
Critical data literacy for democracy education

Joachim Engel

in cooperation with

Florian Weber-Stein

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Ludwigsburg University of Education

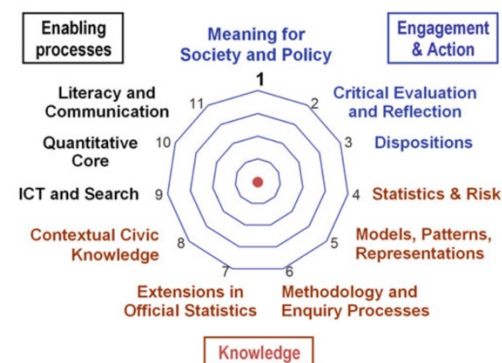
June 19, 2024

Outline

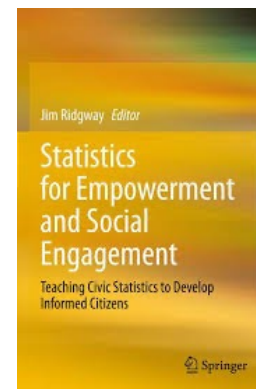
1. Some preliminary thoughts:
 - Critical data literacy
 - Democracy education
2. Making the connection
3. Data literacy as individual competence in democratic societies
4. Democratizing the Data Ecosystem
5. Democracy as topic for data investigations
 - Quality of Democracy
 - Kant's thesis of perpetual Peace

1. Some preliminary thoughts: Critical data literacy

Civic Statistics is about enabling people to make sense of the data that govern our lives in society and politics with the purpose to empower them for engagement and action as concerned citizen in democratic decision processes and civic life.



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1. Some preliminary thoughts: Critical data literacy

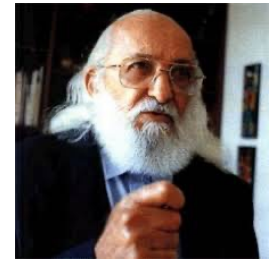
Statistical Literacy, data literacy and being critical: emerging tendencies

- The ability to understand and **critically** evaluate the statistical results that permeate our daily lives (Wallman, 1992).
- The ability of individuals to interpret and **critically** evaluate statistical information, data-driven arguments or stochastic phenomena they encounter in different contexts and, where appropriate, b) their ability to discuss or communicate their reactions to such statistical information (Gal, 2002).
- Schield (1999), Ben-Zvi & Garfield (2004), Watson & Callingham (2004), ProCivicStat (2018)

1. Some preliminary thoughts: Critical data literacy

Focus on critical awareness and political education: **critical statistical literacy**

- Statistics as a grammar of social justice (Lesser, 2007).
- Critical Statistical Literacy (Weiland, 2017) goes beyond the mastery of the cultural techniques of reading and writing.
- The concept of socio-cultural awareness and empowerment links to the literacy concepts of the Brazilian pedagogue Paulo Freire (1921-1997).



Learning to read the word AND the world, which should lead people to be able to "write" both the word and the world.

- Recently, several Latin American authors have adopted this concept (Campos, 2016; Souza & Araújo, 2022; Souza et al, 2020; Tauber et al, 2023; Zapata-Cardona, 2018, Ubilla, 2022, Ruz 2022).

1. Some preliminary thoughts: Critical data literacy

Civic Statistical Literacy (in the sense of PCS)

- Encourage and enable participation and engagement
- Much common ground with ... but not identical

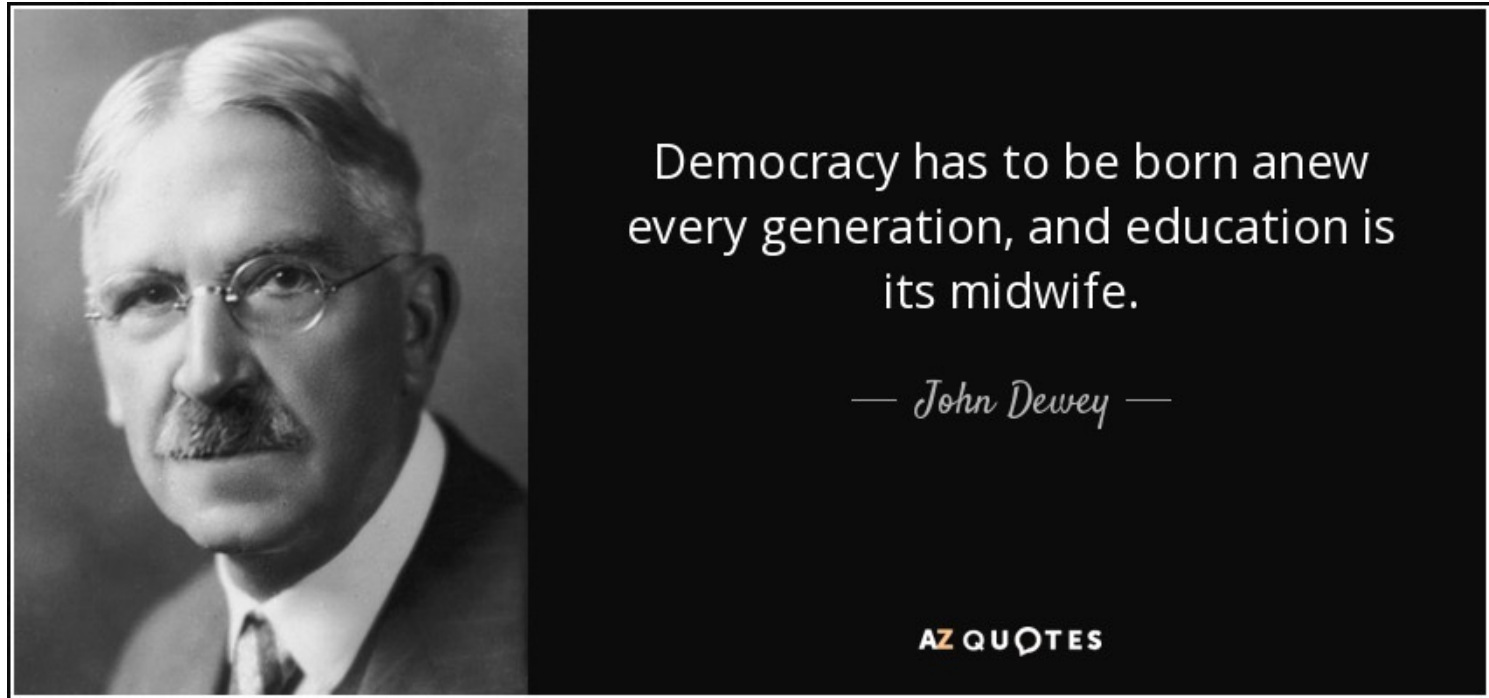
New title:

