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Digital Twins in environmental governance & the human in Digital Twins

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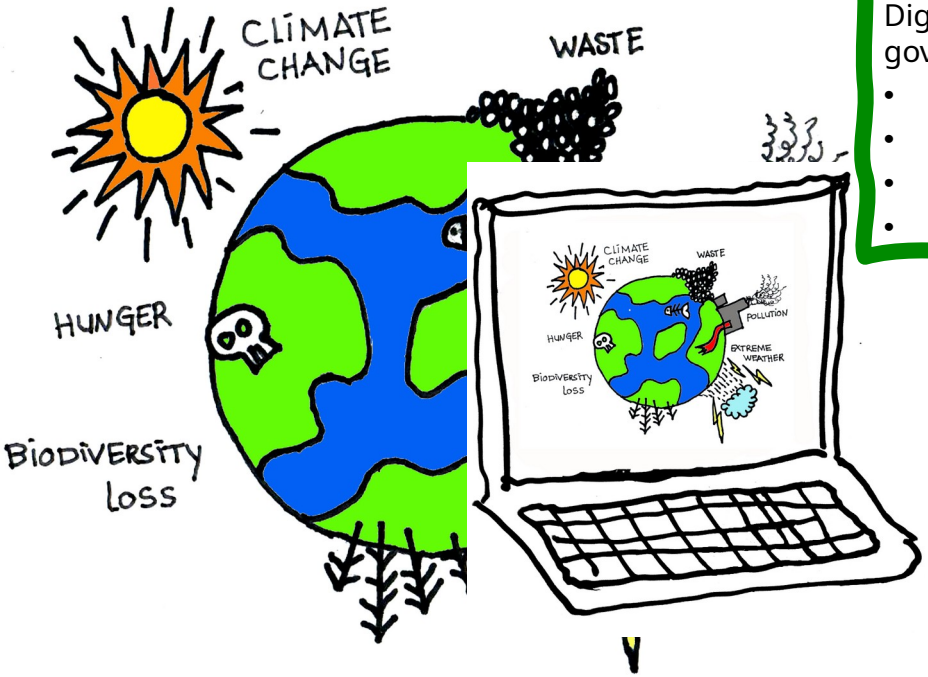
Background Paulan

Background in philosophy of technology, law, and art academy.

Lifelong interest in the materialisation of information: how does the medium affect the message?

Focus on the politics, power relations, materialities and narratives involved in information production processes and infrastructures.

Since 2020: research Digital Twins for environmental governance @ Environmental Policy Department, Wageningen University, the Netherlands.



Digital Twins in environmental governance

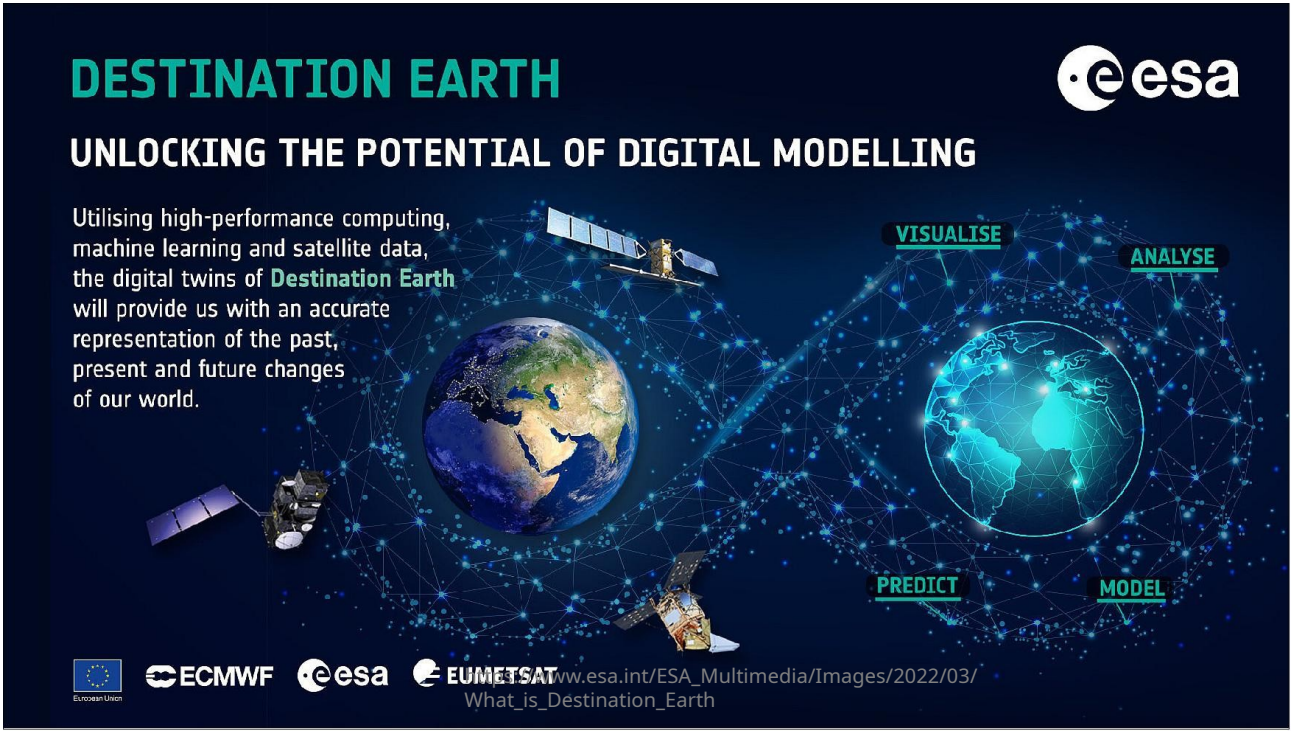
- Monitoring
- Predictions
- Recommendations
- Automation of interventions

