

# **Deep Transitions: text mining historical newspapers for social history**

Peeter Tints (University of Tartu)

Jena, Germany, June 29 2022



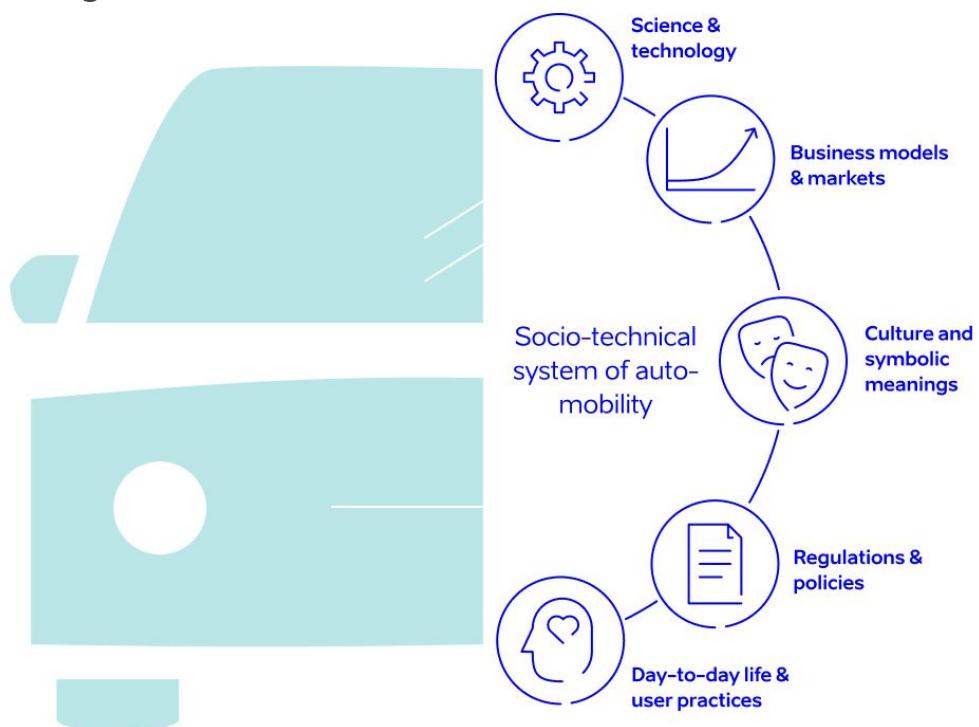


# A sociotechnical system

Society + Technology

Auto-mobility system:

- Car
- Roads + gas stations
- Traffic regulations
- Daily commute & kids to school
- Driving a Porsche
- BMW factories & employees



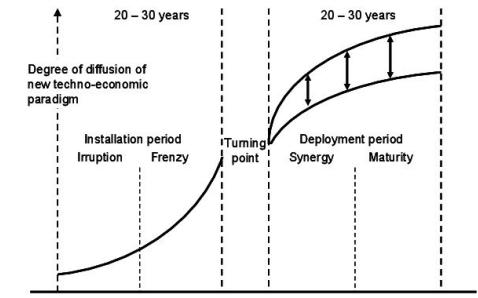
Based on Geels et al (2004)



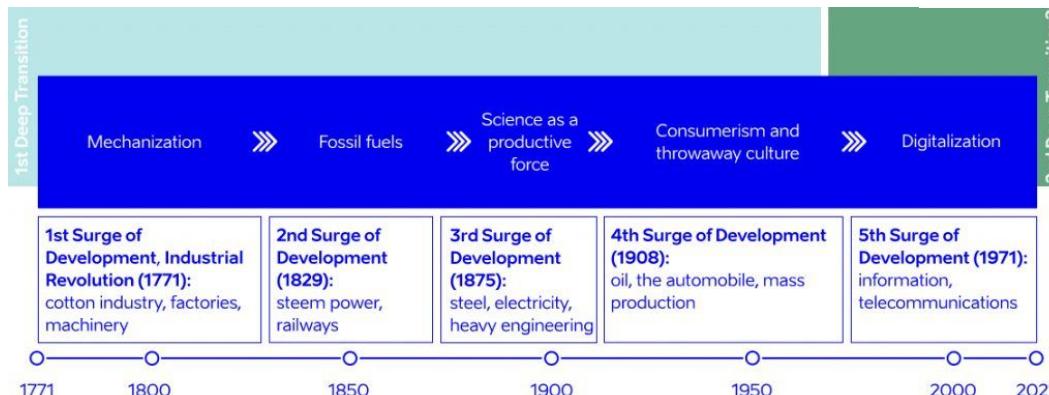
# Evolution of socio-technical systems

5 great surges of development (Perez 2002)

- Technological revolution propagates across the economy, leading to structural changes in production, distribution, communication, consumption & society.



