

Long-Distance /r/-Dissimilation in American English

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1 Introduction

In many varieties of American English, it is possible to drop one /r/ from certain words that contain two /r/s, such as *su(r)prise*, *pa(r)ticular*, *gove(r)nor*, and *co(r)ner*. This type of /r/-deletion is done by speakers who are basically ‘rhotic’; that is, who generally do not drop /r/ in any other position. It is a type of dissimilation, because it avoids the presence of multiple rhotics within a word.¹

This paper has two goals. The first is to expand the description of American /r/-dissimilation by bringing together previously published examples of the process with new examples from an elicitation study and from corpora. This data set reveals new generalizations about the phonological environments that favor dissimilation.

The second goal is to contribute to the long-running debate over why and how dissimilation happens, and particularly long-distance dissimilation. There is dispute over whether long-distance dissimilation is part of the grammar at all, and whether its functional grounding is a matter of articulatory constraints, processing constraints, or perception. Data from American /r/-dissimilation are especially important for this debate, because the process is active, it is not restricted to only a few morphemes, and it occurs in a living language whose phonetics can be studied. Arguments in the literature are more often based on ancient diachronic dissimilation processes, or on processes that apply synchronically only in limited morphological contexts (and hence are likely fossilized remnants of once wider patterns).

In this paper, I will concentrate only on long-distance /r/-dissimilation, which I define as dissimilation of /r/s that are separated by at least one consonant. This means that some of the most famous cases of /r/-dissimilation, such as *lib(r)ary*, *Feb(r)uary*, *mirr(or)* and *pre(r)ogative*, are not discussed. I make this distinction

¹Dissimilation affects both consonantal [r] and vocalic [ɚ]. Throughout this paper, I will use /r/ as a shorthand to refer to both.

because of evidence that short-distance /r/-dissimilation has different causes and operates through different means than long-distance dissimilation (see [Author, in prep.]).

For long-distance /r/-dissimilation, I argue that the data support Ohala (1981)'s contention that dissimilation stems from perceptual errors, when a listener hyper-corrects for perceived assimilation. English /r/ has drawn-out acoustic 'resonances' that can cause a listener to be unsure how many /r/s a word contains. Drawing on phonetic studies, I argue that /r/ tends to disappear precisely where it should be most phonetically masked by the presence of a second /r/. Resonances can also cause listeners to err on the side of perceiving too many /r/s, and this produces colloquial insertion of /r/ in words already containing an /r/, such as *farmiliar*, *perservere*, and *sherbert*.

I argue that /r/-dissimilation in American English remains only a pattern of sporadic lexical changes. While the phonological grammar may affect the way that misperceptions change lexical representations, long-distance dissimilation per se is not an active part of the grammar, and there is no evidence for a phonological constraint against multiple /r/s at a distance.

2 Introducing the pattern

2.1 History and sociolinguistics of /r/-dissimilation

Dissimilatory dropping of /r/ has occurred in America at least since the nineteenth century, and likely earlier. The first description of the phenomenon by a linguist is that of Hempl (1893), based on his own Southern Michigan dialect. It was also sometime in the nineteenth century that the city of *Albuquerque* dropped the first /r/ from its name, likely due to dissimilation. Stephenson (1956:275-6) suggests that dissimilation was active in North Carolina in the eighteenth century, based on (rather scant) evidence from naive spelling patterns. Some writers drop only one *r* from words like *orcha(r)ds* (1730 and 1732), *gove(r)ner* (1781 and 1787), and *la(r)ger* (1799).

My impression, based on discussion with Americans from different regions, is that /r/-dissimilation (at least in unstressed syllables) is now common in most, and perhaps all, rhotic dialects of the US. There are few concrete data on this, however. Only a few examples of dissimilation have been included in dialect surveys—*barbitu(r)ate*, by Bert Vaux; *ca(r)tridge* and *lib(r)ary* by Kurath & McDavid 1961—and each of these is somewhat phonologically atypical.

In general, /r/-dissimilation is not stigmatized in America, in particular not when it occurs in unstressed syllables as in *gove(r)nor* (Wolfram & Schilling-Estes 1998:50, Merriam-Webster 1994:436, American Heritage:220). Dissimila-

tory deletion of /r/ in stressed syllables is rarer and perhaps more frowned upon than deletion in unstressed syllables. I have heard negative remarks about speakers who dissimilate in *f(r)ustrated*, for example. Murray (1986:24) examines /r/-deletion in *qua(r)ter* as a sociolinguistic variable in St. Louis, Missouri, and finds that deletion is more common for lower class speakers and in less formal styles. Even for upper class speakers in a formal style, however, it occurs in 34% of tokens, so the level of stigmatization must be slight. Dissimilation may also be somewhat stigmatized when it involves loss of a syllable. Elster (1999), a prescriptivist, cautions against shortening *lab(or)atory*, and humorist Gene Weingarten, in a Washington Post column of September 17, 2006, describes how his editor ‘speaks like a man who grew up in the Land of the Lost Syllables. Tom takes his dog to the “vetinarian”.’

While this paper concentrates only on strongly rhotic dialects, /r/-dissimilation can occur in non-rhotic dialects, in words that have two post-consonantal /r/s such as *spectrogram*. Dissimilation can also interact with other kinds of /r/-dropping. Myhill (1988:207) studies speakers who have variable deletion of postvocalic /r/, due to competing influence from the white dialect of Philadelphia, which is largely rhotic, and Black English Vernacular, which is largely non-rhotic. He finds that speakers are significantly more likely to drop an /r/ if there is another postvocalic /r/ in the same word, a difference of .60% versus .40%.

2.2 Data set I: previously reported cases

The phonological analysis of dissimilation presented here will be based on two datasets. The first, presented in Table 1, is a list of 115 reported cases of /r/-dropping that are likely to be due to dissimilation.

I have included words only if they meet several criteria, to exclude words which are likely to have lost one of their /r/s in earlier stages or different dialects of English. First, the non-dissimilated form must still be in current American usage. This excludes examples like *Albu(r)querque*, where the first /r/ is never pronounced or spelled today. Second, the dissimilated form must be attested in a dialect that is clearly rhotic. Third, the two forms must not differ by more than the presence of /r/. This excludes cases where dissimilation is accompanied by a change in vowel quality, such as [ˈkætrɪdʒ]/[ˈkɑrtrɪdʒ] for *cartridge* (however, I have included words in which /ɚ/ dissimilates to a non-schwa vowel, such as *peripheral*). This criterion also excludes cases where additional segments besides /r/ are dropped, such as [ˈʃɪvəri] for *charivari* or [sæspəɪlə] for *sarsaparilla*. In such words, the loss of /r/ might be part of a more general ‘erosion’ of material, rather than specifically dissimilatory.

Table 1: Previously reported cases of apparent /r/-dissimilation

	(Broad) transcription ²	Source ³
<i>adve(r)sary</i>	'ædvə,səri	T1936, G2006
<i>aft(e)ward(s)</i>	'æftə,wəːdz	H1893, T1936, KK1953, Y1983
<i>ape(r)ture</i>	'æpətʃə	Y1983, G2006
<i>approp(r)iate</i>	ə'prɒpiət	K. Zuraw
<i>A(r)thur</i>	'aθə	KK1953, Y1983
<i>barbitu(r)ate</i>	,bɑː'bitʃuət	G2006, B. Vaux
<i>(St.) Be(r)nard</i>	bə'nɑːd	KK1953, C2005
<i>(San) Berna(r)dino</i>	,bɜːnə'dino	KK1953
<i>be(r)serk</i>	bə'zɜːk	G2006, B. Vaux
<i>bomba(r)dier</i>	,bɑːmbə'diə	R1988, G2006
<i>cam(ar)aderie</i>	,kə'mɑːdəi	G2006
<i>Cante(r)bury</i>	'kæn(t)ə,bɜːi	KK1953, C2005
<i>cate(r)cornered</i>	'kærə,kɔːnəːd	KK1953
<i>cate(r)pillar</i>	'kærə,pɪlə	KK1953, W1982, Y1983, R1988, M1994
<i>celeb(r)atory</i>	'seləbə,tɔːi	G2006
<i>cereb(r)al palsy</i>	,sɛrəbəl 'pɑːlzi	J. Hall
<i>checke(r)board</i>	'tʃɛkə,bɔːd	Y1983
<i>ci(r)cumference</i>	sə'kʌmfərəns	KK1953, Y1983
<i>comfo(r)ter</i>	'kʌmfərə	H1893, KK1953, Y1983
<i>cont(r)roversy</i>	'kɒntə,vɜːsi	G2006
<i>co(r)morant</i>	'kɒməːənt	G2006
<i>co(r)ner</i>	,kɒnə	H1893, S1947, KK1953, WS1998
<i>co(r)poration</i>	,kɒpə'reɪʃən	H1893, S1947
<i>crib(r)iform</i>	'krɪbəfɔːm	L. Hall
<i>defib(r)illator</i>	dɪ'fɪbjəleɪtə	G2006
<i>do(r)mitory</i>	'dɒmə,tɔːi	B. Flanigan, Tresidder 1943:267
<i>easte(r)ner</i>	'ɪstənə	KK1953

²Many published sources do not include transcriptions, so these should be seen as approximate.

³Throughout the paper, sources are abbreviated as follows: **S1837** Sherwood 1837:67-72; **H1893** Hempl 1893 (Southern Michigan); **E1893** Emerson 1893; **R1906** Rippmann 1906 (British); **T1936** Thomas 1936 (upstate New York); **T1942** Thomas 1942 (downstate New York); **S1947** Swadesh 1947; **T1947** Thomas 1947; **KK1953** Kenyon & Knott 1953; **W1982** Wells 1982; **R1988** Randall 1988; **W1993** Wilson 1993; **M1994** Merriam-Webster 1994:436; **A1996** American Heritage Book of English Usage; **SW1997** Schilling-Estes & Wolfram 1997:65 (Ocracoke); **WS1998** Wolfram & Schilling-Estes 1998; **E1999** Elster 1999; **C2005** Canepari 2005; **G2006** barely-bad.com/words1.htm#rsareus [an amateur linguist's collection; some details have been clarified through personal communication with the site's author]; **Y1983** Yamada 1983. In cases where individuals have reported examples not found in recent published sources, I have given their names.

