

University of Tokyo: Text-as-Data

Day 2, Part II

Arthur Spirling

June 4, 2017

Where Are We?

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and demonstrate challenges that emerge in interpreting the results.

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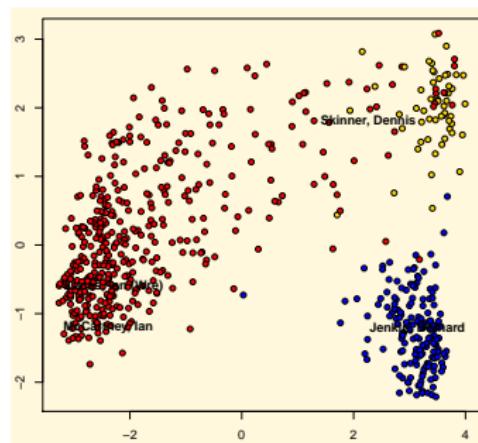
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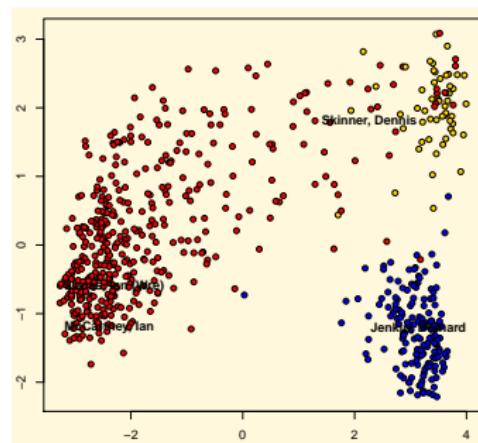
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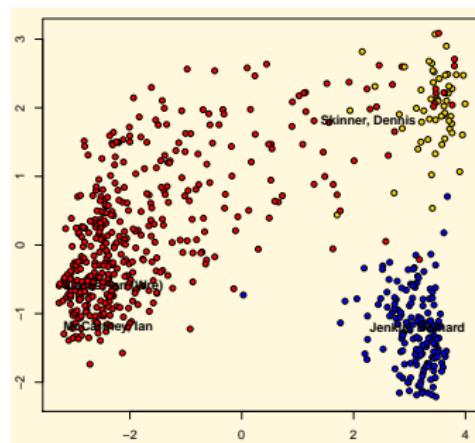


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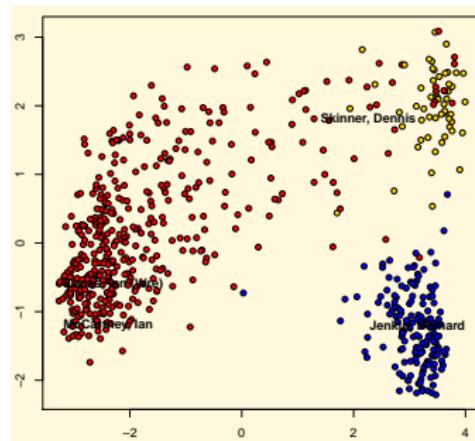


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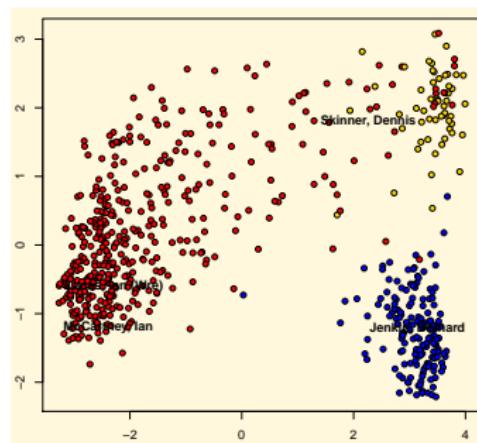
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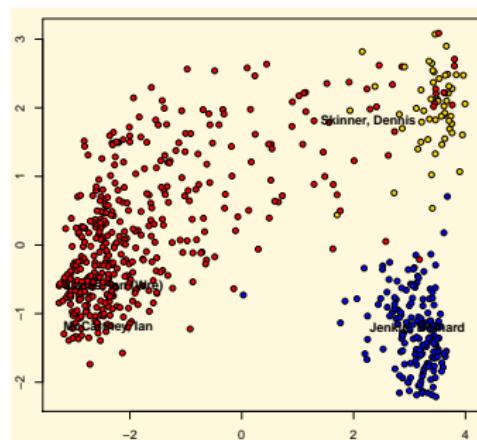
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CRITIC REVIEWS FOR STAR WARS: EPISODE VII - THE FORCE AWAKENS

All Critics (313) | Top Critics (48) | My Critics | Fresh (293) | Rotten (20)

The new movie, as an act of pure storytelling, streams by with fluency and zip.
Full Review... | December 21, 2015

Anthony Lane
New Yorker
★ Top Critic

While Star Wars: The Force Awakens gets temporarily bogged down taking us back to the world that we left in 1983, it introduces us to the new and exciting torch-bearers of the franchise.
Full Review... | December 30, 2015

Blake Howard
Graffiti With Punctuation

At the end The Force Awakens looks more like a nostalgic film that will work as a transition to the new Star Wars' age. [Full Review in Spanish]
Full Review... | December 29, 2015

Salvador Franco Reyes

This film is a well-planned product that balances nostalgia with the capacity to attract new generations into the Star Wars universe. [Full Review in Spanish]
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(**not** "what is the recall/precision/accuracy?")

Basic Techniques: Principal Components and Clustering

Motivating Problem

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Have an $n \times p$ matrix,

