’</td>
</tr>
<tr>
<td>[koxen]</td>
<td>‘to cook’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
</tr>
<tr>
<td>[medczen]</td>
<td>‘girl’</td>
</tr>
<tr>
<td>[kuxen]</td>
<td>‘cake’</td>
</tr>
<tr>
<td>[milc]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[fezer]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[cemil]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

**Step 1: Determine the environments of [x] and [ç].**

- The phones that precede [x]: [u] [o] [a]
- The phones that follow [x]: # [ə] [t]
- The phones that precede [ç]: [i] [d] [l] [e] #
- The phones that follow [ç]: # [ə]
Step 1: Get the Environments

Distribution of [x] and [ç] in German:

- [bux] ‘book’
- [mıc] ‘me’
- [koxên] ‘to cook’
- [bax] ‘brook’
- [medçên] ‘girl’
- [kuxên] ‘cake’
- [milç] ‘milk’
- [feçər] ‘fan’
- [naxt] ‘night’
- [çemi] ‘chemist’

Step 1: Determine the environments of [x] and [ç].

- The phones that precede [x]: [u] [o] [a]
- The phones that follow [x]: # [ə] [t]
- The phones that precede [ç]: [i] [d] [l] [e] #
- The phones that follow [ç]: # [ə] [e]
Step 2: Find Commonalities in the Sounds

Distribution of [x] and [ç] in German:

- [bux] ‘book’
- [mĩç] ‘me’
- [koxən] ‘to cook’
- [bax] ‘brook’
- [medçən] ‘girl’
- [kuxən] ‘cake’
- [mɪlc] ‘milk’
- [feçər] ‘fan’
- [naxt] ‘night’
- [çemi] ‘chemist’

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [x]: [u] [o] [a]
- The phones that follow [x]: # [ə] [t]
- The phones that precede [ç]: [l] [d] [l] [e] #
- The phones that follow [ç]: # [ə] [e]
Step 2: Find Commonalities in the Sounds

Distribution of [x] and [ç] in German:

- [mɪç] ‘me’  [mɪlç] ‘milk’
- [koxən] ‘to cook’  [feçər] ‘fan’
- [bax] ‘brook’  [naxt] ‘night’
- [medçən] ‘girl’  [çəmi] ‘chemist’

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [x]: [u] [o] [a]  
  All Back Vowels!
- The phones that follow [x]: # [ə] [t]
- The phones that precede [ç]: [i] [d] [l] [e] #
- The phones that follow [ç]: # [ə] [e]
Step 2: Find Commonalities in the Sounds

Distribution of [x] and [ç] in German:

<table>
<thead>
<tr>
<th>Alphabet</th>
<th>Word</th>
<th>Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>[miç]</td>
<td>‘me’</td>
<td>[milç]</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
</tr>
</tbody>
</table>

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [x]: [u] [o] [a]  
  **All Back Vowels!**

- The phones that follow [x]: # [ə] [t]  
  **Nothing in Common**

- The phones that precede [ç]: [i] [d] [l] [e] #

- The phones that follow [ç]: # [ə] [e]
Step 2: Find Commonalities in the Sounds

Distribution of [x] and [ç] in German:

[miç] ‘me’  [milç] ‘milk’
[koxən] ‘to cook’  [feçər] ‘fan’
[bax] ‘brook’  [naxt] ‘night’
[medçən] ‘girl’  [çemi] ‘chemist’

Step 2: Look for similarities between the sounds in each environment.

- The phones that precede [x]: [u] [o] [a]
  All Back Vowels!
- The phones that follow [x]: # [ə] [t]
  Nothing in Common
- The phones that precede [ç]: [i] [d] [l] [e] #
  Nothing in Common
- The phones that follow [ç]: # [ə] [e]
Step 2: Find Commonalities in the Sounds

Distribution of [x] and [ç] in German:

- [bux] ‘book’
- [mİç] ‘me’
- [koxən] ‘to cook’
- [baç] ‘brook’
- [medçən] ‘girl’
- [kuxən] ‘cake’
- [mılç] ‘milk’
- [feçər] ‘fan’
- [naxt] ‘night’
- [çemi] ‘chemist’

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [x]: [u] [o] [a]
  All Back Vowels!

- The phones that follow [x]: # [ə] [t]
  Nothing in Common

- The phones that precede [ç]: [i] [d] [l] [e] #
  Nothing in Common

- The phones that follow [ç]: # [ə] [e]
  Nothing in Common
### Step 3: See if an Environment is Unique

#### Distribution of [x] and [ç] in German:

| [mǐç] | ‘me’    | [mîlç]  | ‘milk’ |
| [koxən] | ‘to cook’ | [feçər] | ‘fan’ |
| [bɑx] | ‘brook’ | [nɑxτ]  | ‘night’ |
| [medçən] | ‘girl’ | [çemi]  | ‘chemist’ |

#### Step 3: See if any environments are unique to [x] or [ç].

- **The phones that precede [x]:**  
  [u] [o] [a]  
  **All Back Vowels!**

- **The phones that follow [x]:**  
  # [ə] [t]  
  **Nothing in Common**

- **The phones that precede [ç]:**  
  [ɪ] [d] [l] [e] #  
  **Nothing in Common**

- **The phones that follow [ç]:**  
  # [ə] [e]  
  **Nothing in Common**
Step 3: See if an Environment is Unique

<table>
<thead>
<tr>
<th>Distribution of [x] and [ç] in German:</th>
</tr>
</thead>
<tbody>
<tr>
<td>[bux] ‘book’</td>
</tr>
<tr>
<td>[mîç] ‘me’</td>
</tr>
<tr>
<td>[köxən] ‘to cook’</td>
</tr>
<tr>
<td>[bax] ‘brook’</td>
</tr>
<tr>
<td>[medçən] ‘girl’</td>
</tr>
<tr>
<td>[kuxən] ‘cake’</td>
</tr>
<tr>
<td>[milç] ‘milk’</td>
</tr>
<tr>
<td>[feçər] ‘fan’</td>
</tr>
<tr>
<td>[naxt] ‘night’</td>
</tr>
<tr>
<td>[çemi] ‘chemist’</td>
</tr>
</tbody>
</table>

Step 3: See if any environments are unique to [x] or [ç].
(look at the environ’s where the phones share a feature in common.)

▶ The phones that precede [x]:
  [u] [o] [ə]  
  All Back Vowels!

▶ The phones that follow [x]:
  # [ə] [t]  
  Nothing in Common

▶ The phones that precede [ç]:
  [ɪ] [d] [l] [e] #  
  Nothing in Common

▶ The phones that follow [ç]:
  # [ə] [e]  
  Nothing in Common
Step 3: See if an Environment is Unique

Distribution of [χ] and [ç] in German:

| [mɪç] | ‘me’ | [milç] | ‘milk’ |
| [koxən] | ‘to cook’ | [feçər] | ‘fan’ |
| [bax] | ‘brook’ | [naxt] | ‘night’ |
| [medçən] | ‘girl’ | [çemi] | ‘chemist’ |

Step 3: See if any environments are unique to [χ] or [ç].
(Look at the environ’s where the phones share a feature in common.)

▶ The phones that precede [χ]: [u] [o] [ə]  
All Back Vowels!
### Step 3: See if an Environment is Unique

#### Distribution of [x] and [ç] in German:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[mɪç]</td>
<td>‘me’</td>
<td>[mɪlc]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

#### Step 3: See if any environments are unique to [x] or [ç].
(Look at the corresponding environ. for the other phone.)

- The phones that precede [x]: [u] [o] [ə]

  **All Back Vowels!**
Step 3: See if an Environment is Unique

Distribution of [x] and [ç] in German:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[mîç]</td>
<td>‘me’</td>
<td>[mîlç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Step 3: See if any environments are unique to [x] or [ç].
( Look at the corresponding environ. for the other phone.)

