

*EARLY WARNINGS
ARISING UNCERTAINTIES TO BE TAKEN INTO ACCOUNT*

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TNO innovation
for life

CONTENT OF THIS PRESENTATION

- › Disruptive innovations and forecasting issues
- › How to identify and assess upcoming changes
- › Examples of an assessment of use of new business models and automation for transport services
- › Approach to reduce uncertainty

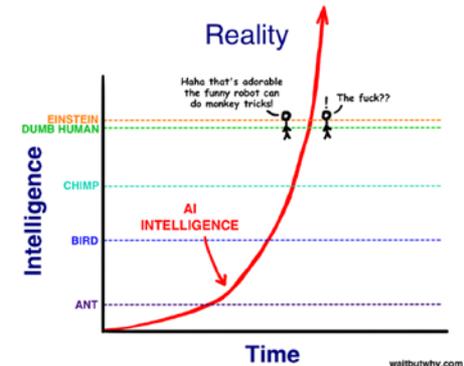
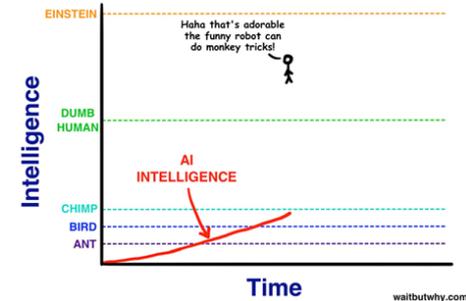
Reference papers:

- › Ming Chen (TNO), '*Impact of disruptive innovations on road transport strategy*', HVVT15 Conference ,3-10-2018, Rotterdam
- › Ming Chen, Hans Quak, Isabel Wilmink, Jaco van Meijeren (TNO), '*Paradigm shifts by multimodal user oriented transport services and platforms*', EARPA FORM Forum, 17-10-2018, Brussels

DISRUPTIVE INNOVATIONS

- › an innovation (or technology) is either disruptive, or not disruptive.
- › disruption is an outcome of an evolution of the impact of the product or service over time.
- › Impact on markets:
 - › affects firms in the way they produce products or services,
 - › it affects consumers in the way they use products or services
 - › the actors that have adopted the innovation will ultimately dominate the market
- › Impact on non-markets (public)
- › delivery and / or use of the product/service is dominated by the respective innovation.

Our Distorted View of Intelligence



EXAMPLES OF FORECASTING ISSUES

› Changing patterns:

- Speed of innovation and market uptake > acceleration historical trends
- Radical productivity improvements > saturation of demand, reshoring
- Asset driven economy > decoupling GDP–labour growth, growing inequality

› Adjusting assumptions:

- Policy driven innovations > energy transition & climate policy (the price is right?), decision major economies India and china (market economy assumption?)
- New market players disrupt (Tesla, Uber, Lyft,...) > Who are the stakeholders of the future?, stakeholder consultations?

EXAMPLES OF FORECASTING ISSUES (2)

› Unpredictable (with traditional models):

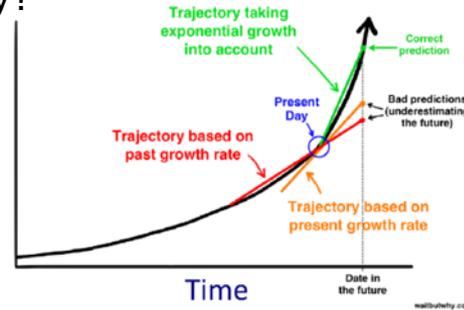
- Automation production and services > disappearing and upcoming activities, geographical locations?
- New mobility & logistics services/concepts > When market introduction?, speed of uptake?, maximum market share?, new systems structure?
- Economical race to the bottom (labour as costs) > limits to labour cost reduction?, inequality?, acceptance?

