

# Computational Political Science

## Session 10

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# Looking ahead

## What we did

So far we focused on how methods for quantitative text analysis work.

We only briefly looked at applications of those methods.

## The road ahead

However, we need to have a *deeper* understanding of how QTA helps us answer *substantive research questions*

In the next sessions, we will therefore evaluate how useful QTA methods are (as opposed to understanding how they work)

## Motivation

While methodological innovations are quite common, articles rarely showcase strong explanatory power of QTA for substantive research questions

E.g. an application challenged a widely established belief or revealed new insights for a specific research area in political science/sociology

# Outline for today

## 1. **Evaluations**

## 2. **Designing research**

- Research questions and research design
- How are we going to evaluate research papers in session 10
- A recommendation on how to present your research ideas in session 11

## 3. **Discussion of published applications**

## 4. **Word embeddings**

- How does it work?
- The Geometry of Culture by Kozlowski et al (2019) as an example

# Course schedule

Session	Date	Topic	Assignment	Due date
1	Feb 02	Overview and key concepts	-	-
2	Feb 09	Preprocessing and descriptive statistics	Formative	Feb 22 23:59:59
3	Feb 16	Dictionary methods	-	-
4	Feb 23	Machine learning for texts: Classification I	Summative 1	Mar 08 23:59:59
5	Mar 02	Machine learning for texts: Classification II	-	-
6	Mar 09	Supervised and unsupervised scaling	Summative 2	Mar 15 23:59:59
7	Mar 16	Similarity and clustering	-	-
8	Mar 23	Topic models	Summative 3	Apr 12 23:59:59
-	-	<i>Break</i>	-	-
9	Apr 13	Retrieving data from the web	-	-
10	Apr 20	<i>Published applications</i>	-	-
11	Apr 27	Project Presentations	-	-

# Designing research

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# Quality criteria

While teachers are paid to read student reports, readers outside the university have no such incentive.

Writers must find other ways to convince their audience to read their work.

A good research design begins with a research question:

- for which the answer/s matter
- that builds on an identifiable body of knowledge
- that is feasible to (at least partially) answer

Why? Because good research is *all* of the below:

- *consequential*: tells us something important
- *novel*: tells us something new
- *valid*: tells us something true

# The consequentiality criterion

There are lots of practicable yet trivial research questions but good research should be consequential

Explain how your research problem is also your reader's problem by showing the consequence or the costs of not solving it.

## Costs of not solving a conceptual problem

Ignorance about a conceptual problem is a lack of understanding that keeps us from understanding something else even more significant.

If we cannot answer how our depictions of romantic love have changed <sup>second</sup> question, then we cannot answer how our culture shapes the expectations of young people about marriage and families? <sup>consequence/more important question</sup>

## Costs of not solving a practical problem

The cost of a practical problem is a tangible thing or situation we would like to avoid

If we do not know the extent of the losses due to the economic crisis, we cannot plan the budget for the next year.

# The novelty criterion

There are a lot of people doing social research

- Someone has already tried to answer a question similar to your question.
- Reviewing the research literature demonstrates that the exact question has not been satisfactorily answered.
- One goal for research is novelty, but you cannot assess novelty without an honest assessment of what has already been done. Research should make a specific contribution to an identifiable literature



# The feasibility criterion

Research design is about understanding feasibility tradeoffs

- If you deploy unlimited budgets or godlike powers, then you are not really engaging with the difficulty of the problem.
- A research design should include the best arguments in favor of your research design decisions
- Real research must be feasible in order to be completed and generate valid conclusions.
- For the purposes of this course, feasibility means in the context of a small-scale research project

# Expectations on a final project

Your research proposal is not going to be the most consequential or the most novel, given the fact that supervisors demand that it be feasible for you to complete as small-scale course project

What supervisors typically want to see is that you can explain

- what you are proposing to do,
- why it is worth doing,
- how it works,
- what we learn from it,
- and what are its limitations.

If you have done this, you will have no difficulty with...

# Dinner party test

Scene: You and a stranger at a dinner party / pub

*Stranger*: "So what do you do?"

*You* (reluctantly): "I'm working on my student research project"

*Stranger* (inevitably): "So what's it about?"

*You* (ramble on for 10 minutes secretly thinking): "this stranger can't possibly understand the complexity and nuance of what I'm doing ..."