Source: based on Perez 2002, p.74



Based on Perez (2010)

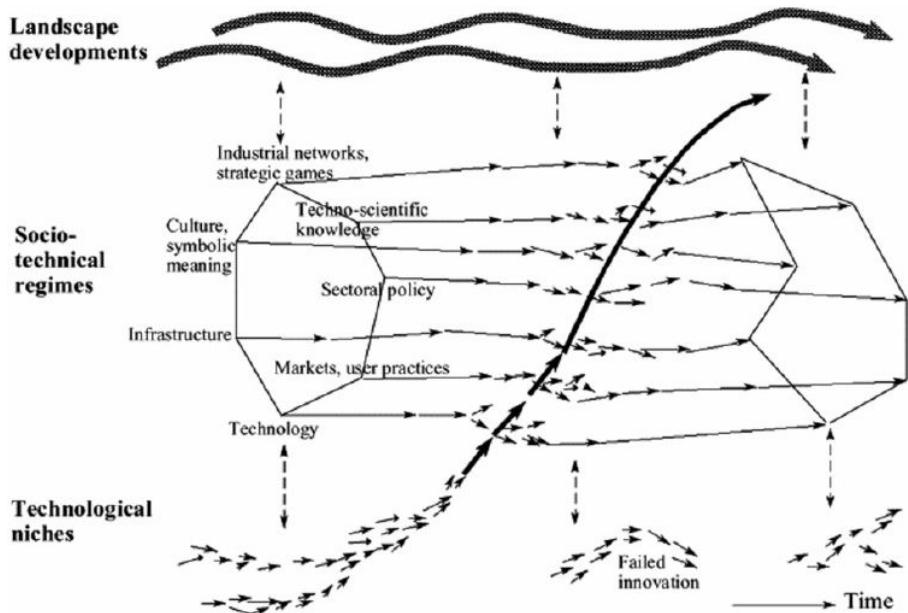


# Evolutionary mechanisms

An evolutionary framework:

- Innovations first take root in niches
- Sociotechnical regimes are ‘dynamically stable’  
- result of many interactions
- Alignment with the regime works as a selective force
- Landscape developments (EU law, resource depletion) can put pressure on the regimes, and create opportunities for niches
- Mature technologies can become landscape

Multi-level perspective model



(Geels, 2011)

# Agency in socio-technical regime change

Historical outcomes are not determined by technology

Trams in USA now mostly gone due to bad management, difficult to restart.

Bicycles in the Netherlands - systemic reforms in the 1970s.



Tramways in the USA (Grand Rapids MI 1926, Los Angeles 2017)



Bicycle Lanes in the Netherlands (Amsterdam 1970s, Amsterdam 2017)



# Niche technologies

**Electric cars & electric scooters in 1920s** - but could not compete with gasoline cars. (Road, charging stations?)

**Solar power plant** in Egypt in 1913, operational and more efficient than coal then, WW1 stopped it. Solar powered heating in California, but cheap gas was found nearby.

**Nutrient pollution** - by early 1900s after long issues problems with soil conservation, advice on sustainable practices grows. 1909 Haber & Bosch invent chemical fertilizers. Great short term, but has caused severe problems for the global nitrogen cycle.

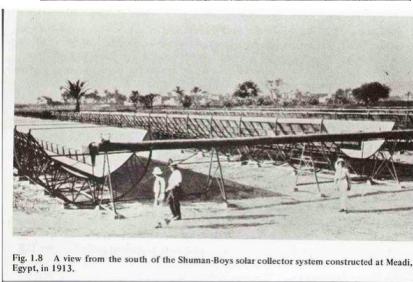
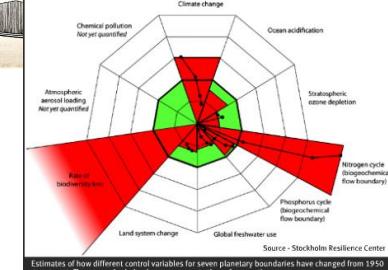
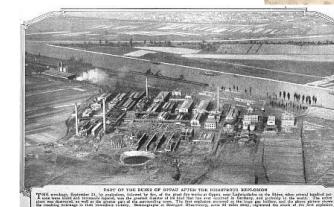
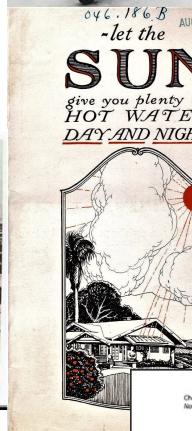


Fig. 1.8 A view from the south of the Shuman-Boys solar collector system constructed at Meadi, Egypt, in 1913.



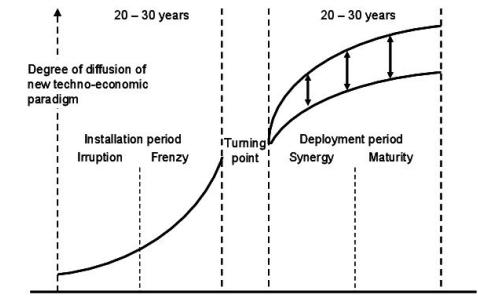
Estimates of how different control variables for seven planetary boundaries have changed from 1950 to present. The green shaded polygon represents the safe operating space.