› (Traditional wild cards:

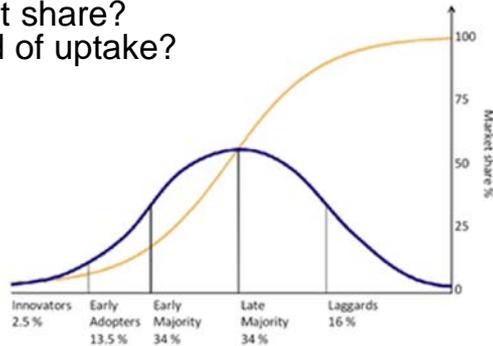
- War
- Natural disasters
- ...)

FUNCTIONS - DETERMINING DIRECTION...

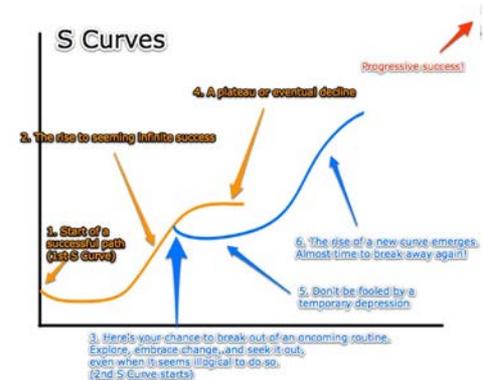
Historical trends can hide the actual direction... What is your theory?



Impacts are finite...
Market share?
Speed of uptake?



Transition pathways...
What is your vision?
What is your strategy?



INCREASING UNCERTAINTY.....?

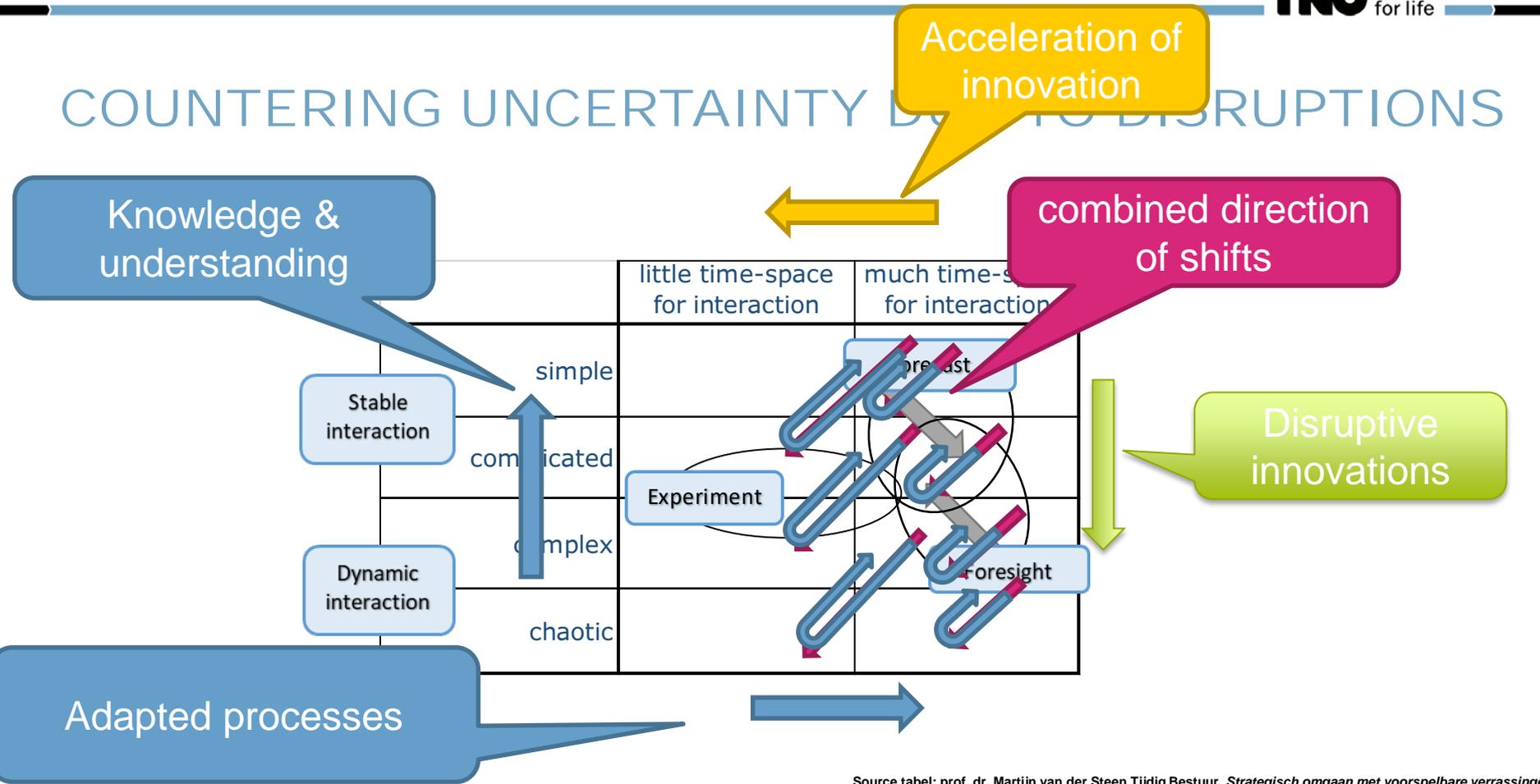
Will we behave more chaotically?

