How crazy is English *r* insertion?
Or: Can OT account for the 'unnatural'?

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1. Introduction

1.1 Death and resurrection of 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 only found in accents which have been non-rhotic and have returned to rhoticity (under pressure from General American).

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

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

Southern US assimilated to GenAm: No hyperrhoticity attested.

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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/ → /tunə/ 'tuna'
   /tunɹ/ → 'tuner'

1.2 Questions to be answered regarding the (un)naturalness of English r *patterns:*

1. Why is *r* inserted and not one of the usual suspects for epenthesis?

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, in press)

2. How can hyper-rhoticity emerge? Is this a grammatical process or extragrammatic hypercorrection?

Wells (1982) assumes an *r* insertion rule. 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: $\emptyset \rightarrow r / V_{[-high]} \_\_$

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?

?

So, is hyperrhoticity outside OT grammar?

And: if Hale & Reiss (2000) are correct in assuming that grammar (phonology) as a computational system has to account for unnatural processes, but not for phonetically, physiologically etc. conditioned patterns, and if OT cannot model the unnatural (e.g., hyperrhoticity), is OT then to be rejected as a theory of grammar?

Is hyperrhoticity the evidence that falsifies OT as a theory of grammar?

Answer:

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.

Thus: We do not have to reject OT as a theory of grammar.

2. Explaining hyperrhoticity

In the acquisition of type (a), all alternating forms with intrusion and linking are stored with an underlying *r*. This gives rise to a more restrictive grammar.

2.1 Taking a Free Ride in morphophonemic Learning (McCarthy 2004)

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

In many American English and some British and Irish English varieties (e.g., Northern Irish) 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.

(8) 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

(9)

/ 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)

(10)

/ 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)

(11)

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

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

(12) 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)

(13) 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)

(14) Desired ranking in line with RotB

/ ɾʌbɪ /	*VTV	*FLAP	IDENT(son)
a. [ɾʌbɪ]		*!	
☞ b. [tʌbɪ]			*

(15) Current ranking

/ ɾʌbɪ /	*VTV	IDENT(son)	*FLAP
💣 a. [ɾʌbɪ]			*
b. [tʌbɪ]		*!	

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

(16) 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)

(17) 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)

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

PhonoConstraint >> *X >> Faith(x)

Since learners cannot rely on negative evidence (e.g., the nonoccurrence 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, BCD algorithm (Prince & Tesar 2004) actually gives us the right grammar without a Free Ride:

(19) **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.

(20)

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.

(21) 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).

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.

2.2 A grammar for r *intrusion*

(22) Following McCarthy (1993), Baković (1999), Krämer (to appear):
H_{FINAL}: ONSET-r » MAX-IO, DEP-IO » FINAL-C » INTEGRITY, IDENT(coronal) » *r

(23)

/tʲuːnə$_1$ɹ$_2$/	ONSET-r	DEP-IO	MAX-IO	FINAL-C	IDENT(cor)	INTEGRITY	*r
a. tʲuːnə$_1$ɹ$_2$	*!						*
b. tʲuːnə$_1$			*!				
☞ c. tʲuːnə$_{1,2}$				*	*	*	

(24)

/tʲuːnə ɪn/	ONSET-r	DEP-IO	MAX-IO	FINAL-C	IDENT(cor)	INTEGRITY	*r
a. tʲuːnə ɪn				*!			
☞ b. tʲuːnəɹ ɪn					*	*	*

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

(25) Initial ranking - H_0:

ONSET-r, FINAL-C, *r » DEP-IO, MAX-IO, IDENT(cor), INTEGRITY

(26) Step 1: Encounter of vowel-final words (e.g., [tʲuːnə])

/ tʲuːnə /	ONSET-r	FINAL-C	*r	DEP	MAX	IDENT(cor)	INTEGRITY
a. tʲuːnə › tʲuːnə$_1$C$_1$	W	L				W	W
b. tʲuːnə › tʲuːnə$_1$C$_2$		L		W			
c. tʲuːnə › tʲuːn		L			W		

- Action: Demote FINAL-C below ONSET-r (a); below DEP-IO (b); below MAX-IO (c).
- Result:

H_1: ONSET-r, *r » DEP-IO, MAX-IO » FINAL-C » IDENT(cor), INTEGRITY

Save surface forms as URs (e.g., /tʲuːnə/ for both 'tuner' and 'tuna').

(27) Step 2: Encounter *r* in onsets.

