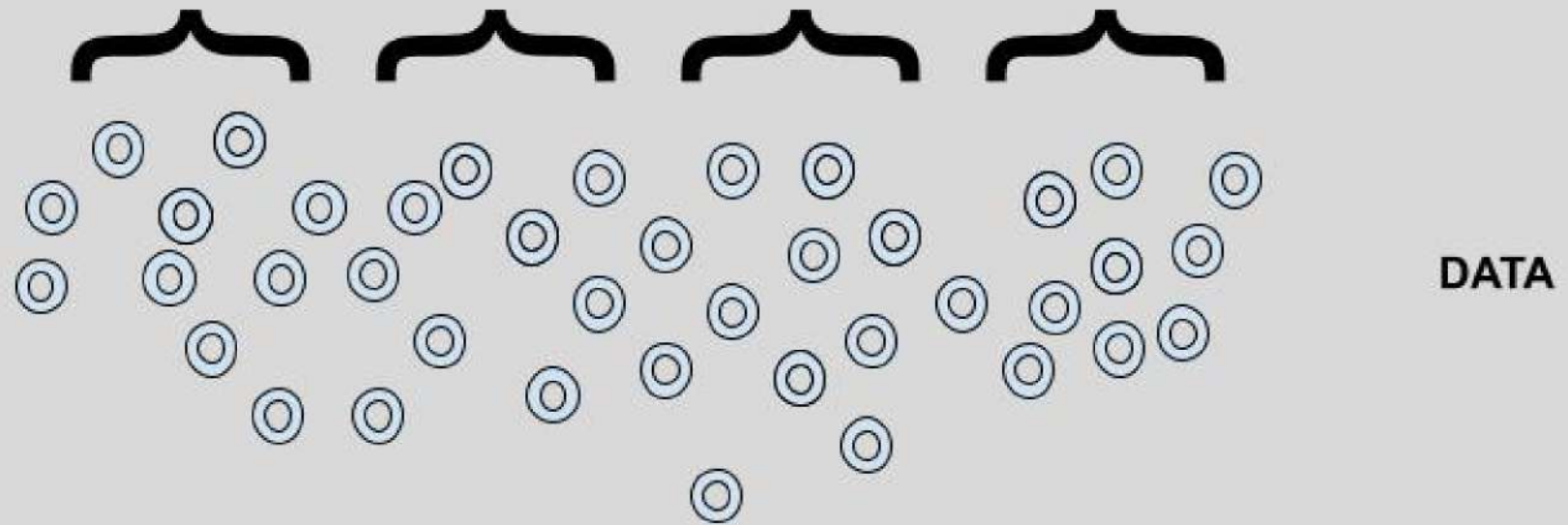AARHUS INSTITUTE OF
ADVANCED STUDIES

Agent-based modelling

(01)

————— DR IZA ROMANOWSKA

Photo by Elissar Haidar on Unsplash

WISDOM
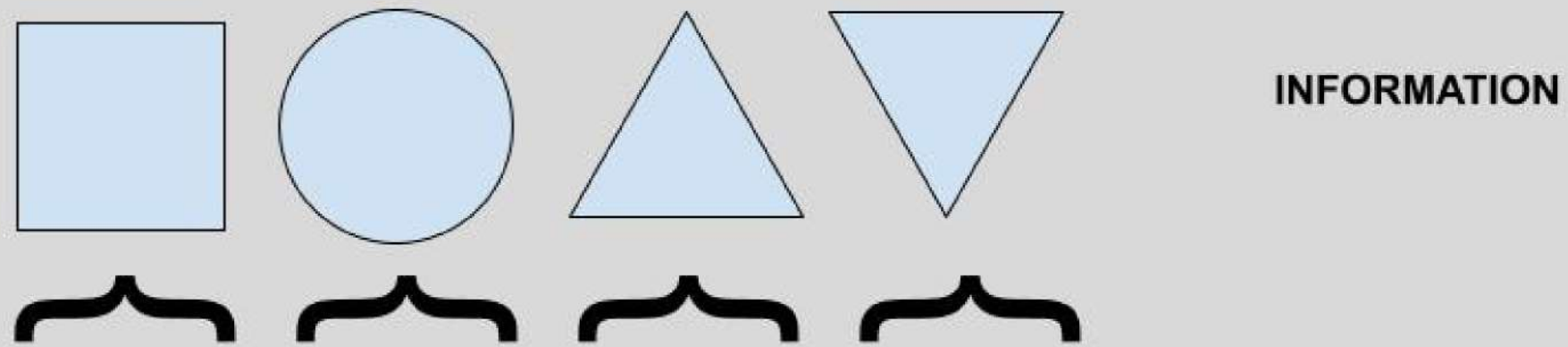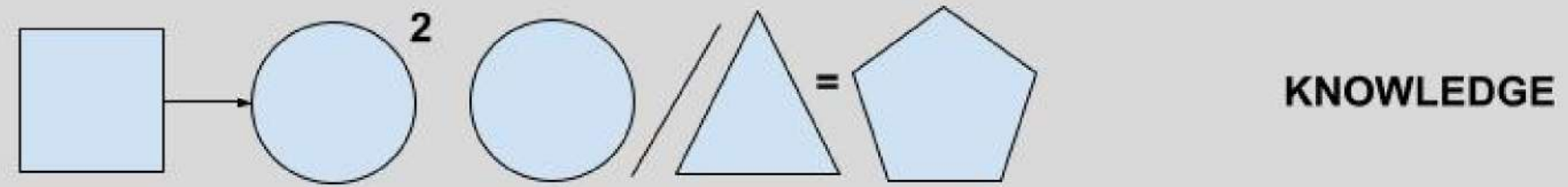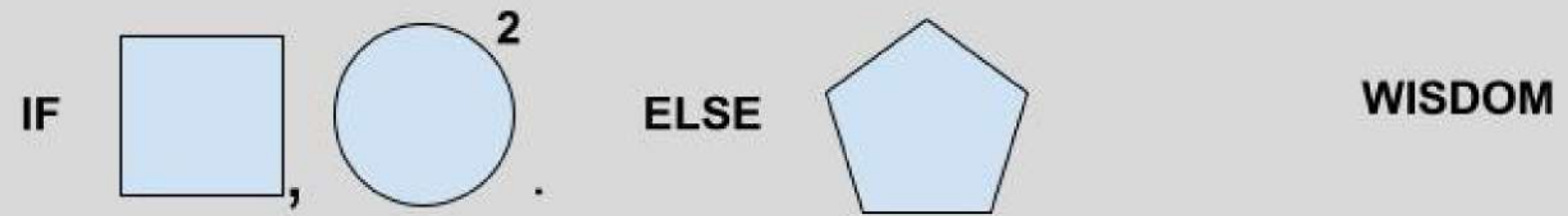
KNOWLEDGE

