Taking a free ride can cau[ɹ]se severe hyperrhoticity

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But I'm a creep,
I'm a weirdo
What the hell am I doin' here?
I don't belong here
(Radiohead (1993), 'Creep'; *Pablo Honey*)

1 Introduction – postvocalic *r* in accents of English

(1) English *r* neutralisation, linking and intrusive *r* (Eastern Mass. and BBC/RP)

a.	[sɔː]	'soar'	f.	[sɔːɹɪŋ]	'soaring'
b.	[sɔː]	'saw'	g.	[sɔːɹɪŋ]	'sawing'
c.	[kɑː]	'car'	h.	[kɑːɹɔːbaɪk]	'car or bike'
d.	[tʲuːnə]	'tuner'	i.	[tʲuːnəɹɪnɔɪl]	'tuner in oil'
e.	[tʲuːnə]	'tuna'	j.	[tʲuːnəɹɪnɔɪl]	'tuna in oil'

(2) Hyperrhoticity in Massachusetts and New York (Wells 1982, Gordon 2004)

a.	[aɪdɪəɹ]	'idea'
b.	[wɒɹʃɪŋtən]	'Washington'
c.	[klɒɹθ]	'cloth'

(3) New York English (Gordon 2004)

a. Non-rhotic		b. Hyper-rhotic	
[stɒət]	'start'	[vɜɹs]	'voice/verse'
[kɑət]	'cart'	[tɜɹlət]	'toilet'
[noəθ]	'north'		
[nɜɪs]	'nurse'		

This type of hyperrhoticity is mostly found in accents which have been non-rhotic and have 'returned' to rhoticity (under pressure from General American).[1]

(4) Southern US English: no intrusion (Wells 1982)

a.	[sɔː]	'soar'	c.	[sɔːɹɪŋ]	'soaring'
b.	[sɔː]	'saw'	d.	[sɔːɪŋ]	'sawing'

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[1] For the reverse, rhotic accents becoming hyperrhotic under pressure from an intrusion variety see end of sec. 4.

Southern US assimilated to GenAm: No hyperrhoticity attested.

Underlying representations: Nonrhotic Southern US English has an underlying contrast detectable in morphophonological alternations. For learners of intrusion accents it is an all or nothing choice: Underlying *r* in all forms or in none (Gick 2002).

(5) Lexical merger in intrusion accents

a. /tunə/, /tunɹ/ → /tunɹ/

b. /tunə/, /tunɹ/ → /tunə/ ‘tuna’ ‘tuner’

Halle & Idsardi (1997), Hale & Reiss (2000): *r* insertion is an unnatural phonological process. Can be accounted for by a language-specific rule.

Answer: *r* is a glide. Intrusive *r* emerges through glide formation, parallel to the high glides *j* and *w*. (See Gnanadesikan 1997, Ortmann 1998, Gick 1999, Baković 1999, Krämer, to appear, but cf. Uffmann 2007)

Wells (1982) assumes an *r* insertion rule for hyperrhoticity. Such a rule would have to insert *r* after every nonhigh vowel. That is, encounter of words like [fɑɹm] leads the learner to insert *r* after all non-high vowels.

(6) *r* insertion rule: $\text{Ø} \rightarrow \text{r} / V_{[\text{-high}]}$ ___

This is possible in rule-based phonology, but not in OT.

(7) OT: Markedness constraints object against marked structure.

*CODA:	Syllables do not have a coda.
*COMPLEX:	Syllables do not have a complex onset or a complex coda.
ONSET:	Syllables have an onset.

r insertion creates a coda (Wa[ɹ]shington), or, worse, a complex coda (clo[ɹ]th).

Increase in markedness can be caused by faithfulness or conflicting markedness.

E.g., syllabification of more than one consonant into one onset in avoidance of a coda creates a complex onset. Same vice versa: Avoidance of complex onsets can be achieved by toleration of codas.

Which markedness constraint could cause the emergence of *r* in codas after nonhigh vowels? Answer: No constraint.

