The digital challenges for archaeology - what do we need to thrive?

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The digital challenges for archaeology
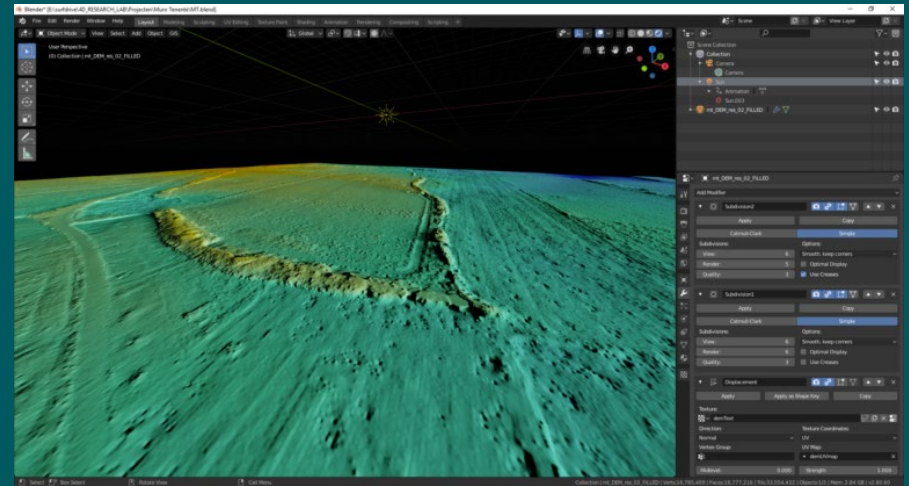
1. New data

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2. Legacy data
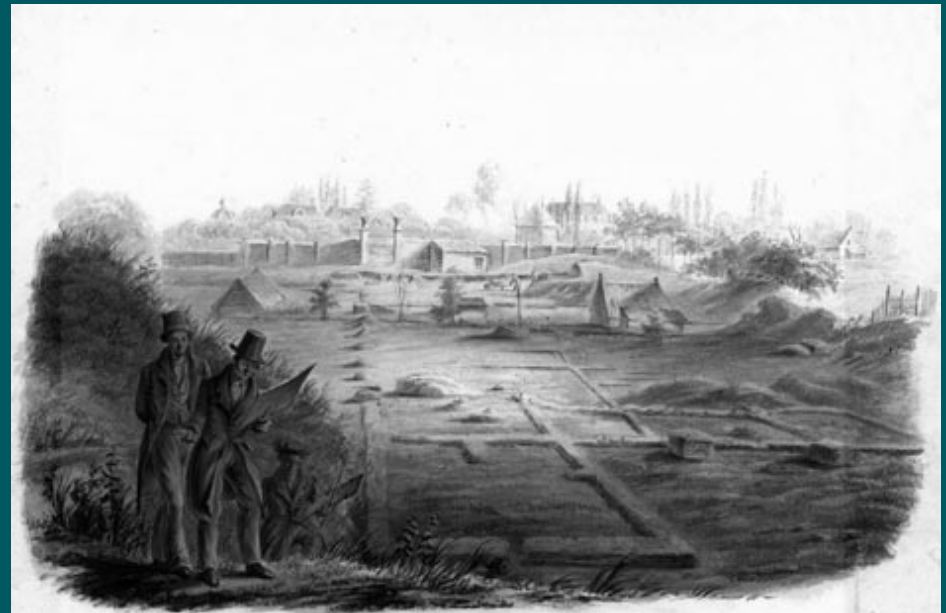
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3. New techniques

www.4dresearchlab.nl

```
[ ] #just push play -- this sets things up to save the visualisations you're going to create
    def SaveImages():
        for item in dirs: #Iterates through each picture
            if os.path.isfile(path+item):
                im = Image.open(path+item)
                f, e = os.path.splitext(path+item)
                imResize = im.resize((256,256), Image.ANTIALIAS)
                # uncomment imResize if necessary
                # save in another format if desired
                im.save(f + ' saved.jpg', 'JPG')
```