(01)

_____

The hierarchy of knowledge
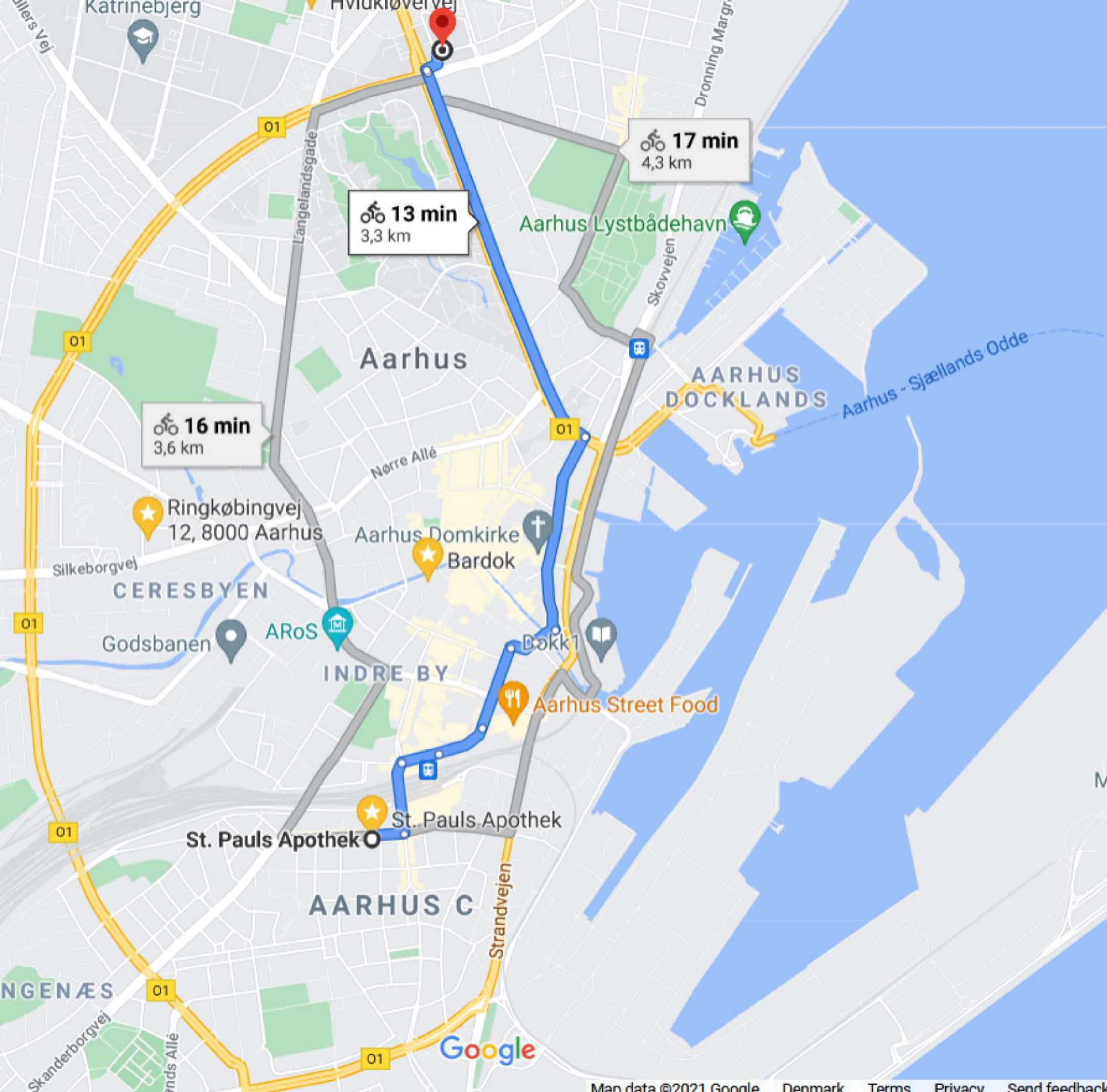
INFORMATION

DATA

- *Scott E. Page "The Model Thinker"*

What is a model?

MODEL DEFINITION

Presentations are communication tools that can be used as demonstrations, lectures, speeches, reports, and