

Conceptual Change and Distributional Semantic Models: an Exploratory Study on Pitfalls and Possibilities

Pia Sommerauer & Antske Fokkens

Computational Lexicology and Terminology Lab
Vrije Universiteit Amsterdam
pia.sommerauer@vu.nl, antske.fokkens@vu.nl

Conceptual model

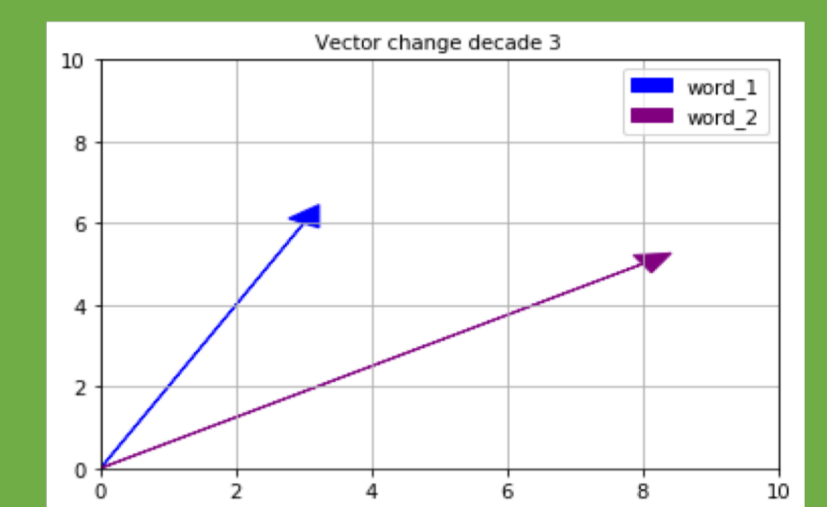
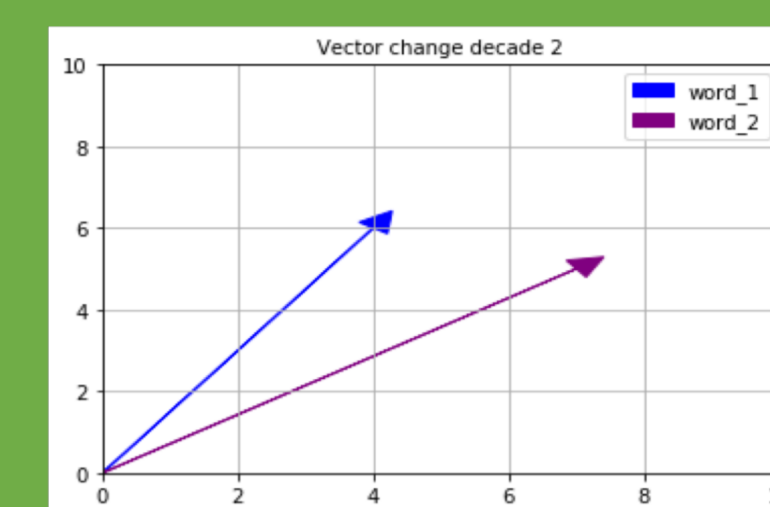
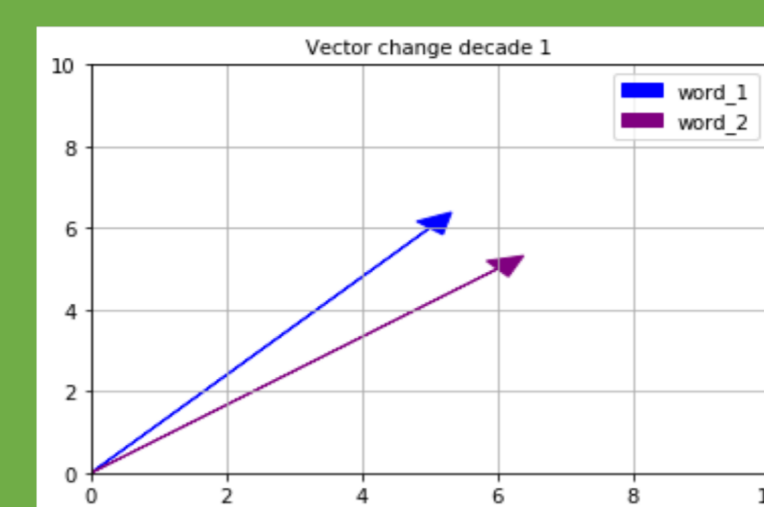
Race – culture – ethnicity
From old to new racism:

level	description	Target words
sub-concepts	'Race' defined in terms of visual attributes, most importantly skin color	skin color
instances	Groups defined by skin color	whites, blacks
related concepts	Emphasis on racial hierarchy	superior, inferior
	Biological justification	genetics
	Fear of intimacy	marriage, relationship