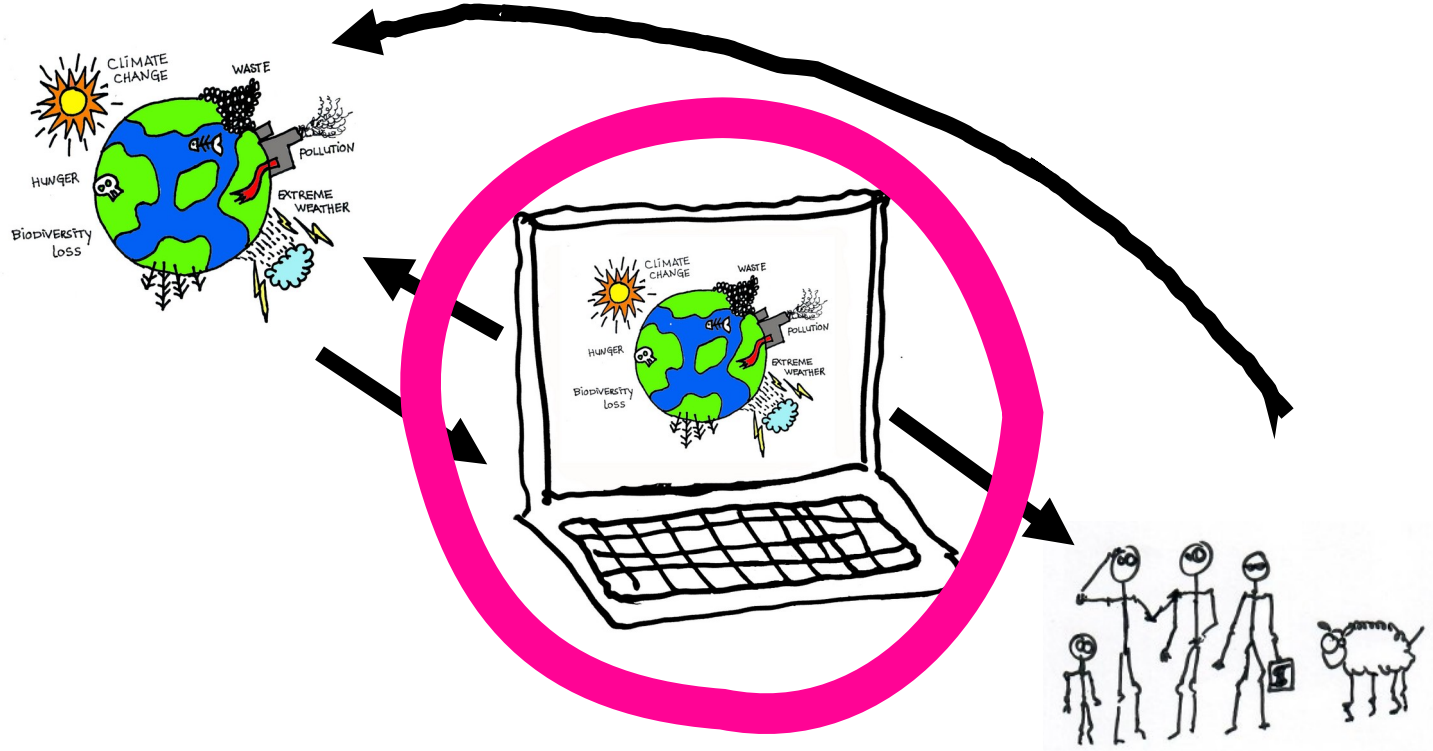
Example: digital twin city

3D map of the city where buildings can be added/removed.

Include citizens in exploring the implications of change (e.g., implications of building and tree shade for heat stress and solar panels).

Example 2: Destination Earth





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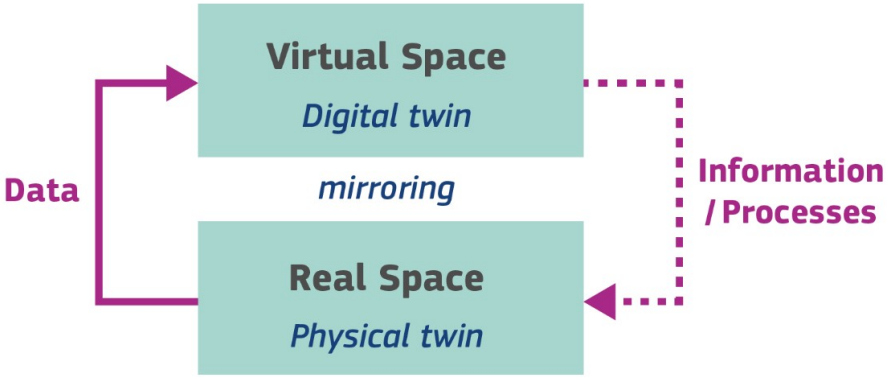
Digital twins: common conceptualisation



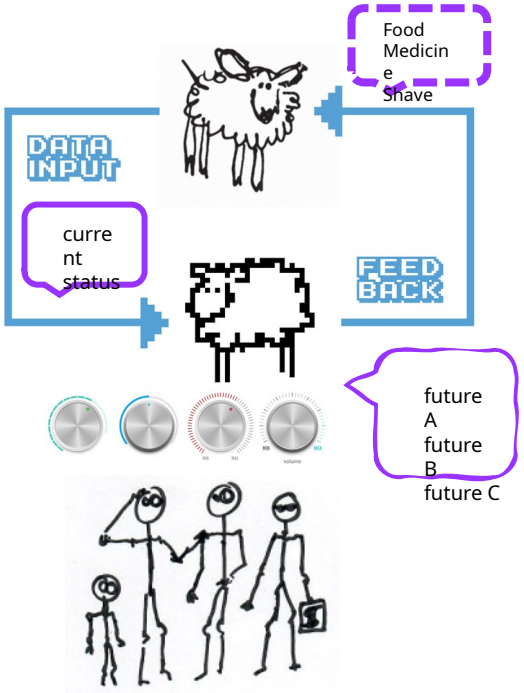
https://digital-strategy.ec.europa.eu/en/library/destination-earth

The idea is that a Digital Twin is a highly accurate - often framed as "realistic" - digital model (or set of models) that mirrors a specific physical twin as it changes and offers actionable information by means of predictions and simulations.

