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Syllable structure in English, Japanese and Kaqchikel
Part I

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Introduction
Introduction

(1) Syllable: a unit/category of organization for a sequence of speech sounds. e.g. monky /mʌŋki/ is composed of two syllables: /mʌŋ/ and /ki/.

(2) A syllable is typically made up of a syllable nucleus (V) with optional initial and final margins (Cs).

a. 
   \[\begin{array}{c}
   \sigma \quad (= \text{syllable}) \\
   \quad \begin{array}{c}
   O \quad (= \text{onset}) \\
   \quad \begin{array}{c}
   C \quad (= \text{consonant}) \\
   \end{array} \\
   \quad \begin{array}{c}
   N \quad (= \text{nucleus}) \\
   \quad \begin{array}{c}
   V \quad (= \text{vowel}) \\
   \end{array} \\
   \end{array} \\
   \end{array} \\
   \end{array}\]

b. 
   \[\begin{array}{c}
   \sigma \\
   \mu \quad (= \text{mora}) \\
   \quad \begin{array}{c}
   C \quad (= \text{consonant}) \\
   \quad \begin{array}{c}
   V \\
   \end{array} \\
   \end{array} \\
   \end{array}\]
(3) Final consonants

a. universally onsets (not codas)

b. i. prosodically weak:
   an onset followed by a silent nucleus
   e.g. English, Japanese

   ii. prosodically strong:
       an onset preceded by an audible nucleus
       e.g. Kaqchikel
Introduction

(4) Roadmap

1. Introduction
2. Final consonants: two views
3. Final consonants in English
4. Final consonants in Japanese
5. Final consonants in Kaqchikel
6. Summary
Final consonants:

two views
Final consonants: two views

(5) Two linguistic traditions which have adopted different perspectives on the syllabification of word-final consonants.

c. “western” or Graeco-Roman tradition running through work on versification and phonology

d. “eastern” tradition which maintains that a word-final consonant occupies the onset of a “dull” syllable – one that lacks an audible nucleus.
Final consonants: two views

(6) a. Amharic (*fidäl* syllabary)

<table>
<thead>
<tr>
<th></th>
<th>Fidäl</th>
<th>Alphabetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.</td>
<td>ው</td>
<td>na</td>
</tr>
<tr>
<td>ii.</td>
<td>ያ ው</td>
<td>ኰናنا</td>
</tr>
<tr>
<td>iii.</td>
<td>ያ ከ</td>
<td>ከና</td>
</tr>
</tbody>
</table>

*γ* represents the word-final [n], implying that this consonant occupies a separate syllable from the preceding [k’ә].

b. Japanese (*Kana* syllabary)

<table>
<thead>
<tr>
<th></th>
<th>Hiragana</th>
<th>Alphabetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.</td>
<td>な</td>
<td>na</td>
</tr>
<tr>
<td>ii.</td>
<td>かな</td>
<td>kana</td>
</tr>
<tr>
<td>iii.</td>
<td>かん</td>
<td>kan</td>
</tr>
</tbody>
</table>

*뉴스* represents the word-final [n][N]), implying that this consonant occupies a separate syllable from the preceding [ka].
Final consonants: two views

(7) Two views of syllable structure

a. Phoneme-centred view
   i. Syllable structure is projected from segment strings.
   ii. Every syllabic position is occupied by a segment.
   iii. Each sonority peak defines a unique syllable (Blevins 1995: 207).
   iv. In all languages, syllable edges correspond with word/utterance edges (Blevins 1995: 209).
      e.g. [blæŋk] ‘blank’: [bl] and [ŋk] are the consonantal mergins of the peak formed by [æ] and are therefore projected as an onset and a coda respectively.
   v. Small closed set of core syllables (including CV) and an open-ended set of other syllables (e.g. sC onsets, 4-C onsets, 5-C codas, ambisyllabicity, ...)