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Name	Party	Vote 1	Vote 2	Vote 3	
Ainsworth, Peter (E S)	Con	NA	1	NA	...
Alexander, Douglas	Lab	NA	0	0	...
Allan, Richard	LD	1	0	1	...
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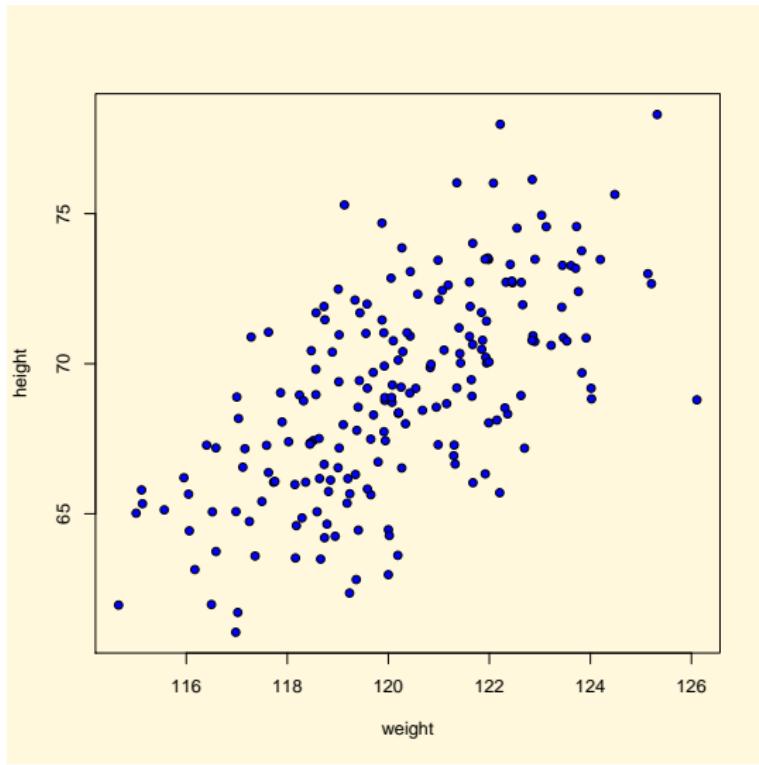
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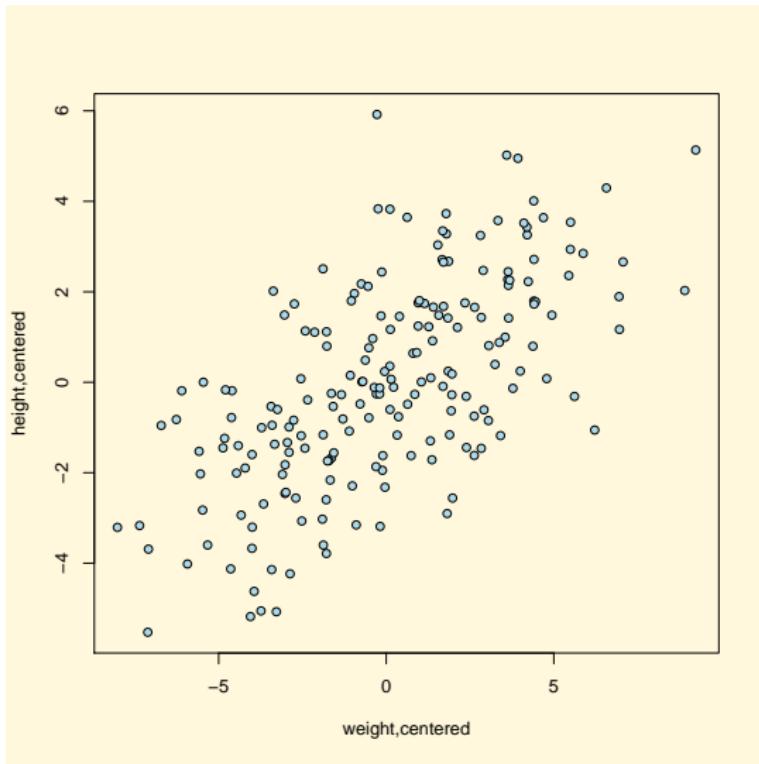
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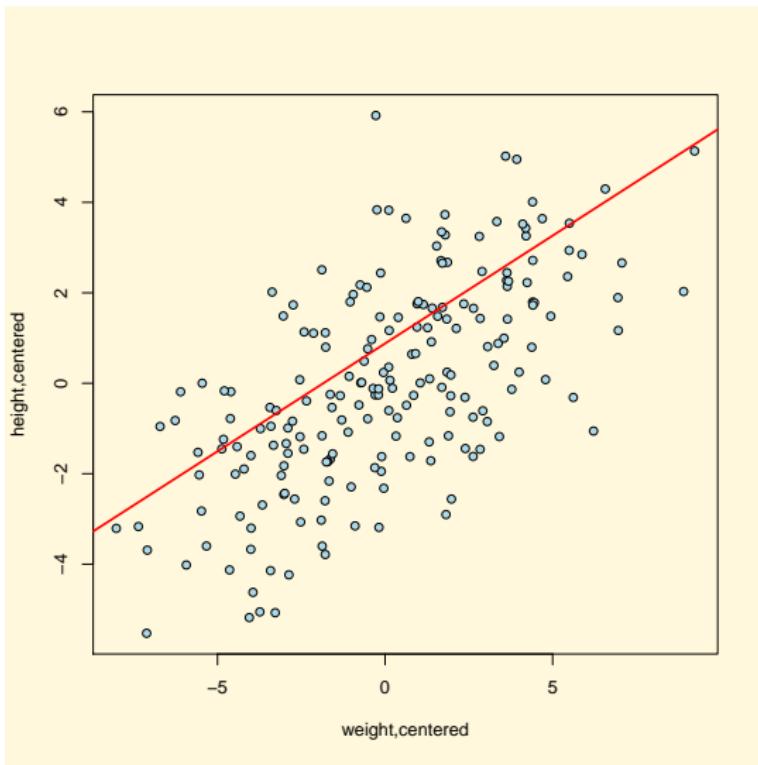
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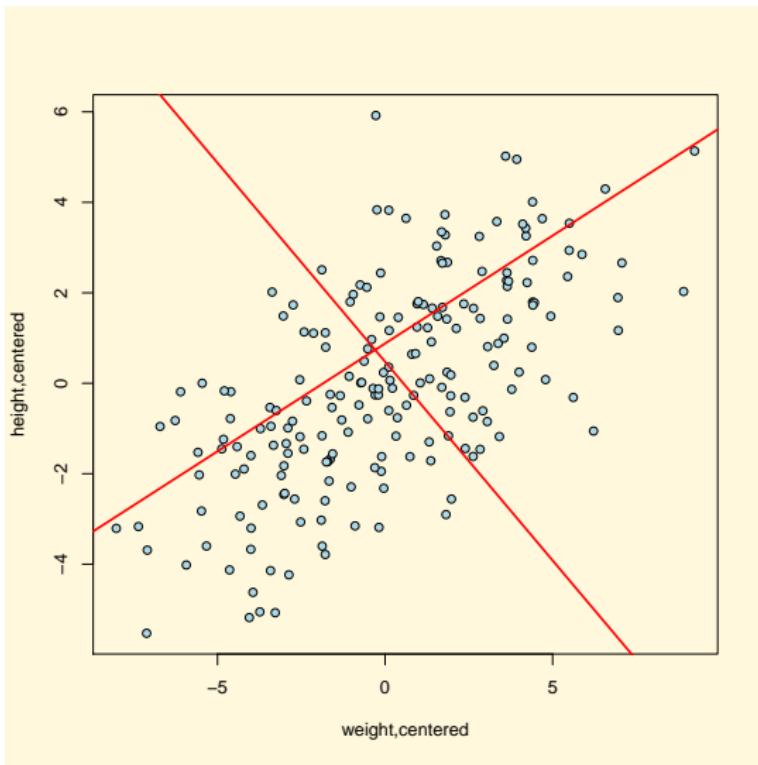
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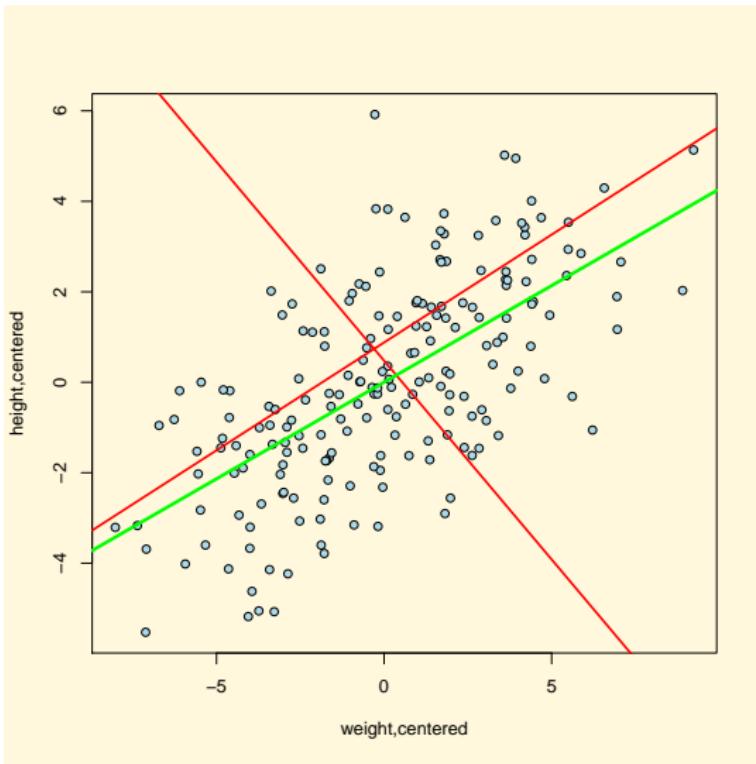
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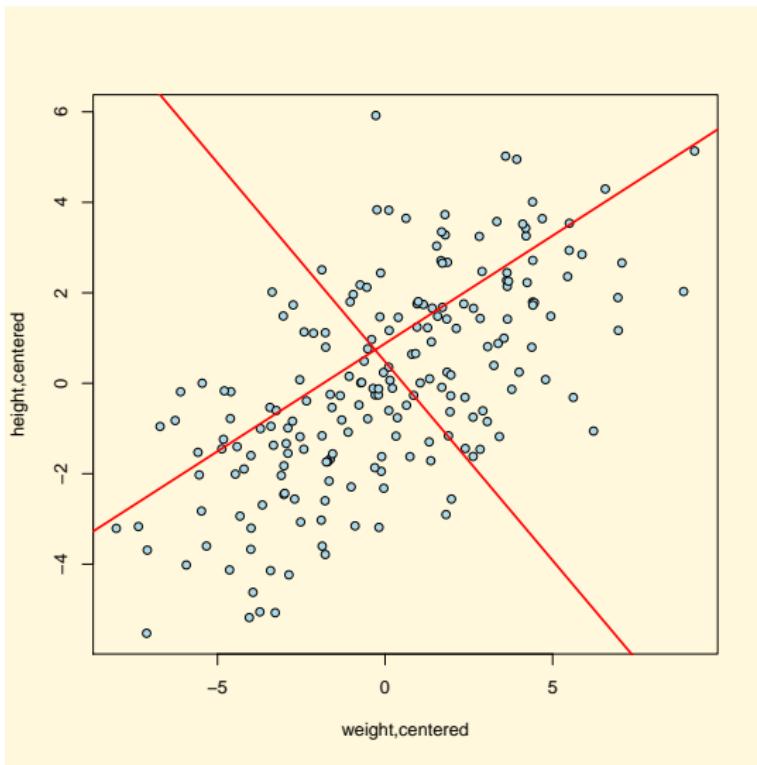
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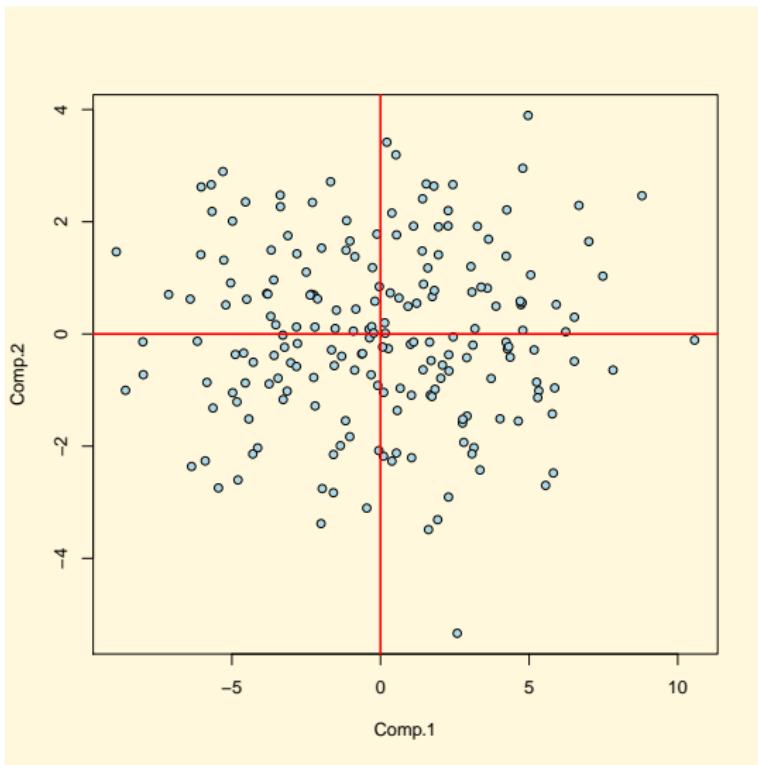
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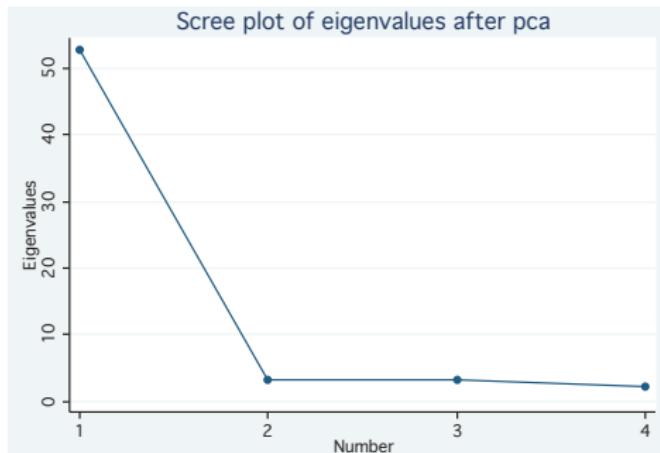
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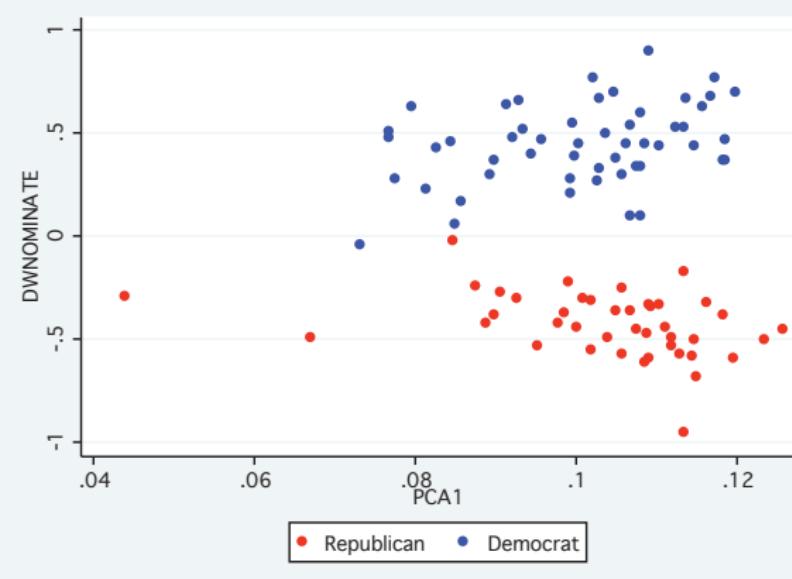
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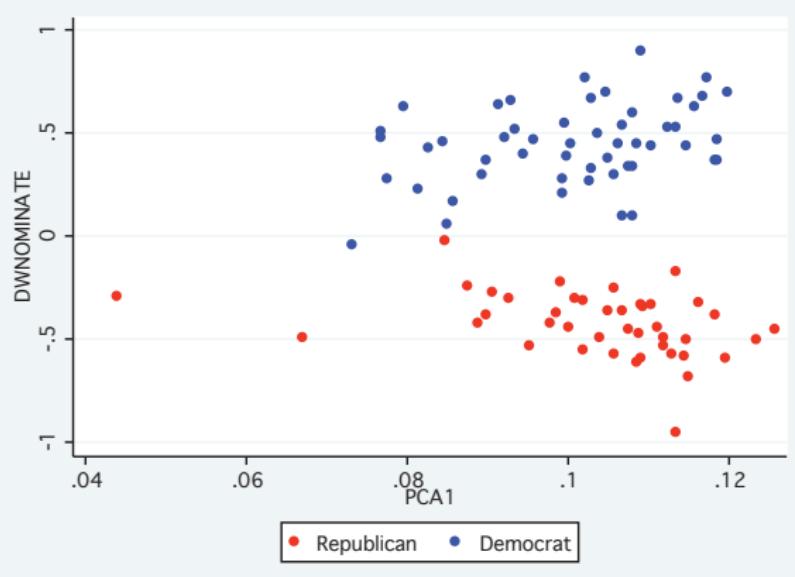
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Partner Exercise

