Rethinking English /h/

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0. Goals of the talk

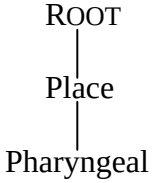
- Demonstrate that the assumption that English /h/ is featurally impoverished leads to some curious puzzles
- Explore an alternate analysis of the structure of English /h/

1. Existing possibilities for /h/

- Rose (1996) proposes that laryngeals may have one of two representations: one in which they bear a Pharyngeal node, as in (1a), and one in which they are impoverished for Place, as in (1b).

(1) *Two possible representations for laryngeals*

a)



b)

- (1a) type laryngeals are found in languages in which laryngeals contrast with pharyngeals
- (1b) type laryngeals are found in languages which lack pharyngeals

2. What about English /h/?

- English lacks pharyngeals, so English /h/ is therefore a (1b) type laryngeal.

2.1. Problem 1: coda /h/

- English /h/ doesn't behave like Placeless /h/ in other languages.
    - Placeless /h/ makes a good coda; languages which severely constrain segments that may appear in codas allow /h/ in this position.

(2) *Macushi* (Rose 1996, after Abbott 1991)

ahbu	'my foot'	ʃumba	'tray'
moh	'worm'	unda	'my mouth'
sahmaŋ	'hard'		

- In English, however, /h/ is banned from coda position.
  - This gap is surprising: Rose argues that the ability of Placeless laryngeals to appear in codas is due precisely to their lack of Place structure.
  - It may be that the coda ban in English reflects something else about /h/ in this language.

2.2. Problem 2: the case of francophone learners of English

- Francophone learners of English don't seem to treat /h/ as though it is Placeless

2.2.1. Previous research

- Francophone learners have been observed to have difficulty with English /h/ in production (Janda & Auger 1992) and perception (LaCharité & Prévost 1999).

(3) *Francophone production errors with English /h/* (Janda & Auger 1992)

"...[h]after the 'olidays..."
"...who (=[u]) [h]are well-informed people..."
"...'ead[h]ache..."
"...'[h]ass'ole..."

(4) *Accuracy rates on /h/ in AX test by francophones* (LaCharité & Prévost 1999)

Total subjects	< 60 % correct	60% - 80% correct	> 80% correct
15	6	4	5

- Brown (1997, 2000) argues that those novel L2 segments which present persistent difficulty to learners are those which require some feature that is not contrastive in the L1 grammar.
  - If English /h/ is as in (1b), it is unclear what feature this could be.
  - Behaviour of francophone learners of English thus appears to be a counterexample to Brown's hypothesis.

2.2.2. An alternate possibility?

- This difficulty could plausibly arise out of purely acoustic considerations.
  - /h/ is a low intensity non-strident voiceless fricative, produced with no inherent constriction in the vocal tract (Ladefoged 2001).

- These properties may conspire, with the result being that /h/ cannot be reliably detected in the speech stream.

- Testing this alternate possibility: Mah, Steinhauer & Goad (2006)
  - An event-related potential (ERP) study, eliciting the mismatch negativity (MMN) as an *automatic* measure of discrimination (Näätänen 1999).
  - Compared performance on /h/ as a linguistic item (5a) vs. /h/ as a non-linguistic item (5b).

(5) *Stimulus pairs*

a) *Linguistic condition (syllables)* b) *Non-linguistic condition (noise bursts)*

[hʌm] vs. [ʌm] [hf] vs. [f]

  - Non-linguistic items were created from sounds recorded for linguistic items: the [h] in [hʌm] was used to create [hf].
  - Stimuli were presented in an adapted oddball paradigm (Phillips et al. 2000).
    - Multiple recordings of each item were used, so discrimination could not be made on the basis of a single acoustic token.
    - Instead, discrimination is made on the basis of representations abstracted across stimuli.
  - Results:
    - In the non-linguistic condition, francophones perform like native English speakers: they show a large significant MMN.