*Civic Statistical Literacy and
Democratic Education*

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1. Some preliminary thoughts: democratic education



The goal of democracy education is to empower individuals to become informed, engaged, and responsible citizens who are capable of contributing to the democratic process and promoting a healthy, vibrant democracy.

1. Some preliminary thoughts: democratic education

What is democratic education?

There are many different understandings of democratic education, depending on the authors' affinity with democratic theory

- liberal,
- neoliberal
- multicultural,
- deliberative,
- participatory,
- Critical
- agonistic

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with correspondingly different ideas of which political skills and abilities should be specifically promoted and are functional for the respective understanding of democracy.

1. Some preliminary thoughts: democratic education

Education about Democracy - Education in Democracy

- Understanding Democratic Principles
- Knowledge of Political Systems
- Civic Rights and Responsibilities
- **Critical Thinking and Debate:** Encouraging the development of critical thinking skills, the ability to engage in informed debate, and the capacity to analyze and evaluate different perspectives on public issues.
- **Participation Skills:** Teaching practical skills for participation in civic and political activities, such as how to vote, how to organize and advocate for causes, and how to engage with public officials and institutions.
- **Values and Attitudes:** Promoting democratic values such as tolerance, respect for others, and a commitment to the common good

2. Making the Connection

Critical Thinking and data based reasoning: Encouraging the development of critical thinking skills, the ability to engage in informed debate, and the capacity to analyze and evaluate different perspectives on public issues.

- Weighing up arguments
- Evidence Informed Decision-Making:
- Resilience to Manipulation and debunking misinformation
- Maintaining Transparency and Trust
- Policy Evaluation and Adaptation

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2. Making the Connection

Statistical education, democracy and citizen empowerment

- The importance of mathematics and statistics plays a key role on the road towards democratic, participatory and socially just structures in society (Skovsmose, 1994).
- Democracy thrives on evidence-based arguments. Disinformation, fake news, lack of information and ignorance are threats to our way of life.
- Living democracies need well-informed citizens who can understand important social issues, debate them and contribute to public decision-making.



3. Data literacy as individual competence in democratic society

Paternalism is older than statistical thinking and secret data is older than open data. The traditional enemies of statistical literacy have been authoritarian governments and lack of public education. But for democracy to work, citizens must be well informed and capable of reasoning based on facts.



Gerd Gigerenzer

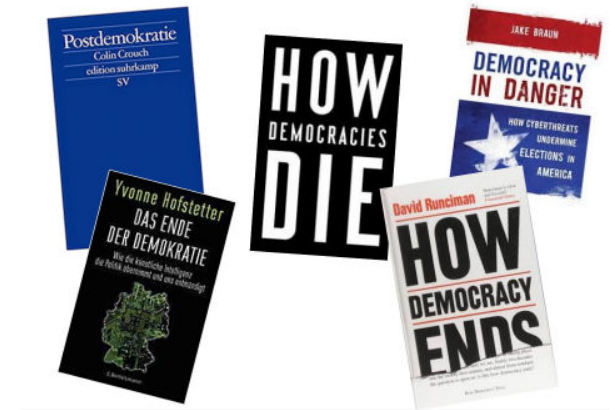
From the foreword to: Statistics for Empowerment and Social Engagement

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3. Data literacy as individual competence in democratic society

Democracy in danger

- Fake news
- Deep fake
- Fake voz

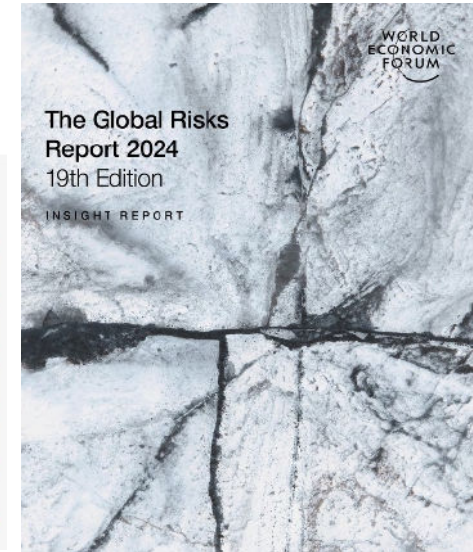


The ability to assess the credibility of information and its sources has never been more important.

3. Data literacy as individual competence in democratic society

Global risks ranked by severity over the short and long term

"Please estimate the likely impact (severity) of the following risks over a 2-year and 10-year period."



Misinformation and disinformation are the biggest threat to humanity in the next two years !

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In order to increase the resilience of our students to misinformation, manipulation and fake news, we must design our teaching in a way that supports critical argumentation informed by data and statistical information.

3. Data literacy as individual competence in democratic society

Awareness of data quality and data adequacy

Data is not „the objective truth“

- Biased
- Collected for a specific purpose
- To serve someone's interests
- With a specifically chosen research design
- Measure manifest variables in a specific way
- Construct latent variables in a specific way
- Collected to tell a story; whose story is it?

