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Perception of repeated /l/ and /n/: Implications for understanding dissimilation

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Abstract. We test Ohala's (1993) hypothesis that phonological dissimilation can result from perceptual errors. Using a task in which American English speakers hear and orthographically transcribe nonce words, we test whether they are more likely to omit an acoustically present /l/ or /n/ when spliced into a word where another token of the same sound is present. We find that this is the case for /l/ but not for /n/. These results mirror the actual prevalence of dissimilation in American English, where /l/-dissimilation occurs occasionally, but /n/-dissimilation rarely or never.

Keywords. dissimilation; speech perception; hypercorrection; nasals; laterals

1. Introduction. Phonological dissimilation is the avoidance of multiple instances of a sound within some domain, typically the word. Dissimilation can occur either through the deletion of a sound, as in the optional pronunciation of *surprise* as [səpraɪz] in American English, or through the replacement of one sound by another, as in Latin *arbore* > Spanish *arbol*. Although dissimilation is fairly common within some languages, and occasionally even grammaticized through morpho-phonemic alternations, it is usually a somewhat unpredictable process, affecting only some lexical items.

The cause of dissimilation is disputed; a variety of perceptual, processing and production factors have been proposed to contribute. For an overview and comparison of several such theories, see Garrett & Johnson 2013 and Hall et al. 2019. This paper reports on two experiments from a series of studies testing a particular theory, namely John Ohala's proposal that dissimilation can result from perceptual hypercorrection (Ohala 1981, 1993).

Ohala argues that the kinds of features cross-linguistically prone to dissimilation, such as nasality, rounding and rhoticity, tend to be those with relatively drawn-out acoustic realizations. Liquids, for example, can affect vowel formants across several syllables (Tunley 1999, West 1999a, Heid & Hawkins 2000), and there is evidence that listeners use these extended coarticulatory effects to identify liquids (West 1999b). Ohala hypothesizes that extended coarticulation can make it unclear to listeners how many instances of a feature are actually present. Listeners must always correct for coarticulation, subtracting its effects from nearby sounds in order to correctly identify them. Yet if there really are two instances of a liquid or nasal present, there is a risk that listeners will over-correct. One instance of the repeated feature may be incorrectly identified as anticipatory or perseverative coarticulation with the other instance of the sound, and hence factored out. The listener will construct a representation of the word that does not include the factored-out feature, and will draw on this representation when they produce the word.

The hypercorrection theory of dissimilation predicts that there should be a connection between patterns of dissimilation attested in a given language, and the types of misperception that occur with repeated sounds in that language. Not every type of feature repetition is necessarily vulnerable to perceptual hypercorrection in every language; it should depend on the language-

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specific phonetic implementation of that feature, particularly its long-range coarticulatory properties. In addition, the particular way that a feature is misperceived (e.g., whether /r/ is misperceived as /l/, or as /n/, or as simply absent) should depend on its perceptual similarity to other features in the same language. Posner (1961:101) notes that in Romance "confusion between l-sounds and r-sounds is frequent even when there is no dissimilatory or assimilatory influence at work"; this may be the reason that l → r and r → l substitutions are a common mechanism of dissimilation in those languages.

1.1. DISSIMILATION IN AMERICAN ENGLISH. The best-attested dissimilation process in American English is r-dissimilation. Otherwise rhotic Americans can optionally drop one of the /ɹ/s in *adve(r)sary*, *be(r)serk*, *entrep(r)eneur*, *pa(r)ticular*, and dozens of other words (Hempl 1893, Hall 2012). (We use /ɹ/ to indicate both consonantal [ɹ] and vocalic [ɚ], which participate together in r-dissimilation). This dissimilation primarily affects unstressed syllables, and nearly always takes the form of [ɚ] losing its rhoticity and becoming [ə], as in *surprise* [sɚˈpɹaiz ~ səˈpɹaiz]. There are only a small number of words where /ɹ/ dissimilates to another consonant, such as [j] in *defibrillator* [diˈfɪbjɛˌleɪɾɚ], *February* [ˈfɛbjuˌɛɹi]. Those cases typically seem to involve similarity to another word (perhaps *calculator, January*).

There is also some evidence for /l/-dissimilation in American English. We have heard speakers omit the parenthesized /l/s from the words in Table 1. Kirk Hazen (p.c.) reports that some Appalachian speakers omit the first /l/ in *B(l)uefield*.

