Things to do with a historical lexical frequency corpus

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Overview

- Presenting COHA
- How to determine lexical establishment and obsolescence using a frequency corpus?
- How do new 4- and 5-letter words come about?
- Are larger societal changes reflected in lexical dynamics?

COHA

- Corpus of Historical American English (COHA)
 - 400M words, 1810-2009
 - Fiction, magazines, newspapers, other non-fiction
 - Freely downloadable
 - Similar corpora: COCA, TIME, Spanish, Portuguese, etc.

COHA

- COHA vs. Google Ngrams
 - Easier and faster to handle
 - Cleaner
 - All occurrences (no minimum limits)

http://corpus.byu.edu/coha/

COHA



decade (starting year)

- How to determine when words are established or become obsolete in a corpus?
 - \rightarrow Presenting an algorithmic approach

NB: In the following 0 here means "absence" and 1 means "presence" in a corpus, but they can be substituted by some relative frequency value

(From Cunha, Evandro L. T. P. and Søren Wichmann. In review. "An algorithm to identify periods of establishment and obsolescence of linguistic items in a diachronic corpus". *Corpora*.)

- Possible states: a) born; b) died; c) established; d) random
- First algorithm
 - 000111 = birth; 111000 = death; 100101 = random
 - Only works for perfect scenarios
- Second algorithm
 - Considers small deviations from perfect scenarios
 - Allows for inclusion of more data

proportionality0100011110011111111footwork000000001111111111

proportionality 0_100011110011111111

position	errors [birth]	errors [death]
1	5	15
2	6	14
3	5	15
4	4	16
5	3	17
6	4	16
	etc	
18	12	8
19	13	7

proportionality 01_00011110011111111

position	errors [birth]	errors [death]
1	5	15
2	6	14
3	5	15
4	4	16
5	3	17
6	4	16
	etc	
18	12	8
19	13	7

proportionality 010_0011110011111111

position	errors [birth]	errors [death]
1	5	15
2	6	14
3	5	15
4	4	16
5	3	17
6	4	16
	etc	
18	12	8
19	13	7

proportionality

0100_011110011111111

position	errors [birth]	errors [death]
1	5	15
2	6	14
3	5	15
4	4	16
5	3	17
6	4	16
	etc	
18	12	8
19	13	7

proportionality

01000_111100111111111

position	errors [birth]	errors [death]
1	5	15
2	6	14
3	5	15
4	4	16
5	3	17
6	4	16
	etc	
18	12	8
19	13	7

proportionality 010001_1110011111111

position	errors [birth]	errors [death]
1	5	15
2	6	14
3	5	15
4	4	16
5	3	17
6	4	16
	etc	
18	12	8
19	13	7

proportionality 01000111100111111_11

position	errors [birth]	errors [death]
1	5	15
2	6	14
3	5	15
4	4	16
5	3	17
6	4	16
	etc	
18	12	8
19	13	7

proportionality 010001111001111111_1

position	errors [birth]	errors [death]
1	5	15
2	6	14
3	5	15
4	4	16
5	3	17
6	4	16
	etc	
18	12	8
19	13	7

proportionality 0100011110011111111

position	errors [l	birth]	errors [death]
1	5		15
2	6		14
3	5		15
4	4		16
5	3		17
6	4		16
		etc	
18	12		8
19	13		7

• How many errors?



Word	Presence / Absence	Result of algorithm
footwork	0000000011111111111	born (1900s)
amain	1111111111110000000	died (1930s)
wrong	1111111111111111111111	established
saddleless	0000000110111100001	random
computer	00000010011111111111	born(1990s)





decade (starting year)

4- and 5-letter words

• Today's (2000s) 10 most frequent 4- and 5-letter words among the ones successfully born in different decades