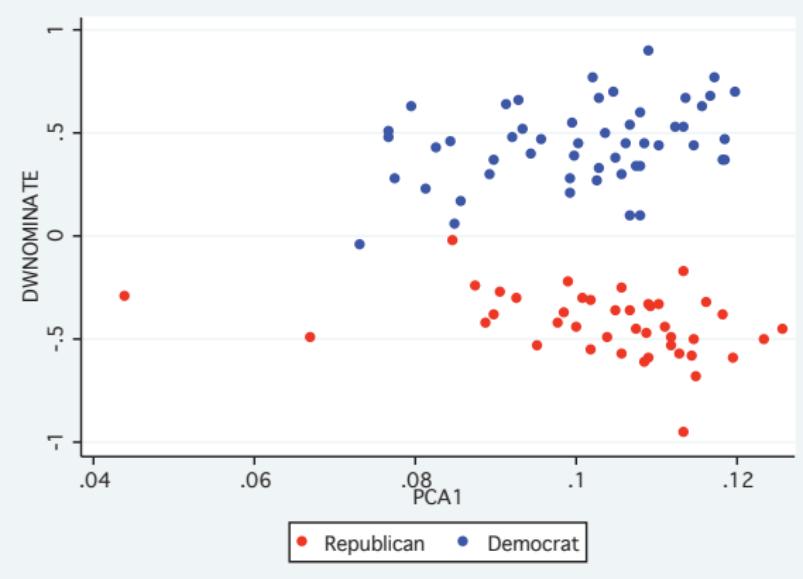


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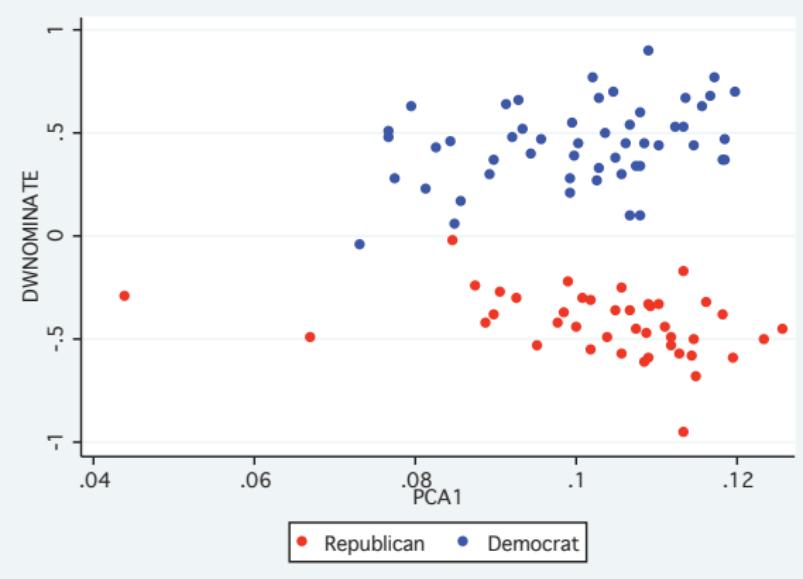
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- observations (documents) within clusters should be as similar as possible, observations (documents) in different clusters should be as different as possible.

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This requires thoughtful **visualization**,

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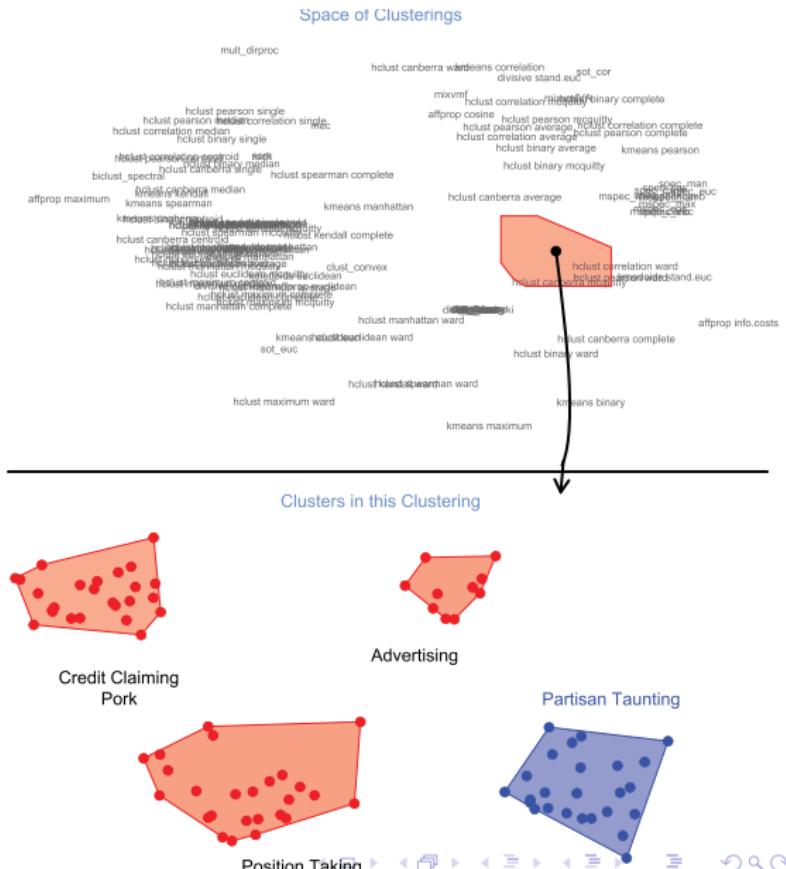
- 1 **Cluster Quality**: randomly draw pairs of documents from **same** cluster and **different** clusters, and ask **human coders** how closely related they are.
- 2 **Discovery Quality**: show scholars the cluster space and see if it improves their understanding of own data

Discovery of Partisan Taunting in Press Releases

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Unsupervised Scaling: Wordfish

Time Series Problems

Time Series Problems



Time Series Problems



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ω_{it} estimate of party's position in a given year (so, this applies to specific manifesto)

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but similar to ideal point estimation wherein the legislators' ideal points are not known: $\Phi(\beta_j' \mathbf{x}_i - \alpha_j)$.

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Or Suppose we knew the party parameters, ω_{it} and α_{it} . Then we could use a Poisson GLM to estimate ψ_j (a constant/fixed effect) and β_j which is a word specific 'effect'.

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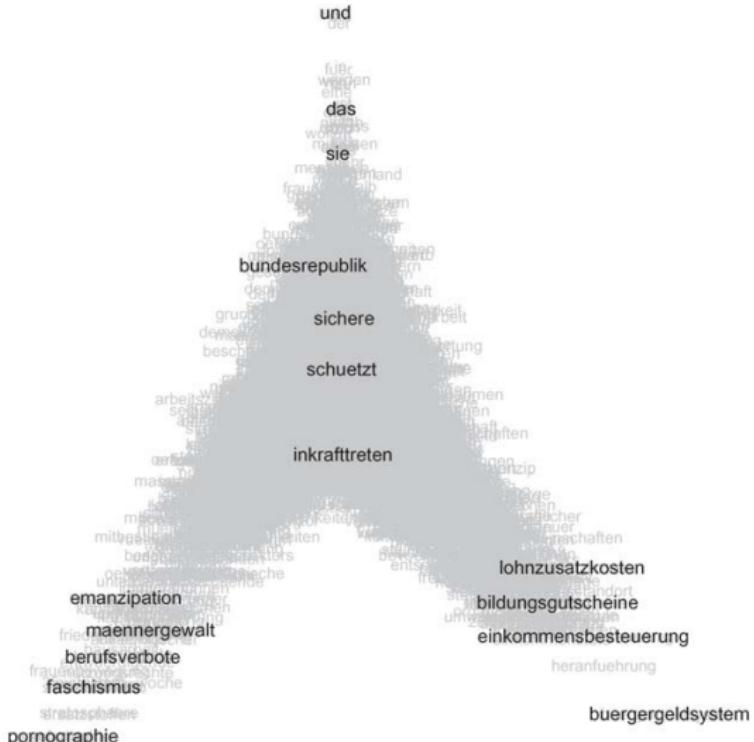
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btw can use parametric bootstrap for uncertainty estimates.