Hypercorrection is a side effect of L1 lexicon acquisition by nonrhotic speakers.

When storing lexical entries for items with alternating *r* they overgeneralise to items without alternation possible.
Once these speakers switch to rhoticity (L2) all underlying *r*'s are realised, which is a superset of the *r*'s emerging in originally rhotic speakers.

McCarthy (2004): Free Rides are taken to increase r-measure.
Here: Free Ride is taken to increase exhaustivity of ranking.

(8) Exhaustivity of ranking
Exhaustivity value (e) = number of unranked constraints.
When confronted with two grammars G_1 and G_2, of which G_1 has an exhaustivity value of x and G_2 a value of y, with $y < x$, a learner prefers G_2.

(9) Exhaustivity value

Grammar G_1: C1 » *C2, C3, C4* » C5	e = 3	(bad)
Grammar G_2: C1 » *C2, C3* » C4 » C5	e = 2	(better)
Grammar G_3: C1 » C2 » C3 » C4 » C5	e = 0	(perfect)

In the acquisition of intrusion varieties, all alternating forms with intrusion and linking are stored with an underlying *r*. This gives rise to a more exhaustively ranked grammar.

2 Background on acquisition

Free rides in phonological acquisition: Example of flapping (not from McCarthy).

In many varieties of English coronal stops are flapped between vowels.

Some flaps don't alternate (e.g., *butter*), some do (as in *hit* / *hitting*)

Once a learner has detected the alternation, s/he can generalise the same unfaithful mapping to nonalternating forms. This gives evidence for a more restrictive grammar.

(10) Starting point of Learning: *FLAP, *VTV » IDENT(son)
(general assumption: M » F at H_0)

Learning step 1: encounter of [bʌɾɹ]; demote M: IDENT(son) » *FLAP

(11)

/ bʌɾɹ /	*FLAP	*VTV	IDENT(son)
[bʌɾɹ] > [bʌtɹ]	L	W	W

Learning step 2: encounter of alternation: [hɪt / hɪɾɪŋ]

*VTV » IDENT(son) (given by H_0)

(12)

/ hɪt -ɪŋ /	*VTV	IDENT(son)	*FLAP
[hɪɾɪŋ] > [hɪtɪŋ]	W	L	L

Learning step 3: Generalisation

∀[ɾ] → /t/

The constraint that favours /ɾ/ → [ɾ] over /ɾ/ → "something else" is demoted under the markedness constraint against flaps:

H_0: *VTV, *FLAP >> IDENT(son)

H_1: *VTV >> IDENT(son) >> *FLAP

H_2. *VTV >> *FLAP >> IDENT(son)

(13) UR formation with LO

	*VTV	IDENT(son)	*FLAP
/ bʌTɹ / - [bʌtɹ]	*!		
/ bʌTɹ / - [bʌɾɹ]		*	*
/ bʌɾɹ / - [bʌɾɹ]			*

Nevins & Vaux (2007): Americans occasionally produce [t] in no-alternating flapping contexts: *enchila*[t]*a* for *enchilada*.

Why should anybody bother if H_1 already produces the right results?

(14) The subset problem: If there are two grammars G_1 and G_2, corresponding to language L_1 and language L_2, respectively, and the output of G_1 is a subset of the output of G_2, then a learner should arrive at G_1 rather than G_2.
Once the learner has hypothesised the more permissive grammar G_2 there is no positive evidence that could lead her to the more restrictive grammar G_1.
(see Baker 1979, Angluin 1980, Prince and Tesar 2004)

(15) The Richness of the Base Hypothesis
The source of all systematic cross-linguistic variation is constraint reranking. In particular, the set of *inputs* to the grammars of all languages is the same. The grammatical inventories of a language are the *outputs* which emerge from the grammar when it is fed the universal set of possible inputs.
(Smolensky 1996: 5)

(16) Desired ranking in line with RotB

/ ɾʌbɹ /	*VTV	*FLAP	IDENT(son)
a. [ɾʌbɹ]		*!	
b. [tʌbɹ]			*
☞ c. [ɹʌbɹ]			

(17) Current ranking

/ ɾʌbɹ /	*VTV	IDENT(son)	*FLAP
💣 a. [ɾʌbɹ]			*
b. [tʌbɹ]		*!	

