

Transport Systems in the digital revolution

Inaugural lecture Francesco Corman



I love travelling



in an

16

Everybody likes travelling

Google	H	Q
	i like	
	i like travelling	
	i love travelling	
	i like reading books	

Press Enter to search.

- Weather
- (Public) transport
- Politics
- Sport, especially national team
- (slow wifi)
- Food
- Partners
- Neighbors,
- Noise, ...etc etc

[Google; ThoughtCatalog; Telegraph]

Core messages of today

- Time machines do not exist
- Digitalization is innovative
- Transport systems are necessary

Those three statements are false.





Transport systems are not necessary

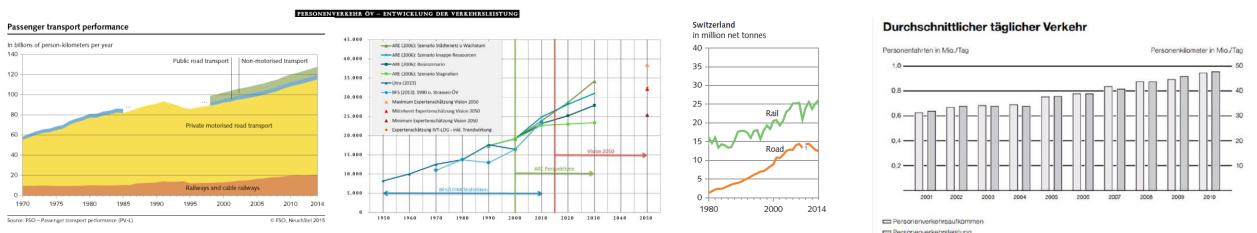
Transport systems have been very useful so far

- The seats
- The screen
- Your clothes
- The food waiting outside, including the coffee and the sweets
- You



Economic impact of transport systems

- Total annual turnover ≥120 bn. CHF (~20 % of CH GDP)
- Total Estimated number of jobs > 250'000 (≥5% of Swiss employment)
- Public transport ≥12 bn CHF turnover, 33'000 jobs
- Share of final energy demand of the country: 34%; of CO2: 46%





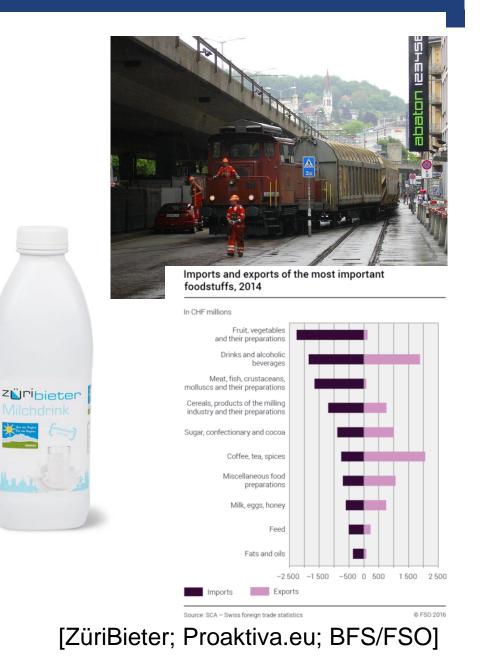
[Boulouchos, 2018; BAFU 2017; VademecumStrasseschweiz, 2018; Automotive Industry Switzerland, Swiss CAR, Vision Mobilität Schweiz 2025; ETH Zurich, 2008; BFS Aktuell, 2017]

Transport systems are not necessary,

 ..But they are very useful, if we want to keep our lifestyle

In that case,

- Infrastructure is necessary
- Organization is necessary
- Funding/economic support is necessary
- Public acceptance is necessary
- how to do that? Research might help



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Digitalization is not something innovative

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How would you describe this weather?







[Ansa; VacationIdea/JFL Photography/Fotolia]

What digitalization entails

- Store data
- Retrieve data
- Communicate data (without significant loss)
- Analyse, visualize
- Replay situations as described by the available data replicate
- Determine how situation might occur again in the future predict
- Find alternative ways to deal with a replayed situation improve

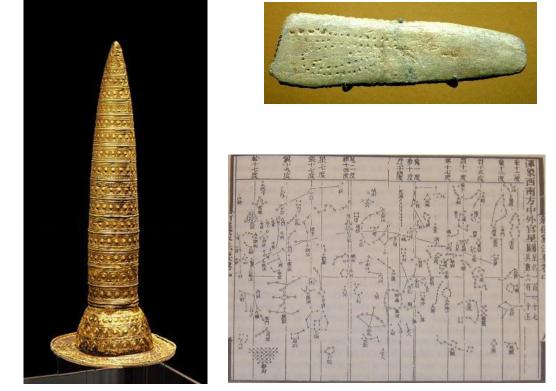


Sky/Weather has been a first key thing to measure and compute

Bone sticks from Africa and Europe, possibly as long ago as 35,000 BC are marked in ways that tracked the **moon's phases.**

Golden Hats (Bronze Age, 1000 BC) are a kind of calendar used to calibrate between the **lunar and solar calendars**, including summer and winter solstices. Su Song (1010-1020 AD) .. created a **celestial atlas** in five maps, which had the hour circles between the xiu forming the astronomical meridians, with stars marked.





