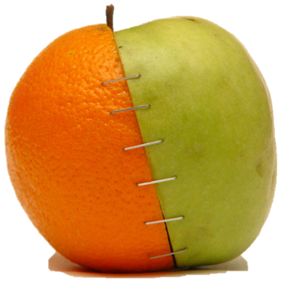
What makes two “languages” different?

Issues analyzed in Kleinberg (2004, *Data Stream Management* 2016), with a Markov model applied for temporal analysis.

Presentation/figures follow Monroe, Colaresi and Quinn, *Political Analysis* (2008)

Persuasion: frame competition

Example: public discussion of GMOs in food

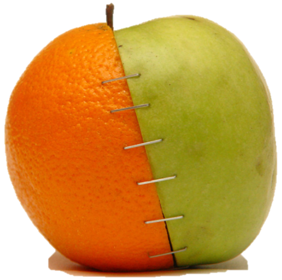


http://www.ourbreathingplanet.com/control-the-world-through-genetically-modified-food/

Persuasion: frame competition

Example: public discussion of GMOs in food

“green revolution”



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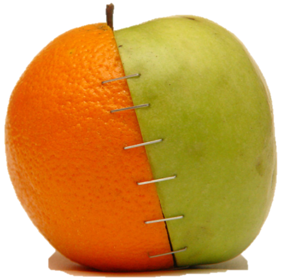

“frankenfood”

http://www.ourbreathingplanet.com/control-the-world-through-genetically-modified-food/

Additional applications:
Differentiating the language of ….

- successful vs. unsuccessful persuaders
- language in one time period vs. another…
- males vs females
- *your experimental condition A vs. your experimental condition B!!*

Also good for sanity-checking your data…

Example: 106th U.S. Senate speeches on abortion

“Frames” → words we might expect from Democrats:

… women’s rights …
… privacy …

“Frames” → words we might expect from Republicans:

... unborn children ...
... murder ...

- Assume a joint vocabulary of terms v_i .
  $p(v_i)$ and $p(v_i)$: **observed** relative frequency of v_i in the blue and red samples

Ranking idea

Top and bottom 20 words according to

$$p(v_i) - p(v_i)$$

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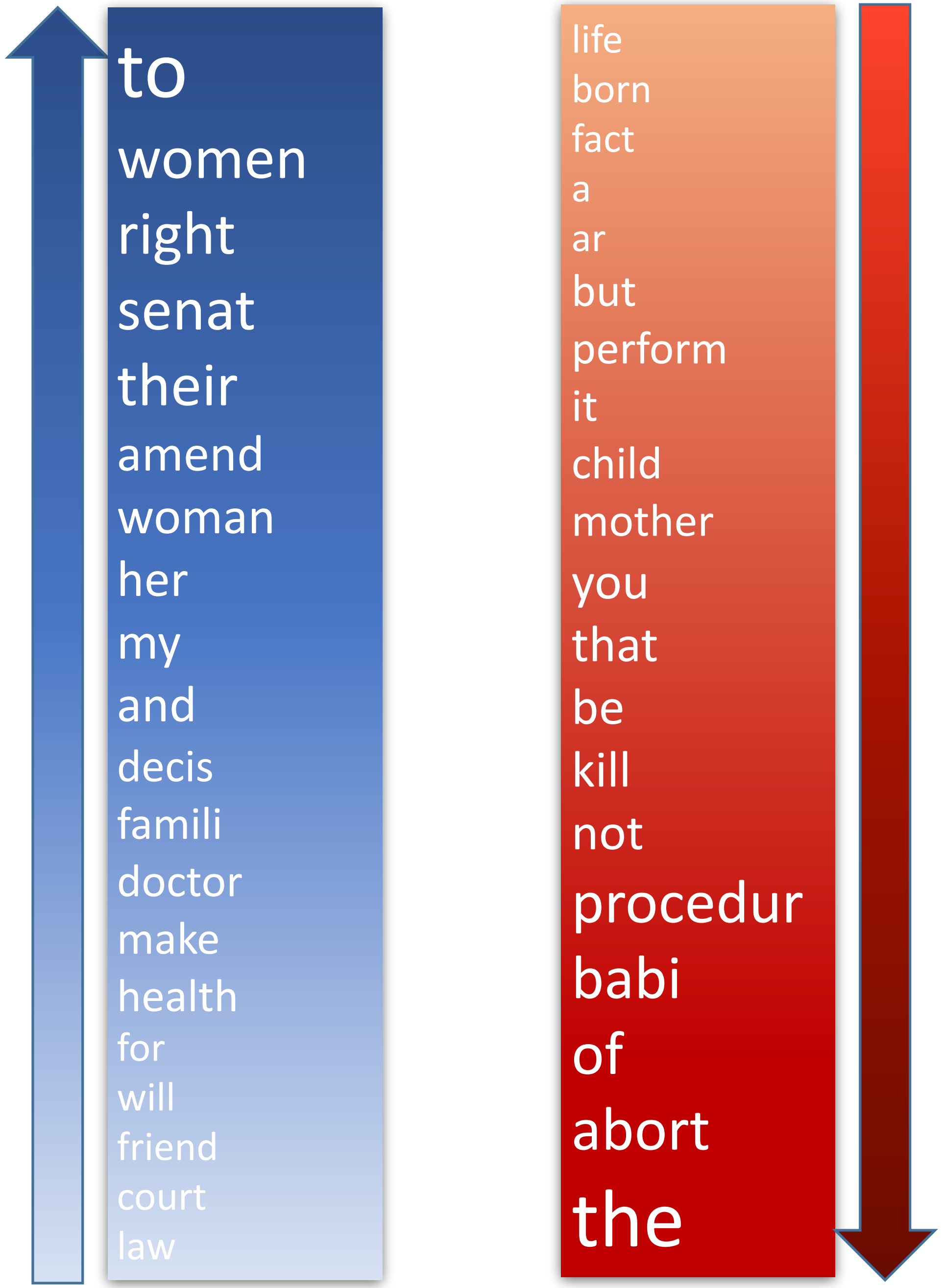