Reconceptualising Digital Twins: ‘maps’ for navigating future change

Digital Twins guide decisions and automated processes:

- Insight into influence of diverse factors
- Finding problems before they occur
- Scenario testing
- Showing possible futures and how to reach them



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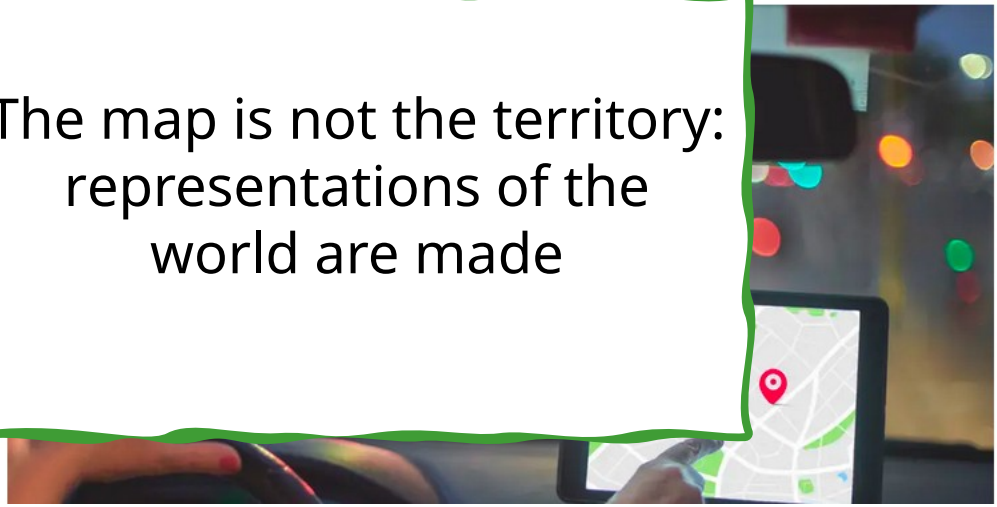
The map is not the territory: representations of the world are made