b. Syllable-centred view
   i. Syllable structure is defined independently of segment strings and word structure.
   ii. Not every syllabic position is necessarily occupied by a segment.
   iii. Small closed set of possible syllables (including CV). No other types of syllable.
Final consonants: two views

(8) Two perspectives on word-final consonants

a. The ‘western’ prospect (…VC · ]):
   any consonant following the last vowel of a word belongs to a **coda**
   (· = syllable boundary)

b. The ‘eastern’ prospect (…V · C□]):
   a word-final consonant occupies the **onset** of a dull syllable (one that lacks
   an audible nucleus). Embodied in syllable writing systems, e.g.
   Brahmi-derived scripts: (Devanagari (Sanskrit, Hindi), Bengali, Gujarati,
   Terugu, Sinhalese, …), Ethiopian fidal (Ge’ez, Amharic, Tigrinya, Oromo,
   …), …
Final consonants: two views

Typology

Languages divide into two main syllabic types – one which permits only open syllables (the CV type) and one which tolerates both open and closed syllables (the CVC type).

a. i. Any CV language simultaneously lacks both internal codas and final consonants. e.g. Zulu, Yoruba, ...

ii. Any CVC language simultaneously allows for both internal codas and final consonants. e.g. English, Polish, ...

b. Four-way typology

<table>
<thead>
<tr>
<th>final VC?</th>
<th>internal CV · ?</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>NO</td>
<td>Ia ...V · CV]</td>
</tr>
<tr>
<td></td>
<td>Zulu</td>
</tr>
<tr>
<td>YES</td>
<td>Ib ...V · CV(C)]</td>
</tr>
<tr>
<td></td>
<td>Luo</td>
</tr>
</tbody>
</table>

- This contradicts the predictions in (9a).
- It also undermines any assumption that a domain-final consonant should automatically be equated with a domain-internal coda.
Final consonants in English
Final consonants in English

(10) English morpheme-internal rhymes

<table>
<thead>
<tr>
<th>Light V</th>
<th>Heavy VV</th>
<th>Heavy VC</th>
<th>Super-heavy VVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>city</td>
<td>Peter</td>
<td>factor</td>
<td>shoulder</td>
</tr>
<tr>
<td>mutton</td>
<td>putrid</td>
<td>winter</td>
<td>cauldron</td>
</tr>
<tr>
<td>cushion</td>
<td>rowdy</td>
<td>pamper</td>
<td>poultry</td>
</tr>
<tr>
<td>petrol</td>
<td>capon</td>
<td>anchor</td>
<td>oyster</td>
</tr>
<tr>
<td>cotton</td>
<td>sofa</td>
<td>fancy</td>
<td>saunter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>finger</td>
<td>chamber</td>
</tr>
</tbody>
</table>
Final consonants in English

(11) English morpheme-final VC sequences

a. VC]
   pat
tip
den
gull

b. VVC]
   late
own
light
feat

c. VCC]
   fist
desk
   fact
gulp

b. VVCC]
   paste
rind
paint
child

e. VCCCC]
   text
mulct
Final consonants in English

(12) Against final codas

<table>
<thead>
<tr>
<th>Sonority</th>
<th>the number of peaks</th>
<th>the number of syllables</th>
</tr>
</thead>
<tbody>
<tr>
<td>pie</td>
<td>[pɛɪ]</td>
<td>1</td>
</tr>
<tr>
<td>pity</td>
<td>[pɪti]</td>
<td>2</td>
</tr>
<tr>
<td>spy</td>
<td>[sɒpɪ]</td>
<td>2</td>
</tr>
<tr>
<td>tax</td>
<td>[tæks]</td>
<td>2</td>
</tr>
</tbody>
</table>
Final consonants in English