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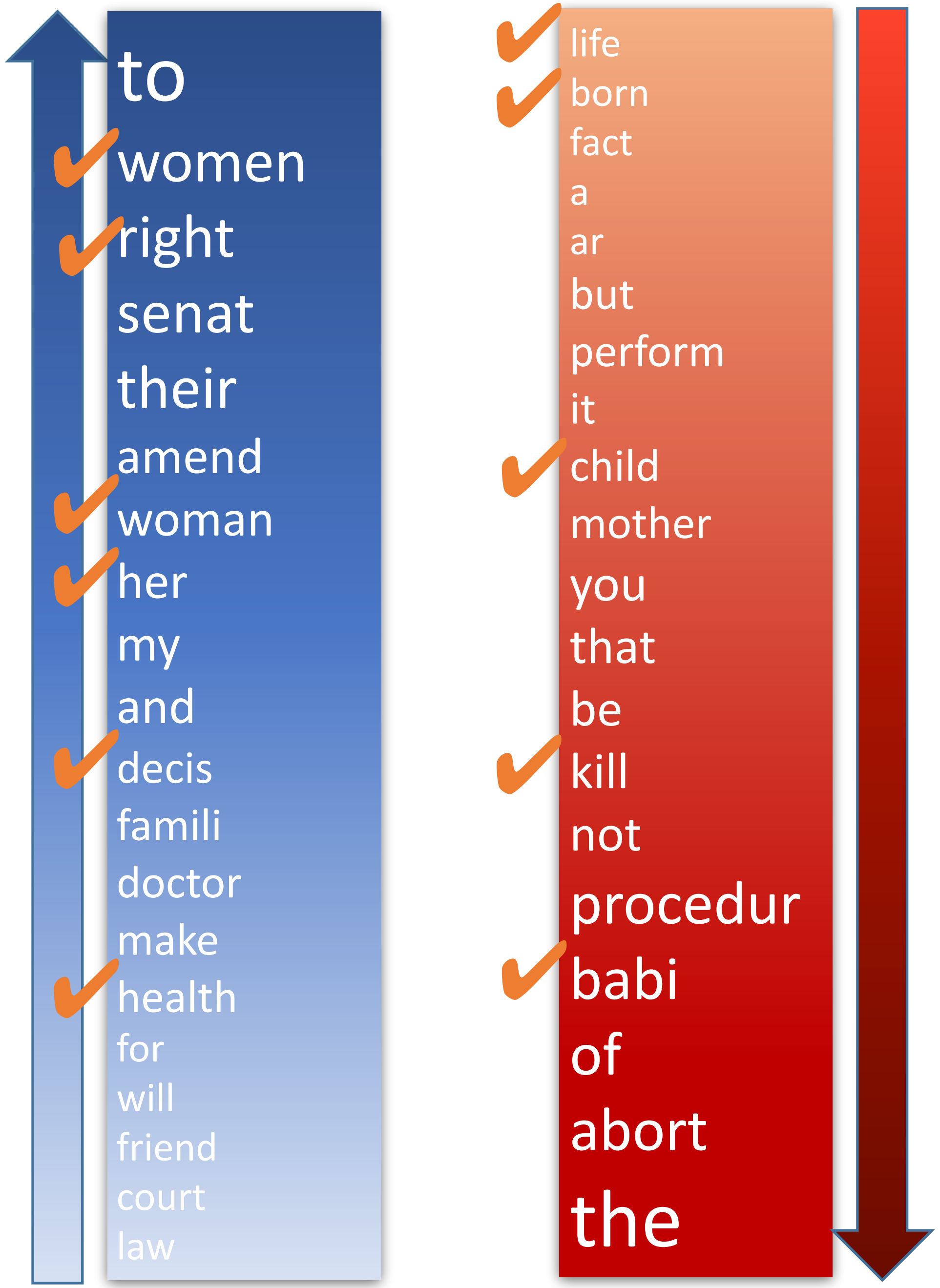
Ranking idea