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4. Increased computing power
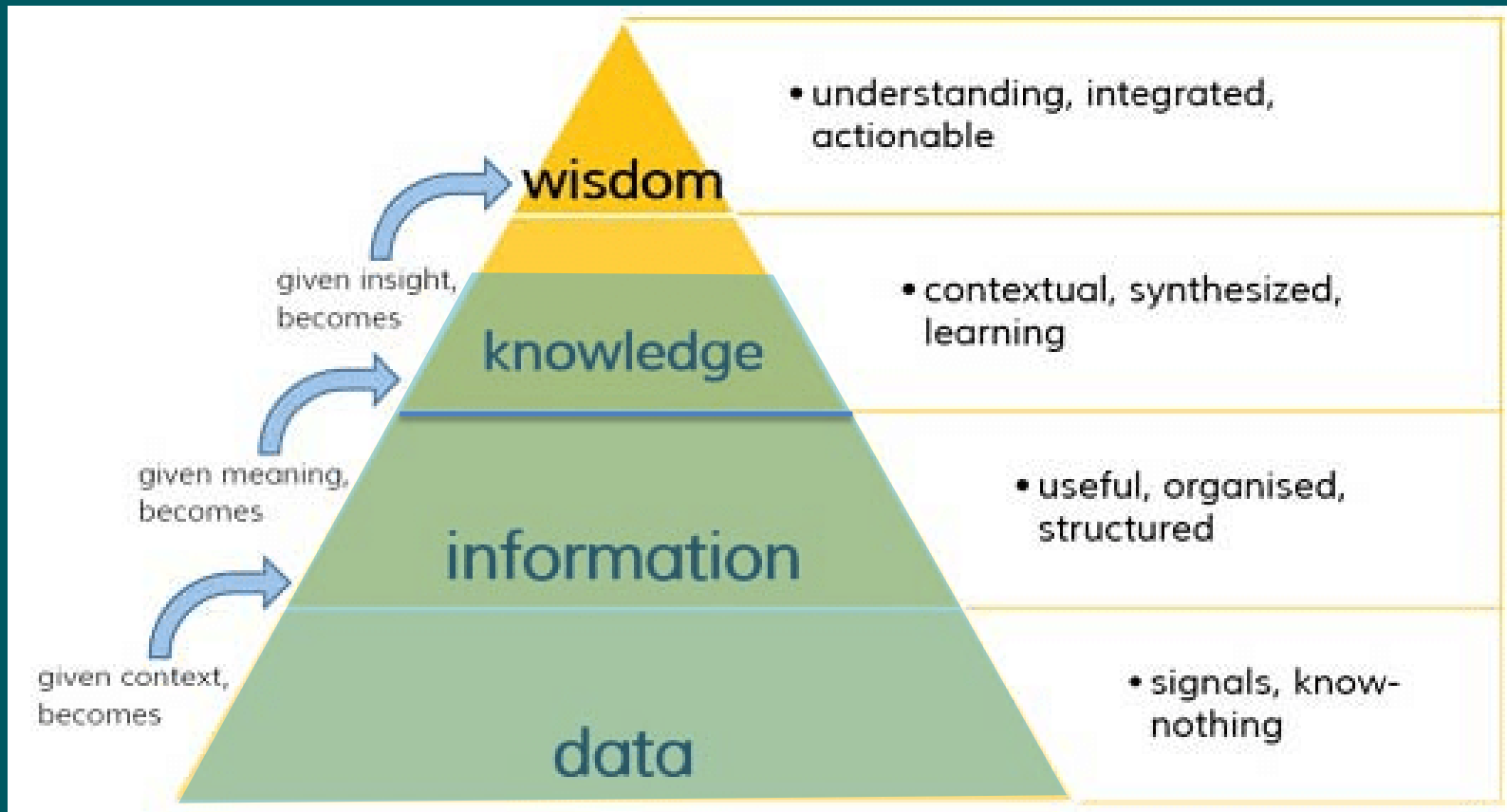

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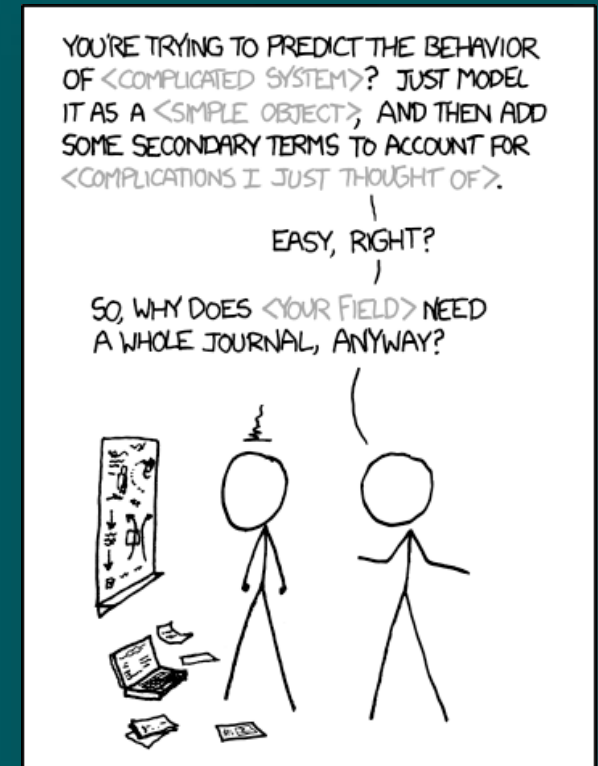
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Together, these developments open unprecedented possibilities for large-scale, interdisciplinary analysis of past societies.