(13) Extra-metricality effects

a. Sub-regularity in English verbs:
   right-most stress on super-heavy final; else penultimate
   
   i.     tormént    cajóle    ii.     édit
          lamént    maintáin    astónish
          colláspse  caróuse    cáncel

b. The final C does not contribute to the weight of the preceding rhyme:
   tor(mén)<t>    vs.    (édí)<t>
   main(tái)<n>   vs.    as(tóni)<sh>
   col(láp)<se>   vs.    (cánce)<l>

c. Negative conclusion: final C is not a coda.
Final consonants in English

(14) Vowel length

a. V(V)C sequences in English:
   is there a connection between the length of V and the identity of C?
   Internal (V)VC · (yes) vs. final (V)VC] (no).

b. Internal (V)VC:
   there are severe constraints on the type of consonant that can appear in an
   internal super-heavy VVC · sequence.
   (e.g. shoulder ['ʃɔuldə], council ['kaʊntə], manger ['meŋdʒə], pastry
   [pɛrstri], ...)
   i. the C must be a fricative or a sonorant;
   ii. if sonorant, C must be homorganic with a following onset;
   iii. in the case of (ii), the place is (almost) always coronal.

c. Final C]
   Any consonant is free to occur here, and there are no systematic constraints
   on the length of the preceding vowel.
   i. Short VC]     lid, run, back, top, step, foot, fill, spliff, rich, ...
   ii. Long VVC]    slide, spoon, rake, soap, boot, feel, leaf, reach, ...
Final consonants in English

(14) Vowel length

d. Closed-syllable (rhyme) vowel shortening: Under certain conditions (including those in (b)), a vowel must be short when followed by an internal coda consonant; a final consonant has no such effect.

\[
\begin{array}{ll}
\text{VVC]} & \text{VC} \cdot \text{C} \\
\text{i. perceive [pə'si:v]} & \text{perceptive [pə'sept.triv]} \\
\text{describe [di'skræib]} & \text{description [di'skrip.ʃən]} \\
\text{reduce [ri'dju:s]} & \text{reduction [ri'dək.ʃən]} \\
\text{five [faiv]} & \text{fifth [fifth]} \\
\text{wise [waiz]} & \text{wisdom [ˈwɪz.dəm]} \\
\text{ii. intervene [,mtə'vei:n]} & \text{intervention [,mtə'ven.ʃən]} \\
\text{retain [ri'tem]} & \text{retentive [ri'ten.triv]} \\
\end{array}
\]

e. Negative conclusion: final C is not a coda.
## Final consonants in English

(15) Phonotactics of CC clusters

a. Phonotactically, English final \(-CC\) clusters are either a proper subset of or identical coda-onset \(C \cdot C\) clusters.

<table>
<thead>
<tr>
<th>Medial</th>
<th>Final</th>
<th>Medial</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Stop-stop</td>
<td>apt</td>
<td>ii. Snorant-stop</td>
<td>damp</td>
</tr>
<tr>
<td>chapter</td>
<td>sect</td>
<td>winter</td>
<td>flint</td>
</tr>
<tr>
<td>vector</td>
<td></td>
<td>filter</td>
<td>guilt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>scalpel</td>
<td>scalp</td>
</tr>
<tr>
<td>iii. Fricative-stop</td>
<td>mist</td>
<td>iv. Snorant-fricative</td>
<td>manse</td>
</tr>
<tr>
<td>mister</td>
<td>mist</td>
<td>cancer</td>
<td>dolphin</td>
</tr>
<tr>
<td>after</td>
<td>raft</td>
<td></td>
<td>golf</td>
</tr>
<tr>
<td>whisper</td>
<td>wisp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>whisker</td>
<td>brisk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Final consonants in English

(15)  Phonotactics of CC clusters

b. Under both the final-coda and the extra-syllabicity views, the phonotactic parallels between internal -C · C- and final CC] clusters are entirely accidental. The same set of regularities has to be stated twice – once for internal coda-onset -C · C- clusters, and again for final alleged coda CC] clusters (the final-coda view) or final C<C>es] clusters (the extra-syllabicity view).

c. Positive conclusion: final C is an onset.
Final consonants in English

(16) Final onsets and cluster phonotactics

a. Under the assumption that a final C occupies an onset, internal -C · C- and final -C · C] clusters are syllabically identical; both form coda-onset sequences.

