# Probing the unnatural*

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TIN-Dag 2010 – Utrecht – 6 February 2010

## §1 . . . . . . . . . . . . . . . . . . ❖ Introduction: The challenge of unnatural classes ❖

- Phonology generally deals in natural classes. As Hyman (1975: 25) puts it:

  > [T]he arbitrariness of /s, k, b, r/, as opposed to /s, z, t, d/, is revealed only when an attempt is made to *extract* the phonetic property shared by all of the segments. When a phonetic property can be extracted, a generalization is revealed. When no phonetic property can be extracted, these segments should not be expected to occur as a class in linguistics.

- This expectation is made formally explicit by theories of innate, universal, phonetically definable phonological features.

- Mielke's (2004; 2008) Emergent Feature Theory:
  Phonological features are neither universal nor innate, but language-specific and emergent.

- Evidence for EFT (or at least against universal features) comes from "unnatural" classes—sets of segments that pattern together phonologically, but which cannot be captured by a conjunction of feature values in any proposed universal system of features.

- Relatively few unnatural classes are "crazy"; most can be characterized in terms of adding or subtracting natural classes.

(1)  a. Labials + nasals:    b. Obstruents – /p/:    c. Vls stops + nasals / Stops – vd plosives:

| a. | | | | b. | | | | | c. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **p** | t | ʧ | k | p | **t** | | **k** | | **p** | **t** | **ʧ** | **k** |
| **b** | d | ʤ | g | **b** | **d** | | **g** | | b | d | ʤ | g |
| **m** | **n** | | **ŋ** | | | **s** | **ʃ** | **h** | **m** | **n** | | **ŋ** |
| **f** | s | ʃ | x | | | **z** | | | f | s | ʃ | x |
| **v** | z | ʒ | ɣ | m | n | | | | v | z | ʒ | ɣ |
| | r, l | j | | | ɾ | j | ɰ | | | r, l | j | |

- In EFT, "Features are abstract generalizations made by language learners on the basis of the phonological patterns found in the language they are learning" (Mielke 2004: 8).

- Because of how they arise historically, phonological patterns frequently do involve natural classes. But any grouping of segments is possible in principle.

- This talk: A closer look at four putative cases of unnatural classes in which…

  1. …the process can refer to a natural class (Japanese, Pero), or

  2. …the 'unnatural' class is involved in two separate processes (Bukusu, Kiowa).

§2 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ❁ Japanese *rendaku* ❁

The language: Japanese (Japan)

2.1   The unnatural class: All voiceless obstruents except /p/

- Both Mielke (2004, 2008) and Samuels (2009) mention Japanese *rendaku* as an example of a process affecting an unnatural class of segments.

- Generally speaking, *rendaku* voices a consonant at the beginning of the second member of a (non-*dvandva*) compound word (provided the second member of the compound does not already contain another voiced obstruent).

(2)   a.   [mizɯ]   'water'   +   [teppoː]   'gun'   =   [mizɯdeppoː]   'water pistol'
      b.   [eda]    'branch'  +   [ke]       'hair'   =   [edage]        'split end'
      c.   [maki]   'roll'    +   [sɯʃi]     'sushi'  =   [makizɯʃi]     'rolled sushi'
      d.   [hana]   'nose'    +   [ʃirɯ]     'soup'   =   [hanadʑirɯ]    'snot'

- Mielke (2004: 156–157): the set of segments affected by *rendaku,* namely /t k s ʃ h/, can be described as having several (SPE) features in common,

    […] but there is a segment in the complement (/p/) which also shares all of these feature values. As a result, there is no way to distinguish the phonologically active class from the other segments in the language in terms of a conjunction of SPE features, so it is unnatural in the SPE framework.

(3)   Voiceless obstruents except /p/:

| p | t |   | k |   |
|---|---|---|---|---|
|   | s | ʃ |   | h |
| b | d |   | ɡ |   |
|   | z |   |   |   |
| m | n |   |   |   |
|   | ɾ | j | ɰ |   |

2.2   The natural class: All voiceless obstruents

- But the application of *rendaku* is restricted in another way: it applies primarily—though not quite exclusively—to the native (*Yamato*) vocabulary (Vance 1987: ch. 10).

- In the *Yamato* and Sino-Japanese vocabulary, [p] is in complementary distribution with [h] and [ɸ]: [p] occurs in geminates and (in Sino-Japanese only) after a moraic nasal, [ɸ] before the high back vowel, and [h] elsewhere (McCawley 1968: 77–78).