1850	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950	1960	1970	1980
users	photo	bike	phone	movie	okay	flips	sexy	piss	pizza	salsa	rehab	jihad	pesto
eerie	cops	taxi	radio	grill	shit	goofy	robot	vinyl	radar	geek	scuba	tofu	pager
typed	chili	patio	golf	kinda	genes	zoom	bikes	labs	opted	stats	execs	sushi	futon
hefty	tuna	neon	toxic	reps	jazz	raspy	yoga	manic	stash	viral	antsy	meds	chem o
avid	peek	flick	foyer	vodka	buddy	tarp	audio	binge	funky	geeks	dicey	carb	nerdy
norm	salty	chic	penis	denim	grid	co-op	input	sync	kudzu	bagel	hyped	biker	cyber
dunes	slots	beers	polo	savvy	dorm	tummy	nylon	angst	smog	techs	layup	miso	dorky
ozone	beta	malls	muted	exams	hiked	moron	outta	flak	combo	zips	ероху	apnea	hrer
ethic	norms	menus	heck	khaki	decor	medic	blah	memos	corny	yummy	fucks	dork	glitz
squid	glint	thugs	booze	phony	amino	exec	fetus	picky	wacky	clit	slurp	krill	detox

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eerie	cops	taxi	radio	grill	shit	goofy	robot	vinyl	radar	geek	scuba	tofu	pager
typed	chili	patio	golf	kinda	genes	zoom	bikes	labs	opted	stats	execs	sushi	futon
hefty	tuna	neon	toxic	reps	jazz	raspy	yoga	manic	stash	viral	antsy	meds	chemo
avid	peek	flick	foyer	vodka	buddy	tarp	audio	binge	funky	geeks	dicey	carb	nerdy
norm	salty	chic	penis	denim	grid	со-ор	input	sync	kudzu	bagel	hyped	biker	cyber
dunes	slots	beers	polo	savvy	dorm	tummy	nylon	angst	smog	techs	layup	miso	dorky
ozone	beta	malls	muted	exams	hiked	moron	outta	flak	combo	zips	epoxy	apnea	hrer
ethic	norms	menus	heck	khaki	decor	medic	blah	memos	corny	yummy	fucks	dork	glitz
squid	glint	thugs	booze	phony	amino	exec	fetus	pick y	wacky	clit	slurp	krill	detox



decade (starting year)



From Fargo, season 3 (2017)











New emerging words on Twitter in 2013 (Grieve et al. 2016: Fig. 2), including *famo* 'family & friends'

Similarity between all new words

For different decades:

Measure similarities among matrices of frequencies of letters

Similarity between new words

1850	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
-	0	0	2	27	54	40	19	10	6	4	1	0	1	0	0	0	0
а	61	137	82	71	54	83	70	73	39	21	18	13	6	1	0	0	0
b	55	5	32	19	24	20	7	8	9	2	1	1	1	0	0	0	0
С	102	19	67	39	28	41	30	22	27	14	5	7	4	0	0	0	1
d	60	8	37	37	29	31	36	39	31	33	22	20	11	5	3	2	1
е	35	163	65	144	133	130	95	93	88	70	48	26	11	11	4	1	0
f	60	4	24	27	15	19	4	3	1	0	0	0	0	0	1	0	0
g	28	3	29	29	15	26	19	25	22	20	9	6	13	1	1	1	0
h	45	46	11	28	33	18	19	8	10	6	5	2	2	1	0	0	0
i	58	119	65	98	83	109	97	74	58	40	41	12	10	5	2	1	0
j	3	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0
k	4	0	5	25	16	4	6	5	5	9	0	0	2	0	0	0	0
1	45	45	75	50	72	52	62	49	34	35	28	12	6	7	3	0	0
m	60	20	43	29	16	16	13	21	10	9	5	0	1	1	1	0	1
n	24	87	86	60	68	49	62	63	51	36	31	30	5	6	4	3	0
0	28	162	86	60	69	53	67	42	29	24	18	8	4	5	3	0	0
р	83	18	56	35	25	20	9	7	7	4	2	0	0	1	0	0	0
q	6	4	1	2	1	1	2	1	0	0	0	0	0	0	0	0	0
r	59	82	91	90	92	72	71	33	23	20	10	9	5	3	1	0	0
S	131	6	54	57	71	69	79	60	50	45	30	26	18	8	3	4	3
t	69	29	78	79	77	75	68	59	66	37	25	25	13	2	0	0	1
u	36	95	46	34	33	24	23	20	11	6	4	2	2	0	0	0	0
V	10	12	19	14	5	3	7	8	3	4	6	1	2	1	0	0	0
w	29	10	14	6	7	11	4	2	5	2	1	0	0	1	0	0	0
X	0	9	8	2	3	0	1	1	0	0	0	0	0	0	0	0	0
У	3	11	10	11	29	21	13	13	13	14	14	25	8	2	5	1	0
Z	1	1	8	6	2	1	8	4	7	5	2	0	1	0	0	0	0