Concept	description	Target words
sub-concepts	'Race' defined in terms of cultural background consisting of nationality, language and religion	linguistic, national, religious
instances	Group labels of 'the others'	Immigrants, foreigners
	Ethnic group labels	Jews, Turks, Arabs
related concepts	Emphasis on difference	different
	Defense of seemingly liberal values	values, attitudes, beliefs
	Historic reasons for differences	historic

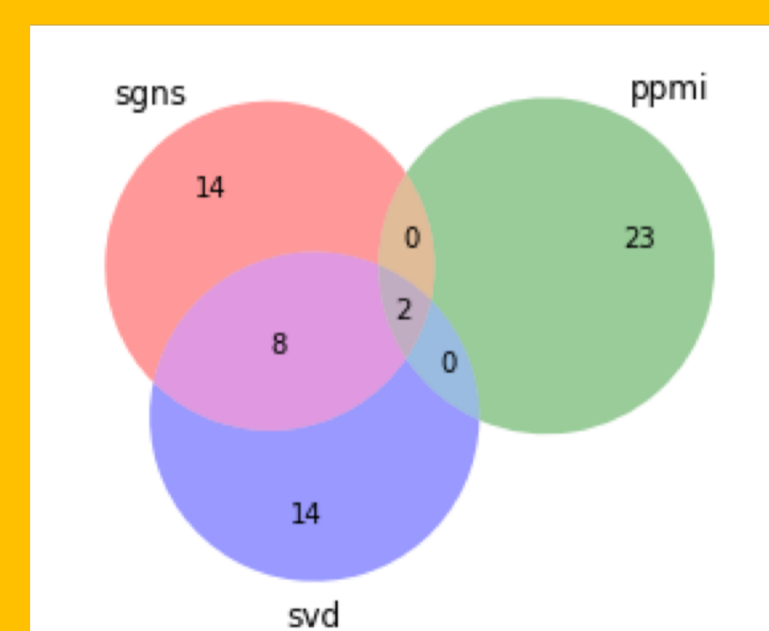
Method: Comparing distributional vectors



Hypothesized and observed changes

Change direction	hypothesized	Coha	Ngrams
← →	[race] - [sub-concepts of old racism] [race] - [instances of old racism] [race] - [related concepts of old racism]	whites-races marriage-cultural	whites-races marriage-cultural inferior-cultural superior-cultural
→ ←	[race] - [sub-concepts of new racism] [race] - [instances of new racism] [race] - [related concepts of new racism]	values-cultures religious-racial different-cultural national-cultural	values - cultures linguistic-cultural

Diving deeper: Variations & model stability



Overlaps of nearest neighbors (n=25) in three models in (n-grams 1900)

Bigger corpus → lower difference

1900	1950	1990
Cultural ethnic	Stereotypes Ethnic backgrounds discrimination	Discrimination segregation

Shared nearest neighbors of racial across SGNS, SVD and PPMI in the n-gram corpus (n=25).

decades	1900	1950	1990
Million tokens	25.7	29.0	33.2
Init1-init2	47.08	31.92	6.24
Init1-init3	27.04	31.00	7.20
Init2-init3	22.60	13.32	7.68
Init2-init1	22.32	33.48	8.96
Init3-init1	35.16	13.28	14.12
Init3-init2	49.00	26.52	12.72