/ ɹ$_1$a$_2$ɪd /	ONSET-r	*r	DEP	MAX	FINAL-C	IDENT(cor)	INTEGRITY
a. ɹaɪd › a$_{1,2}$ɪd		L				W	W
b. ɹaɪd › a$_2$ɪd		L		W			

- Action: demote *r below Faith:
- Result: H_2

ONSET-r » DEP-IO, MAX-IO, » FINAL-C » IDENT(cor), INTEGRITY » *r

(28) Step 3: Encounter *r* insertion (e.g., [tʰu:nə ɹ ɪnɔɪl])

/ tʰu:nə ɪn /	ONS-r	DEP	MAX	FINAL-C	IDENT	INTEGRITY	*r
a. tʰu:nə$_1$ɹ$_1$ɪn › tʰu:nə ɪn				W	L	L	L
b. tʰu:nə$_1$ɹ$_1$ɪn › tʰu:nə$_1$ʔ$_2$ɪn		W			L	L	L
c. tʰu:nə$_1$ɹ$_1$ɪn › tʰu:nə$_1$ɹ$_2$ɪn		W			L	L	
d. tʰu:nə$_1$ɹ$_2$ɪn › tʰu:nə ɪn		L		W			L
e. tʰu:nə$_1$ɹ$_2$ɪn › tʰu:nə$_1$ʔ$_2$ɪn		L					L

Epenthetic *r* always loses out against epenthetic glottal stop (e). Epenthetic glottal stop loses out against glide formation (b) in this grammar.
- Action: None. Glide formation happens automatically.

The algorithm stops here.

No winner-loser pairs left over.

Grammar produces desired outputs.

(29)

/tʰu:nə ɪn/	ONS-r	DEP	MAX	FINAL-C	IDENT(cor)	INTEGRITY	*r
☺ a. tʰu:nə$_1$ɹ$_1$ɪn					*	*	*
b. tʰu:nə$_1$ɹ$_2$ɪn		*!					
c. tʰu:nə$_1$ʔ$_2$ɪn		*!					
d. tʰu:nə ɪn				*!			

Step 4: Learner encounters intervocalic *r* after [ə, ɔ, ɒ, ɑ], but not after [i, u].
The learner takes a Free Ride: All nonhigh vowels are followed by an underlying *r*:

(30) New underlying representations at this stage:

a.	/ tʰu:nə$_1$ɹ$_2$ /	[tʰu:nə]	'tuna'
b.	/ tʰu:nə$_1$ɹ$_2$ /	[tʰu:nə]	'tuner'
c.	/ wɒ$_1$ ɹ$_2$ ʃ /	[wɒʃ]	'wash'
d.	/ k ɑ$_1$ ɹ$_2$ /	[kɑ:]	'car'

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

(31)

/ tʰu:nə$_1$ɹ$_2$ /	ONS-r	DEP	MAX	FINAL-C	IDENT	INTEGRITY	*r
a. tʰu:nə$_{1,2}$ › tʰu:nəɹ	W			L	L	L	W
b. tʰu:nə$_1$ › tʰu:nəɹ	W		L				W

(32)

/ tʲuːnəɹ ɪn /	ONS-r	DEP	MAX	FINAL-C	IDENT	INTEGRITY	*r
tʲuːnəɹ ɪn › tʲuːnə ɪn	W			W	L	L	L

(33)

/ ɹ$_1$a$_2$ɪd /	ONS-r	DEP	MAX	FINAL-C	IDENT	INTEGRITY	*r
a. ɹaɪd › a$_{1,2}$ɪd					W	W	L
b. ɹaɪd › a$_2$ɪd			W				L
c. ɹaɪd › ʔaɪd					W		L

Step 5: With *r*-full URs,

- the learner can rank INTEGRITY at the bottom after this reassessment.
- /*r*/'s surfacing in onsets (e.g., 'ride') are protected by high ranking MAX and by IDENT(cor).

(34)

/ ɹ$_1$a$_2$ɪd /	ONS-r	DEP	MAX	FINAL-C	IDENT	*r	INTEGRITY
a. ɹaɪd › a$_{1,2}$ɪd					W	L	W
b. ɹaɪd › a$_2$ɪd			W			L	
c. ɹaɪd › ʔaɪd					W	L	

(35)

/ tʲuːnəɹ ɪn /	ONS-r	DEP	MAX	FINAL-C	IDENT	*r	INTEGRITY
a. tʲuːnəɹ ɪn › tʲuːnə$_{1,2}$ ɪn				W	W	L	W
b. tʲuːnəɹ ɪn › tʲuːnə$_1$ ɪn			W	W		L	
c. tʲuːnəɹ ɪn › tʲuːnəʔ ɪn		W	W			L	

Grammar before Free Ride - H_3:

ONS-r » DEP, MAX » FINAL-C » IDENT(cor) » INTEGRITY » *r

r-measure: 6

Grammar after Free Ride - H_4:

ONS-r » DEP, MAX » IDENT(cor) » FINAL-C » *r » INTEGRITY

r-measure: 7

Step 8:

The learner (maybe enters school and) acquires rhotic English. First measure after encounter of *r* in coda position: Demote ONSET-r below Faith.