They force us to reconsider concepts of e.g. archaeological survey and the nature of traces of human behaviour.
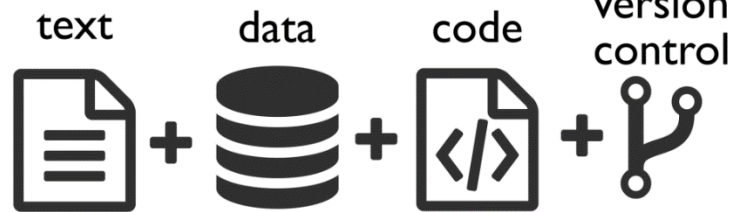
Simulation techniques can explore a multitude of 'what if' scenarios to support our understanding of the causes and effects of long-term transformations.

The (lack of) paradigm shift

- understanding, integrated, actionable

- contextual, synthesized, learning

- useful, organised, structured

- signals, know-nothing

wisdom

knowledge

information

data

given insight, becomes

given meaning, becomes

given context, becomes

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Open Science

advertising: text & final results only

text + data + code + version control

science: text, code & data available, linked & licensed

0% ←→ 100%

reproducibility spectrum

Adapted with permission from Rodríguez-Sánchez F, Pérez-Luque AJ, Bartomeus I, Varela S (2016) Ciencia reproducible: qué, por qué, cómo. Ecosistemas, 25(2): 83-92. http://doi.org/10.7818/ECOS.2016.25-2.11. See also Marwick, B. (2016). Computational Reproducibility in Archaeological Research: Basic Principles and a Case Study of Their Implementation. Journal of Archaeological Method and Theory 23(2): 1–27. http://doi.org/10.1007/s10816-015-9272-9. This figure is CC-BY

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# FAIR principles

by Katherine Cook 2018

Technology readiness level

TECHNOLOGY READINESS LEVEL (TRL)

DEPLOYMENT	9	ACTUAL SYSTEM PROVEN IN OPERATIONAL ENVIRONMENT
	8	SYSTEM COMPLETE AND QUALIFIED
	7	SYSTEM PROTOTYPE DEMONSTRATION IN OPERATIONAL ENVIRONMENT
DEVELOPMENT	6	TECHNOLOGY DEMONSTRATED IN RELEVANT ENVIRONMENT
	5	TECHNOLOGY VALIDATED IN RELEVANT ENVIRONMENT
	4	TECHNOLOGY VALIDATED IN LAB
RESEARCH	3	EXPERIMENTAL PROOF OF CONCEPT
	2	TECHNOLOGY CONCEPT FORMULATED
	1	BASIC PRINCIPLES OBSERVED

consumer / user / developer

almost no archaeologists involved

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The current landscape: data

- Dutch 'heritage' repositories
  - DANS Easy, ARCHIS, PAN (NWO, RCE)
  - linked to non-archaeological data (RCE, PDOK)
  - linked to international infrastructures (ARIADNE+)

- lacking infrastructures
  - 'academic' data sets collected outside the Netherlands
  - remote sensing data
  - linking of specialist data (archaeo-ecology, forensic archaeology, geoarchaeology, archaeometry)