(4)   Distribution of [p, ɸ, h] in Yamato
          [p] / Q __          e.g., [kappa]   'vodník'
          [ɸ] / __ ɯ          e.g., [ɸɯda]    'sign'
          [h] / elsewhere     e.g., [hako]    'case'

(5)  Singleton [h] / geminate [pp] alternations:
    a.  Free(ish) variation:
       [ni**h**on] ∼ [ni**pp**on] 'Japan' (*[ni**hh**on], *[ni**p**on])
    b.  Gemination for emphasis:
       [ja**h**ari] → emphatic [ja**pp**ari] 'as expected' (Hirayama 2005: 129)

- There are thus no instances of [p] to which *rendaku* would be expected to apply.

- Word-initial [h] and [ɸ] undergo *rendaku* as expected, voicing to [b]:

(6)  a.  [ha**ʃ**i]  'chopstick'  +  [**h**ako]     'case'   =  [ha**ʃi**b**ako]       'chopstick case'
    b.  [sɯna]  'sand'      +  [**h**okori]  'dust'   =  [sɯna**b**okori]   'cloud of dust'
    c.  [kawa]  'river'     +  [**ɸ**ɯne]    'boat'   =  [kawa**b**ɯne]     'riverboat'
    d.  [kami]  'paper'    +  [**ɸ**ɯkɯro]  'bag'    =  [kami**b**ɯkɯro]  'paper bag'

- We can therefore simply say that *rendaku* applies to the natural class of voiceless obstruents (in the relevant class of words); the fact that it never has the opportunity to apply to /p/ need not be built into the phonological rule.

## 2.3  Complications regarding the lexical strata

- Mielke (2008: 14) gives one example of word-initial /p/ failing to undergo *rendaku*:

(7)  [genmai] 'whole rice'  +  [**p**an] 'bread'  =  [genmai**p**an] 'whole rice bread'

- However, [pan] is a borrowing (from Portuguese *pão*).

- Some old, well-established borrowings from Portuguese (and other languages) do undergo *rendaku*:

(8)  a.  [ɯta] 'poetry'  +  [**k**arɯta] 'cards'      =  [ɯta**g**arɯta] 'poetry cards'
                   (< Port. *carta*)
    b.  [ame] 'rain'    +  [**k**appa] 'raincoat'  =  [ama**g**appa] 'raincoat'
                   (< Port. *capa*)[†]

- Others don't:

(9)  [ozaʃiki] 'tatami room'  +  [**t**empɯra] 'tempura'  =  [ozaʃiki**t**empɯra]
                           (< Port. *tempera*)  'tempura cooked and served in a private room'

- Takayama (2005: 179): The presence of initial [p] (or other non-native phonotactic patterns) may make some loan words more resistant to nativization.

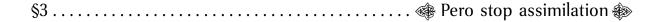- Vance (1996: 24), Ohno (2000: 157): The nativization story risks circularity.

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[†]The homophony between [kappa] 'raincoat' in (8b) and [kappa] 'vodník' in (4) is both accidental and incomplete; the two words differ in the position of pitch accent.

- Rice (1996, 1997, 2005): The stratification of the Japanese lexicon may not be learnable—why should the child posit separate strata?

- In the worst case:

  - Each item in the lexicon is labelled as [±RENDAKU] (rather than, e.g., [±FOREIGN]).

  - By (historical) accident, all words beginning with [p] happen to be [−rendaku].

  - Putting it that way does make it sound as if we're missing a phonological generalization.

  - But we're really dealing with an unnatural class of *words,* not of *sounds.*

§3 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ❈ Pero stop assimilation ❈

The language: Pero (West Chadic, Nigeria)

3.1   The unnatural class: Nasals and voiceless stops

- Mielke (2008: 144), citing Frajzyngier (1989: 23, 33): Morpheme-final stops undergo total assimilation to a following nasal (10) or voiceless stop (11).

  (10)   a.   /pét/       +   /**nà**/   =   [pé**nn**à]       'he went out'
         b.   /ʧìré**p**/   +   /**mù**/   =   [ʧíré**mm**ù]   'our women'

  (11)   a.   /ká**p**/   +   /**kò**/   =   [ká**kk**ò]   'he told'
         b.   /ʧú**p**/   +   /**kò**/   =   [ʧó**kk**ò]   'he has shown'

- The obvious feature grouping nasals and voiceless stops together would be [−continuant], but that would also include voiced plosives.

