

The CAS Year: Stability and Change mid Aug '22 to mid June '23



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Pre-CAS Workshop, 11/v/2022

Themes, ideas, fellows, workshops, plans ...

N.L. Hjort and H. Hegre lead the CAS project

Stability and Change, from mid Aug '22 to mid June '23:

♠ 45% peace-, war-, conflict researchers

♠ 45% statisticians (theoreticians and appliedniks)

♠ 10% others

Statisticians:

datasamlere, datavitenskapere, registerbyggere, registerkoplere, tallknusere, datasyntetikere, sannsynlighetsteoretikere, dataanalytikere, modellbyggere, algoritmikere, maskinlærere, informasjonskondensører, informasjonskombinasjonsfolk, prediksjonskonstruktører, mønstergjenkjennerne, kunstigintelligensianere, metaanalytikere, generalister, generaliserere – med matematikk, filosofi, numerikk, m.m.

Statisticians in Stability and Change

The Two Cultures: 'to explain or to predict'.

Statisticians may use **the same data** (and partly the same models) for different purposes:

Statistician A aims at fine models, fine analyses, clear interpretations, understanding, achieving fine control over claims about the world (and uses this to **change it**¹, when needed).

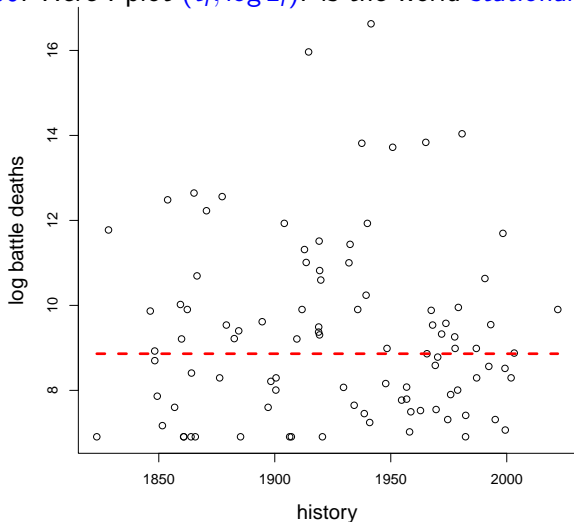
Statistician B constructs models that to reasonable degree fit lots of data, often without clear interpretation, and delivers clever methods for **classification** ('this is a conflict of Type III') and for **prediction** ('here are prognoses for conflicts if Types I, II, III for 2025–2055').

Stability and Change project: yes please, both.

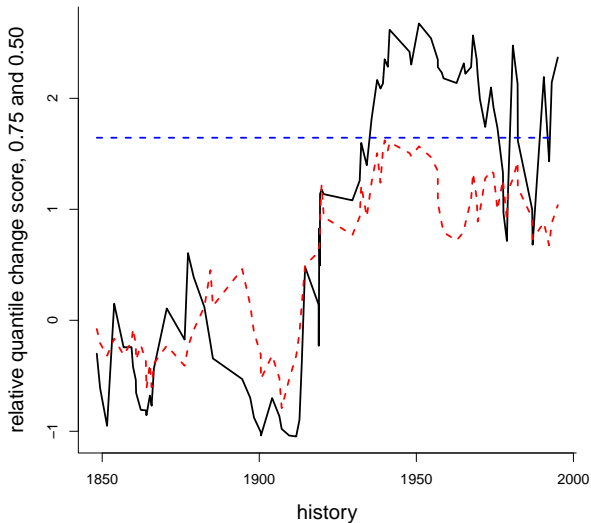
¹es kommt darauf an, sie zu verändern

Large interstate wars, deaths in battle

From [Correlates of War](#) database, with (t_i, z_i) , startpoint and no. of fallen, for 95 interstate wars from 1823 to 2003, those with $z_i \geq 1000$. Here I plot $(t_i, \log z_i)$: is the world stationary?



Inference and plotting methods from Cunen and Hjort –
for median $F^{-1}(\frac{1}{2})$ (red curve, not significant),
for upper quartile $F^{-1}(\frac{3}{4})$ (black curve, p-value 0.022).