Similarity between all new words



similarity between new words in different decades

Similarity between all new words



similarity between new words in different decades

Similarity between all new words, hyphenated ones excluded

similarity between new words in different decades



Similarity between new short words



similarity between new words in different decades

Similarity between new short words



similarity between new words in different decades

Intermediate conclusion

THE SHAPE FASHION EFFECT:

• There is a small tendency for new words of a given decade to be more similar to new words of other decades that are closest in time to the decade in which the word in question was born.

Is the shape of new words also a matter of survival of the fittest in terms of sound-meaning patterns?

- Hypothesis: a new word should bear some phonological similarity to the words which it is semantically closest to.
- Test: a linear correlation between semantic distance and Levenshtein distance (normalized by the length of the longest word), where semantic distance is measured as will be described.
- We compare winners—today's most frequent new words from different decades—and losers—words that appear in at least three successive decades during 1850-1989 but not before or after.

Related work

Wordform Similarity Increases With Semantic Similarity: An Analysis of 100 Languages

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Abstract

Although the mapping between form and meaning is often regarded as arbitrary, there are in fact well-known constraints on words which are the result of functional pressures associated with language use and its acquisition. In particular, languages have been shown to encode meaning distinctions in their sound properties, which may be important for language learning. Here, we investigate the relationship between semantic distance and phonological distance in the large-scale structure of the lexicon. We show evidence in 100 languages from a diverse array of language families that more semantically similar word pairs are also more phonologically similar. This suggests that there is an important statistical trend for lexicons to have semantically similar words be phonologically similar as well, possibly for functional reasons associated with language learning.

Semantic distance

- There are different metrics to choose from which are all based on comparisons of co-occurrence vectors (cf. Firth 1957: "You should know a word by the company it keeps")
- The best one selected by performing the following experiment:
 - define a set of synonyms and antonyms (we use adjectives from http://usefulenglish.ru/vocabulary/synonyms-adjectives-main-list)
 - measure semantic distances between pairs of synonyms and antonyms as well as other random words using the different metrics
 - set a cut-off point of semantic distance below which all pairs should be synonyms or antonyms; this is set such that the distribution of false positives (type I errors) and false negatives (type II errors) are equal
 - select the metric which minimizes the proportion of errors

Performance of different metrics



Best performing method: "p-Jaccard"

- Like Jensen-Shannon, but excluding contexts that are shared between word A and B
- Measures the sum of relative frequencies of co-occurrences in bigrams between A and words not co-occurring with B plus the sum of relative frequencies of co-occurrences in bigrams between B and words not co-occurring with A
- When divided by four this produces a number between 0 and 1, where the former means that all contexts are shared and the latter that no contexts are shared

хА	freq(xA)	Ах	freq(Ax)	хВ	freq(xB)	Вх	freq(Bx)
her	14	smile	20	her	12	affair	5
а	18	laugh	3	а	16	state	4
little	5	request	5	little	6	idea	3
sweet	3	wish	14	cute	5	thing	23
very	6	look	2	great	7	look	5
too	2	desire	8	funny	3	desire	11
your	1	deal	1	one	2	deal	2

хА	freq(xA)	Ах	freq(Ax)	хВ	freq(xB)	Вх	freq(Bx)
her	0.2857	smile	0.3774	her	0.2353	affair	0.0943
а	0.3673	laugh	0.0566	а	0.3137	state	0.0755
little	0.1020	request	0.0940	little	0.1176	idea	0.0566
sweet	0.0612	wish	0.2642	cute	0.0980	thing	0.4334
very	0.1224	look	0.0377	great	0.1372	look	0.0943
too	0.0408	desire	0.1509	funny	0.0588	desire	0.2075
your	0.0204	deal	0.0189	one	0.0392	deal	0.0377