- data access and sustainability issues

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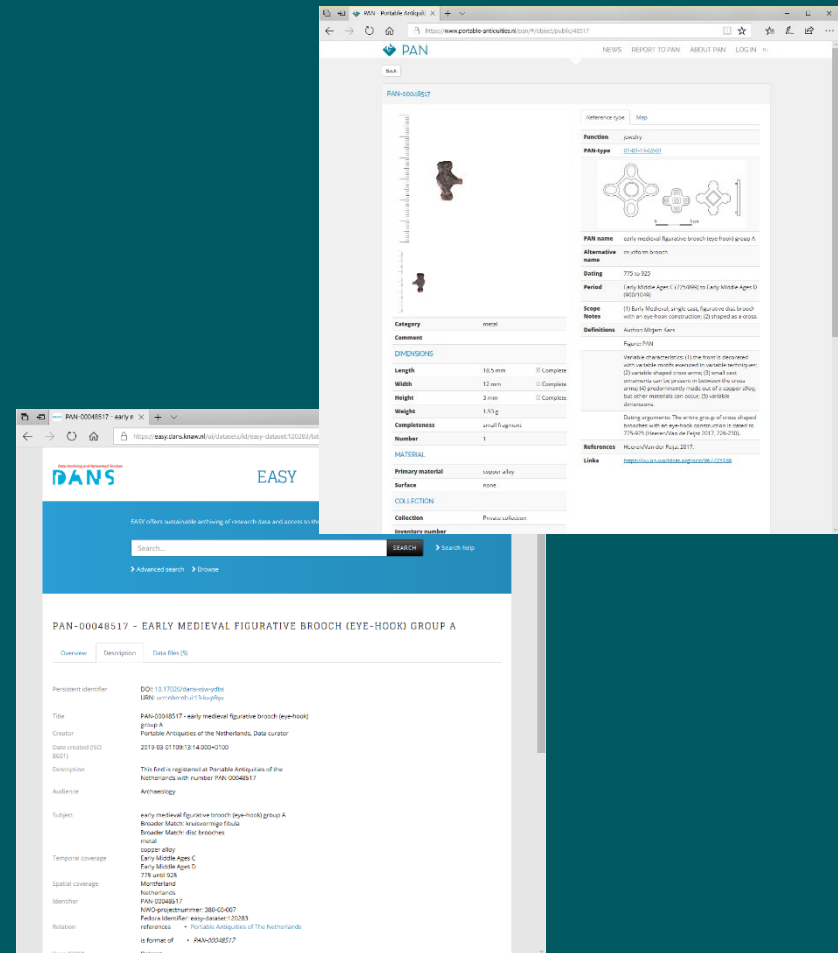
The current landscape: tools

- (very) small base of developers
  - Machine Learning (LU)
  - 3D modelling and VR (4D Lab UvA)
  - Simulation modelling (VU, LU)
  - Linked Open Data / semantic web (DANS, RCE, RUG)
  - problematic recognition!

- limited (international) collaboration
  - lack of overarching infrastructures
  - problematic funding structures ('it is not archaeology')

- limited collaboration with computer scientists
  - not very interested in applied work
  - but: Netherlands eScience Centre

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The current landscape: communities of practice

- active (international) user base
  - dedicated conferences
  - small-scale initiatives
  - increased sharing of tools

- educational programmes
  - basic instruction at BA level
  - MA track (LU)
  - postgraduate instruction (ARCHON)
  - limited advanced instruction
  - limited sharing of resources

- limited shared support services
  - 4D Lab UvA, E-RIHS
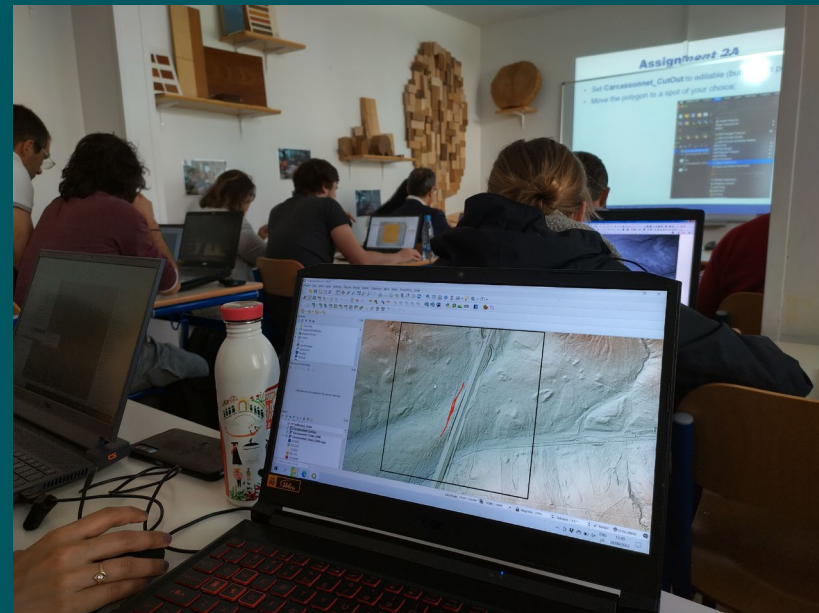
What do we need to do?

- develop our own tools
  - in collaboration with other developers and stakeholders
  - focus on (facilitating) knowledge creation

- apply principles of Open Science
  - provide immediate access to data and methods
  - ensure transparency, robustness & dissemination
  - allow cumulative improvement
  - recognize efforts as research outputs

- extend and set up communities of practice
  - share best practices and resources
  - widen impact to 'non-digital' researchers