<i>elde(r)berry</i>	'ɛldə,beri	KK1953, M1994, C2005
<i>ente(r)prise</i>	'ɛn(t)ə,praɪz	H1893, E1893, KK1953, A1996
<i>ent(r)epreneur</i>	,antəprə'nɪr	G2006
<i>fa(r)mer</i>	'famə	H1893
<i>fa(r)ther</i>	'fɑðə	H1893
<i>fo(r)lorn</i>	fə'lɔrn	T1936
<i>fo(r)ward</i>	'fowəd	H1893
<i>forwa(r)d</i>	'forwɪd	Wolfram 1969:111
<i>fo(r)mer(ly)</i>	'fomə	H1893, C. Moffatt
<i>forme(r)ly</i>	'forməli	H1893, KK1953, Hall 1942:64
<i>f(r)aternity</i>	fə'tɜ:nɪti	G2006
<i>fu(r)ther</i>	'fʊðə	C2005
<i>furthe(r)more</i>	'fɜ:ðə,mɔr	KK1953, Y1983
<i>gove(r)nor</i>	'gʌvənə	T1936, KK1953, W1982, W1993, M1994
<i>habe(r)dasher</i>	'hæbə,dæʃə	KK1953
<i>hambu(r)ger</i>	'hæmbəgə	B. Erickson, B. Vaux
<i>hype(r)baric</i>	,haɪpə'bærɪk	G2006
<i>imp(r)opriety</i>	,ɪmpə'praɪəri	KK1953, Y1983, A1996
<i>inco(r)porate</i>	ɪn'kɒpəreɪt	H1893
<i>inf(r)rastructure</i>	'ɪnfə,straʊktʃə	G2006
<i>inte(r)fere</i>	,ɪntə'fɪr	Y1983
<i>interp(r)et</i>	ɪn'tɜ:pət	KK1953, G2006
<i>Knicke(r)bocker</i>	'nɪkə,bɒkə	Y1983
<i>lab(or)atory</i>	'læbə,tɔri	E1999
<i>lit(er)ature</i>	'lɪrətʃə	G2006, H. Schiffman, B. Vaux
<i>live(r)wurst</i>	'lɪvəwɜ:st	Y1983
<i>mu(r)derer</i>	'mɛdə	C2005
<i>northe(r)n</i>	'nɔ:ðən	KK1953
<i>northe(r)ner</i>	'nɔ:ðənə	H1893, T1936, KK1953, C2005
<i>no(r)thern(er)</i>	'nɒðənə	H1893, C2005
<i>No(r)thrup</i>	'nɒθrɒp	H1893
<i>North(r)up</i>	'nɔ:θɒp	KK1953, Y1983
<i>offe(r)tory</i>	'ɒfə,tɔri	M1994
<i>o(r)der</i>	'ɒdə	C2005
<i>o(r)dinary</i>	'ɒdə,nəri	A. Dinkin
<i>o(r)nery</i>	'ɒnəri	G2006
<i>o(r)thography</i>	,ɔ'θagrəfi	H1893
<i>Otte(r)burn</i>	'ɒrəbɜ:n	KK1953, C2005
<i>ove(r)ture</i>	'ɒvətʃə	Y1983
<i>paraphe(r)nalia</i>	,pærəfə'neɪljə	KK1953, M1994, G2006

<i>pa(r)liamentary</i>	ˌpələˈmɛntəri	H1893
<i>pa(r)lor</i>	ˈpələ	H1893
<i>pa(r)ticular</i>	pəˈtɪkjələ	H1893, T1936, KK1953, Y1983, G2006
<i>pe(r)form(ance)</i>	pəˈfɔrməns	H1893, T1936, KK1953, Y1983
<i>pe(r)fumery</i>	pəˈfju:məri	H1893, KK1953, Y1983
<i>periphe(r)al</i>	pəˈrɪfiəl	G2006, B. Vaux
<i>photog(r)apher</i>	fəˈtəgəfə	C2005
<i>photomic(r)ography</i>	ˌfɔrɒmɑːˈkɑgrəfi	Barrs 1962
<i>po(r)trait</i>	ˈpɒtrɪt	G2006
<i>p(r)eliminary</i>	pəˈlɪmɪnəri	G2006
<i>prep(ar)atory</i>	ˈprɛpəˌtɔri	B. Vaux
<i>pre-p(r)ofessional</i>	ˌprɪpəˈfeʃənəl	KK1953
<i>p(r)ofessor</i>	pəˈfɛsə	T1936, C2005, SW1997
<i>p(r)oliferate</i>	pəˈlɪfəɪt	SW1997 (Ocracoke)
<i>p(r)oportional(al)</i>	pəˈpɔrʃənəl	KK1953, Y1983, B. Samuels
<i>p(r)oprietor</i>	pəˈprɪəriə	KK1953
<i>propriet(r)ess</i>	prəˈprɪəriəs	G2006
<i>Purmo(r)t</i>	ˈpɜ:mət	H1893
<i>qua(r)ter</i>	ˈkwɔ:tə	H1893, S1947, KK1953
<i>recip(r)ocate</i>	rɪˈsɪpəkeɪt	G2006
<i>repe(r)toire</i>	ˈrɛpəˌtwɑ	G2006, D. Kamholz
<i>repe(r)tory</i>	ˈrɛpəˌtɔri	Y1983
<i>rep(r)esent</i>	ˌrɛpəˈzɛnt	E1893, Y1983
<i>rese(r)vation</i>	ˌrɛzəˈveɪʃən	Y1983
<i>rese(r)voir</i>	ˈrɛzəˌvwɑ	KK1953, C2005
<i>resp(ir)atory</i>	ˈrɛspəˌtɔri	Y1983, G2006, L. Hall
<i>reverb(er)atory</i>	rɪˈvɜ:bətɔri	KK1953
<i>rolle(r)coaster</i>	ˈrɒlɪkɒstə	M. Covarrubius, Donahue 2006
<i>sec(r)etary</i>	ˈsɛkəˌtəri	E1893, T1947, KK1953, Y1983, C2005
<i>southe(r)ner</i>	ˈsaʊðənə	KK1953, C2005
<i>spect(r)ogram</i>	ˈspɛktəˌgræm	often heard by author
<i>stenog(r)apher</i>	stəˈnɑgəfə	T1947, C2005
<i>su(r)prise</i>	səˈpraɪz	H1893, T1936, KK1953, W1982, Y1983, M1994, G2006
<i>su(r)veyor</i>	səˈveɪə	KK1953, Y1983
<i>Swa(r)thmore</i>	ˈswɑθˌmɔ	KK1953, Goodman & Halvey 2006
<i>synch(r)otron</i>	ˈsɪŋkəˌtrɒn	M1994
<i>temp(er)ature</i>	ˈtɛmpətʃə	T1936, Y1983, G2006
<i>terrest(r)ial</i>	təˈrɛstʃəl	G2006
<i>the(r)mometer</i>	θəˈmɒmɪtə	H1893, T1936, KK1953, W1982, Y1983, W1993, M1994, G2006
<i>tu(r)meric</i>	ˈtʊməˌɪk	G2006, B. Vaux

<i>ve(r)nacular</i>	və'nækjələʃ	KK1953, Y1983, M1994, G2006
<i>vet(er)inarian</i>	ˌvɛtə'nɛriən	G2006
<i>wa(rr)ior</i>	'wojəʃ	G2006
<i>Wate(r)bury</i>	'wærə,bɜːi	KK1953, C2005
<i>weathe(r)board</i>	'wɛðə,bɔːd	Pederson 1967 (Missouri)
<i>weathe(r)board</i>	'wɛðəˌbɔd	Pederson 1967 (Missouri)
<i>weste(r)ner</i>	'wɛstənəʃ	KK1953
<i>Winde(r)mere</i>	'wɪndəmir	R1988

2.3 Data set II: an elicitation study of two dialects

To get a clearer picture of the extent of dissimilation in specific dialects, I conducted an elicitation study with speakers from two locations: Southern California (SoCal) and the Arkansas Ozarks (AR).

Procedure Words were elicited through a pseudo-psycholinguistic task, advertised as a “word identification study”. Subjects were presented with sentences on a computer screen. In each sentence, one word (the target word) was missing some letters. A random number of stars appeared in the position from which the letters were missing.

(1) Sample elicitation sentences

When his wife left him, he went totally b****erk. (answer: *berserk*)

When the patient suffered a heart attack, the doctors used a defib****tor to restart his heart. (answer: *defibrillator*)

Subjects read the sentences aloud, filling in the missing word. Their reading was audio-recorded on a Marantz PMD-660 solid state recorder with a Shure PG81 microphone. Instructions given to subjects implied that recording was merely a convenience so that they would not have to write down the answers.

In words which were being tested for dissimilation, the number of letters missing varied, but at a minimum included the *r* considered likely to drop, the unstressed vowel (if any) adjacent to that *r*, and at least one other consonant. This word-guessing procedure was designed to minimize spelling pronunciations, both by forcing subjects to pronounce the word without seeing the *r* in question and by preventing them from sounding out words they might not actually know.

Each subject was asked afterwards what they thought the experiment was studying and whether they had noticed anything that many of the words had in common;

5 (all SoCal) suggested pronunciation, and 2 noticed that a lot of words contained *r*. Both said they had noticed this only near the end of the experiment, so their data was included.

Materials In the SoCal experiment, subjects had to guess 300 words, a task that usually took around half an hour. There were 150 words that contained two /r/s and 40 that contained one /r/. The words with one /r/ served two purposes: they acted as a control to see whether subjects had non-dissimilatory /r/-dropping, and some were items which have been reported to undergo /r/-assimilation, discussed in section 4.2. The remaining 110 words contained no /r/s. Most of these items served purely as distractors, but 9 contained two /l/s in order to check for /l/-dissimilation, also discussed later.

The AR experiment had the same design, but included only 214 sentences, of which 110 contained two /r/s and 30 contained one /r/.

The ordering of words was largely random, except that the first 15 items were all distractors, and three words which are known pronunciation shibboleths (*February*, *library*, *librarian*) were put at the very end, lest they alert subjects early on that the experiment was studying pronunciation.

Subjects Twenty-five SoCal speakers participated. All were native English speakers and had grown up in SoCal; 11 were female, 14 male. Twenty-one were between the ages of 19–27; the remaining 4 were between 36 and 53. Fourteen identified themselves as white, 3 as black, 4 as Hispanic, 3 as Asian, and 1 as a Pacific Islander. All had or were working toward 4-year degrees.

Fifteen Arkansas speakers participated. Fourteen were female, 1 male. Six speakers were between the ages of 18-29; 7 were between 33 and 44, and 2 were 75 and 79. All subjects were white, and were natives or long-term residents of the Ozarks who lived or worked in the town of Marshall (pop. 1,300), where recordings were made. Four subjects had no education beyond high school; 5 had or were working toward 2-year degrees, 6 had or were working toward 4-year degrees.

Scoring The recordings were initially scored by the author and another phonetically-trained native English speaker. Scorers noted any cases where /r/ or /l/ was deleted or inserted. Productions were scored as invalid if a subject produced the wrong word, no word, or a significantly non-standard form of a word (for example, with stress on the wrong syllable, or addition of sounds other than /r/ or /l/). Cases of discrepancy between the first two scorers were resolved by a third scorer.

Although the experiment was only designed to examine the target words, occasionally subjects also had interesting pronunciations of words in the frame sen-

tences that they read aloud, and I will refer to some of them below. Transcriptions of frame sentence words are based on the author's scoring only; they were not double-checked by a second scorer.

Results Words containing only one /r/ had low rates of /r/-dropping: in SoCal, 5 / 926 productions, in AR, 0 / 401 productions. This confirms that the subject group was highly rhotic, and that the experiment elicited careful speech in which little /r/-dropping would be expected to occur due to speech errors or fast-speech elision.

Table 2 shows the 96 words in which some speakers dropped an /r/ in the SoCal experiment. For each /r/, the table gives the number of productions with that /r/ dropped divided by the total number of valid productions. In some of the words, different subjects dropped different /r/s. In these cases, the word is listed twice, with the second occurrence starred. Parentheses indicate which /r/ was dropped. The table omits word from the experiment that had short-distance /r/-dissimilation (*February*, *library*, *librarian*) because they will be discussed in another paper. It also omits *Worcestershire sauce*, because subjects had around a dozen different pronunciations of this word. Also, a single instance of *thunderstorm* in which both /r/s dropped is ignored.