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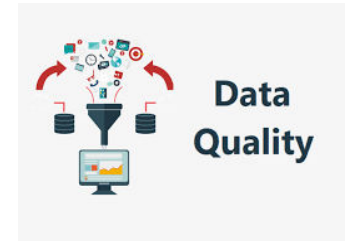


It is important to educate students to be sceptical, not cynical.
Attitude that accepts reports, but needs to be convinced by evidence..

3. Data literacy as individual competence in democratic society

Awareness of data quality and data adequacy

- Are the measures (e.g. a questionnaire) well defined? Are the measures robust and fit for purpose?
- Is metadata available (i.e. detailed explanations of how variables were defined, sample characteristics, etc.)?
- Were the sampling procedures adequate, and who is missing from the data collected
- What is the quality of evidence presented in a media article or claim to support claims about needed policies or actions



4. Democratizing the Data Ecosystem: Opportunities

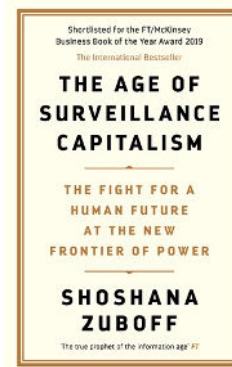
Democratizing access to data involves making data widely available, understandable, and usable by a broad audience, e.g. through

- Open Data Policies by governments and corporate transparency
- Accessible Platforms through public repositories and user friendly interfaces
- Data literate and technology savvy citizen
- Technology and Infrastructure
- Privacy and Ethics (Anonymization techniques and ethical guidelines)

to provide innovative pathways for increased citizen participation and more e-democracy, from increased pressure for direct democracy and new ideas to engage citizens in service to direct democracy.

4. Democratizing the Data Ecosystem: Threats

- High level of pollution in the information eco-system
 - Fake news, misinformation & disinformation, unchecked dissemination of news
- Surveillance Capitalism (Shoshana Zuboff)
 - Big Data Companies collect massive user data as a valuable commodity (data as gold of 21 century)



=> User Awareness

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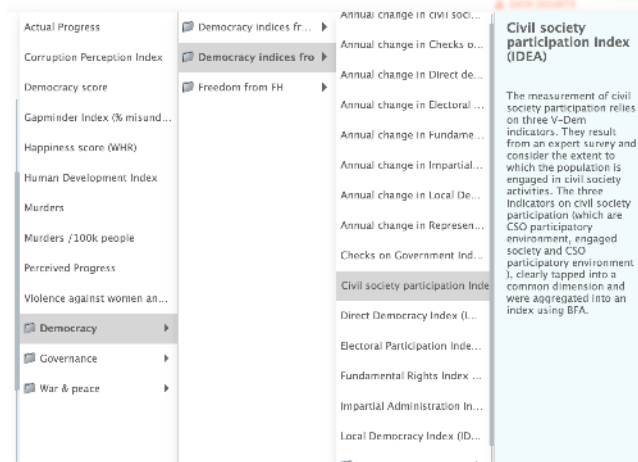
=> Ownership of Data

=> Users need to reflect on their own data track

5. Democracy as Topic for Data Investigations: Quality of Democracy

Investigating and Comparing Quality of Democracy

- Rule of law
- Impartial administration
- Government control
- civil liberties
- citizen participation
- Equality
- electoral participation

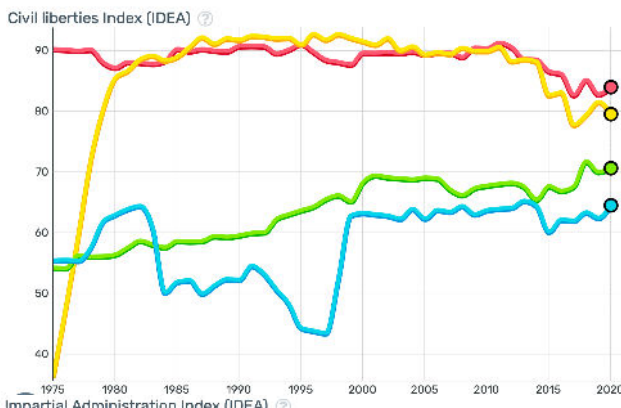


Data available from Gapminder

www.gapminder.org

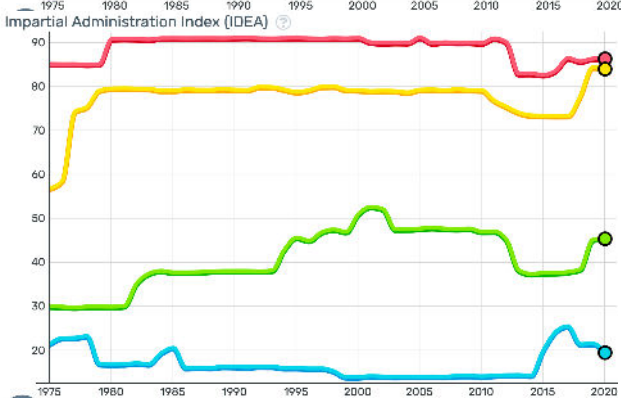
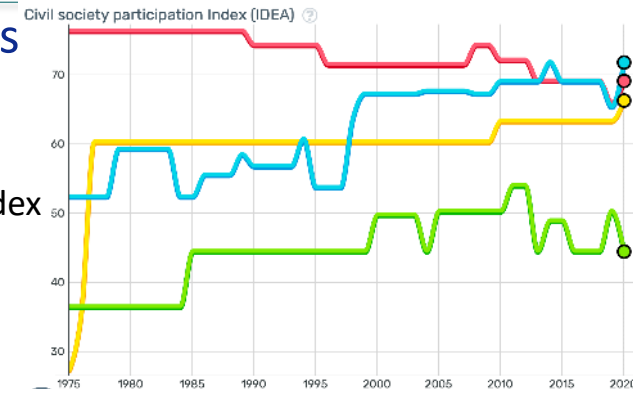
5. Democracy as Topic for Data Investigations: Quality of Democracy

