



Problem 1

Central Yup'ik

*composed by
presented by*

*Lai Otsuka
Bruno L'Astorina*

qasgulek
ribbon seal

Problem 1

- 01 **The Author**
- 02 The Language
- 03 The Problem
- 04 The Results





Lai Otsuka_(they / them)



Contestant at IOL 2022, Isle of Man
honorable mention



Undergrad in linguistics + mathematics
Currently doing master in linguistics
Universidade de Campinas (Unicamp)



PC member / volunteer at OBL
Olimpíada Brasileira de Linguística



Author of two problems at IOL 2026
Arctic and Amazonia





București > Norton Sound
7800 km



Lai's home (Campinas) > Norton Sound
13500 km

Problem 1

01 The Author

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Eskimo-Aleut languages

A map of North America and Greenland showing the distribution of Eskimo-Aleut languages. The map is color-coded by language family: Aleut (green), Yupik (orange), Inuit (blue), and Unangam Tunuu (green). Major language groups labeled include Unangam Tunuu (Aleut), Central Siberian Yupik, Sirenik, Naukan Yupik, Inupiaq, Yupik, Alutiiq, W. Canadian Inuit, Inuktitut, and Kalaallisut. Smaller labels indicate specific dialects or subgroups like Unalut, Kik, and various Inuit dialects in the Arctic region.

Yup'ik language



yuk + *-p'ik*

PERSON REAL, TRUE

'true person'



10k speakers (Alaska + Siberia)



currently vulnerable

only in 25% of villages,
children still learn it as L1

Norton
Sound
Yup'ik

NS

General
Central
Yup'ik

GCV

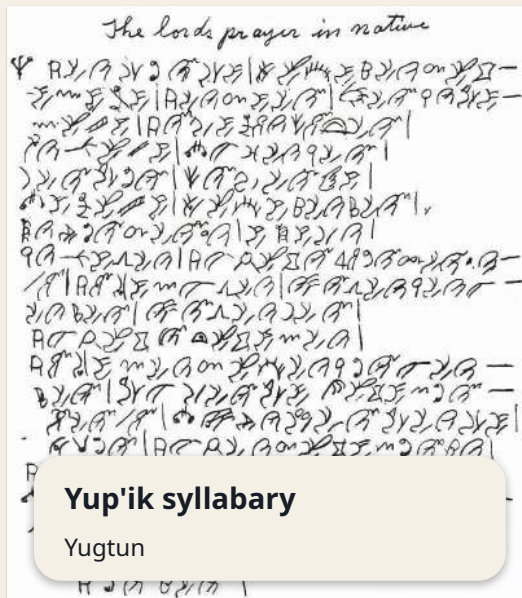


The Real People



Yup'ik child

Could be a contestant at IOL



Yup'ik syllabary

Yugtun



Yup'ik adult (Sally Samson)

Professor, native sp., consultant

qayaq
romanian: caiac

Problem 1

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Principles

Linguistics Problems



"It is not enough to just *look for patterns*,
you need to *use your language intuition*"

— Great Horned Owl

Problems about Sounds

principles to guide your pattern seeking

- ✖ Language (sound) comes first,
Writing represents it
- ✖ Language is systematic similar sounds
behave similarly
- ✖ Borders are blurry sounds are influenced
by what is around
- ✖ Patterns can spread backwards, to the
front or both