	Standard	Dissimilated
multiplication	ˌməltəpləˈkeɪʃən	ˌməltəpəˈkeɪʃən
fulfill	fəlˈfɪl	fəˈfɪl
ophthalmologist	ˌɑfθəlˈmɑlədʒɪst	ˌɑfθəˈmɑlədʒɪst
simultaneously	ˌsaɪməlˈteɪniəsli	ˌsaɪməˈteɪniəsli
vulnerable	ˈvəlnəɹəbəl	ˈvənəɹəbəl
Pachelbel	ˈpɑkəlˌbɛl	ˈpɑkəˌbɛl

Table 1. Examples of optional /l/-dissimilation

These examples resemble American r-dissimilation in that they occur through deletion of /l/, rather than changing /l/ to /r/ or another consonant. We have found only one possible dialectal example of l → r dissimilation: Hall (1942:97) reports *flail* ('to whip') as [freɪl] in Smoky Mountain English[1].

Nasals, interestingly, do not seem to be involved in dissimilation in American English. We are not aware of any clear examples where a nasal drops or changes features due to presence of another nasal. Nor does English show l → n or r → n dissimilation, both of which exist in Romance (e.g. *pilula* > *pinula*, Posner 1961:174). Contemporary dissimilation seems to be confined to liquids.

Incidentally, the lower number of words with l-dissimilation compared to r-dissimilation may in part reflect the relative scarcity of words with two /l/s compared to two /ɹ/s. To obtain a rough estimate of how many words are eligible to undergo each type of dissimilation, we

[1] The l → r dissimilation seen in the pronunciation of *colonel* as [ˈkɚnəl] is a popular textbook example, but it is not contemporary. It likely represents survival of a form that originally dissimilated in Romanic (Oxford English Dictionary).

searched the CMU Pronouncing Dictionary (http://www.speech.cs.cmu.edu/cgi-bin/cmudict, version 0.7b), an open-source machine-readable list of pronunciations for around 134,000 words, including inflected forms, of North American English. Counts of words with two /ɹ/s, /l/s, or /n/s are given in Table 2. The count for /ɹ/ includes both [ɹ] (transcribed R in the dictionary) and [ɚ] (transcribed ER). Overall, there are almost four times as many words with two /ɹ/s as words with two /l/s, and this may in part explain why there are fewer reported examples of l-dissimilation. However, the lack of n-dissimilation cannot be similarly explained: there are nearly as many words with two /n/s as words with two /ɹ/s.

	Number	% of Total Words
Words containing 2 /r/s	9125	6.8%
Words containing 2 /l/s	2474	1.8%
Words containing 2 /n/s	7407	5.5%

Table 2. Words with two /ɹ/s, /l/s, or /n/s in the CMU Pronouncing Dictionary

1.2. PREVIOUS RESULTS. In a previous small-scale study (Hall et al. 2019), we found evidence that listeners may misperceive repeated /ɹ/s in a way that roughly mimics the pattern of r-dissimilation in American English. We created spliced nonce words, in which a syllable containing /ɹ/ was spliced to continuations that did or did not contain a second /ɹ/: for example, [tɚˈmɚt] vs. [tɚˈmɛt]. When listeners were asked to orthographically transcribe these nonce words, they omitted the first /ɹ/ in about 5% of responses to stimuli containing two /ɹ/s, producing spellings like *tummert, temert*. The same /ɹ/ was omitted only 1.5% of the time if there was no second /ɹ/ in the stimulus. The difference between conditions was significant, suggesting that the presence of a second acoustic /ɹ/ was causing the first one to be missed. We argue that these results are compatible with the perceptual hypercorrection analysis, but acknowledge that other factors, such as difficulty with mentally serializing repeated elements (Frisch 2004) could also play a role.

In this paper, we extend this approach to examine the perception of the repeated /l/ and /n/.

2. Experiment 1: /l/ dissimilation. The two experiments reported here were run together. Data collection for both experiments was approved by the IRB of California State University, Long Beach (protocol #18-217), and occurred during the 2018-2019 academic year.

2.1. MATERIALS. Items consisted of 19 pairs of nonce words[2]. To create each pair, we used a single naturally produced stretch of speech containing an /l/ (the 'target' for dissimilation), and spliced it to two continuations or beginnings: one that contained another /l/ (the 'trigger' for dissimilation), and one which contained no /l/s, as shown in Figure 1. This allows us to test the effect of the trigger /l/ on perception of the target /l/. We hypothesize that the target /l/ will be perceived less often in the test condition, where trigger /l/ is present, than in the control condition where there is no other /l/. It is also possible, of course, that dissimilation could occur in the other direction, i.e. that the intended 'target' /l/ could cause dissimilation in the intended 'trigger' /l/. However, the design does not allow us to tell whether deletion of 'trigger' /l/ is dissimilatory.

[2] There were intended to be 20 pairs, but one pair was excluded due to experimenter error.