Top and bottom 20 words according to

$$p(v_i) - p(v_i)$$



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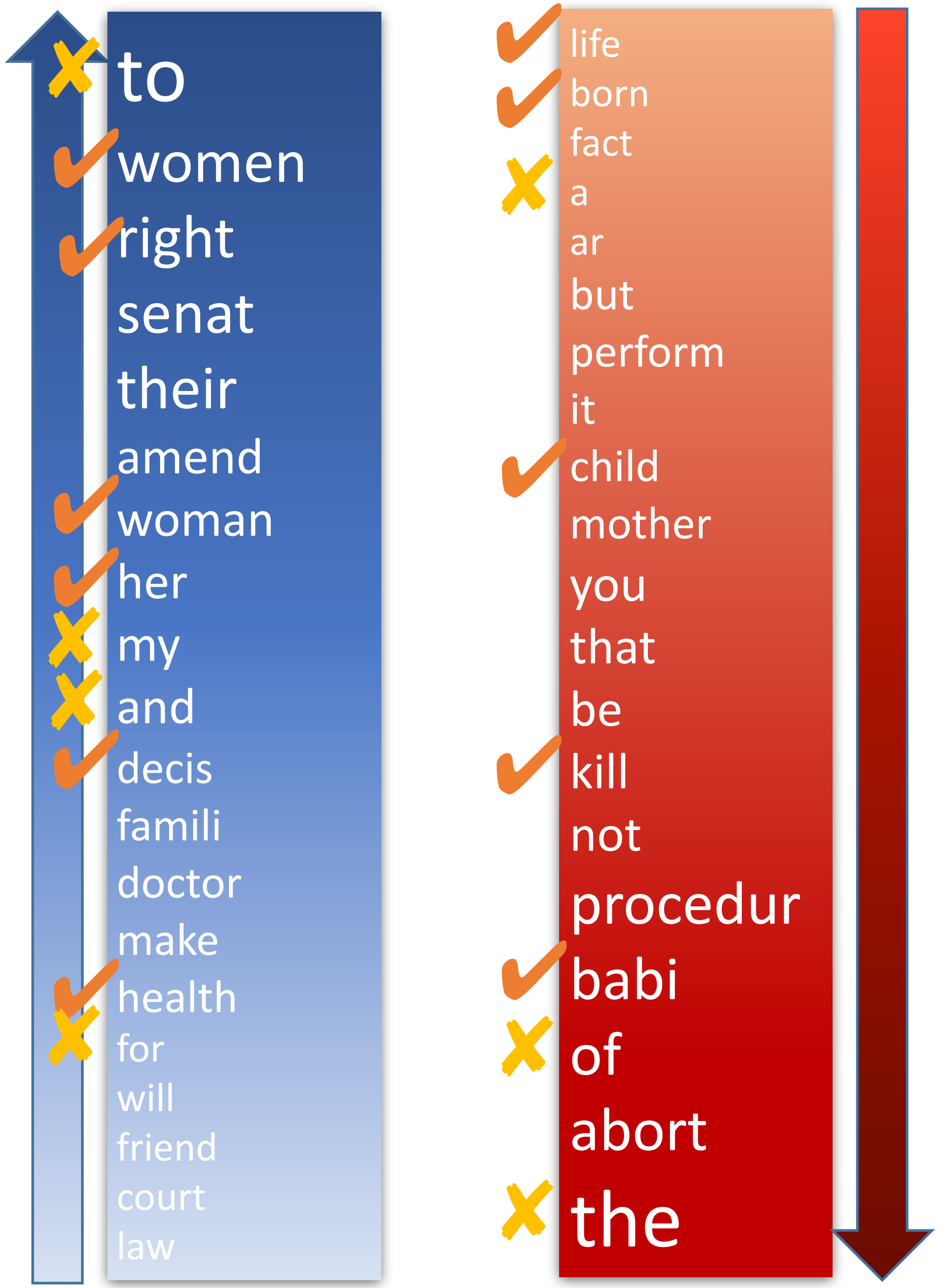