*Stranger* (desperately seeks escape and/or stiff drink, vowing never to ask that question again)

If you cannot give a synoptic, ordinary language explanation in two or three minutes of what you are focusing on and what you hope to achieve, the **chances are very high that in a very fundamental way you do not yet understand your thesis topic.** (Dunleavy 2003: 22)

# Tell me about your research



## Preparation for dinner-party test

1. Topic: I am studying ...
2. Question: because I want to find out what/why/how ...,
3. Significance: in order to help my reader understand ...

## Projecting outcomes of the study

- What kind of answer do expect from your study?
- How might your results change our view on the social phenomenon that you are studying?

## Methods

- Which methods might be useful for collecting and analyzing data?

# Template for a Research Design

1. Background/literature review
2. Research question(s)
3. Data collection strategies
4. Data analysis strategies
5. Potential impact and relevance of the study
6. Limitations and further research
7. References / bibliography

# Implicit Questions

Implicitly, a research design asks these questions

1. What do we know already?
2. What are you going to try to learn?
3. What kind of evidence are you going to collect and how will you collect it?
4. How does that evidence enable us to draw conclusions?
5. What might those conclusions be and why do they matter?
6. What are the limitations of what you are going to do? What have you done to mitigate these limitations? What more could be done with extra time and/or resources?
7. References / bibliography

# Research questions

[R]esearch questions can provide the key to planning and carrying out a successful research project (Robson and McCartan 2016: 59)

They help to:

- Define your project (summarize its focus)
- Set boundaries (demarcate the parameters of your project and so enhance feasibility)
- Give direction (signal what literature to search [relevance vs comprehensiveness], what data to collect, what methods to employ...)
- Define success (answerable research questions enable you to show that you have done what you set out do to)

# Setting-up research questions

We need to consider not only what questions enable us to do, but also where we get them from - how can we set-up/motivate our research question/s

- 'Consequentiality' and 'novelty' criteria is key to this
- Importance of showing that our research matters and that it contributes somehow to our existing understanding of social phenomena

'Gap-spotting' in the academic literature a conventional way of motivating research

- Substantiate our contribution by reviewing what we (collectively) know already
- Multiple modes of 'gap-spotting', e.g. confusion spotting, neglect spotting... (Sandberg and Alvesson 2011); also methodological gap spotting





# Supplementary sources

Can also signal the importance of our work in other ways. These include framing our research in relation to:

- contemporary social problems/puzzles (e.g. political debates or policy conundrums)
- why does this research matter beyond the ivory towers?
- apparent ‘gaps’ between official discourse and social practice
- socio-technical developments and trends
- interdisciplinary (‘spending time in the next village’ – e.g. how have commensurate processes been studied in other disciplines?)
- ‘problematization’ (Sandberg and Alvesson 2011)
- personal experience (‘starting where you are’ [Robson and McCartan 2016: 49-50])

# Identifying research questions

2016

Ertug, Yogev, Lee, and Hedström

129

## Practical Implications

Our study provides practical implications not only for contemporary artists, but also those whose careers involve interacting with clients (or audiences for their work) with diverse concerns and interests. Even after achieving a positive reputation with a particular group of clients, those in such careers need to be aware that this same reputation may not be relevant for a different group of clients. Hence, such people would need to manage their careers to focus on one audience over others, depending on the attributes for which their reputation(s) is (are) relevant. This would also apply to, for example, managers who work as brokers between external clients and internal service providers (e.g., in an R&D department), whose key objectives and concerns differ. Given that a good reputation among external clients may not directly translate into an equally beneficial reputation among internal service providers, these managers should be aware of the differential effect of reputation and might need to separately build a relevant reputation for each audience group. Furthermore, as our arguments and findings regarding the contingent effects suggest, to further enhance one's positive reputation (or to fully benefit from it) with a given audience in a set, it would also be important to consider the accountability of that audience. In the example above, for instance, if the external client (rather than the internal service providers) were more accountable for their decisions vis-à-vis the output of the R&D department, the managers would also need to be mindful that it would become even more important to have other consistent signals of the quality of their work in their dealings with these external clients.

