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Phonology I

Vowel Lowering in Quechua: An Optimality Theory Approach

# Introduction

Quechua describes a dialect continuum that was once spoken across the Incan Empire in South America, and in the present day ranges geographically from southern Ecuador to northern Argentina. Due to colonialization by the Spanish, Quechua has had extensive contact with Spanish, resulting in extralinguistic and linguistic changes. Extralinguistically, Quechua monolingualism has fallen dramatically, whereas Quechua-Spanish bilingualism has risen. Linguistically, Spanish loanwords have been adopted across word categories, such as *fiesta* (“party, feast”, Sp: fiesta) or *faltay* (“to lack”, Sp: faltar). Non-native sounds have also been introduced to Quechua, typically restricted to loan words, such as the labiodental fricative /f/ or the mid vowels /e/ and /o/ (Torero, 1983).

Quechua is typically divided into two major dialect groups, Quechua I and Quechua II, both of which have further subdivisions. This works focuses on South Bolivian Quechua (henceforth, SBQ), a Quechua II dialect. This paper will investigate vowel lowering in SBQ, which occurs when a high vowel is adjacent to /q/, using an Optimality Theory approach.

# Phoneme Inventory

## Consonants

SBQ presents the typical inventory of phonemes for a Quechua language (Table 1), retaining the three-way series of simple, aspirated, and glottalized (AKA ejective) stops.

Table 1. South Bolivian Quechua consonant inventory (Bills et al., 1969).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **bilabial** | **alveolar** | **palatal** | **velar** | **uvular** | **glottal** |
| **nasal** |  | m | n | ɲ |  |  |  |
| **stop** | *simple* | p | t |  | k | q |  |
| *aspirated* | pʰ | tʰ |  | kʰ | qʰ |  |
| *glottalized* | pʼ | tʼ |  | kʼ | qʼ |  |
| **affricate** | *simple* |  |  | tʃ |  |  |  |
| *aspirated* |  |  | tʃʰ |  |  |  |
| *glottalized* |  |  | tʃʼ |  |  |  |
| **fricative** |  |  | s |  |  |  | h |
| **flap** |  |  | ɾ |  |  |  |  |
| **lateral** |  |  | l | ʎ |  |  |  |
| **approximant** |  | w |  | j |  |  |  |

## Vowels

There is an active and historic debate about whether Quechua should be represented orthographically with a three-vowel or five-vowel system. Institutions like the Peruvian Academy of the Quechua Language established a five-vowel system in 1987 (Coronel-Molina, 1997), whereas other institutions and linguists prefer the three-vowel system. The three-vowel system (/i a u/) is motivated by the fact that the mid vowels /o/ and /e/ only surface in Spanish loanwords and as allophones when adjacent to the uvular stop.

Although this essay will take for granted that Quechua has a three-vowel system, it will make use of a SBQ dictionary (Lott, 1978), a tri-dialectal dictionary that includes a SBQ dialect, Cochabamba (Parker & Ibañez, 1964), and a corpus (Hubbel, 2016), all of whichuse a five-vowel system. Henceforth, all instances of [e] and [o] are assumed to be underlying /i/ and /u/ respectively, unless otherwise stated.

## Mid Vowels

Lott’s dictionary (1978), although using a five-vowel system, actually makes a good case for a three-vowel system by thoroughly demonstrating the conditioning factor of the mid vowels. In fact, of the 359 words in which <e> or <o> occur in the dictionary, approximately 83% of the cases can be explained by its adjacency to <q> or it being a loanword from Spanish.

The remaining instances of <e> and <o> occur adjacent to syllable-final <j> (e.g. *sojta* “six”, *Diosman kutirej* “convert”). The phonetic status of <j> here is unclear. Molina-Vital (2020), a speaker of Southern Quechua, transcribes and pronounces *suqta* [soχta] “six”, indicating that the underlying phoneme here is /q/. What Lott transcribes as *wajtan* “rib” is recorded in other dictionaries as *waqta* (Soto Ruiz, 1976)*.* However, there is not a clear correspondence between <j> in this dictionary and <q> /q/. For example, *ujyay* “to drink” has correspondences with *upyay* in other dialects (Soto Ruiz, 1976). The <j> in the Spanish loanword *carajo* “damn it” corresponds to Spanish /x/, which most likely is realized as [h] in SBQ. *Uj* “one” corresponds to [huh], [huk], and [uh] in other dialects (Parker & Ibañez, 1964).