Table 2: SoCal: Words where subjects dropped one of two /r/s

barbitu(r)ates	18 / 20	.90	Abe(r)crombie	2 / 23	.09
paraphe(r)nalial	20 / 24	.83	Aberc(r)ombie*	2 / 23	.09
su(r)prise	20 / 24	.83	p(r)ogressive	2 / 23	.09
bomba(r)dier	12 / 15	.80	p(r)oprietor	2 / 23	.09
tu(r)meric	11 / 14	.79	cinematog(r)apher	2 / 23	.09
Trist(r)am Shandy	6 / 8	.75	brothe(r)ly	2 / 24	.08
San Berna(r)dino	18 / 25	.72	inf(r)astructure	2 / 24	.08
be(r)serk	16 / 24	.67	kinde(r)garten	2 / 24	.08
d'U(r)bervilles	3 / 6	.50	fo(r)ward	2 / 25	.08
cate(r)pillar	11 / 22	.50	afte(r)wards	2 / 25	.08
rese(r)voir	12 / 24	.50	ente(r)prise	2 / 25	.08
forme(r)ly	12 / 25	.48	f(r)aternities	2 / 25	.08
repe(r)toire	9 / 20	.45	rep(r)esents	2 / 25	.08
Cante(r)bury	10 / 23	.43	p(r)efer	2 / 25	.08
entrep(r)eneur	10 / 25	.40	adve(r)tisers	2 / 25	.08
southe(r)ner	9 / 24	.38	counte(r)featers	2 / 25	.08
resp(ir)atory	9 / 25	.36	co(r)duroy	2 / 25	.08
repe(r)tory	5 / 15	.33	pu(r)portedly	1 / 14	.07

cereb(r)al palsy	7 / 21	.33	reperto(r)y*	1 / 15	.07
defib(r)illator	6 / 18	.33	Aspe(r)ger's syndrome	1 / 16	.06
prep(ar)atory	8 / 25	.32	p(r)oliferation	1 / 17	.06
Ruthe(r)ford	7 / 22	.32	imp(r)ropriety*	1 / 19	.05
gube(r)natorial	4 / 13	.31	wate(r)ress	1 / 19	.05
adve(r)sary	7 / 23	.30	reperto(i)r*	1 / 20	.05
gove(r)nor	7 / 25	.28	libe(r)tarian	1 / 22	.05
northe(r)ner	7 / 25	.28	pe(r)turbed	1 / 22	.05
temp(er)ature	7 / 25	.28	co(r)porations	1 / 23	.04
furthe(r)more	7 / 25	.28	comfo(r)ter	1 / 23	.04
ape(r)ture	4 / 15	.27	the(r)mometer	1 / 23	.04
frate(r)nize	6 / 25	.24	int(r)amural	1 / 23	.04
ve(r)nacular	5 / 22	.23	live(r)wurst	1 / 23	.04
rolle(r)coasters ⁴	5 / 25	.20	hambu(r)ger	1 / 24	.04
ove(r)ture	4 / 23	.17	celeb(r)atory	1 / 24	.04
easte(r)ners	4 / 25	.16	Lab(r)ador retriever	1 / 24	.04
hermaph(r)odite	4 / 25	.16	biog(r)apher	1 / 24	.04
weste(r)ner	4 / 25	.16	wiza(r)dry	1 / 24	.04
vet(er)inarian	4 / 25	.16	cap(r)icorns	1 / 24	.04
disp(r)oportionate	4 / 25	.16	ba(r)bwire	1 / 24	.04
cam(ar)aderie	3 / 21	.14	f(r)ustrated	1 / 25	.04
fo(r)lorn	2 / 15	.13	fo(r)mer	1 / 25	.04
photog(r)apher	3 / 23	.13	ag(r)iculture	1 / 25	.04
northe(r)n	3 / 24	.13	lab(or)atory	1 / 25	.04
borde(r)line	3 / 25	.12	lit(er)ature	1 / 25	.04
pa(r)ticular	3 / 25	.12	pe(r)formance	1 / 25	.04
silve(r)ware	3 / 25	.12	qua(r)ter	1 / 25	.04
prop(r)ietary	2 / 17	.12	pe(r)verted	1 / 25	.04
alte(r)nator	2 / 20	.10	f(r)ustration	1 / 25	.04
frankfu(r)ter	2 / 20	.10	p(r)ocrastinate	1 / 25	.04
periph(er)al	2 / 22	.09	maste(r)card	1 / 25	.04

There were also a number of words containing two /r/s in which no /r/-dropping occurred; these are given below.

⁴Although the pronunciation [ˈrɒlɪkɒstəz] has been previously reported, all the SoCal subjects who dissimilated said [ˈrɒləkɒstəz].

- (2) 51 words with two /r/s and no instances of /r/-dropping (SoCal):
 abracadabra arbitration arthur barbershop bernards bumperstickers
 cheeseburger checkerboard christopher circumference controversy corner
 counterpart energizer entertainers evergreen extra-terrestrial extrovert
 farther fingerprints furniture gingerbread hovercraft inappropriate interfere
 intermarry intermediary interpret knickerbockers migratory ordinary
 overdraft overboard overturned persevered pre-professional professor
 propeller repercussions reservation Schwarzenegger secretary supervisor
 surveyors survivors thunderbird thunderstorm trajectory waterboarding
 waterfront waterproof

Table 3 gives the results of the Arkansas experiment.

Table 3: AR: words where subjects dropped one of two /r/s

gube(r)natorial	4 / 4	1.00	be(r)nards	3 / 15	.20
su(r)prise	13 / 13	1.00	disp(r)oportionate	2 / 10	.20
be(r)serk	14 / 15	.93	inte(r)mediary	1 / 6	.17
cate(r)pillar	12 / 14	.86	co(r)porations	2 / 13	.15
paraphe(r)nalial	12 / 14	.86	fa(r)ther	2 / 13	.15
forme(r)ly	11 / 13	.85	wiza(r)dry	2 / 14	.14
adve(r)sary	9 / 11	.82	afte(r)wards	2 / 15	.13
bomba(r)dier	3 / 4	.75	counte(r)feiter	2 / 15	.13
frate(r)nize	11 / 15	.73	fo(r)ward	2 / 15	.13
cereb(r)al	8 / 12	.67	fu(r)thermore	2 / 15	.13
gove(r)nor	10 / 15	.67	rolle(r)coasters	2 / 15	.13
vet(er)inarian	10 / 15	.67	ext(r)a-terrestrial	1 / 10	.10
ape(r)ture	3 / 5	.60	cap(r)icorns	1 / 13	.08
temp(er)ature	9 / 15	.60	entrep(r)eneur*	1 / 13	.08
alte(r)nator	8 / 15	.53	pe(r)turbed	1 / 12	.08
defib(r)illator	8 / 15	.53	photog(r)apher	1 / 12	.08
pa(r)ticular	8 / 15	.53	ab(r)acadabra	1 / 15	.07
the(r)mometer	8 / 15	.53	comfo(r)ter	1 / 14	.07
rese(r)voir	7 / 15	.47	ene(r)gizer	1 / 15	.07
libe(r)tarian	4 / 9	.44	f(r)ustration	1 / 14	.07
resp(ir)atory	6 / 14	.43	ginge(r)bread	1 / 15	.07
easte(r)ners	5 / 12	.42	interp(r)et	1 / 14	.07
lit(er)ature	6 / 15	.40	kinde(r)garten	1 / 15	.07
northe(r)ners	5 / 14	.36	lab(r)ador	1 / 14	.07
periph(er)al	5 / 14	.36	pe(r)formance	1 / 15	.07
ba(r)bwire	5 / 15	.33	p(r)opeller	1 / 14	.07

inf(r)rastructure	2 / 6	.33	rese(r)vations	1 / 14	.07
silve(r)ware	4 / 14	.29	respirato(r)y*	1 / 14	.07
ove(r)ture	2 / 8	.25	superviso(r)	1 / 15	.07
ent(r)epreneur	3 / 13	.23	wizard(r)y*	1 / 14	.07
southe(r)ners	3 / 14	.21			

- (3) 52 words with 2 /r/s and no /r/-dropping (AR): advertisers agriculture arbitration arthur barbershop biographer brotherly bumperstickers checkerboard christopher controversy corduroy corner counterpart enterprise entertainers evergreen extrovert fingerprints former frankfurter fraternities frustrated hamburger impropriety inappropriate interfere irrelevant laboratory mastercard migratory ordinary overboard overdraft overturned persevered perverted prefer procrastinate professor proprietor quarter repercussions represents reproduce secretary surveyors survivors thunderbird thunderstorm trajectory waterproof

2.4 Characteristics of American /r/-dissimilation

This section describes the basic phonological characteristics of American long-distance /r/-dissimilation, based on previous reported examples, data collected in the experiments, and also some data from corpora.

In interpreting statistical tests on the experiment data, bear in mind that the words tested in the experiments are not a random sample of all English words containing two /r/s; the word list was heavily weighted towards words that have already been reported to have dissimilation. For this reason, trends seen within the experiment data cannot be reliably generalized to all English words.⁵

Environments blocking deletion It has never been reported that Americans drop word-initial or word-final /r/ due to dissimilation (this includes lemma-final /r/s, even if followed by an inflectional suffix). In the experiment, final /r/-deletion occurred once in *reperto(r)e* (SoCal) and once in *superviso(r)* (AR). These cases are few enough to be dismissed as random errors. We can conclude that dissimilation is blocked at word edges.

There are very few words where an intervocalic /r/, or an /r/ next to a vowel, deletes through dissimilation. The only reported examples are *periphe(r)al* as [pə'rifɪəl] and *barbitu(r)ate* as [bɑr'bitʃuət]. One AR subject deleted the second /r/ in *respirato(r)y*, but this again appears to be an isolated error.

⁵Statistics were produced using R (R Development Core Team 2009).

Because of the almost categorical lack of dissimilation in these positions, I have not included the drop rates for word-initial, word-final, or intervocalic /r/ (except for *peripheral* and *barbiturate*) in the statistical analyses of the experiment data reported in the rest of this section. The analysis compared the drop rates only for word-medial, consonant-adjacent /r/s.

Effects of stress In both the SoCal and AR experiments, /r/ was less likely to drop if stressed. In SoCal, the 134 unstressed /r/s have an average drop rate of .13, the 81 stressed /r/s, .03. A Welch two sample t-test shows the difference to be highly significant ($t = 5.01$, $df = 210$, $p < .001$). There are two outliers where stressed [r] does delete often: *tu(r)meric* (.79) and *d'U(r)bervilles* (.50). In AR, the 100 unstressed /r/s have an average drop rate of .20, the 56 stressed /r/s, .02 ($t = 6.20$, $df = 112$, $p\text{-value} < .001$).

Some dialects may have more dissimilation of stressed /r/ than the two dialects studied; Hempl (1893) reports fairly extensive dropping of stressed coda /r/s in Southern Michigan.

Effects of morphological structure The only effect of morphological structure on dissimilation is to block deletion at morpheme boundaries (certainly compound boundaries, and perhaps others).

The words that undergo dissimilation have a variety of morphological structures. The two /r/s may belong to a single morpheme, as in *tu(r)meric* or *be(r)serk*, or be separated by a morpheme boundary as in *pre#p(r)ofessional* or *gove(r)n#or*. Dissimilation often causes morphological alternations. For example, deletion is possible in *gove(r)ner* but not *govern*; *adve(r)sary* but not *adverse*; *no(r)thern* / *northe(r)n* but not *north*. Stress shifts caused by morphological factors can also make dissimilation possible in one form but not another. Thus, deletion is possible in *'hambu(r)ger* but not *'burger*; *the(r)'mometer* but not *thermo'nuclear*; *p(r)o'fessor* but not *profe'ssorial*.

Although dissimilation can operate over morpheme boundaries, it is rare for an /r/ to drop when it is directly adjacent to a morpheme boundary. Yamada (1983) claims that dissimilation is rare in /r/-final prefixes, as in *afterbirth* and *undercharge*. Similarly, the reported data include only 4 cases of /r/ deleting when it is the last sound in the first member of a compound: *checke(r)board*, *elde(r)berry*, *furthe(r)more* and *weathe(r)board*.

The experiment data confirm that an /r/ is far less likely to drop if it is located at the boundary of a compound. In SoCal, the 22 /r/s that fall at a compound edge (all of which are unstressed) have a lower average drop rate (.04) than the 112 unstressed /r/s that are not at a compound edge (.15), and a Welch two sample t-test

finds the difference to be highly significant ($t = 4.42$, $df = 92$, $p < .001$). In AR, the average drop rate for the 16 examples of unstressed /r/ at a compound edge is .03, versus .23 for the 84 unstressed /r/s not at a compound edge, ($t = 5.25$, $df = 89$, $p < .001$). However, a few compound words from the frame sentences had higher rates of /r/-dropping: 2/15 AR subjects and 8/25 SoCal subjects dissimilated in *pape(r)work* (3 of the SoCal subjects had syncope of the whole syllable, producing [peɪpwɔ:k]), and 2/15 AR subjects dissimilated in *weathe(r)man*. This suggests that there may be some compounds that dissimilate more often than the ones included the experiment.