Democracy in four countries (Gapminder)



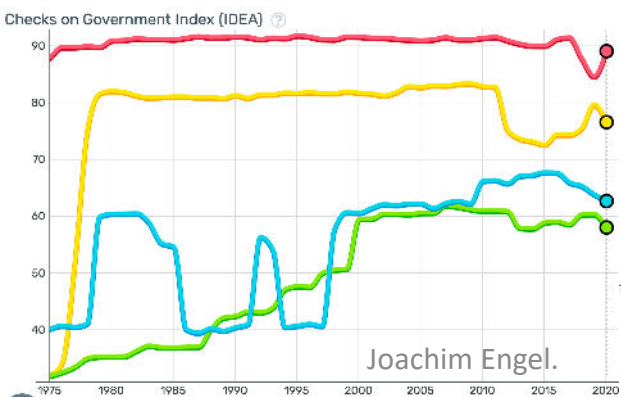
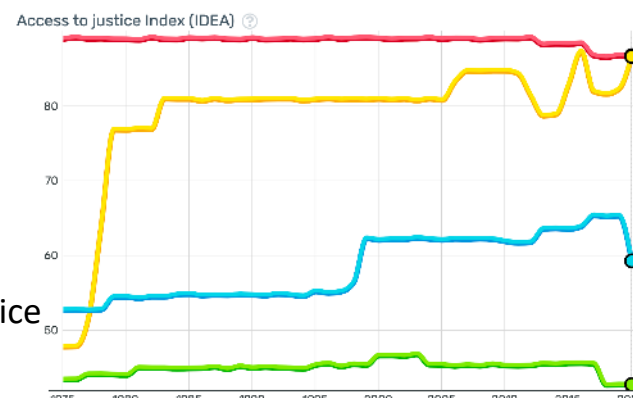
Civil liberties index

Civil Society
participation index



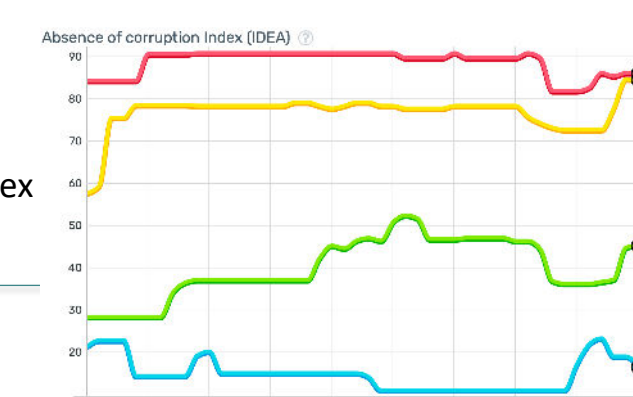
Impartial
Administration index

Access to Justice
Index



Checks on
Government index

Absence of
corruption index



Joachim Engel.

ProDaBi, June 19, 2024

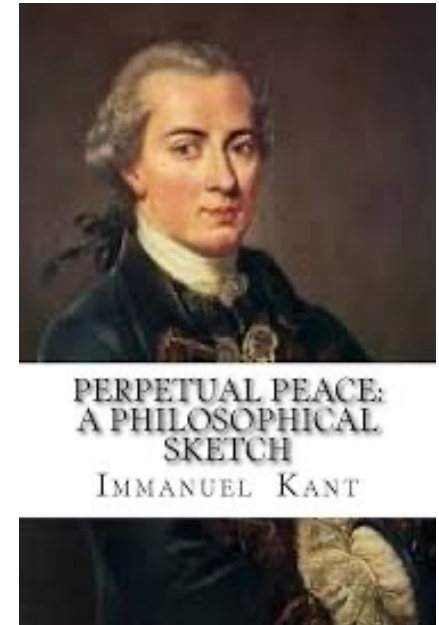
5. Democracy as Topic for Data Investigations: Kant's Thesis of perpetual Peace

Immanuel Kant (1795) „thesis of perpetual peace“.

Democratic states:

- 1) are less likely to go to war in general;
- 2) are much less likely to go to war with other democratic states;
- 3) help to create a more peaceful international system.

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Can we investigate these claims with data?

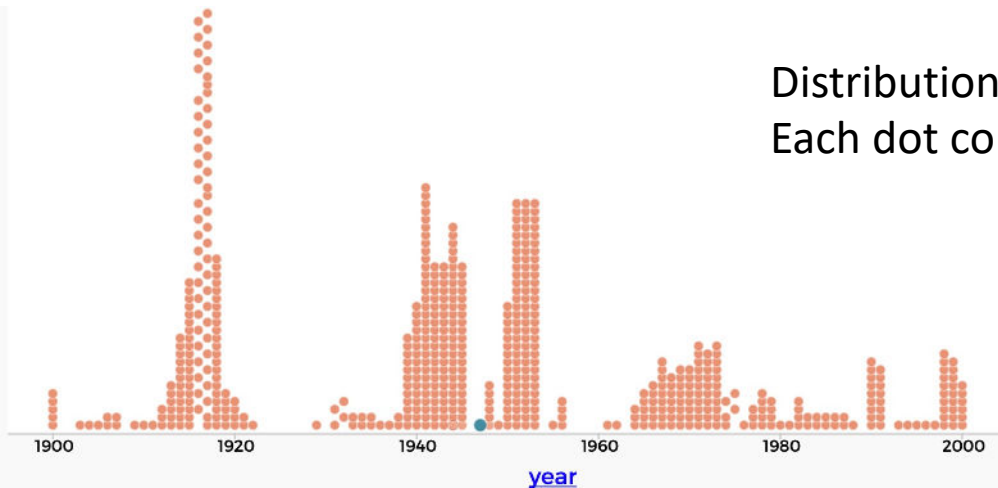
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The Data