b. Internal coda-onset -C · C-
   guilty
   \[\text{word diagram}\]

   Final coda-onset -C · C]
   guilt
   \[\text{word diagram}\]

c. Closed-syllable (rhyme) vowel shortening
   i. five
   ii. fifth
   iii. fifty
   \[\text{word diagram}\]
Final consonants in English

(17) Final empty nuclei

a. If we assume that any onset must be licensed by a following nucleus, we are forced to conclude that a final onset C] is followed by a nucleus without any manifest phonetic content: \(\rightarrow\) ‘eastern’ view

b. English stress (sub-regularity) – stress falls on heavy non-final syllable or on ‘super-heavy’ final:
   i. a.gén.da
   ma.gén.ta
   a.ró.ma
   ii. tor.mén.t\(\Box\)
   la.mén.t\(\Box\)
   ca.jó.le \(\text{ca.jó.l\(\Box\)}\)

c. Positive conclusion: final ‘empty’ nuclei sometimes betray their presence metrically.
Final consonants in English

(18) The four-way VC typology revisited

a. Intersection of two independent parameters
   i. Branching rhyme? OFF = no codas.
   ii. Domain-final empty nuclei? OFF = every word ends in a vowel
       ON allows for final C

b. 

<table>
<thead>
<tr>
<th>final empty nuc</th>
<th>Branching rhyme</th>
</tr>
</thead>
<tbody>
<tr>
<td>[OFF]</td>
<td>[OFF]</td>
</tr>
<tr>
<td>Ia, Zulu</td>
<td>...V · CV</td>
</tr>
<tr>
<td>IIa, Italian</td>
<td>...V(C) · CV</td>
</tr>
<tr>
<td>[OFF]</td>
<td></td>
</tr>
<tr>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>Ib, Luo</td>
<td>...V · CV(C)</td>
</tr>
<tr>
<td>IIb, English</td>
<td>...V(C) · CV(C)</td>
</tr>
</tbody>
</table>
Final consonants in Japanese
Final consonants in Japanese

(19)  a. One of the differences between English and Japanese comes from an empty nucleus: the empty nucleus usually remains silent in English, whereas in Japanese it manifests itself phonetically by some way.

b. The placeless nasal ː the only final consonant permitted

c. The aim of this section is to provide evidence to support the claim that the placeless nasal does not occupy a syllable coda.
Final consonants in Japanese

(20) $n$ shows both consonantal and vocalic characteristics

a. C characteristics: the lexical contrast of nasality and pitch accentuation
   i. Nasality is not distinctive on vowels in Japanese; since consonants are the only segments on which a nasality contrast is expressed, $n$ is considered to have a consonant trait.
   ii. $n$ never bears pitch accent, which is also the case with consonants in Japanese (McCawley 1968, Vance 1987).

   e.g. L H H H L L L L L L

   ro sa n ze l ru su wa c i l n to n
Final consonants in Japanese

(20) $\eta$ shows both consonantal and vocalic characteristics

b. V characteristics:
   i. Like vowels, but unlike consonants, $\eta$ has no clear place of articulation.
   ii $\eta$ bears high/low pitch just as vowels do. This makes native speakers of Japanese detect a ‘beat’ called moraicity or syllabicity in the nasal segment. For this reason, $\eta$ behaves like a vowel in certain phonological processing tasks such as transposition in speech errors (Kubozono 1985), secret language games (e.g. Babibu language: Haraguchi 1991) and particle vowel reduction in casual speech (Hasegawa 1979).

   e.g. L H H H L H L L
   se $\eta$ da i re $\eta$ b a l n o $\eta$
Final consonants in Japanese

(20)  \( n \) shows both consonantal and vocalic characteristics

c. Hiragana and Katakana: in which most of the letters represent a CV sequence. Given that CV is a basic structure of Japanese letters, \( n \) and the five vowels \( a, i, u, e, o \) do not fit this pattern.