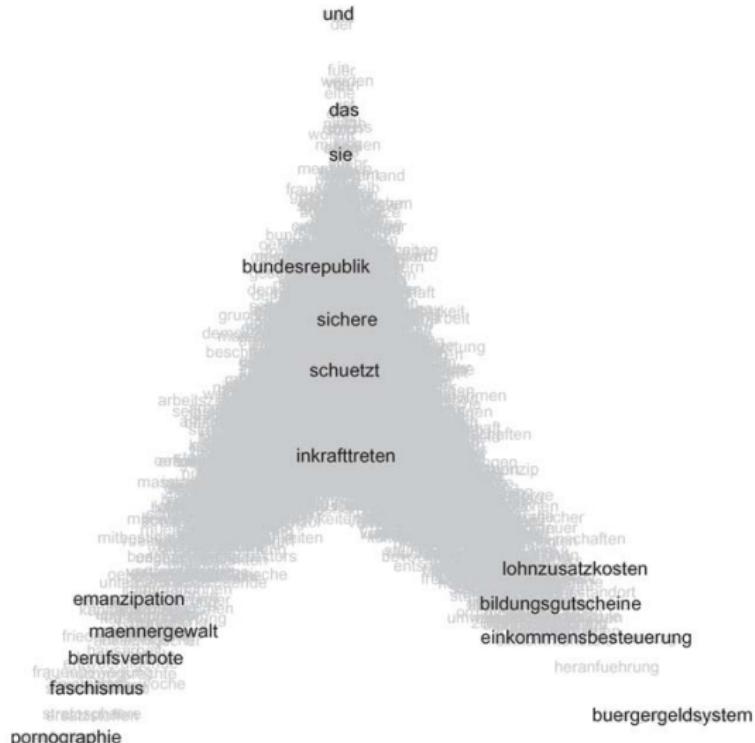
Results

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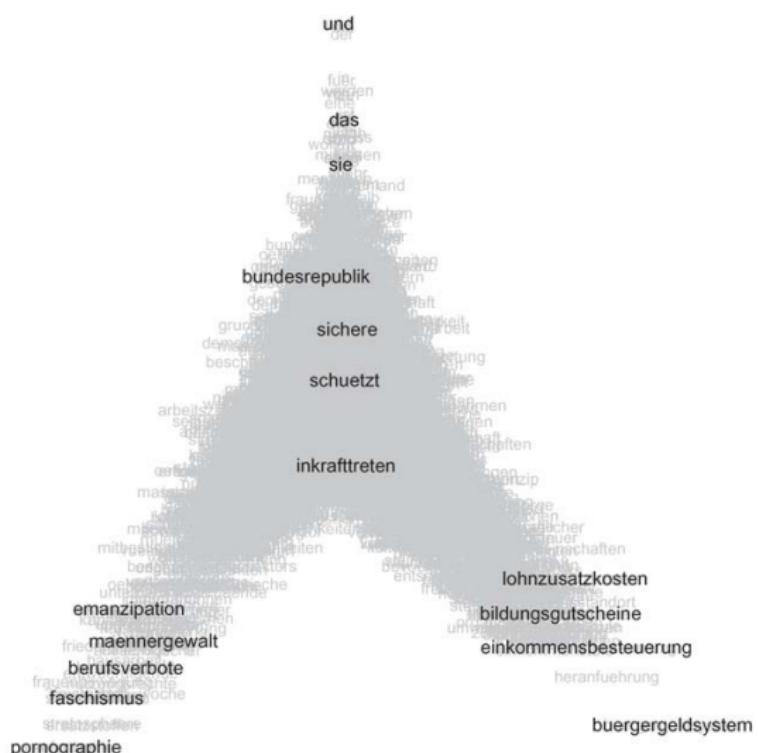
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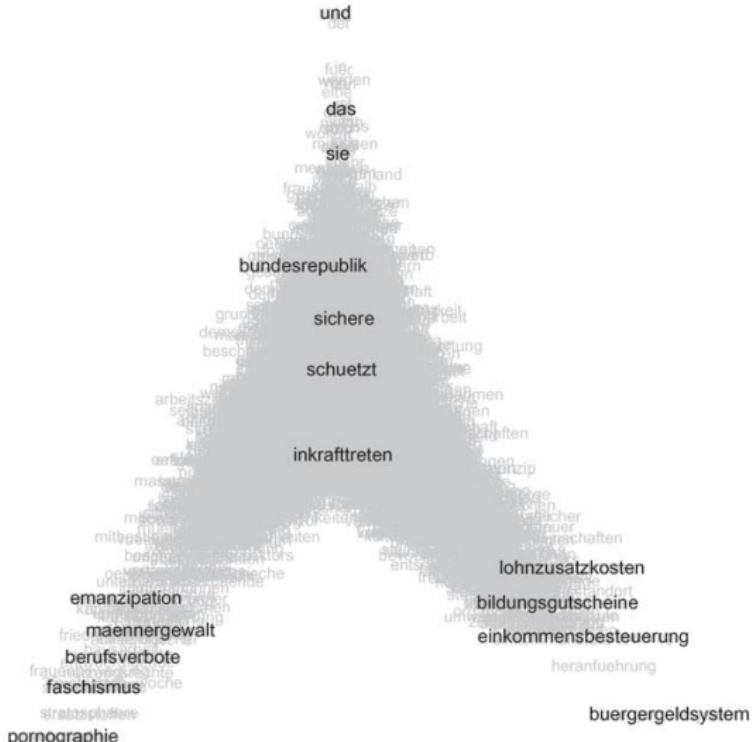
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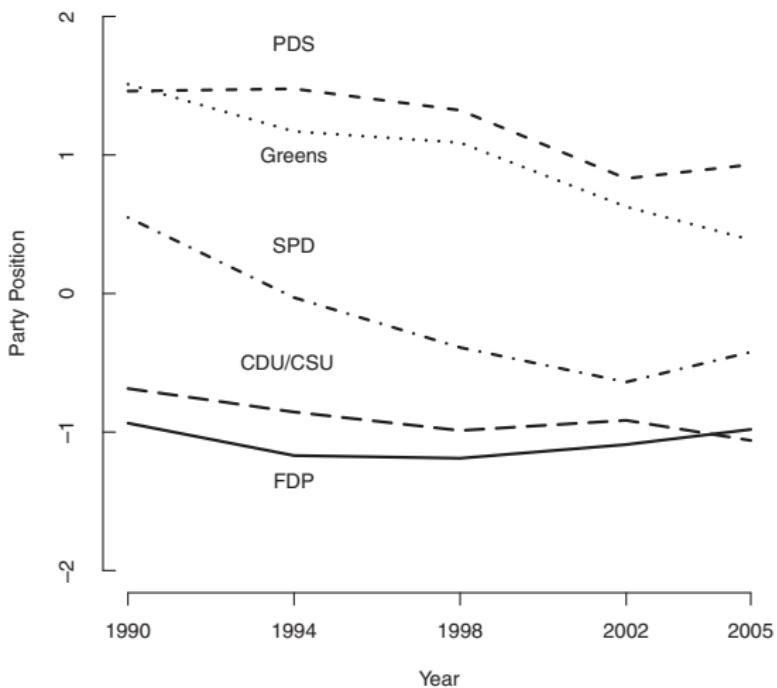
Top 10 Words Placing Parties on the . . .

Dimension	Left	Right
Left-Right	Federal Republic of Germany (BRD) immediate (sofortiger) pornography (Pornographie) sexuality (Sexualität) substitute materials (Ersatzstoffen) stratosphere (Stratosphäre) women's movement (Frauenbewegung) fascism (Faschismus) Two thirds world (Zweidrittewelt) established (etablierten)	general welfare payments (Bürgergeldsystem) introduction (Heranführung) income taxation (Einkommensbesteuerung) non-wage labor costs (Lohnzusatzkosten) business location (Wirtschaftsstandort) university of applied sciences (Fachhochschule) education vouchers (Bildungsgutscheine) mobility (Beweglichkeit) peace tasks (Friedensaufgaben) protection (Protektion)

Results III, the ω_{it} s

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(A) Left–Right



Topic Models

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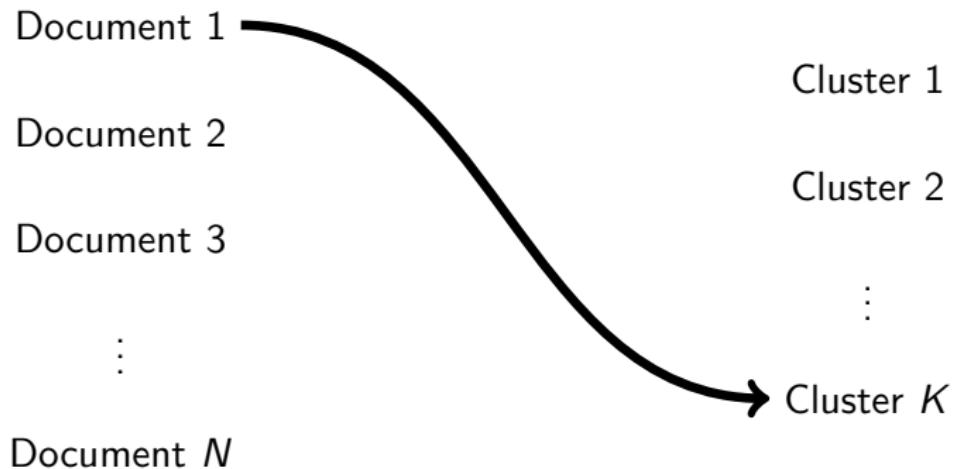
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“who pays more attention to education policy, conservatives or liberals?”

Recall: Clustering

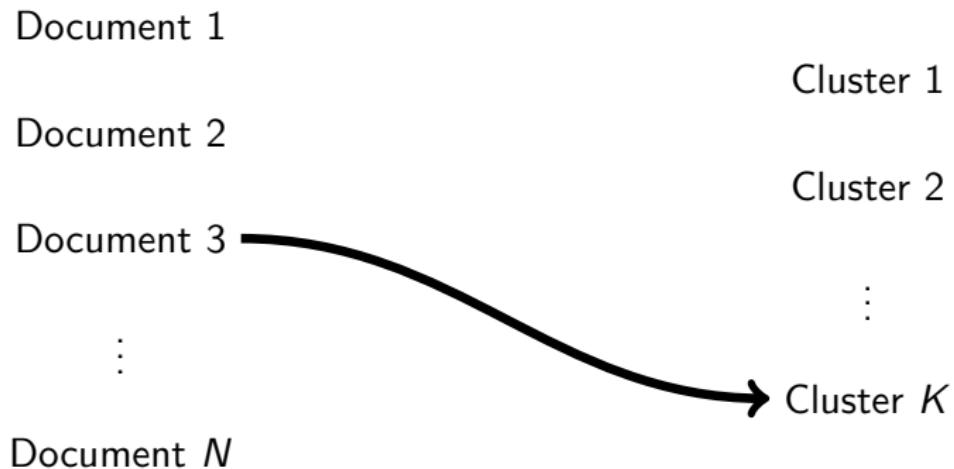
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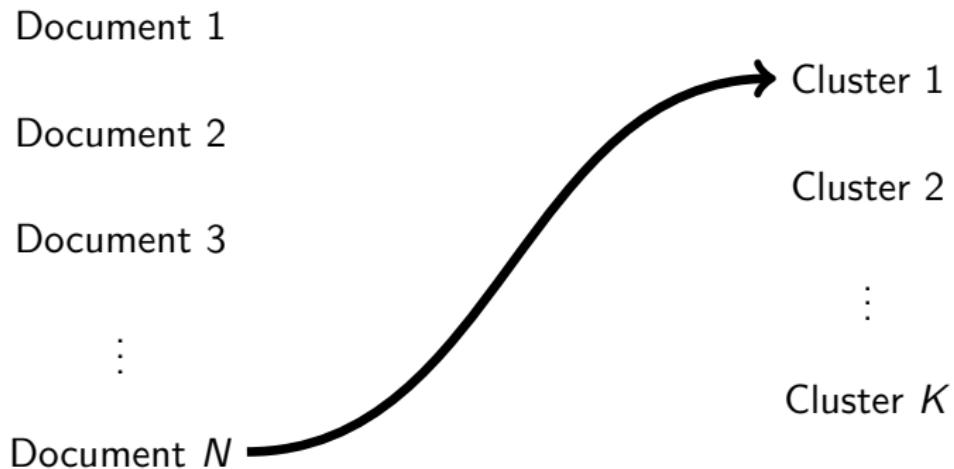
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Document 1

Cluster 1

Document 2

Cluster 2

Document 3

⋮

⋮

Cluster K

Document N

Topic Modeling

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Topic 1

Document 2

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Document 3

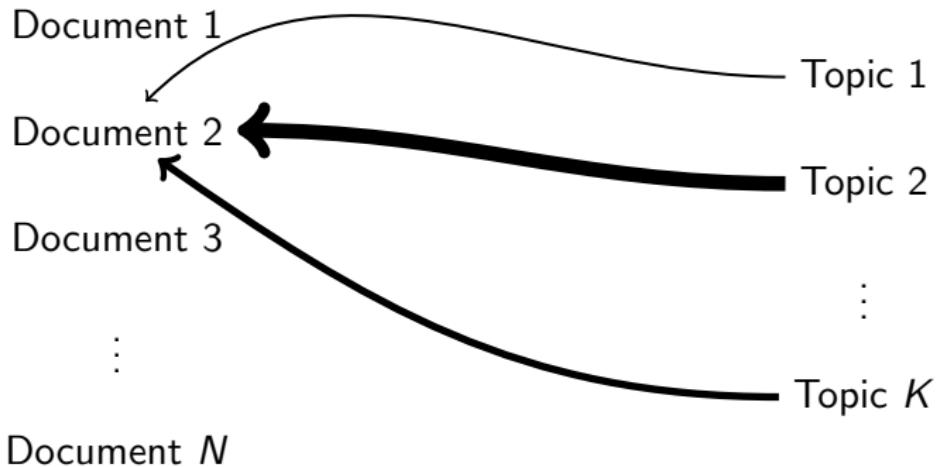
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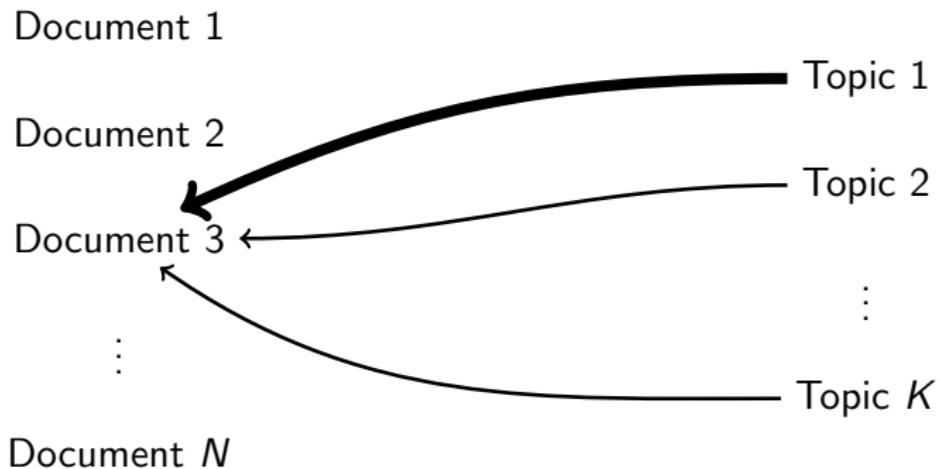
Topic K

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Now, where do the **words** in the documents come from?