more. It is mostly presented before an audience. It serves a variety of purposes, making presentations powerful tools for convincing and teaching.
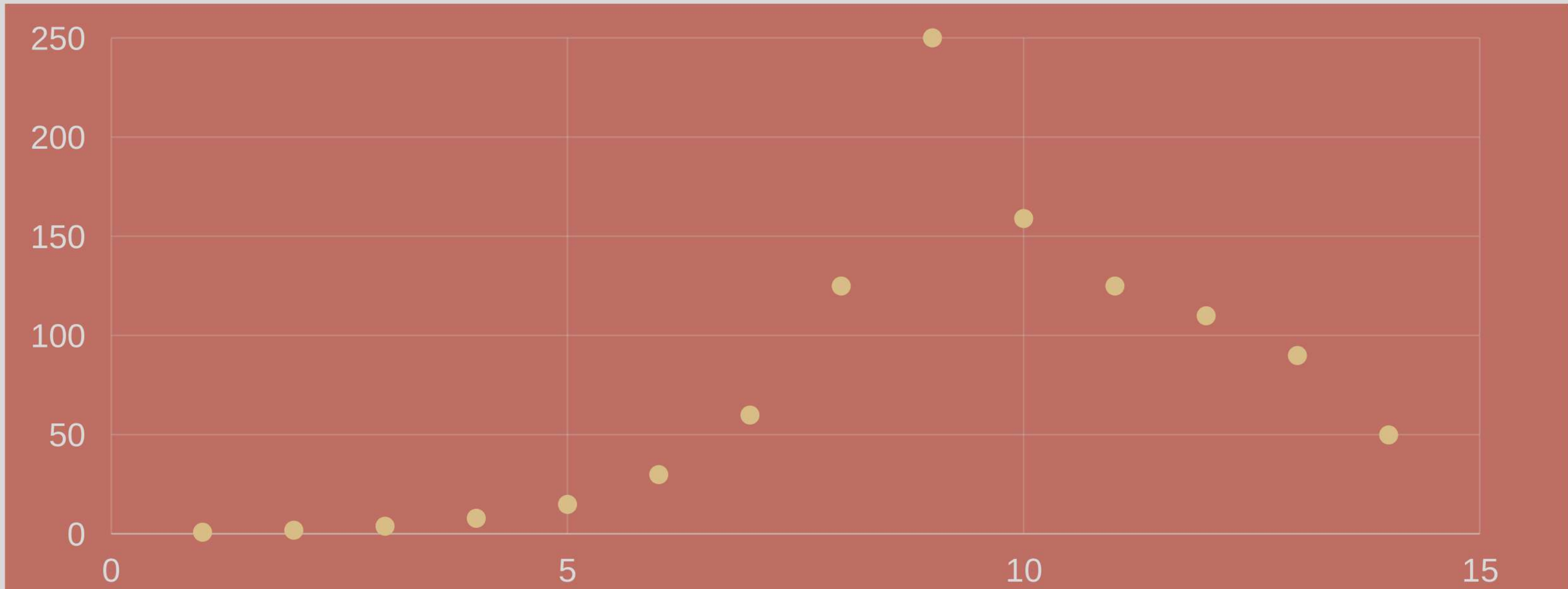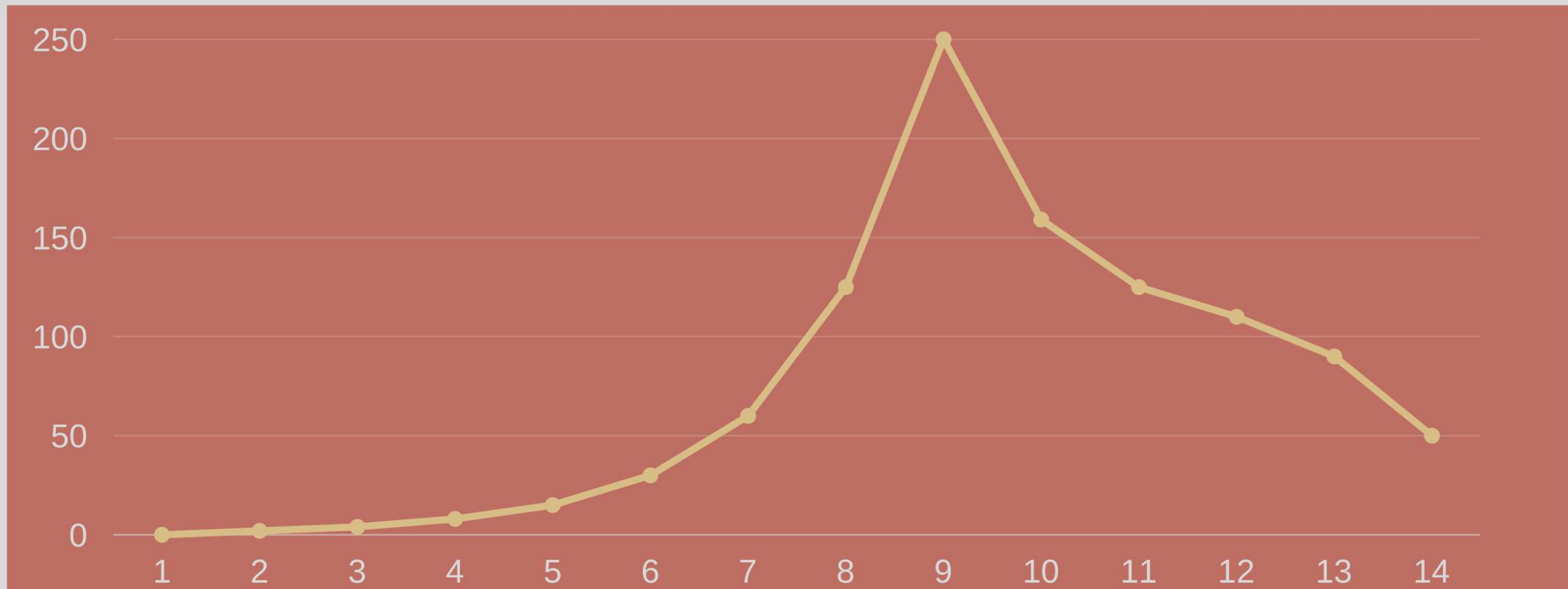
What is a model?