The Data

qasgulek	[ˈqaz.ɣu.ʒəkʰ]
nanevpak	[na.ˈnəf.pakʰ]
tep'liuq	[ˈtəp.ʒi.uqʰ]
nav'pagtuq	[ˈnav.pax.tuqʰ]
qamiq'vak	[qa.ˈmiq.vakʰ]
nat'rarkaɣ	[ˈnat.ɤax.kaqʰ]
calugun	[ca.ˈʒu:.ɣun]
kaal'taaq	[ka.ˈaʒ.ta.aqʰ]
ullelluku	[u.ˈtət.tu.ku]
ilquineq	[ˈiʔ.qu.ˈi:.nəqʰ]
kaltuuvvilaq	[ˈkaʔ.tu.ˈu:.fi.ʒaqʰ]
kayangurngalnguq	[ka.ˈja:.ŋuɤ.ˈŋaʒ.ŋuqʰ]
assikekeka	[a.ˈsi:.kə.ˈkək.ka]
paluteqerru	[pa.ˈʒu:.tə.ˈqəx.ɣu]
iggiggiayuli	[i.ˈxi:.xi.ˈa:.ju.ʒi]
ilalkumalria	[i.ˈʒaʔ.ku.ˈmaʒ.ɓi.a]
apepailgaku	[a.ˈpəp.pa.ˈiʒ.ɣa.ku]
yuarutlertangqertuq	[ju.ˈa:.ɤuth.ˈtəx.taŋ.ˈqəx.tuqʰ]
tutgarrlugaq	[ˈtutʰ.xax.ˈtu:.ɣaqʰ]
cuukvagtalek	[cu.ˈukʰ.fax.ˈta:.ʒəkʰ]
cangatenrituten	[ca.ˈŋa:.tən.ˈɓi:.tu.tən]
cungagcessvakartat	[cu.ˈŋax.cəs.ˈfa:.kax.tatʰ]

ribbon seal
big lake
he is making aged fish-heads
it really broke
a type of moth
sole material for skin boots
skin scraper
playing card
turning it inside out
skull
potato
oval thing
I like him
please close it
great horned owl
victim
before asking him
there is an old song
grandchild
place with many pike (fish)
there is nothing wrong with
you
how green they are!

The Data

"The changes are purely phonetic, not semantic"

— A Contestant

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kaltuuvvilaq	[ˈkaʔ.tu.ˈu:.fi.ʒaqʰ]
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apepailgaku	[a.ˈpəp.pa.ˈiʒ.ɣa.ku]
yuarutlertangqertuq	[ju.ˈa:.ɐʉʰ.ˈʔəɣ.taŋ.ˈqəɣ.tuqʰ]
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there is nothing wrong with you
how green they are!

What is to be discovered?

syllables & stress (.')
with a twist ;)



the writing system

[phones] ↔ <letters>

1 [] ↔ 1 <>

easy part

2+ [] ↔ 1 <>

changes in sound environment

1 [] ↔ 2+ <>

strategies of the writing

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tutgarrrlugaq	[ˈtutʰ.xax.ˈtu:.ɣaqʰ]
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cangatenrituten	[ca.ˈŋa:.tən.ˈɓi:.tu.tən]
cungagcessvakartat	[cu.ˈŋax.cəs.ˈfa:.kaχ.taʔʰ]

[phones] ↔ <letters>

[a, ə, i, u] ↔ <a, e, i, u>

[m, n, ŋ, j] ↔ <m, n, ng, y>

vowels

nasals

**no points for that
but important**

tep'liuq	['təp.ɬi.uqʰ]
nat'rarkaɣ	['nat.ɤaɣ.kaqʰ]
tutgarlugaɣ	['tuʰ.xaɣ.ʈu:.ɣaɣʰ]
cungagcessvakart	[cu.'ŋax.cəs.'fa:.kaɣ.taʰ]
at	

[phones] ↔ <letters>

[a, ə, i, u] ↔ <a, e, i, u>

[m, n, ŋ, j] ↔ <m, n, ng, y>

[t] ↘
 [tʰ] ↙ <t>

BORDERS
ARE BLURRY

vowels

nasals

else

end of word
before some sounds

qamiq'vak
nat'rarka^q

[qa.'miq.vak^h]
['nat.ɤax.kaq^h]

[phones] ↔ <letters>

[a, ə, i, u] ↔ <a, e, i, u>

[m, n, ŋ, j] ↔ <m, n, ng, y>

[p, t, c, k, q]
[p^h, t^h, c^h, k^h, q^h] ↔ <p, t, c, k, q>

vowels

nasals

plosives



LANGUAGE IS
SYSTEMATIC

else

end of word
before some sounds

nane**v**pak [na.'nə**f**.pak^h]
 qamiq'**v**ak [qa.'miq.**v**ak^h]
 cuuk**v**agtalek [cu.'uk^h.**f**ax.'ta:..ʒək^h]
 cungagcess**v**akart [cu.'ŋax.cəs.'**f**a:.kaʃ.tat^h]
 at