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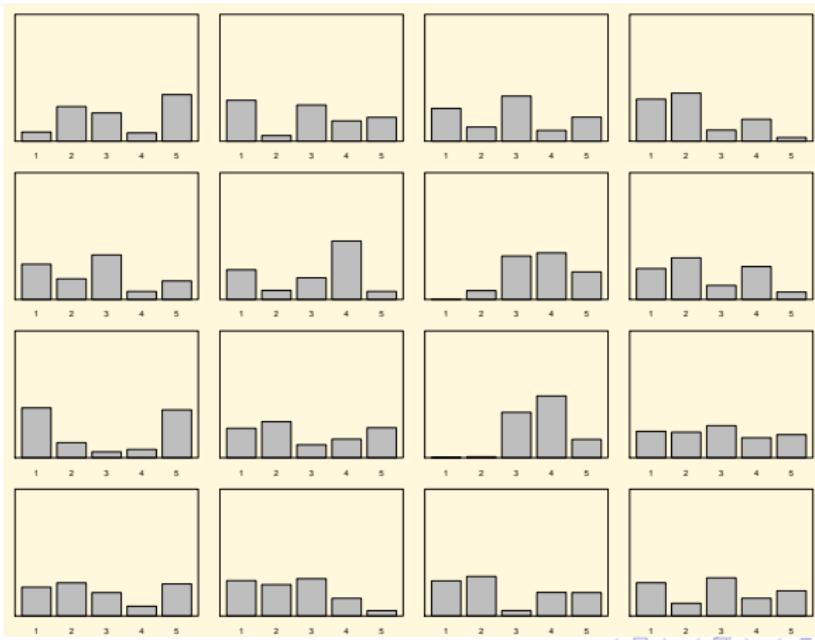
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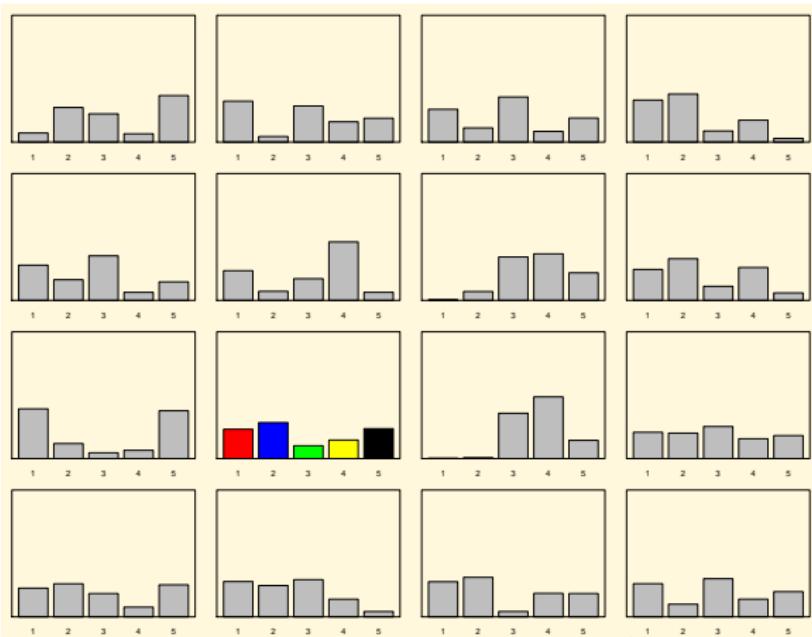
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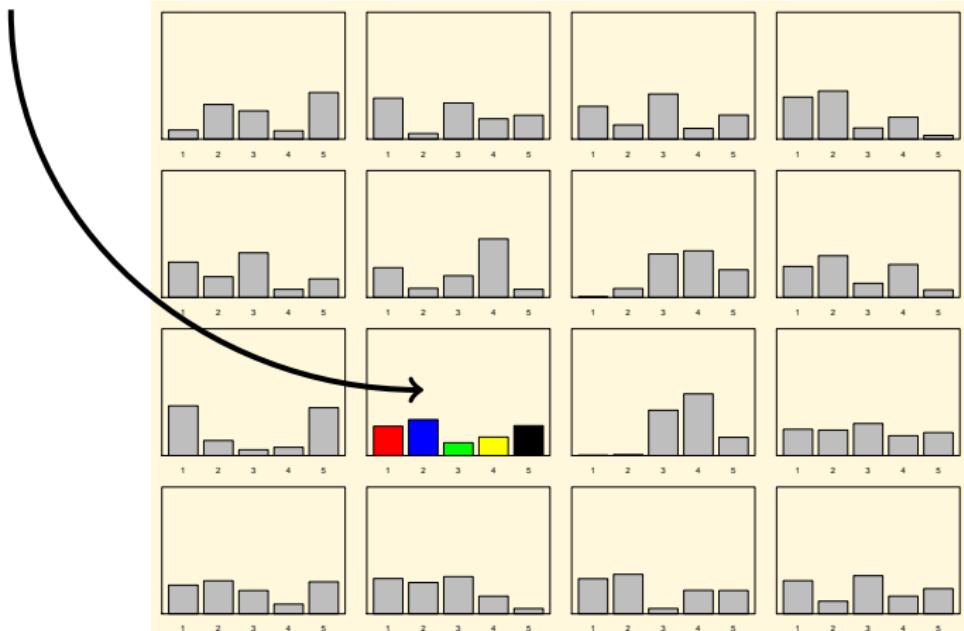
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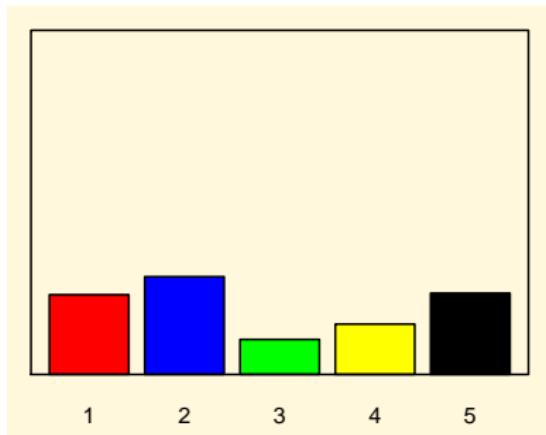
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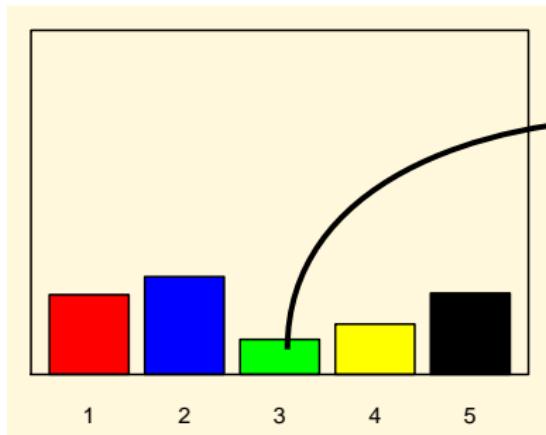
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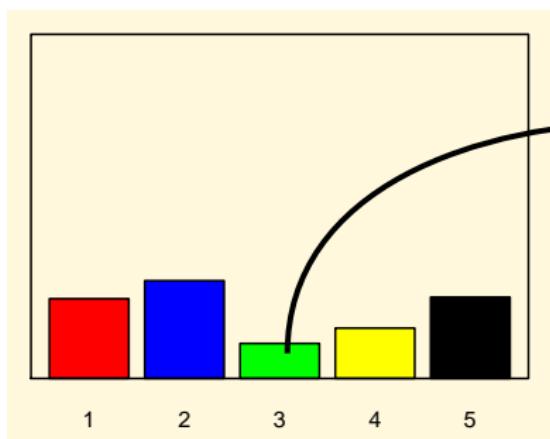
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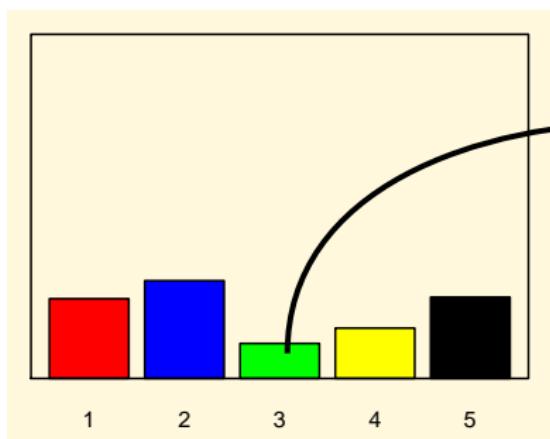
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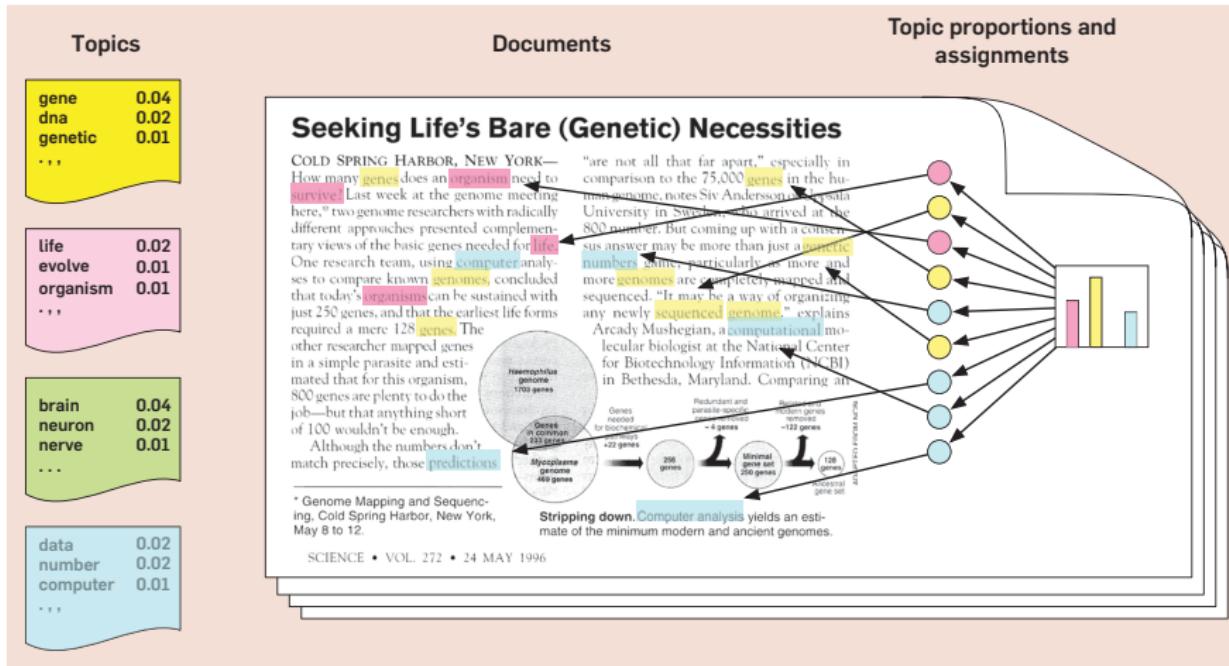
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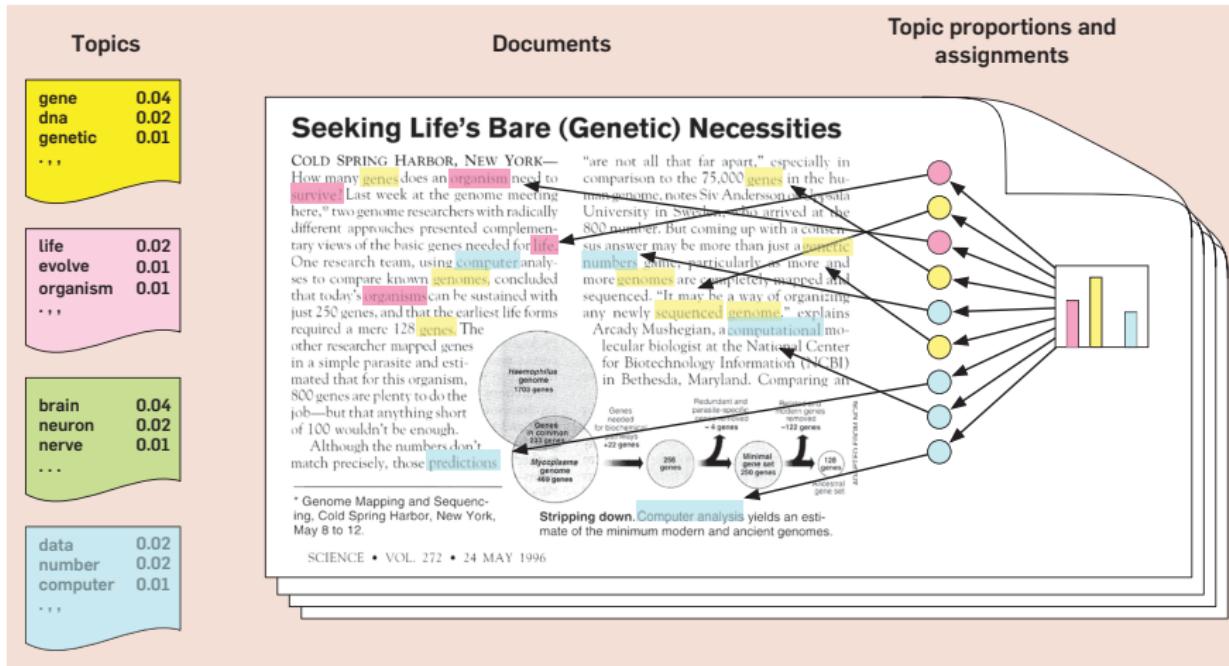