MODEL DEFINITION

An abstract simplified representation of the world which preserves some aspects of reality but not all. Multiple models of any one system are possible. Simulation is a model with a time dimenision.

IS THIS A MODEL?

IS THIS A MODEL?

IS THIS A MODEL?

THE SECOND WORLD WAR HAPPENED BETWEEN 1939 AND 1945.

THE SECOND WORLD WAR WAS A DIRECT RESULT OF AN ECONOMIC CRISIS.

THE ROMAN REPUBLIC ENDED IN 27BC WITH THE ESTABLISHMENT OF OCTAVIAN AS AUGUST.

HUMAN SOCIETIES GO THROUGH CYCLES OF DEMOCRACY AND AUTHORITARIAN REGIMES.

ARMY X HAS LOST 20 000 MEN IN BATTLE Y.

ARMY X HAS WON BATTLE Y THANKS TO THEIR ARTILLERY.

There are many different models

MAP

Spatial model

REGRESSION

Statistical model

IDEAS & HYPOTHESES

Conceptual model

SIMULATION

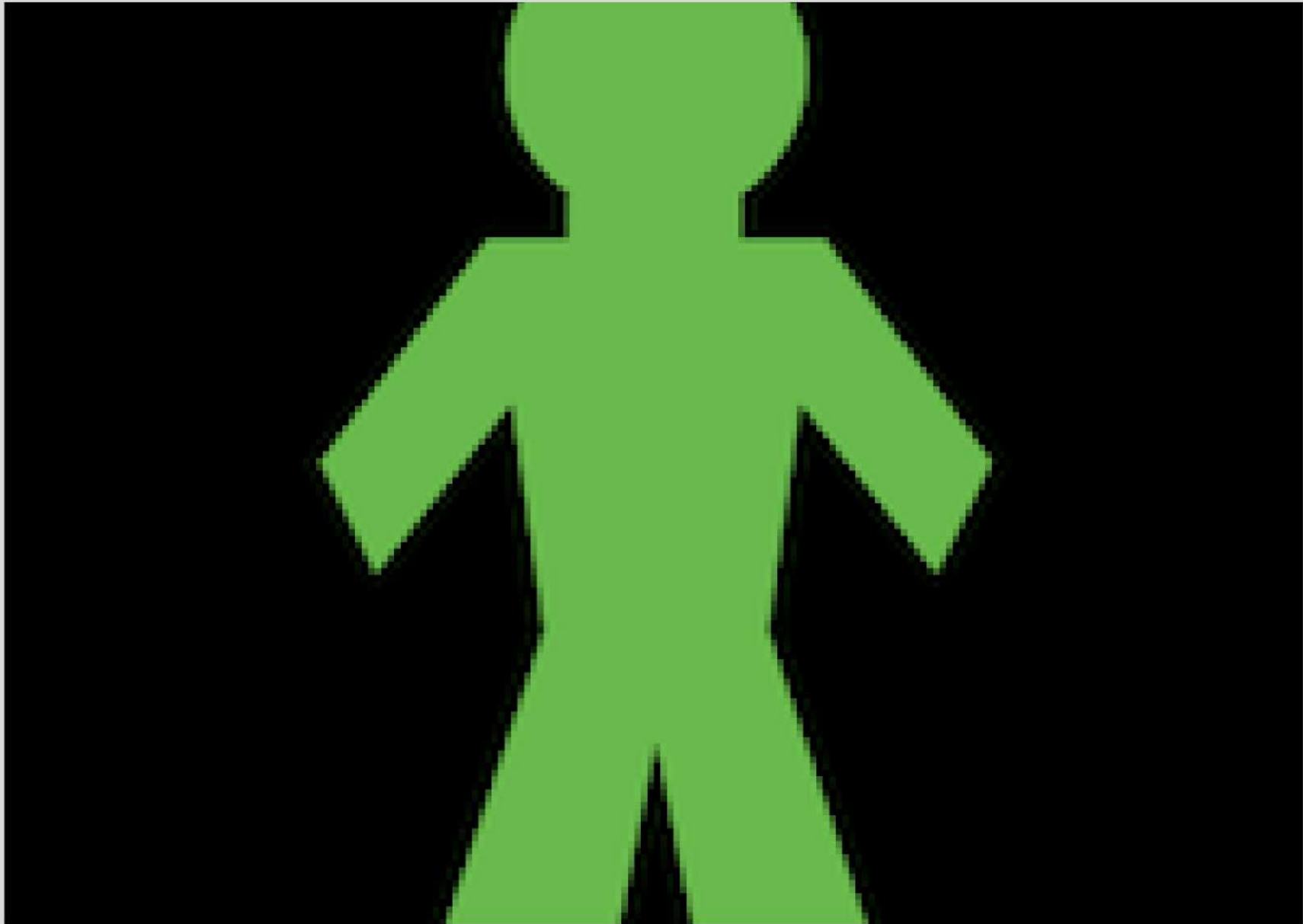Dynamic model

Agent-based modelling

Agents

Environment

Time

MAIN COMPONENTS

AGENTS

Individual
Each agent has attributes: age, energy, wealth, speed, location, preference…

Unique
The combination of attributes may be unique in the population

Adaptable
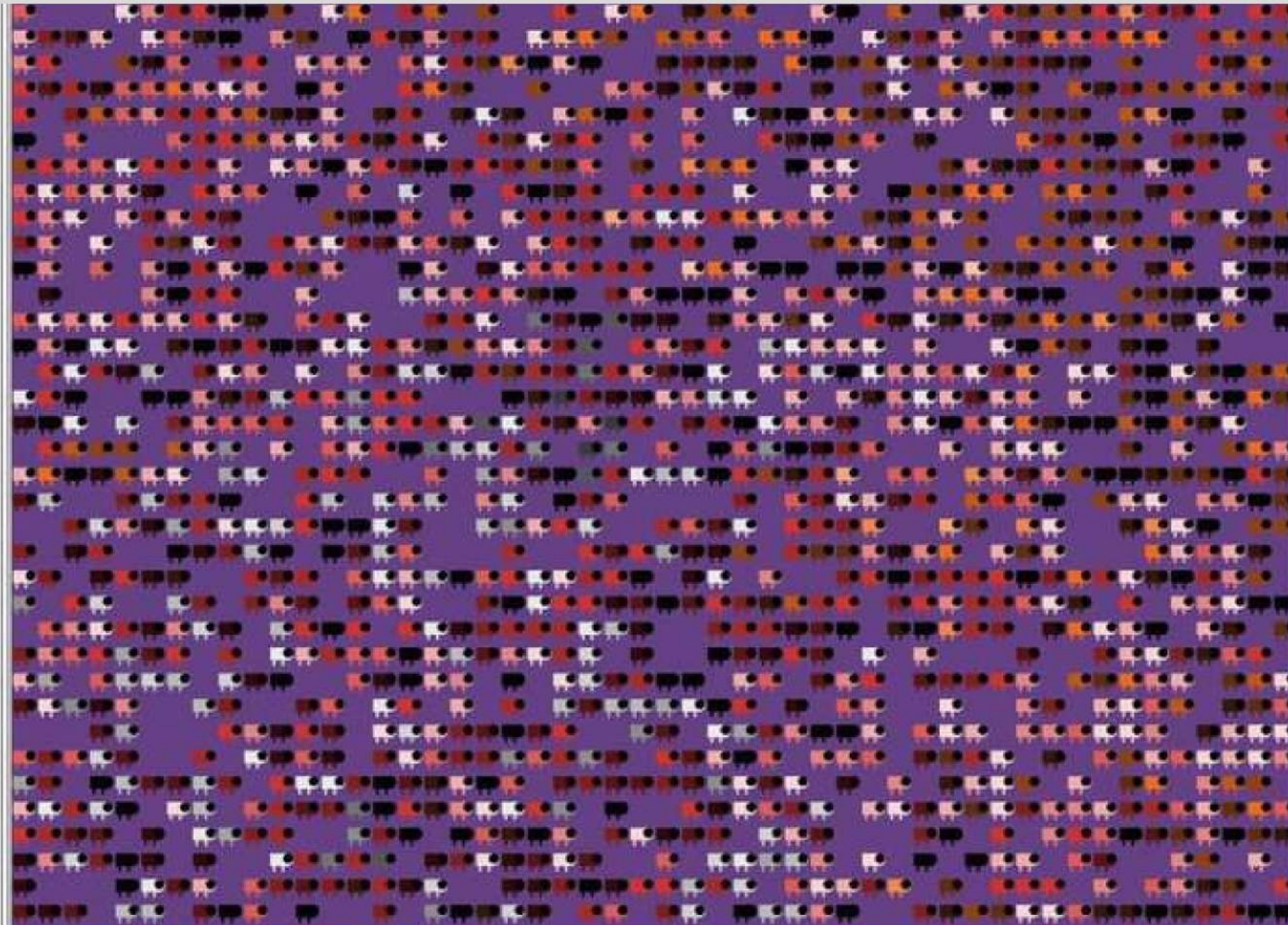Can change rules of behaviour dependinng on their unique circumstances