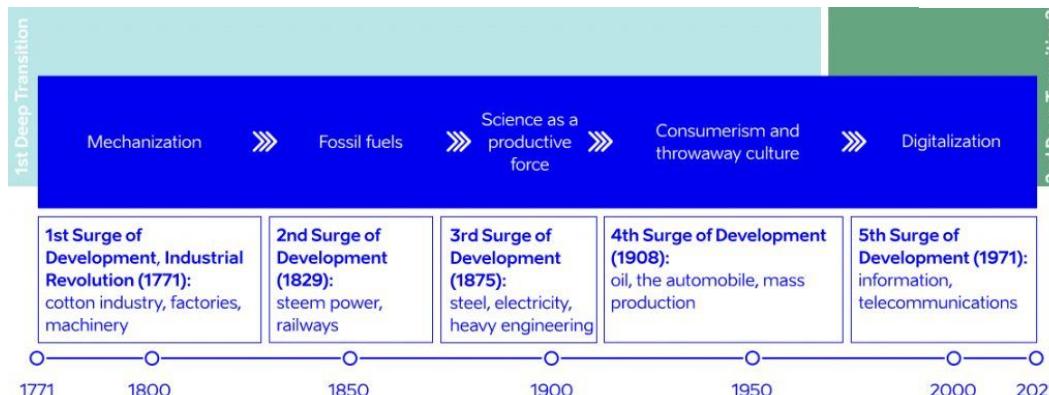
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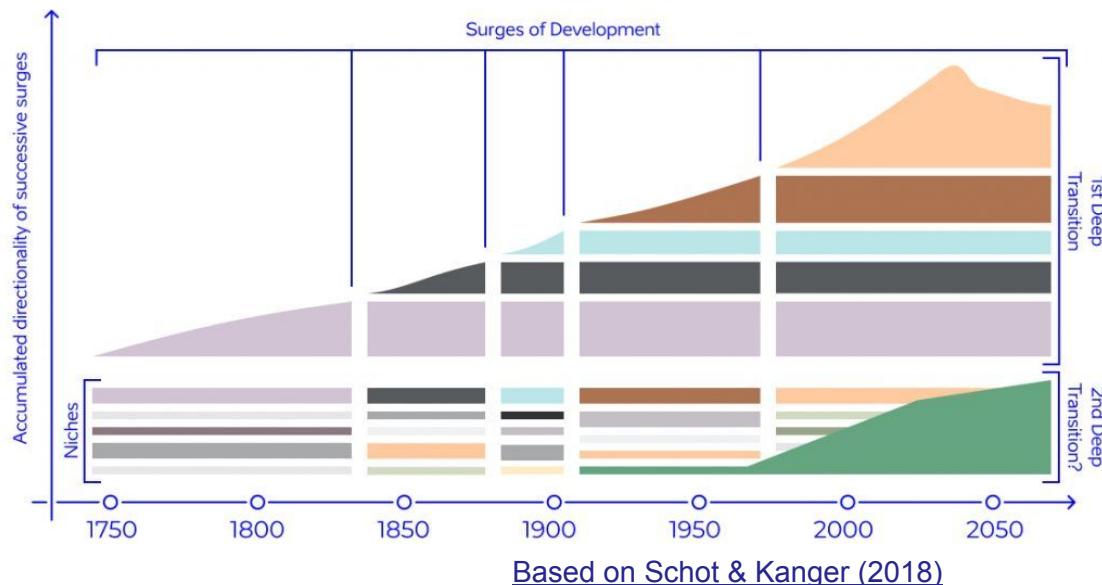


# Deep Transitions

All surges were in the same direction and accumulated and intensified features

## 1st Deep Transition (Industrial Modernity)

- increased labour productivity,
- mechanization, increasing complexity
- reliance on fossil fuels,
- resource-intensity,
- energy-intensity,
- reliance on global value chains





# The challenge for Industrial Modernity

Unprecedented prosperity but also

Recurrent problems

- climate change (caused by the use of fossil fuels),
- pollution and an enormous waste of resources (caused by the assumptions of limitless supply of resources and limitless capacity to absorb waste),
- inequality (caused by system innovation mainly aimed at the richer markets) and
- persistent unemployment (caused by a relentless emphasis on productivity growth).

Schot & Kanger (2018) skeptical if can be solved within the same deep transition.