The intermediate flapping grammar is less restrictive than the initial ranking. Moreover, the non-occurrence of the flap in word-initial and word-final positions is an accidental gap. (see tableaux above)

(18) The r-measure

The r-measure for a constraint hierarchy is determined by adding, for each faithfulness constraint in the hierarchy, the number of markedness constraints that dominate that faithfulness constraint. (Tesar & Prince 2004: 252)

(19) r-measures for flapping grammars

H_0: *VTV, *FLAP >> IDENT(son) r-measure = 2 (too restrictive)
H_1: *VTV >> IDENT(son) >> *FLAP r-measure = 1 (too permissive)
H_2. *VTV >> *FLAP >> IDENT(son) r-measure = 2 (just right)

(20) OT ranking for non-structure preserving phonology:

Phono-Constraint >> *X >> Faith(x)

Since learners cannot rely on negative evidence (e.g., the non-occurrence of flaps in initial and final position) they have to rely on something else.
Alternations alone do not always do the job.

In this case, the BCD algorithm (Prince & Tesar 2004) actually gives us the right grammar without a Free Ride:

(21) Faithfulness Delay

On each pass, among those constraints suitable for membership in the next stratum, if possible place only *markedness constraints*. Only place faithfulness constraints if no markedness constraints are available to be placed in the hierarchy.

(22) H_0: *VTV, *FLAP >> IDENT(son)
H_1: *VTV >> *FLAP >> IDENT(son)

McCarthy (2004): Free ride works only with complete neutralisation, not with positional neutralisation.

(23) German final devoicing

a.	Rat	[...t]	'advice'	c.	dick	[#d...]	'fat'
	Räte	[...t...]	'advice' pl.	d.	Tick	[#t...]	'tick'
b.	Rad	[...t]	'wheel'				
	Räder	[...d...]	'wheels'				

Once the learner has detected the /d/ - [t] unfaithful map, s/he could take a free ride and posit underlying /d/ for all surface [t]s.

Some German learning children do so, which is manifest in a deaspiration pattern displayed in acquisition (Grijzenhout and Joppen 1999).

"Taking a free ride on a neutralization process is a bad choice. the FRLA requires learners to consider this choice, but through BCD it also supplies a way of rapidly detecting the error and recovering from it." (McCarthy 2004: 14)
(FRLA: Free Ride Learning Algorithm; BCD Biased Constraint demotion)

In fact: Learners take too many free rides and sometimes get caught for dodging the fare (see German; see Kager's 1999 example from Dutch temporary inter-V voicing; see the 'sporatic enchilata syndrome' reported by Nevins & Vaux 2007).

If learners of nonrhotic varieties of English posit more underlying *r*s than we find in surface forms in rhotic varieties, this has no consequences since most nonrhotic varieties have intrusive *r* anyway, i.e., the 'wrong' underlying forms don't make a difference at the surface - except when these speakers convert to rhotic GA.

3 A grammar for r intrusion

(24) Following Bermudez-Otero (2006), Krämer (to appear):
- r-intrusion is breaking of lax non-high vowels
- r-dropping is vocalisation/coalescence (depending on the preceding vowel)

(25) Following Itô & Mester (2007), r-insertion is triggered by ONSET
(rather than FINAL-C, as proposed by McCarthy 1993)

(26) Faithfulness constraints
a. MAX: No deletion. (Ranks high, /r/ is never literally deleted.)
b. DEP-C: No insertion. (Ranks high, low glide formation preferred over C insertion.)
(We will also need DEP-V.)

c. UNIFORMITY ‘No coalescence.’ */a i/ -> [e] or */ə$_1$ɹ$_2$/ -> [ə$_{1,2}$]

d. INTEGRITY ‘No breaking.’ */e/ -> [ai] or / ə$_1$/ -> [ə$_1$ɹ$_1$]

e. IDENT(cor)

f. IDENTONSET(cor)