- The phones that precede [x]: [u] [o] [a]  
  **All Back Vowels!**
- The phones that precede [ç]: [i] [d] [l] [e] #
Step 3: See if an Environment is Unique

Distribution of [x] and [ç] in German:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[mɪç]</td>
<td>‘me’</td>
<td>[mɪlç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Step 3: See if any environments are unique to [x] or [ç].
(See if the feature shared in [x]’s environ. can be found in [ç]’s)

▶ The phones that precede [x]: [u] [o] [a]  
  **All Back Vowels!**

▶ The phones that precede [ç]: [ɪ] [d] [l] [e] #
Step 3: See if an Environment is Unique

Distribution of [x] and [ç] in German:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[mɪç]</td>
<td>‘me’</td>
<td>[milç]</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
</tr>
</tbody>
</table>

Step 3: See if any environments are unique to [x] or [ç].
(See if the feature shared in [x]’s environ. can be found in [ç]’s)

- The phones that precede [x]: [u] [o] [ə] All Back Vowels!
- The phones that precede [ç]: [ɨ] [d] [ɨ] [e] # No Back Vowels!

Only [x] is preceded by back vowels!
Step 4: Write the Rule!

Distribution of [x] and [ç] in German:

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[bux]</td>
<td>[kuxən]</td>
<td>‘book’</td>
<td>‘cake’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[mǐç]</td>
<td>[milç]</td>
<td>‘me’</td>
<td>‘milk’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[koxən]</td>
<td>[feçər]</td>
<td>‘to cook’</td>
<td>‘fan’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[bax]</td>
<td>[naxt]</td>
<td>‘brook’</td>
<td>‘night’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[medçən]</td>
<td>[çemi]</td>
<td>‘girl’</td>
<td>‘chemist’</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Step 4:
If there’s an environ. unique to one allophone, write the rule!

- The phones that precede [x]: [u] [o] [a]
  All Back Vowels!

- The phones that precede [ç]: [i] [d] [l] [e] #
  No Back Vowels!

Only [x] is preceded by back vowels!
Step 4: Write the Rule!

Distribution of [x] and [ç] in German:

<table>
<thead>
<tr>
<th></th>
<th>‘book’</th>
<th></th>
<th>‘cake’</th>
</tr>
</thead>
<tbody>
<tr>
<td>[bux]</td>
<td></td>
<td>[kuxən]</td>
<td></td>
</tr>
<tr>
<td>[mιç]</td>
<td>‘me’</td>
<td>[mιlç]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[koxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Step 4: If there’s an environ. unique to one allophone, write the rule!

Only [x] is preceded by back vowels!
Step 4: Write the Rule!

Distribution of [x] and [ç] in German:

- [mɪç] ‘me’  [mɪlç] ‘milk’
- [koxən] ‘to cook’  [feçər] ‘fan’
- [bɑx] ‘brook’  [nɑxt] ‘night’
- [medçən] ‘girl’  [çemi] ‘chemist’

Step 4:
If there’s an environ. unique to one allophone, write the rule!

Only [x] is preceded by back vowels!

Rule of Thumb (for Writing Rules):
If there are two allophones [X] and [Y], and only [X] appears in environment Z, the rule is: “/Y/ is pronounced as [X] in Z”
Step 4: Write the Rule!

Distribution of [x] and [ç] in German:

- [bux] ‘book’
- [mǐç] ‘me’
- [koxən] ‘to cook’
- [bax] ‘brook’
- [medçən] ‘girl’
- [kuxən] ‘cake’
- [milç] ‘milk’
- [feçər] ‘fan’
- [naxt] ‘night’
- [çemi] ‘chemist’

Step 4:
If there’s an environ. unique to one allophone, write the rule!

Only [x] is preceded by back vowels!

Rule of Thumb (for Writing Rules):
If there are two allophones [X] and [Y], and only [X] appears in environment Z, the rule is: “/Y/ is pronounced as [X] in Z”

The Rule:
/ç/ is pronounced as [x] when preceded by a back vowel
Step 4: Write the Rule!

Distribution of [x] and [ç] in German:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[mɪç]</td>
<td>‘me’</td>
<td>[mɪlc]</td>
<td>‘milk’</td>
</tr>
<tr>
<td>[kɔxən]</td>
<td>‘to cook’</td>
<td>[feçər]</td>
<td>‘fan’</td>
</tr>
<tr>
<td>[bax]</td>
<td>‘brook’</td>
<td>[naxt]</td>
<td>‘night’</td>
</tr>
<tr>
<td>[medçən]</td>
<td>‘girl’</td>
<td>[çemi]</td>
<td>‘chemist’</td>
</tr>
</tbody>
</table>

Step 4:
If there’s an environ. unique to one allophone, write the rule!

Only [x] is preceded by back vowels!

Rule of Thumb (for Writing Rules):
If there are two allophones [X] and [Y], and only [X] appears in environment Z, the rule is: “/Y/ is pronounced as [X] in Z”

The Rule In Formal Notation:

/ç/ → [x] / Back-V

(“/ç/ is pronounced as [x] when following a back vowel”)
Question: In German, are [x] and [ç] allophones of the same phoneme?

Answer: Yes. They are allophones of the same phoneme (/ç/)
Fricatives in Southern Congo

In ‘Southern Congo’, there are four fricatives found in English:

- [s] : voiceless oral alveolar fricative
- [z] : voiced oral alveolar fricative
- [ʃ] : voiceless oral alveopalatal fricative
- [ʒ] : voiced oral alveopalatal fricative

Some Illustrative Words:

- [ʃiˈoθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’
Fricatives in Southern Congo

In ‘Southern Congo’, there are four fricatives found in English:

- [s]: voiceless oral alveolar fricative
- [z]: voiced oral alveolar fricative
- [ʃ]: voiceless oral alveopalatal fricative
- [ʒ]: voiced oral alveopalatal fricative

Some Illustrative Words:

- [ʒɪma] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zenɡa] ‘cut’

Questions:

- Are [s] and [ʃ] allophones of the same phoneme?
Fricatives in Southern Congo

In ‘Southern Congo’, there are four fricatives found in English:

- [s]: voiceless oral alveolar fricative
- [z]: voiced oral alveolar fricative
- [ʃ]: voiceless oral alveopalatal fricative
- [ʒ]: voiced oral alveopalatal fricative

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zen̩ga] ‘cut’

Questions:

- Are [s] and [ʃ] allophones of the same phoneme?
- Are [z] and [ʒ] allophones of the same phoneme?
First Main Sub-Task: Minimal Pairs

Some Illustrative Words:

| [ʒiːma] | ‘stretch’   | [ʃioθe] | ‘all’       |
| [kasu]  | ‘emaciation’| [nselele] | ‘termite’  |
| [kunezulu] | ‘heaven’ | [aʒimola] | ‘alms’      |
| [nzwetu] | ‘our’       | [loloŋzi] | ‘to wash’   |
| [kesoka] | ‘to be cut’ | [ŋkoʃi]   | ‘lion’      |
| [zevo]  | ‘then’      | [zeŋga]   | ‘cut’       |

First Main Sub-Task:

- Determine if there are minimal pairs for [s] and [ʃ].
- Determine if there are minimal pairs for [z] and [ʒ].
First Main Sub-Task: Minimal Pairs

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zenja] ‘cut’

First Main Sub-Task:

- Determine if there are minimal pairs for [s] and [ʃ].
  - Result: There are none.
- Determine if there are minimal pairs for [z] and [ʒ].
First Main Sub-Task: Minimal Pairs

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

First Main Sub-Task:

- Determine if there are minimal pairs for [s] and [ʃ].
  - Result: There are none.
- Determine if there are minimal pairs for [z] and [ʒ].
  - Result: There are none.
First Main Sub-Task: Minimal Pairs

Some Illustrative Words:

- [.raise] 'stretch'
- [kasu] 'emaciation'
- [kunezulu] 'heaven'
- [nzwetu] 'our'
- [kesoka] 'to be cut'
- [zevo] 'then'

- [joθe] 'all'
- [nselele] 'termite'
- [aŋimola] 'alms'
- [lolonzi] 'to wash'
- [ŋkoʃi] 'lion'
- [zeŋga] 'cut'

First Main Sub-Task:

▶ Determine if there are minimal pairs for [s] and [ʃ].
  ▶ Result: There are none.