[phones] ↔ <letters>

[a, ə, i, u] ↔ <a, e, i, u>

[m, n, ŋ, j] ↔ <m, n, ng, y>

[p, t, c, k, q] ↘
 [p^h, t^h, c^h, k^h, q^h] ↙ <p, t, c, k, q>

[v] ↘
 [f] ↙ <v>

BORDERS
ARE BLURRY

vowels

nasals

plosives

else

end of word
before some sounds

voiced

unvoiced

nav'pagtuq
calugun

['nav.pax.tuq^h]
[ca.'ʒu:.ɣun]

[phones] ↔ <letters>

[a, ə, i, u] ↔ <a, e, i, u>

[m, n, ŋ, j] ↔ <m, n, ng, y>

[p, t, c, k, q]
[p^h, t^h, c^h, k^h, q^h] ↔ <p, t, c, k, q>

[v, ɬ, z, ʃ, ʁ]
[f, ɬ, s, x, ɣ] ↔ <v, l, s, g, r>

vowels

nasals

plosives
(unvoiced)

voiced fricatives
unvoiced fricatives

fricatives become unvoiced
near (unvoiced) plosives

[ʒT] > [ST] [ʒZ] > [TZ]

LANGUAGE IS
SYSTEMATIC

else

end of word
before unvoiced fr.



SPREAD IN
BOTH DIRECTIONS

qasgulek
assikekeka

['qaz.ɣu.ʒəkʰ]
[a.'si:.kə.'kək.kə]

the writing system

<a, **e**, i, u> <m, n, **ng**, **y**>

[p, t, c, k, q] <p, t, c, k, q>
[pʰ, tʰ, cʰ, kʰ, qʰ]

[v, ʒ, z, ɣ, ʁ] <v, l, s, g, r>
[f, ɬ, s, x, χ]

[f, ɬ, s, x, χ] <vv, ll, ss, gg, rr>

double letter = unvoiced

(when voice is expected
e.g. within vowels)

qasgulek
assikekeka

['qaz.ɣu.ʒəkʰ]
[a.'si:.kə.'kək.kə]

nanevpak
nav'pagtuq

[na.'nəf.pakʰ]
['nav.pax.tuqʰ]

the writing system

<a, e, i, u> <m, n, ng, y>

[p, t, c, k, q] <p, t, c, k, q>
[pʰ, tʰ, cʰ, kʰ, qʰ]

[v, ʒ, z, ɣ, ʁ] <v, l, s, g, r>
[f, ɬ, s, x, χ]

[f, ɬ, s, x, χ] <vv, ll, ss, gg, rr>

change in voicing <'>

double letter = unvoiced

(when voice is expected
e.g. within vowels)

(e.g. between consonants)
<T'Z> = [TZ] , <Z'T> = [ZT]

qasgulek
assikekeka

[ˈqaz.ɣu.ʒəkʰ]
[a.ˈsi:.kə.ˈkək.kə]

nanevpak
nav'pagtuq

[na.ˈnəf.pakʰ]
[ˈnav.pax.tuqʰ]

cungagcessvakart
at

[cu.ˈɣax.cəs.ˈfa:.kaɣ.tath]

the writing system

<a, e, i, u> <m, n, ng, y>

[p, t, c, k, q] <p, t, c, k, q>
[pʰ, tʰ, cʰ, kʰ, qʰ]

[v, ʒ, z, ɣ, ʁ] <v, l, s, g, r>
[f, ɬ, s, x, χ]

[f, ɬ, s, x, χ] <vv, ll, ss, gg, rr>

change in voicing <'>

fricative-fricative
devoiced <SSF>

double letter = unvoiced
(when voice is expected
e.g. within vowels)

(e.g. between consonants)
<T'Z> = [TZ] , <Z'T> = [ZT]

only first is written double

qasgulek	[ˈqaz.ɣu.ʒəkʰ]
nanevpak	[na.ˈnəf.pakʰ]
tep'liuq	[ˈtəp.ʒi.uqʰ]
nav'pagtuq	[ˈnav.pax.tuqʰ]
qamiq'vak	[qa.ˈmiq.vakʰ]
nat'rarkaq	[ˈnat.ɤax.kaqʰ]
calugun	[ca.ˈʒu:.ɣun]
kaal'taaq	[ka.ˈaʒ.ta.aqʰ]
ullelluku	[u.ˈtət.tu.ku]
ilquineq	[iʔ.qu.ˈi:.nəqʰ]
kaltuuvvilaq	[ˈkaʔ.tu.ˈu:.fi.ʒaqʰ]
kayangurngalnguq	[ka.ˈja:.ŋuɤ.ˈŋaʒ.ŋuqʰ]
assikekeka	[a.ˈsi:.kə.ˈkək.ka]
paluteqerru	[pa.ˈʒu:.tə.ˈqəx.χu]
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aepailgaku	[a.ˈpəp.pa.ˈiʒ.ɣa.ku]
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syllables & stress (. ')