Statistical modelling of battle death counts

Broad empirical finding, several papers: the **sufficiently big wars** (and lots of other phenomena, related to conflict, murder, violence) follow a **power-law type distribution**, with

$$\Pr(Z \geq z) \approx c/z^\theta \quad \text{for all large } z \geq z_0.$$

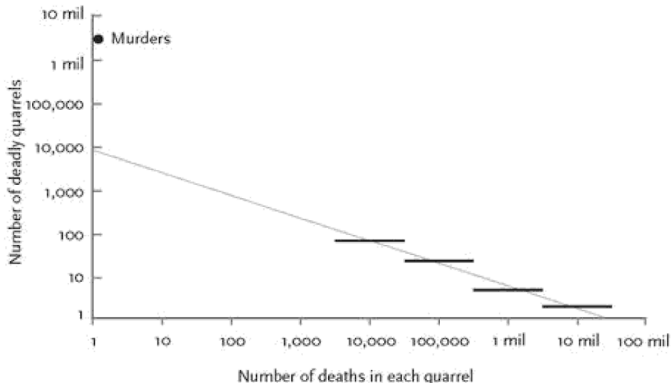


Figure 5.7 from Pinker (2011). Number of deadly conflicts of different sizes.

We work

- a with good statistical models, fitting data well;
- b but also with plausible and interpretable background models which explain (a) type models.

An illustration of (a): number of battle deaths follow a distribution of this type:

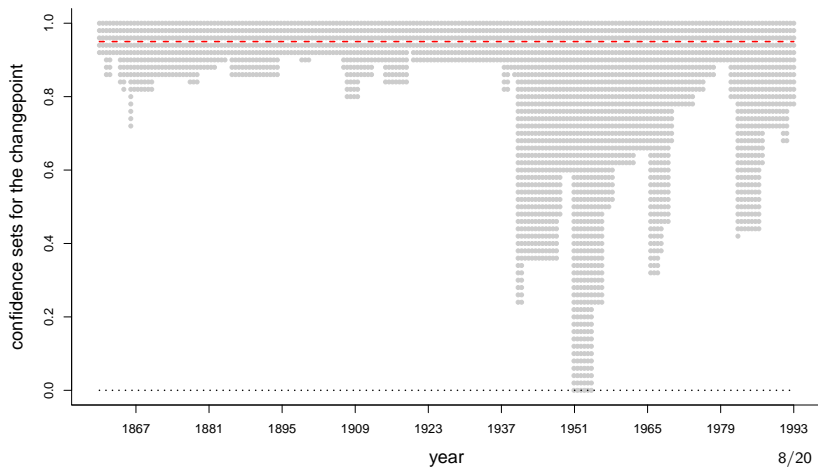
$$\Pr(Z \leq z) = \left[\frac{\{(z - 1000)/\mu\}^\theta}{1 + \{(z - 1000)/\mu\}^\theta} \right]^\alpha$$
$$\approx 1 - \alpha/(z - 1000)^\theta \text{ for large } z.$$

Data (for different time series, with war, violence, conflict) are used to

- to estimate;
- to understand;
- to compare;
- to predict;
- (and, sometimes) to intervene.

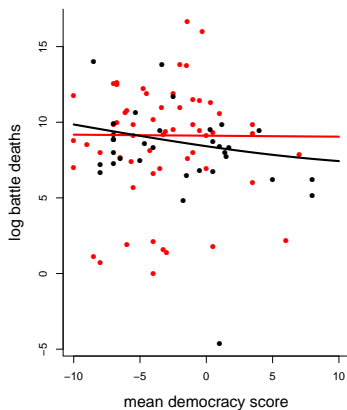
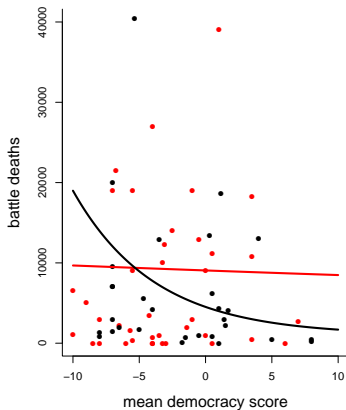
A somewhat more peaceful planet since 1950

With careful analysis of the battle death counts time series, we may estimate the **change point** (transition to a bit more peace than before) ... which happens to be **Korea 1950**. The **confidence plot** shows the uncertainty:



How does 'degree of democracy' influence sizes of wars?

Each country has its **democracy score** (big and endless topic, also for CAS project) – and these can be put into our models:



Before Korea: little effect; after Korea: **democracy helps**.

How to combine (very) different types of information?

Responding to Cunen-Hjort work, Steven Pinker has proposed that we should work also with this type of information:

Google Books Ngram Viewer

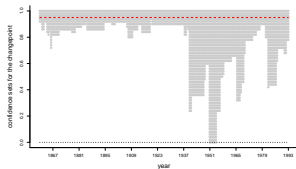
Graph these comma-separated phrases: case-insensitive

between and from the corpus with smoothing of [Search lots of books](#)

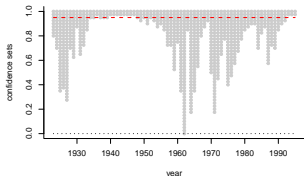
Replaced anti-war with anti - war to match how we processed the books.