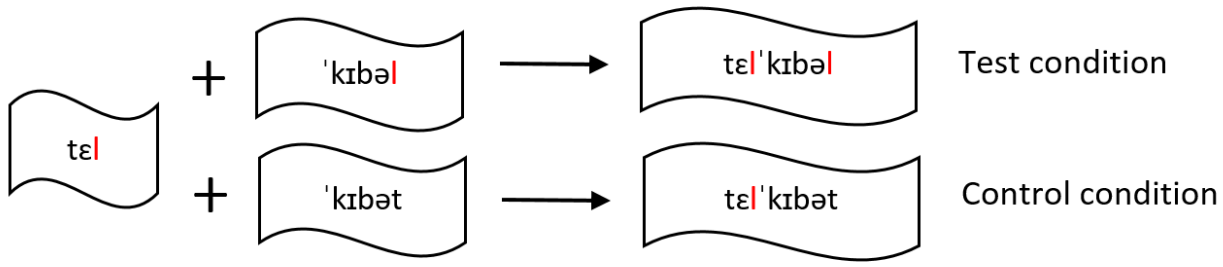

Figure 1. Sample pair of spliced nonce word stimuli

All speech was naturally produced by the second author. The target portion was extracted from a different recording than the trigger and control portions, so that each stimulus is spliced from two recordings, and a total of three recordings were used to produce each pair. The splice points, made at zero-crossing points of the waveform, are inaudible, and the words are produced with highly consistent intonation and timing so that each spliced stimulus sounds like a single recording. The full list of stimulus pairs is given in Table 1.

In 15 pairs cases, the target /l/ is the first /l/; in the remaining 4, it is the second /l/. Throughout the paper, target sounds are shown in bold. Both target and trigger /l/s occur in a variety of structural contexts, including onset, coda and syllabic positions. Note that sequences transcribed [əl] are often phonetically [l̩].

Each word was produced within a frame sentence, as shown in Table 3. The nonce word is always the final word in the sentence.

Frame	Two /l/s	One /l/
Can you bring a…	təˈmɛn**l**ɪkəl	təˈmɛn**l**ɪkən
Did you get the…	mə**l**ˈfænəl	mə**l**ˈfænɪs
Pass me the…	pɛ**l**ˈkɑnəl	pɛ**l**ˈkɑnək
Today has been…	ˈmɪm**l**ɪkəl	ˈmɪm**l**ɪkən
Did you get the…	do**l**ˈtənlɛs	do**l**ˈtənɛs
Can you bring a…	sɑ**l**ˈtɛnəl	sɑ**l**ˈtɛnək
I have to buy a…	tɛ**l**ˈkɪbəl	tɛ**l**ˈkɪbət
Did you get the…	sə**l**ˈfɪskəli	sə**l**ˈfɪskəni
Today has been…	ˌənəˈk**l**ɛɾəbəl	ˌənəˈk**l**ɛɾəbən
Have you read about…	kju**l**ˈtələmi	kju**l**ˈtəvəmi
This is Mrs….	sɑ**l**ˈtɪlɪdʒɚ	sɑ**l**ˈtɪsɪdʒɚ
Have you read about…	hɛˈk**l**ɑnɪʃəl	hɛˈk**l**ɑnɪʃəp
We need to get a…	mɑ**l**ˈdɑnələt	mɑ**l**ˈdɑnəsət
I have to buy a…	vɛlɚˈkænlɪt	vɛlɚˈkænɪt
He went to the…	sə**l**ˈmɑntɚɑl	sə**l**ˈmɑntɚɑp
This is Mrs….	ləˈjɑnɪʃ**l**ɛt	nəˈjɑnɪʃ**l**ɛt
We need to get a…	ˌhɪploˈmæz**l**ət	ˌhɪpoˈmæz**l**ɛt
She seems kind of…	pləˈtɑɾə**l**nɪʃ	pəˈtɑɾə**l**nɪʃ
Use an…	olɪˈfɑɾə**l**wɪk	okɪˈfɑɾə**l**wɪk

Table 3. /l/ stimulus pairs, with target /l/ bolded

2.2. PARTICIPANTS. 60 participants were recruited on the CSULB campus through flyers and word of mouth. All were native speakers of American English, with no history of hearing or speech disorders. Their median age was 21, with a range of 18-49. 37 were female, 22 male and 1 non-binary. Participants were compensated with $20 gift cards.

2.3. DATA COLLECTION AND ANALYSIS. Each sentence was embedded in a numbered Powerpoint slide, accompanied by a picture of a generic or unnamed object or person, as in Figure 2. The Powerpoint was set to play automatically, with slides changing every 15 seconds. The resulting presentation was then converted to a video. Participants watched the video, listening through headphones, in a quiet room. They were asked to listen for the unfamiliar word in each sentence, and type it into a numbered list in a .txt document on laptop computer, spelling it the way it sounded. They heard each sentence only once. This method of stimulus presentation was intended to mimic a typical situation of natural lexical acquisition, in which an unfamiliar word is encountered in context and remembered from a single hearing. The video began with instructions and a practice item, during which the experimeter was present. After this, the participant had an opportunity to pause the video and ask questions before the experimenter left the room. The test portion of the video contained 93 items: 20 from this experiment including the item later excluded, 20 from the /n/ experiment described below, and 53 from other experiments. The total length of the video, including instructions, was about 25 minutes.