▶ Determine if there are minimal pairs for [z] and [ʒ].
  ▶ Result: There are none.

So, on to Second Main Sub-Task:...
Second Main Sub-Task: Find the Rule

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’

- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Second Main Sub-Task:

- Determine if there is a rule deriving [s] and [ʃ] from the same phoneme.
- Determine if there is a rule deriving [z] and [ʒ] from the same phoneme.
Second Main Sub-Task: Find the Rule

Some Illustrative Words:

- [ʒima] 'stretch'
- [kasu] 'emaciation'
- [kunezulu] 'heaven'
- [nzwetu] 'our'
- [kesoka] 'to be cut'
- [zevo] 'then'
- [ʃioθe] 'all'
- [nselele] 'termite'
- [aʒimola] 'alms'
- [loloŋzi] 'to wash'
- [ŋkoʃi] 'lion'
- [zeŋga] 'cut'

Second Main Sub-Task:

- Determine if there is a rule deriving [s] and [ʃ] from the same phoneme.
- Determine if there is a rule deriving [z] and [ʒ] from the same phoneme.

Let’s now do each one at a time...
Second Main Sub-Task: Find the Rule

Some Illustrative Words:

- [3ima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [jioloe] ‘all’
- [nselele] ‘termite’
- [a3imola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkojʃi] ‘lion’
- [zengo] ‘cut’

Second Main Sub-Task:
Determine if there is a rule deriving [s] and [ʃ] from the same phoneme.
Second Main Sub-Task: Find the Rule

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zęŋga] ‘cut’

Second Main Sub-Task:
Determine if there is a rule deriving [s] and [ʃ] from the same phoneme.

► Step 1: Determine the environments of [s] and [ʃ].
Second Main Sub-Task: Find the Rule

Some Illustrative Words:

- [ʒi̞ma] ‘stretch’
- [ka̞su] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [əzimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zepta] ‘cut’

Second Main Sub-Task:
Determine if there is a rule deriving [s] and [ʃ] from the same phoneme.

▶ Step 1: Determine the environments of [s] and [ʃ].
▶ Step 2: Look for similarities between the sounds in each environment.
Second Main Sub-Task: Find the Rule

Some Illustrative Words:

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ʒima]</td>
<td>‘stretch’</td>
<td>[ʃioθe]</td>
</tr>
<tr>
<td>[kasu]</td>
<td>‘emaciation’</td>
<td>[ŋselele]</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>‘heaven’</td>
<td>[aʒimola]</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>‘our’</td>
<td>[loloŋzi]</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>‘to be cut’</td>
<td>[ŋkoʃi]</td>
</tr>
<tr>
<td>[zevo]</td>
<td>‘then’</td>
<td>[zeŋga]</td>
</tr>
</tbody>
</table>

Second Main Sub-Task:
Determine if there is a rule deriving [s] and [ʃ] from the same phoneme.

▶ Step 1: Determine the environments of [s] and [ʃ].
▶ Step 2: Look for similarities between the sounds in each environment.
▶ Step 3: See if any environments are unique to [s] or [ʃ].
Second Main Sub-Task: Find the Rule

Some Illustrative Words:

[ʒima] ‘stretch’  [ʃioθe] ‘all’
[kasu] ‘emaciation’  [nselele] ‘termite’
[kunezulu] ‘heaven’  [aʒimola] ‘alms’
[nzwetu] ‘our’  [lolonzi] ‘to wash’
[kesoka] ‘to be cut’  [ŋkoʃi] ‘lion’
[zevo] ‘then’  [zeŋga] ‘cut’

Second Main Sub-Task:
Determine if there is a rule deriving [s] and [ʃ] from the same phoneme.

▶ Step 1: Determine the environments of [s] and [ʃ].
▶ Step 2:
Look for similarities between the sounds in each environment.
▶ Step 3: See if any environments are unique to [s] or [ʃ].
▶ Step 4:
If there’s an environment unique to one phone, write out the rule.
Second Main Sub-Task: Find the Rule

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’

- [jioθe] ‘all’
- [nselele] ‘termite’
- [aζimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Second Main Sub-Task:
Determine if there is a rule deriving [z] and [ʒ] from the same phoneme.

- Step 1: Determine the environments of [z] and [ʒ].
- Step 2: Look for similarities between the sounds in each environment.
- Step 3: See if any environments are unique to [z] or [ʒ].
- Step 4: If there’s an environment unique to one phone, write out the rule.
Step 1: Get the Environments

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 1: Determine the environments of [s] and [ʃ].
Step 1: Get the Environments

Some Illustrative Words:

[žeima] ‘stretch’  [jioθe] ‘all’
[kasu] ‘emaciation’  [nselele] ‘termite’
[kunezulu] ‘heaven’  [ažimola] ‘alms’
[nzwetu] ‘our’  [lolonzi] ‘to wash’
[kesoka] ‘to be cut’  [ŋkoʃi] ‘lion’
[zevo] ‘then’  [zeŋga] ‘cut’

Step 1: Determine the environments of [s] and [ʃ].

► The phones that precede [s]:

[žeima]  [a]  [e]  [n]  [u]  [o]  [e]
[kasu]  [e]  [n]  [u]  [o]  [e]
[kunezulu]  [e]  [n]  [u]  [o]  [e]
[nzwetu]  [e]  [n]  [u]  [o]  [e]
[kesoka]  [e]  [n]  [u]  [o]  [e]
[zevo]  [e]  [n]  [u]  [o]  [e]
Step 1: Get the Environments

Some Illustrative Words:

<table>
<thead>
<tr>
<th>[zima]</th>
<th>‘stretch’</th>
<th>[jiöθe]</th>
<th>‘all’</th>
</tr>
</thead>
<tbody>
<tr>
<td>[kasu]</td>
<td>‘emaciation’</td>
<td>[nselele]</td>
<td>‘termite’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>‘heaven’</td>
<td>[aʒimola]</td>
<td>‘alms’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>‘our’</td>
<td>[loloŋzi]</td>
<td>‘to wash’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>‘to be cut’</td>
<td>[ŋkoʃi]</td>
<td>‘lion’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>‘then’</td>
<td>[zeŋga]</td>
<td>‘cut’</td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [s] and [ʃ].

- The phones that precede [s]: [a]
Step 1: Get the Environments

Some Illustrative Words:

[s]ima] ‘stretch’ [ʃioθe] ‘all’
[kasu] ‘emaciation’ [nselele] ‘termite’
[kunezulu] ‘heaven’ [aʒimola] ‘alms’
[nzwetu] ‘our’ [lolonzi] ‘to wash’
[kesoka] ‘to be cut’ [ŋkoʃi] ‘lion’
[zevo] ‘then’ [zeŋga] ‘cut’

Step 1: Determine the environments of [s] and [ʃ].

- The phones that precede [s]: [a] [e]
Step 1: Get the Environments

Some Illustrative Words:

[ʒima] ‘stretch’  [ʃioθe] ‘all’
[kasu] ‘emaciation’  [nselele] ‘termite’
[kunezulu] ‘heaven’  [ɑzimola] ‘alms’
[nzwetu] ‘our’  [lolonzi] ‘to wash’
[kesoka] ‘to be cut’  [ŋkoʃi] ‘lion’
[zevo] ‘then’  [zeŋga] ‘cut’

Step 1: Determine the environments of [s] and [ʃ].