---

Agents can represent individuals. Or not.

DYNAMICS

Local   Each agent assessed their particular situation

Bounded   No assumption of full rationality or global knowledge

Flexible   Rules of behaviour may change

Anything goes.

The whole is greater than the sum of its parts

Emergence — Patterns of population-level behaviour that are unexpected

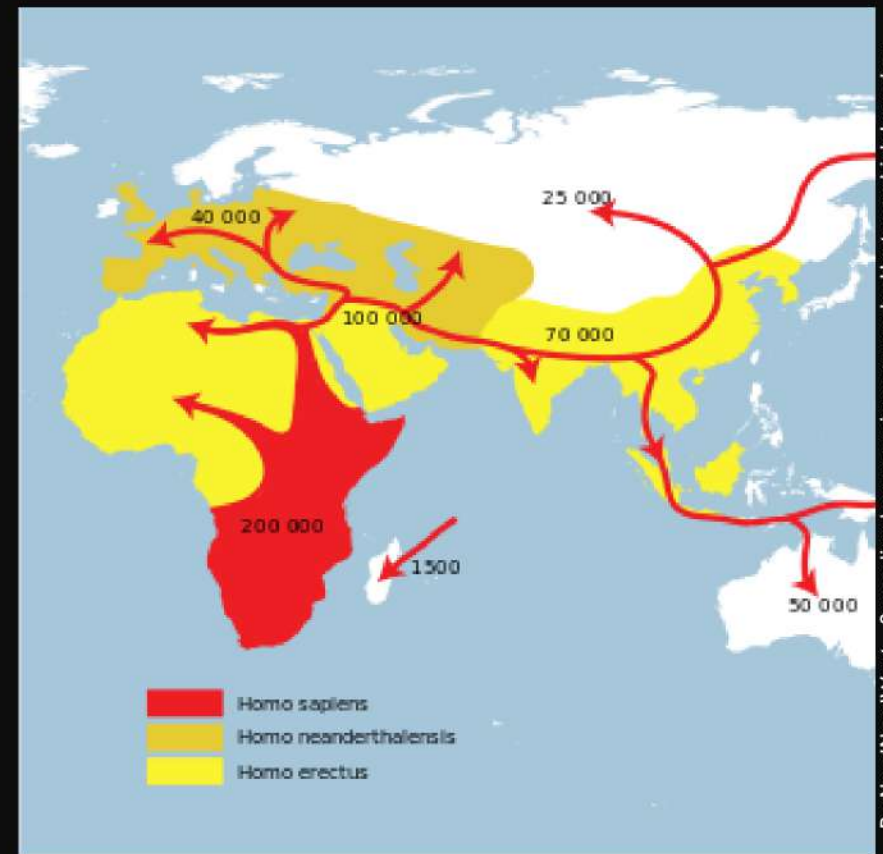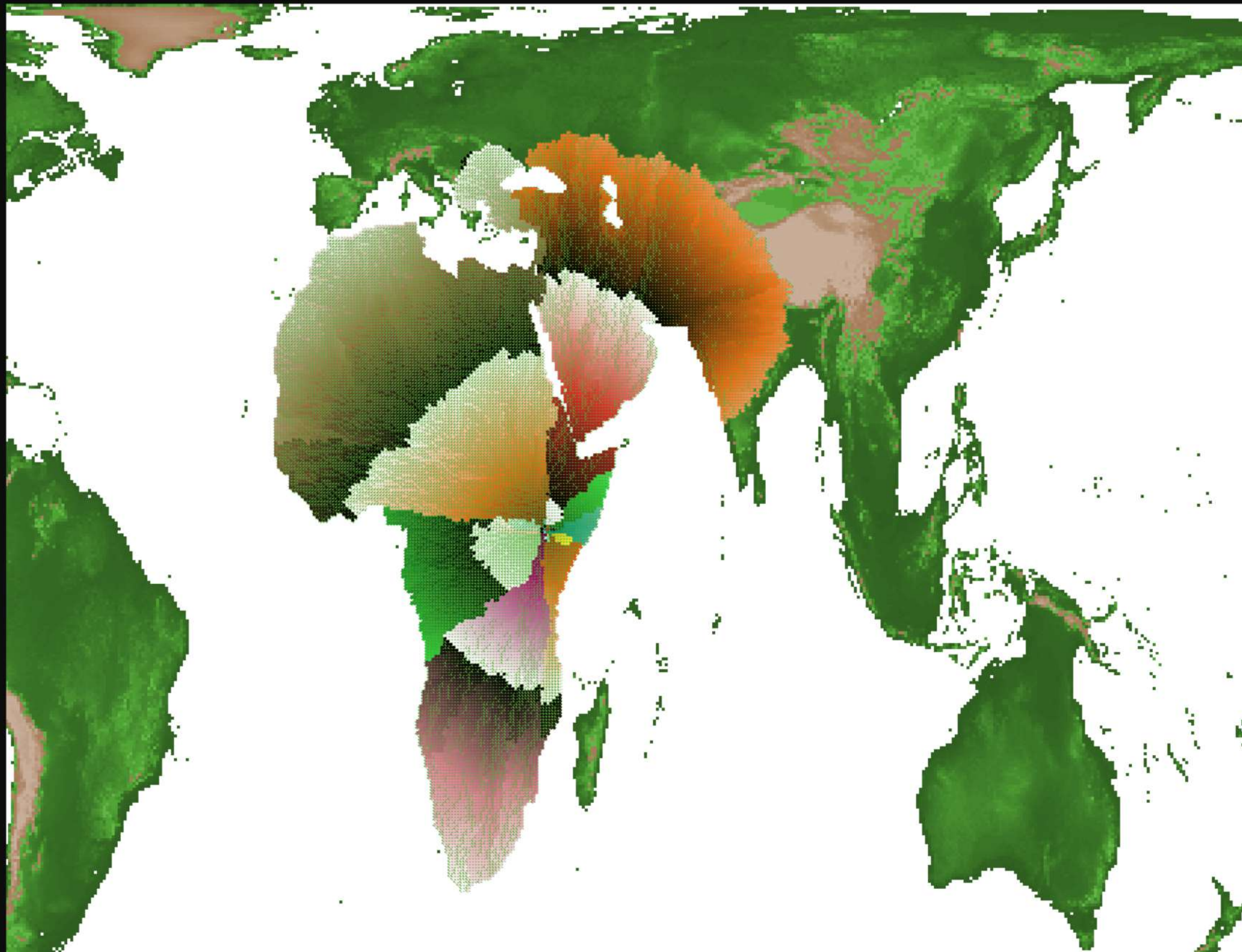*Alternative realities* — In silico laboratory where everything goes