(27) Markedness constraints

a. ONSET

b. *r

(28) Intrusive ranking

H$_{FINAL}$: ONSET, DEP-C » IDO, MAX » *r » UNIFORMITY, INTEGRITY, IDENT, DEP-V

(29) r-drop as coalescence

/tuːnəɹ/	ONS	DEP-C	IDO	MAX	*r	UNIFORM	INTEGR	ID	DEP-V
a. tuːnə$_1$ɹ$_1$					*!				
b. tuːnə$_1$ɹ$_2$					*!				
☞ c. tuːnə$_{1,2}$						*		*	
d. tuːnə$_1$				*!					
e. tuːnə$_1$ɹ$_2$ə$_3$					*!				*
f. tuːnə$_1$ɹ$_2$ə$_2$					*!		*		

(30) Intrusion as breaking

/tuːnə ɪn/	ONS	DEP-C	IDONS	MAX	*r	DEP-V	ID	UNIF	INTEGR
☞ a. tuːnə$_1$ɹ$_1$ɪn			*		*		*		*
b. tuːnə$_1$ɹ$_2$ɪn		*!			*				
c. tuːnə$_1$ʔ$_2$ɪn		*!							
d. tuːnə ɪn	*!								

4 Hyperrhoticity as a free ride effect in the acquisition of *r* intrusion

(31) Initial ranking - H$_0$:

ONSET, *r » DEP-C, IDO, MAX, UNIFORMITY, INTEGRITY, IDENT, DEP-V

(32) Step 1: Encounter *r* in onsets.

/ɹ$_1$a$_2$ɪd/	ONS	*r	DEP-C	DEP-V	MAX	IDO	ID	UNIF	INTEGR
a. ɹaɪd › a$_{1,2}$ɪd	W	L				W	W	W	
b. ɹaɪd › a$_2$ɪd	W	L			W				
c. ɹaɪd › w$_1$a$_2$ɪd		L				W	W		
d. ɹaɪd › ʔa$_2$ɪd		L	W		W				
e. ɹaɪd › ʔ$_1$a$_2$ɪd		L				W	W		

IDENTONS » *r (3 cand’s) ONSET » *r (2 cand’s); MAX » *r (2 cand’s)

Save surface forms as URs (e.g., /t$^{(j)}$uːnə/ for both ‘tuner’ and ‘tuna’).

(33) Learner encounters *r* intrusion

/tuːnə ɪn/	ONS	IDONS	MAX	*r	DEP-C	DEP-V	ID	UNIF	INTEGR
☹ a. tuːnə$_1$ɹ$_1$ɪn		*!		*			*		*
b. tuːnə$_1$ɹ$_2$ɪn				*!	*				
💣 c. tuːnə$_1$ʔ$_2$ɪn					*				
d. tuːnə ɪn	*!								

(34) Learning intrusion

/tuːnə ɪn/	ONSET	IDO	MAX	*r	DEP-C	DEP-V	ID	UNIF	INTEGR
a. tuːnə$_1$ɹ$_1$ɪn › tuːnə ɪn	W	L		L			L		L
b. tuːnə$_1$ɹ$_1$ɪn › tuːnə$_1$ʔ$_2$ɪn		L		L	W		L		L
c. tuːnə$_1$ɹ$_1$ɪn › tuːnə$_1$ɹ$_2$ɪn		L			W		L		L

Pairs (b,c) show: DEP-C ›› IDENTONSET

(35) Successfully learned *r* intrusion

/tuːnə ɪn/	ONS	DEP-C	IDONS	MAX	*r	DEP-V	ID	UNIF	INTEGR
☞ a. tuːnə$_1$ɹ$_1$ɪn			*		*		*		*
b. tuːnə$_1$ɹ$_2$ɪn		*!			*				
c. tuːnə$_1$ʔ$_2$ɪn		*!							
d. tuːnə ɪn	*!								

At this stage all data are exhausted. No further learning is possible.