# Some features of Industrial Modernity

## Ideas

- Limitless supply or substitutability of resources
- Societal problems, however deep and complex, can be solved through technological innovation
- Any human task can and should be substituted with technologies, whenever possible, to increase productivity and efficiency

## Institutions

- Prioritization of societal over environmental concerns in institutional design
- Largely reactive approach to regulating innovation
- Normalization of temporary unemployment due to technological displacement
  - constant pressure towards the upgrading skills

## Practices

- Specific socio-metabolic profile: 'mineral', fossil fuel based and linear economy
- Techno-fixes: solve problems created by current technologies and infrastructures with new and more complex technologies
- Increasing dependence on energy- & resource-intensive sociotechnical systems for everyday life



# Operationalizing Industrial Modernity

The concept, very simplified

- Neglect of the environment
- No caution in approach to science and innovation

The approach

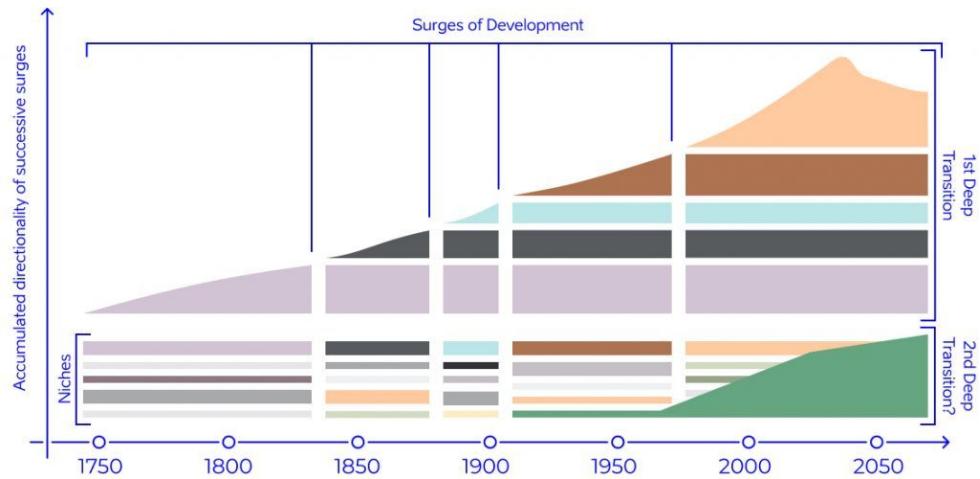
- Ideas, institutions, practices in noticing environmental effects
- Ideas, institutions, practices with caution in science & innovation



# Trying to measure Deep Transitions

Controversies have existed throughout. But how much influence do they have?

Is there continuity in Deep Transition 1, is there a change towards Deep Transition 2?





# Data sources

Historical data 1900-2020 is not easy, many relevant measurements from 1980s onwards.

Canvassed datasets and collections that could have info for 1900-2020 on some countries

- Newspapers collections: various sources (Canberra Times, Pravda, Spiegel, NYT etc, combined for 1900-2020 coverage)
- ECOLEX - database of environmental law
- MS Academic - database of scientific publications
- PATSTAT - database of patents
- The Shift - resource use database



# Five countries

Based on data availability & profiles

- Australia
- Germany
- India
- USSR/Russia
- United States

But mostly data availability

	Australia	Germany	India	USA	USSR/Russia
Total population in thousands (% share of global population) <sup>1</sup>	25,500 (0.33)	83,784 (1.07)	1,380,004 (17.7)	331,003 (4.25)	145,934 (1.87)
GDP in trillion current US\$ (% share of global GDP) <sup>2</sup>	1.33 (1.57)	3.85 (4.55)	2.62 (3.1)	20.94 (24.75)	1.48 (1.75)
Total primary energy production in EJ (% of global production) <sup>3</sup>	9.11 (2.95)	4.8 (0.74)	18.09 (2.79)	107.48 (16.6)	68.14 (10.52)
Economy <sup>4</sup>	Liberal market economy	Coordinated market economy	Statist market economy	Liberal market economy	Planned economy shifting to patrimonial market economy
Polity <sup>5</sup>	Liberal democracy	Liberal democracy	Liberal democracy	Liberal democracy	Communist ideology shifting to electoral autocracy
Culture <sup>6</sup>	Secular/ self-expression	Secular/ self-expression	Traditional/ survival	Secular/ self-expression	Secular/survival
Time of industrialization <sup>7</sup>	Second phase	First phase	Third phase	First phase	Second phase



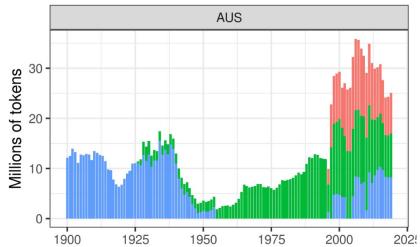
# Finding 1st and 2nd Deep Transition

	Environment	Science	Technology
Ideas	NEWS <ul style="list-style-type: none"><li>• discussions on each (how much)</li><li>• sentiments in them (caution)</li></ul>		
Institutions	ECOLEX (international treaties)	NEWS (technocracy in government)	ECOLEX (caution in legislation)
Practices	SHIFT (renewable energy production)	MS ACADEMIC (sustainability in publications)	PATSTAT (green patents)