Process-focused — Unravelling the causality chains

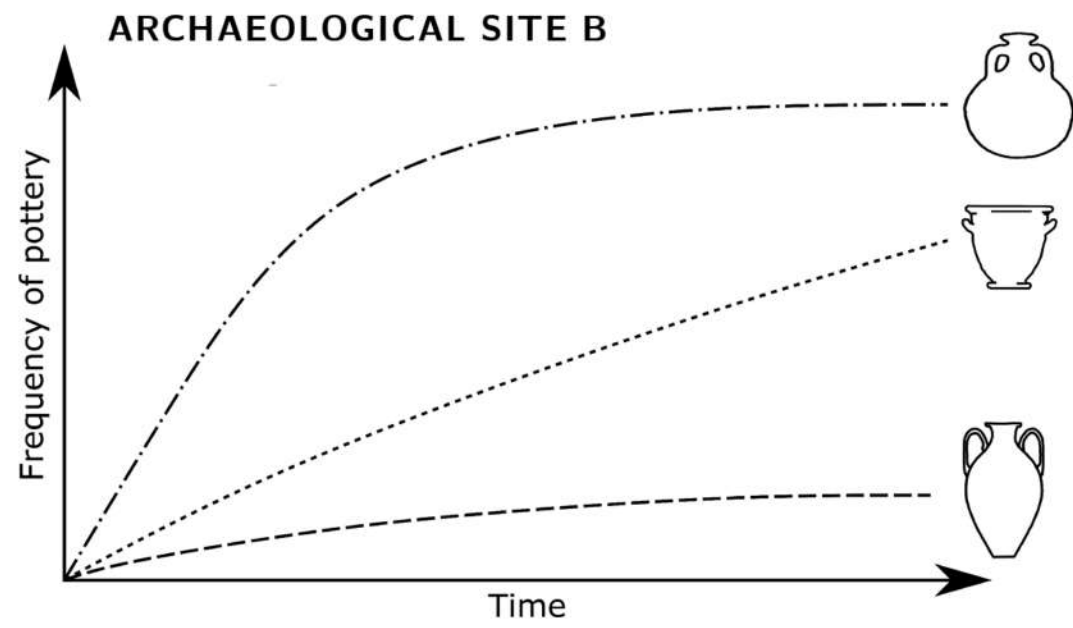# HOW IS THAT USEFUL FOR STUDYING THE HUMAN PAST?