(36) (Pre-)Final ranking - H_F:
ONSET » DEP-C » IDO, MAX » *r » UNIFORMITY, INTEGRITY, IDENT, DEP-V

On the basis of detected alternations change URs: /tuːnə/ → /tuːnəɹ/
Free Ride: Change ALL URs containing the appropriate context.

(37) Free Ride:

a.	/t$^{(j)}$uːnə/	→	/t$^{(j)}$uːnə$_1$ɹ$_2$/	[t$^{(j)}$uːnə]	‘tuna’
b.	/t$^{(j)}$uːnə/	→	/t$^{(j)}$uːnə$_1$ɹ$_2$/	[t$^{(j)}$uːnə]	‘tuner’
c.	/kɑ/	→	/kɑ$_1$ɹ$_2$/	[kɑː]	‘car’
d.	/wɒʃ/	→	/wɒ$_1$ ɹ$_2$ʃ/	[wɒʃ]	‘wash’
e.	...				

Does the learner gain any new information for the ranking from the new input-output mappings?

(38) Changed URs don't make a difference in the surface pattern

/tuːnəɹ/	ONS	DEP-C	IDO	MAX	*r	UNIF	INTEGR	ID	DEP-V
a. tuːnə$_1$ɹ$_1$					*!				
b. tuːnə$_1$ɹ$_2$					*!				
☞ c. tuːnə$_{1,2}$						*		*	
d. tuːnə$_1$				*!					
e. tuːnə$_1$ɹ$_2$ə$_3$					*!				*
f. tuːnə$_1$ɹ$_2$ə$_2$					*!		*		
/wɒ$_1$ɹ$_2$ʃ/									
☞ g. wɒ$_{1,2}$ʃ						*		*	
h. wɒ$_1$ʃ				*!					
i. wɒ$_1$ɹ$_2$ə$_2$ʃ					*!		*	*	
j. wɒ$_1$ɹ$_2$ə$_3$ʃ					*!				*
k. wɒ$_1$ə$_2$ʃ	(*)							*	
l. wɒ$_1$ɹ$_2$ʃ					*!				

(An additional constraint against centring diphthongs comes into play for the non-New Yorkers (cand. k), but I ignore this here to keep things simple.)

(39) Learning continues I

/tuːnəɹ/	ONS	DEP-C	IDO	MAX	*r	UNIF	INTEGR	ID	DEP-V
a. tuːnə$_{1,2}$ › tuːnəɹ					W	L			
b. tuːnə$_{1,2}$ › tuːnə$_1$				W		L		L	
c. tuːnə$_{1,2}$ › tuːnə$_1$ɹ$_2$ə$_3$		W			W	L			W
d. tuːnə$_{1,2}$ › tuːnə$_1$ɹ$_2$ə$_2$					W	L			

Pair (c) shows: DEP-V above UNIFORMITY, Pair (d): *r ›› UNIFORMITY

(40) Learning continues II

/dɒɹg/	ONS	DEP-C	MAX	IDO	*r	DEP-V	INTEGR	UNIF	ID
a. dɒ$_{1,2}$g › dɒɹg					W			L	L
b. dɒ$_{1,2}$g › dɒ$_1$g			W					L	L
c. dɒ$_{1,2}$g › dɒɹ$_2$ə$_2$g					W		W	L	
d. dɒ$_{1,2}$g › dɒɹ$_2$ə$_3$g					W	W		L	
e. dɒ$_{1,2}$g › dɒə$_2$g	W							L	

i. INTEGRITY can be ranked above UNIFORMITY

No decisive new rankings, but the number of unranked constraints has been reduced.

What happens if such a speaker when grown up encounters a new word and uses it in intrusion context? Presumably s/he doesn't give it a free ride. At least it's not necessary:

(41) E.g., Norwegian *lefse* 'thin soft flatbread' as in 'I ate lefse in Norway.'