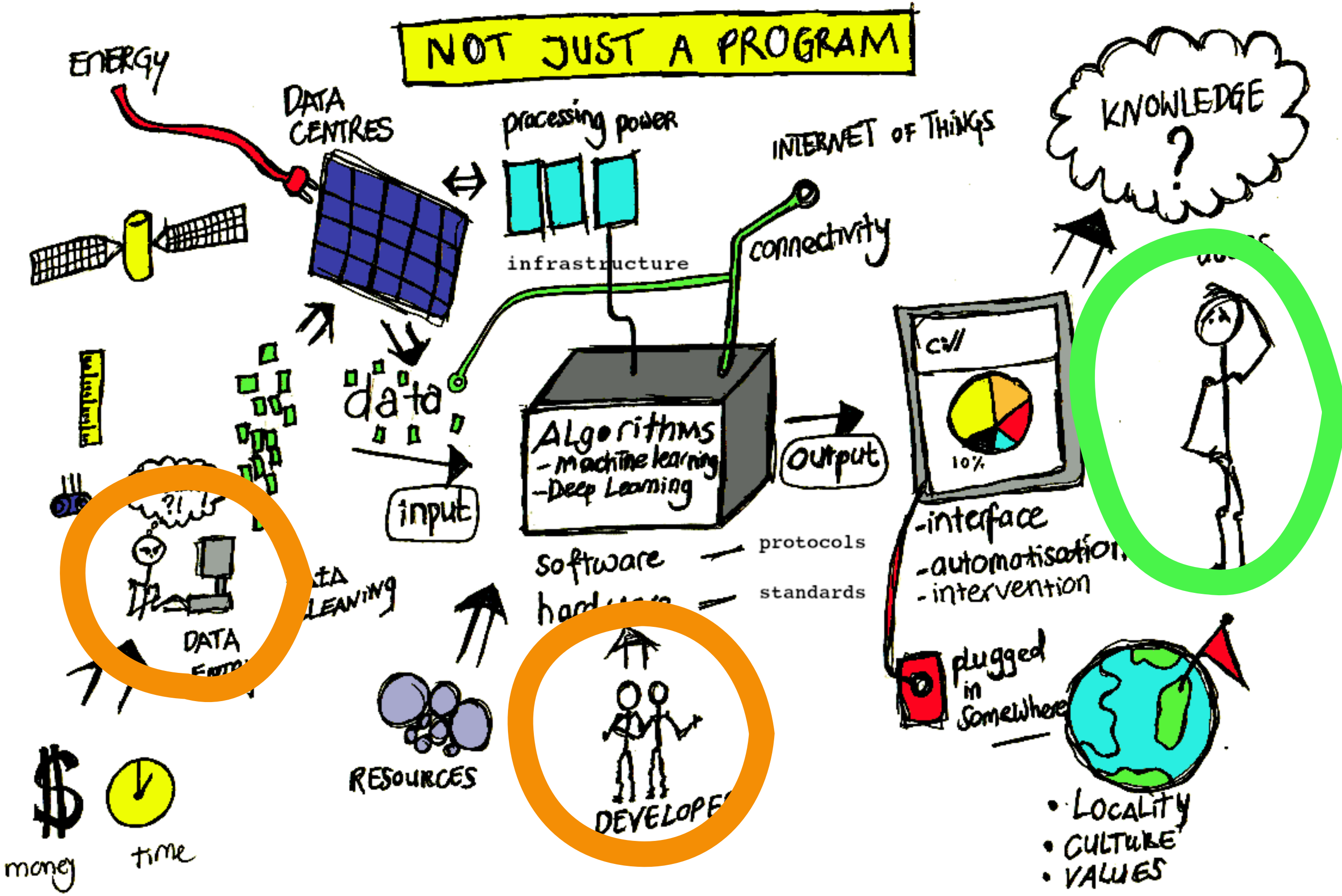
NEWS

Tourists in Hawaii followed their GPS and drove their car straight into a harbor: 