Topic Modeling a Document (Blei, 2012)

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Note that all documents share **same set of topics**: but some (e.g. **neuro**) may be (basically) absent in a given document.

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→ Latent Dirichlet Allocation. **LDA**.

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The multinomial distribution for the i th topic is denoted β_i , and $|\beta_i| = V$, meaning that the 'size' of this multinomial is equal to the number of different words in the corpus.

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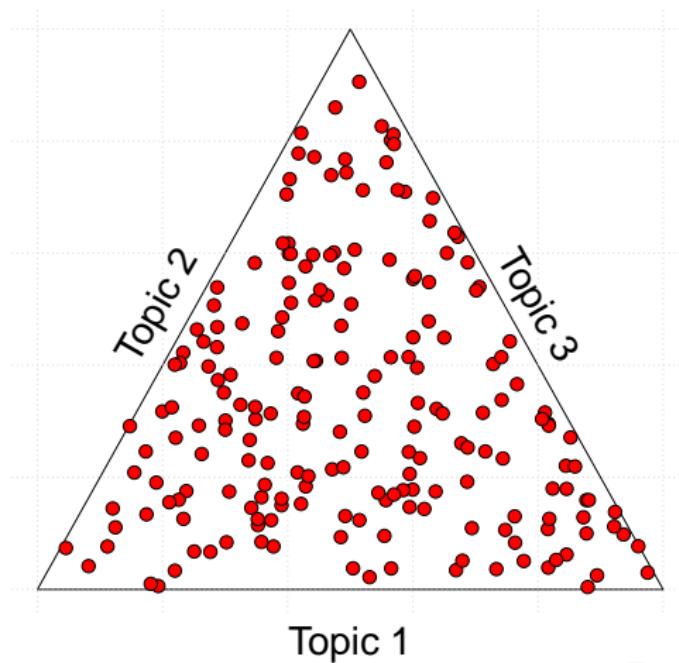
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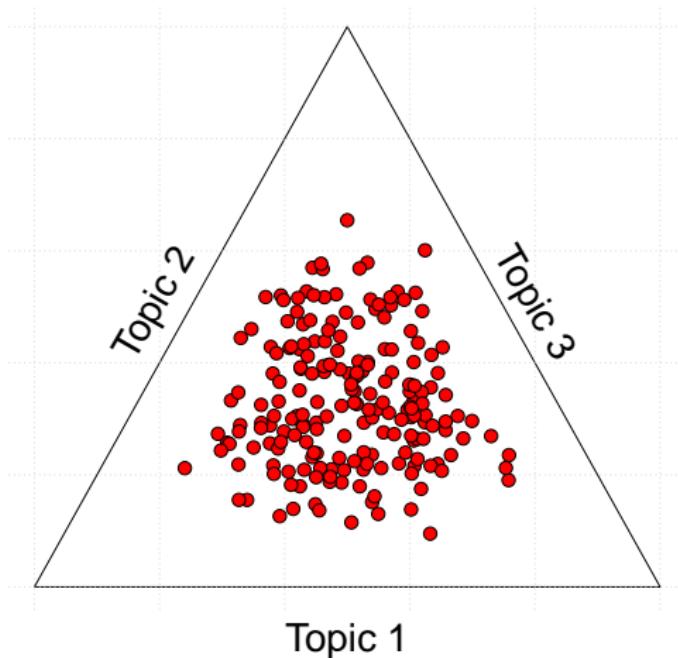
Example of Dirichlet

200 documents, 3 topics, $\alpha = 1$
(uniform)



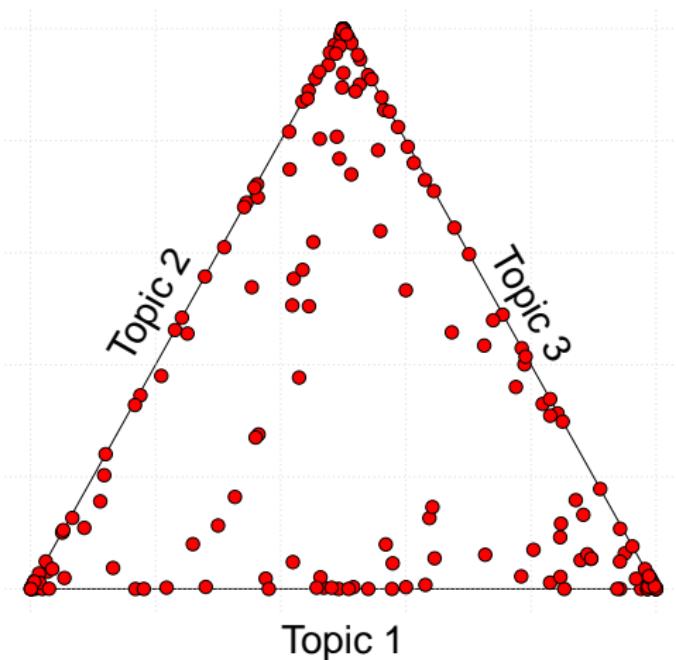
Example of Dirichlet

200 documents, 3 topics, $\alpha = 5$



Example of Dirichlet

200 documents, 3 topics, $\alpha = 0.2$



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We now know that...

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And we know that the actual value that $w_{d,n}$ takes depends on the distribution over words that the relevant topic entails, the β ("the word from topic 4 is "income" in this case")

While the β depends on the prior for the relevant Dirichlet, η

Plate Diagram for LDA

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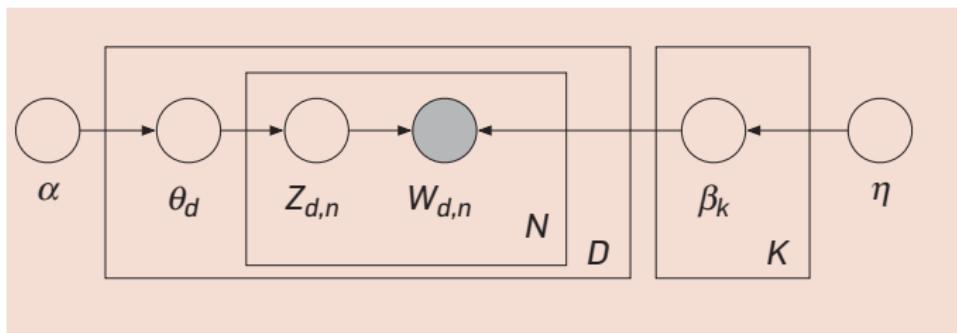
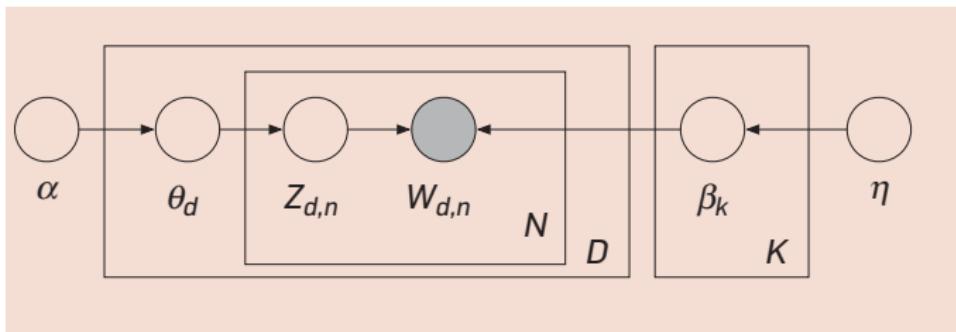
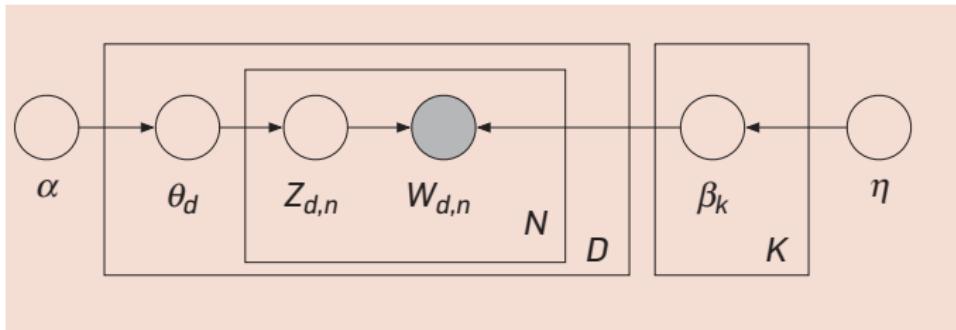