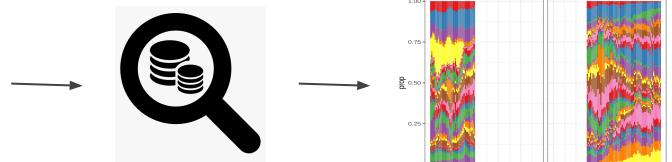


# Methods, text

Lemmatized corpus  
AUS: 1,361M tokens



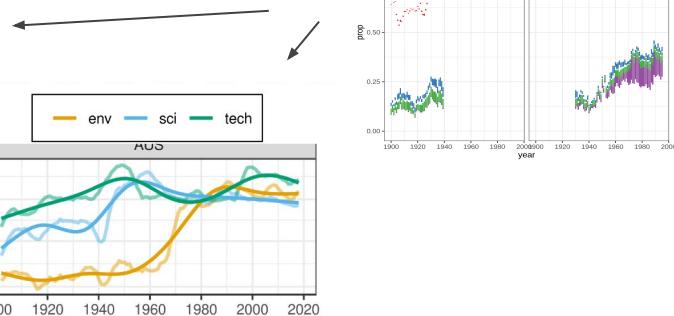
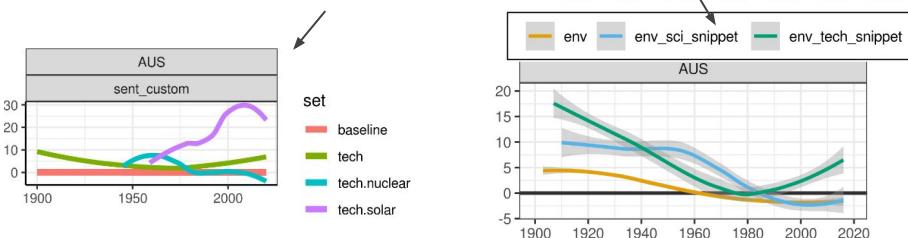
Keyword sets for each lang  
e.g. nature, discover\*, technolog\*



Query disambiguation  
Vs 'human nature', 'police discovered'



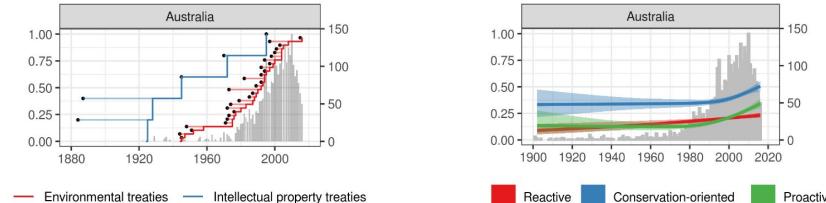
Sentiment analysis (custom adjectives)  
*successful, substantial, effective, efficient*  
*alarming, severe, disastrous*





# Methods, datasets

ECOLEX:



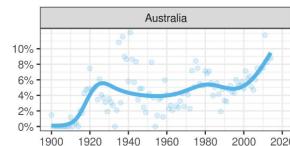
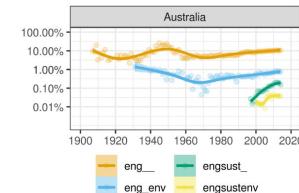
- Compare large international environmental treaties with large international intellectual property rights (IP) treaties
- Manual classification - conservationist, reactive, proactive policies in tags.

MS Academic:

