DiaCollo: on the trail of diachronic collocations

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Abstract

DiaCollo is a new software tool for the efficient extraction, comparison, and interactive visualization of **collocations** from a **diachronic text corpus**. Unlike other conventional collocation extractors, DiaCollo is suitable for extraction and analysis of diachronic collocation data: collocate pairs whose association strength depends on the date of their occurrence. By tracking changes in a word's typical collocates over time, DiaCollo can help to provide a clearer picture of diachronic changes in the word's usage, especially those related to semantic shift or discourse environment.

The Situation

Diachronic Text Corpora

- heterogeneous text collections
  - especially with respect to **date of origin**
- increasing number available, e.g.
  - *Deutsches Textarchiv* (DTA) [4]
  - Historical American English (COHA) [2]
- even putatively "synchronic" corpora have a nontrivial temporal extension [8]

Collocation Profiling

> *"You shall know a word by the company it keeps"* – J. R. Firth

- find "significant" collocates of a **target term**
  - rank candidates by **association score**
  - filter out "chance" co-occurrences
  - statistical methods require large sample
- existing methods [1, 3, 7] implicitly assume **corpus homogeneity**

Diachronic Profiling

Idea

- represent terms as **attribute n-tuples**
  - *including document date!*
- partition term vocabulary **on-the-fly**
  - *user-specified epochs*
- collect epoch profiles into final result-set

Advantages

- full support for diachronic axis
- variable query-level granularity
- flexible attribute selection

Drawbacks

- sparse data requires larger corpora
- computationally expensive
- large index size