No dissimilation over word boundaries Dissimilation appears to be largely confined to individual words, operating across word boundaries only in (perhaps) some idiomatic or high-frequency phrases. Although it has previously been claimed that function words containing /r/ may dissimilate before a lexical word containing /r/, in phrases like *our po(r)ch* or *you(r) mercy* (Canepari 2005), a corpus study suggests that such cases are better analyzed as random /r/-dropping, not conditioned by the following /r/.

I examined 7 function words containing /r/ in the Buckeye Corpus, a phonetically transcribed 300,000 word speech corpus based on interviews with 40 speakers from Columbus, Ohio (Pitt et al. 2007). For the words *from*, *are*, *our*, *their*, *your*, *or*, and *for*, I ran a Perl script to divide cases where the word is pronounced with or without a rhotic, and then separated these according to whether the following word's pronunciation did or did not contain an [r]. For the 6 function words ending in /r/, the script excluded all cases where the following word began with /r/, since the difference between [r] and [r̥] is likely hard to detect, and also excluded cases where the following word began with a vowel, since /r/-dropping is generally rare when it would create a vowel-vowel sequence. The results are shown in (4). A Pearson's chi-square test shows that altogether, the seven words are significantly *less* likely to drop an /r/ when the following word contains an [r] ($\chi^2 = 9.56$, $df = 1$, $p = 0.002$). Rather than dissimilation, these sequences show a kind of assimilatory effect (see discussion of /r/-assimilation in section 4.2).

(4)			<i>following word</i>			
			∅	r	expected:	
	<i>function word</i>	r	2937	959	2966	930
		∅	423	95	394	124

A few linguists have reported dissimilation in idioms or common collocations:

more o(r) less (Kenyon & Knott 1953), *wa(r)m water* and *wa(r)m weather* (Hempl 1893).⁶

Directionality /r/-deletion can be triggered by either a preceding or a following /r/; it is unclear whether dissimilation is more common in one direction than the other.

In the list of previously reported examples, there are 88 words where the first of two or more /r/s deletes (anticipatory direction), 18 where the last of two or more /r/ deletes (perseverative direction), and 9 where the /r/ that deletes is both preceded and followed by other /r/s (I will call this mixed direction). This asymmetry suggests that dissimilation is largely anticipatory.

However, the experiment does not support this conclusion. In SoCal, the average drop rates for anticipatory direction (135 examples) and perseverative direction (66 examples) are both .08. When stressed /r/ and /r/ at compound edges are excluded, the difference between the anticipatory and perseverative directions still remains non-significant. Mixed direction (14 examples) has an average drop rate of .26, which is significantly higher than either of the other directions (for a Welch two sample t-test comparing anticipatory and mixed direction $t = -4.10$, $df = 16$, $p < .001$; for perseverative vs. mixed direction $t = -3.71$, $df = 23$, $p = .001$).

In AR, the average drop rate for 99 cases of anticipatory dissimilation is .16, for 48 cases of perseverative, .08, and the difference is not quite significant ($t = 1.92$, $df = 111$, $p\text{-value} = 0.058$). The 9 cases of mixed direction have an average drop rate of .16, which is not significantly different from either anticipatory or perseverative direction.

In short, the reported data and the AR results hint but do not prove that anticipatory direction might be preferred, while the CA results indicate that an /r/ is most likely to drop if both preceded and followed by other /r/s. The question needs further exploration, but for now I will assume that directionality is not a very strong factor in predicting dissimilation, if it is a factor at all. Indeed, for the words *forward*, *Northrup*, *northern*, *formerly*, and *weatherboard*, it has been reported that either /r/ (but not both) may delete.

Local context of dropped /r/ Nearby consonants' place of articulation may have an effect on the likelihood of dissimilation. In (5), drop rates are averaged according to the place of the preceding and following consonants (L = labial, C = coronal, V = velar). Cases where a non-schwa vowel intervenes are excluded. We can see

⁶Hempl further speculates that his dialect developed /r/-dropping in *Satu(r)day* and *yeste(r)day* through dissimilation in common collocations such as *yesterday morning*, *Saturday afternoon*, etc.

that in both dialects, drop rates are lower before and after velars, but one-way ANOVAs find no significant differences.

(5) SoCal:

	Preceding consonant			Following consonant		
	labial	coronal	velar	labial	coronal	velar
n	99	67	16	65	96	18
avg. drop rate	.10	.14	.02	.10	.12	.04

AR:

	Preceding consonant			Following consonant		
	labial	coronal	velar	labial	coronal	velar
n	73	50	10	46	73	11
avg. drop rate	.17	.15	<.01	.11	.20	.03

In (6), drop rates for unstressed /rə/ and /ɚ/ are averaged according to the place of preceding and following consonants together. (*Barbitu(r)ate* and *periphe(r)al*, where no consonant follows /ɚ/, are excluded). The combinations labial-coronal, coronal-labial, and coronal-coronal have the highest drop rates in each dialect. Again, none of the differences are significant.

(6) SoCal:

	Preceding & following consonants (unstressed /r/ only)								
	LL	LC	LV	CL	CC	CV	VL	VC	VV
n	16	52	11	32	20	6	6	2	1
avg. drop rate	.05	.16	.03	.16	.13	.06	.04	.00	.04

AR:

	Preceding & following consonants (unstressed /r/ only)								
	LL	LC	LV	CL	CC	CV	VL	VC	VV
n	11	41	6	23	15	4	4	2	1
avg. drop rate	.06	.27	.03	.16	.24	.05	.02	.00	.00

Although the results did not reach significance, the consistently low drop rates before and after velars in both dialects is interesting, and suggests that velars may have some blocking function. An experiment with more velar tokens would be needed to confirm this.

More dissimilation of /ə/ than /rə/ Unstressed /ə/ is more likely than /rə/ to dissimilate to [ə]. In SoCal, the 84 examples of unstressed [ə] have a drop rate of .15, the 41 examples of unstressed [rə], .08. A Welch two sample t-test finds a mildly significant difference ($t = 2.04$, $df = 109$, $p = 0.044$) In AR, the 61 examples of unstressed [ə] have a drop rate of 0.24; the 33 examples of unstressed [rə], 0.08 ($t = 3.20$, $df = 91$, $p = .002$). Words like *veterinarian*, whose full form would include /əˈə/, are excluded from these counts.⁷

In dividing unstressed /r/ into /ə/ and [ə], I have followed the orthography, but this is an admittedly imperfect method. American English has optional ‘metathesis’ of /rə/ to /ə/ (and more rarely vice versa), particularly after /p/. It is likely that dissimilation in /rə/ sequences sometimes arises through an intermediate stage of metathesis. For example, *professor* might first have metathesized to [pəˈfɛsə], then dissimilated to [pəˈfɛsə].

No effect of word length The experiment finds no effect of word length on the likelihood of /r/ dropping. The drop rates for words of 2 through 6 syllables are summarized below. A one-way ANOVA finds no significant effects in either dialect.

(7) Drop rate by word length

	SoCal					Arkansas				
syllables	2	3	4	5	6	2	3	4	5	6
n	23	106	63	18	5	17	81	42	12	4
avg. drop rate	.12	.08	.10	.11	.08	.17	.10	.13	.23	.32

No blocking by intervening sounds In some languages, liquid dissimilation is blocked by certain intervening sounds, especially other liquids: for example, /l/-dissimilation in Latin is blocked by an intervening /r/ or non-coronal consonant (Cser 2007). There are no categorical blocking effects in American English; dissimilation can take place over any kind of consonant. Examples of /r/-dissimilation over intervening /l/s include *caterpillar* (drop rate: SoCal .50, AR .86), *defibrillator* (.33, .53), *vernacular* (.23, NA), *particular* (.12, .53), and several other words.

No effect of word frequency Word frequencies were estimated by counting occurrences of each word’s lemma (that is, the uninflected form) in the Corpus of Con-

⁷It is clear that in words like *veterinarian*, dissimilation follows syncope. The non-dissimilated form is usually pronounced [vɛtrənəriən] or [vɛtəˈnəriən], not the prescriptive [vɛtəˈnəriən]. But since neither of the syncopated forms can be described as standard, it is not clear how to group such words.

temporary American English (<http://www.americancorpus.org/>) which contained over 385 million words when accessed in June 2009.

In both SoCal and AR, a Spearman correlation test finds no significant correlation between word frequency and drop rate (for SoCal, $r_s = -0.027$, $p = 0.696$; for AR, $r_s = -0.054$, $p = 0.5$). The test was repeated with stressed [r]s excluded; the results were similar (for SoCal, $r_s = 0.004$, $p = 0.962$; for AR, $r_s = -0.095$, $p = 0.346$).

It is possible that the lack of frequency effects is partly due to the concentration of very low frequency words in the experiment. The words in the SoCal data had a median frequency of 1119 occurrences in over 385 million words; for the AR data, the median is 1533 occurrences. Perhaps variations in frequency within this low level have no practical effect on a word's usage or development.

A better way to analyze the effects of frequency might be to compare the pronunciations of a word by groups of people who use the word more or less often. Anecdotal evidence hints that people are likely to dissimilate in words they use frequently in their professions. For example, only two SoCal subjects dissimilated in *alte(r)nator*, but one of those was an auto repair major. Gary Toops reports (p.c.) that Kansas TV weather forecasters regularly dissimilate in *temp(er)ature*, and Linda Hall reports (p.c.) that all the lecturers in pulmonary medicine at her Maryland medical school dissimilate in *resp(ir)atory*. I have met a graduate student in physics who was unaware of the first /t/ in *synch(r)otron*, and I myself frequently drop the first /t/ in *spect(r)ogram*.

Occasional effects of spelling There are a small number of words where /ɜ:/ dissimilates to a vowel other than schwa. In *peripheral*, *turmeric*, and *barbiturate*, it appears that the spelling has influenced the dissimilated pronunciations ([pəɹɪfiəl, tuməɹɪk, bɑːrbɪtʃuət]): the words are pronounced as if spelled *peripheal*, *tumeric*, and *barbituate*. This may relate to the fact that replacing the /ɜ:/s in *peripheral* or *barbiturate* with /ə/ would result in a [əV] sequence that is phonotactically illegal. That is, without the spelling-influenced vowel changes, the process would not be structure-preserving.

Violations of structure preservation? It has been claimed that dissimilation does not introduce new sounds or sound sequences into a language. Ohala (1993:255-6) claims that, in all languages, 'the end product of dissimilation seems to be a segment drawn from the same set that the language had before the sound change', and Kiparsky (1995:658) agrees that the result of dissimilation 'should be a well-formed structure of the language, hence in particular one representable in terms of its authentic phonological inventory'.

However, Swadesh (1947:142) claims that dissimilatory deletion of /r/ after stressed /o/ regularly leaves behind a vowel that has no more than a marginal presence in such contexts otherwise:

In addition I have o, varying to a certain extent with ɔ, in the position before r (*story, for*); [...] Colloquial variants with r lost by dissimilation provide additional illustrations of o before a consonant other than r: kónə, kwódə, kòpə-éɪfn beside kórənə, kwórdə or kwórtə, kòrpə-éɪfn (*corner, quarter, corporation*).

Similarly, Canepari (2005:89) claims that when /r/ is dropped from /or/, ‘words do not become ambiguous, because the vowel timbre alone is distinctive’. He describes the vowel that is left as back rounded lower-mid, higher than [ɔ] but lower than [o], and his illustrations of vowel quality do not show this vowel occurring in American English except as a result of dissimilation.