## Limitations and Future Research

Our study is subject to certain limitations. First, we find no statistical support for the differential effect of appearing on a magazine cover on success with museums and success with galleries (Hypothesis 1b). We believe that the lack of support is due to the data available to measure a reputation for commercial viability in this setting. Specifically, magazines might also feature artists on their covers who possess artistic qualities in addition to their commercial viability. This is relevant because such occurrences would add to measurement error, making our indicator of a reputation for commercial viability noisier than we would like (as it might also capture some information about artistic quality). While this

is true for appearing on a magazine cover, the reverse is not true for awards. Awards are commended and defended as championing artistic quality, therefore making our indicator of a reputation for artistic quality more informative and less noisy. We suggest that this is one reason that we find support for the differential effect of winning an award (Hypothesis 1a) but not for the differential effect of appearing on a magazine cover (Hypothesis 1b). The literature and mechanisms we use for our framework, and the consistent results we find for the differences in contingent effects on status and interaction with other audiences, suggest that the lack of support for Hypothesis 1b is due to the noisy measurement issue noted above. **In theory, one might improve on our measure of magazine covers by using data on auctions, for example, with the implication that artists whose works have appeared in auctions more often, or have a higher sales ratio (the proportion of lots sold among those made available), have a reputation for commercial viability.** However, for the artists in our estimation sample, we were unable to find a database that offers anywhere close to systematic and comprehensive coverage. We note this, again, to suggest that, based on the support we have for the other predictions and on the foundations of our framework, we expect our predictions to be broadly applicable, despite the lack of support for Hypothesis 1b with the measure we use.

Second, we examine only two signals, among possibly multiple types of other signals. Accordingly, future research can consider signals or intangible assets other than status or interaction with other audiences (Pfarrer et al., 2010; Pollock & Gulati, 2007) and determine whether they, in conjunction with reputation, would be informative for audiences, and how this contingent relationship might again vary on the basis of accountability or other broadly applicable constructs that constrain the decision making of audiences.

Third, the research context of the contemporary art field was used to develop our hypotheses and assess audience-specific reputations. The unique characteristics of this setting reduce the generalizability of our findings, and future studies in other contexts are needed to further establish the generalizability of the framework underlying our hypotheses. However, we view the contextual specificity of our study as a strength rather than a weakness because the nuances of audience-specific reputations require an in-depth understanding of specific audiences and the sources of their concerns and uncertainty in a particular setting. Our framework can be applied to

- Unlike much funded or commissioned research, for independent projects (course projects, BA and MA theses) you are expected to come up with research questions yourselves
- Identifying and reading around topics of interest (being sure to include cutting edge studies) should help with this
- You might identify the gap yourself but often empirical papers also include further research directions in their conclusions. Could you feasibly address any of these?
- Journal editorials/review papers can often serve as a source of inspiration

# Topic $\neq$ research question/s

- Once you have a topic, clarifying the purpose/s of your research can be crucial to developing research questions
- Beyond contributing to knowledge, typical broad purposes include exploration, description and explanation (and possibly impact for more applied research)
- Don't be afraid of coming up with multiple questions – this is normal, and a set of (often nested) questions can indeed be advantageous/more readily answerable (as long as the questions are feasible)
- Use the feasibility criterion to help you prioritize your research questions

# Example immigration-related questions

## What is the type of answer you expect from doing research?

- |   |  |
|---|--|
| 1. <b>How many</b> people in my dataset of German residents said they thought there should be less immigration? | 1. A question about particular data                        |
| 2. <b>How</b> do people living in post-industrial towns in Germany perceive immigration in their local areas?   | 2. An exploratory question about a population              |
| 3. <b>What fraction</b> of people in Germany think there should be less immigration?                            | 3. A quantifiable question about a population              |
| 4. <b>What kinds</b> of people in Germany tend to say there should be less immigration?                         | 4. A question about a relationship in a broader population |
| 5. Do people in Germany become more or less favorable towards immigration <b>if</b> they work with immigrants?  | 5. A question about causal relationship size               |
| 6. <b>Why</b> do some people in Germany say there should be less immigration?                                   | 6. A question about causal relationship mechanisms         |

# Topically Related Research Questions

## What is the type of answer you expect from doing research?

1. How many people in my dataset of German residents said they thought there should be less immigration?
2. How do people living in post-industrial towns in Germany perceive immigration in their local areas?
3. What fraction of people in Germany think there should be less immigration?
4. What kinds of people in Germany tend to say there should be less immigration?
5. Do people in Germany become more or less favorable towards immigration if they work with immigrants?
6. Why do some people in Germany say there should be less immigration?

1. Description
2. Exploration
3. Population Inference (description)
4. Population Inference (description)
5. Causal Inference (cause-effect)  
[explanation]
6. Causal Inference (causal mechanisms)  
[exploration/explanation]

# Discussion of published applications

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# Today's discussion

Text	Presenter
How Censorship in China Allows Government Criticism but Silences Collective Expression (King et al 2014)	T.O.
Rhetorics of Radicalism (Karell and Freedman 2019)	A.V., M.M.
Racialized Discourse in Seattle Rental Ad Texts (Kennedy et al 2020)	N.R.
Whose Ideas Are Worth Spreading? The Representation of Women and Ethnic Groups in TED Talks (Schwemmer and Jungkunz 2019)	V.O.
The Geometry of Culture: Analyzing the Meanings of Class through Word Embeddings (Kozłowski et al 2019)	D.B.