Implementation

Interfaces

- Perl API & command-line utilities
- RESTful **web-service plugin** + GUI

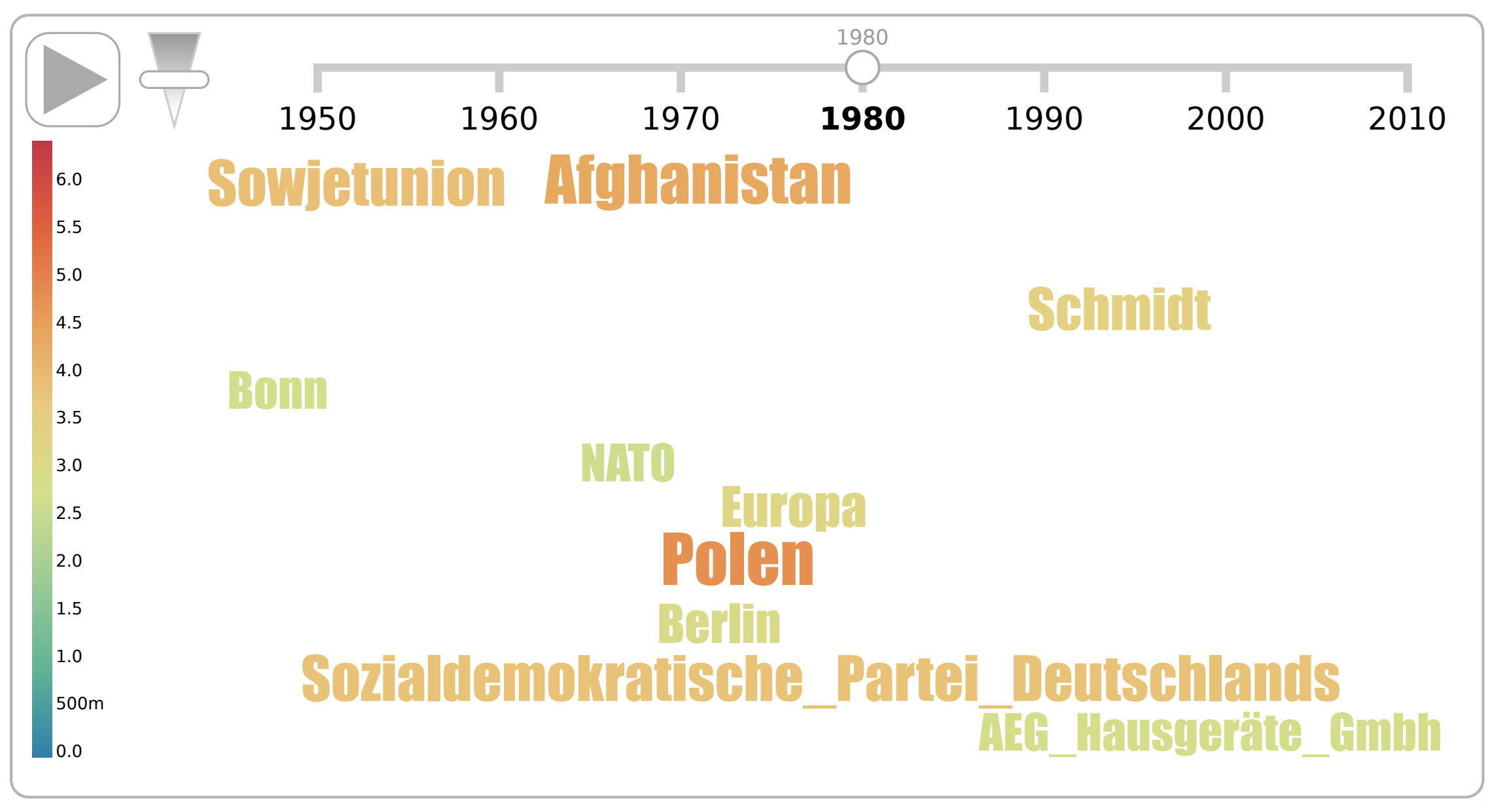
Features

- scalable even in a high-load environment
  - no persistent server process required
  - index access via file I/O or `mmap()` syscall
- supports both unary and "diff" profiles
- full DDC query support via `ddc` back-end

Output & Visualization

- TSV, JSON, HTML, Highcharts, d3-cloud, …

Example 1: *Krise* ("crisis") in the weekly *Die Zeit* (1946–2014)