For the Powerpoint slides related to the experiments reported here, there were two counterbalanced versions: the participants divided into two groups of 30, and each group heard 9 or 10 stimuli with two /l/s, and 9 or 10 stimuli with one /l/. The total number of responses for the /l/ experiment was 1140 (60 x 19).

Figure 2. Sample stimulus slide. Audio: *I have to buy a [tɛlˈkɪbəl].*

To identify possible cases of l-dropping, we ran a Perl script to count the number of single or double orthographic <l>s in each word, and pull out examples with more or fewer than expected. These were then examined by 3 of the authors and coded for whether the response was missing target /l/, trigger /l/, or both. Seven tokens were excluded from analysis, either because they were missing the whole syllable where the target was expected (e.g., *kibble* for [tə**l**ˈkɪbəl]), or because the participant appeared to have written an unrelated word. Appendix A lists all responses to /l/ stimuli that were missing target and/or trigger /l/.

2.4. RESULTS. As predicted, target /l/ was more likely to drop when the word contained another /l/. Target /l/ was missing in 9.5% of responses to stimuli containing two /l/s, versus 4% of stimuli containing one /l/, as shown in Table 4. The difference is statistically significant in a chi-square test on the boxed numbers: $\chi^2 = 13.4$, $p = .000245$.

	Target /l/ not written	Target /l/ written	Excluded tokens	Total (19 items x 30 subjects)
Test condition (2 /l/s)	54	512	4	570
Control condition (1 /l/)	23	544	3	570

Table 4. Target /l/ drops by condition

It is interesting to note that the intended 'trigger' /l/ (which occurs only in the test condition) also dropped 32 times, as shown in Appendix A. We cannot know whether this dropping is dissimilatory or not, because these /l/s never occurred in a control condition (i.e. without another /l/ present). Nevertheless, there is no particular reason for them to be less perceptible than the target /l/s, so their high drop rate suggests that the actual rate of dissimilation in stimuli with 2 /l/s may be considerably higher than the count of only target droppings would indicate. Altogether, 83 responses to the two /l/ condition (14.5%) were missing target and/or trigger /l/, including 3 responses missing both.

As noted earlier, l-dissimilation in American English typically occurs through deletion, rather than substitution of another consonant sound. However, the written responses suggest that perceptual errors took both of these forms. In some responses, target /l/ seems to be deleted, such as *tikibbel* for [tɛ**l**ˈkɪbəl] or *kyutolamy* for [kju**l**ˈtələmi]. In others, we had reasonable confidence that another consonant or group of consonants was written in place of the /l/. For example, [mə**l**ˈfænəl] was written once as *Morfanil*, with l → r dissimilation, and [do**l**ˈtənlɛs] as *do**n**tolnus*, with l → n dissimilation. The rate of such substitutions by letter is given in Table 5, and the actual tokens identified as showing substitution can be seen in Appendix A.

Instances of substitution are very unequally spread across items. For example, 9 of the 16 cases of l → r substitution occurred in responses to [sə**l**ˈmɑntə-ɑl], and 9 out of 10 cases of l → w occurred in responses to the pair [ˌənəˈk**l**ɛɾəbəl], [ˌənəˈk**l**ɛɾəbən]. It is likely that substitution patterns were affected by idiosyncratic factors either in the speaker's pronunciation of the token, or in the token's resemblance to existing words. In particular, <qu> spellings in the [ˌənəˈk**l**ɛɾəbəl] pair may be influenced by the accidental similarity of this nonce item to the real words *equitable* [ˈɛkwəɾəbl] and *acquittable* [əˈkwɪɾəbəl].

Substitution of other consonants for /l/ also occurs in the control condition, as shown in Table 5. There is a trend that /l/s which are missing from the control condition are more likely to have undergone substitution than /l/s missing from the test condition, but the difference does not reach significance (in a chi-square test on the 4 boxed numbers).

Target /l/ written as	Test words	Control words
r	13	3
n	6	2
u [w]	3	7
dr	1	
g		1
Missing /l/s with C substitution	23	13
Missing /l/s without C substitution	31	10
Total missing /l/s	54	23
Percent of missing /l/s that are written as other consonants	43%	56%

Table 5. Use of letters for other consonants to represent stimulus [l]. <u> is assumed to represent [w] in the context of <qu>.

The substitution counts should be taken with two caveats. First, there are probably some additional instances of consonant substitution that were not coded as such, because they co-occurred with other alterations to word structure (metathesis, epenthesis, syncope) in a way that made it unclear which consonant letter corresponded to the /l/. For example, when [ˈmɪm**l**ɪkəl] is written *minimicle*, there are three nasals where there should be two. One of those nasals could plausibly be a mishearing of the target /l/, but none is in the same structural position, so the word was not coded as an example of substitution.