## Note:

These are good examples of articles that addresses substantial social science questions

However, you may also present a different article if it better fits your research interest

You find the literature on [ILIAS](#)

# Word embeddings

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# Word embeddings

- Bag of word approaches only track the frequency of terms, but ignore context, grammar, word order
- One alternative to the bag-of-words approach are word embeddings (word vectors)
- Word embeddings represent words as real-valued vectors in a multidimensional space (often 100–500 dimensions)
- The goal is to obtain a measure of a word’s “meaning” by its position in that space relative to the position of other words
- “You shall know a word by the company it keeps” (John Rupert Firth, 1957)
- Algorithms learn the vector representations of words through the context in which the words appear in training texts

# Word embeddings

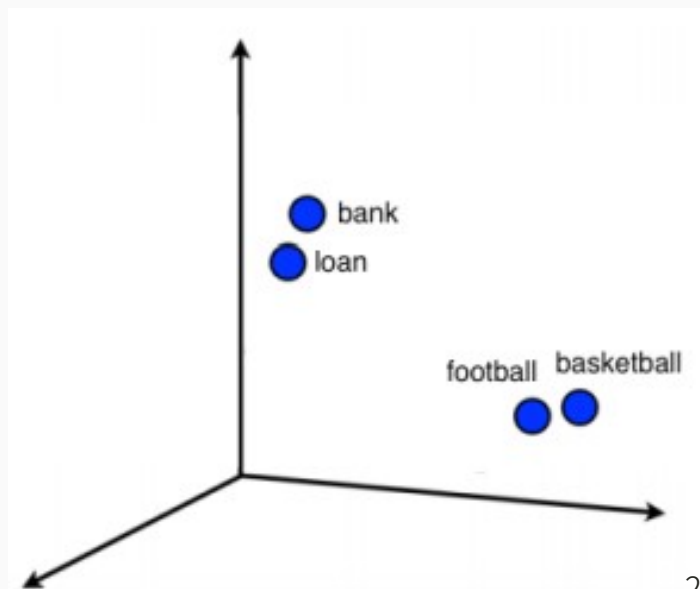
- Learning vector representations of words has been an area of research for long, not just since 2013. See e.g. Bengio et al. (2003): "A neural probabilistic language model"
- Yet, word2vec (Mikolov, et al. 2013) was able to yield word embeddings of previously unknown quality
- Other frequently used word embeddings are e.g. GloVe (Pennington et al., 2014)
- Embeddings are used for analysis themselves or as inputs in many machine learning models
- Very recent work in word embeddings: Contextual embeddings such as e.g. *BERT* (Devlin et al., 2018) which yield different vectors for the same word in different contexts (word2vec and GloVe in contrast yield a single vector for each word in a corpus)

# Word embeddings example

After training a model e.g. on the corpus of Wikipedia, four exemplary embeddings with 300 dimensions could look like the following

word	$D_1$	$D_2$	$D_3$	...	$D_{300}$
bank	0.46	0.67	0.05	...	...
loan	0.46	-0.89	-0.08	...	...
football	0.79	0.96	0.02	...	...
basketball	0.80	-0.58	-0.14	...	...

- You can think of each vector as a point in space
- Words that tend to appear together in texts should be close in vector space
- Stylized visualization in three dimensions:



# Visualising word vectors

- Word vectors are often visualised in lower dimensions
- Common methods to bring vectors down from e.g. 300 to 2 or 3 dimensions are:
  - PCA (principal component analysis)
  - t-SNE (t-distributed stochastic neighbour embeddings) by van der Maaten et al. (2008)
  - t-SNE is a tool specifically for visualisation which tries to preserve clusters from high dimensional space also in lower dimensional plots in the commonly shown plots
- Yet, its nonlinear mapping from the high to the low dimensional space will distort linear relationships in the low dimensional space
- In general, it is important to keep in mind that the high dimensional space still has much richer structures which we cannot see
- Illustration by [Tensorflow](#)