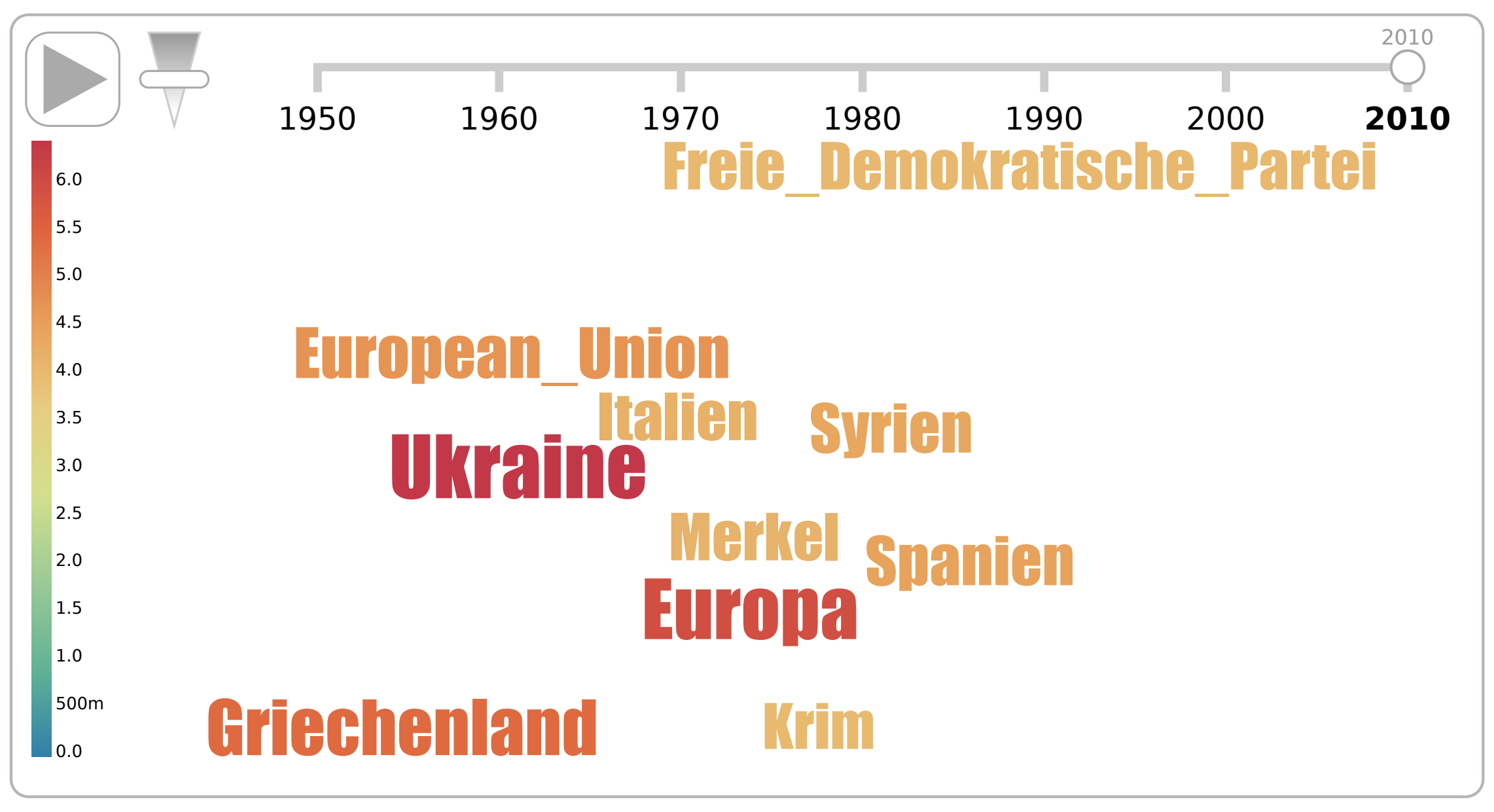


1980–1989

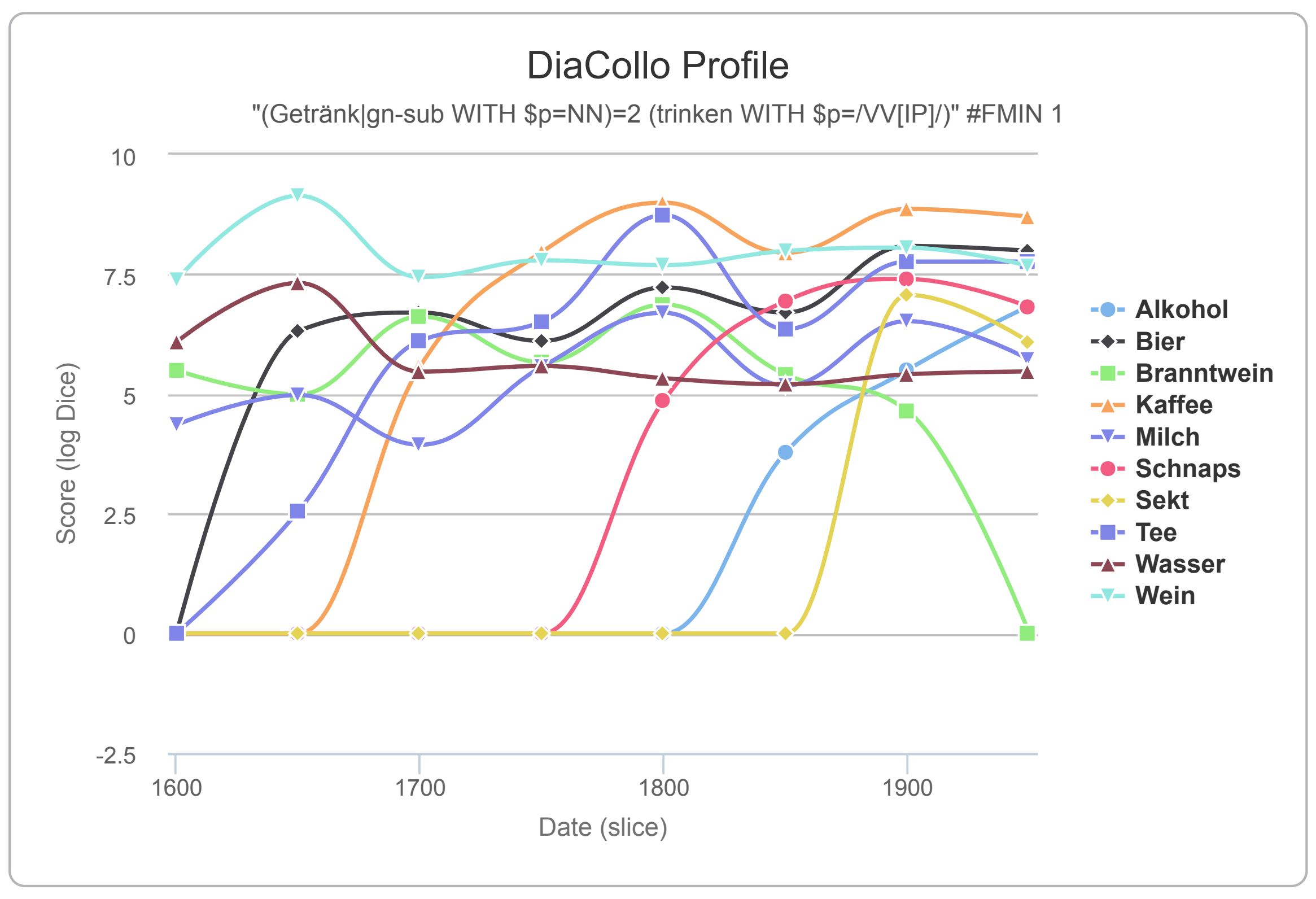
- Soviet war in Afghanistan
- *Solidarność* & martial law in Poland
- collapse of Helmut Schmidt (SPD) coalition
- AEG sells consumer electronics division
  - subsequent takeover by Daimler-Benz AG
- NATO Pershing-II missiles in western Europe