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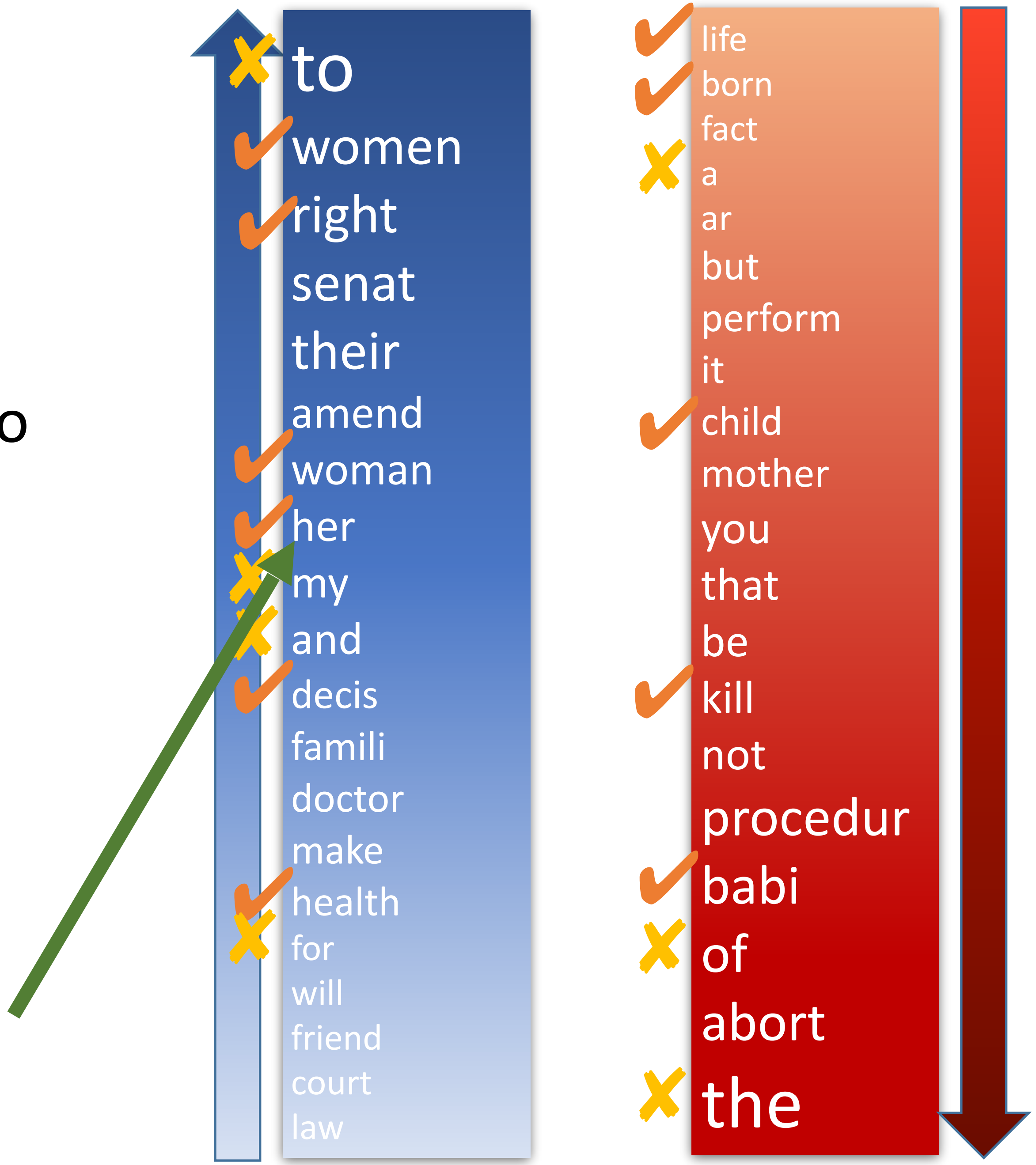
Ranking idea

Top and bottom 20 words according to

$$p(v_i) - p(v_i)$$

important, but would be lost with stopword filtering



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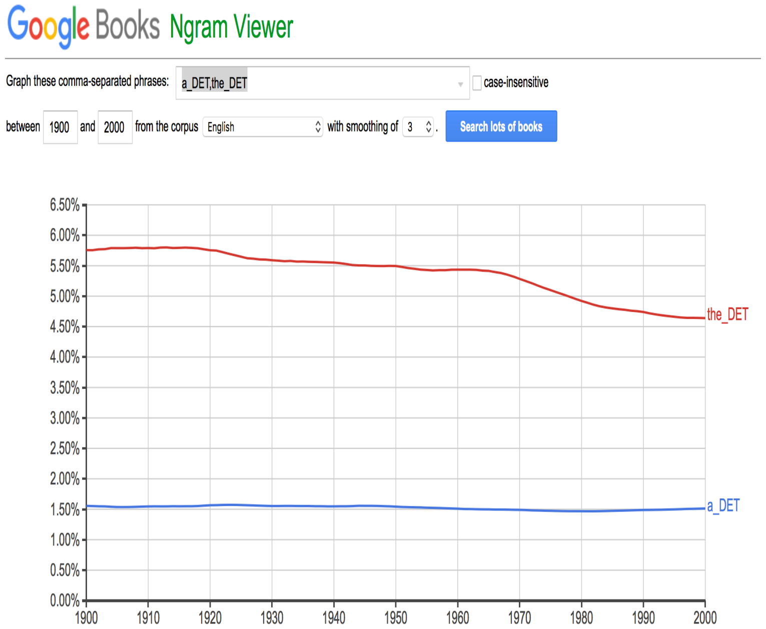
- ✗ of
- abort
- ✗ the

Aside: “stopword removal” not recommended

- Very-frequent terms have been proving “increasingly” useful, e.g., for stylistic or psychological cues

- “a” vs “the” is surprising



Graph these comma-separated phrases: a_DET,the_DET □ case-insensitive

between 1900 and 2000 from the corpus English with smoothing of 3 .