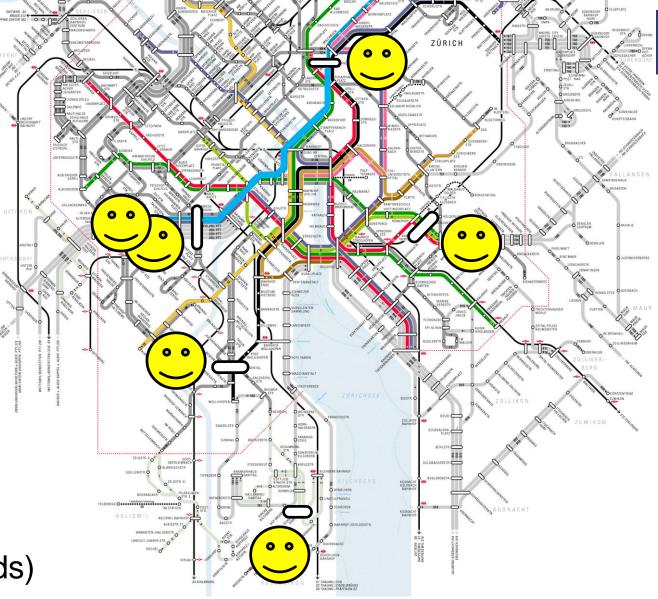
During the 1940s and 1950s, JPL used the word "computer" to refer to a person rather than a machine The all-female computer team, many of the members recruited right out of high school, were responsible for doing all the math by hand required to plot **satellite trajectories** and more.