Second, we did not attempt to count cases where /l/ might be replaced by a vowel. There are several cases where this clearly occurred with word-final 'trigger' /l/s, such as *polcano* for [pɛ**l**ˈkɑnəl] or *solteno* for [sɑ**l**ˈtɛnəl]. It may well have also occurred within words, but here the rules of English orthography limit our ability to interpret the responses. In *mofanal* for [mə**l**ˈfænəl], for example, the orthographic <o> could represent [o], as in *motel* [moˈtɛl], or [ə], as in *police* [pəˈlis].

2.5. SUMMARY OF EXPERIMENT 1. When orthographically transcribing nonce words, listeners were less likely to represent an /l/ as <l> if the same word contained another /l/. Rather, they tended to either simply omit the /l/, or replace it with a letter representing [ɹ], [n], or [w].

3. Experiment 2: /n/ dissimilation. The second experiment was run together with the first and has the same structure, except that 19 pairs of nonce words contained one or two /n/s rather than /l/s (one additional item was excluded due to experimenter error). The list of items is given in Table 6. These items were presented to listeners intermixed with the set of /l/ items described above, as well as filler items; the description of procedure and participants is thus identical to the last experiment.

Frame	Two /n/s	One /n/
She seems kind of…	ˈglɛ**n**dən	ˈglɛ**n**dəm
He's a…	θə**n**ˈtɑpnətɪst	θə**n**ˈtɑpətɪst
Have you read about…	ˈmɪ**n**dəʃɪn	ˈmɪ**n**dəʃɪp
Can you bring some…	ˈnomə**n**ˌglɑtʃɪz	ˈtomə**n**ˌglɑtʃɪz
We need to get a…	ˈmeɪ**n**dənɛt	ˈmeɪ**n**dətɛt
We went to the…	nəˈfɑ**n**tɪlɪm	bəˈfɑ**n**tɪlɪm
This is Mrs…	ə**n**ˈtɛndʒuləs	ə**n**ˈtɛdʒuləs
Have you read about…	ˌwɑ**n**dəˈtɪʃən	ˌwɑ**n**dəˈtɪʃəl
This is Mrs…	ˈhɑl**n**əˌtoni	ˈhɑl**n**əˌtovi
The doctor has me take…	məˈlɛkju**n**tɪn	məˈlɛkju**n**tɪf
This is Mrs…	fə**n**ˈtɛvənət	fə**n**ˈtɛvəkət
He went to the…	ˌtozə**n**ˈtɛnjəl	ˌtozə**n**ˈtɛkjəl
She seems kind of…	ˈwaɪrə**n**ˌflɑnɪd	ˈwaɪrə**n**ˌflɑrɪd
Welcome to…	ˈnɑzə**n**lɪk	ˈtɑzə**n**lɪk
I have to buy a…	ˈhɛ**n**tənɪk	ˈhɛ**n**təpɪk
She seems kind of…	mə**n**ˈʃæni	mə**n**ˈʃæsi
Pass me the…	ˈhɛ**n**zlɪn	ˈhɛ**n**zlɪt
The doctor has me take…	ˈto**n**dəˌpleɪnd	ˈto**n**dəˌpleɪd
She seems kind of…	gɑ**n**ˈfɪntɪd	gɑ**n**ˈfɪktɪd

Table 6. List of /n/ stimuli pairs, with target /n/ bolded

3.1. RESULTS. Responses showing /n/ dropping or substitution are listed in Appendix B. At first glance, the results for /n/ look roughly similar to those for /l/: target /n/ was over three times more likely to drop in words containing a second /n/, as shown in Table 7. A chi-square test on the boxed numbers is significant: $\chi^2 = 12.2$, $p = .0005$.

	Target /n/ not written	Target /n/ written	Excluded tokens	Total (19 items x 30 subjects)
2 /n/s	34	536	0	570
1 /n/	11	558	1	570

Table 7. /n/ dropping by context (initial results, all items included)

However, on closer inspection, the pattern with /n/ turns out to be driven by a single pair: the item [məˈlɛkju**n**tɪn] had 23 missing /n/s out of 30 responses, versus 4 in its control version [məˈlɛkju**n**tɪf]. Nine of these were cases where /n/ was represented as <m>, as in *molecumtin*.

Given how anomalous the results for this pair are compared to the other 18 pairs, we believe it is appropriate to exclude it. Although the rate of n-dropping and n → m substitution in this pair is intriguing, we suspect that it reflects some acoustic or perceptual quirk of this specific recording. It is worth noting that [məˈlɛkju**n**tɪn] has very little distance between the two /n/s compared to most of the items, and also that the target /n/ is preceded by /u/, whose labiality may have contributed to the frequent perception of this /n/ as [m].