Imperfect rhotic grammar - H_5:

DEP, MAX » FINAL-C » IDENT(cor) » ONS-r » *r » INTEGRITY

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

(36)

	DEP	MAX	FIN-C	IDENT	ONS-r	*r	INTEGR
☞ a. / wɒɹʃ / [wɒɹʃ]					*	*	
b. / wɒɹʃ / [wɒʃ]				*!			*
☹ c. / wɒɹʃ / [wɒʃ]		*!					
☞ d. / aɪdɪəɹ / [aɪdɪəɹ]					*	*	
e. / aɪdɪəɹ / [aɪdɪə]			*!	*			*
☹ f. / aɪdɪəɹ / [aɪdɪə]		*!	*				

The distinction between pairs like 'tuna' and 'tuner' has to be learned token-wise now and FINAL-C has to be demoted below IDENT(cor).

> "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)

When learners of ('old fashioned') Southern US English go for the free ride, 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.

- The Subset Problem is solved without positive evidence of non-occurring forms by extending the input set.

- Even if the Free Ride would not result in a stricter ranking, what reason could there be to reverse this decision on lexical representations if it doesn't lead to ungrammatical outputs?

3. Conclusion

- intrusive *r* is not crazy (and neither is intrusive *l*, see Bermúdez-Otero 2005);

- even hyperrhoticism (very crazy at first sight, see Wells 1982) 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;

- 'Crazy' phonological patterns are no stumbling block for a theory that doesn't allow arbitrary unnatural rules/constraints;

- more generally: crazy rules are only crazy as long as we don't understand what's going on

References

Bermúdez-Otero, Ricardo (in press). Phonological Change in Optimality Theory. To appear in Keith Brown (ed.) (2005). *Encyclopedia of Languages and Linguistics*. 2nd edition. Oxford: Elsevier.

Bermúdez-Otero, Ricardo and Kersti Börjars (in press). Markedness in phonology and syntax: the problem of grounding. To appear in *Lingua*.

Gick, Bryan (1999). A gesture-based account of intrusive consonants in English. *Phonology* 16: 29-54.

Gick, Bryan (2002). The American intrusive *l*. American Speech 77: 167-183.

Gordon, Matthew J. (2004). New York, Philadelphia, and other northern cities: phonology. In Edgar W. Schneider, Kate Burridge, Bernd Kortmann, Rajend Meshtrie and Clive Upton (eds.) *A Handbook of Varieties of English. Volume 1: Phonology*. Berlin, New York: Mouton de Gruyter. 282-299.

Grijzenhout, Janet and Sandra Joppen (1999). *First Steps in the Acquisition of German Phonology: A Case Study.* Ms. Heinrich-Heine-University Düsseldorf.

Hale, Mark and Charles Reiss (2000). Substance abuse and dysfunctionalism: Current trends in phonology. *Linguistic Inquiry* 31: 157-169.

Halle, Morris and William J. Idsardi (1997). *r*, Hypercorrection, and the Elsewhere Condition. In Iggy Roca (ed.) *Derivations and Constraints in Phonology*. Oxford: Clarendon Press.

Kahn, Daniel (1976). *Syllable-based Generalizations in English Phonology*. Phd. thesis, MIT.

Kamińska, Tatiana Ewa (1995). *Problems in Scottish English Phonology*. Tübingen: Niemeyer.

Lamontagne, Greg and Keren Rice (1995). A correspondence account of coalescence. *University of Massachusetts Occasional Papers in Linguistics* 18: 211-224.

McCarthy, John J. (1993). A case of surface constraint violation. *Canadian Journal of Linguistics/Revue Canadienne de Linguistique* 38: 169-195.

McCarthy, John J. (2004). Taking a Free Ride in Morphophonemic Learning. Ms. UMass. To appear in *Catalan Journal of Linguistics* 4 (Special issue on Phonology in Morphology, ed. by Maria Rosa Lloret and Jésus Jiménez).

McCarthy, John J. and Alan S. Prince (1995). Faithfulness and Reduplicative Identity. In *University of Massachusetts Occasional Papers in Linguistics* 18. Amherst, MA: MIT. 249-384.

Ortmann, Albert (1998). Consonant epenthesis: Its distribution and phonological specification. In Wolfgang Kehrein and Richard Wiese (eds.). *Phonology and Morphology of the Germanic Languages*. Tübingen: Niemeyer. 51-76.

Prince, Alan and Paul Smolensky (1993). Optimality Theory: Constraint Interaction inGenerative Grammar. Ms. Rutgers University and University of Colorado.

Stuart-Smith, Jane (1999). Glasgow: Accent and voices quality. In Paul Folkes and Gerard Docherty (eds*.) Urban Voices. Accent Studies in the British Isles.* London: Arnold. 203-222.

Uffmann, Christian (to appear). Intrusive [r] and optimal epenthetic consonants. To appear in *Language Sciences.*

Wells, J. C. (1982). *Accents of English*. (Three volumes) Cambridge: Cambridge University Press.

Wells, J. C. (2000). Longman Pronunciation Dictionary. First published 1990. Longman.