According to Swadesh and Canepari’s descriptions, dissimilation creates a new vowel contrast. Before most consonants, General American has a contrast between ɔ and ɔ (odor [ˈoʊrə], audit [ˈɔrt]). Before [r], there is a collapse of this contrast and the phone realized in this position is [o], as in *order* [ˈorrə]. In general, [o] does not occur except as an allophone of /ɔ/ or /ɔ/ before [r]. However, when /r/ is deleted through dissimilation, this allophone remains, creating words like *order* [ˈorə]. This in effect creates a ɔ/ɔ/o contrast which does not exist except when the [o] derives from dissimilation. Canepari also claims that dissimilation creates a second kind of distinctive stressed vowel: in dissimilated *mu(r)derer* and *fu(r)ther*, he transcribes a half-long [ə], [məˈdərə]. He does not show this vowel as occurring in stressed syllables except as a result of dissimilation.

Since the experiment subjects had very little /r/-dropping in /or/, I cannot confirm these descriptions, but point them out here because of their relevance to debates about structure preservation in dissimilation.

Summary Dissimilatory /r/-dropping occurs in medial /r/s only. It is more likely in unstressed syllables; when /r/ is not adjacent to a compound boundary (or possibly other morphological boundary); and when /r/ is vocalic (ə) rather than part of an onset cluster. It is more frequent in the contexts labial-coronal, coronal-labial, and coronal-coronal than when other combinations of consonants precede and follow. It does not operate over word boundaries. No effect was found of word length, word frequency, or blocking by intervening segments. It is unclear whether direction has an effect.

3 Dissimilation through misperception?

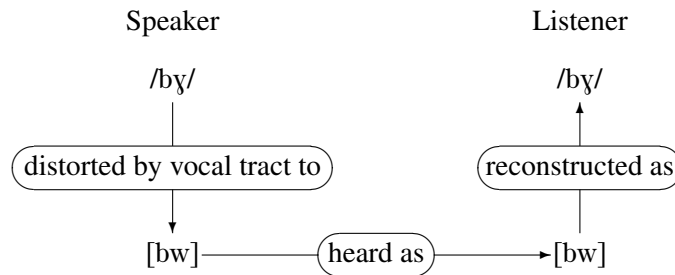
There is controversy as to what causes long-distance dissimilation, cross-linguistically. I will argue that for American /r/-dissimilation, the most plausible theory is that of Ohala (1981), who proposes that dissimilation occurs when a listener **hyper-corrects** for phonetic assimilation. The predictions of the hypercorrection theory relate well to the patterns in American /r/-dissimilation discussed above.

3.1 Hyper-correction

Ohala proposes that dissimilation and assimilation (as diachronic processes) both originate as mistakes on the part of listeners. These mistakes stem from the fact that the acoustic effects of certain phonological features tend to spread across adjacent sounds. For example, a consonant's place of articulation affects the formant transitions on neighboring vowels and consonants, and vowels affect vowels in neighboring syllables, even over intervening consonants (Öhman 1966).

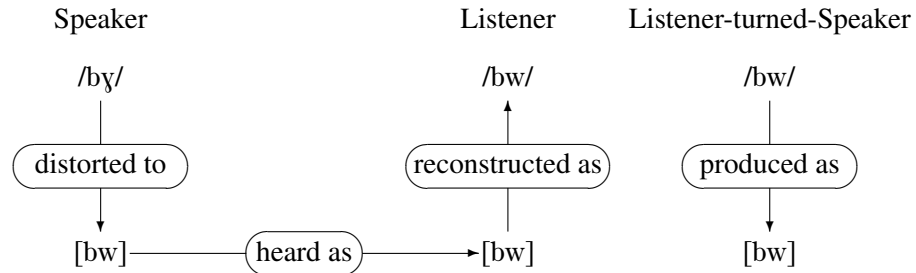
This coarticulation poses a problem for the listener. In order to correctly identify the intended utterance, the listener must learn to factor out coarticulation. For example, when a speaker produces a sequence of /by/, the initial labial can make the following /y/ sound like /w/. A listener, hearing an apparent [bw], must know how to correct for the coarticulation and deduce that /by/ was intended, as shown in (8). (The following three diagrams are adapted from Ohala 1981.)

(8) Correction



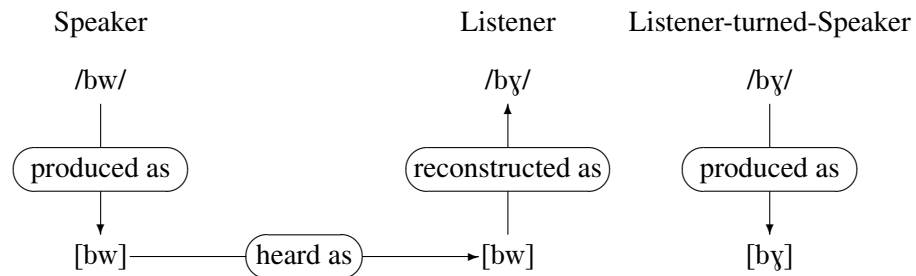
Ohala points out that there are two possible errors a listener could make. First, the listener could fail to factor out the coarticulation, instead taking the phonetic assimilation at face value. The result of this **hypo-correction** is phonological assimilation: the listener constructs an underlying representation in which the two phonemes agree on the coarticulated feature.

(9) Hypo-correction (assimilation)



The second possible error is that the listener could over-correct; that is, he could assume that coarticulation exists where it actually doesn't. Alert for the possibility that /bɣ/ might be distorted by the vocal tract to sound like [bw], he could make the mistake of assuming that a 'real' [bw] is intended as /bɣ/. The result of this **hyper-correction** is dissimilation: the listener constructs an underlying representation in which a feature that should be assigned to two phonemes is assigned only to one.

(10) Hyper-correction (dissimilation)



The examples above concern only sounds that are immediately adjacent, but Ohala argues that the same scenarios can account for assimilation or dissimilation at a distance as well, since some features can have very drawn-out acoustic cues. This claim remains controversial. In a recent evaluation of work on dissimilation, Alderete & Frisch (2006:8) argue that 'this analysis does not seem to work... in cases where the target and trigger of dissimilation are separated by more than a consonant or vowel', based on the assumption that coarticulation only spreads that far.

3.2 Long-range acoustic effects of English /r/

Several phonetic studies have shown that English liquids have extremely long-range acoustic effects and that listeners are attuned to these effects. These studies

have been done only on British English dialects. While it would be ideal to have similar phonetic evidence from American English to compare with the primarily American data above, I will assume that long-distance effects of liquids are likely to exist in American English as well.

Long-range acoustic effects of liquids were first reported by Kelly & Local (1986), who call these effects ‘resonances’. Kelly and Local claim, based on impressionistic descriptions and visual inspection of spectrograms in three non-standard British dialects, that resonances are primarily a matter of F2 values, and have the domain of a phonological foot. The existence of long-range resonances is experimentally confirmed by Tunley (1999), who measures F2 and F3 values two syllables before and after liquids in British English. She finds that the presence of /l/ raises the F2 and F3 of high vowels throughout that domain, relative to a neutral /h/, while /r/ lowers the F2 and F3 of the vowels. West (1999a) presents an EPG and EMA study of a Southern British English speaker that finds similar non-local differences between /r/ and /l/, with lower F3, more lip rounding, and the tongue higher and backer preceding /r/ than /l/. Although none of the preceding studies examined vowels more than two syllables away from the liquid, Heid & Hawkins (2000) find even longer distance effects. In sentence pairs like *We heard it might be a ram / lamb*, anticipatory resonance effects were found five syllables away in the word *heard*, a second before the liquid.

Of course, the existence of long-range /r/-resonances is only relevant to the hypercorrection theory if listeners are able to perceive and interpret the resonances. West (1999b) shows that listeners can indeed use long-distance resonance effects to identify a liquid. Speakers of two British dialects were asked to identify minimal pairs such as *belly / berry*, spoken in frame sentences, when varying amounts of the sentence, including the liquid, were deleted and replaced with white noise.

- (11) *No, I uttered berry today*
No, I uttered belly today
*No, I uttered b*****ay*

It was found that speakers of RP could identify /r/ with better than chance accuracy even when a time period corresponding to VrVCVC was obscured, as in the third sentence above (this was the longest period tested). This means that speakers are able to use resonance effects in vowels not adjacent to a liquid in order to identify that liquid.

Long-range resonances may help the listener to perceive that a word contains an /r/, but the spread-out quality of rhotics could also make it more difficult to tell how many /r/s a word contains, or where they are located. Hearing an [ə̃]-like sound in a word that clearly contains a later /r/, the listener may be unsure whether

this corresponds to an underlying /ɚ/, or is a [ə] overlaid with /r/-resonances. If the listener incorrectly guesses the latter, perceptual dissimilation occurs. Hence, the existence of these long-range resonance effects makes the hypercorrection theory at least initially plausible as an explanation for English /r/-dissimilation. Furthermore, I will argue in the next section that the phonetic facts accord well with the particular characteristics of English /r/-dissimilation.

An alternative: anti-repetition constraints Another, more common view is that dissimilation is caused by a phonological constraint against repeated elements within certain domains. There have been several formalizations of this basic idea, such as Alderete (1997)'s local conjunction of markedness constraints and Boersma (1998)'s anti-repetition constraints. I will summarize them as *[r...r]_d, defined below.

(12) *[r...r]_d: Two [r]s do not occur within a domain *d*.

In the case of American /r/-dissimilation, such a constraint would have to have only a gradient effect, but that in itself is not problematic.

For /r/s in close proximity (for example, within the same syllable, or separated by only a vowel), there is evidence that such a constraint is both functionally grounded and synchronically active, albeit in a gradient way, in English. Walter (2007) presents mathematical modeling and phonetic studies of the difficulties of very quickly repeated articulations, such as consonants of identical place that are separated by only a vowel. Martin (2007:76-83) shows that that /rVr/ and /rVr/ sequences are under-represented in neologisms and names, and in Author (in preparation), I show that [rər] sequences are avoided by a variety of phonological means as well.

It's not clear, however, what functional grounding exists for such a constraint penalizing identical segments at longer distances, like the two /r/s in *thermometer* or *particular*. As Ohala (1993:250) notes, 'we are unable to invoke any principles of speech production that would predict changes in this direction.' Another possible explanation is presented by Frisch (2004), who argues that repeated elements cause higher-level processing difficulties. Yet the processing account does not predict that repetitions of /r/ should cause more processing difficulties than repetitions of other sounds, and hence does not explain why /r/ in particular dissimilates.

Besides the lack of clear functional grounding, I argue that a constraint like *[r...r]_d does not provide principled explanations for the characteristics of the dissimilation pattern in question: for example, why /r/ dissimilates more than other

sounds, why it dissimilates through deletion, etc. All these factors must be specified in an arbitrary way in a grammatical account, yet many of them have principled explanations in the perceptual hypercorrection account. These are laid out in the next section.

4 Explaining the pattern

The hyper-correction theory has a number of advantages for explaining the English pattern. Several of the patterns identified in section 2.4 are predictable based on American English phonetics: /r/-dropping occurs in exactly the contexts where /r/ is most likely to be perceptually masked, and the outcome of dissimilation is what a listener would most likely hear if she did not detect one of the /r/s.

Why r? The perceptual theory predicts that only consonants with long-range acoustic effects should participate in long-range dissimilation. Since /r/ is known to have long-range resonances, its participation in dissimilation is expected. In theories that treat dissimilation as a purely grammatical phenomenon, by contrast, the confinement of dissimilation to certain sounds is essentially arbitrary, with no principled connection to the language's phonetics.

Incidentally, the perceptual theory predicts that English might dissimilate /l/ as well as /r/, since both sounds have long-range resonances. There are, in fact, a few reported cases of /l/-dissimilation. Words that showed /l/-dropping in the experiments are listed below.