▶ The phones that precede [s]:  [a] [e] [n]
Step 1: Get the Environments

Some Illustrative Words:

\[
\begin{align*}
[\text{zima}] & \quad \text{‘stretch’} & [\jio\theta e] & \quad \text{‘all’} \\
[\text{kasu}] & \quad \text{‘emaciation’} & [\text{nselele}] & \quad \text{‘termite’} \\
[\text{kunezulu}] & \quad \text{‘heaven’} & [\text{azimola}] & \quad \text{‘alms’} \\
[\text{nzwetu}] & \quad \text{‘our’} & [\text{lolonzi}] & \quad \text{‘to wash’} \\
[\text{kesoka}] & \quad \text{‘to be cut’} & [\jikoji] & \quad \text{‘lion’} \\
[\text{zevo}] & \quad \text{‘then’} & [\text{ze\jga}] & \quad \text{‘cut’}
\end{align*}
\]

Step 1: Determine the environments of \([s]\) and \([\j]\).

- The phones that precede \([s]\): \([a] [e] [n]\)
- The phones that follow \([s]\):
Step 1: Get the Environments

Some Illustrative Words:

- [ʒima]  ‘stretch’  [ʃioθe]  ‘all’
- [kasu]  ‘emaciation’  [nselele]  ‘termite’
- [kunezulu]  ‘heaven’  [aʒimola]  ‘alms’
- [nzwetu]  ‘our’  [loloŋzi]  ‘to wash’
- [kesoka]  ‘to be cut’  [ŋkoʃi]  ‘lion’
- [zevo]  ‘then’  [zeŋga]  ‘cut’

Step 1: Determine the environments of [s] and [ʃ].

- The phones that precede [s]: [a] [e] [n]
- The phones that follow [s]: [u]
### Step 1: Get the Environments

#### Some Illustrative Words:

<table>
<thead>
<tr>
<th>Word</th>
<th>Meaning</th>
<th>Word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[3ima]</td>
<td>‘stretch’</td>
<td>[fioθe]</td>
<td>‘all’</td>
</tr>
<tr>
<td>[kasu]</td>
<td>‘emaciation’</td>
<td>[nselele]</td>
<td>‘termite’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>‘heaven’</td>
<td>[aʒimola]</td>
<td>‘alms’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>‘our’</td>
<td>[loloŋzi]</td>
<td>‘to wash’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>‘to be cut’</td>
<td>[ŋkoʃi]</td>
<td>‘lion’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>‘then’</td>
<td>[зеŋga]</td>
<td>‘cut’</td>
</tr>
</tbody>
</table>

#### Step 1: Determine the environments of [s] and [ʃ].

- **The phones that precede [s]:** [a] [e] [n]
- **The phones that follow [s]:** [u] [o]
Step 1: Get the Environments

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 1: Determine the environments of [s] and [ʃ].

- The phones that precede [s]: [a] [e] [n]
- The phones that follow [s]: [u] [o] [e]
Step 1: Get the Environments

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [jioθe] ‘all’
- [nselele] ‘termite’
- [ažimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 1: Determine the environments of [s] and [ʃ].

- The phones that precede [s]: [a] [e] [n]
- The phones that follow [s]: [u] [o] [e]
- The phones that precede [ʃ]:

...
Step 1: Get the Environments

Some Illustrative Words:

<table>
<thead>
<tr>
<th>Word</th>
<th>Sound</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[3ima]</td>
<td>[ʃi ]</td>
<td>‘stretch’</td>
</tr>
<tr>
<td>[kasu]</td>
<td>[J'joθe]</td>
<td>‘emaciation’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>[nselele]</td>
<td>‘heaven’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>[azimola]</td>
<td>‘all’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>[loloŋzi]</td>
<td>‘termite’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>[ŋkoji]</td>
<td>‘our’</td>
</tr>
<tr>
<td></td>
<td>[ŋɛŋga]</td>
<td>‘to wash’</td>
</tr>
<tr>
<td></td>
<td>[kunezulu]</td>
<td>‘heaven’</td>
</tr>
<tr>
<td></td>
<td>[SioTe]</td>
<td>‘all’</td>
</tr>
<tr>
<td></td>
<td>[kasu]</td>
<td>‘emaciation’</td>
</tr>
<tr>
<td></td>
<td>[nzwetu]</td>
<td>‘our’</td>
</tr>
<tr>
<td></td>
<td>[zesoka]</td>
<td>‘to be cut’</td>
</tr>
<tr>
<td></td>
<td>[zevo]</td>
<td>‘then’</td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [s] and [ʃ].

- The phones that precede [s]: [a] [e] [n]
- The phones that follow [s]: [u] [o] [e]
- The phones that precede [ʃ]: #
Step 1: Get the Environments

Some Illustrative Words:

\[\text{[zima]} \quad \text{‘stretch’} \quad \text{[jioθe]} \quad \text{‘all’} \]
\[\text{[kasu]} \quad \text{‘emaciation’} \quad \text{[nselele]} \quad \text{‘termite’} \]
\[\text{[kunezulu]} \quad \text{‘heaven’} \quad \text{[aʒimola]} \quad \text{‘alms’} \]
\[\text{[nzwetu]} \quad \text{‘our’} \quad \text{[lolonzi]} \quad \text{‘to wash’} \]
\[\text{[kesoka]} \quad \text{‘to be cut’} \quad \text{[ŋkoʃi]} \quad \text{‘lion’} \]
\[\text{[zevo]} \quad \text{‘then’} \quad \text{[zeŋga]} \quad \text{‘cut’} \]

Step 1: Determine the environments of \([s]\) and \([ʃ]\).

- The phones that precede \([s]\): \([a] [e] [n]\)
- The phones that follow \([s]\): \([u] [o] [e]\)
- The phones that precede \([ʃ]\): \(# [o]\)
Step 1: Get the Environments

Some Illustrative Words:

\[
\begin{align*}
\text{[zima]} & \quad \text{‘stretch’} & \quad \text{[jioθe]} & \quad \text{‘all’} \\
\text{[kasu]} & \quad \text{‘emaciation’} & \quad \text{[nselele]} & \quad \text{‘termite’} \\
\text{[kunezulu]} & \quad \text{‘heaven’} & \quad \text{[aŋimola]} & \quad \text{‘alms’} \\
\text{[nzwetu]} & \quad \text{‘our’} & \quad \text{[loloŋzi]} & \quad \text{‘to wash’} \\
\text{[kesoka]} & \quad \text{‘to be cut’} & \quad \text{[ŋkoʃi]} & \quad \text{‘lion’} \\
\text{[zevo]} & \quad \text{‘then’} & \quad \text{[zeŋga]} & \quad \text{‘cut’}
\end{align*}
\]

Step 1: Determine the environments of \([s]\) and \([ʃ]\).

- The phones that precede \([s]\): \([a] \ [e] \ [n]\)
- The phones that follow \([s]\): \([u] \ [o] \ [e]\)
- The phones that precede \([ʃ]\): \# \([o]\)
- The phones that follow \([ʃ]\):
Step 1: Get the Environments

Some Illustrative Words:

- [ʒima] 'stretch'  [ʃioθe] ‘all’
- [kasu] ‘emaciation’  [nselele] ‘termite’
- [kunezulu] ‘heaven’  [aʒimola] ‘alms’
- [nzwetu] ‘our’  [lolonzi] ‘to wash’
- [kesoka] ‘to be cut’  [ŋkoʃi] ‘lion’
- [zevo] ‘then’  [zeŋga] ‘cut’

Step 1: Determine the environments of [s] and [ʃ].

- The phones that precede [s]: [a] [e] [n]
- The phones that follow [s]: [u] [o] [e]
- The phones that precede [ʃ]: # [o]
- The phones that follow [ʃ]: [i]
Step 1: Get the Environments

Some Illustrative Words:

- [ʒɪmɑ] ‘stretch’
- [kæsu] ‘emaciation’
- [kuːnɛzʊlʊ] ‘heaven’
- [nɛɬətu] ‘our’
- [keˈsoʊka] ‘to be cut’
- [zeˈvo] ‘then’
- [ʃioθɛ] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋɡa] ‘cut’

Step 1: Determine the environments of [z] and [ʒ].
Step 1: Get the Environments

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 1: Determine the environments of [z] and [ʒ].