- Sequences of stop + voiced stop like the ones in (12) show epenthesis, not assimilation:

  (12)   a.   /ká**p**/   +   /**ʤí**/   =   [ká**víʤí**]   'eat (habit.)'
         b.   /ʧú**g**/   +   /**ʤí**/   =   [ʧú**gíʤí**]   'talk (habit.)'

- Mielke (2008) concludes that assimilation affects an unnatural class.

  (13)
  | p | t | ʧ | k |
  |---|---|---|---|
  | b | d | ʤ | g |
  | m | n |   | ŋ |
  | ɓ | ɗ |   |   |
  | f | s | ʃ | x |
  | v | z | ʒ | ɣ |
  |   | r, l | j |   |

3.2   The natural class: [−continuant]

- If the facts are as Mielke describes them, we do not need to say that assimilation affects an unnatural class of segments.

- Rather, all that is necessary is that epenthesis bleed assimilation:

(14)

| U.R. | /pét+nà/ | /káp+kò/ | /ʧúg+ʤí/ |
|---|---|---|---|
| Epenthesis | — | — | ʧúgíʤí |
| Assimilation | pénnà | kákkò | — |
| S.F. | [pénnà] | [kákkò] | [ʧúgíʤí] |

- In OT, the same result might be accomplished by a high-ranking constraint against geminate voiced obstruents, along the lines of Itô and Mester's (1995: 819) *DD, perhaps functionally motivated by the relative difficulty of sustaining voicing in this context.[‡]

(15)

| /pét+nà/ | *DD | Agree | Dep | Ident |
|---|---|---|---|---|
| a. ☞ [pénnà] | | | | * |
| b.    [pétinà] | | | *! | |
| c.    [pétnà] | | *! | | |

(16)

| /ʧúg+ʤí/ | *DD | Agree | Dep | Ident |
|---|---|---|---|---|
| a.    [ʧúʤʤí] | *! | | | * |
| b. ☞ [ʧúgíʤí] | | | * | |
| c.    [ʧúgʤí] | | *! | | |

## 3.3 Complications

- Actually, it's not entirely clear that this is what's going on.

- Frajzyngier (1989) gives (12) not as examples of epenthesis before voiced stops, but rather of epenthesis breaking up obstruent clusters containing palatals.

- Epenthesis breaks up obstruent clusters with palatals even when the second consonant is (underlyingly) voiceless:[§]

(17)   a. /káʤ/   +   /kò/   =   [káʒóɣò]   'he moved'
      b. /máʤ/   +   /kò/   =   [máʒóɣò]   'he asked'

- Frajzyngier (1978, 1989) does not give any examples that would show what happens when a morpheme-final non-palatal stop is followed by a non-palatal voiced plosive.

  - If epenthesis (or some other process) applies, then the bleeding analysis is plausible.

  - If assimilation applies, then the bleeding analysis is unnecessary.

  - If nothing happens, then the assimilation rule may indeed need to refer to an unnatural class.

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[‡]An analysis along these lines would be made more difficult by the fact that Pero does permit geminate voiced obstruents; Frajzyngier (1978: 112) reports that voiced obstruents undergo gemination in the environment V+_V.

[§]The quality of the epenthetic vowel depends in part on the following vowel (Frajzyngier 1989: 30–31). In (17), the /k/ undergoes intervocalic voicing and spirantization fed by epenthesis (Frajzyngier 1989: 17–19).

§4 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ❄ Bukusu nasal deletion ❄

The language: Bukusu (Niger-Congo, Kenya)

4.1   The unnatural class: Nasals and fricatives

- Mielke (2008: 66–67), citing Austen (1975): Nasals in Bukusu delete before fricatives (18) and before other nasals (19).