Battle deaths data
(hard work leads to this):

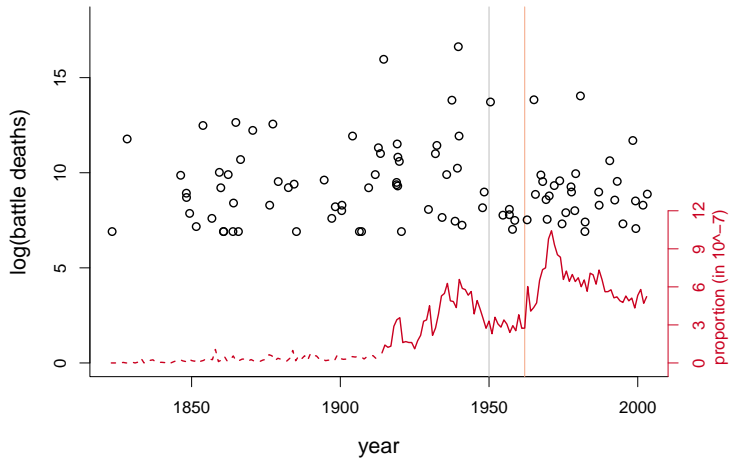


'Anti-war' Ngram data
(hard work leads to this):

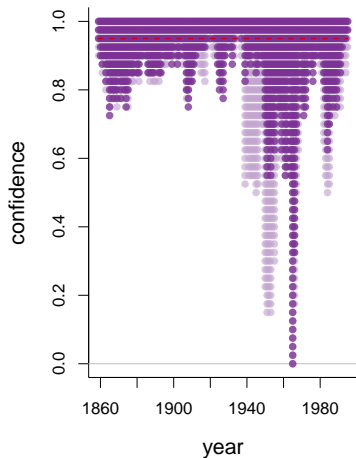
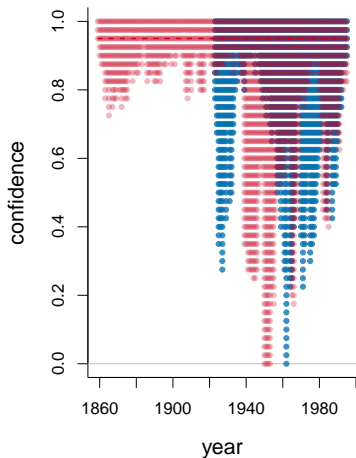


We have methods for combining also such (very different) information sources:

- ♣ Number of conflicts, their intensity, number of deaths.
- ♣ Levels of aggression (or the opposite), military training, rhetoric (by government, and in society).
- ♣ Protests, reading and interpreting sociale media.
- ♣ Degree of cooperation (export-import), common interests.



log battle deaths, alongside Ngram for 'anti-war'



Fused confidence curves, from the two information sources

Background processes implying Power-Law Behaviour

Since Lewis Fry Richardson (1944, 1948, 1960), it's an established **empirical fact** the deadly quarrels (and other types of violence) exhibit **power-law behaviour**:

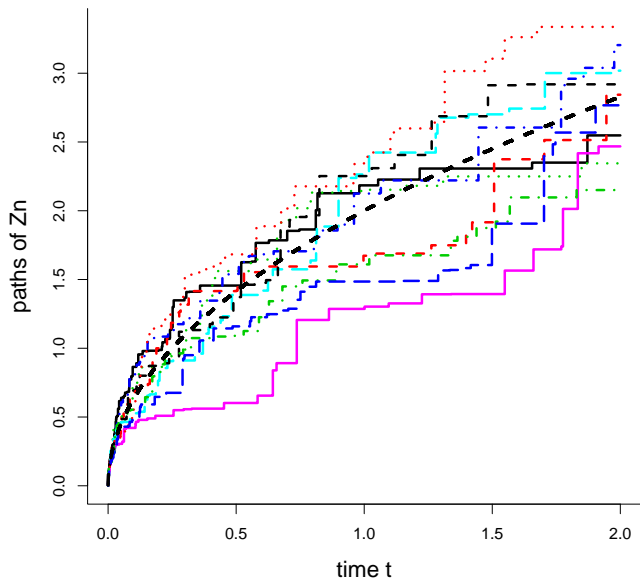
$$\Pr(T \geq t) \approx \frac{c}{t^\theta} \quad \text{for all large } t.$$

This means **long, fat tails** – if a war has 10,000 deaths, we should not be statistically shocked if it escalates to 50,000.