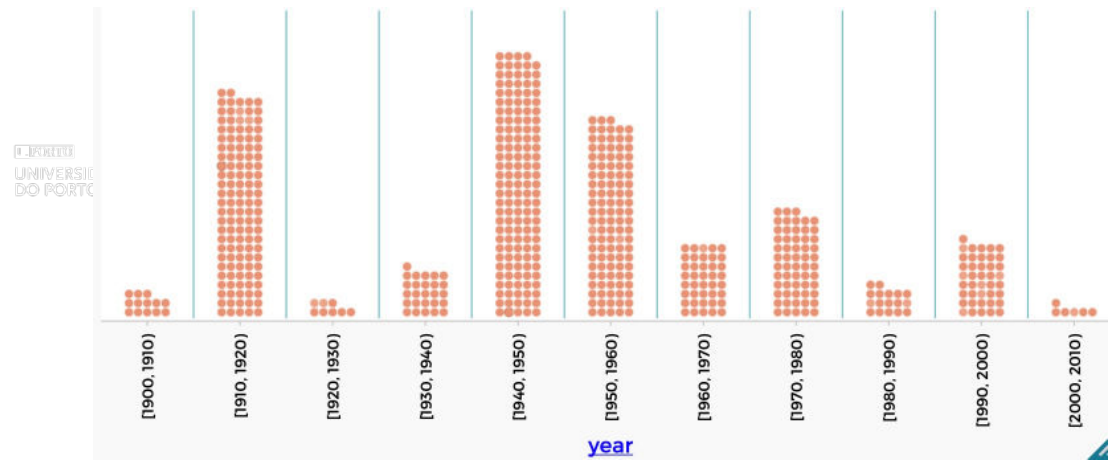
year	Jahr
demscore_a	Demokratiequalität des Staates A (gemäß v-dem Polyarchy-Index; Werte zw. 0=Autokratie und 1=vollständige Demokratie)
demscore_b	Demokratiequalität des Staates A (gemäß v-dem Polyarchy-Index; Werte zw. 0=Autokratie und 1=vollständige Demokratie)
distance	Abstand zwischen den Hauptstädten beider Staaten der Dyade
trade_inter_grwth	Prozentuales Wachstum des Handelsvolumens in der Dyade (pro Jahr)
capratio	Verhältnis /Ratio der höheren zu den niedrigeren militärischen Fähigkeiten (military capabilities) in der Dyade, die Werte reichen von 0 (= identische militärische Fähigkeiten) bis 1 (max. Differenz militärischer Fähigkeiten).
majpowra	Ist Staat A eine „Großmacht“? (0 = nein; 1 = ja). Die Einschätzung wird durch diplomatiehistorische Expert:innen vorgenommen und bezieht die Anerkennung als Großmacht durch andere Staaten ein.
majpowrb	Ist Staat B eine „Großmacht“? (0 = nein; 1 = ja).

Altman et al. (2021), An interactive model of democratic peace. In: Journal of Peace Research 58(3), pp. 384–398

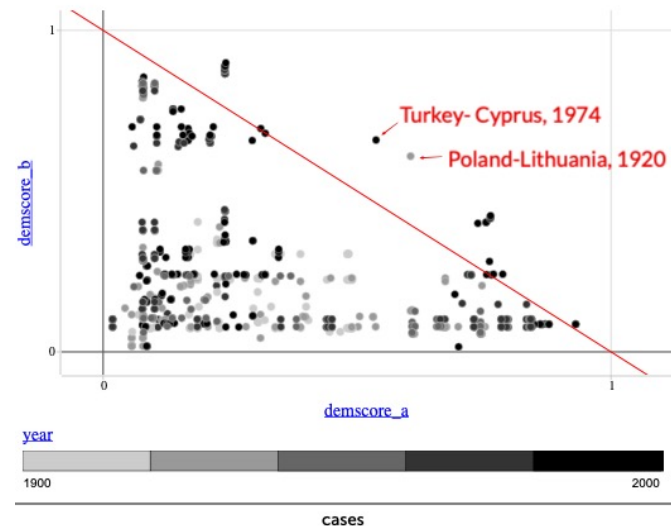
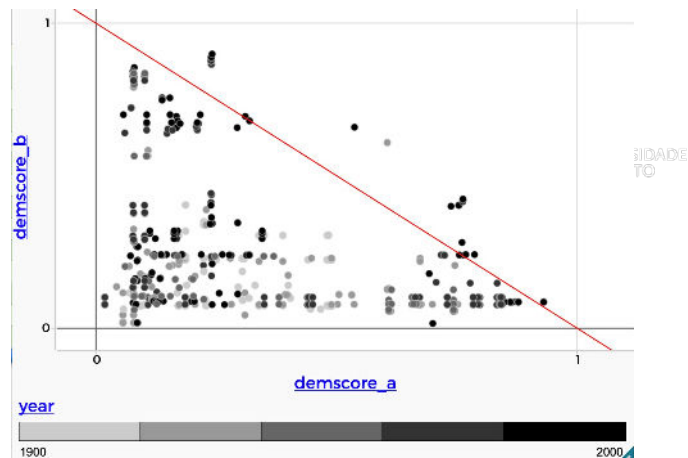
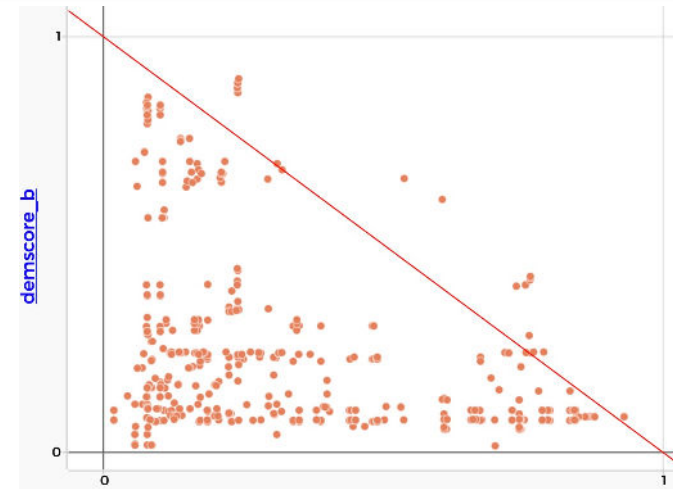
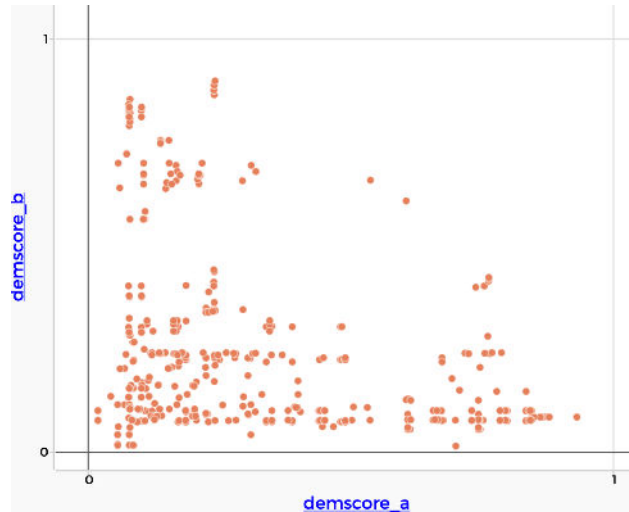
5. Democracy as Topic for Data Investigations: Kant's Thesis of perpetual Peace