[for years LL assumed this was a bug, but see Language Log, Jan 3 2016:
“The case of the missing determiners”]

$p(v_i)$ vs. count

to
women
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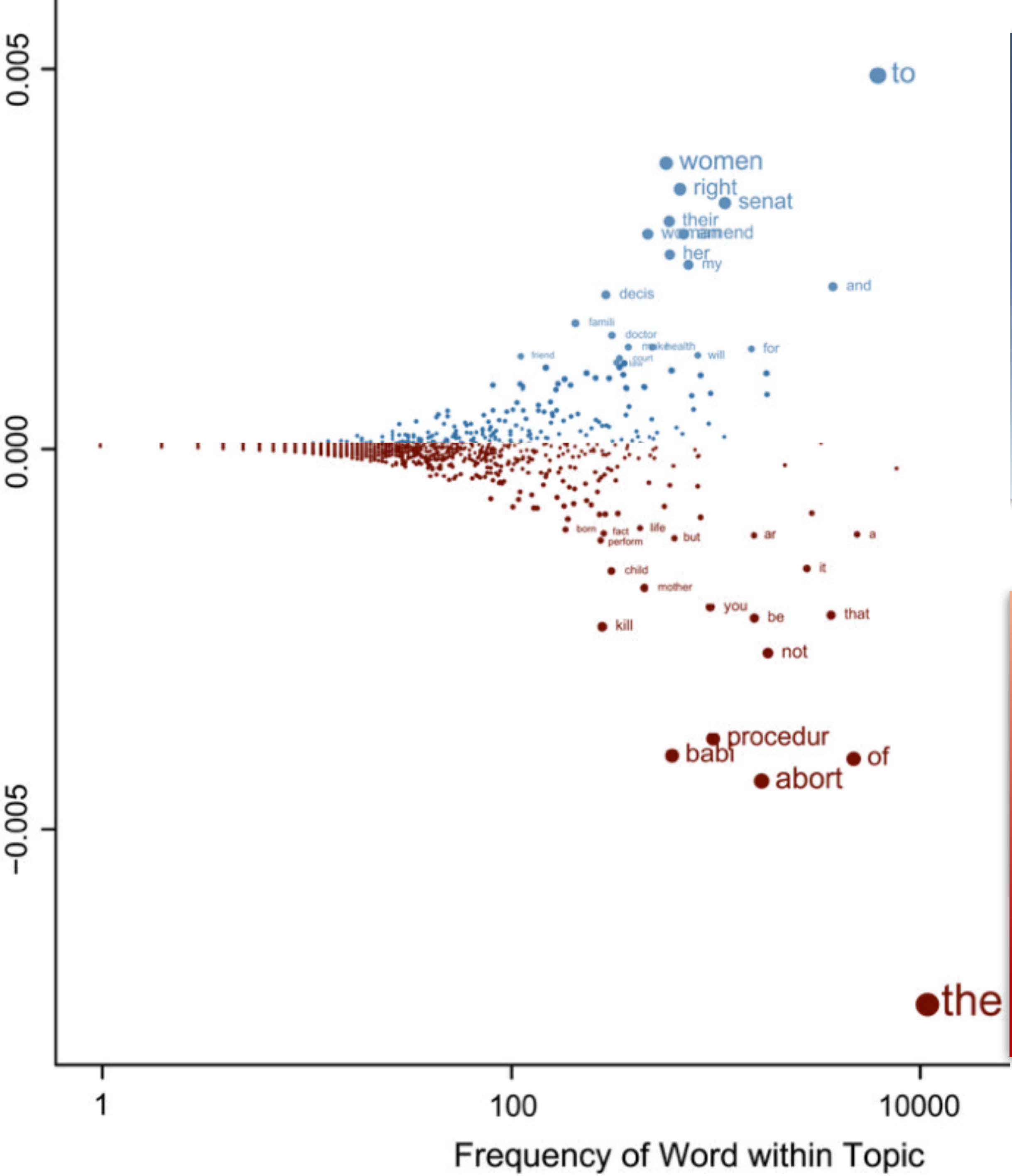
$p(v_i)$ vs. count