Figure 1a: Native English speaker responses – non-linguistic condition

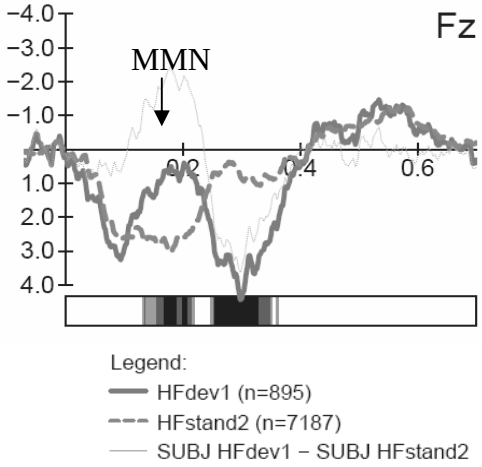
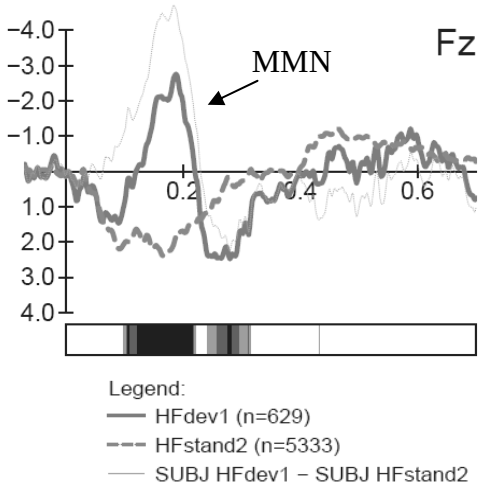


Figure 1b: Francophone responses – non-linguistic condition



- These results suggest that francophones (and anglophones) are able to detect the presence of /h/ on deviant [hf] items among [f] standards.

- In the linguistic condition, francophones' performance differs significantly from that of native English speakers: here, while the native English speakers show a significant MMN, the francophones do not.

Figure 2a: Native English speaker responses – linguistic condition

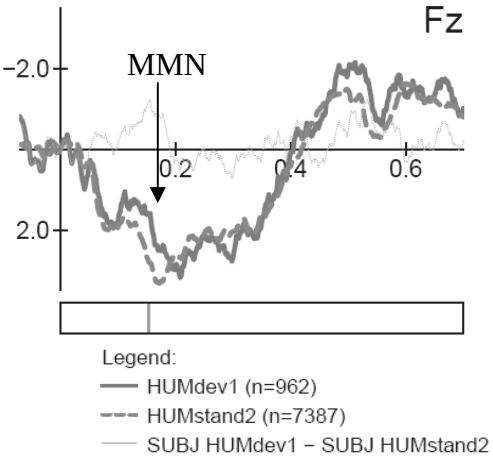
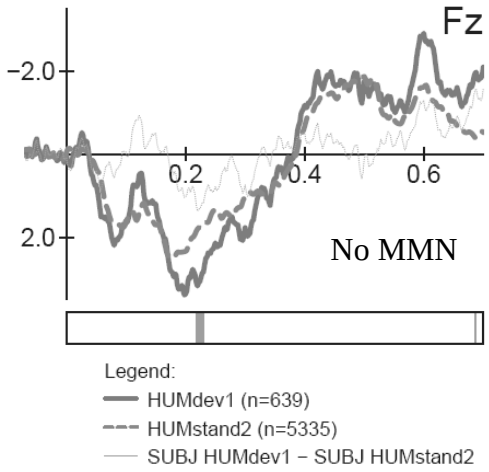


Figure 2b: Francophone responses – linguistic condition



- These results suggest that, unlike native English speakers, francophones are unable to detect the presence of /h/ on deviant [hʌm] items among [ʌm] standards.

- We thus have evidence against the hypothesis that it is the acoustic properties of /h/ that make it problematic for francophones.

- Once again, francophone learners of English appear to be a counterexample to Brown.
  - Only if we assume that /h/ is as in (1b). What if it's not?