Distribution of War-Dyads in the 20th Century:
Each dot corresponds to a war between two countries



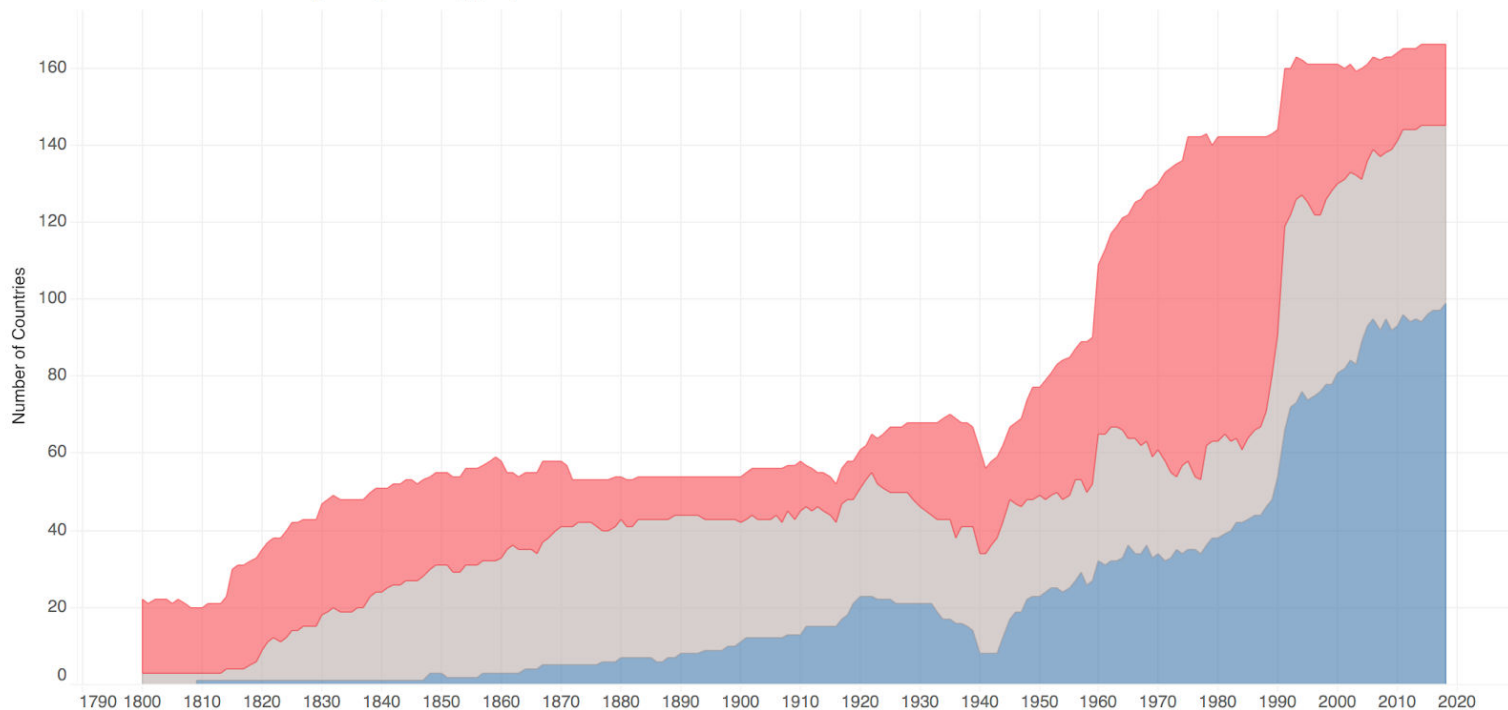
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5. Democracy as Topic for Data Investigations: Kant's Thesis of perpetual Peace

Political regimes based on the classification by Lührmann et al. (2018) and the estimates by V-Dem's experts.