Or can we break up the uncertainty into solvable problems:

- › Methodological paradigm shift - Future structures different than in historical data
- › Competing technological options....
- › Lack of understanding of new and disruptive developments....
- › Lack of insight in derived changes from foreseen disruption....

=> A temporal problem?

COUNTERING UNCERTAINTY BY PROACTIVE DISRUPTIONS



UNDERSTANDING: 'MIRACLES' & PARADIGM SHIFTS – NEW SOLUTIONS, NEW SITUATIONS

	tragedy	problem
undesired outcome	yes	yes
solution available	no	yes



Innovations may turn tragedies into problems – (a miracle....)

	tragedy	problem
aware	adapt	solve
not aware	frustration	risk



Not solving a 'former tragedy' will not be accepted

	tragedy	problem
aware	adapt	solve
		risk

	tragedy	problem
aware	adapt	solve
not aware	frustration	risk



Solving a problem may lead to new problems and/or tragedies

DIGITALISATION VS DIGITAL TRANSFORMATION

- › Digitalisation – automation of current organisation
- › Digital transformation – taking full benefit of automation by removing redundancies in organisation

Note: Incremental changes with current stakeholders > digitalisation

JEFF BEZOS' (CEO AMAZON) BUSINESS APPROACH

Obsession for clients/society

- Create a 'magical' experience
- Accept that there will be failures

Sceptical about protocols

- Adapt the rules if it stands in the way of something good

Open minded for external trends

- Embrace new possibilities; do not try to resist

Fast decision making

- No standard decision making process but dedicated to the specific case (as light as possible)
- Do not wait for full information, but adapt later if needed (slow decisions will be more expensive)
- Aim for commitment rather than consensus

	tragedy	problem
undesired outcome	yes	yes
solution available	no	yes

Innovations may turn tragedies into problems – (a miracle....)

NEW BUSINESS MODELS...

	tragedy	problem
undesired outcome	yes	yes
solution available	no	yes

Innovations may turn tragedies into problems – (a miracle...)

Business model components (Tim O'Reilly) and impact on transport system:

- **Information instead of material:** Vehicle sharing, reduced stocks,... > lower prices
- **Deliver a magical user experience:** Personal treatment, no redundant actions, fully informed, combined services,...
- **On-demand service:** (only) available when it is needed
- **Network platforms:** Information accessibility, availability
- **Coordination by algorithms:** Increased reliability and flexibility (for majority users), real time, ...
- **Employees supported by technology:** High service requirements, personalised information and solutions
- **On-demand asset and labour management:** Reduced business risks

PRACTICAL IMPLICATIONS OF NEW BUSINESS MODELS

- › Significant cost reduction and service improvement > disruptive
- › The platforms set the rules
- › Workers (where still needed) are easily replaceable
- › Ownership of assets is avoided where possible
- › Availability of real time and integrated information is a key requirement (which is easier to do without cooperation....)
- › Tendency towards a few large (global) players dominating the market

	tragedy	problem	
aware	adapt	solve	
	tragedy	problem	risk
aware	adapt	solve	
not aware	frustration	risk	