With this pair excluded, the overall drop rate becomes small, and the difference between conditions insignificant, as shown in Table 8.

	Target /n/ not written	Target /n/ written	Other excluded tokens	Total (18 items x 30 subjects)
2 /n/s	11	529	0	540
1 /n/	7	532	1	540

Table 8. /n/ dropping by context (revised results, excluding pair [məˈlɛkju**n**tɪn], [məˈlɛkju**n**tɪf])

This dominance of one item pair in the /n/ experiment contrasts with the results for /l/, where the missing /l/s were more evenly spread across items. In the /l/ experiment, 15 out of 19 items showed at least one missing target /l/ in the test condition, and no single item accounted for more than 10 of the 54 target drops (19%). Although the /l/ and /n/ experiments are not designed for comparison to one another, it is worth noting that /l/-dropping was simply more common across the board than /n/ dropping, as shown in Table 9. Even with [məˈlɛkju**n**tɪn] included, there were more total drops, involving more total items, of both target and trigger /l/ compared to target and trigger /n/. This could reflect either a difference in the items used in the two experiments (their phonological forms and/or the way the speaker pronounced them), or a more general difference between the perceptibility of American /n/ and /l/.

	Items with ≥ 1 missing target (out of 38)	Items with ≥ 1 missing trigger (out of 19)	Responses with missing targets (out of 1140)	Reponses with missing triggers (out of 570)
/l/ items	24	11	77 (6.8%)	32 (5.6%)
/n/ items	15	5	45 (3.9%)	11 (1.9%)

Table 9. Comparison of /n/ and /l/ dropping rates by type and token (all items included).

3.2. SUMMARY OF EXPERIMENT 2. In contrast to experiment 1, experiment 2 did not find clear evidence of perceptual dissimilation. With the exception of one item pair, nonce words containing two /n/s showed very little dropping of either /n/ in the orthographic transcriptions, and no significant difference between the test and control conditions.

4. Discussion. In experiment 1, we found that listeners are more likely to omit or replace an /l/ when writing a nonce word containing multiple /l/s, compared to hearing the same /l/ in a word without other /l/s. This is similar to our previous results for /ɹ/ (Hall et al. 2019). However, we do not find robust evidence for the same phenomenon with /n/. In experiment 2, only one item appeared to show n-dissimilation; the rest showed very little /n/-dropping at all, and no difference between omission of /n/ in words with one versus two /n/s.

In one way, these results resemble the pattern of dissimilation in real American English words, which show some instances of /l/ dissimilation, but no instances of /n/ dissimilation that we are aware of. This resemblance supports the idea that perceptual errors could be the cause of real-life dissimilation.

In another way, however, the pattern of /l/ omission in experiment 1 does not resemble real American l-dissimilation. Close to half of the omitted /l/s were replaced by another consonant letter, suggesting the /l/s were misheard as [ɹ], [n], or [w]. As noted in section 1.1, l-dissimilation

in American English almost never involves substitution of another consonant, so there is a mismatch between the perceptual pattern and attested phonological changes.

It is also important to acknowledge that the /l/ and /n/ experiments are not designed to be compared to one another. They use different sets of items, which have not been controlled across experiments for factors such as stress, distance between repeated sounds, or structural positions of trigger and target. In future work, we hope to compare perceptions of repeated /ɹ/, /l/, and /n/ more systematically.

References

Garrett, Andrew & Keith Johnson. 2013. Phonetic bias in sound change. In Alan C. L. Yu (ed.), *Origins of sound change: Approaches to phonologization*. 51–97. Oxford: Oxford University Press.

Hall, Joseph Sargent (1942). *The phonetics of Great Smoky Mountain speech*. New York: King's Crown Press.

Hall, Nancy. 2012. Perceptual errors or deliberate avoidance? Types of English /r/-dissimilation. *Berkeley Linguistics Society (BLS)* 34. 133–144. https://doi.org/10.3765/bls.v34i1.3563.

Hall, Nancy, Bianca Godinez, Megan Walsh, Irene Orellana, and Coleen Villegas. 2019. Evidence for perceptual hypercorrection in American r-dissimilation: A pilot study. *Proceedings of the Linguistic Society of America (PLSA)* 4. 52:1–12. https://doi.org/10.3765/plsa.v4i1.4549.

Heid, Sebastian & Sarah Hawkins. 2000. An acoustical study of long-domain /r/ and /l/ coarticulation. *Proceedings of the 5th Seminar on Speech Production: Models and Data*. 77–80.

Hempl, George 1893. Loss of r in English through dissimilation. *Dialect Notes* 1. 279–81.

Ohala, John. J. 1981. The listener as a source of sound change. In Carrie S. Masek, Roberta A. Hendrick & Mary Frances Miller (eds.), *Papers from the parasession on language and behavior*. 178–203. Chicago: Chicago Linguistic Society.