Number of Countries by Regime Type, 1800-2018



5. Democracy as Topic for Data Investigations: Kant's Thesis of perpetual Peace

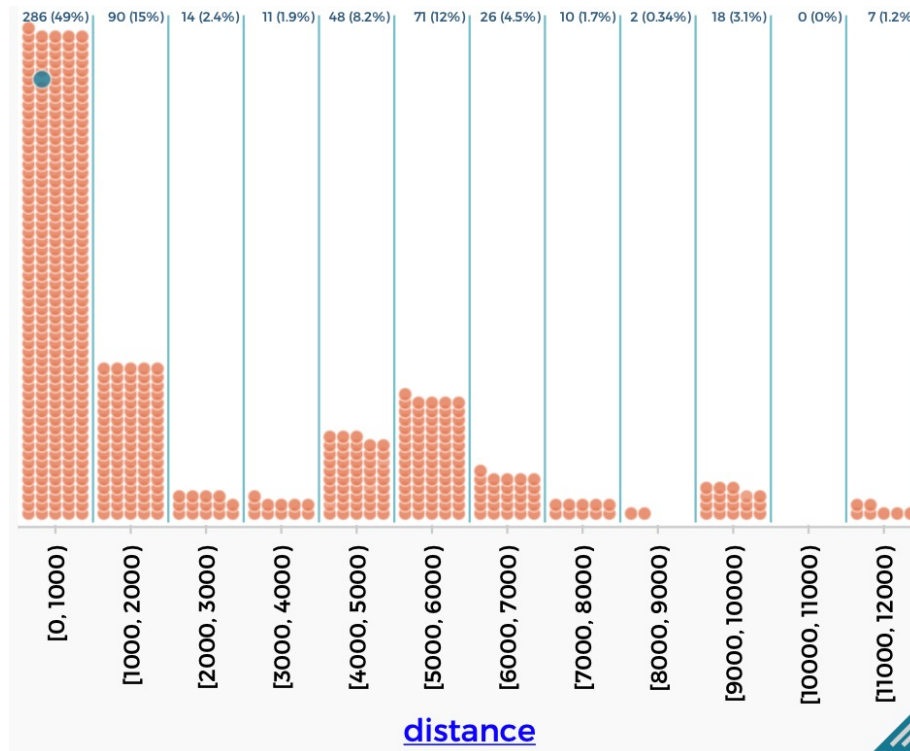
Possible Confounders

- Distance of capitals,
H1: the further away the capitals, the lower the probability of conflict
- Military capacity,
H2: the greater the difference in military capacity, the more likely is a conflict
- Great power versus great power,
H3: a conflict between two great powers is rather unlikely
- Trade
H4: Trade relations reduce the probability of conflict
- Great power versus small state,
H5: no one starts a war against a great power, but a great power attacks another power that is not a great power

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5. Democracy as Topic for Data Investigations: Kant's Thesis of perpetual Peace

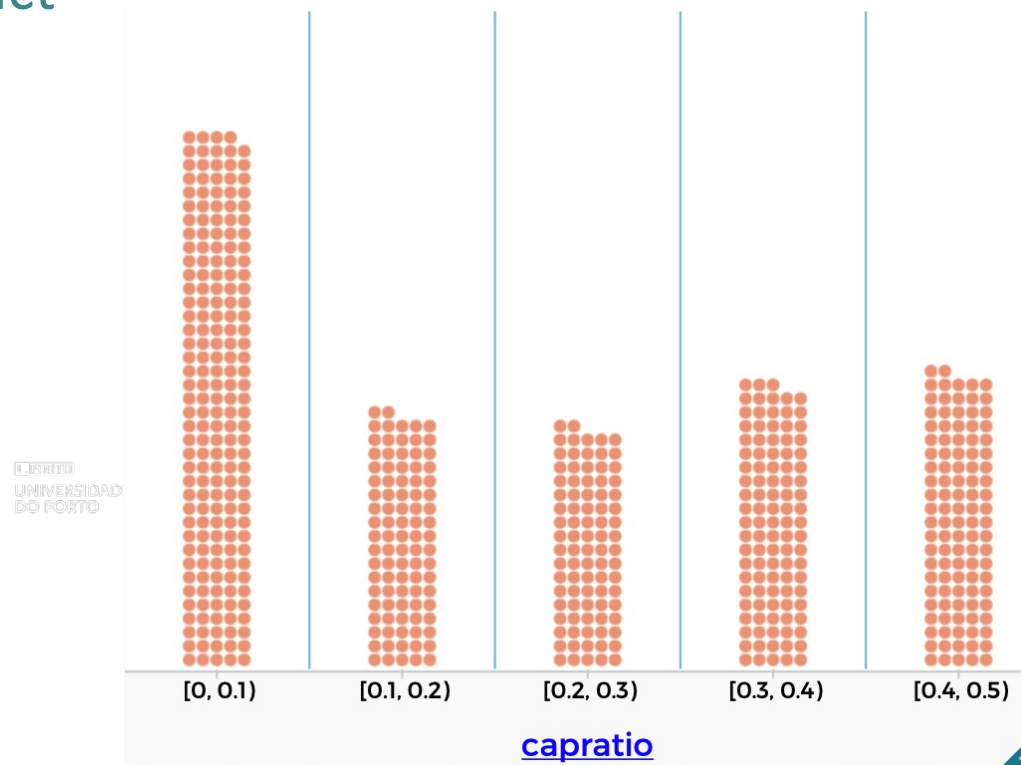
- Distance of capitals,
H1: the further away the capitals, the lower the probability of conflict



5. Democracy as Topic for Data Investigations: Kant's Thesis of perpetual Peace

- Military capacity,

H2: the greater the difference in military capacity, the more likely is a conflict