- The phones that precede [z]:
  - [e n #]
  - [a n #]

- The phones that follow [z]:
  - [u w e]
  - [ŋ]
  - [i]
Step 1: Get the Environments

Some Illustrative Words:

<table>
<thead>
<tr>
<th>Word</th>
<th>Meaning</th>
<th>Word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ʒima]</td>
<td>‘stretch’</td>
<td>[ʃioθe]</td>
<td>‘all’</td>
</tr>
<tr>
<td>[kasu]</td>
<td>‘emaciation’</td>
<td>[nselele]</td>
<td>‘termite’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>‘heaven’</td>
<td>[aʒimola]</td>
<td>‘alms’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>‘our’</td>
<td>[lolonzi]</td>
<td>‘to wash’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>‘to be cut’</td>
<td>[ŋkoji]</td>
<td>‘lion’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>‘then’</td>
<td>[zeŋga]</td>
<td>‘cut’</td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [z] and [ʒ].

- The phones that precede [z]: [e]
Step 1: Get the Environments

Some Illustrative Words:

- [ʒiːmə] ‘stretch’
- [kəsu] ‘emaciation’
- [kʊnɛzulu] ‘heaven’
- [nʒwɛtu] ‘our’
- [kɛsoka] ‘to be cut’
- [zɛvo] ‘then’

- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lɔloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zɛŋɡa] ‘cut’

Step 1: Determine the environments of [z] and [ʒ].

- The phones that precede [z]: [e] [n]
Step 1: Get the Environments

Some Illustrative Words:

<table>
<thead>
<tr>
<th>[ʒima]</th>
<th>‘stretch’</th>
<th>[ʃioθe]</th>
<th>‘all’</th>
</tr>
</thead>
<tbody>
<tr>
<td>[kasu]</td>
<td>‘emaciation’</td>
<td>[nselele]</td>
<td>‘termite’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>‘heaven’</td>
<td>[aʒimola]</td>
<td>‘alms’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>‘our’</td>
<td>[lolonzi]</td>
<td>‘to wash’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>‘to be cut’</td>
<td>[ŋkoʃi]</td>
<td>‘lion’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>‘then’</td>
<td>[zeŋga]</td>
<td>‘cut’</td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [z] and [ʒ].

- The phones that precede [z]: [e] [n] #
Step 1: Get the Environments

Some Illustrative Words:

- [žima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’

- [jioθe] ‘all’
- [nselele] ‘termite’
- [ažimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 1: Determine the environments of [z] and [ʒ].

- The phones that precede [z]: [e] [n] #
- The phones that follow [z]:

Step 1: Get the Environments

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunzulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʒioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 1: Determine the environments of [z] and [3].

- The phones that precede [z]: [e] [n] #
- The phones that follow [z]: [u]
Step 1: Get the Environments

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’

- [jioθe] ‘all’
- [nselele] ‘termite’
- [aʐimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zęŋga] ‘cut’

Step 1: Determine the environments of [z] and [ʒ].

- The phones that precede [z]: [e] [n] #
- The phones that follow [z]: [u] [w]
Step 1: Get the Environments

Some Illustrative Words:

\[
\begin{align*}
[zima] & \quad \text{‘stretch’} & [žioθe] & \quad \text{‘all’} \\
[kasu] & \quad \text{‘emaciation’} & [nselele] & \quad \text{‘termite’} \\
[kunezulu] & \quad \text{‘heaven’} & [aʒimola] & \quad \text{‘alms’} \\
[nzwetu] & \quad \text{‘our’} & [lolonzi] & \quad \text{‘to wash’} \\
[kesoka] & \quad \text{‘to be cut’} & [ŋkoʃi] & \quad \text{‘lion’} \\
[zevo] & \quad \text{‘then’} & [zeŋɡa] & \quad \text{‘cut’}
\end{align*}
\]

Step 1: Determine the environments of \([z]\) and \([ʒ]\).

- The phones that precede \([z]\): \([e] [n] \#\)
- The phones that follow \([z]\): \([u] [w] [e]\)
Step 1: Get the Environments

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [jioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoji] ‘lion’
- [zeŋga] ‘cut’

Step 1: Determine the environments of [z] and [ʒ].

- The phones that precede [z]: [e] [n] #
- The phones that follow [z]: [u] [w] [e]
- The phones that precede [ʒ]:
Step 1: Get the Environments

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ji̞oθe] ‘all’
- [nselele] ‘termite’
- [aζimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 1: Determine the environments of [z] and [ʒ].

- The phones that precede [z]: [e] [n] #
- The phones that follow [z]: [u] [w] [e]
- The phones that precede [ʒ]: #
Step 1: Get the Environments

Some Illustrative Words:

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[zima]</td>
<td>[̪ɛjoθe]</td>
<td>‘stretch’</td>
</tr>
<tr>
<td>[kasu]</td>
<td>[nselele]</td>
<td>‘all’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>[nselele]</td>
<td>‘termite’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>[loloŋzi]</td>
<td>‘to wash’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>[ŋkoji]</td>
<td>‘lion’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>[zeŋga]</td>
<td>‘cut’</td>
</tr>
</tbody>
</table>

Step 1: Determine the environments of [z] and [ʒ].

- The phones that precede [z]: [e] [n] #
- The phones that follow [z]: [u] [w] [e]
- The phones that precede [ʒ]: # [a]
Step 1: Get the Environments

Some Illustrative Words:

\[
\begin{align*}
\text{[zima]} & \quad \text{‘stretch’} & \quad \text{[ʃioθe]} & \quad \text{‘all’} \\
\text{[kasu]} & \quad \text{‘emaciation’} & \quad \text{[nselele]} & \quad \text{‘termite’} \\
\text{[kunezulu]} & \quad \text{‘heaven’} & \quad \text{[aʒimola]} & \quad \text{‘alms’} \\
\text{[nzwetu]} & \quad \text{‘our’} & \quad \text{[lolonzi]} & \quad \text{‘to wash’} \\
\text{[kesoka]} & \quad \text{‘to be cut’} & \quad \text{[ŋkɔjɪ]} & \quad \text{‘lion’} \\
\text{[zevo]} & \quad \text{‘then’} & \quad \text{[zeŋga]} & \quad \text{‘cut’}
\end{align*}
\]

Step 1: Determine the environments of [z] and [ʒ].

- The phones that precede [z]: [e] [n] #
- The phones that follow [z]: [u] [w] [e]
- The phones that precede [ʒ]: # [a] [n]
Step 1: Get the Environments

Some Illustrative Words:

[zima] ‘stretch’  [jiəθe] ‘all’
[kasu] ‘emaciation’  [nselele] ‘termite’
[kunezulu] ‘heaven’  [aʒimola] ‘alms’
[nzwetu] ‘our’  [lolonzi] ‘to wash’
[kesoka] ‘to be cut’  [ŋkoʃi] ‘lion’
[zevo] ‘then’  [zeŋga] ‘cut’

Step 1: Determine the environments of [z] and [ʒ].

▶ The phones that precede [z]: [e] [n] #
▶ The phones that follow [z]: [u] [w] [e]
▶ The phones that precede [ʒ]: # [a] [n]
▶ The phones that follow [ʒ]:
Step 1: Get the Environments

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’

- [jioθe] ‘all’
- [nselele] ‘termite’
- [azimola] ‘alms’
- [lolenzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zɛŋga] ‘cut’

Step 1: Determine the environments of [z] and [ʒ].