'Pretty sure that was not supposed to happen'

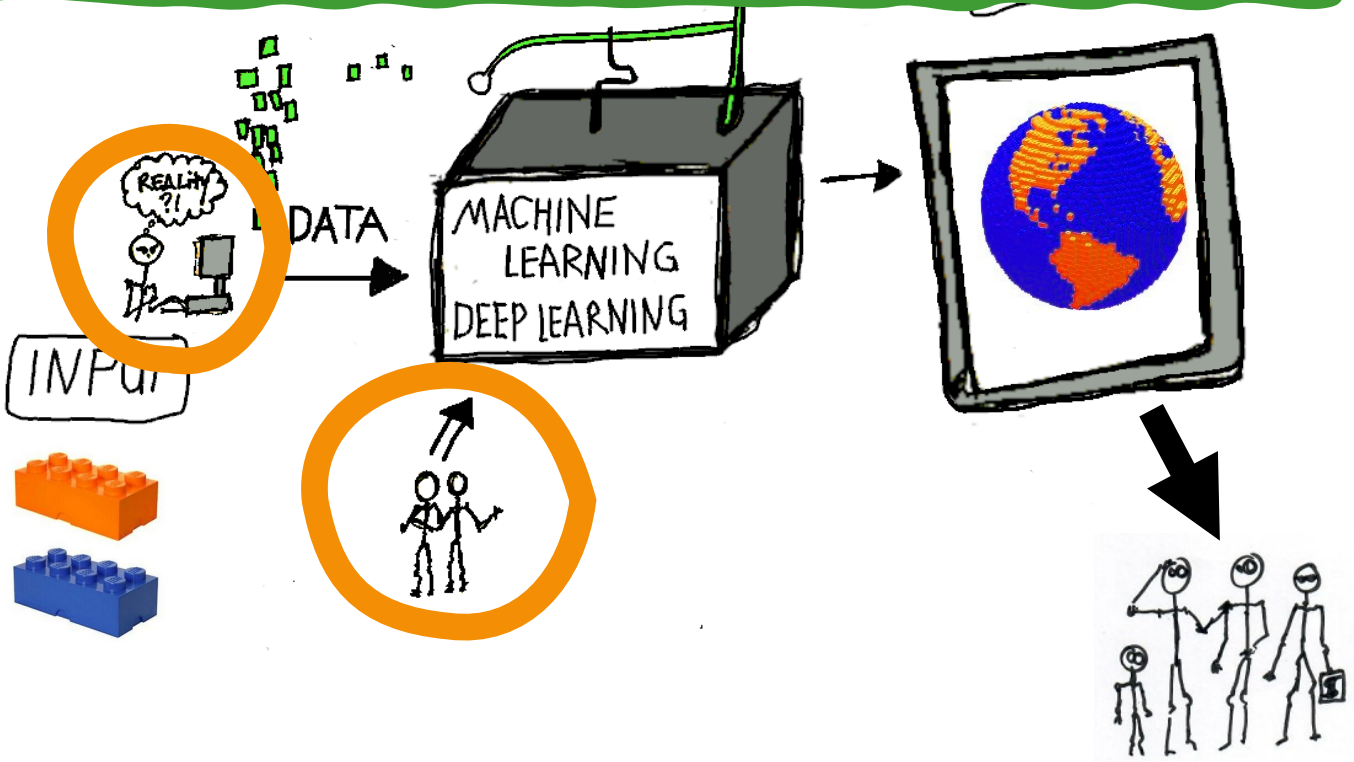
Aditi Bharade May 3, 2023, 10:21 AM CEST