<table>
<thead>
<tr>
<th>あ(a)</th>
<th>い(i)</th>
<th>う(u)</th>
<th>え(e)</th>
<th>お(o)</th>
</tr>
</thead>
<tbody>
<tr>
<td>か(ka)</td>
<td>き(ki)</td>
<td>く(ku)</td>
<td>け(ke)</td>
<td>こ(ko)</td>
</tr>
<tr>
<td>さ(sa)</td>
<td>し(si)</td>
<td>す(su)</td>
<td>せ(se)</td>
<td>そ(so)</td>
</tr>
<tr>
<td>た(ta)</td>
<td>ち(ti)</td>
<td>つ(tu)</td>
<td>て(te)</td>
<td>と(to)</td>
</tr>
<tr>
<td>な(na)</td>
<td>に(ni)</td>
<td>ぬ(nu)</td>
<td>ね(ne)</td>
<td>の(no)</td>
</tr>
<tr>
<td>は(ha)</td>
<td>ひ(hi)</td>
<td>ふ(hu)</td>
<td>へ(he)</td>
<td>ほ(ho)</td>
</tr>
<tr>
<td>ま(ma)</td>
<td>み(mi)</td>
<td>む(mu)</td>
<td>め(me)</td>
<td>も(mo)</td>
</tr>
<tr>
<td>や(ya)</td>
<td>ゆ(yu)</td>
<td>よ(yo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ら(ra)</td>
<td>り(ri)</td>
<td>る(ru)</td>
<td>れ(re)</td>
<td>ろ(ro)</td>
</tr>
<tr>
<td>わ(wa)</td>
<td>ん(n)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Final consonants in Japanese

(21) Phonotactics of nasals

a. In phonemic terms, Japanese has three kinds of nasals: \(n\), \(m\) and \(n\).

b. Unlike \(n\) and \(m\), \(n\) exhibits four allophonic variants:

\[
\begin{align*}
[n]: & \quad ho[n]doo \text{ ‘main temple’} < hon \text{ ‘main, real’} + doo \text{ ‘temple’} \\
[m]: & \quad ho[m]mono \text{ ‘real thing’} < hon \text{ ‘main, real’} + mono \text{ ‘thing’} \\
[i]: & \quad ho[i]kan \text{ ‘main building’} < hon \text{ ‘main, real’} + kan \text{ ‘building’} \\
[N]: & \quad ho[N]i \text{ ‘real intention’} < hon \text{ ‘main’} + i \text{ ‘intention’}
\end{align*}
\]

c. i. Those variants of \(n\) retain their moraicity/syllabicity.
ii. In terms of phonotactics, the placed nasals \((n\) and \(m\)) never occupy word-final position: they are always followed by a vowel.
iii. On the other hand, the placeless nasal \((n)\) can never occupy a word-initial position: it is always preceded by a vowel.

Bearing these facts in mind, phonologists have a consensus that placed nasals \((n\) and \(m)\) occupy syllable onsets.
Final consonants in Japanese

(22) The representations of $N$

a. 

\[
\begin{align*}
O & \rightarrow R \\
R & \rightarrow N \\
N & \rightarrow V
\end{align*}
\]

b. 

\[
\begin{align*}
O & \rightarrow \mu \\
\mu & \rightarrow \mu \\
C & \rightarrow V \\
V & \rightarrow N
\end{align*}
\]

c. Yoshida (1990)

\[
\begin{align*}
O & \rightarrow R \\
R & \rightarrow \mu \\
\mu & \rightarrow \mu \\
C & \rightarrow V \\
V & \rightarrow [N] \\
N & \rightarrow N
\end{align*}
\]
Final consonants in Japanese


a. 

\[
\begin{array}{cc}
\text{O} & \text{R} \\
\text{X} & \text{X} \\
\text{C} & [\text{N}] \\
\end{array}
\]

b. 