Solving a problem may lead to new problems and/or tragedies

DIGITAL TRANSFORMATION BY SAE LEVEL

› Level 3 :

- energy/cost saving by platooning

› Level 4 :

- labour cost saving (can be -50%!)
- (virtual) level 4 network
- rise of hub-hub services (platforms)
- **Potential shift freight to road from other modes**

		tragedy	problem
aware		adapt	solve
	tragedy	problem	risk
aware	adapt	solve	
not aware	frustration	risk	



Solving a problem may lead to new problems and/or tragedies

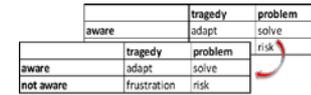
› Level 5 :

- automated city distribution service (platforms)
- rise of mixed passenger/freight services
- **Potentially congested urban areas**

TRANSFORMATION PASSENGER MOBILITY

Market potential of PT mobility options with level 5 automation (future);
5=high potential, 1=low potential

services	urban	inter-urban	rural
On demand car	5	3	2
on demand bus (different sizes)	3	2	4
scheduled bus	1	3	
tram	3		
metro	3		
train		4	1



Solving a problem may lead to new problems and/or tragedies

PROCESS OF UNCERTAINTY REDUCTION

Broaden:

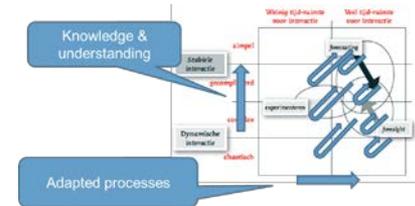
- › Identify upcoming innovations (all sectors)
- › Monitor and assess cross sectoral (disruptive) developments and impacts

Generalise:

- › Identify similarities and generalise observed impacts

Reduce (Possible > likely > realistic future) :

- › Boundaries to the system (saturation demand, resource availability, etc)
- › Determine key drivers for uptake of innovations:
 - › Business benefits
 - › User benefits
 - › Barriers for implementation
- › Determine relative likelihood/benefits of alternatives (high if business + user benefits)
- › Assess required mitigating measures and acceptability (Climate, energy, inclusiveness, labour ...)
- ›



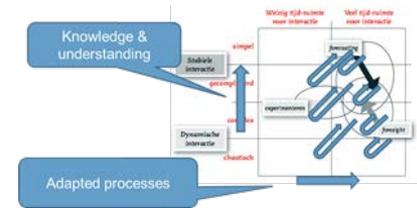
PROCESS OF UNCERTAINTY REDUCTION

Algorithms will determine outcomes:

- › Use algorithms as ‘reliable agents’ in modelling
- › Get control on the Algorithms

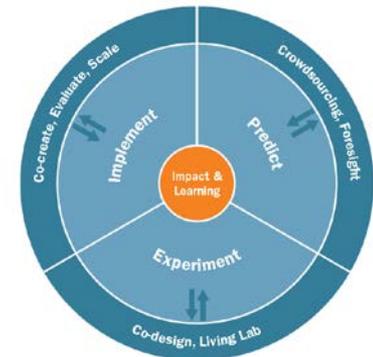
Anticipating governance (adapted processes):

- › Vision (know what you want or get what you do not want...)
- › Solve problems before they could arise (so also know what we do not want....)
- › Accept that mistakes will be made:
 - › Monitor developments
 - › Create flexibility in policy implementation
 - › Simplify decision making processes (faster and dedicated)



RELATED TNO INITIATIVES

- › Impact assessment of disruptions:
 - › Mobility/MaaS
 - › Logistics
- › Early Research Program Innovation Outlook
- › Early Research Program Wise Policy Making
- › Policy Lab



A nighttime photograph of a city street. On the left is a multi-story brick building with many windows. On the right is a modern building with a curved facade and many lit windows. A long-exposure light trail of a green vehicle is visible, curving across the middle of the frame. A white horizontal line with arrowheads at both ends is positioned across the bottom of the image.

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