5. Democracy as Topic for Data Investigations: Kant's Thesis of perpetual Peace

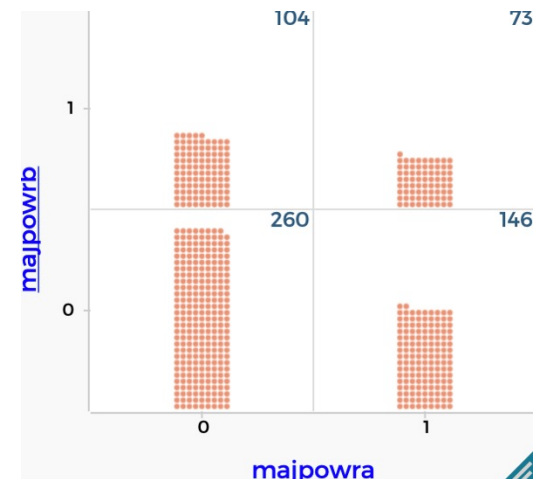
- Great power versus great power,
H3: a conflict between two great powers is rather unlikely

- Chi-square test:

`chisq.test(matrix(c(104, 73, 260, 146), nrow = 2))`

Pearson's Chi-squared test with Yates' continuity correction

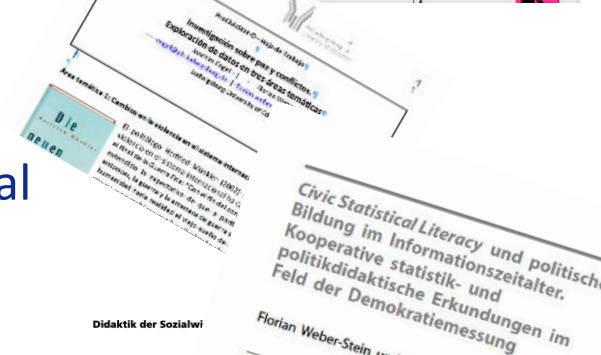
- data: `matrix(c(104, 73, 260, 146), nrow = 2)`
- X-squared = 1.2499, df = 1, p-value = 0.2636
- No statistical significance Keine statistische Signifikanz, dass Großmächte nur gegen andere Krieg führen



5. Democracy as Topic for Data Investigations

Project „Data Citizens“ at Ludwigsburg

- Cooperation Mathematics & Political Science (Weber-Stein)
- Joint seminars for mathematics and political science students to empower them to think critically with data
- Development of curricula and teaching material
- Accompanying design based research with empirical evaluation
- Publications: conceptual development, empirical evaluations



Digitale tools zum Einsatz von Statistischer Politikunterricht

Exploration, Analyse und Visualisierung von sozialwissenschaftlichen Daten

Florian Weber-Stein und Joachim Engel

1. Gesellschaftliche Datafizierung und Politik

Bereits im Vorwort seines Evaluationsberichts (Bundesgesundheitsministerium, 2021) betonte der „Corona-Expertenrat“, dass „eine ausreichende und stringente Datenerhebung (bisher), die notwendig gewesen wäre, um die Evaluierung von Maßnahmen oder Maßnahmenpakete zu ermöglichen“ (ebd., S. 11). Exemplarisch wurde hier noch einmal deutlich, was mehr als zwei Jahre Pandemieführung uns eindrücklich gelehrt haben: Das Überlegen von Risiken und Wahrscheinlichkeiten auf der Basis statistischer Daten hat für die Organisation des gesellschaftlichen Zusammenlebens und die Legitimierung politischer Entscheidungen eine fundamentale Bedeutung erlangt (Deutsche Arbeitsgemeinschaft Statistik 2022). Die Bereitschaft zur Einhaltung beschlossener Maßnahmen zur Eindämmung des Virus verlangt in dem

5. Democracy as Topic for Data Investigations

Some preliminary empirical Results (Winterterm 23/24)

Data literacy: Political Explorations in Times of Fake News

- 14 class meetings of 90 minutes
- Two class meetings separate by major
- 31 BA students (~3rd year),
 - 17 math majors
 - 12 Political Science major
 - 2 double major (Math & Pol Sc)

5. Democracy as Topic for Data Investigations

- Pre-Post test design with control group
- Test Instruments:
 - *Survey of Attitudes Toward Statistics SATS* , Schau 2006
 - *SCAS* (Gal, Ginsburg, Schau, 1997)
 - *Political Efficacy*, Beierlein et al. 2014
 - *Political self-attributed Competence*, Krampen 1991 (5 Items)
 - *Information Attitudes*, Behm 2018,
 - *Verhältnis Wissenschaft und Politik* , *Vertrauen in die Wissenschaft* Wissenschaftsbarometer 2023

5. Democracy as Topic for Data Investigations

Some empirical Tendencies

Table: Attitudes towards Statistics, Effect Size Cohens d, TG Mathematics

	Cohens_d	lower_CI	upper_CI
Affect (N=19/17)	1.066	0.334	1.784
Competence (N=19/17)	1.046	0.316	1.763
Value (N=19/17)	0.794	0.084	1.493
Difficulty (N=19/17)	0.622	-0.076	1.311
Statistical Efficacy (N=19/17)	1.004	0.277	1.717
Relevance (N=19/17)	0.778	0.070	1.476
Math Competence (N=19/17)	-0.248	-0.926	0.434

Table: Attitudes towards Politics, Effect Size Cohens d, TG_Math

	cohens_d	lower_CI	upper_CI
Political Efficacy (N=17)	0.500	-0.191	1.184
Political Competence (N=17)	0.792	0.083	1.491
Interest in Politics (N=17)	0.671	-0.031	1.362

Table: Attitudes towards Statistics, Effect Size Cohens d, TG Political Science

	Cohens_d	lower_CI	upper_CI
Affect (N=12/11)	1.288	0.087	2.448
Competence (N=12/11)	1.588	0.333	2.797
Value (N=12/11)	0.274	-0.810	1.347
Difficulty (N=12/11)	0.721	-0.400	1.816
Statistical Efficacy (N=12/11)	0.289	-0.795	1.363
Relevance (N=12/11)	0.402	-0.690	1.479
Math Competence (N=12/11)	-0.437	-1.516	0.289

Thank you – Gracias – Obrigado – Merci – Grazie – Danke
Questions – Comments - Ideas

Materials available
<https://tinyurl.com/ProDaBiJune24JE>

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