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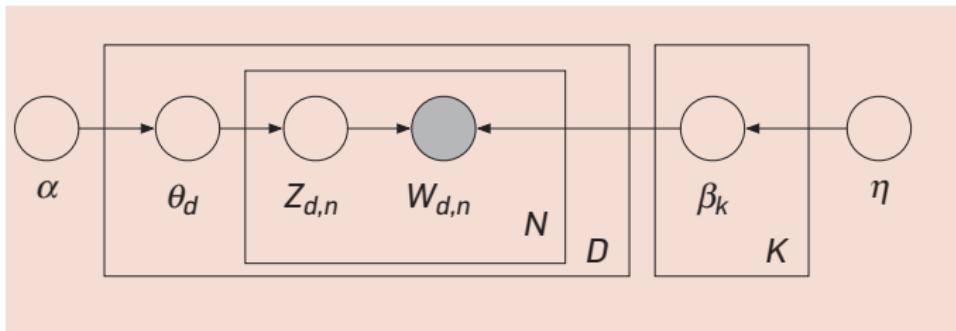
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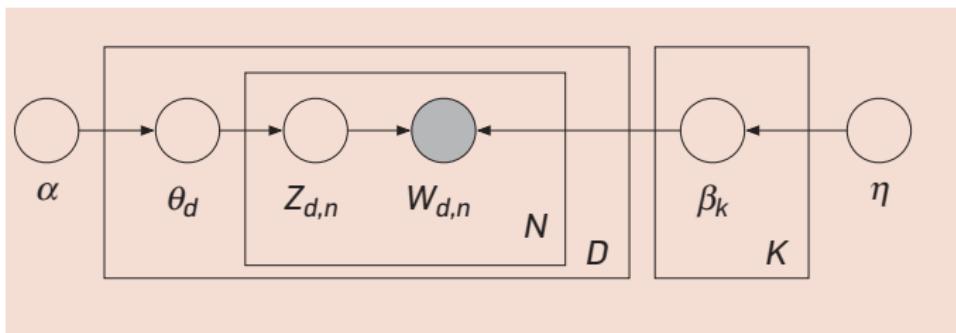
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Note that $w_{d,n}$ depends on $z_{d,n}$ (the mix of topics for that document) and $\beta_{1:K}$ (all the topics in terms of their distributions over the words).

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Can get ‘evidence’ (denominator) by summing joint distribution over **every possible topic structure**: every possible way of assigning each word to a topic. But this is impossible, so simulate/approximate.

Results

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For a user-selected k , a typical implementation of LDA will return...

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Some implementations allow you to estimate e.g. α , in which case this is also returned. And perhaps some kind of fit statistic(s).

A Manifesto Example

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69 UK manifestos.

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party	0.00145	0.00067	0.00066	0.00577	0.00093
general	0.00073	0.00033	0.00018	0.00192	0.00040
election	0.00079	0.00053	0.00022	0.00235	0.00076
manifesto	0.00059	0.00078	0.00032	0.00099	0.00048
:	:	:	:	:	:

Continued...

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'Top' 6 most frequent words in each topic:

Continued...

'Top' 6 most frequent words in each topic: might help interpretation (!)

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
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2	local	government	people	labour	government
3	government	people	new	government	labour
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Continued

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doc 2	0.00011	0.00011	0.00011	0.00011	0.99954
doc 3	0.00010	0.00010	0.00010	0.00010	0.99959
doc 4	0.00006	0.00006	0.00006	0.00006	0.99978
doc 5	0.00002	0.00002	0.00002	0.00002	0.99991
doc 6	0.00019	0.00019	0.00019	0.00019	0.99924
:	:	:	:	:	:

Continued

The topic distribution for each document...

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
doc 1	0.00009	0.00009	0.00009	0.00009	0.99965
doc 2	0.00011	0.00011	0.00011	0.00011	0.99954
doc 3	0.00010	0.00010	0.00010	0.00010	0.99959
doc 4	0.00006	0.00006	0.00006	0.00006	0.99978
doc 5	0.00002	0.00002	0.00002	0.00002	0.99991
doc 6	0.00019	0.00019	0.00019	0.00019	0.99924
:	:	:	:	:	:

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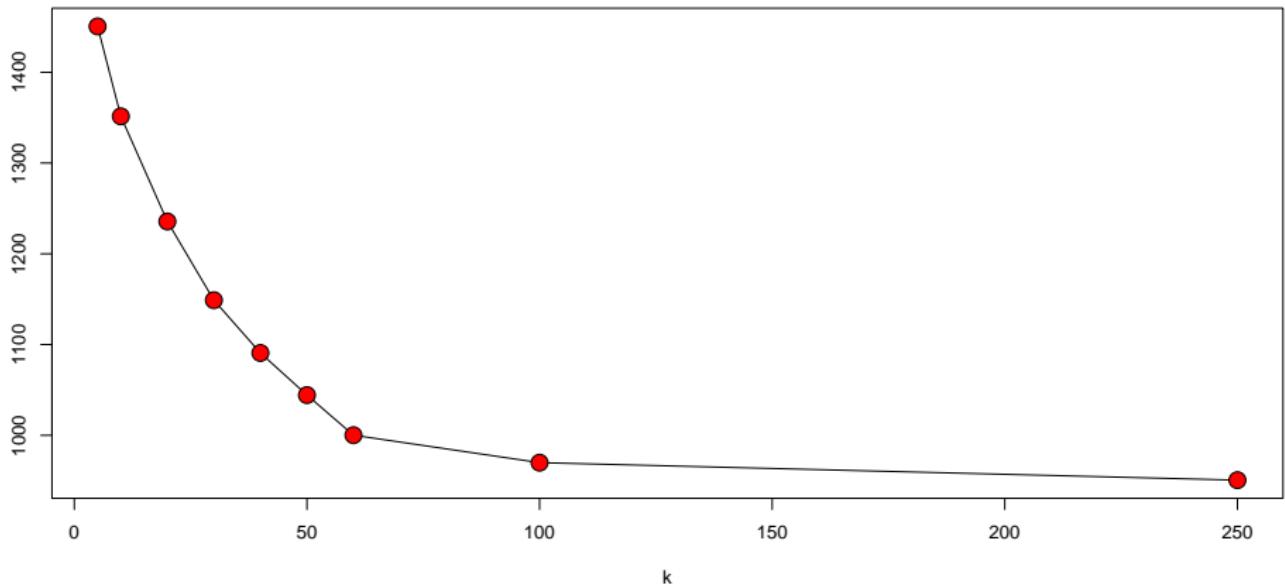
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But: the topic models that hold-out calculations suggest are optimal and not much liked by humans! “Reading Tea Leaves: How Humans Interpret Topic Models” by Chang et al.

Perplexity Likes a Lot of Topics (manifestos)



Pork to Policy (Catalinac, 2016)

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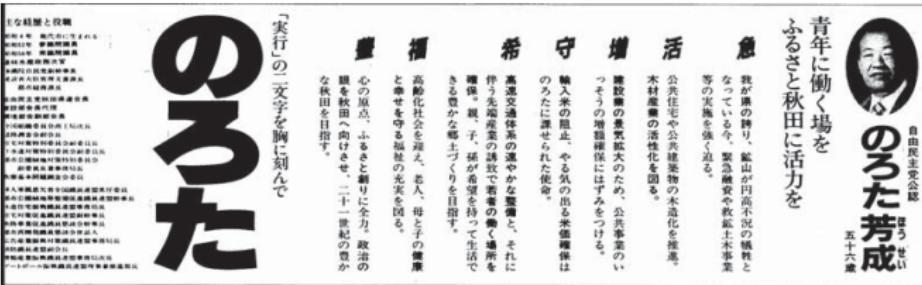
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Manifestos

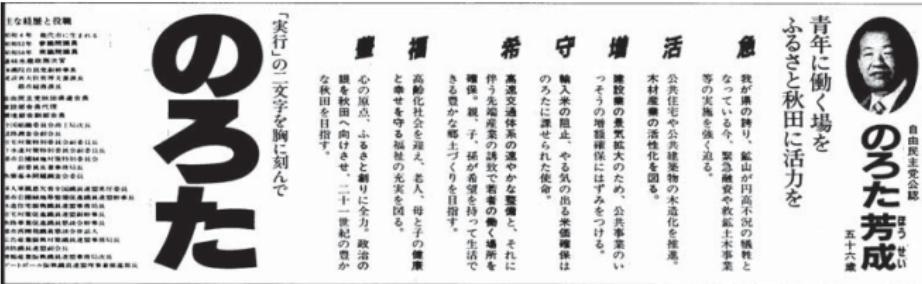


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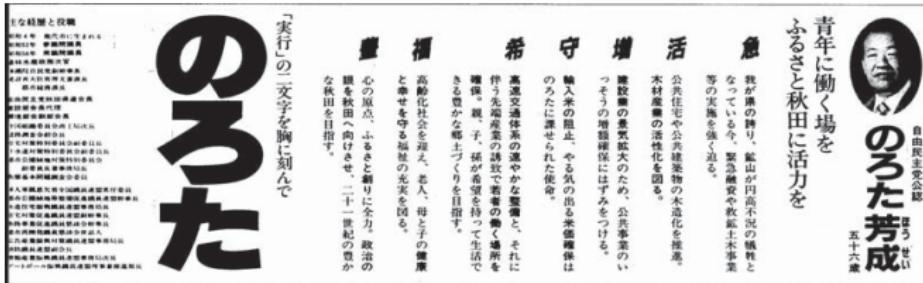
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Manifestos



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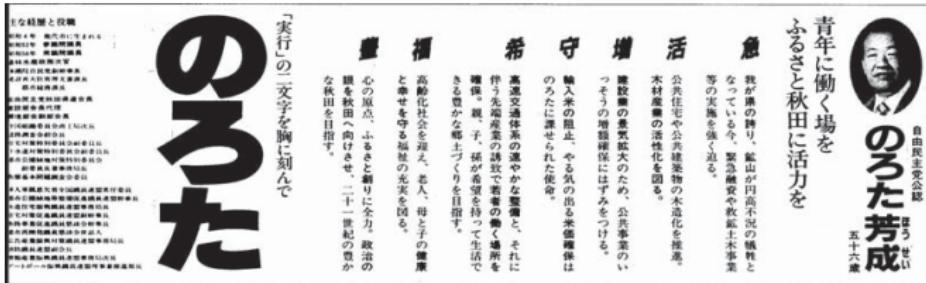
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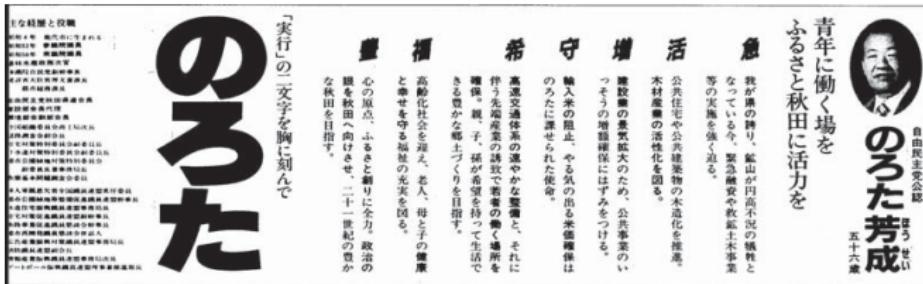