EHzürich

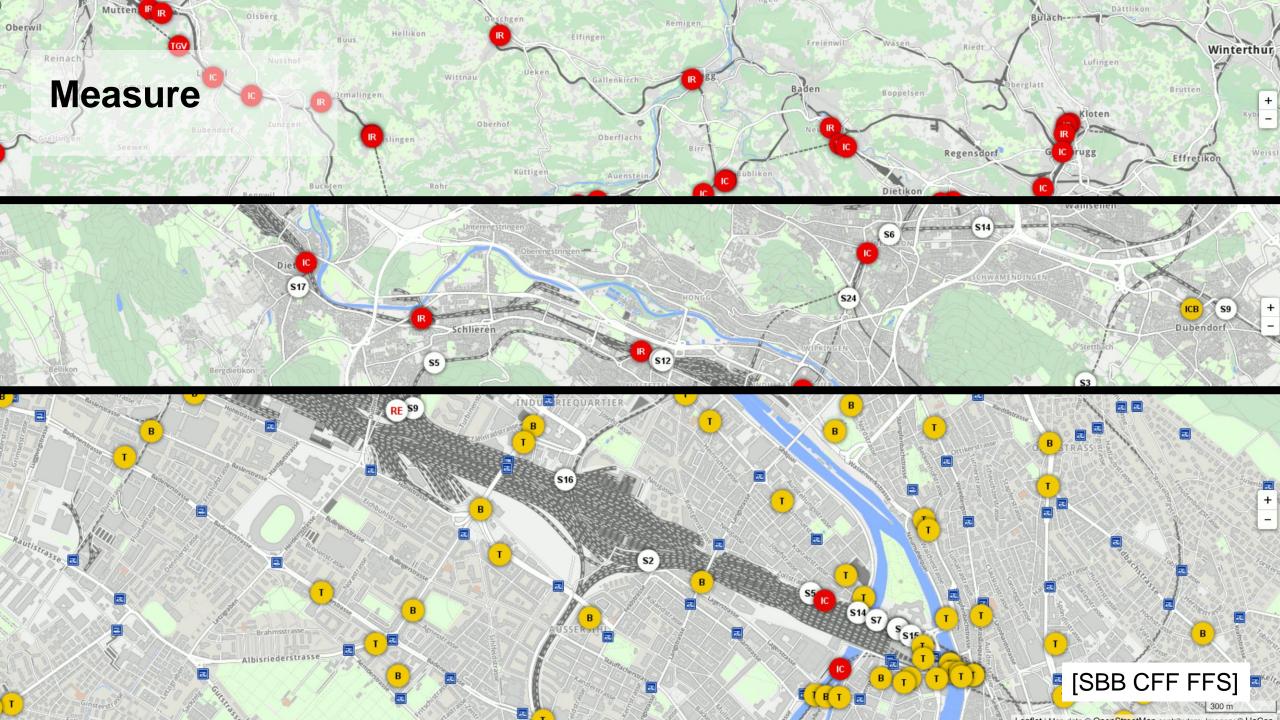
What a transport system is

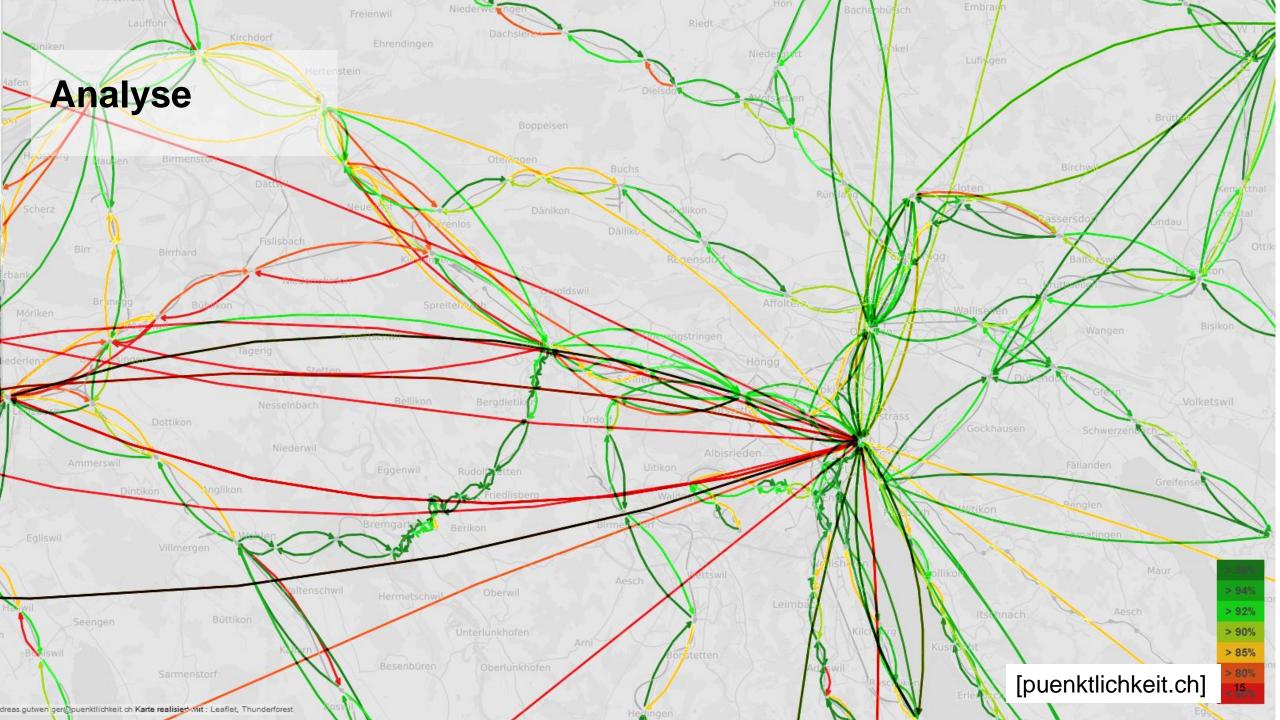
- Demand
- \rightarrow stop planning,
- \rightarrow line planning,
- \rightarrow to timetabling,
- Measuring/Computing

 network structure,
 vehicles movement
 object of movement (people or goods)