Share | Save




NOT JUST A PROGRAM
ENERGY
DATA CENTRES
processing power
INTERNET OF THINGS
KNOWLEDGE ?
infrastructure
connectivity
data
input
Algorithms
-machine learning
-Deep Learning
output
10%
-interface
-automatisation
-intervention
software
protocols
standards
plugged in somewhere
DATA
RESOURCES
DEVELOPE
money
time
• Locality
• CULTURE
• VALUES

DT design shapes the boundaries of ‘map’ to navigate the future



Locked in representation

- Digital Twin is made →representations always entails a focus on an entity or selection thereof: political choice materialised in data and parameter selections.
- Choice to twin reveals a problem perception: physical twin as 'problem' → sense that something needs to be improved or controlled.
- Datafication: data and algorithm choices define a particular problem and and prioritise certain types of knowledge: knowledge politics.
- A Digital Twin rests partly on an ideal framing of what constitutes a "good" physical twin and what values are central to it. → this shapes the potential futures a Digital Twin can direct us to.

The human in the system

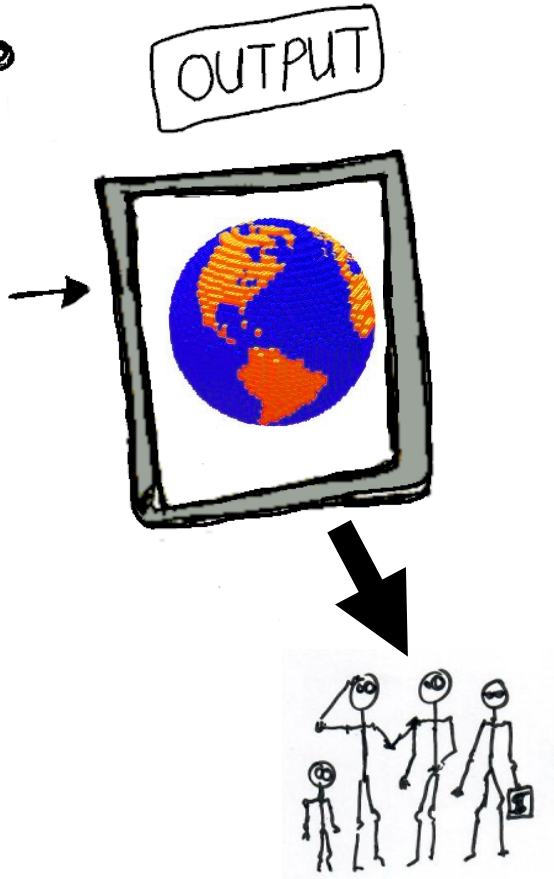
Problem perception

Goals

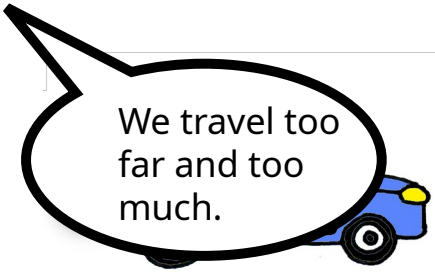
Norms

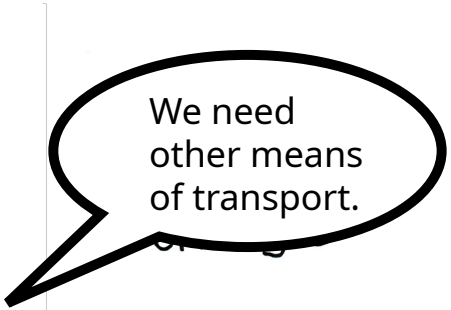
Visions about the future

Expectations about users



Problem perception: car emissions and sustainability





Digital Twins of ?

