The sustainability transition perspective applied to aviation

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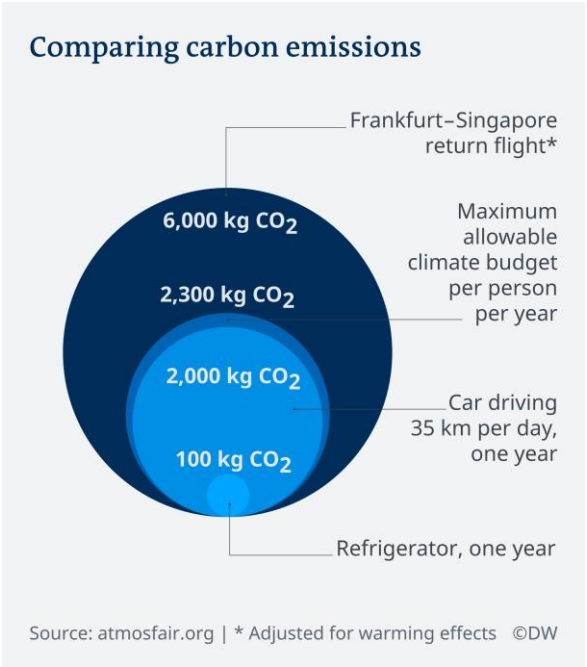


Overview

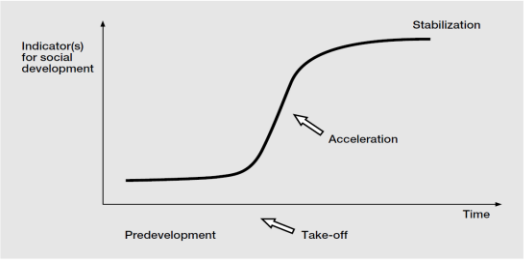
- What's behind the interest in transitions?
- What are transitions?
- Key elements of the transition perspective
- An exemplary transition analysis: the transition from horses to automobiles
- What does it add?

Background

- The notion of transition came up in discussions about unsustainable systems in late 90s
- It is used as a concept for policy in the Netherlands (8 transition platforms in the area of energy + interdepartmental cooperation)
- In NL we had a big research programme on system innovation and transitions (20 mln euro)
- Transition researchers interact with practitioners about transition experiments

The transition story line

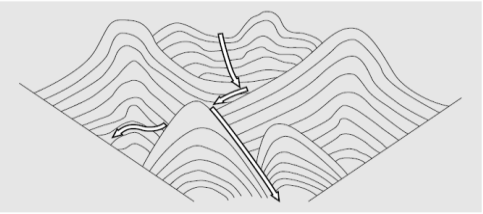
- For dealing with *persistent* problems (such as animal disease epidemics, climate change, transport problems related to car use) one needs alternative systems of provision and consumption (system innovation)
- The *shift* towards to a new system is a transition



- The transition perspective is a **useful organiser for thinking about systemic change** *with inherent sustainability benefits* (by making people think about alternative systems, pathways, possible steps; it helps to take useful short-term actions for long-term change)
- The perspective may be used to **evaluate policy**: whether it is contributing to merely a greening of unsustainability trajectories, or contribution to a creating of a regime shift / transition?

The transition perspective sees change

- Occuring in a sociotechnical **landscape**
- in which there are **regimes** with associated practices, technologies, actors and institutions
- And **niches** (domains with new or old practices, products, actor configurations)



Regimes consist of

- Dominant practices (at supply and user side)
- Dominant ways of looking and thinking
- Knowledge systems and technologies
- Product designs

that are being **reproduced** & build upon

In the aviation regime we have

- Kerosine powered airplanes
- Cheap air travel competing with trains and cars
- Untaxed fuels
- Cultural acceptance of flying (until recently)

The landscape consists of the wider context consisting of

- Roads, towns, cities, ..
- Values, beliefs, norms, ..
- Aspirations and concerns of people
- Political associations,
- Prices, taxes, ..
- Life styles
- …

Examplary analysis

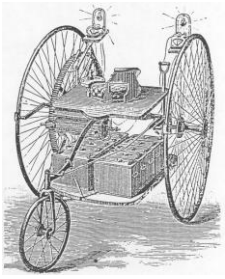
The transition from horses to cars as a co-evolutionary multilevel process

Emergence of automobiles in niches

<u>3.1. Electric vehicles:</u>

a) Light tricycles

b) Heavy coaches



EV used in:

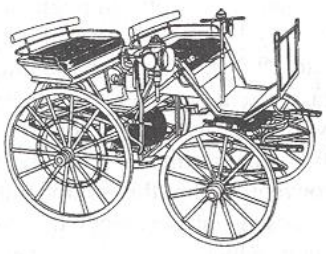
- Parks, promenading
- Taxi-niche (EVC, 1898-1902)
- Speed racing
- Long-distance racing (failed)

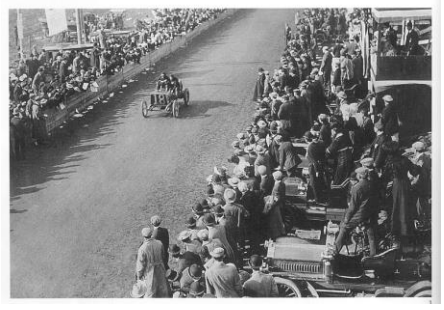
Bron: presentation Frank Geels in Maastricht, 2007