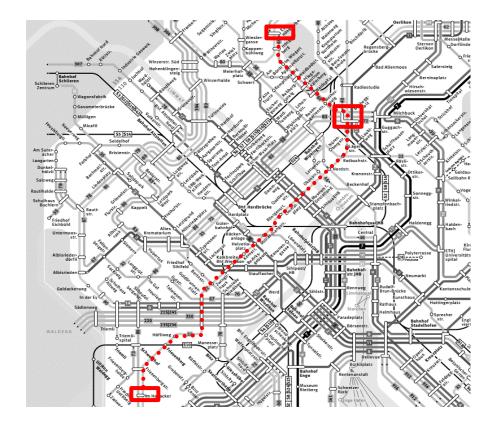


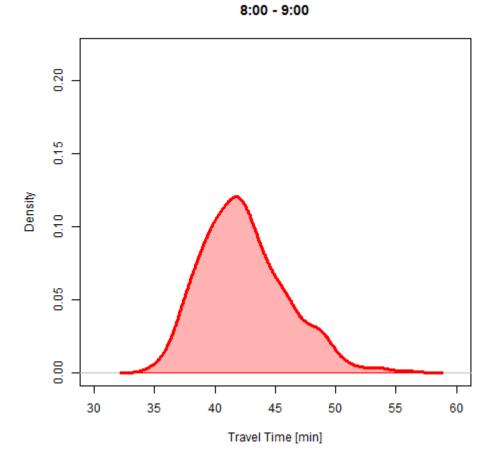






Understand

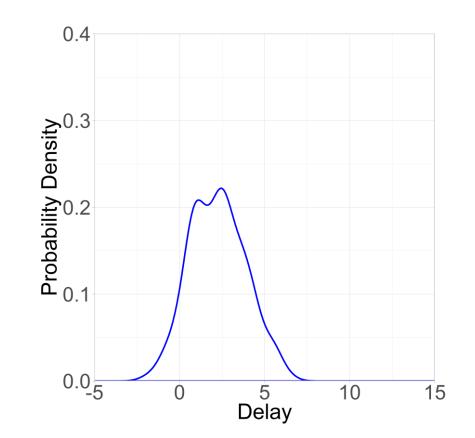




[Büchel, SBB Data]

Predict





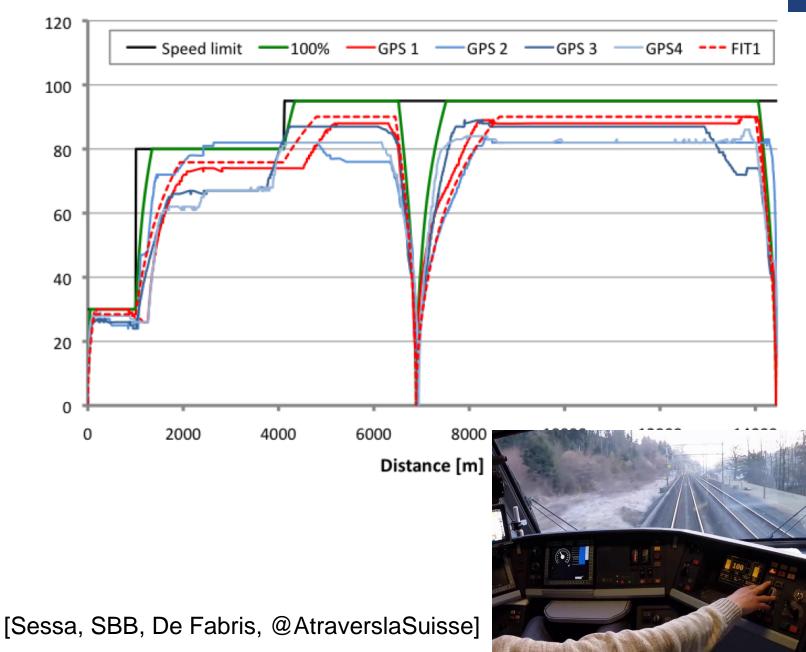


Destination Station [Marra, TrafikVerket Data]

Improve

Vehicles

Speed, trajectory planning

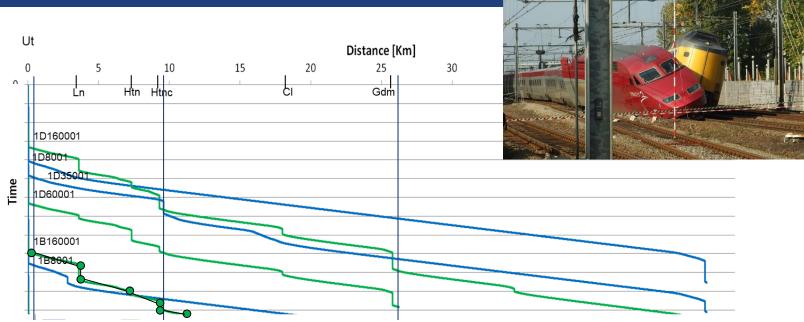




Improve

Vehicles

- Speed, trajectory planning
- Interaction, Traffic control



 $run_{xy} dwell_y t_y$



[Corman et al, Wikimedia]



Improve

Vehicles

- Speed, trajectory planning
- Interaction, traffic control

Commodity

Multi commodity, capacity





[Corman et al, Keystone/Swissinfo]

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	[SBB]			

Digitalization is not innovative...

- We use digitalization since forever
- Digital information is much easier to store access and communicate
- But what we can do know is that is even easier to analyse, compare correlate, predict and optimize
- This trend of increasing digitalization, and increasing expectations on performance from it, is getting faster and faster
- Transport systems can benefit a lot of it





Time machines exist



Time, movement, time machines, teleportation

- Type-A time machines: they can go in the future
- Type-B time machines: they can go in the past
- ZHNΩN



Zeno

Augustine



Ready?

Time machines exist...

- But of a very sloppy type
- What is needed is not to transfer your current self in the future; is to exploit them little time we have in our lives to act.
- So a time machine is not what you want to use.
- Mix research and industry, deliver scientific and practical value







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