/lefsə ɪn/	ONSET	DEP-C	IDO	MAX	*r	INTEGR	DEP-V	ID	UNIF
a. lefsə ɪn	*!								
b. lefsə$_1$ɹ$_2$ɪn		*!			*				
c. lefsəʔ$_2$ɪn		*!							
☞ d. lefsə$_1$ɹ$_1$ɪn			*		*	*		*	

(42) Comparison of rankings

a. Post-Free Ride ranking - H_{PFR}: e = 4

ONSET » DEP-C » IDO, MAX » *r » INTEGRITY » DEP-V » IDENT, UNIFORMITY

b. (Pre-)Final ranking - H_F: e = 6

ONSET » DEP-C » IDO, MAX » *r » UNIFORMITY, INTEGRITY, IDENT, DEP-V

c. $H_{PFR} > H_F$

The difference between intrusion dialects and those without is the relative ranking of INTEGRITY and IDENTONSET.

If a speaker who has taken this free ride shifts to a rhotic accent the now underlying post-vocalic *r*s in words such as *cough* will surface once *r is demoted under the faithfulness block.

(43) Learning rhoticity

/wɒ$_1$ɹ$_2$m/	ONS	DEP-C	MAX	IDO	*r	DEP-V	INTEGR	ID	UNIF
a. wɒɹm › wɒ$_{1,2}$m					L			W	W
b. wɒɹm › wɒ$_1$m			W						
c. wɒɹm › wɒ$_1$ɹ$_2$ə$_2$m							W		
d. wɒɹm › wɒ$_1$ɹ$_2$ə$_3$m						W			
e. wɒɹm › wɒ$_1$ə$_2$m					L			W	

(44) Rhoticity

/wɒ$_1$ɹ$_2$m/	ONS	DEP-C	MAX	IDO	DEP-V	INTEGR	ID	*r	UNIF
a. wɒ$_{1,2}$m							*!		*
b. wɒ$_1$m			*!						
c. wɒ$_1$ɹ$_2$ə$_2$m						*!	*	*	
d. wɒ$_1$ɹ$_2$ə$_3$m					*!			*	
e. wɒ$_1$ə$_2$m							*!		
☞ f. wɒ$_1$ɹ$_2$m								*	

Now all these underlying /r/'s surface, i.e., the learner has become hyperrhotic.

(45) Hyperrhoticity

/wɒ$_1$ɹ$_2$ʃ/	ONS	DEP-C	MAX	IDO	DEP-V	INTEGR	ID	*r	UNIF
a. wɒ$_{1,2}$ʃ							*!		*
b. wɒ$_1$ʃ			*!						
c. wɒ$_1$ɹ$_2$ə$_2$ʃ						*!	*	*	
d. wɒ$_1$ɹ$_2$ə$_3$ʃ					*!			*	
e. wɒ$_1$ə$_2$ʃ							*!		
☞ f. wɒ$_1$ɹ$_2$ʃ								*	

The distinction between pairs like 'law' and 'lore' has to be learned token-wise now.

> "Since hyper-rhotic pronunciations (...) are even more ludicrous in the eyes of the American majority than traditional Boston non-rhoticity, they are unlikely to become established." (Wells 1982: 522)

If learners of ('old fashioned') **Southern US English** go for the free ride at all, they will reverse this decision once they come across positive evidence to do so, i.e., only SOME nonhigh vowels have an *r* following if another vowel follows.
Hence, after that overgeneralisation is repaired, only the historical underlying *r*'s are stored.
Once these speakers turn to rhotic GenAm, there are no hidden underlying *r*'s that could go wild.

West England/Wales: According to Trudgill (1986) and Britain (in press), hyperrhoticity is an overreaction in the struggle against incoming nonrhoticity, that is the local feature of rhoticity is enforced by introducing nonetymological postvocalic rhotics.
Confronted with intrusive *r* rhotic learners go through the same Free Ride to increase exhaustivity of domination.

5 Conclusion

- hyperrhoticism can be accounted for as a side effect of lexicon acquisition (same for hyperlambdacity, described in Gick 2002);
- no further machinery is necessary in OT;
- grammars strive for exhaustive ranking

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