

Empirical neighborhoods of nonwords: Assessing the 1-edit model

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1. Introduction

- Phonological neighbors affect processing
- They interfere with lexical access (Luce & Pisoni, 1998; Vitevitch & Luce, 2001)
- 1-edit neighborhood** is typically used

But, lexical access is also affected by:

- Phonetic similarity
- Frequency
- Linear order (McClelland & Elman 1986; Marslen-Wilson, 1987; Norris & McQueen, 2008, et seq.)

How close are ‘empirical neighborhoods’ to 1-edit neighborhoods?

2. Stimuli

- Two syllable nonwords, initial stress
- Neighbors found in CMU
- Log frequencies from Subtlex_{US}
- 2x2x3 design, with three factors:

Neighborhood Size:

small (2 neighbors) large (9-11 neighbors)

glambə <i>lumber, slumber</i>	muzi <i>moos, moonie, mozy, movie, moody, boozy, muzzy, boozy, doozy</i>
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Neighborhood Entropy:

low		high	
medi <i>merry, medley</i>	glambə <i>lumber, slumber</i>	2.02	0.21
0.54	0.57		

→ Low-entropy neighborhoods should act ‘smaller’

Edit Location:

early	mixed	late
zali <i>collie, Bali, dolly, folly, golly, holly, jolly, lolli, Molly, volley</i>	tɛɹət <i>tariff, tearing, terrace, tara, tenet, carrot, ferret, merit, parrot</i>	muzi <i>moos, movie, moonie, mozy, moody, muzzy, boozy, choosy, doozy</i>

→ Later edits should affect processing more

5. Conclusions

Generation Task: The 1-Edit model is not a good predictor of empirical neighborhoods

- It does not predict neighborhood size
- Over 80% of empirical neighbors are outside the 1-edit neighborhoods
- Edit location* and *Terminal Cohort size* do affect neighborhood size

Lexical Decision Task: Empirical neighborhoods better predict RTs than 1-Edit neighborhoods

These results suggest that phonological neighborhoods may be substantially larger and more structured than the 1-Edit model assumes, with sensitivity to Phonetic Distance, Linear Order, and Terminal Cohort size.

3. Neighborhood generation task

Task: Think of a word that sounds similar

Example responses from 70 participants:

medi
bedroom, **medley**, bed, medicine, meddle, battery, medical, melody, murder, ready, mead, meter, wed, legging, meredith, meadow, medal, muddy, mediocre, mattress, dream, early, reverie, petty, medic, meddling, **marry**

tɛɹət
carrot, tarot, **parrot**, **terrace**, **ferret**, terrorist, turret, Terrence, karat (tariff, tearing, tara, tenet, merit)

glambə
slumber, **lumber**, glum, somber, plumber, lumbar, gloomy, timber, bumper, glob, sunder, glummer, rubber, gopher, blubber

1-edit neighbors given, or (not given by any participant)

1-edit and empirical neighborhoods overlap, but:

- 1-edit neighborhood size does not predict empirical size
Median **19** emp. neighbors for **small** items; **20** for **large** (Similar results for 1-edit entropy)
- Many neighbors more than 1-edit away are given
- Linear order matters (but is complicated)
Early edits are more common than late edits
A nonword’s **terminal cohort** matters
The set of real words that diverge at the uniqueness point

tɛɹət: territorial, territories, territory

medi: meadow, meadows, meadowlands, medley, meditate, meddlesome, medal, medic, medical, medicate, meditate ...

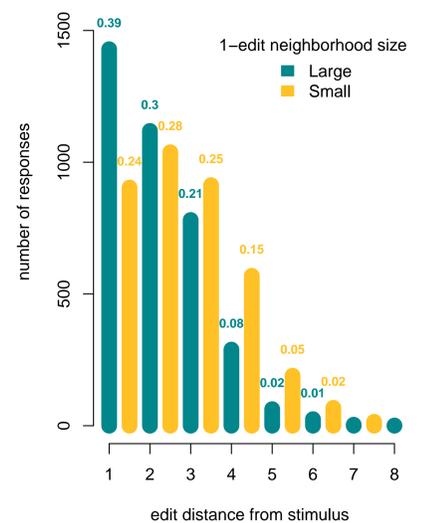
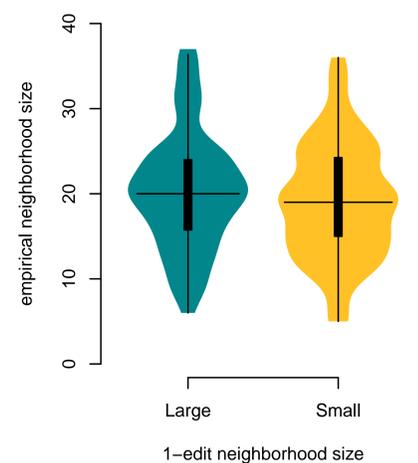
	β	p
(Intercept)	2.81	<2e-16 ***
EditLoc1	.265	<1.2e-5 ***
EditLoc2	-.013	0.868
Small	.071	0.087
Editloc1:Small	-.197	0.021 *
Editloc2:Small	-.018	0.862
GNM (Bailey & Hahn 2001)	.086	0.085
TermCohortSize	.043	0.001 **

Poisson regression predicting empirical neighborhood size after forward selection with AIC. Edit location is Helmert coded (EditLoc1 compares Early v. Mixed/Late).

	β	p
1Edit:TRUE	.32	<4.6e-16 ***
logFreq	.10	<2e-16 ***
EditDist	-.55	<2e-16 ***

Multinomial Regression predicting participants’ real-word responses.

Larger words were given more often



4. Lexical Decision

Task: Is this a word? YES NO

Longer reaction times → increased difficulty of lexical access (Vitevitch & Luce, 1998, 1999; Vitevitch et al. 2016)

	1-edit	
empirical	Small	Large
Small	3-10 (8)	6-13 (10.5)
Large	16-31 (20)	17-29 (22)
	min-max (median) empirical neighbors	

10 stimuli/ cell, chosen based on generation results, and balanced for avg. neighbor frequency (empirical & 1-edit) & bigram prob.

- Atypically, longer RTs for *smaller* neighborhoods (Also for real words)
- Empirical size a better predictor than 1-edit

RT ~ 1editSize + empSize + 1editLogFreq + empLogFreq + bigram
Random intercepts for subjects and items

	Est.	t value	model comp. p
(Intercept)	6.92	111.631	
1Edit:Small	0.032	1.881	0.048 *
emp:Small	0.052	3.121	0.002 **
meanLogFreqEmp	0.073	2.483	0.011 *
meanLogFreq1ed	-0.088	-2.306	0.017 *
bigramProb	-1.679	-0.527	0.570

Nonword reaction times