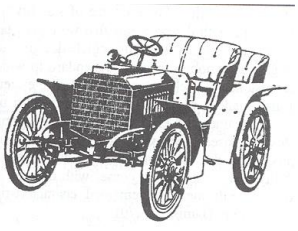
<u>Gasoline cars, used in:</u>

a) racing

b) touring (adventure, practicing health, repair skills)



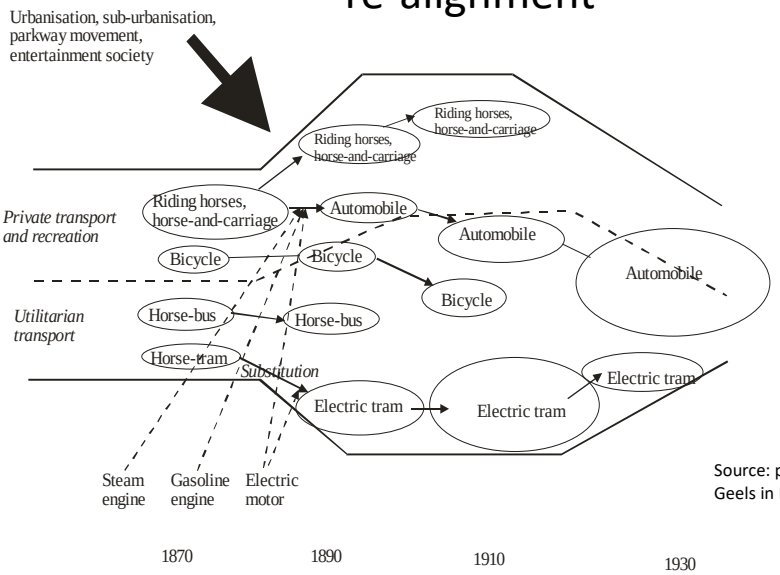




Build on: petrol infrastructure, repair network, cultural enthusiasm

Bron: presentation Frank Geels in Maastricht, 2007

Wider transition path: De-alignment and re-alignment



Source: presentation Frank Geels in Maastricht, 2007

Take home points

- **Innovation diffusion** is not a simple process of substitution (filling a bottle)
- It includes many actors (beyond users/adopters)
- User characteristics and environments are not known in advance, but **co-evolve** during the technological diffusion process, and
- **Societal embedding is full of choices and struggles** that affect the directionality and thus shape of socio-technical systems

Source: Kanger et al. (2019) Technological diffusion as a process of societal embedding: Lessons from historical automobile transitions for future electric mobility, *Transportation Research Part D* 71, 47–66

Key theoretical assumptions

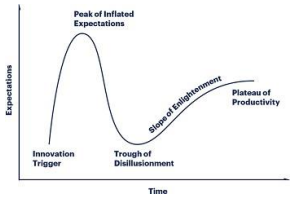
- Technologies **co-evolve** with users and institutions
- Novelties emerge in **niches**, some novelties break out
- Landscape pressures and the pressures of alternatives leads old regimes to fall apart or to get transformed
- New regimes get created in a **top-down & bottom-up** manner (helped by landscape developments)
- Transitions are the outcome of multilevel processes

In transition studies we look at

- Niche developments (all over the world)
- Regime actors' strategic games
- Landscape developments
- Retrospectively, and prospectively

Transition patterns identified in transition studies

- Fit-stretch developments
- Hybrid forms (example of Prius)
- Peak-Disillusionment Cycles
- Cartels of resistance falling apart
- Finance and government policies shifting to niche alternatives (moving away from regime-improving options)
- Waiting games followed by innovation races
- Social embedding (cultural acceptance, institutional arrangements for niche innovations)



Sustainable aviation from a multilevel perspective

Landscape pressures	Paris Climate Agreement of 2015 Flying shame Opposition to airport noise CO2 emissions from air travel being part of ETS Discussions about jet fuel tax and air travel tax (F and NL) Criticisms of short distance flights as being unnecessary flights
Regime actors initiatives towards sustainable aviation	Carbon Offsetting and Reduction Scheme for International Aviation, or CORSIA, to stabilise CO2 emissions at 2020 levels xxx
Disruptive (niche) alternatives	Fast trains Holidays without air travel Electric planes Hydrogen planes Helicopters and flying cars
Non-disruptive niche alternatives	Bio-kerosine CO2 offsets

Norway's plan for a fleet of electric planes in 2040

- Why Norway?
  - Many short-haul flights (towards off-shore islands and in mountainous areas)
  - Snowed and iced roads dangerous for cars
  - People in Norway are environmentally minded

Bio-kerosene initiative of KLM

- Bio-kerosene factory of 250 mln euro in Delfzijl
- From Amsterdam already bio-kerosene flights to LA and Oslo
- KLM is counting on government subsidies
- CO2 reductions have economic value
- Public Relations
- Appeal to green consumers (making them opt for KLM instead of other carriers)
- …

A regime NOT under treat

- No disruptive alternative posing a threat
- People will keep flying in large numbers (with some opting for CO2 compensated lights and flights with battery electric & hydrogen powered airplanes
- Current growth in air travel creates problems for the air liners (KLM wants to get rid of 30 minute flights from Schiphol to Brussels)
- But the money from CO2 compensation, jet fuel tax and air travel tax can be used to fund energy transition projects (which is how aviation can make a contribution to the energy transition)