However, it seems that when <j> occurs with <e> or <o>, there are clear correspondences with /q/ in other varieties. For example, *mosoj* “new” is *musuq* in other dictionaries (Soto Ruiz, 1976); *yachayniyoj* “teacher” is *yachachiq* in other dictionaries (Soto Ruiz, 1976). Most notably, *wijsayoj* “pregnant” is *wiksayuq* in other dictionaries (Soto Ruiz, 1976). This gives strong motivation that <j> is not a single phoneme, as the orthography might suggest. That is, if it were representing the same phoneme, we would expect \**wejsayoj*. The present evidence suggests that <j> can represent the surface forms [h] and [χ]. Where other dialects have /q/, the surface form [χ] most likely surfaces; otherwise, [h] surfaces. Furthermore, there is evidence that the underlying phoneme is /q/ in such cases that vowel lowering occurs.

The second (Hubbel, 2016) and third (Parker & Ibañez, 1964) sources for data also use a five-vowel system, and /q/ transparently has a one-to-one correspondence to /q/.

With this in mind, I will investigate vowel lowering only in proximity to <q> /q/ (and its aspirated/glottalized counterparts) and <j> only when it clearly has correspondences to /q/ in other dialects.

# Environments of Vowel Lowering

As discussed above, high vowels lower to mid vowels when adjacent to /q/. However, /q/ can also lower vowels across some consonants regressively. In the corpuses under investigation here, /q/ can lower /i/ to [e] when there is an intervening /n/ (which is realized as the homorganic sequence [ɴq]), /r/, or /l/; it can lower /u/ to [o] when there is an intervening /n/, /r/, /s/, or /l/ (Table 2). There are no instances in this dictionary where /q/ can lower a vowel progressively across a consonant, and Steriade (1995) claims that this process cannot happen.

Table 2. Vowel lowering across a phoneme.

|  |  |  |  |
| --- | --- | --- | --- |
| **Vowel** | **Intervening phoneme** | **Quechua** | **English gloss** |
| e | n | enqhay | to add wood to the fire |
| senqa | nose |
| p'enqachiy | shame |
| chaki senqa | shin (bone) |
| akatenqa | black-beetle |
| r | perqa | wall |
| lerq'o | one-eyed |
| erqhe | crybaby |
| l | qelqey | to write |
| o | n | ch'onqay | to suck |
| tonqoriy | throat, neck |
| sonqoyoh | bad |
| qonqoriy | kneel |
| onqosqa | sick |
| sonqon | heart |
| r | morq'o | ball, round object |
| orqo | male |
| orq'oy | remove, take away |
| q'orqoy | snore |
| orqokuna | mountains |
| s | mosqoy | dream, to dream |
| l | tolqa | son-in-law |
| qolqe | silver, money |

This situation is similar to what Adeelar (1977) records for another Quechua variety, Tarma Quechua. However, he claims that vowel lowering can occur across /l/ for back vowels, but not front vowels (which is not found to be the case here; both front and back vowels lower before the sequence /lq/). Furthermore, Steriade (1995) claims that in Cochabamba Quechua, /s/ blocks vowel lowering (/riku-sqa/ 🡪 [rikusqa], “he/she had seen it”), which contradicts the data here (Lott, 1978; Parker & Ibañez, 1964).

There is exactly one entry for the sequence /ulq/ *p’ulqo* “baby boots made from yarn”, which exhibits blocking of vowel lowering for /u/. The sequence /wq/ *does* appear, and thus legal, but not with /i/ and /u/. Adeelar (1977) notes that stop+/q/ sequences are phonotactically allowed in other dialects of Quechua, but such sequences are not found in these corpuses.

In summary, /q/ can lower a high vowel in SBQ, according to the corpuses under study here (Lott, 1978; Parker & Ibañez, 1964; Hubbel, 2016), when it occurs after a segment that is [-vocoid, +coronal]. Since there are no occurrences of stop+/q/, it is unknown is stops are transparent to vowel lowering. Notably, /s/ is transparent to lowering effects only for the back vowel /u/. However, due to overwhelming evidence from other studies (e.g. Adeelar, 1997 and Steriade, 1995), the two vowels will be treated the same in this analysis, and differences between them found in this dictionary (e.g. the occurrence [osq], but not [esq]) will be assumed to be a data availability issue.

What follows is an Optimality Theory approach to vowel lowering in the environment of /q/ in SBQ. Although this specifically treats SBQ, it can be further modified to account for other instances of vowel lowering in the context of uvular consonants, such as in Greenlandic or Arabic.