V, CV
VC, CVC

open
closed



qasgu-
nav'pag-
nanev-
calu-

['qaz.yu...]
['nav.pax...]
[na.'nəf...]
[ca.'ɬu:...]

syllables & stress (. ')

V, CV
VC, CVC

stress: 1st or 2nd syllable

open
closed

If 1st is closed: 1st is stressed

If 1st is open: 2nd is stressed

kaltuuvilaq ['kaɫ.tu.'u:.fi.ɬaɫh]
 yuarutlertangqertuq [ju.'a:.ɬutʰ.'ɬəχ.taŋ.'qəχ.tuɫh]
 cangatenrituten [ca.'ŋa:.tən.'ɬi:.tu.tən]

syllables & stress (. ')

V, CV
VC, CVC

stress: 1st or 2nd syllable

...and then alternated
(but never the last one)

open
closed

If 1st is closed: 1st is stressed
If 1st is open: 2nd is stressed



**Tamakunek qayam una painga,
iciw' uivenqellriit?**

With those, the kayak rims, you
know how they're round?

kaltuuvilaq ['kaɫ.tu.'u:.fi.ɬaɫʰ]
 yuarutlertangqertuq [ju.'a:.ɬuθ.'ɬəχ.taŋ.'qəχ.tuɫʰ]
 cangatenrituten [ca.'ŋa:.tən.'ɬi:.tu.tən]

apepailgaku [a.'pəp.pa.'iɬ.ɣa.ku]

syllables & stress (.'')

V, CV
VC, CVC

stress: 1st or 2nd syllable

...and then alternated
(but never the last one)

If open syl. is stressed
the vowel turns long

But not ə

open
closed

If 1st is closed: 1st is stressed
If 1st is open: 2nd is stressed



CV > 'CV:

Cə.CV > 'CəC:CV

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syllables & stress (. ')
with a twist ;)

[ˈtutʰ.ˈxax.ʈu.ɣaqʰ]
[cu.ˈukʰ.ˈfax.ta.ʒəkʰ]
[ca.ˈŋa:.ˈtən.bi.ˈtu:.tən]
[cu.ˈŋax.ˈcəs.fa.ˈkax.tatʰ]

stress changes with dialect
NS vs. GCY

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cuukvagtalek	[cu.ˈukʰ.fax.ˈta:.ʒəkʰ]
cangatenrituten	[ca.ˈŋa:.tən.ˈɓi:.tu.tən]
cungagcessvakartat	[cu.ˈŋax.cəs.ˈfa:.kax.tatʰ]

syllables & stress (. ')
with a twist ;)

Norton Sound (NS)

[ˈtutʰ.ˈxax.ʔu.ɣaqʰ]
[cu.ˈukʰ.ˈfax.ta.ʒəkʰ]
[ca.ˈŋa:.ˈtən.ɓi.ˈtu:.tən]
[cu.ˈŋax.ˈcəs.fa.ˈkax.tatʰ]