(13) /l/-dissimilation

	SoCal speakers		AR speakers		previous reports
ophtha(l)mologist	18 / 18	1.00	NA		R1988
Pache(l)bel	4 / 6	.67	NA		
fu(l)filling	10 / 24	.42	4 / 12	.33	T1947, Lamberts (1972)
simu(l)taneously	2 / 25	.08	4 / 11	.36	
multipl(ication)	2 / 25	.08	4 / 14	.29	KK1953
vu(l)nerable	2 / 25	.08	2 / 12	.17	P. Brians

English has far fewer reported examples of /l/-dissimilation than /r/-dissimilation, but this is partly because there are fewer words containing two /l/s. In the CMU Pronouncing dictionary, the number of words containing two /l/s (2350) is only about a quarter of the number of words containing two /r/s (8826).⁸

⁸Since the dictionary includes inflected forms, the number of separate lexical items in each category is smaller than these numbers, but this count gives a rough idea of the relative proportions.

Why deletion, and not substitution? Cross-linguistically, dissimilation can occur either through deleting one of the repeated sounds, or through substituting one sound for another. In earlier stages of English one can find many examples of dissimilation through consonant substitution (see Goodall 1917 for such cases in Old English place names, such as *Spernore* > *Spernal*), and there are a few modern cases, such as those in (14).

- (14) /r/ changing to other consonants
- | | | | |
|-------|----------------------|----------------|-------------------------|
| r → j | <i>defibrillator</i> | di'fibjə,leɪrə | G2006, B. Kennedy |
| r → l | <i>frustrate(d)</i> | 'flʌs,treɪrəd | S1837, also heard today |
| | <i>fritters</i> | 'flɪrəz | S1837 |
| r → n | <i>Purmort</i> | 'pərmənt | H1893 |

Yet these are rare; the American pattern is basically one of dissimilation through deletion. Rhoticity is lost without additional features, such as nasality or laterality, being added.

Ideally, a theory of dissimilation should explain in a non-arbitrary way why deletion or substitution is used in a given language. I suggest that deletion occurs if a listener cannot detect the presence of the dissimilated element at all, while segmental change occurs if the listener can tell that some segment is present but cannot correctly identify it. Which type of error a listener is likely to make depends on the phonetics of the segments in the language in question.

In the case of American English, most dissimilation affects the sound [ə̃], where rhoticity is spread across a vowel. If a listener, hearing *berserk* pronounced [bə̃zə̃k], thinks that the rhoticity of the first syllable is an anticipatory resonance of the rhoticity of the second syllable, he mentally subtracts the rhoticity from the first rhoticized schwa and is left with a plain schwa: [bəzə̃k].

Similarly, American coda /r/ is often realized as rhoticity spread across a vowel. Olive et al. (1993:220) note that coda /r/ gives the entire preceding vowel a 'rhotic color': F3 begins to descend close to the onset of the vowel, so that a vowel followed by coda /r/ has a lower F3 than vowels followed by an onset /r/ or by a different consonant. The region of the /r/ itself has formant values similar to a [ə̃]. Olive et al. note that "all back and mid vowels occurring before a light [coda] /r/ have the low F3 configuration and therefore the /r/-colored vowel quality. . . since the vowel quality in the /r/ context is so distinct from the vowel quality in other contexts, we could consider [u^r], [ɔ^r] or [ɑ^r] as allophones of /u/, /ɔ/, and /ɑ/, respectively" [223]. This coproduction of the vowel and coda /r/ may create conditions where the rhoticity on the vowel can be mistaken for long-range resonances of a following /r/, and a listener subtracting this rhoticity could be unaware of the presence of the coda /r/.

Moreover, the phonetic facts fit well with the observation that coda /r/ seems to dissimilate only after certain vowels. Stressed coda /r/ dissimilates mostly when it follows /o/ or /a/; these are among the vowels that Olive et al. identify as being most affected by coda /r/. In a sequence like /ir/, Olive et al. show a more distinct formant movement between the vowel region and /r/-region, and indeed no dissimilation has been reported in /ir/ sequences.

Less dissimilation in more perceptible positions As noted in section 2.4, dissimilation is less common in stressed syllables, and never affects initial or final /r/. Under the perceptual theory, this is explained by the fact that these positions are relatively perceptually prominent (see Barnes (2006) for an overview of perceptually privileged positions). A listener is less likely to mistake [ɚ] for [ə], or miss the presence of /r/, in these positions.

Effects of morphology We have seen that the only apparent effect of morphology on /r/-dissimilation is that /r/ is unlikely to drop when directly adjacent to a morphological boundary. I suggest that perceptual dissimilation fails to happen in these words because a pre-boundary [ɚ] is realized with greater duration than an [ə] that is not boundary-adjacent, making it relatively perceptually distinct. I have not found phonetic studies that directly compare the kinds of words in question, but to my ear, it seems that in a compound like *supermarket*, the underlined rhyme is phonetically longer than a rhyme in the corresponding position within a monomorphemic word like *caterpillar*. If so, this extra duration should make the /r/ in *supermarket* less likely to be perceptually masked. By this theory, the effect of morphology on dissimilation is an indirect result of the relationship between morphology and prosody.

Under grammatical theories of dissimilation, the more surprising fact is the absence of other expected effects of morphology. We have seen that when dissimilation creates morphological alternations, it is usually roots rather than affixes that alternate. In a word like *governor*, for example, it is possible to dissimilate the /ɚ/ in the root ('gʌvənɚ) but not the /ɚ/ in the suffix (*'gʌvɚnə). This runs counter to a general cross-linguistic tendency for deletions and other changes to occur more readily in affixes than roots. In an optimality theoretic framework, McCarthy & Prince (1995) propose that constraints requiring faithfulness to root material universally outrank constraints requiring faithfulness to affix material; and this effect is seen in some more clearly grammaticized types of dissimilation. For example, the Latin suffix *-al* dissimilates to *-ar* when it attaches to a root containing /l/ (*tonal* vs. *solar*); the root is unchanged.

I propose that the reason the typical root–affix asymmetry can be violated here

is that root faithfulness is a property of grammars, and will only show its effects when a process is truly grammaticized. In a process that consists of sporadic lexical changes prompted by misperceptions, there is less reason for root faithfulness to have an effect. I will discuss in section 6 the possibility that this violation of root faithfulness is part of the reason that American /r/-dissimilation has not in fact become fully grammaticized and productive.

No dissimilation across word boundaries We have seen that dissimilation does not occur across word boundaries. Comparing phrases like *our tree* and *our tea*, the /r/ of *our* is actually less likely to drop if there is an /r/ in the following word. This may seem surprising, given that resonances do cross word boundaries (Heid & Hawkins 2000) and hence are expected to cause perceptual errors like missing the first /r/ in *ou(r) tree*.

However, the crucial question is whether such perceptual errors, by themselves, could affect future productions of the same phrase. There are essentially two ways that this could happen. The first would be if a phrase like *our tree* were stored as a whole, with its own phonological representation, so that a misperceived phonological form could be saved and called up again. This is highly implausible. Although idioms and some very high-frequency collocations may be stored as chunks (Sosa & MacFarlane 2002), it would take millions of lexical entries to store a phonological form for every collocation of a function word and a lexical word. We can assume that phrases like *our tree* are normally assembled anew every time they are spoken, by calling up the lexical representations of *our* and *tree* and applying whatever phonological rules are relevant.

The second way that sandhi dissimilation could occur would be if dissimilation were encoded in the phonological grammar, and hence applied to new collocations actively. If sandhi dissimilation did occur, this would be strong evidence that dissimilation had been grammaticized. But in the absence of a grammar favoring dissimilation, the perceptual account predicts that dissimilation can only occur within units that are lexically stored, and this is exactly what we find.

Weak effects of direction Since phonetic studies have found that /r/-resonances spread in both directions, it is expected that both anticipatory and perseverative dissimilation are possible, as is the case. There are some indications that /r/-resonances may be stronger before an /r/ than after; an acoustic study in West (1999b) found ‘robust anticipatory, not perseverative, resonance distinctions’ [419], and Heid & Hawkins (2000) found anticipatory resonances stretching five syllables, although they did not look at perseverative resonances. As noted above, there are far more reported cases of anticipatory dissimilation than perseverative dissim-

ilation, and it is possible that an asymmetry between the strength of resonances in each direction is at work.

Effects of local context I suggest that /r/ is more likely to go unperceived when it is next to a labial or coronal because those consonants help to mask the labial and coronal components of the /r/ itself. American English rhotics are believed to involve three articulatory gestures: a raising of the tongue blade, a slight rounding of the lips, and a retraction of the tongue root. Labial and coronal consonants, obviously, involve articulations in roughly the same regions as the /r/'s lip rounding and tongue blade gestures, and hence should make it more difficult to perceive the presence of the rhotic.

In this way, a local labial or coronal causes a local perceptual dissimilatory effect that complements the long-range perceptual dissimilation caused by /r/-resonances. Heid & Hawkins (2000) show that the acoustic effects of /r/ consists of two components. There is a relatively large local perturbation of formants, and a long-range effect (resonance) that is smaller. Usually, even if a local labial or coronal obscures the local formant perturbations of /r/, the /r/ is still recoverable due to its long-range resonances, which are heard on neighboring syllables. However, when another /r/ in the word has overlapping long-range resonances, the first /r/ can be fully masked. In this way, the local and non-local contexts interact in producing complete perceptual dissimilation.

Why does onset /r/ drop less? We have seen that unstressed /rə/ is less likely to become [ə] than /ɚ/ is. Under the perceptual account, this is probably because the combination of [ə] and /r/-resonances is more similar to, and hence more confusable with, /ɚ/ than /rə/. This seems reasonable. In /rə/ sequences as produced by the experiment subjects, there is often (though not always) a distinct transition from /r/ to /ə/, which should make the sequence less confusable with [ə].

Facts that are challenging for the perceptual account While many facts about /r/-dissimilation fit well with known phonetic tendencies, there are also a few facts that are surprising. While none of these are necessarily fatal for the perceptual theory, I note them here as areas that need clarification.

The failure of an intervening /l/ to block /r/-dissimilation is surprising under the perceptual theory, given that /l/ is reported to have its own long-range resonances (at least, in British dialects). However, there has been no phonetic work on how the resonances of /r/ and /l/ interact. The relative rareness of /l/-dissimilation, as discussed above, might indicate that /l/-resonances are weaker or less perceptible in American English, but this is a topic for future research.

The pronunciation of orthographic vowels in *tu(r)meric*, *barbitu(r)ate*, and *periphe(r)al* obviously indicates that factors beyond perceptual mistakes are at play in the history of these words. The idea that phonological forms are occasionally a melange of audio and orthographic input is quite possible. For example, the word *Worcestershire (sauce)*, whose dictionary pronunciation is [wʊstəʃə], received about a dozen different pronunciations in the experiment, ranging from [wʊstə] to [wɔɪtʃɛstəʃaɪ], with many in-between variants such as [wɔɪstəʃaɪ]. Apparently many subjects remembered that the orthography has more syllables and more *rs* than the pronunciation, but were unsure which to pronounce. A similar kind of confusion may have produced forms like *barbituate*. As long as such cases are relatively rare, they are not too problematic for the perceptual theory.

Finally, the reports of non-structure-preserving dissimilation, where /or/ dissimilates to [o] in contexts that otherwise do not have [o], is surprising under some interpretations of the perceptual account. Ohala (1993) argues that, since a listener expects speakers to produce phonologically acceptable forms, sound change through misperception should not result in sounds or sound sequences that were not already phonotactically possible. However, Blevins & Garrett (1998:520) disagree, pointing out that perceptual dissimilation may occur in listeners who are have not fully acquired the language's sound system. Thus, the predictions of the perceptual account in this area are not fully clear.

4.1 Another alternative: the P-map hypothesis

If we accept that dissimilation tends to affect less perceptible /r/s, this does not necessarily entail that dissimilation happens through perceptual errors as Ohala claimed. Steriade (2003), in the 'P-map' theory, proposes that the phonological grammar takes account of the relative perceptibility of different contrasts, and prefers phonological changes where the input and output are perceptually similar. Under this approach, one could argue that dissimilation is motivated by a grammatical dispreference for multiple /r/s, but is constrained to avoid /r/-deletion where the change would be highly perceptible. Most of the advantages cited above for the perceptual hypercorrection account could equally be cited as advantages for the P-map account.