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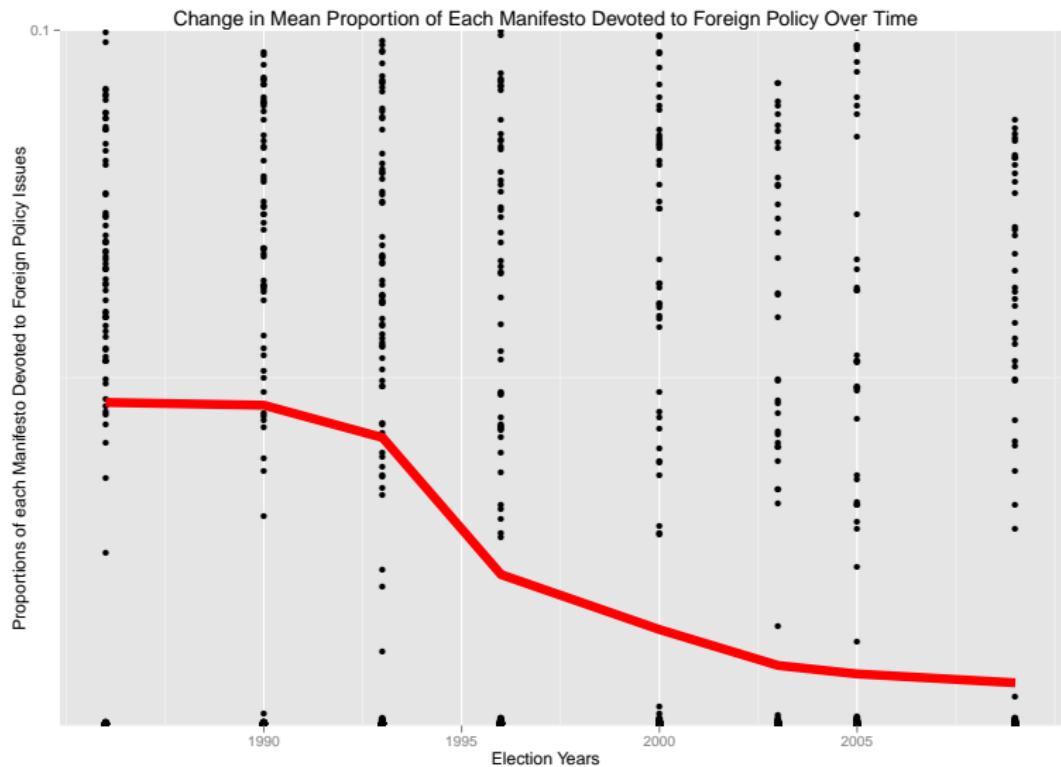
Topic Distribution over Words

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Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
1 改革	年金	推進	区	政治	日本
2 郵政	円	整備	政策	改革	国
3 民営	廃止	図る	地域	国民	外交
4 小泉	改革	つとめる	まち	企業	国家
5 構造	兆	社会	鹿児島	自民党	社会
6 政府	実現	対策	全力	日本	国民
7 官	無駄	振興	選挙	共産党	保障
8 推進	日本	充実	国政	献金	安全
9 民	増税	促進	作り	金権	地域
10 自民党	削減	安定	横浜	党	拉致
11 日本	一元化	確立	対策	選挙	経済
12 制度	政権	企業	中小	禁止	守る
13 民間	子供	実現	発電	憲法	問題
14 年金	地域	中小	推進	腐敗	北朝鮮
15 実現	ひと	育成	エネルギー	団体	教育
16 進める	サラリーマン	制度	企業	区	責任
17 斷行	制度	政治	声	ソ連	力
18 地方	議員	地域	実現	守る	創る
19 止める	金	福祉	活性	平和	安心
20 保障	民主党	事業	自民党	円	目指す
21 財政	年間	改革	地方	反対	誇り
22 作る	一掃	確保	尽くす	真	憲法
23 賛成	郵政	強化	商店	是正	可能
24 社会	道路	教育	いかす	一掃	道
25 国民	交代	施設	全国	悪政	未来
26 公務員	社会保険庁	生活	政党	抜本	ひと
27 力	月額	支援	ひと	定数	再生
28 経済	手当	環境	支援	政党	将来
29 国	談合	発展	経済	金九	解決
30 安心	吉澤	施策	福祉	改革	其本

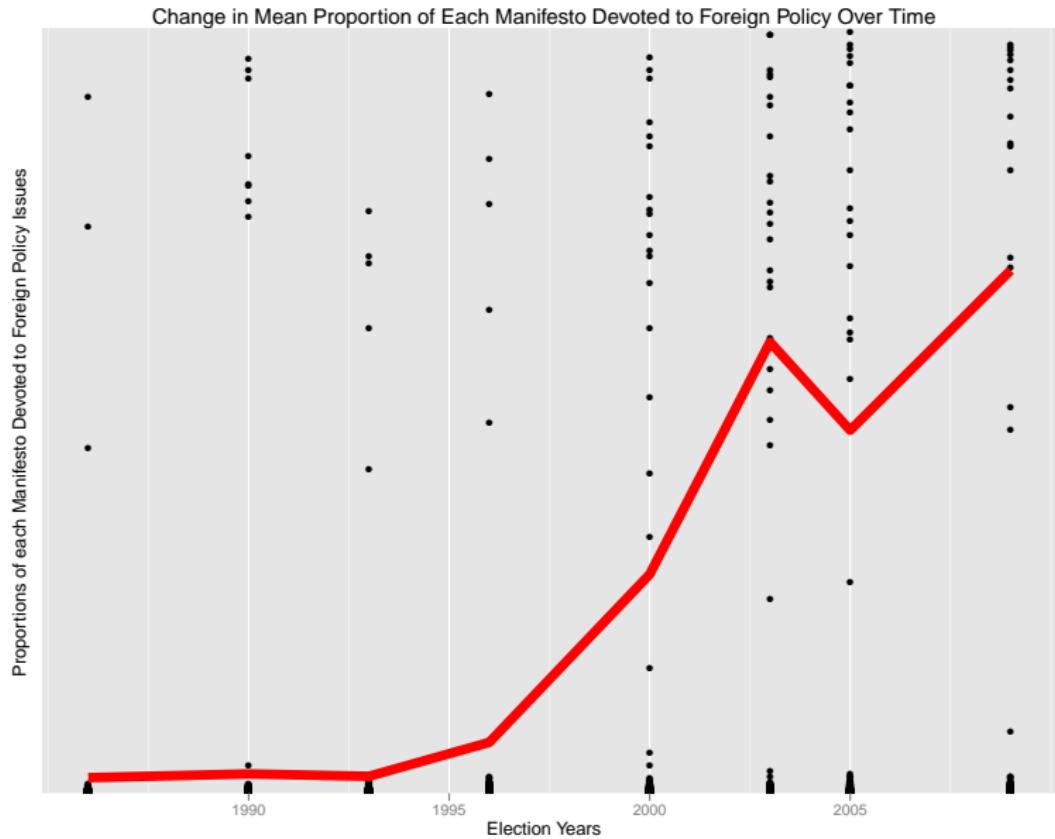
Change in proportion of 'Pork' Topic

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Change in proportion of 'Foreign Policy' Topic

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Special Topics: Structural Topic Model

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Also allows us to ‘test’ hypothesis in more sensible way (though be careful!)

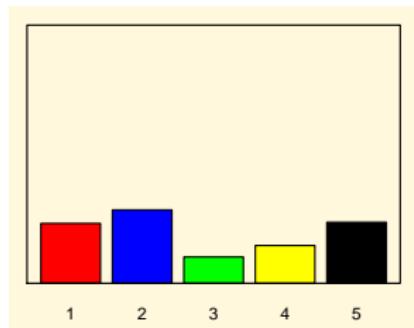
Compare: Per Document Topic Distribution (θ)

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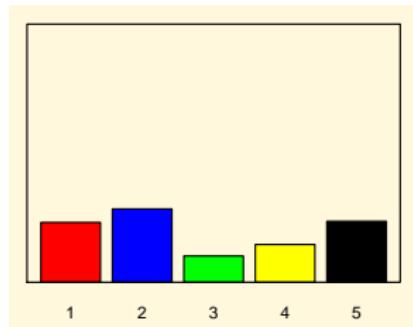
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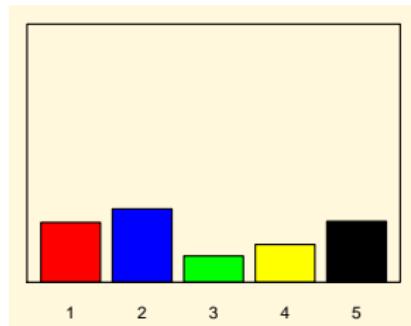


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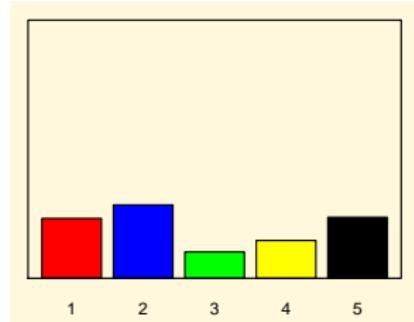
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e.g. perhaps male author ($X = 0$) documents have different topics relative to female ($X = 1$) author docs.



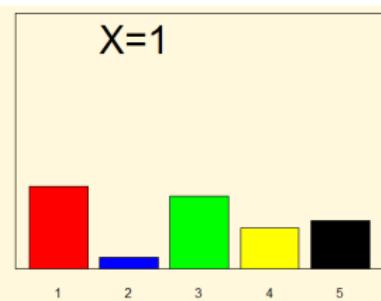
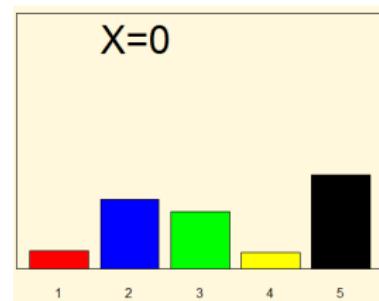
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$X=0$

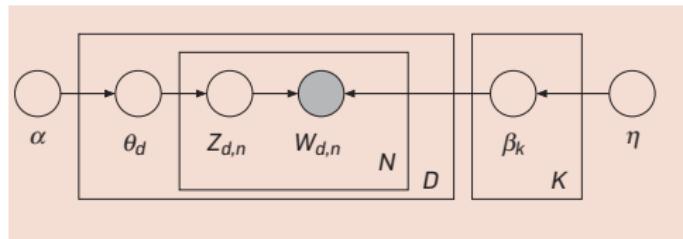
A word cloud visualization for $X=0$ showing topics related to immigration and population. The words are colored in shades of blue. The most prominent words are "immigration" (large), "population" (large), "british" (medium), "people" (medium), and "system" (medium). Other visible words include "according", "percent", "immigrants", "statistics", "social", "well", "national figures", "figures", "shall", "people", "ethnic", "uk", "within", "bnp", "asylum", and "illegal".

$X=1$

A word cloud visualization for $X=1$ showing topics related to immigration and population. The words are colored in shades of blue. The most prominent words are "immigration" (large), "system" (large), "people" (medium), and "britain" (medium). Other visible words include "responsibility", "citizenship", "checks", "end", "ensure", "fair", "asylum", "detention", and "persecution".

Compare: Plate Diagram

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