3. An alternative to (1b)

3.1. Voicing in English

- Several recent works have argued that voicing in English is not stored in representations through the feature [voice], as in (6a), but rather through [spread glottis] ([SG]) (or equivalent), as in (6b) (Harris 1994, Iverson & Salmons 1995, Avery 1996).

(6) *Voicing in English*

a) /p, t, k/ /b, d, g/ b) /p, t, k/ /b, d, g/
| |
[voice] [SG]

- There is, however, evidence indicating that this position is too strong: Curtin, Goad & Pater (1998) found that native English speakers taught Thai words exploiting the language's three-way laryngeal contrast performed significantly more poorly on the Plain vs. Aspirated contrast than they did on the Voiced vs. Plain contrast, suggesting that the

Plain vs. Aspirated contrast was funneled into a single input representation. Since the task tapped stored representations, these results support (6a).

- Under (6a), aspiration results from undominated position sensitive constraints, e.g. $_{Ft}$[SG, $_{PWd}$[SG.

3.2. [SG]?

- Could [SG] play a role in the input representation of /h/? That is, could /h/ be as in (7)?

(7) *English /h/*

ROOT
|
Laryngeal
|
[SG]

3.2.1. Evidence for (7): target English

- In English, the distribution of /h/ exactly mirrors the distribution of aspiration (Jensen 1993: 33 (/h/), 129 (aspiration)), which is marked by the feature [SG] (Jensen 1993: 129).
  - Both occur word-initially, both in stressed (8a, b) and unstressed (8c, d) syllables.
  - Both occur word-medially in the onsets of stressed syllables (8e, f), but not unstressed syllables (8g, h).

(8) *Distribution of /h/ and aspiration in English*

a)	hábit	b)	[p^h]árent
	hístory		[t^h]órrent
	hórror		[k^h]áptive
c)	habítual	d)	[p^h]aréntal
	histórical		[t^h]orréntial
	horréndous		[k^h]aptívity
e)	vehícular	f)	a[t^h]ómic
	prohíbit		ra[p^h]ídity
	habílitate		cir[k^h]úitous
g)	vé~~h~~icle	h)	á[t/ɾ]om
	pro~~h~~ibítion		rá[p]id
	re~~h~~abílitate		cír[k]uit

3.2.2. Evidence for (7): L1 acquisition of English

- /h/ and aspiration *emerge* at almost the same point in the productions of Amahl, an English-speaking child (Smith 1973).

Table 1: Amahl's /h/ production

Stage	Age (years.days)	Number of targets	[h] Production	[h] Deletion	Other
1-13	2.60-2.242	84	0	98%	2%
14-15	2.247-2.271	28	46%	54%	0
16-29	2.271-3.355	81	96%	3%	1%

Table 2: Amahl's aspiration production

Stage	Age (years.days)	Number of targets	Aspirated [p^h t^h k^h]	Vclss Fortis [p t k]	Vclss Unasp Lenis [b̥ d̥ g̊]	Other
1-12	2.60-2.227	465	0	19%	78%	3%
13-18	2.233-2.312	223	41%	56%	0	3%
19-29	2.317-3.355	236	96%?[1]	0?	0	4%

4. Consequences of (7)

- If (7) is the correct representation for English /h/, then the puzzles seen here may be accounted for.
  - The ban on coda /h/ follows from the well-attested observation that laryngeal features are often barred from this position; [SG] is banned from coda position in English.
  - A representation like (7) with [SG] specified may allow us to account for the observations about francophone learners of English in a way that is consistent with Brown's hypothesis, as [SG] is not contrastive in French.

[1]Smith does not transcribe aspiration after Stage 19. Though he does not say this directly, we assume that this change indicates that aspiration had become target-like; he offers the following comment: "The other main development [at Stage 13] was also partially a function of the completion of the acquisition of voicing contrasts. At this stage A[mahl] (usually) had the correct allophones of the voiced and voiceless segments; for instance, voiceless plosives were aspirated initially, etc." (p. 118).

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