GI Science challenges for Nationwide Digital Twins

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#1 Catch-all term in which many (remaining) problems fit

We have had similar concepts:

- GIS, GeoBIM, Smart Cities, SDI, IoT

..with shared objectives:

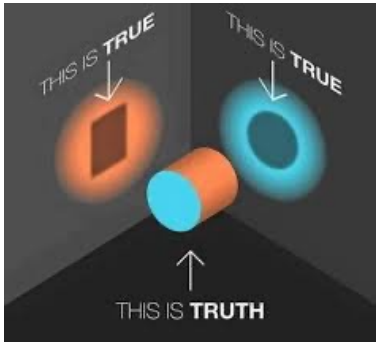
- …represent current state of reality
- …integrate geo-data from different domains
- …serve more than one purpose

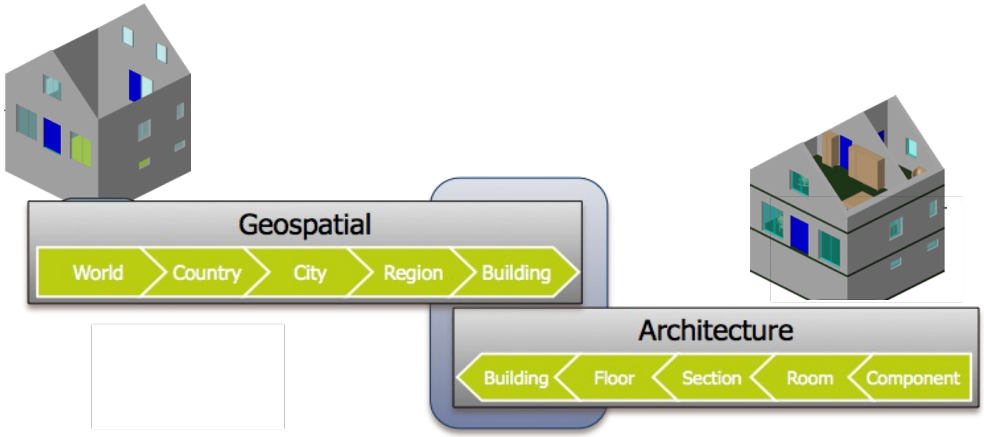
Solved within individual projects; not as ***open data platform***

- Broad term; risk of partial and not fundamental solutions for global challenges
- Fundamental problems remain (are not resolved by renaming them)

#2 Exact mirror concept of DT

- Works for single product; but not for complex reality
  - Abstraction/generalisation is needed for nationwide DTs
  - Different applications need different data views on same reality

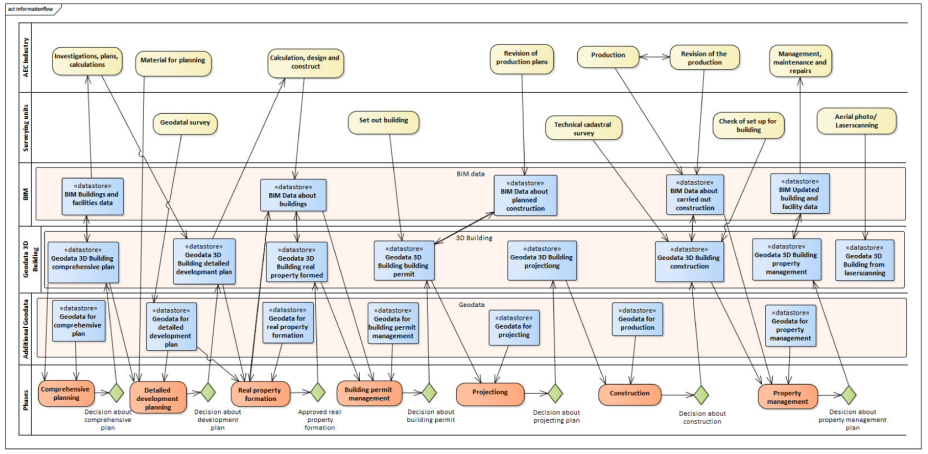




- How to translate 1:1 expectations to data for fitness for use?
  - Twin as metaphor is not sufficient…need litter of DTs….
- How to implement this multi-view DT concept in practice?