$p(v_i) - p(v_i)$ favors big counts, i.e., v_i towards the righthand side of this plot



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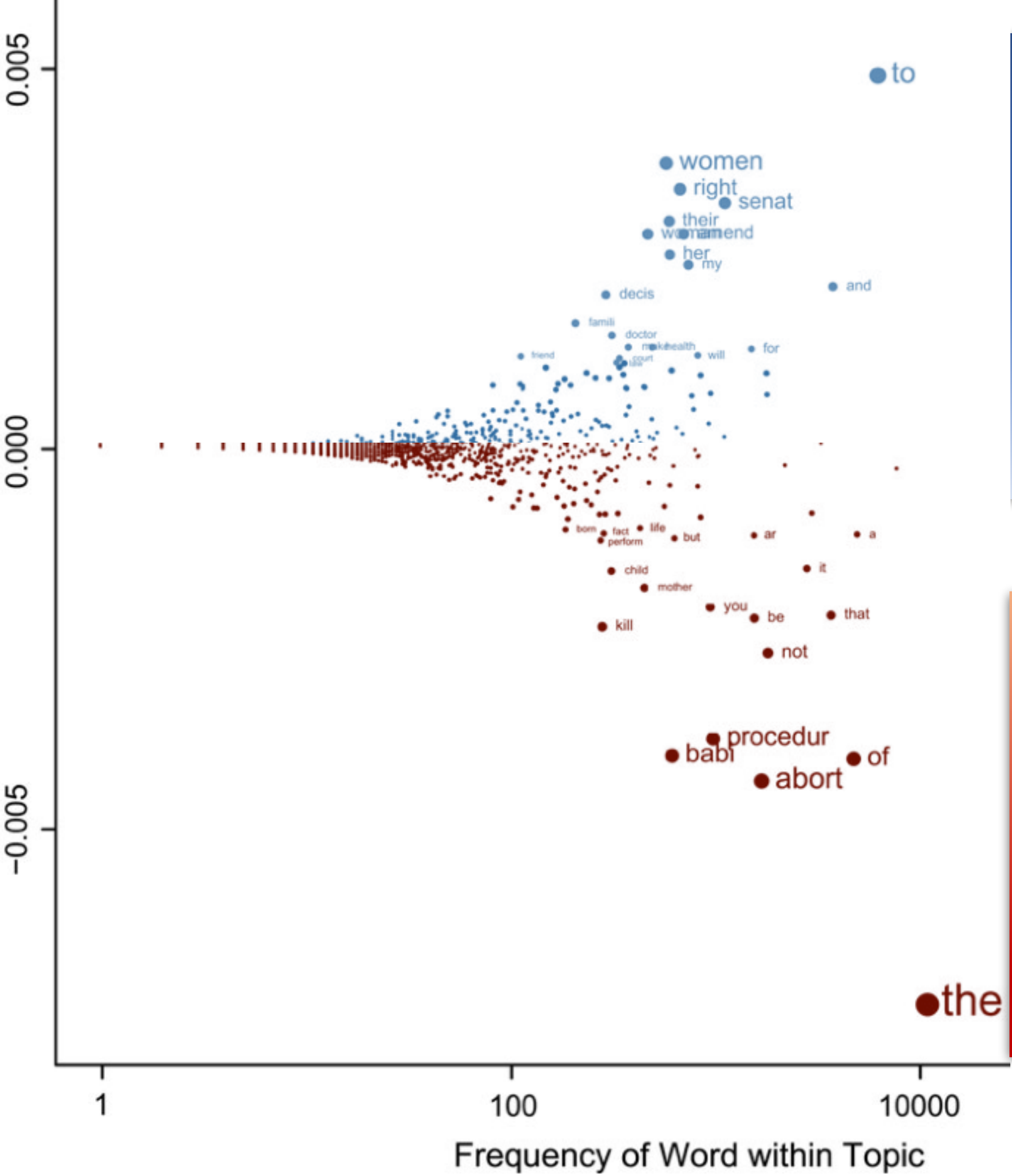
$p(v_i)$ vs. count

$p(v_i) - p(v_i)$ favors big counts, i.e., v_i towards the righthand side of this plot

(can’t have a large difference between two small differences)