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a	0.3673	laugh	0.0566	a	0.3137	state	0.0755
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a	0.3673	laugh	0.0566	a	0.3137	state	0.0755
little	0.1020	request	0.0940	little	0.1176	idea	0.0566
sweet	0.0612	wish	0.2642	cute	0.0980	thing	0.4334
very	0.1224	look	0.0377	great	0.1372	look	0.0943
too	0.0408	desire	0.1509	funny	0.0588	desire	0.2075
your	0.0204	deal	0.0189	one	0.0392	deal	0.0377
SUM	0.2449		0.7925		0.3333		0.6604

pJaccard = (0.2449 + 0.7925 + 0.3333 + 0.6604)/4 = 0.5078

Comparing winners and losers

- winners: today's most frequent new short words from different decades
- losers: short words that appear in at least three successive decades during 1850-1989 but not before or after.
- For both winners and losers we compute the correlation between semantic and phonological distance (Levenshtein distance) to the 4,000 semantically most similar words among words found in all decades.

Winners

word	correlation	birth decade	glosses
shit	0.2956	1900	
bike	0.2826	1870	
buddy	0.2658	1900	
pizza	0.2628	1940	
okay	0.2621	1900	
antsy	-0.0008	1960	1. Restless or impatient; fidgety. 2. Nervous; apprehensive.
kudzu	-0.0087	1940	An East Asian vine in the pea family. Grown for fodder, forage, and root starch.
glitz	-0.0614	1980	Ostentatious showiness; flashiness.

Losers

word	correlation	decades	glosses
util	0.1741	1940-1989	A theoretical measure of utility derived from the consumption of a good or service.
biro	0.1265	1890-1989	A pen that has a small metal ball as the point of transfer of ink to paper.
renig	0.1022	1890-1929	Common misspelling of renege, 1. to back out of an agreement; fail to follow suit (in game)
poilu	0.0824	1910-1959	A soldier in the French army: term used esp. in WWI.
fogy	0.0516	1850-1989	A person who is old-fashioned or highly conservative in ideas and actions.
pukka	0.0425	1910-1989	1. Anglo-Ind. good or first-rate of its kind. 2. Brit., Informal upper-class. 3. Brit. genuine.
drome	0.033	1920-1989	1. a track or racecourse: motordrome. 2. A large field or arena: airdrome, hippodrome.
socko	0.0194	1930-1989	Very popular, impressive, or successful.
phono	0.0073	1920-1989	Phonograph.
zowie	-0.0506	1920-1959	Used to express excitement, enthusiasm, admiration, etc.

Comparing winners and losers: end result



Results of a Mann-Whitney U-test of difference in the correlation of semantic and phonological distance :

p < 0.01

losers

Conclusion on new short words in English

- Seem to be subject to 'survival of the fittest':
 - SHAPE FASHION: They tend to resemble temporally close new short words more than temporally distant new short words
 - SOUND-MEANING FIT: Their semantic distance must correlate with their phonological distance to established words to become successful.

Are larger societal changes reflected in lexical dynamics?

Hypotheses:

- Overall *frequency changes*: takes the "pulse" of societal changes
- Overall *semantic changes*: points to specific trends

Frequency change



Kullback-Leibler measure of changes in frequency vectors:

Universals versus historical contingencies in lexical evolution

V. Bochkarev, V. Solovyev and S. Wichmann

J. R. Soc. Interface 2014 11, 20140841, published 1 October 2014





Figure 1. Change rates over time in the English lexicon.







Figure 8. Rates of change for British English, American English, German, French, Spanish and Italian.

Mean semantic change by decades

• Do we see fluctuations caused by major historical ruptures as for the frequency changes?

Means of semantic distances between same words from decade to decade

Surprise: something is going on, perhaps relating to some major changes in the postwar decades.