# Optimality Theory Approach to Vowel Lowering

Optimality Theory posits a list of constraints that are ranked for a given language. Within Optimality Theory, an input is submitted to Generator, which generates a list of possible output candidates. The candidates are then submitted to Evaluator, which evaluates each candidate based on the ranked constraints for the language. The most optimal candidate i.e., the candidate that incurs the least number of violations of higher-ranked, relevant constraints (Prince & Smolensky, 1993).

## Vowel lowering local to /q/

In SBQ, the constraints \*e and \*o are at work to prohibit [e] and [o] from surfacing in the output. These must be highly ranked, but there must be higher-ranked constraints that prevent the high vowels [i] and [u] from surfacing when the vowels are adjacent to /q/ in the input. This constraint is proposed to be two similar constraints that are equally ranked above \*e and \*o: \*V(HIGH)/\_q and \*V(HIGH)/q\_. These two constraints prohibit high vowels from surfacing when adjacent to q.

\*e: [e] should be prohibited in the output.   
\*o: [o] should be prohibited in the output.  
\*V(HIGH])/\_q: A [+high] vowel should be prohibited in the output when to the left of /q/.  
\*V(HIGH)/q\_: A [+high] vowel should be prohibited in the output when to the right of /q/.  
IDENT(V): The feature values of an input vowel should not be changed in the output.  
IDENT(V-high): The feature value HIGH of an input vowel should not be changed in the output.  
IDENT(V-low): The feature value LOW of an input vowel should not be changed in the output.

These constraints are ranked in the following order:

\*V(HIGH)/\_q, \*V(High)/q\_ >> IDENT(V-low) >> \*o, IDENT(V-high) >> IDENT(V)

With this constraint ranking, high vowels incur a crucial penalty for surfacing when adjacent to /q/ in the input. IDENT(V) must be lowly ranked to allow for the high vowels to change their height features. However, there is a higher ranked IDENT(V-low) constraint that dominates IDENT(V-high), which prevents the high vowels from lowering to [a]. Within the current dataset, there is no motivation to give a relative ranking of \*o, \*e, and IDENT(V-high). Tables (3) and (4) demonstrate the constraint ranking.

Table 3. Alqo 'dog'

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| alqu --> alqo | **\*V[HIGH]/q\_** | **IDENT(V-low)** | **\*o** | **IDENT(V-high)** | **IDENT(V)** |
| ☞ alqo |  |  | \* | \* | \* |
| alqu | !\* |  |  |  |  |
| alqa |  | !\* |  | \* | \* |

Table 4. ch'useqa ‘owl’

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ch'usiqa --> ch'useqa | **\*V[HIGH]/\_q** | **IDENT(V-low)** | **\*e** | **IDENT(V-high)** | **IDENT(V)** |
| ☞ ch'useqa |  |  | \* | \* | \* |
| ch'usiqa | !\* |  |  |  |  |
| ch'usaqa |  | !\* |  | \* | \* |

## Non-local vowel lowering from /q/

Although the above constraints and ranking account for vowel lowering local to /q/, it does not yet explain instances where /q/ triggers regressive vowel lowering across another segment. The constraint must allow for vowels to be lowered when they occur to the left of /q/ and there is an intervening coronal segment, but not if such a situation occurs to the right. To account for instances of regressive lowering (e.g., /pirqa/ [perqa] ‘wall’) and blocking of progressive lowering, further constraints must be proposed.

/q/ is posited to have the feature [RTR], which spreads to vowels and induces lowering (Rose, 1996). Here, [RTR] can be viewed as spreading through a constraint SPREAD-L([RTR]). Since vowels in Quechua are not specified for [RTR], spreading can only occur from /q/. The feature [RTR] propagates only to the first vowel to the left of /q/. It is a highly ranked constraint, so violation of it is a serious penalty, preventing [pirqa] from surfacing.

SPREAD-L([RTR]): [RTR] must spread to the left.

The new constraint is equally ranked with IDENT(V-low), and thus dominates all other constraints proposed:

IDENT(V-low), SPREAD-L([RTR]) >> \*e, \*o, IDENT(V-high) >> IDENT(V)

Crucially, [RTR] can only spread across placeless segments, an argument that comes from underspecification. I propose that coronal segments are placeless in Quechua and that [RTR] can only spread over a placeless segment. This leaves me with the task of justifying that the remaining non-coronal segments are specified for PLACE in the underlying representation. Avery & Rice (1989) claim that only contrasts are recorded in the underlying representation. For example, in Catalan, PLACE is only specified for the bilabial, palatal, and velar nasals, whereas the alveolar nasal is placeless. The same situation can be seen here. /s/ seems the most difficult to justify as placeless, but I claim that PLACE is not actually a distinctive feature for it underlyingly, as it can contrast with sonorants, using [-sonorant] and the stop obstruents by using [+continuant]. Therefore, /s/ in Quechua is placeless and later filled in with the default CORONAL.