However, there are at least two areas where the hypercorrection account makes different predictions from the P-map account. The first concerns dissimilation across word boundaries. The hypercorrection account predicts that this should never be possible, because perceptual errors can be reproduced in speech only if stored in the lexicon or encoded in the grammar. The P-map account does not predict this limitation; there is no reason that a sandhi dissimilation process could not arise that would be grammar-driven yet guided by perceptual similarity. Of course,

it is possible in the P-map theory (as in any grammatical theory) to introduce a constraint arbitrarily limiting dissimilation to the domain of a word, so the lack of sandhi dissimilation is not problematic for the P-map theory. But the hypercorrection theory makes a narrower prediction here, and narrower predictions are to be preferred as long as they fit the data.

The second and more significant difference concerns the possibility of perceptual mistakes in the opposite direction, which would produce /r/-assimilation instead of /r/-dissimilation. In the next section, I argue that these do occur and that they are problematic for any account of dissimilation as being primarily grammar-driven.

4.2 The reverse of dissimilation: long-distance liquid spreading

The perceptual account predicts that /r/ should sometimes be *inserted* in the same kind of contexts where dissimilation occurs. If the effect of /r/-resonances on [ə] is confusable with [ɚ], mistakes should be possible in both directions. Hence, we should find cases of assimilation that are exactly the reverse of a given type of dissimilation. Alderete & Frisch (2006) claim that this prediction is not borne out, because cross-linguistically ‘liquid dissimilation is extremely common... but liquid assimilations are vanishingly rare’.⁹

I claim that American English actually does have a sporadic process of assimilatory /r/-insertion, where /r/ is inserted into words that already contain an /r/. Before giving examples of this process, it is necessary to distinguish it from several other processes by which /r/ may be added to a word in rhotic dialects. First, /aɹ/ or /ɔɹ/ sequences may gain an /r/ in words like *wash*, *squash*, *mosh pit*, *Washington*, and *gosh*. Gick (1999:33) attributes this to a perceptual effect caused by gestural overlap. Second, some dialects such as Tangier Island (Shores 2000) and the Great Smoky Mountains (Hall 1942:80) rhotacize final schwas, especially in words that have final [o] in Standard American English, such as *pillow* and *yellow* (pɪlɚ, jɛlɚ). Third, there are reports of speakers who substitute [ɚ] for [ɔɹ] in words like *oyster*, *toilet*, and *boil*. This phenomenon is spottily described and has been variously explained as a gestural effect (Gick 1999:51) or as conscious hypercorrection for certain dialectal pronunciations of /ɔɹ/ that sound to outsiders like [ɚ].

Assimilatory /r/-insertion is distinct from these other /r/-insertion phenomena. Moreover, it is not confined to areas of mixed rhoticity, or areas that have become rhotic after a period of non-rhoticity, where it might be analyzed as hyper-

⁹See Poultney (1972) and Eckhardt (1938:96–97) for historical examples of long-distance assimilatory insertion of liquids in Indo-European languages, including English. None of them are regular changes, but neither are most cases of long-distance dissimilation.

correction for [r]-dropping. The earliest examples I have found of assimilatory /r/-insertion are from Emerson (1893:118, 164)’s list of words with “excrecent r” in the dialect of Ithaca. He gives ten examples of non-final insertion of /r/. As shown in (15), eight of these involve insertion of an /r/ into a word that contains a later /r/. (In two of these examples, *oughta* and *potatoes*, the second /r/ is itself non-etymological, a result of the final-rhotacization process mentioned above.) Although Emerson does not identify the presence of a second /r/ as a conditioning factor for /r/-insertion, the fact that 8/10 of the words with medial /r/-insertion contain second /r/s suggests that the second /r/ is a trigger.

(15) r-assimilation in Ithaca,

a.	<i>daughter</i>	dartr	<i>ought to</i>	ɔrtɹ
	<i>Mather</i>	marðr	<i>familiar</i>	fərmiljər
	<i>master</i>	marstr	<i>potatoes</i>	pərtetɹz
	<i>Auburn</i>	ɔrbərn	<i>tavern</i>	tərvɹn

To check whether /r/-insertion is indeed more common in words already containing /r/, I searched the Buckeye corpus (Pitt et al. 2007) for words where the speakers’ pronunciation contains more instances of [r] and [ɹ̥] than the dictionary pronunciation provided by the corpus. Monosyllabic function words, which are prone to rhotacizing near words that contain rhotics, were excluded. The results were manually checked, and tokens where the extra [r] was an error (due to a misplaced word boundary or an incorrect dictionary pronunciation) were excluded. Among the remaining words, there were 86 whose pronunciation contained an added [r] or [ɹ̥] that was separated from any other [r] in the environment by at least a consonant or a full vowel. Of these, 60 tokens (70%) occur in words that contain another rhotic, while 26 (30%) occur in words that do not contain another rhotic. In the corpus as a whole, when 134 common monosyllabic function words are excluded, there are 36554 words (26%) containing a rhotic, and 103200 words (74%) not containing a rhotic. A Pearson’s chi-square test shows a significant association between the presence of an original rhotic and the addition of another rhotic ($X^2 = 2$, $df = 1$, $p\text{-value} = 0.1573$).

Some of the words that showed /r/-insertion in the Buckeye corpus were included in the elicitation experiment, along with other words I have heard with assimilatory /r/-insertion. Words which subjects pronounced with /r/-insertion are listed in (4), excluding a few examples that sounded like speech errors to me. Some of these examples come from the frame sentences rather than the target words; these are listed separately.

Table 4: /r/-assimilation in the experiment data

		SoCal	AR	Previous reports
<i>sherbet</i>	'ʃəˌbət	21 / 25 .84		Zuraw (2002), D. Kamholz
<i>persevered</i>	ˌpɜːsəˈvɪrd	7 / 24 .29	6 / 11	.55 E1999, G2006, J. Kammert
<i>pejorative</i>	pəˈdʒɔrətɪv	2 / 7 .29		G2006
<i>lavatory</i>	'lævə(ə)ˌtɔri	5 / 23 .22	5 / 10	.50 J. Kammert
<i>infomercials</i>	'ɪnfəˌmɜːʃəlz	5 / 24 .21	6 / 13	.46 Buckeye corpus
<i>integers</i>	'ɪntəˌdʒɜːz	4 / 25 .16	4 / 11	.36
<i>fervently</i>	'fɜːvəntli	2 / 15 .13		
<i>photographer</i>	fəˈtɒɡəˌfɜː	3 / 23 .13	4 / 12	.33 G2006, R. Sittler
<i>tuberculosis</i>	təˌbɜːkjəˈlɔʊsɪs	3 / 25 .12		
<i>categorize</i>	'kæɾəˌɡəˌaɪz	2 / 25 .08	4 / 12	.33 G2006
<i>Dr. Kevorkian</i>	kəˈvɔrkɪən	1 / 15 .07		
<i>defibrillator</i>	dɪˈfrɪbrɪleɪtə	1 / 18 .06		
<i>contractual</i>	kənˈtræktʃəəl	1 / 19 .05		
<i>beneficiary</i>	ˌbɛnəˈfɪʃəri	1 / 21 .05	2 / 14	.14
<i>camaraderie</i>	kəmˈrædəˌi	1 / 21 .05		G2006
<i>overture</i>	'ɔrvətʃə	1 / 23 .04		
<i>familiar</i>	fəˈmɪljə	1 / 25 .04	4 / 15	.27 S1837, T1936, D. Kamholz
<i>christopher</i>	kɪstəˌfɜː	1 / 25 .04		
<i>entrepreneur</i>	ˌɛntəˌpɜːnə	1 / 13 .03		
<i>repercussions</i>	rɪˌpɛrˌkɪʃən	1 / 12 .08		
<i>arbitration</i>	ˌɑrbəˈtreɪʃən	1 / 6 .17		Buckeye corpus
<i>immigrants</i>	'ɪməˌɡrænts	1 / 15 .07		
<i>christopher</i>	'kɪstəˌfɜː	1 / 15 .07		Buckeye corpus
<i>supreme</i>	səˈprɪm	1 / 15 .07		
<i>veneer</i>	vəˈniːr	1 / 7 .14		
<i>professor</i>	prəˈfɛsə	1 / 15 .07		
<i>daughter</i>	'dɑːtə	1 / 15 .07		
<i>author</i>	'ɑθə		2 / 15	.13 C. Moffatt
<i>poverty</i>	'pɔrvəri, 'pɒrvəri		2 / 14	.14 Hall 1942:95, Buckeye corpus
Words from the frame sentences				
<i>dormitory</i>	'dɔrməˌtɔri	5 / 25 .20		
<i>theater</i>	'θiəˌtɜː	1 / 25 .04		
<i>coverage</i>	'kʌrvɪdʒ	1 / 25 .04		
<i>officers</i>	'ɒfɜːsəz	1 / 25 .04	1 / 15	.07
<i>soccer</i>	'sɔkə		2 / 15	.13

A few more examples of /r/-spreading that I have heard, or that have been reported to me, are given in Table 5.

Table 5: Other reported cases of /r/-assimilation

<i>integral</i>	'ɪnrɛgrəl ~ 'ɪntəːgrəl	G2006, P. Brians
<i>frustum</i>	'frʌstrəm	KK 1953, M. Hall
<i>bupropion</i>	ˌbuːprɔʊpiən	L. Hall
<i>curvature</i>	'kəːvɜrtʃə	M. Hall
<i>cotter (pin)</i>	'kɔrtə	G2006
<i>Covarrubius</i>	ˌkɔrvəˈrɪbjəs	M. Covarrubius
<i>Hawthorne</i>	'hɔːθɔrn	E. Keer
<i>mascarpone</i>	ˌmɑːskəˈpɔʊn	B. Hassan
<i>pomegranate</i>	'prɔməˌgræniːt	S. Jacobson

According to the perceptual account, it is predictable that a listener may mistake the long-range resonances of one /r/ for the presence of another /r/, just as in other cases he mistakes the presence of one /r/ for the long-range resonances of the second. It is interesting to note that some words whose standard form contains two /r/ can either add or drop an /r/: *photographer*, *camaraderie*, *dormitory*, *entrepreneur*, *defibrillator*, and *overture* all had both one-/r/ and three-/r/ pronunciations in the experiment.

Analyses of dissimilation as grammar-driven, however, have trouble accounting for assimilatory /r/-insertion. A constraint like *[r...r]_d can only compel /r/-deletion. If one /r/ is phonologically better than two, there is no grammatical mechanism that would add an /r/ to a word already containing an /r/.

5 Dissimilation in the lexicon

In the preceding sections, I have argued that listeners sometimes confuse [əː] with [ə], or [r] with zero, in words that contain an additional /r/. This section addresses the question of how and why speakers may adopt misheard pronunciations into their production lexicons—and why not all misheard pronunciations are equally likely to be adopted.

There are at least two objections to the theory that misperception, by itself, leads to changes like assimilation and dissimilation in the lexicon. First, people usually don't have to learn a word from a single hearing. They are likely to hear multiple tokens, some slower and clearer than others. This is especially true with common, familiar words like *surprise*. Although it is plausible that a listener sometimes fails to hear the first /r/, it seems unlikely that any listener would always miss

its presence. Probably most speakers who say [səpraɪz] are aware of the pronunciation [səˌpraɪz] as well, and literate speakers like the experiment subjects have seen the two *rs* written. We cannot assume, then, that speakers are simply ignorant of the standard pronunciation, as an account based only on misperception might imply.

Secondly, as Alderete & Frisch (2006) point out, we need to explain why dissimilation is common in some environments while assimilation is common in others. American English has more /r/-dissimilation than /r/-assimilation, and the same is true cross-linguistically. Yet some other sound sequences are cross-linguistically far more likely to undergo assimilation than dissimilation (/np/ → /mp/ is common; the reverse rare or nonexistent). If assimilation and dissimilation are simply perceptual errors in opposite directions, we expect the errors to be more evenly balanced.