2010–2014

- civil wars in Ukraine & Syria
- Russian annexation of Crimea
- Greek government-debt crisis
  - speculation regarding Italy & Spain
  - bailout terms re-negotiated with EU Troika
- German FDP loses *Bundestag* presence



Example 2: 400 Years of Potables (1600–1999)



Remarks

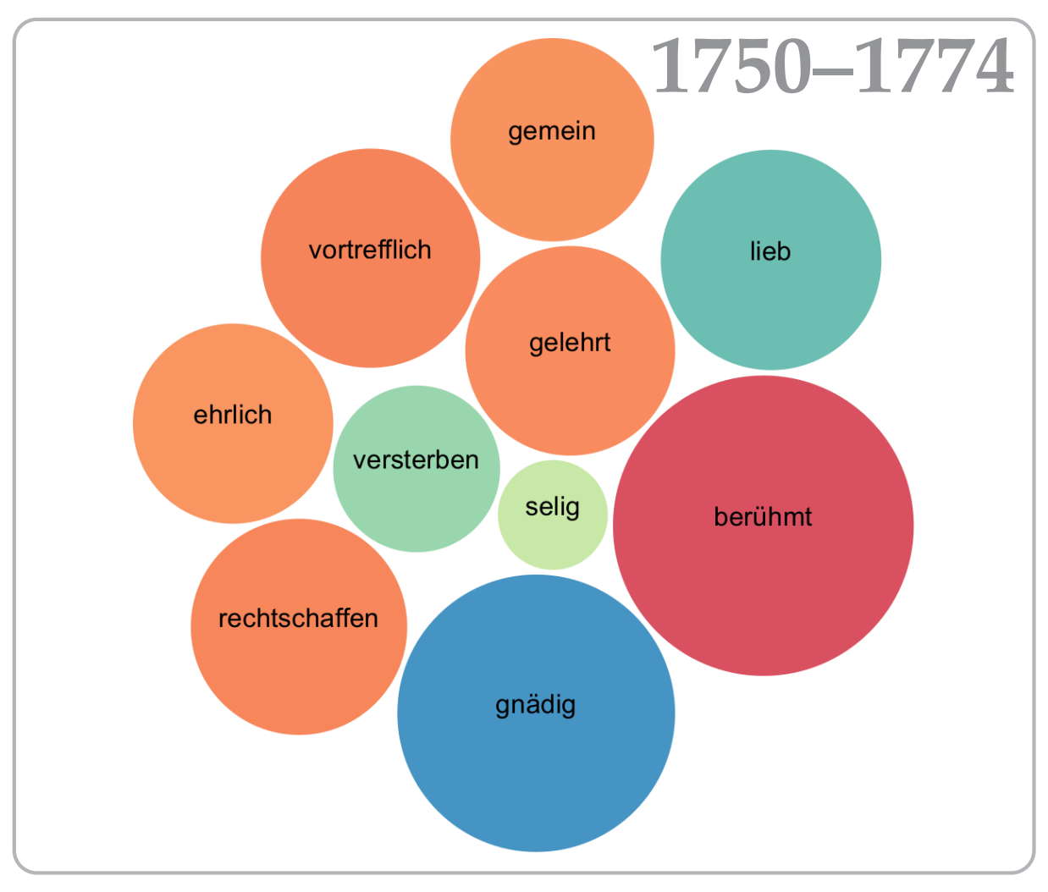
- DDC back-end + GermaNet [5, 6] expansion
- fine-grained search for beverages in object position of verb *trinken* ("to drink")