- The phones that precede [z]: [e] [n] #
- The phones that follow [z]: [u] [w] [e]
- The phones that precede [ʒ]: # [a] [n]
- The phones that follow [ʒ]: [i]
Step 2: Find Commonalities in the Sounds

Some Illustrative Words:

<table>
<thead>
<tr>
<th>Word</th>
<th>Meaning</th>
<th>Word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ʒima]</td>
<td>‘stretch’</td>
<td>[ʃioθe]</td>
<td>‘all’</td>
</tr>
<tr>
<td>[kasu]</td>
<td>‘emaciation’</td>
<td>[nselele]</td>
<td>‘termite’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>‘heaven’</td>
<td>[aʒimola]</td>
<td>‘alms’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>‘our’</td>
<td>[lolonzi]</td>
<td>‘to wash’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>‘to be cut’</td>
<td>[ŋkoʃi]</td>
<td>‘lion’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>‘then’</td>
<td>[zeŋga]</td>
<td>‘cut’</td>
</tr>
</tbody>
</table>

Step 2:
Look for similarities between the sounds in each environment.
Step 2: Find Commonalities in the Sounds

Some Illustrative Words:

- [3ima] ‘stretch’  
- [kasu] ‘emaciation’  
- [kunezulu] ‘heaven’  
- [nzwetu] ‘our’  
- [kesoka] ‘to be cut’  
- [zevo] ‘then’

- [jioθe] ‘all’  
- [nselele] ‘termite’  
- [aζimola] ‘alms’  
- [loloŋzi] ‘to wash’  
- [ŋkoʃi] ‘lion’  
- [zeŋga] ‘cut’

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [s]: [a] [e] [n]
- The phones that follow [s]: [u] [o] [e]
- The phones that precede [ʃ]: [# [o]
- The phones that follow [ʃ]: [i]
Deducing Allophonic Rules
Part 2
Supplementary Readings
Introduction and Review
Fricatives in German
Fricatives in Southern Congo
Task 1: Minimal Pairs
Task 2: Find the Rule
Step 1: Environments
Step 2: Commonalities?
Step 3: Uniqueness?
Step 4: Write the Rule

Step 2: Find Commonalities in the Sounds

Some Illustrative Words:

- [3ima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [joθe] ‘all’
- [nselele] ‘termite’
- [aζimola] ‘alms’
- [lolenzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [s]: [a] [e] [n]
  Nothing in Common
- The phones that follow [s]: [u] [o] [e]
- The phones that precede [ʃ]: # [o]
- The phones that follow [ʃ]: [i]
### Step 2: Find Commonalities in the Sounds

#### Some Illustrative Words:

<table>
<thead>
<tr>
<th>Word</th>
<th>Meaning</th>
<th>Word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[3ima]</td>
<td>‘stretch’</td>
<td>[ʃioθe]</td>
<td>‘all’</td>
</tr>
<tr>
<td>[kasu]</td>
<td>‘emaciation’</td>
<td>[nselele]</td>
<td>‘termite’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>‘heaven’</td>
<td>[ażimola]</td>
<td>‘alms’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>‘our’</td>
<td>[lolonzi]</td>
<td>‘to wash’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>‘to be cut’</td>
<td>[ŋkoʃi]</td>
<td>‘lion’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>‘then’</td>
<td>[zeŋga]</td>
<td>‘cut’</td>
</tr>
</tbody>
</table>

#### Step 2: Find Commonalities in the Sounds

Look for similarities between the sounds in each environment.

- **The phones that precede [s]:** [a] [e] [n]  
  *Nothing in Common*

- **The phones that follow [s]:** [u] [o] [e]  
  *All are Vowels!*

- **The phones that precede [ʃ]:** # [o]

- **The phones that follow [ʃ]:** [i]
Step 2: Find Commonalities in the Sounds

Some Illustrative Words:

- [ʒima] ‘stretch’  
- [kasu] ‘emaciation’  
- [kuneζulu] ‘heaven’  
- [nzweτu] ‘our’  
- [kesoka] ‘to be cut’  
- [zevo] ‘then’  
- [ʃioθe] ‘all’  
- [nselele] ‘termite’  
- [aζimola] ‘alms’  
- [loloŋzi] ‘to wash’  
- [ŋkoʃi] ‘lion’  
- [zəŋga] ‘cut’

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [s]: [a] [e] [n]  
  **Nothing in Common**

- The phones that follow [s]: [u] [o] [e]  
  **All are Vowels!**

- The phones that precede [ʃ]: # [o]  
  **Nothing in Common**

- The phones that follow [ʃ]: [i]
Step 2: Find Commonalities in the Sounds

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’

- [ʃioθe] ‘all’
- [ⁿselele] ‘termite’
- [aζimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [s]: [a] [e] [n]  
  Nothing in Common

- The phones that follow [s]: [u] [o] [e]  
  All are Vowels!

- The phones that precede [ʃ]: # [o]  
  Nothing in Common

- The phones that follow [ʃ]: [i]  
  All are [i]!
Step 2: Find Commonalities in the Sounds

Some Illustrative Words:

- [zima]  ‘stretch’  [ʃioθe]  ‘all’
- [kasu]  ‘emaciation’  [nselele]  ‘termite’
- [kunezulu]  ‘heaven’  [aʒimola]  ‘alms’
- [nzwetu]  ‘our’  [lolonzi]  ‘to wash’
- [kesoka]  ‘to be cut’  [ŋkoʃi]  ‘lion’
- [zevo]  ‘then’  [zenɡa]  ‘cut’

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [z]:  [e] [n] #
- The phones that follow [z]:  [u] [w] [e]
- The phones that precede [ʒ]:  # [a] [n]
- The phones that follow [ʒ]:  [i]
Step 2: Find Commonalities in the Sounds

Some Illustrative Words:

- [zima] ‘stretch’  
- [kasu] ‘emaciation’  
- [kunezulu] ‘heaven’  
- [nzwetu] ‘our’  
- [kesoka] ‘to be cut’  
- [zevo] ‘then’  
- [jiioθe] ‘all’  
- [nselele] ‘termite’  
- [aʒimola] ‘alms’  
- [lolonzi] ‘to wash’  
- [ŋkoʃi] ‘lion’  
- [zeŋga] ‘cut’

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [z]: [e] [n] #  
  Nothing in Common

- The phones that follow [z]: [u] [w] [e]

- The phones that precede [ʒ]: # [a] [n]

- The phones that follow [ʒ]: [i]
Step 2: Find Commonalities in the Sounds

Some Illustrative Words:

- [3ima] 'stretch'
- [kasu] 'emaciation'
- [kunezulu] 'heaven'
- [nzwetu] 'our'
- [kesoka] 'to be cut'
- [zevo] 'then'
- [jiotbe] 'all'
- [nselele] 'termite'
- [a3imola] 'alms'
- [lolonzi] 'to wash'
- [njkoji] 'lion'
- [zejga] 'cut'

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [z]: [e] [n] #
  Nothing in Common

- The phones that follow [z]: [u] [w] [e]
  Nothing in Common

- The phones that precede [3]: # [a] [n]

- The phones that follow [3]: [i]
Step 2: Find Commonalities in the Sounds

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [z]: [e] [n] #
  Nothing in Common

- The phones that follow [z]: [u] [w] [e]
  Nothing in Common

- The phones that precede [ʒ]: # [a] [n]
  Nothing in Common

- The phones that follow [ʒ]: [i]
  Nothing in Common
Step 2: Find Commonalities in the Sounds

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 2:
Look for similarities between the sounds in each environment.

- The phones that precede [z]: [e] [n] #
  Nothing in Common
- The phones that follow [z]: [u] [w] [e]
  Nothing in Common
- The phones that precede [ʒ]: # [a] [n]
  Nothing in Common
- The phones that follow [ʒ]: [i]
  All are [i]!
Step 3: See if an Environment is Unique

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoji] ‘lion’
- [zeŋga] ‘cut’

Step 3: See if any environments are unique to [s] or [ʃ].