Both of these facts suggest that perceptual errors can be only part of the reason that lexical representations change. I argue that misperceptions create a pool of possible variant forms for a word, but that speakers make active choices among these variants, and are more likely to adopt a variant that is phonologically better. On the reasonable assumption that it is easier to pronounce words with fewer /r/s, a variant with /r/-dissimilation is more likely to be adopted than a variant with /r/-assimilation.

The diagram in Table 6 shows how the misperception and selection process could happen. It shows a situation in which a listener hears the same word, *photographer*, from four speakers. These speakers all have the same target pronunciation, the standard form [fəˈtɑgrəfə]. However, the speakers have varying degrees of long-range /r/-resonances, which cause their pronunciations to sound different. Speakers 1 and 2 have relatively weak /r/-resonances, so that the schwa in the initial syllable is little affected, and sounds like a plain schwa. Speakers 3 and 4 have strong /r/-resonances, which cause the schwa of the initial syllable to sound rhoticized. The listener detects these differences, and must attempt to correct for the /r/-resonances. For speaker 1, the listener rightly decides that no correction is necessary, and reconstructs the word with two /r/s. For speaker 2, the listener mistakenly hypercorrects: he thinks that the speaker has strong /r/-resonances, and that the /r/ of the third syllable is an anticipatory resonance of the /r/ of the fourth syllable, and hence he incorrectly reconstructs the word with only one /r/. For speaker 3, the listener accurately corrects for the extended /r/-resonance and realizes that the first schwa is not supposed to be rhoticized. He reconstructs the word with two /r/s. For speaker 4, the listener mistakenly hypocorrects. He fails to realize that the initial schwa is only rhoticized through anticipatory resonance effects, and reconstructs the initial syllable as containing an /r/.

Hence, the listener believes he has heard three pronunciations of *photographer*:

Target pronunciation for all 4 speakers: [fə'tagrəfə]

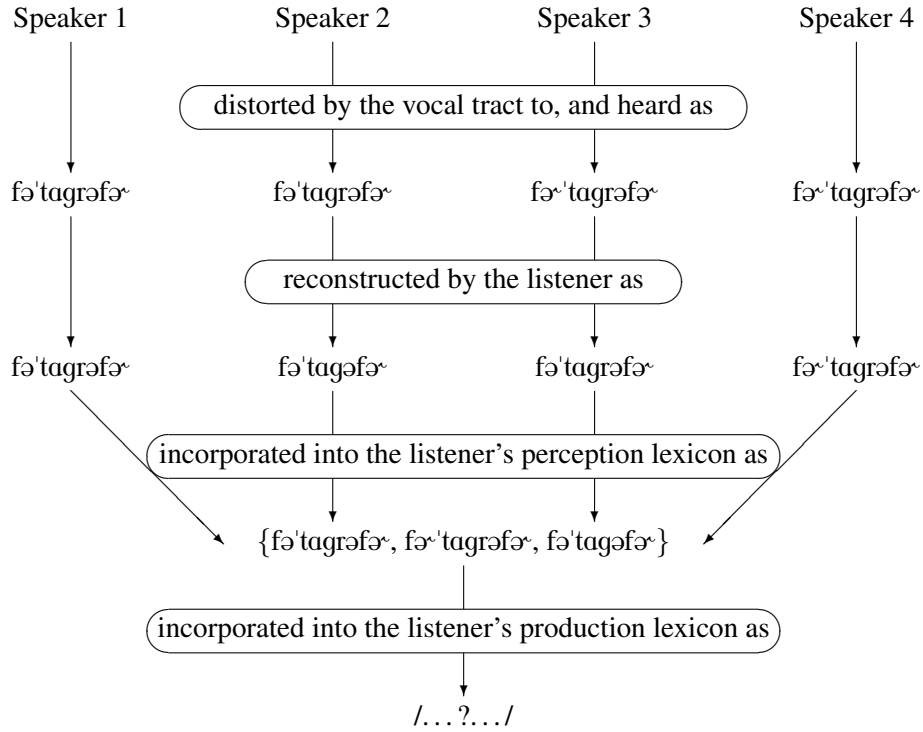


Table 6: Four production and perception scenarios for *photographer*

[fə'tagrəfə], [fə'tagəfə], and [fə'tagrəfə]. He cannot be sure that these varying percepts are only due to phonetic variation among the speakers's productions and variation in his own perception system; as far as the listener can tell, there may be multiple underlying forms of the word in the community (as there are for many words).

When it comes time to speak, the listener-turned-speaker has several possible models for his own pronunciation, and must choose between them. The speakers' choice might be influenced by statistical factors, with a preference for the pronunciation that is most common. In the hypothetical scenario of (6), the most common

percept is the correct one, [fə'tagrəfə̃], so a speaker trying to imitate the majority would not dissimilate or assimilate. The choice could also be affected by social factors; if the listener wished to be associated with speaker 2 or speaker 4, this could lead him to choose the dissimilated or assimilated pronunciations. (To give a real-life example, Goodman & Halvey (2006) argue that students and staff at *Swa(r)thmore* College are more likely to adopt the dissimilated pronunciation of the college's and town's name if they identify with the local community, which uses the dissimilated pronunciation.)

The speaker's choice could also be influenced by purely phonological factors: he evaluates variant pronunciations using his phonological grammar, and prefers the pronunciation that is judged by that grammar to be least marked. Continuing with the assumption that [ə̃] is less marked than [ə̃̃] or [rə̃], it is predicted that a speaker is more likely to choose a variant with dissimilation than one with assimilation, as shown in (16).

	*[ə̃]	*[r]
fə'tagə̃fə̃	*	
fə'tagrə̃fə̃	*	*
fə̃'tagrə̃fə̃	**	*

The phonological dispreference for /r/s can explain, in this model, why variants with dissimilatory deletion of /r/ are more likely to enter the lexicon than variants with assimilatory insertion of /r/. Note, by the way, that there is no need for a constraint against multiple [r]s (*[r..r]_d) to explain why the dissimilated form is preferred. A constraint against [r] in general is sufficient.

This idea is in line with several theories that to model the process by which variants are chosen. Haspelmath (1999), for example, emphasizes that linguistic evolution is partly intentional on the part of speakers. "Speakers speak and listen intentionally, and their choices of specific expressions from a range of options can also be said to be intentional, although these are usually fairly automatic." Martin (2007) proposes that psycholinguistic processing models can also account for the selection of less-marked variants among a range of choices. Martin's study concerns the choice among phonologically unrelated lexical variants (e.g., *soda* versus *pop*), but his model could likely be extended to account for the choice between variant phonological forms as well.

6 Dissimilation and the phonological grammar: a case of underphonologization?

Long-distance /r/-dissimilation is fairly common in American English today, and according to Hempl (1893), it was common over a century ago as well. Yet it remains only a pattern of sporadic lexical change; it has not become a regular or obligatory process. Some speakers hardly dissimilate at all, and many words that contain two /r/s fail to undergo dissimilation. This irregularity is typical of dissimilation, cross-linguistically (Campbell 2004:30). In a series of postings on Linguist List in 1992, Jose Ignacio Hualde, Jennifer Cole and Chuck Kisseberth ask readers to supply cases of truly productive long-distance dissimilation rules, and conclude that there are only two or three possible cases (Meeussen's Rule of tonal dissimilation, Georgian liquid dissimilation, and possibly Latin liquid dissimilation). Given that many languages show at least some gradient or sporadic dissimilatory phenomena, the near-universal failure of dissimilatory processes to become grammaticized and productive is surprising. The American case gives us a chance to examine factors that might inhibit grammaticization.

To make the discussion concrete, let us focus on a particular way in which dissimilation could potentially become regular. There are many words where suffixes containing /r/ may trigger /r/-deletion in roots, such as *gove(r)nor*, *alte(r)nator*, *counte(r)feiter*, *photog(r)apher*, *p(r)ofessor*, and *fa(r)mer*. For each of these words, there is a related word in which the /r/ cannot be deleted (*govern*, *photograph*, etc.), so there is an alternation between morphemes with /r/ and without /r/, the latter occurring before the suffix *-er*. A learner could hypothetically notice this pattern and extend it to new words, creating a regular alternation. The question is why this has not happened.

One possibility is that dissimilation has never been common enough, as a pattern of sporadic lexical change, to provide learners with enough input to draw such a generalization. It's not clear how many examples of a particular type of alternation a learner needs in order to generalize the process, but it seems plausible that dissimilation is simply too rare. A related problem is the limited number of words affected. For what I have argued to be phonetic reasons, dissimilation primarily affects unstressed medial /ə/, and only in limited environments (for example, it rarely deletes an /r/ that falls at the end of the first half of a compound, as in *water-carrier*). Thus, even a speaker who has relatively extensive dissimilation in those words that allow it will still produce many words containing two /r/s. Perhaps the list of conditions under which dissimilation occurs is too complex to be easily learned.

A second possibility is that the American /r/-dissimilation pattern happens to

be difficult to represent in the grammar, due to its tendency to delete /r/s from word roots. As mentioned earlier, there are arguments in theoretical phonology (McCarthy & Prince 1995) that deletion or other changes in affixes is always preferred over changes in roots. In the two productive cases of long-distance liquid dissimilation mentioned above (Georgian and Latin), it is indeed the affixes, not the roots, that alternate. As the tableau in (17) shows, there is no way to produce the mapping of /gʌVəʁn/ + /əʁ/ to [gʌVənəʁ] as long as the ranking of FAITH-ROOT » FAITH-AFFIX is maintained.

	/gʌVəʁn/ + /əʁ/	*[əʁ...əʁ] _{word}	MAX-əʁ-ROOT	MAX-əʁ-AFFIX
(17)	gʌVəʁnəʁ	*		
	gʌVəʁnə			*
	gʌVənəʁ		*	

Finally, it is worth questioning whether the appropriate markedness constraint to trigger the dissimilation, *[r...r]_{word}, even exists. As noted above, there is no clear phonetic grounding for such a constraint, and the theory does not require such a constraint to explain why dissimilated forms are preferred in the lexicon. If the universal constraint set does not contain a constraint of the form *[r...r]_d (at least for larger domains such as the word), this would go far towards explaining why long-distance dissimilation so rarely develops into a truly regular process.¹⁰

7 Conclusion and further questions

This paper has offered a more extensive description and analysis of American /r/-dissimilation than had previously been available. I have argued that this dissimilation results from perceptual hypercorrection, as proposed by Ohala (1981). However, I have expanded the perceptual model to admit some role for phonological factors as well. Perceptual hypercorrection only makes dissimilated forms available as variants; the choice to use and preserve these variants reflects the fact that they are phonologically simpler and better.

There are a number of remaining questions about American /r/-dissimilation, and much potential for further study of the process. As yet there are no phonetic studies of the production and perception of liquid resonances in American English,

¹⁰Of course, eliminating the constraint *[r...r]_d would require finding an explanation for the few cases where regular morphological alternations do seem to be governed by long-distance dissimilation. One might argue that not every morphological alternation must have a phonological justification, that some are truly historical residues. More work is necessary to determine whether this restrictive a theory is sustainable in this case.

and a better understanding of these is crucial for evaluating perceptual models of changes involving liquids.

A better understanding of American /r/-dissimilation has the potential to clarify more general questions about the nature of dissimilation cross-linguistically. A great deal of the debate about dissimilation has been based on ancient, completed diachronic processes, or on limited morphological alternations. In both cases, we can only speculate about the phonetic conditions that originally gave rise to dissimilation; there is no possibility of testing the production or perceptual patterns of, for example, ancient Latin speakers. It would be valuable to have more study of dissimilation processes that are active and not morphologically limited. American /r/-dissimilation has the added advantage that it takes place in dialects whose speakers are widely accessible. I hope that this preliminary study will stimulate further interest in the phenomenon.

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