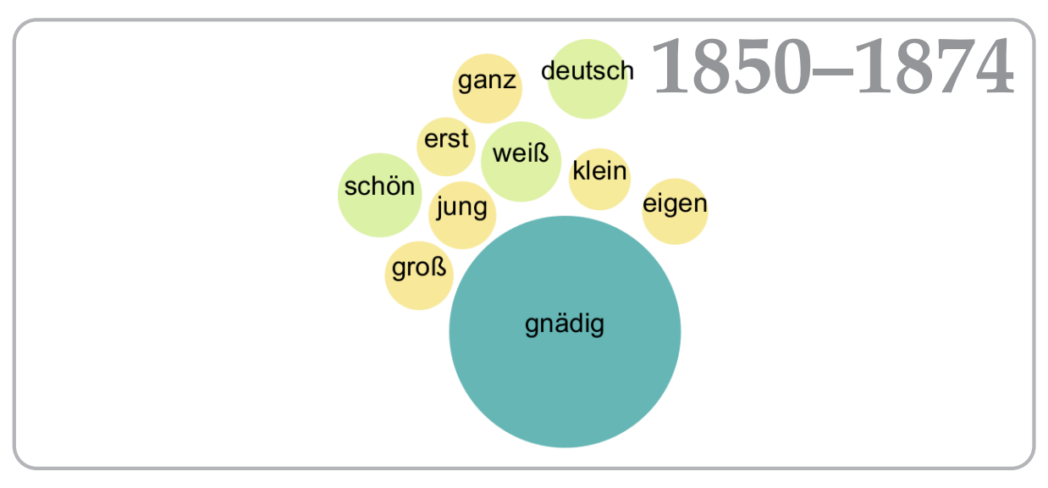
Observations

- staples ∼ constants, e.g.
  - *Bier, Milch, Wasser* ("beer, milk, water")
- 1650–1750: *Tee, Kaffee* ("tea, coffee") appear
- 1800–1900: *Schnaps* displaces *Branntwein*
- 1850–1900: *Alkohol* ("alcohol") as a beverage

Example 3: Gender Bias (1600–1900)

- comparison profile: ***Mann*** ("man") vs. ***Frau*** ("woman")
  - node size indicates absolute association score difference
- fixed & formulaic expressions very prominent
  - ***gnädige*** *Frau* ("milady") → masculine: *gnädiger Herr*
  - *Frau X* ***geborene*** *Y* ("born") → birth- vs. married surname
  - *der* ***gemeine*** *Mann* ("common") → masculine generic
- historical corpus data can reveal persistent cultural biases
  - ***Mann*** ⇝ *berühmt, ehrlich, gelehrt, …* ("famous, honest, learned, …")
  - ***Frau*** ⇝ *lieb, schön, verwitwet, …* ("dear, beautiful, widowed, …")
- differences grow less pronounced in late 18th & 19th centuries
  - political discourse: *deutsch, eigen, frei* ("German, own, free")





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