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Ranking by log odds-ratio

$$\log \frac{p(v_i)/(1 - p(v_i))}{p(v_i)/(1 - p(v_i))}$$

Ranking by log odds-ratio

$$\log \frac{p(v_i)/(1 - p(v_i))}{p(v_i)/(1 - p(v_i))}$$

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Ranking by log odds-ratio

$$\log \frac{p(v_i)/(1 - p(v_i))}{p(v_i)/(1 - p(v_i))}$$

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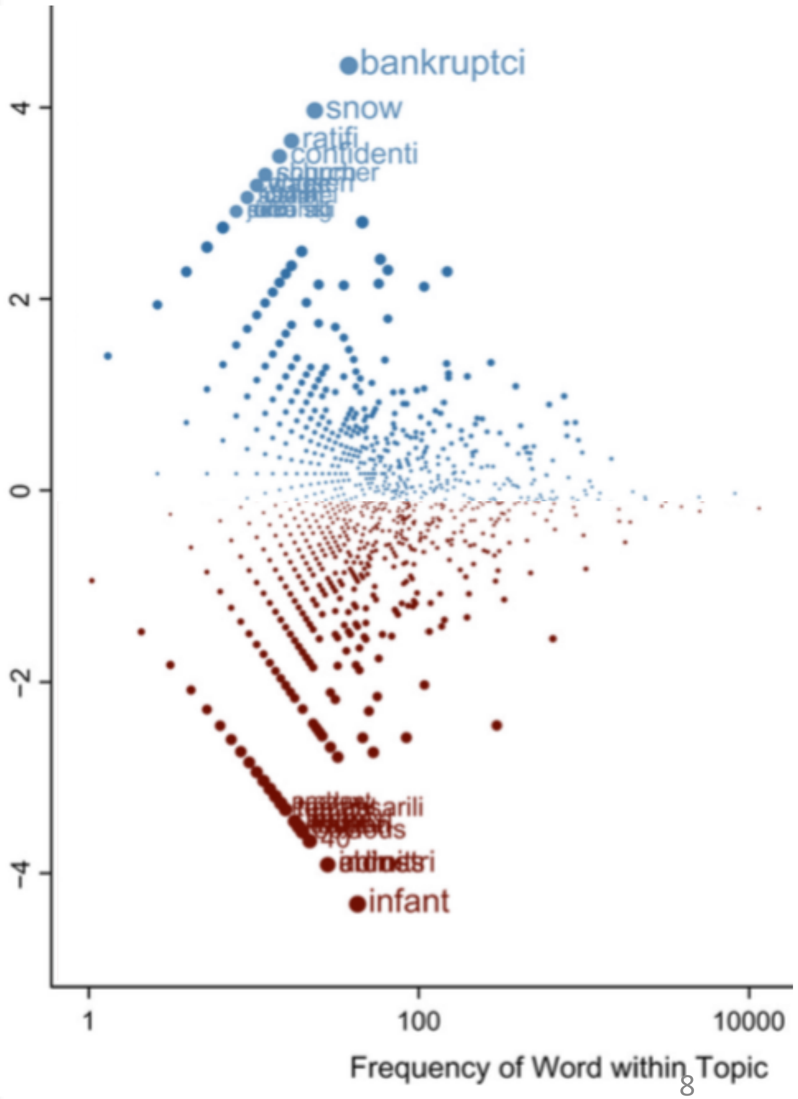

(Move to handout: model choices)

Aside: warning on ignoring (language) history

Should we really write $P(v_i)$, with no conditioning on context?

- Previous lectures: language accommodation/coordination
- Church 2000: "Empirical Estimates of Adaptation: The chance of Two Noriegas is closer to $p / 2$ than p^2 ". COLING.
  - "Finding a rare word like *Noriega* in a document is like lightning. We might not expect lightning to strike twice, but it happens all the time, especially for good keywords."

Ranking by z-score of log odds-ratio, with model of variance (uninformative prior)

Ranking by z-score of log odds-ratio, with model of variance (uninformative prior)

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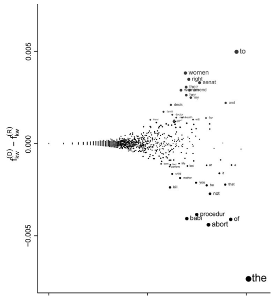
Ranking by z-score of log odds-ratio, with model of variance (uninformative prior)