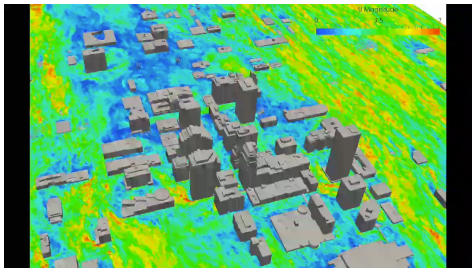
#3 Temporal data in Digital Twins:
"…to mirror the life of its corresponding twin"

- Requires realtime data and continous updating
- For geospatial-data actuality of few days/weeks is high/sufficient



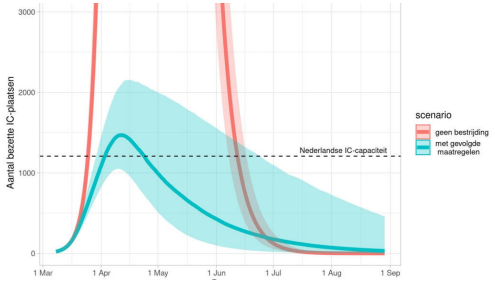
- How real-time is (near) real-time?
- How to continuously synchronize (various) digital twin-dataflows with physical counterpart?
- Versioning

#4 Simulations in DTs



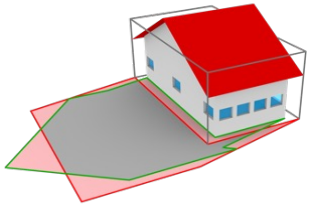
Sanchez, 2020

- Most require mathematical models on high end hardware
  - CFD, agent-based modelling, voxel based, path finding algorithms
  - Not all simulations can be part of one synchronised DT



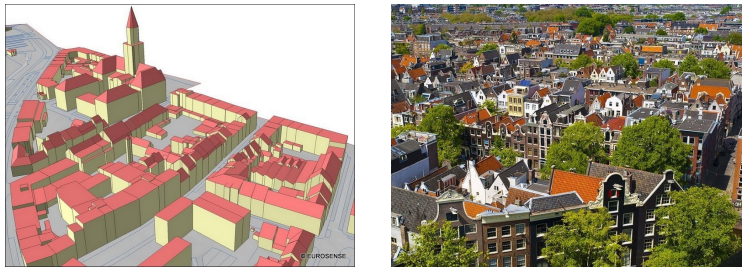
  - How to integrate different simulations in one dashboard?
  - How to expose uncertainty (not accuracy!) of simulations in one dashboard concept of DT?
  - How to cummunicate uncertainty aspect to the user of DT?

#5 DT: experiencing realism versus realistic

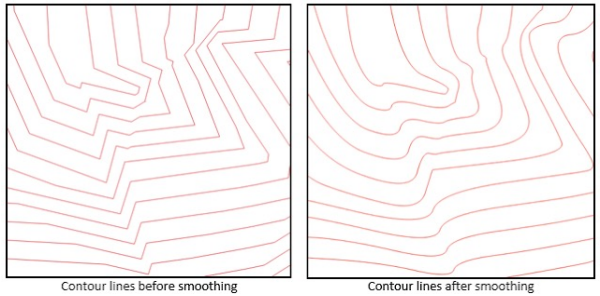


"The more realism is experienced, the better"

- Realistic *looking* models are not per se realistic mirror, they can: be outdated; contain errors; be less (or equally) accurate



Reality is not a LoD2 model



Smoothing of contour lines

How to prevent overvaluation realism experience and undervaluation of data quality aspect