- Articles with engineering, environment or sustainability tags

PATSTAT

- Green patents vs all patents

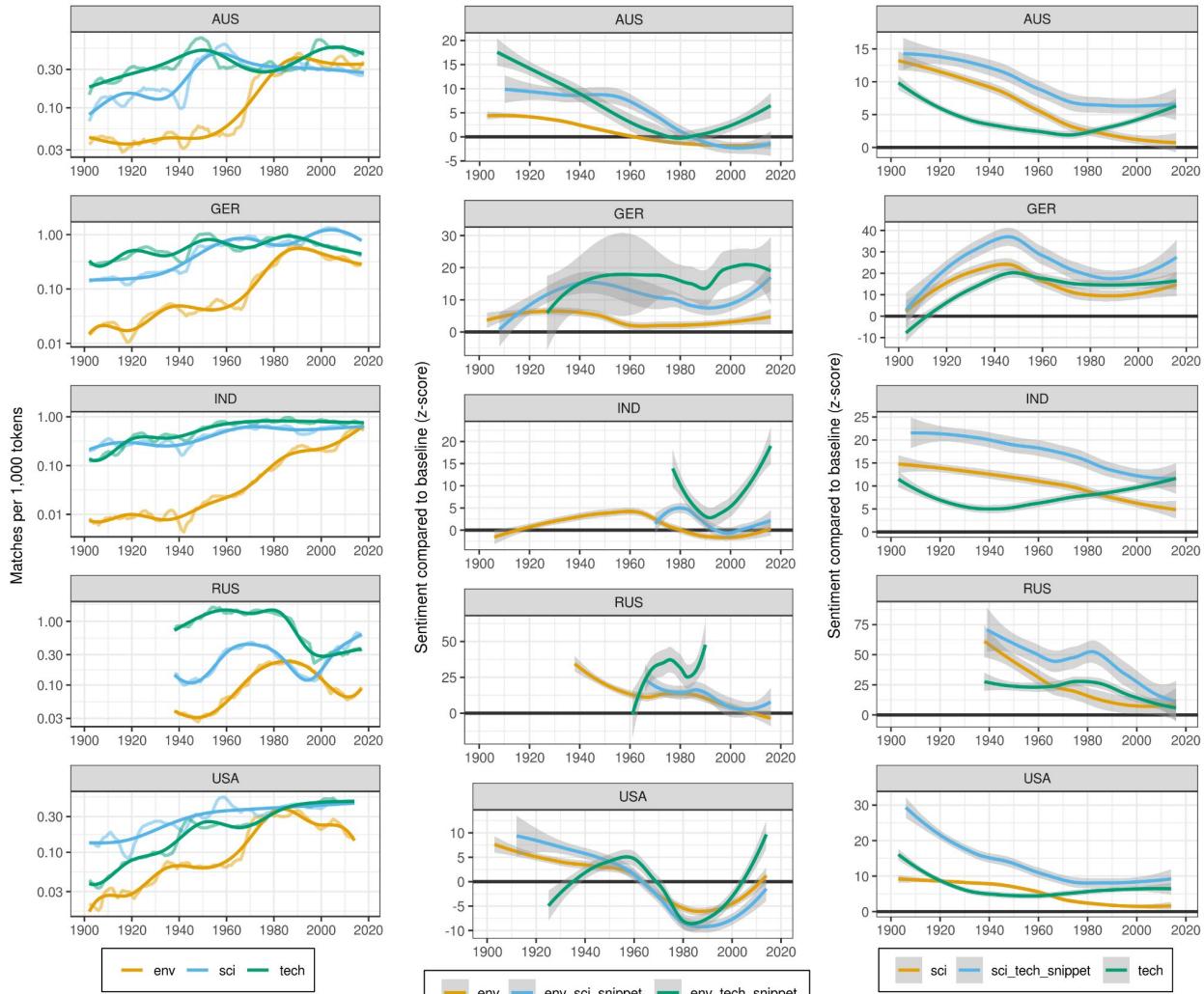




# Ideas

## Some results

- Environment emerging in 1960-70s in all countries (neg attitudes often)
- Sentiments on technology stay positive, science a bit more cautious