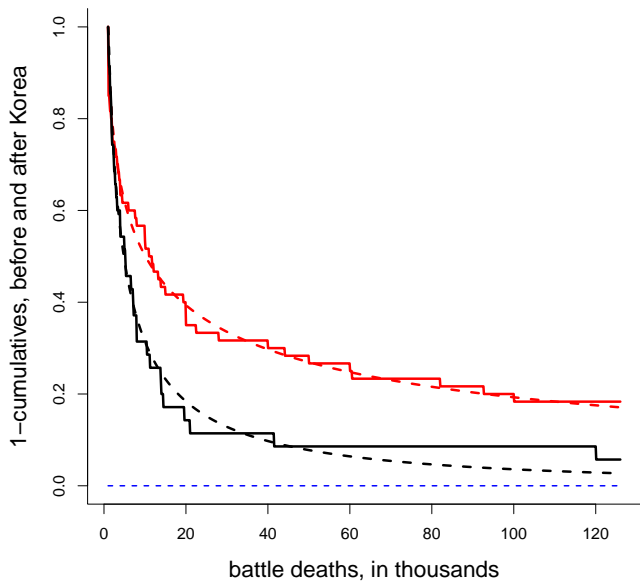
But **why**? We can search for **sets of plausible conditions** that imply power-law tails. One such example (Nils, 2022): consider

$$Z_n(t) = \sum_{i \leq [nt]} J_i c(i/n)^\alpha U_i \quad \text{for } t \geq 0,$$

with U_i being i.i.d., and J_i being Bernoulli with $p_i = 1/i$: steadily rarer, but steadily bigger. **Theorem**: $Z_n \rightarrow_d Z$, and **time to hit threshold for Z** has power-law tails.



Simulations for Z_n process



Nils model, fitted to **pre-Korea** and **after-Korea** battle deaths.

A number of further 'Stability and Change' themes

'Everyone who has been murdered should be remembered' – says [Human Rights Data Analysis Group](#) Director of Research, Patrick Ball (winner of the Rafto Prize 2021). How to get hold of good data?

Two data sources give list of deads: we observe N_{01} , N_{10} , N_{11} – can we estimate

N_{00} = no. of deads not present in any of the two lists?

What do we measure, and what do we really wish to measure?

What do people really mean, before, during, after conflict?

What can machineries of [statistical causality](#) tell us?

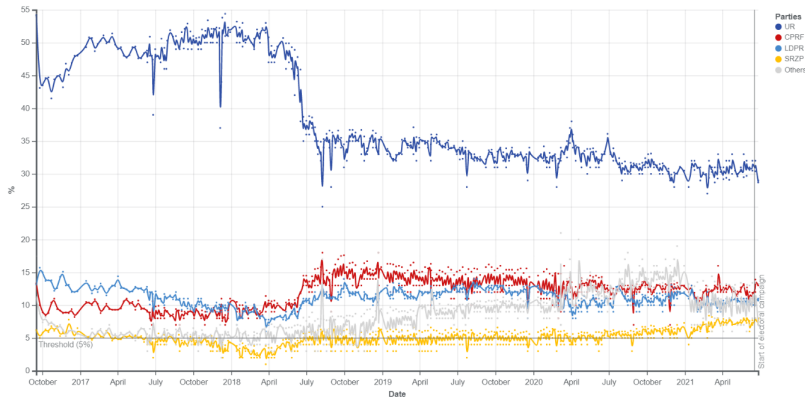
How to act in a conflict, when to give up (cf. preface to my 1935 copy of [Vom Kriege](#), by A. Hitler)? Bayesian statisticians know the answer to [Decline of War](#): put up a full loss function, put priors on all unknowns, and minimise posterior expected loss.

Opinion polls – in troubled nations, in troubled times

Opinion polls [\[edit \]](#)

This section is an excerpt from [Opinion polling for the 2021 Russian legislative election § Graphical summary](#). [\[edit \]](#)

Pre-campaign [\[edit \]](#)



January 2019 to September 2021, polling for the different parties

Единая Россия goes down, May-June 2019 – why?

Stability and Change, mid Aug '22 to mid June '23

- # Clever people!, from two disciplines: collaborations
- # Pre-CAS-Workshop, May 11-12, PRIO/Røde Kors
- # One or two open and broad conferences
- # About four Special Themes Workshops
 - # getting the right data (with the right quality)
 - # change points
 - # from processes to models
 - # measuring democracy (and their trends)
 - # decline of war
- # Statisticians: to explain AND to predict (?!)
- # How to spot that a (major or not-major) conflict is coming?
- # Possible excursions to medicine, sociology, history, biology, climate, economics, ...
- # What is the potential for generalisability, to other themes, other applications?

A few references

- C. Cunen, N.L. Hjort, H.M. Nygård (2020). [Statistical Sightings of Better Angels](#). *Journal of Peace Research*.
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- N.L. Hjort (2022). Processes with bigger shocks at rarer rates.
- S. Pinker (2011). [The Better Angels of Our Nature](#).
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