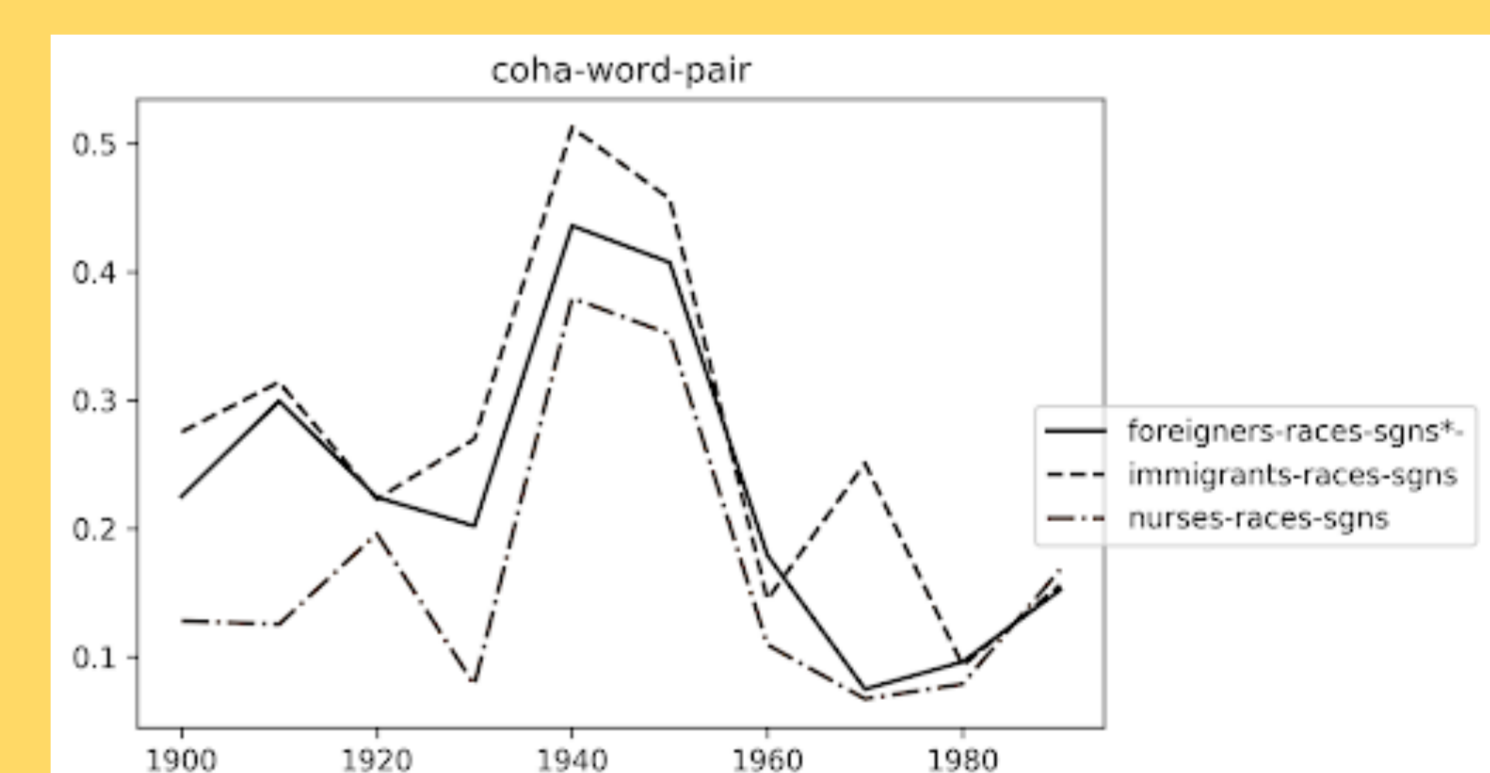
Average differences in rank between the top 25 nearest neighbors of racial in three initializations of the same sgns model trained on the same COHA split.

Decades	1900	1950	1990
Million tokens	25.7	29.0	33.2
Init1-init2	15	15	20
Init1-init3	16	18	20
Init2-init3	16	16	19
Init1-init2-init3	11	14	18

Number of shared nearest neighbors of racial (n=25) compared across 3 different random initializations of an SGNS model

Bigger corpus → lower difference

Diving deeper: Control words



Diving deeper: What holds and what doesn't?

'naive'	data	models	Control words
Nn racial indicate shift towards meta-discourse	yes	yes	n.a.
Cultures → ← values	yes	yes	yes
Races ← → immigrants	no	partly	no
Cultural ← → superior	no	partly	partly
Cultural ← → inferior	no	partly	yes

Recommendations:

How to use distributional models for studying conceptual change

- Define a range of verifiable hypotheses
- Compare the outcomes of multiple models and consider:
 - Count models reflect co-occurrences, but are influenced by frequency.
 - Random factors in predict-models. Use multiple versions
- Adapt ranges of nearest neighbors
- Use control words which are comparable to the target words