\[
\begin{array}{cc}
\text{O} & \text{R} \\
\text{X} & \text{X} \\
\text{C} & [\text{N}] \\
\end{array}
\]

\[
\begin{array}{cc}
\text{V} & [\text{R}] \\
\text{N} & [\text{mu}] \\
\end{array}
\]

c. Moraicity comes from the interpretation of a following nucleus, which is unspecified in terms of melodic material.

d. In Japanese, unlike English, a final-empty nucleus must be phonetically interpreted, which means that words/morphemes usually have a vowel ending.

e. A final-empty nucleus following an onset position with a place feature is phonetically interpreted as a high back unrounded vowel, which is the most neutral vowel within the Japanese vocalic space and is often used as an unmarked vowel in the nativisation of loanwords (e.g. slip ‘slip’ > *swrippu*).

f. The existence of a place feature (such as coronality) prevents its associated position from being phonetically superimposed by the characteristic acoustic resonance of a following empty nucleus.
Evidence to support the claim that $n$ is the phonetic manifestation of a placeless nasal and empty nucleus.

a. With regard to physical duration, $n$ is longer than the other nasal consonants and is equal to the duration of a consonant plus a vowel.

b. The most weak vowel $uu$ plus a nasal consonant is often interpreted as a placeless moraic nasal (e.g. uma ‘hourse’ > $n(m)ma$)

c. $n$ is perceived as a sequence consisting of $uu$ plus a nasal consonant by kindergarten children when they play a word game called Shiritori (which one player has to say a word starting with the last syllable of the word given by the previous player).
Some simplified explanations.

a. Oogami (one of the Okinawa dialects) and Kagoshima dialects:

Nouns ending with the sequence *nu* in the Tokyo dialect are pronounced with in word-final position (e.g. *in* ‘dog’ in these dialects is the equivalent of *inuu* in Tokyo dialect).

i. Tokyo Japanese

```
ONON
| | |
×××××
| | |
[I] [N]
[?]
[R]
{i n u}
```

ii. Oogami Japanese

```
ONON
| | |
×××××
| | |
[I] [N]
[?]

{i N}
```
Final consonants in Japanese

(25) Some simplified explanations

b. The structure in (23a) involves no prosodic reorganization in the course of morphological concentration.

\[ n \text{ in onset} \rightarrow n \text{ in onset} \]

i. Verb inflexion

\[
\begin{align*}
\text{si}.n & + uu & \rightarrow & \text{si}.n u u & \text{NON-PAST} \\
\text{si}.n & + da & \rightarrow & \text{si}.n d a & \text{PAST} \\
\text{si}.n & + a.na.i & \rightarrow & \text{si}.n a.na.i & \text{NEGATIVE}
\end{align*}
\]

ii. Compounding

\[
\begin{align*}
\text{si}.N & + puu & \rightarrow & \text{si}.m.puu & \text{‘bride’} \\
\text{si}.N & + ka & \rightarrow & \text{si}.\eta.ka & \text{‘evolution’} \\
\text{si}.N & + i & \rightarrow & \text{si}.N.i & \text{‘real intention’}
\end{align*}
\]
Final consonants in Japanese

(25) Some simplified explanations

c. On the other hand, the structures in (23) involve prosodic reorganization in the course of morphological concentration.

\[ n \text{ in coda} \rightarrow n \text{ in onset} \]

### i. Verb inflexion

\[
\begin{align*}
\text{sin.} + uu & \rightarrow \text{si.n uu} & \text{NON-PAST} \\
\text{sin.} + da & \rightarrow \text{si.n da} & \text{PAST} \\
\text{sin.} + a.n a.i & \rightarrow \text{si.na.na.i} & \text{NEGATIVE}
\end{align*}
\]

### ii. Compounding

\[
\begin{align*}
\text{sin.} + puu & \rightarrow \text{si.m.puu} & \text{‘bride’} \\
\text{sin.} + ka & \rightarrow \text{si.y.ka} & \text{‘evolution’} \\
\text{sin.} + i & \rightarrow \text{si.N.i} & \text{‘real intention’}
\end{align*}
\]