ALTERNATIVES

↓

Large transformations

The human in the **system**

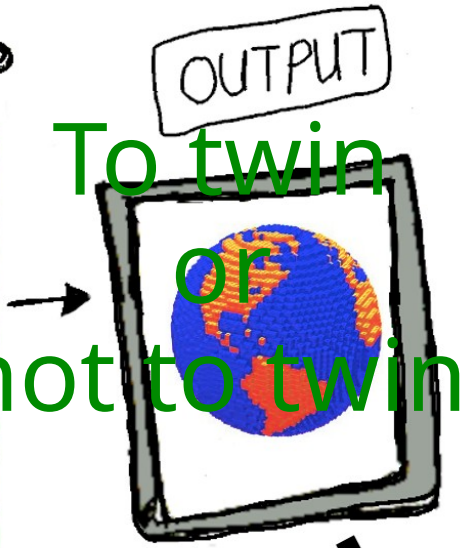
Problem perception

Goals

Norms

Visions about the future

Expectations about users



To twin
or
not to twin?

Example: Destination Earth project

Destination Earth first models will be adapted and optimised to run efficiently on three of the most powerful European supercomputer infrastructures:

LUMI

LUMI, hosted by Finland's CSC IT Center for Science, with a measured Linpack performance of 309.1 (428.7 peak) petaflops per second.

(Image courtesy of LUMI)

Leonardo

Leonardo, hosted by Italy's Cineca, with a Linpack performance of 174.7 (255.7 peak) petaflops per second.

(Image courtesy of Cineca)

MareNostrum 5

MareNostrum 5 of the Barcelona Supercomputing Centre (BSC).

(Featured image shows new site where MareNostrum 5 is being installed)

https://destination-earth.eu/

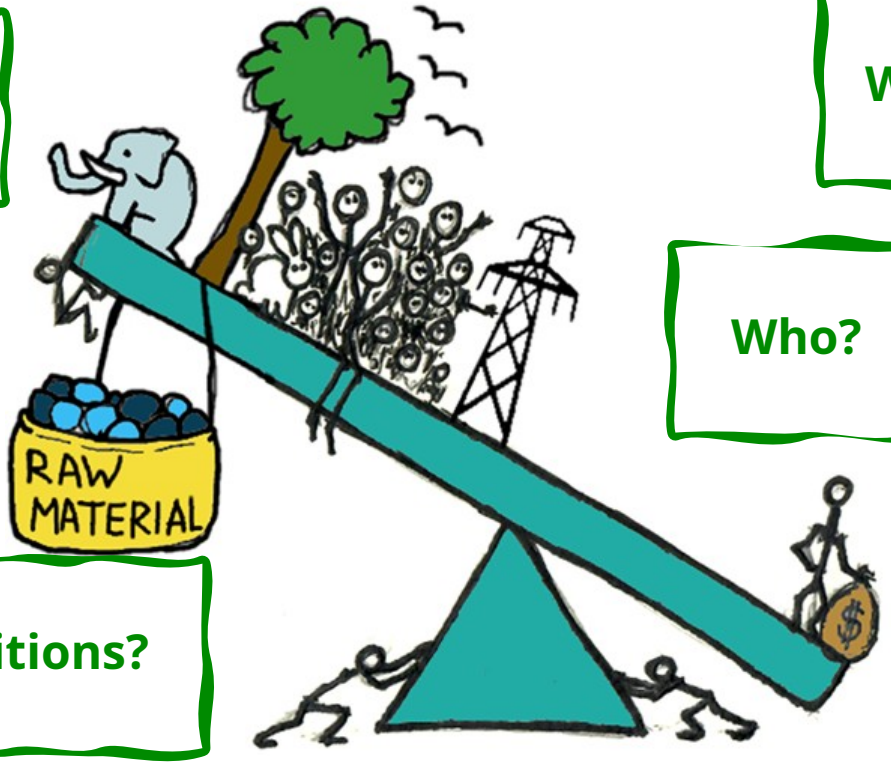
Why?

When?

How?

Who?

What conditions?



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Conclusion: the ‘problem’ with Digital Twins

- There are values and wordlviews built into DTs.
- DTs are productive of (new) power relations.
- DTs bring along shifts in tasks and responsibilities.
- DTs open up new goals and resources (e.g., data economy).
- DTs affects our practices and resource use.

-> Digital Twins are neither neutral, not mere representations. Yet, this is easily obscured by the framing of a Digital Twin as a ‘replica’.