- The phones that precede [s]: [a] [e] [ŋ]  
  Nothing in Common

- The phones that follow [s]: [u] [o] [e]  
  All are Vowels!

- The phones that precede [ʃ]: # [o]  
  Nothing in Common

- The phones that follow [ʃ]: [i]  
  All are [i]!
Step 3: See if an Environment is Unique

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’

- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [azimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 3: See if any environments are unique to [s] or [ʃ].
( Look at the environ’s where the phones share a feature in common. )

- The phones that precede [s]: [a] [e] [n]
  Nothing in Common

- The phones that follow [s]: [u] [o] [e]
  All are Vowels!

- The phones that precede [ʃ]: # [o]
  Nothing in Common

- The phones that follow [ʃ]: [i]
  All are [i]!
Step 3: See if an Environment is Unique

Some Illustrative Words:

[3ima] ‘stretch’  [ʃioθe] ‘all’
[kasu] ‘emaciation’  [nselele] ‘termite’
[kunezulu] ‘heaven’  [aŋimola] ‘alms’
[nzwetu] ‘our’  [loloŋzi] ‘to wash’
[kesoka] ‘to be cut’  [ŋkoʃi] ‘lion’
[zevo] ‘then’  [zeŋga] ‘cut’

Step 3: See if any environments are unique to [s] or [ʃ].
(Look at the environ’s where the phones share a feature in common.)

▶ The phones that follow [s]: [u] [o] [e]
   All are Vowels!

▶ The phones that follow [ʃ]: [i]
   All are [i]!
Step 3: See if an Environment is Unique

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’

- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [ɑʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zɛŋga] ‘cut’

Step 3: See if any environments are unique to [s] or [ʃ].
(Look at the corresponding environ. for the other phone)

- The phones that follow [s]: [u] [o] [e] All are Vowels!
- The phones that follow [ʃ]: [i] All are [i]!
Step 3: See if an Environment is Unique

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [ŋselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 3: See if any environments are unique to [s] or [ʃ].
(See if the feature shared in [s]’s environ. can be found in [ʃ]’s)

- The phones that follow [s]: [u] [o] [e]
  All are Vowels!

- The phones that follow [ʃ]: [i]
  All are [i]!
Step 3: See if an Environment is Unique

Some Illustrative Words:

<table>
<thead>
<tr>
<th>[ʒima]</th>
<th>‘stretch’</th>
<th>[ʃioθe]</th>
<th>‘all’</th>
</tr>
</thead>
<tbody>
<tr>
<td>[kasu]</td>
<td>‘emaciation’</td>
<td>[nselele]</td>
<td>‘termite’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>‘heaven’</td>
<td>[aʒimola]</td>
<td>‘alms’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>‘our’</td>
<td>[loloŋzi]</td>
<td>‘to wash’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>‘to be cut’</td>
<td>[ŋkoʃi]</td>
<td>‘lion’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>‘then’</td>
<td>[zeŋɡa]</td>
<td>‘cut’</td>
</tr>
</tbody>
</table>

Step 3: See if any environments are unique to [s] or [ʃ].
(See if the feature shared in [s]’s environ. can be found in [ʃ]’s)

- The phones that follow [s]: [u] [o] [e]
  All are Vowels!

- The phones that follow [ʃ]: [i]
  All are [i]!

Vowels can also follow [ʃ]...
Step 3: See if an Environment is Unique

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [jioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋgə] ‘cut’

Step 3: See if any environments are unique to [s] or [ʃ].
(See if the feature shared in [s]’s environ. can be found in [ʃ]’s)

- The phones that follow [s]: [u] [o] [e]
  All are Vowels!

- The phones that follow [ʃ]: [i]
  All are [i]!

Vowels can also follow [ʃ]...
So it isn’t true that only [s] can be found before vowels...
Step 3: See if an Environment is Unique

Some Illustrative Words:

<table>
<thead>
<tr>
<th>Phoneme</th>
<th>Word</th>
<th>Phoneme</th>
<th>Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>[zima]</td>
<td>‘stretch’</td>
<td>[jioθe]</td>
<td>‘all’</td>
</tr>
<tr>
<td>[kasu]</td>
<td>‘emaciation’</td>
<td>[nselele]</td>
<td>‘termite’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>‘heaven’</td>
<td>[ažimola]</td>
<td>‘alms’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>‘our’</td>
<td>[lolonzi]</td>
<td>‘to wash’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>‘to be cut’</td>
<td>[ŋkoʃi]</td>
<td>‘lion’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>‘then’</td>
<td>[zejga]</td>
<td>‘cut’</td>
</tr>
</tbody>
</table>

Step 3: See if any environments are unique to [s] or [ʃ].

(See if the feature shared in [s]’s environ. can be found in [ʃ]’s)

- The phones that follow [s]: [u] [o] [e]
  All are Vowels!

- The phones that follow [ʃ]: [i]
  All are [i]!

Vowels can also follow [ʃ]...
So it isn’t true that only [s] can be found before vowels...
So there really isn’t an environment that is unique to [s]
Step 3: See if an Environment is Unique

Some Illustrative Words:

[ʒima] ‘stretch’    [ʃioθe] ‘all’
[kasu] ‘emaciation’ [nselele] ‘termite’
[kunezulu] ‘heaven’ [aʒimola] ‘alms’
[nzwetu] ‘our’      [loloŋzi] ‘to wash’
[kesoka] ‘to be cut’ [ŋkoʃi] ‘lion’
[zevo] ‘then’       [zeŋga] ‘cut’

Step 3: See if any environments are unique to [s] or [ʃ] .  
(See if the feature shared in [ʃ]’s environ. can be found in [s]’s)

▶ The phones that follow [s]:  [u] [o] [e]  
All are Vowels!

▶ The phones that follow [ʃ]:  [i]  
All are [i]!
### Step 3: See if an Environment is Unique

#### Some Illustrative Words:

| [ʒima]  | ‘stretch’       | [ʃioθe] | ‘all’        |
| [kasu]  | ‘emaciation’    | [nselele] | ‘termite’    |
| [kunezulu] | ‘heaven’       | [aʒimola] | ‘alms’       |
| [nzwetu] | ‘our’           | [lołonzi] | ‘to wash’    |
| [kesoka] | ‘to be cut’     | [ŋkoʃi]  | ‘lion’       |
| [zevo]  | ‘then’          | [zeŋga]  | ‘cut’        |

#### Step 3: See if any environments are unique to [s] or [ʃ].

(See if the feature shared in [ʃ]’s environ. can be found in [s]’s)

- The phones that follow [s]: [u] [o] [e]  
  **All are Vowels!**

- The phones that follow [ʃ]: [i]  
  **All are [i]!**

Only [ʃ] can be followed by [i]!
Step 3: See if an Environment is Unique

Some Illustrative Words:

- [3ima] 'stretch'
- [kasu] 'emaciation'
- [kunezulu] 'heaven'
- [nzwetu] 'our'
- [kesoka] 'to be cut'
- [zevo] 'then'
- [ʃioθe] 'all'
- [nselele] 'termite'
- [aʒimola] 'alms'
- [lolenzi] 'to wash'
- [ŋkoʃi] 'lion'
- [zeŋga] 'cut'

Step 3: See if any environments are unique to [z] or [ʒ].

- The phones that precede [z]: [e] [n] #
  Nothing in Common

- The phones that follow [z]: [u] [w] [e]
  Nothing in Common

- The phones that precede [ʒ]: # [a] [n]
  Nothing in Common

- The phones that follow [ʒ]: [i]
  All are [i]!
### Step 3: See if an Environment is Unique

#### Some Illustrative Words:
- [3ima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [jioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoji] ‘lion’
- [zega] ‘cut’

#### Step 3: See if any environments are unique to [z] or [ʒ].

(Look at the environ’s where the sounds have something in common.)