stress changes with dialect
NS vs. GCY

qasgulek	[ˈqaz.ɣu.ʒəkʰ]
nanevpak	[na.ˈnəf.pakʰ]
tep'liuq	[ˈtəp.ʒi.uqʰ]
nav'pagtuq	[ˈnav.pax.tuqʰ]
qamiq'vak	[qa.ˈmiq.vakʰ]
nat'rarkaq	[ˈnat.ɤax.kaqʰ]
calugun	[ca.ˈʒu:.ɣun]
kaal'taaq	[ka.ˈaʒ.ta.aqʰ]
ullelluku	[u.ˈʔəʔ.tu.ku]
ilquineq	[ˈiʔ.qu.ˈi:.nəqʰ]
kaltuuvilaq	[ˈkaʔ.tu.ˈu:.fi.ʒaqʰ]
kayangurngalnguq	[ka.ˈja:.ŋuɤ.ˈŋaʒ.ŋuqʰ]
assikekeka	[a.ˈsi:.kə.ˈkək.ka]
paluteqerru	[pa.ˈʒu:.tə.ˈqəx.ɣu]
iggiggiayuli	[i.ˈxi:.xi.ˈa:.ju.ʒi]
ilalkumalria	[i.ˈʒaʔ.ku.ˈmaʒ.bi.a]
aepailgaku	[a.ˈpəp.pa.ˈiʒ.ɣa.ku]
yuarutlertangqertuq	[ju.ˈa:.ɤuth.ˈʔəx.taŋ.ˈqəx.tuqʰ]
tutgarrrugaq	[ˈtuth.xax.ˈʔu:.ɣaqʰ]
cuukvagtalek	[cu.ˈukʰ.fax.ˈta:.ʒəkʰ]
cangatenrituten	[ca.ˈŋa:.tən.ˈbi:.tu.tən]
cungagcessvakartat	[cu.ˈŋax.cəs.ˈfa:.kax.tath]

syllables & stress (. ')
with a twist ;)

Norton Sound (NS)

General Central Yup'ik (GCY)

[ˈtuth.ˈxax.ʔu.ɣaqʰ]
[cu.ˈukʰ.ˈfax.ta.ʒəkʰ]
[ca.ˈŋa:.ˈtən.bi.ˈtu:.tən]
[cu.ˈŋax.ˈcəs.fa.ˈkax.tath]

stress changes with dialect
NS vs. GCY

NS

GCY

['tutʰ | xax.ʰu: | ɣaqʰ]
[cu.'ukʰ | fax.'ta: | ʒəkʰ]
[ca.'ɲa: | tən.'ɬi:.tu | tən]
[cu.'ɲax | əs.'fa:.kax | tatʰ]

['tutʰ | 'xax.ʰu | ɣaqʰ]
[cu.'ukʰ | 'fax.ta | ʒəkʰ]
[ca.'ɲa: | 'tən.ɬi.'tu: | tən]
[cu.'ɲax | 'cəs.fa.'kax | tatʰ]

['tutʰ | ['xax.ʰu] | ɣaqʰ]
[cu.'ukʰ | ['fax.ta] | ʒəkʰ]
[ca.'ɲa: | ['tən.ɬi]. 'tu: | tən]
[cu.'ɲax | ['cəs.fa]. 'kax | tatʰ]

syllables & stress (.' ')
with a twist ;)

beginning & end: the same

but the closed syllable
"steals" stress from the open

repetition of the
pattern of the beginning

...then it restarts the alternance

stress changes with dialect
NS vs. GCY



If 1st is closed: 1st is stressed
If 1st is open: 2nd is stressed

Two conflicting patterns

pair
Str.-Unst.

Rhythmic
Alternance

The variants (dialects) have
different accommodations



- | | | |
|-------------------------|----------------------------|-------|
| 1. melquleliurta | ['məʔ.qu.'ʒəʒ.ʒi.'uχ.ta] | |
| 2. qayapigkani | [qa.'ja:pix.'ka:.ni] | (NS) |
| 3. tallirraq | [ta.'ʔi:χaqh] | |
| 4. keggsailkutaq | ['kəx.sa.'iʔ.ku.taqʰ] | |
| 5. cup'gallagtuq | ['cup.ɣa.'ʔax.tuqʰ] | |
| | | |
| 6. aartartuq | [a.'aχ.taχ.tuqʰ] | |
| 7. akekataki | [a.'kək.ka.'ta:.ki] | |
| 8. negavgun | [nə.'ɣav.ɣun] | |
| 9. atasuak | [a.'ta:..zu.akʰ] | |
| 10 ner'ciquq | ['nəʔ.ci.quqʰ] | |
| · alikenritaqa | [a.'ʒi:..kən.'ʔi:..ta.qa] | (NS) |
| 11 | [a.'ʒi:..'kən.ʔi.'ta:..qa] | (CGY) |
| · neqlinrrarmek | ['nəqʰ.ʔin.'χaʔ.məkʰ] | |

12

.