# Similarities

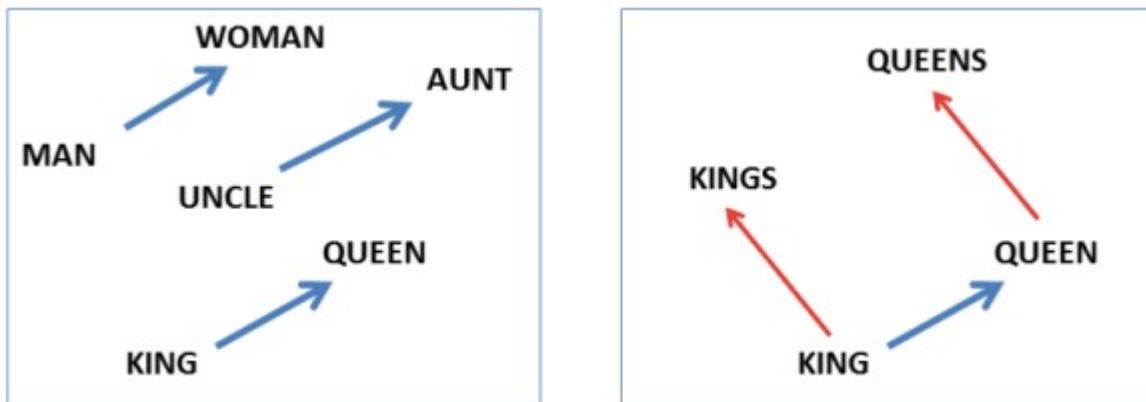
- Always use original vectors to compute similarities, not the visualization ones
- Similarity between word vectors are usually computed with

$$\text{cosine similarity}(x, y) = \frac{x \cdot y}{||x|| ||y||}$$

- Cosine similarity is the cosine of the angle between the two vectors and therefore normalised on the interval  $[-1, 1]$
- A cosine similarity of 1 implies an angle between the two vectors of 0 degrees, 0 implies 90 degrees, and -1 implies 180 degrees
- If you want to use Euclidian distance instead, normalize all vectors to the same length as otherwise differences in lengths can mechanically drive differences in semantic similarity (particularly relevant to document vectors with different amount of words but the same shares of words)

# Analogies

Among the most widely discussed features of word embeddings is their ability to capture analogies via their geometry



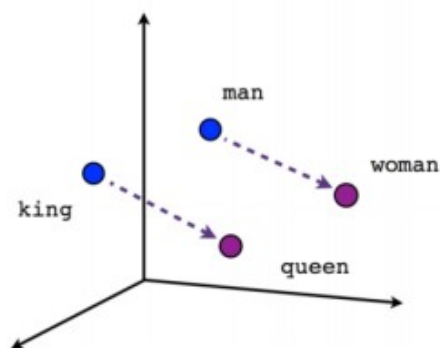
$$\begin{aligned} & \text{vector}(\text{'king'}) + (\text{vector}(\text{'woman'}) - \text{vector}(\text{'man'})) \\ &= \text{vector}(\text{'king'}) - \text{vector}(\text{'man'}) + \text{vector}(\text{'woman'}) \approx \text{vector}(\text{'queen'}) \end{aligned}$$

How to find 'queen' in detail:

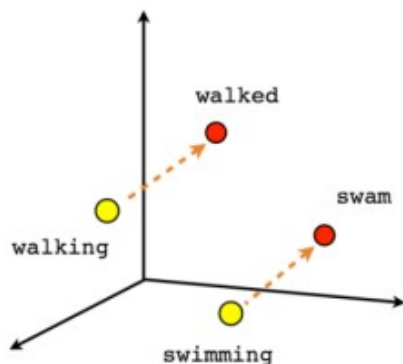
1. Compute the new vector  $x = \text{vector}(\text{'king'}) - \text{vector}(\text{'man'}) + \text{vector}(\text{'woman'})$
2. Find the vector most similar to  $x$  via cosine similarity (convention to exclude the vectors 'king', 'man', 'women' individually from outcomes)

# Analogies

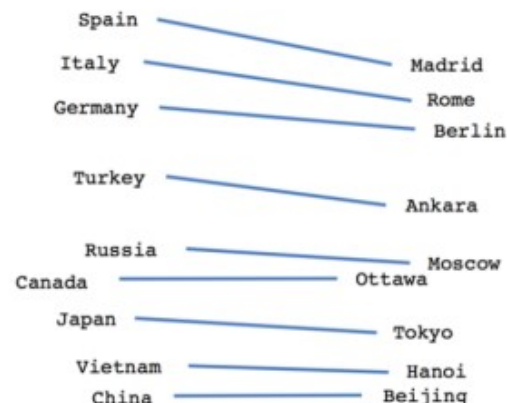
Among the most widely discussed features of word embeddings is their ability to capture analogies via their geometry