- **The phones that precede [z]:**
  - [e] [n] #
  - **Nothing in Common**

- **The phones that follow [z]:**
  - [u] [w] [e]
  - **Nothing in Common**

- **The phones that precede [ʒ]:**
  - # [a] [n]
  - **Nothing in Common**

- **The phones that follow [ʒ]:**
  - [i]
  - **All are [i]!**
Step 3: See if an Environment is Unique

Some Illustrative Words:

- [ʒima] 'stretch'
- [kasu] 'emaciation'
- [kunezulu] 'heaven'
- [nzwetu] 'our'
- [kesoka] 'to be cut'
- [zevo] 'then'
- [ʃioθe] 'all'
- [nselele] 'termite'
- [aʒimola] 'alms'
- [lolonzi] 'to wash'
- [ŋkoʃi] 'lion'
- [zəŋga] 'cut'

Step 3: See if any environments are unique to [z] or [ʒ].

(Look at the environ's where the sounds have something in common.)

- The phones that follow [ʒ]:
  - [i]
  All are [i]!
Step 3: See if an Environment is Unique

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [jiθe] ‘all’
- [nselele] ‘termite’
- [aζimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoji] ‘lion’
- [zeŋga] ‘cut’

Step 3: See if any environments are unique to [z] or [ʒ] .
(Look at the corresponding environ. for the other phone.)

- The phones that follow [ʒ]: [i]
  All are [i]!
Step 3: See if an Environment is Unique

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’

- [jiioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 3: See if any environments are unique to [z] or [ʒ] .
(Look at the corresponding environ. for the other phone.)

- The phones that follow [ʒ]: [i]
  All are [i]!

- The phones that follow [z]: [u] [w] [e]
**Step 3: See if an Environment is Unique**

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’

- [jioθe] ‘all’
- [nselele] ‘termite’
- [aẓimola] ‘alms’
- [lOLONzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

**Step 3: See if any environments are unique to [z] or [3].**

(See if the feature shared in [3]’s environ. can be found in [z]’s)

- The phones that follow [3]: [i]  
  **All are [i]!**

- The phones that follow [z]: [u] [w] [e]
Step 3: See if an Environment is Unique

Some Illustrative Words:

- [ʒiˈoθə] ‘all’
- [ŋkoʃi] ‘lion’
- [nselele] ‘termite’
- [naZimola] ‘alms’
- [loloŋzi] ‘to wash’
- [loZi] ‘to wash’
- [aZimola] ‘alms’
- [keˈsoʊka] ‘to be cut’
- [kunezulu] ‘heaven’
- [kəso] ‘emaciation’
- [zwetwet] ‘our’
- [ziˈma] ‘stretch’
- [nselele] ‘termite’
- [kəso] ‘emaciation’
- [kunezulu] ‘heaven’
- [kwetu] ‘our’
- [zima] ‘stretch’

Step 3: See if any environments are unique to [z] or [ʒ] .

(See if the feature shared in [ʒ]’s environ. can be found in [z]’s)

- The phones that follow [ʒ]: [i]
  All are [i]!

- The phones that follow [z]: [u] [w] [e]
  Only [ʒ] can be followed by [i]!
Step 4: Write the Rule!

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [jioθe] ‘all’
- [nselele] ‘termite’
- [aζimola] ‘alms’
- [loloNZi] ‘to wash’
- [ŋkoji] ‘lion’
- [zeŋga] ‘cut’

Step 4:
If there’s an environment unique to one phone, write the rule!
Step 4: Write the Rule!

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 4:
If there’s an environment unique to one phone, write the rule!

Only [ʃ] can be followed by [i]!
Only [ʒ] can be followed by [i]!
Step 4: Write the Rule!

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 4:
If there’s an environment unique to one phone, write the rule!

Only [ʃ] can be followed by [i]!
Only [ʒ] can be followed by [i]!

Rule of Thumb (for Writing Rules):
If there are two allophones [X] and [Y], and only [X] appears in environment Z, the rule is: “/Y/ is pronounced as [X] in Z”
Step 4: Write the Rule!

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’

- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [loloŋzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 4:
If there’s an environment unique to one phone, write the rule!

/s/ is pronounced as [ʃ] when followed by [i]
Only [ʒ] can be followed by [i]!

Rule of Thumb (for Writing Rules):
If there are two allophones [X] and [Y], and only [X] appears in environment Z, the rule is: “/Y/ is pronounced as [X] in Z”
Step 4: Write the Rule!

Some Illustrative Words:

- [zima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [jioθe] ‘all’
- [nselele] ‘termite’
- [ažimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoŋi] ‘lion’
- [zeŋga] ‘cut’

Step 4:
If there’s an environment unique to one phone, write the rule!

- /s/ is pronounced as [ʃ] when followed by [i]
- /z/ is pronounced as [ʒ] when followed by [i]

Rule of Thumb (for Writing Rules):
If there are two allophones [X] and [Y], and only [X] appears in environment Z, the rule is: “/Y/ is pronounced as [X] in Z”
Step 4: Write the Rule!

Some Illustrative Words:

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[zi:ma]</td>
<td>[ʃi:əθe]</td>
<td>‘stretch’</td>
</tr>
<tr>
<td>[kasu]</td>
<td>[ŋselele]</td>
<td>‘emaciation’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>[aʒimola]</td>
<td>‘heaven’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>[lolonzi]</td>
<td>‘our’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>[ŋkoʃi]</td>
<td>‘to be cut’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>[zeŋga]</td>
<td>‘then’</td>
</tr>
<tr>
<td>[SioTe]</td>
<td>[aZimola]</td>
<td>‘all’</td>
</tr>
<tr>
<td>[kasu]</td>
<td>[ŋselele]</td>
<td>‘termite’</td>
</tr>
<tr>
<td>[kunezulu]</td>
<td>[aʒimola]</td>
<td>‘alms’</td>
</tr>
<tr>
<td>[nzwetu]</td>
<td>[lolonzi]</td>
<td>‘to wash’</td>
</tr>
<tr>
<td>[kesoka]</td>
<td>[ŋkoʃi]</td>
<td>‘lion’</td>
</tr>
<tr>
<td>[zevo]</td>
<td>[zeŋga]</td>
<td>‘cut’</td>
</tr>
</tbody>
</table>

Step 4:
If there’s an environment unique to one phone, write the rule!

**The Rules:**

/s/ is pronounced as [ʃ] when followed by [i]
/z/ is pronounced as [ʒ] when followed by [i]
Step 4: Write the Rule!

Some Illustrative Words:

- [ʒima] ‘stretch’
- [kasu] ‘emaciation’
- [kunezulu] ‘heaven’
- [nzwetu] ‘our’
- [kesoka] ‘to be cut’
- [zevo] ‘then’
- [ʃioθe] ‘all’
- [nselele] ‘termite’
- [aʒimola] ‘alms’
- [lolonzi] ‘to wash’
- [ŋkoʃi] ‘lion’
- [zeŋga] ‘cut’

Step 4:
If there’s an environment unique to one phone, write the rule!

The Rules (in Formal Notation):

\[
\begin{align*}
/s/ &\rightarrow [ʃ] / \quad [i] \\
/z/ &\rightarrow [ʒ] / \quad [i]
\end{align*}
\]
Summing Up

Questions:

▶ Are [s] and [ʃ] allophones of the same phoneme?
▶ Are [z] and [ʒ] allophones of the same phoneme?

Answers:

▶ [s] and [ʃ] are allophones of the same phoneme (/s/).
▶ [z] and [ʒ] are allophones of the same phoneme (/z/).
Questions:

- Are [s] and [ʃ] allophones of the same phoneme?
- Are [z] and [ʒ] allophones of the same phoneme?

Answers:

- [s] and [ʃ] are allophones of the same phoneme (/s/).
- [z] and [ʒ] are allophones of the same phoneme (/z/).

The Rules:

- /s/ → [ʃ] / --- [i]
- /z/ → [ʒ] / --- [i]