Ohala, John. J. 1993. The phonetics of sound change. In Charles Jones (ed.), *Historical linguistics: Problems and perspectives*. 237–278. London: Longman.

Posner, Rebecca R. 1961. Consonantal dissimilation in the Romance languages. Oxford: Basil Blackwell.

Tunley, Alison. 1999. *Coarticulatory influences of liquids on vowels in English*. Cambridge, UK: University of Cambridge dissertation.

West, Paula. 1999a. The extent of coarticulation in English liquids: An acoustic and articulatory study. *Proceedings of International Congress of Phonetic Sciences (ICPhS)* 3. 1901–1904.

West, Paula. 1999b. Perception of distributed coarticulatory properties of English /l/ and /r/. *Journal of Phonetics* 27(4). 405–426. https://doi.org/10.1006/jpho.1999.0102.

Appendix A. Responses for /l/ dissimilation experiment

Listed below are all responses that were identified by Perl scripts as missing at least one orthographic <l>, divided by whether the target or trigger /l/ is unrepresented. Words where both target and trigger /l/ are missing are marked with a *, and listed in both columns. In cases where another consonant or cluster of consonsants appears in the position where <l> would be expected, the pronunciation of that consonant or cluster is given in brackets. Matched test/control items are given for comparison even if only one item in the pair showed dropping.

Test stimuli (two /l/s)			Matched control stimuli (one /l/)	
	responses with target /l/ missing	responses with trigger /l/ missing		responses with target /l/ missing
kju**l**ˈtələmi	*kyutolamy*	*kyoltonemi* [n] *kiltoeame* *Kyultonomy* [n] *cultonamy* [n]	kju**l**ˈtəvəmi	*kyoutabimin* *Quetubony* *quiotubiney*
pɛ**l**ˈkɑnəl	*pikonil* *per̲conil* [ɹ]	*pelcono* *polcano*	pɛ**l**ˈkɑnək	
pləˈtɑɾə**l**nɪʃ	*pertondonish** *plutotanish* *peltodinish* *platonodish* *platonanish* *plutodish* *pultodenish*	*pertondonish** [ɹ] *pertoddilnish* [ɹ] *Pertodilnish* [ɹ]	pəˈtɑɾə**l**nɪʃ	
hɛˈk**l**ɑnɪʃəl		*Heglonosho* *Haglonisha*	hɛˈk**l**ɑnɪʃɪp	*heckgonoship* [g] *Hegwanaship* [w]
olɪˈfɑɾə**l**wɪk	*Olafaddowick* *olafoddawick* *olifodowick* *olefadawick* *olafoddenwick* [n] *ALADfidawick* *olafodowick* *olofuttuwick* *Olirphutowick* *olofautowick*		okɪˈfɑɾə**l**wɪk	*okerwaterfit* [ɹ] *Okaphoduet* *Nokiphodiwick* *okofodanik* [n]
mə**l**ˈfænəl	*Morfanil* [ɹ] *mofanal* *mofanel*		mə**l**ˈfænɪs	*merfanin* [ɹ]
tɛ**l**ˈkɪbəl	*bafdakible* *tikibbel* *tokibble*	*Telkiber* [ɹ]	tɛ**l**ˈkɪbət	*ackatibit*
ˈmɪm**l**ɪkəl	*minimicle*	*Milmiker* [ɹ]	ˈmɪm**l**ɪkən	
mɑ**l**ˈdɑnələt	*modolonet* *madolaney* *modonalate*		mɑ**l**ˈdɑnəsət	*modonaset* *modonisit* *nodanathit*
sɑ**l**ˈtɛnəl	*sontone** [n]	*sontone** *solteno*	sɑ**l**ˈtɛnək	
ləˈjɑnɪʃ**l**ɛt	*misslosyngnit*	*Iyonnaschlette* *Mrs. Yoryonoslet*	nəˈjɑnɪʃ**l**ɛt	
do**l**ˈtənlɛs	*dotunis** *dontolnus* [n]	*dotunis** *doltumnis* *glotunsensus*	do**l**ˈtənɛs	