Table 5. perqa 'wall'

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| pirqa --> perqa | **IDENT(V-low)** | **SPREAD-L([RTR])** | **\*e** | **IDENT(V-high)** | **IDENT(V)** |
| perqa |  |  | \* | \* | \* |
| pirqa |  | !\* |  |  |  |
| parqa | !\* | \* |  | \* | \* |

With the addition of SPREAD-L([RTR]), it should be noted that \*V(HIGH)/\_q becomes redundant. However, \*V(HIGH)/q\_ is still necessary to account for local progressive vowel lowering.

Table 6. Reanalysis of alqo 'dog'

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| alqu 🡪 alqo | **IDENT(V-low)** | **SPREAD-L([RTR])** | **\*e** | **IDENT(V-high)** | **IDENT(V)** |
| alqo |  |  | \* | \* | \* |
| alqu |  | !\* |  |  |  |
| alqa | !\* | \* |  | \* | \* |

## [RTR] Spreading Motivation

The spreading of [RTR] to account for vowel lowering can be justified by appealing to feature geometry (McCarthy, 1988; Rose, 1996). McCarthy’s feature tree (1988) provides a more transparent and succinct representation of vowel lowering in this case. According to Rose (1996), taking McCarthy’s tree as a base, /q/ has both ORAL and PHARYNGEAL nodes dominated by PLACE. The ORAL nodes dominate DORSAL, whereas the PHARYNGEAL node dominates the terminal feature node [RTR] (Figure 1). Within her analysis, vowel lowering and vowel retraction is explained by the independent spreading of PHARYNGEAL and [RTR], respectively.

[RTR] is used in the current analysis to explain vowel lowering, as the spreading of [RTR] would implicate the spreading of [PHARYNGEAL] as well, which directly dominates it. With more phonetic data from SBQ, a more specific account could be made.

A diagram of a structure

Description automatically generated

Figure 1. Feature geometry of /q/ (Rose, 1996).

As previously explained, [RTR] can spread over a placeless segment, which allows for /pirqa/ to surface as [perqa] (Figure 2).

A diagram of a place

Description automatically generated

Figure 2. /q/ lowers a [+high] V over an underlyingly placeless consonant /r/.

# Remaining Issues

Although the current analysis can be used to explain vowel lowering in South Bolivian Quechua, it is not entirely sufficient. For example, it cannot be determined from the current data whether [RTR] or [PHARYNGEAL] is spreading from the /q/ to the high vowels. To determine this, corpuses with narrow transcription or phonetic analysis of speech would have to be done to determine how speakers produce mid vowels. Adeelar (1977) in his analysis of Tarma Quechua found that high vowels adjacent to /q/ surfaced variably as [e] ~ [ɛ] and [o] ~ [ɔ], apparently in free variation.

Another issue comes in the form of /t/. According to Adeelar (1977), the sequence /tq/ is allowed in Tarma Quechua, but that sequence does not appear in the corpuses under analysis for SBQ. Under the current analysis, /t/ would also be treated as placeless. Just as is the case with the Catalan nasals, /t/’s PLACE node would be filled in with [CORONAL] by a default rule, whereas /p/ and /k/ would be specified for PLACE. Thus, it is predicted that /t/ would be transparent to the vowel lowering effects of /q/ in a sequence /itq/ or /utq/. In order to determine the legitimacy of this prediction, more data, especially sentence-level data, would be needed.

Finally, the current analysis does not consider the reality of many speakers: bilingualism. As explained in the introduction, the vast majority of Quechua speakers are bilingual, also speaking Spanish. Spanish has the mid vowels /e/ and /o/ in its phonology. In bilingual communities, we may expect Quechua to have phonemic /e/ and /o/ in their phonological inventories, and thus the constraints \*e and \*o may be ranked lower than proposed here.

# Conclusion

The current work presented an Optimality approach to local and non-local vowel lowering induced by /q/ in South Bolivian Quechua. The constraints SPREAD-L([RTR]) and \*V(HIGH)/q\_ work to prevent high vowels from occurring with /q/, and allow for non-phonemic vowels [e] and [o] to surface.

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