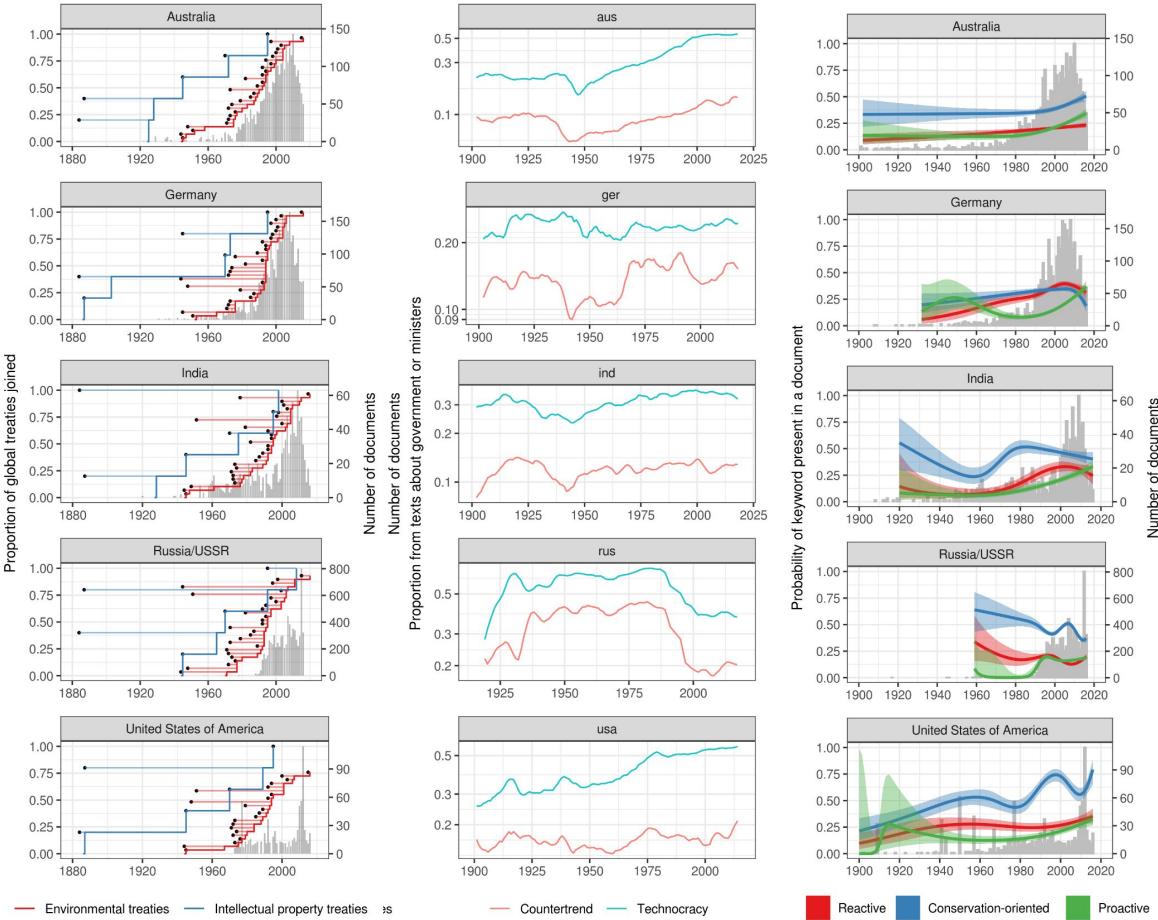




# Institutions

## Some results

- IP treaties precede env. ones - growth in 190s
- Proactive legislation gaining momentum in 2000s



— Environmental treaties    — Intellectual property treaties    — Countertrend    — Technocracy

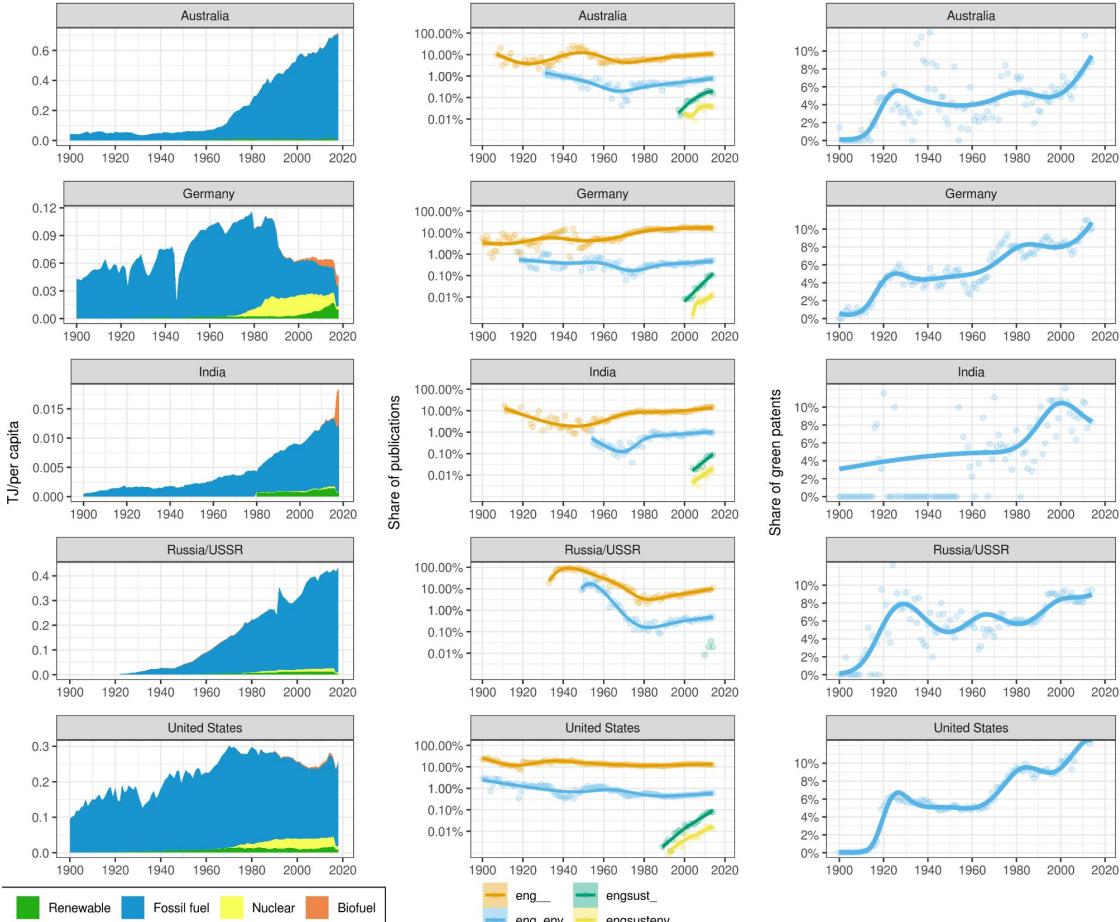
— Reactive    — Conservation-oriented    — Proactive