mukluk

soft boots made of
reindeer or seal skin

Problem 1

- 01 The Author
- 02 The Language
- 03 The Problem
- 04 **The Results**



Graders

Tufiş #1



Bru.no L'As.to.ri.na

Sa.muel Ah.med

Mi.hail Bra.tu

Ma.ria Ru.bin.stein

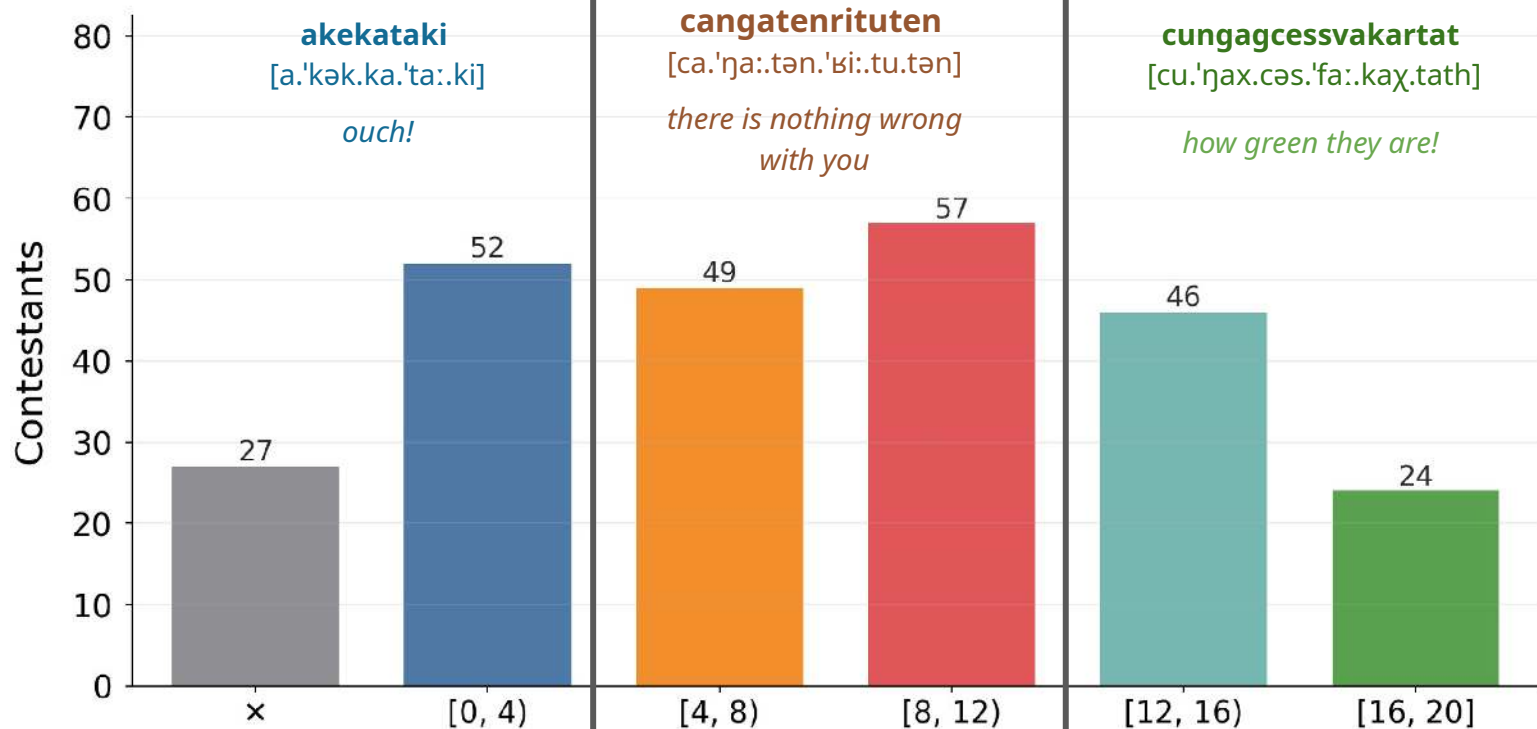
Ka.zu.ne Sa.to

A.le.xan.der Pi.per.ski

228 submissions
27 non-submissions

Stats

mean 7.75
4 people 19+
2 best solutions



**Best
Solution**

Zhou
Haoxuan

China, Qian



Best
Solution

Veronika
Havlová

Czechia, Čtyřlístek





Quyana

Muṭumim

drink water!