sə**l**ˈmɑntəˠɑl	*sermontreal* [ɹ] *sermontral* [ɹ] *Sermanteral* [ɹ] *Surmonteral* [ɹ] *sermanteral* [ɹ] *cirmonteral* [ɹ] *sermonteral* [ɹ] *sermonteral* [ɹ] *cermontreal* [ɹ]	*sulmatrot* [t]	sə**l**ˈmɑntəˠɑp	*Surmontrop* [ɹ]
ˌənəˈklɛɾəbəl	*unequetable* [w] *unincredible* [ɹ] *uncredible* [ɹ] *Unequetable* [w] *unequettible* [w]		ˌənəˈklɛɾəbən	*Unacqettabin* *unaquetabin* [w] *Unequidabin* [w] *unequittibin* [w] *Unequetibin* [w] *Unequetiben* [w] *unequetaben* [w]
sɑ**l**ˈtɪlɪdʒəˠ		*Solternadger* [rn]	sɑ**l**ˈtɪsɪdʒəˠ	
ˌhɪploˈmæz**l**ət	*hiplomazit* *hyplomasnite* [n] *hiplomaznit* [n] *hiplomaznit* [n]	*hipnophlasnet* [n] *hipomazlet* *Hippomaslette* *hipomaslit* *Hipomaslet* *hypomaslet* *hipomaslit* *hyptnolasnic* [n] *hippomazlit*	ˈhɪpoˈmæz**l**ɛt	
sə**l**ˈfɪskəli		*sulphesticcy*	sə**l**ˈfɪskəni	
təˈmɛn**l**ɪkəl	*termindricful* [dɹ] *tomenucul*		təˈmɛn**l**ɪkən	
vɛ**l**əˠˈkænlɪt			vɛ**l**əˠˈkænɪt	*vennergenick* [n]
TOTAL	54	32		23

Tokens excluded from the /l/-dissimilation experiment:

2 /l/s		1 /l/	
tɛ**l**ˈkɪbəl	*kibble* (twice)	tɛ**l**ˈkɪbət	*kibbit*
sɑ**l**ˈtɛnəl	*Tennol*	pəˈtɑɾəlnɪʃ	*ertoin*
hɪploˈmɑz**l**ət	*merflases*	vɛ**l**əˠˈkænɪt	*cannit*
TOTAL	4		3

Appendix B. Responses for /n/ dissimilation experiment

Listed below are all responses that were identified by Perl scripts as missing at least one orthographic <n>, divided by whether the target or trigger /n/ is unrepresented. Words where both

target and trigger /n/ are missing are marked with a *, and listed in both clumns. In cases where another consonant appears in the position where <n> would be expected, the pronunciation of that consonant is given in brackets. Matched test/control items are given for comparison even if only item in the pair showed dropping.

Test stimuli (two /n/s)			Matched control stimuli (one /n/)	
	Responses with target /n/ missing	Responses with trigger /n/ missing		Responses with target /n/ missing
məˈlɛkju**n**tɪn	*Molecutim**	*Molecutim** [m]	məˈlɛkju**n**tɪf	*mulecutif*
	*Milecutem**	*Milecutem** [m]		*molecutiff*
	molucutin			*molecutif*
	Molecutin			*mclifitif*
	moleckutin			
	meleckmilten			
	meletletin			
	molecumtin [m]			
	Molecumtin [m]			
	Molecutin			
	molecutin			
	mulecumtin [m]			
	molecumtin [m]			
	Molecutin			
	molemcutine			
	Molecumtin [m]			
	molequemtin [m]			
	Mullecumtin [m]			
	molecutin			
	mulecumten [m]			
	molecutan			
	molecumtin [m]			
	molecutin			
ˌtozə**n**ˈtɛnjəl	*tersitenil*		ˌtozə**n**ˈtɛkjəl	*mctecioal*
ˈwaɪrə**n**ˌflɑnɪd	*whydiphlonid*	*Widenflotted* [ɾ]	ˈwaɪrə**n**ˌflɑɾɪd	
		widenflodded [ɾ]		
		widenflauted [ɾ]		
ˈhɛ**n**zlɪn	*heslin*		ˈhɛ**n**zlɪt	*hemslet* [m]
ˈto**n**dəˌpleɪnd		*Tondaplamed* [m]	ˈto**n**dəˌpleɪd	
θə**n**ˈtɑpnətɪst	*Fetomtomist**	*Fetomtomist** [m]	θə**n**ˈtɑpətɪst	*himtopitist* [m]
	Phaltopmentist	*phyntoposis*		
	[l]	*psintopithist*		
ˈmeɪ**n**dənɛt	*Tidermidenleck*		ˈmeɪ**n**dətɛt	
ˈhɑl**n**əˌtoni	*halmotony* [m]		ˈhɑl**n**əˌtovi	*holutovie*
	hallatoni			*holvatomie*
	holitony			
	halmetony [m]			

gɑ**n**ˈfɪntɪd			*gontithid* *gonfitid*	gɑ**n**ˈfɪktɪd	
ˈnomə**n**ˌglɑtʃɪz	*nomegloches*			ˈtomə**n**ˌglɑtʃɪz	
fə**n**ˈtɛvənət				fə**n**ˈtɛvəkət	*mictevicit*
mə**n**ˈʃæni				mə**n**ˈʃæsi	*Mechassie*
TOTALS	34	11			11

Token excluded from the /n/-dissimilation experiment

ˈwaɪrənˌflɑrɪd	*flodded*