# Practices

Some results

- Fossil fuels dominate (some hope in Germany)
- Sustainability emerging in engineering papers in 2000s
- Many early green patents (some classification issues too), new wave of green patents in 2000s



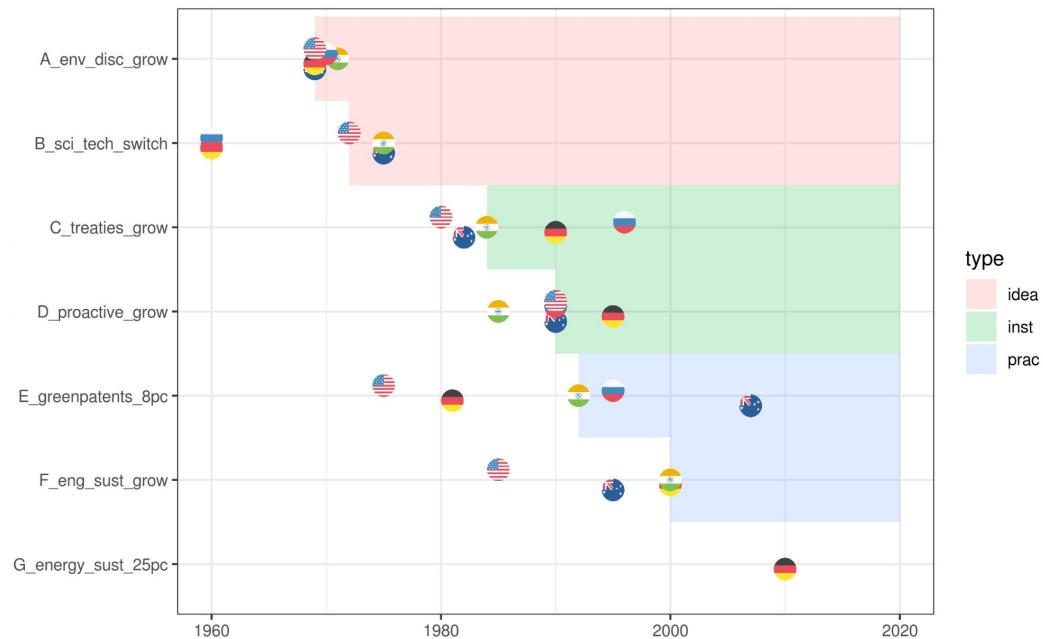


# Notable transitions

Some results

- Ideas: environmental discourse grows in 1960-70s
- Institutions: growth in laws/treaties 1980-90s
- Practices: sustainability in research and patents 1990s
- Ideas -> institutions -> practices ?

Not much caution on technology, fossil fuels going strong





# Discussion

Distinctions from theoretical insight can be hard to map into data.

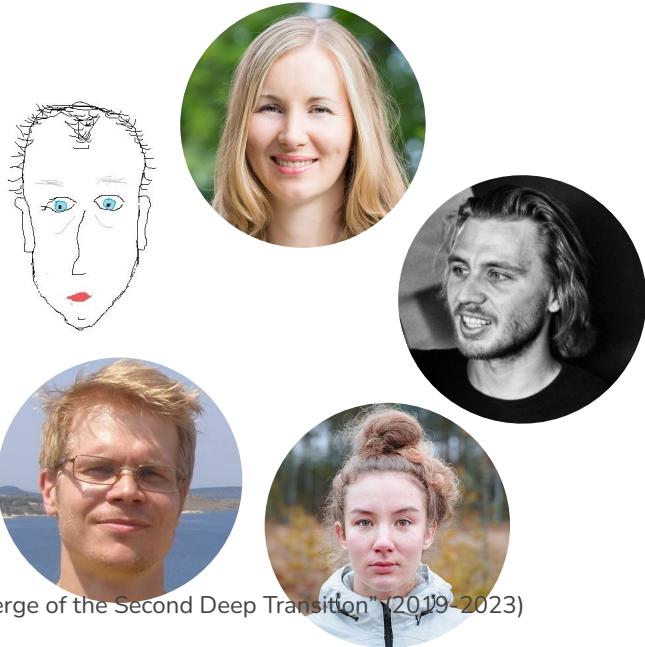
Change in culture happens due to many reasons at the same time (most of which can be difficult to track). Here, only used descriptive indicators, simplified and abstracted.

Historical digitized newspapers allow research to previously inaccessible eras.

Text is a detailed record of the ideas and practices, but it is unstructured. Requires steps to get a good measurement, simple tools may work, but validity, robustness need systematic steps probably.



# Thank you



“Reshaping Estonian energy, mobility and telecommunications systems on the verge of the Second Deep Transition” (2019–2023)  
University of Tartu, Estonia.

Thank you