(the year that separates the two decades compared)

ambition	conduct	eventful	great	neglect	rendering	thrice	wretch
among	consciousness	exclamation	hopeless	overspread	reward	thrilling	wrought
animated	dashed	exquisite	hundred	parting	righteous	toil	
apostle	deceived	extricating	injustice	peculiarly	sail	unceasing	
beheld	delight	fancy	instruction	peopled	scorning	ungrateful	
bind	delightfully	fetters	intimate	perpetuity	secure	universal	
boughs	desolation	fixed	kindled	picturesque	secured	uplifted	
breathless	distress	flowers	knowledge	placed	selfish	utter	
character	earth	forego	liberally	preparations	singular	utterly	
charm	encamped	forth	loftiest	qualities	soul	vessels	
charms	endeavors	gallant	memorials	rapidity	specimens	wealth	
cherished	endeavor	garments	mere	rapturous	splendor	whom	
commodious	endure	gladly	mischief	reckless	sympathy	wild	
compelled	ensued	glory	necessities	remained	thither	wilful	

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cherished	endeavor	garments	mere	rapturous	splendor	whom	
commodious	endure	gladly	mischief	reckless	sympathy	wild	
compelled	ensued	glory	necessities	remained	thither	wilful	

36 items which mostly would be adjectives and adverbs

ambition	conduct	eventful	great	neglect	rendering	thrice	wretch
among	consciousness	exclamation	hopeless	overspread	reward	thrilling	wrought
animated	dashed	exquisite	hundred	parting	righteous	toil	
apostle	deceived	extricating	injustice	peculiarly	sail	unceasing	
beheld	delight	fancy	instruction	peopled	scorning	ungrateful	
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cherished	endeavor	garments	mere	rapturous	splendor	whom	
commodious	endure	gladly	mischief	reckless	sympathy	wild	
compelled	ensued	glory	necessities	remained	thither	wilful	

16 items relating to the endeavors and objectives of the individual

ambition	conduct	eventful	great	neglect	rendering	thrice	wretch
among	consciousness	exclamation	hopeless	overspread	reward	thrilling	wrought
animated	dashed	exquisite	hundred	parting	righteous	toil	
apostle	deceived	extricating	injustice	peculiarly	sail	unceasing	
beheld	delight	fancy	instruction	peopled	scorning	ungrateful	
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boughs	desolation	fixed	kindled	picturesque	secured	uplifted	
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charm	encamped	forth	loftiest	qualities	soul	vessels	
charms	endeavors	gallant	memorials	rapidity	specimens	wealth	
cherished	endeavor	garments	mere	rapturous	splendor	whom	
commodious	endure	gladly	mischief	reckless	sympathy	wild	
compelled	ensued	glory	necessities	remained	thither	wilful	

14 items relating to the troubles the individual may encounter

ambition	conduct	eventful	great	neglect	rendering	thrice	wretch
among	consciousness	exclamation	hopeless	overspread	reward	thrilling	wrought
animated	dashed	exquisite	hundred	parting	righteous	toil	
apostle	deceived	extricating	injustice	peculiarly	sail	unceasing	
beheld	delight	fancy	instruction	peopled	scorning	ungrateful	
bind	delightfully	fetters	intimate	perpetuity	secure	universal	
boughs	desolation	fixed	kindled	picturesque	secured	uplifted	
breathless	distress	flowers	knowledge	placed	selfish	utter	
character	earth	forego	liberally	preparations	singular	utterly	
charm	encamped	forth	loftiest	qualities	soul	vessels	
charms	endeavors	gallant	memorials	rapidity	specimens	wealth	
cherished	endeavor	garments	mere	rapturous	splendor	whom	
commodious	endure	gladly	mischief	reckless	sympathy	wild	
compelled	ensued	glory	necessities	remained	thither	wilful	

Key items hinting at the central importance of the individual

The "me generation"

The "Me" Decade and the Third Great Awakening

"... The new alchemical dream is: changing one's personality—remaking, remodeling, elevating, and polishing one's very *self*... and observing, studying, and doting on it. (Me!)..."

By Tom Wolfe

2 Comments



HEALTHY LIVING 03/21/2017 04:52 pm ET | Updated 3 days ago

Are Baby Boomers A 'Generation Of Sociopaths'?

A controversial new book argues boomers are beset with egotism, impulsivity and a shocking lack of empathy — and they're leaving the world a worse place.

By Carolyn Gregoire



MARK HUNT

Long before millennials were dubbed the "Me Generation," journalist <u>Tom Wolfe</u> used the label to describe the young baby boomers coming of age in the mid-1970s, a time of heightened focus on the self and personal development.

Thanks and good luck with the exploration of Irish!