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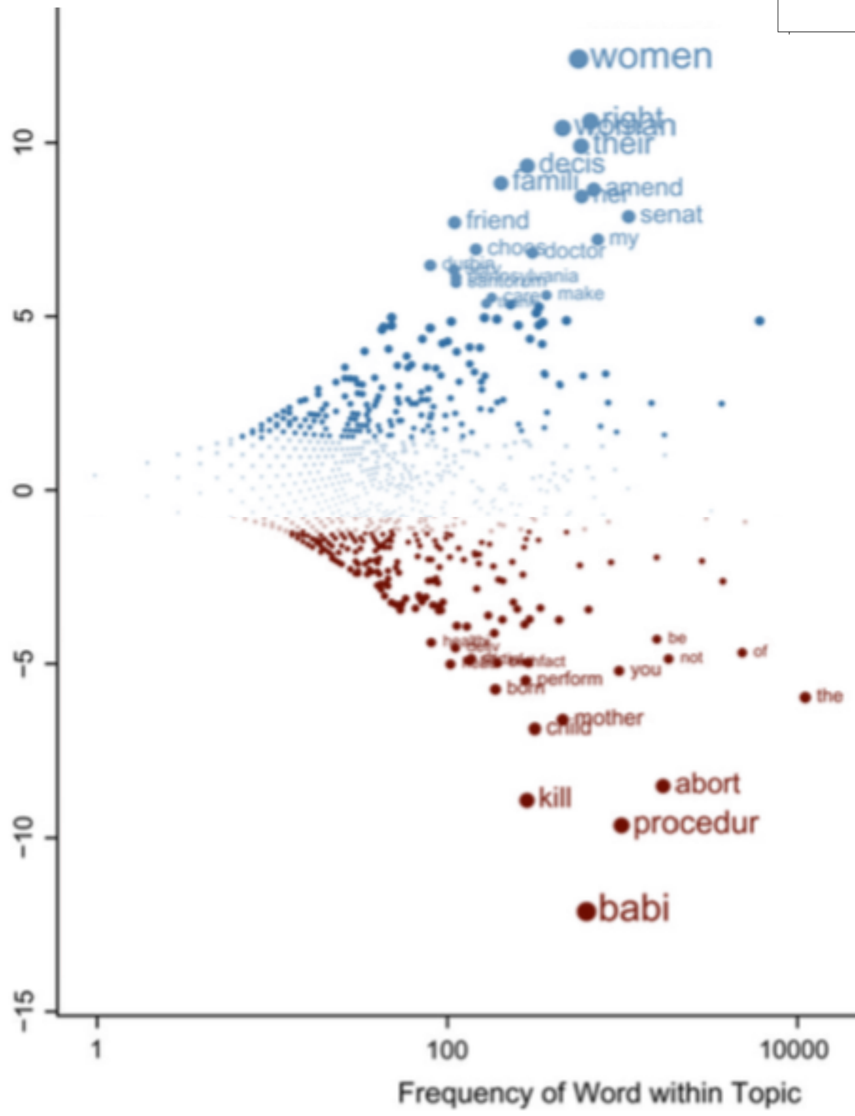
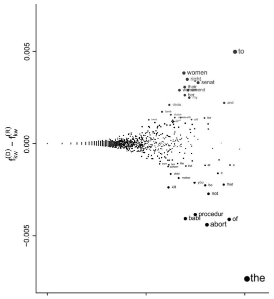


Ranking by z-score of log odds-ratio, with model of variance (informative prior)



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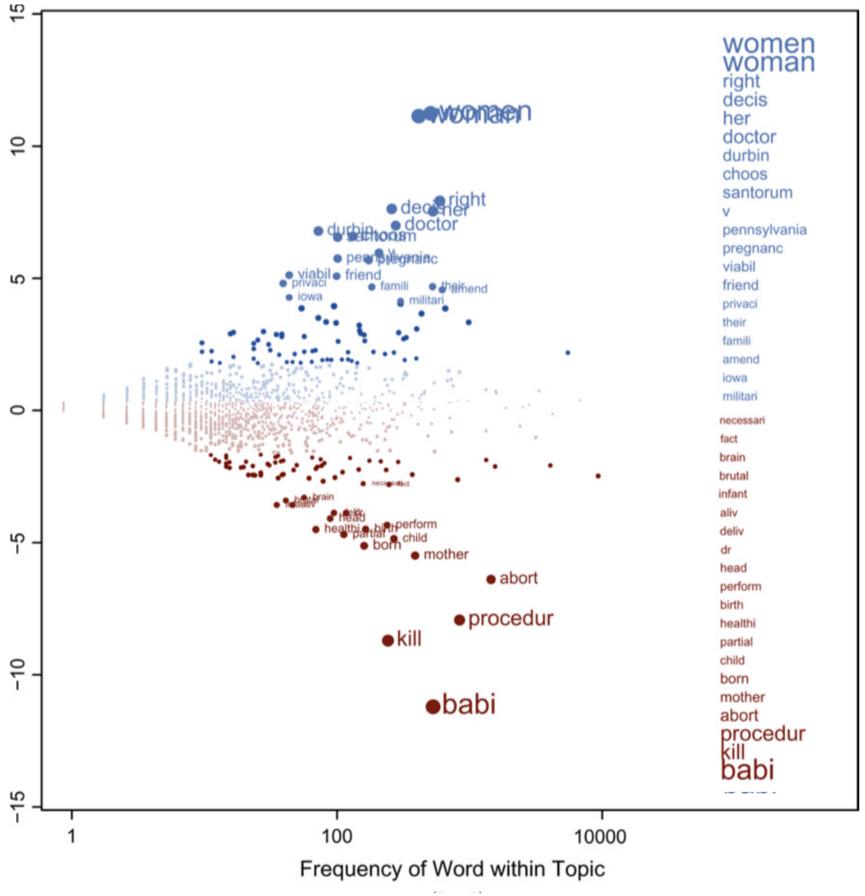
Frequency of Word within Topic
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