  (18)   Nasal deletion before fricatives:
    a.   /i+**n+f**ula/      →   [e:**f**ula]      'rain'
    b.   /i**n+s**om+ij+a/   →   [e:**s**omia]     'I teach'
    c.   /i+**n+x**ele/      →   [e:**x**ele]      'frog'

  (19)   Nasal deletion before nasals:
    a.   /i**n+m**eel+a/     →   [e:**m**eela]     'I am drunk'
    b.   /i**n+n**uun+a/     →   [e:**n**uuna]     'I suck'
    c.   /i+**n+ɲ**aɲa/      →   [e:**ɲ**aɲe]      'tomato'
    d.   /i+**n+ŋ**uaŋua/    →   [e:**ŋ**waŋwa]    'camel'

- Before plosives (which would be included in any obvious natural class that encompasses both nasals and fricatives), nasals do not delete, but rather (in most cases) assimilate in place:

  (20)   a.   /i**n+p**im+a/   →   [e**mp**ima]   'I measure'
         b.   /i**n+b**on+a/   →   [e**mb**ona]   'I see'
         c.   /i+**n+g**oxo/   →   [e**ŋg**oxo]   'hen'

  (21)   p          ʧ   k
         b     d    ʤ   g
         **m**   **n**   **ɲ**   **ŋ**
         **f**   **s**        **x**
         w     r, l   j

4.2   Separate processes: Deletion, assimilation, degemination

- What if there are two different processes at work in the simplification of the two types of clusters?

- Suppose that a nasal before another nasal undergoes the place assimilation independently attested in (20), and then degeminates.

(22)

| U.R. | /i+n+fula/ | /in+meel+a/ | /in+pim+a/ |
|---|---|---|---|
| NASAL DELETION | ifula | — | — |
| PLACE ASSIMILATION | — | immeela | impima |
| DEGEMINATION | — | imeela | — |
| Other processes¶ | e:fula | e:meela | empima |
| S.F. | [e:fula] | [e:meela] | [empima] |

¶Viz., vowel lowering and compensatory lengthening.

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- In OT, the same effect could be accomplished by a high-ranking constraint against geminate nasals—or against geminates more broadly (see below).

- Mielke (2005: 184, fn. 5):

  > A reviewer notes that the deletion of nasals before nasals and fricatives can be interpreted as two distinct processes, i.e. nasal degemination and pre-spirant nasal effacement. Both of these are attested in other languages, and there is no reason to expect them not to occur in the same language. On the other hand, any pattern involving a featurally unnatural class can be reanalysed as two or more identical patterns involving only featurally natural classes. It would be interesting to find independent evidence […] for treating Bukusu fricative/nasal deletion […] in this way.

- There is at least circumstantial evidence for this. Mutonyi (2000: 178):

  > Simply put, the deletion of nasals before other nasals results from a general ban in the language on sequences of identical segments, specifically geminates.

  (5.63)  **No Geminates**
          $*C_i C_i$

  **No Geminates** bans sequences of identical consonants.

- By saying that degemination is responsible for forms like [eːmeela], we do essentially make it a coincidence that nasals delete both before other nasals and before fricatives.

- However, if we try to formulate a unified process of nasal deletion triggered by an unnatural class, then the systematic absence of geminates becomes a coincidence instead.


§5 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ❦ Kiowa vowel height changes ❦

The language: Kiowa (Tanoan, Oklahoma)

5.1   The unnatural class: Non-mid vowels

- Mielke (2008: 145), citing Watkins (1984): "vowel lowering and raising" before nasals targets high and low vowels, but not mid vowels.

  (23)   a.   /min/   →   [mĩn]   'about to'
         b.   /gun/   →   [gõn]   'dance/pf.'
         c.   /jan/   →   [jɛ̃n]   '2sg/pat:pl/obj.'

- Although the height changes go in opposite directions, we might want to try to unify this as a kind of centralization, laxing, or reduction.

- (24)

  | i ĩ | u ũ |
  |-----|-----|
  | e ẽ | o õ |
  |     | ɔ ɔ̃ |
  | **a ã** | |

5.2   Separate processes: Lowering and raising

- The characterization of lowering and raising as a single process rests on the assumption that the triggering environment is the same for /a/ → [ɛ] as it is for /i, u/ → [ɪ, ʊ].

- The minimal pair in (25) makes it clear that what conditions the raising of /a/ in (23c) is the preceding glide, not the following nasal.

  (25)   a.   /sjan/   →   [ʃɛ̃nʔ]   'be small pl.'
         b.   /san/    →   [sãnʔ]    'child'

- Watkins (1984: 10):

    The low front vowel /a/ is fronted and raised after /y/.

- There is thus no reason to look for a unified account of lowering and raising.

  (26)   Process:              lowering/laxing   raising/fronting
         Segments affected:    high vowels       low vowels
         Environment:          / __ [+nasal]     / j __


Conclusion: If it looks unnatural, it's worth a closer look.


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