- uncertainty, temporal & spatial resolutions

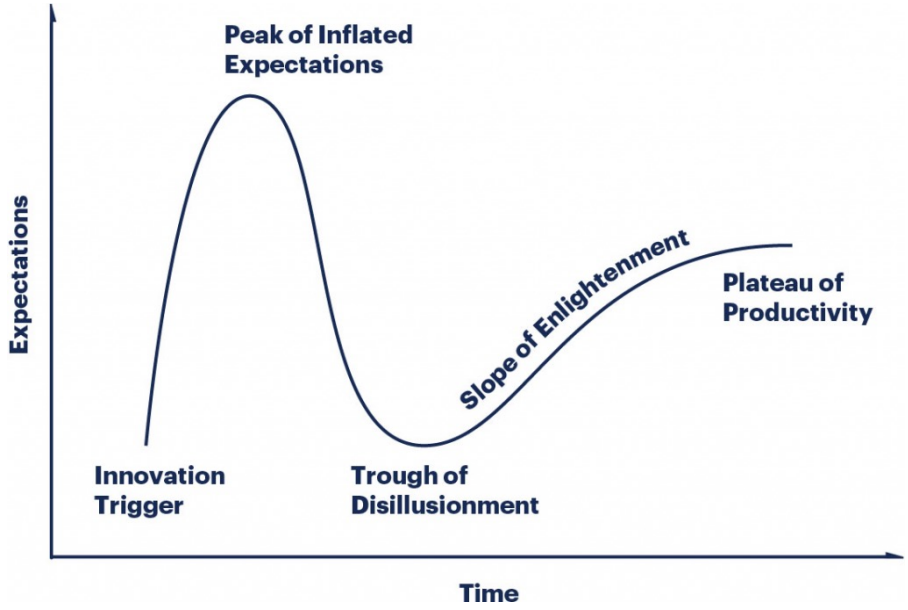
- How to specify and deal with different LoDs/accuracy levels of DTs

#6 DT: Sharing data & interoperability

- Open data and models are key elements
  - Sharing data across organizations/sectors still a challenge
  - Becomes more prominent if even more data (and sim models) need to be shared/synchronised

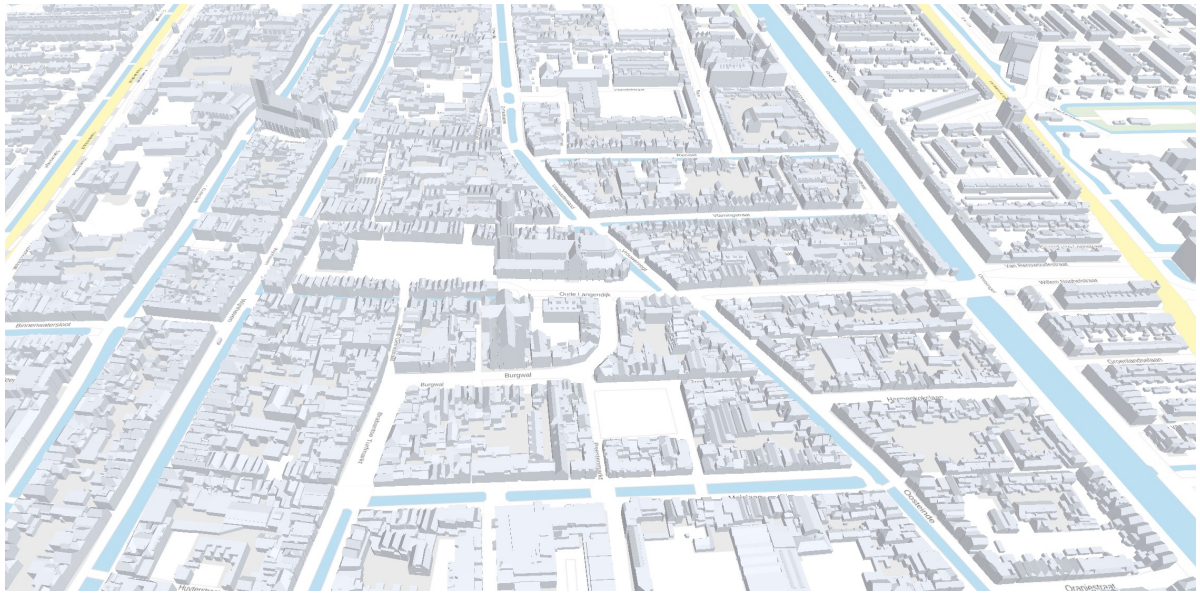
  - Interoperability:
    - standards that work in practice
    - integrate different domains and temporal, spatial scales
  - Security, privacy, accountability issues of data sharing

#7 DT beyond pilots: Practice readiness



Gartner's hype cycle

- understanding of implementations in practice
- investments in digital twin infrastructures
- coordination
- collaboration between many different stakeholders & processes within govs and across sectors



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Thank you!

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For more information, visit 3D.bk.tudelft.nl