Male-Female



Verb tense



Country-Capital

- Vectors capture general semantic information about words and their relationships to one another
- Analogies work for a surprisingly wide range of examples (see coding session)



# Geometry of culture



## The Geometry of Culture: Analyzing the Meanings of Class through Word Embeddings

American Sociological Review  
2019, Vol. 84(5) 905–949  
© American Sociological  
Association 2019  
DOI: 10.1177/0003122419877135  
[journals.sagepub.com/home/asr](https://journals.sagepub.com/home/asr)



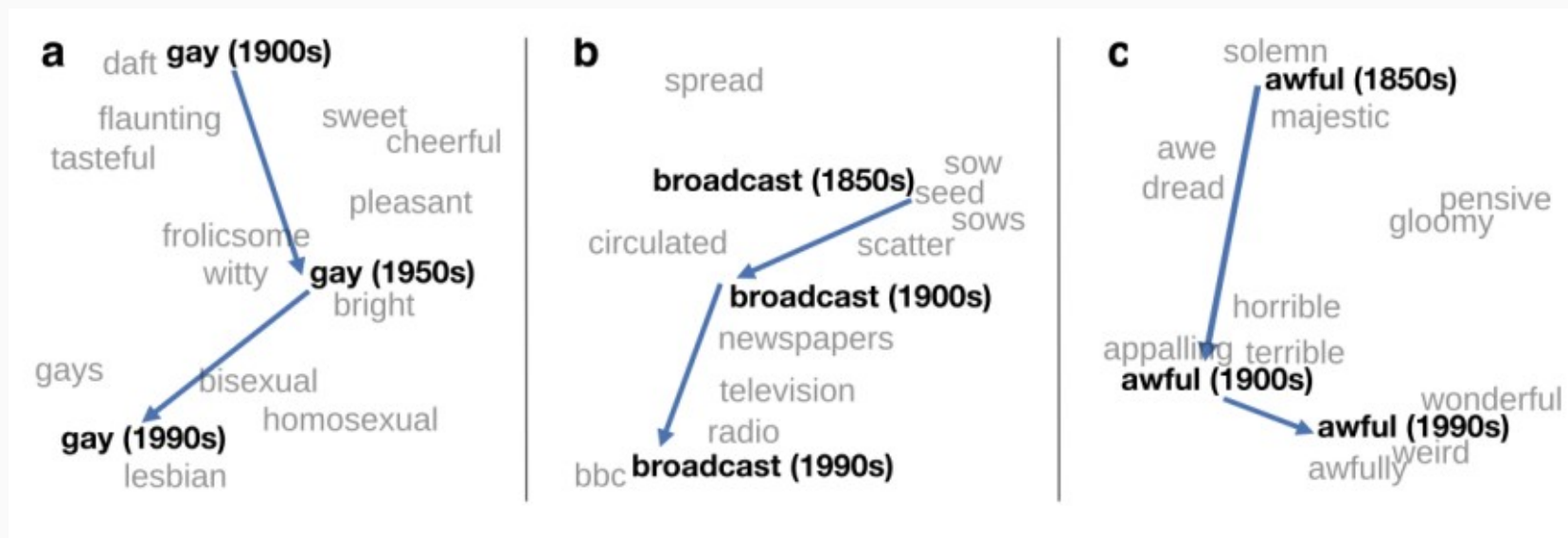
Austin C. Kozlowski,<sup>a</sup>  Matt Taddy,<sup>b</sup>  
and James A. Evans<sup>a,c</sup> 

### Abstract

We argue word embedding models are a useful tool for the study of culture using a historical analysis of shared understandings of social class as an empirical case. Word embeddings represent semantic relations between words as relationships between vectors in a high-dimensional space, specifying a relational model of meaning consistent with contemporary theories of culture. Dimensions induced by word differences (*rich – poor*) in these spaces correspond to dimensions of cultural meaning, and the projection of words onto these dimensions reflects widely shared associations, which we validate with surveys. Analyzing text from millions of books published over 100 years, we show that the markers of class continuously shifted amidst the economic transformations of the twentieth century, yet the basic cultural dimensions of class remained remarkably stable. The notable exception is education, which became tightly linked to affluence independent of its association with cultivated taste.



# Semantic shifts



Source: Hamilton et al. (2016) ACL

<https://nlp.stanford.edu/projects/histwords/>

# Coding example

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