(13)

FIRST OUT OF AFRICA

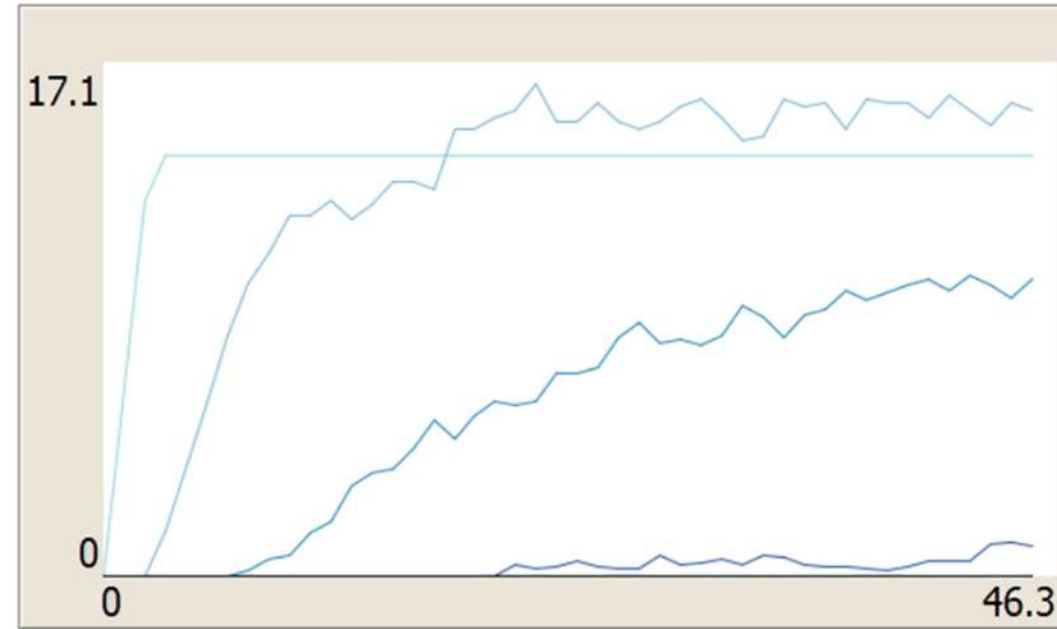The spatial distribution of the first dispersal can be largely explained by geography and biomes.
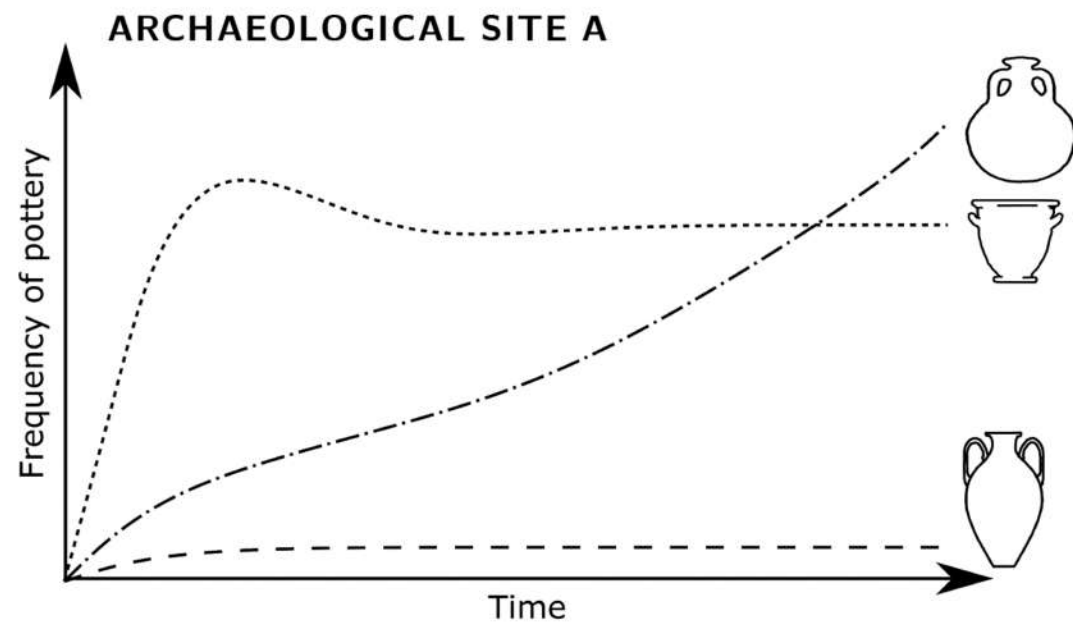
Romanowska 2017

(14)

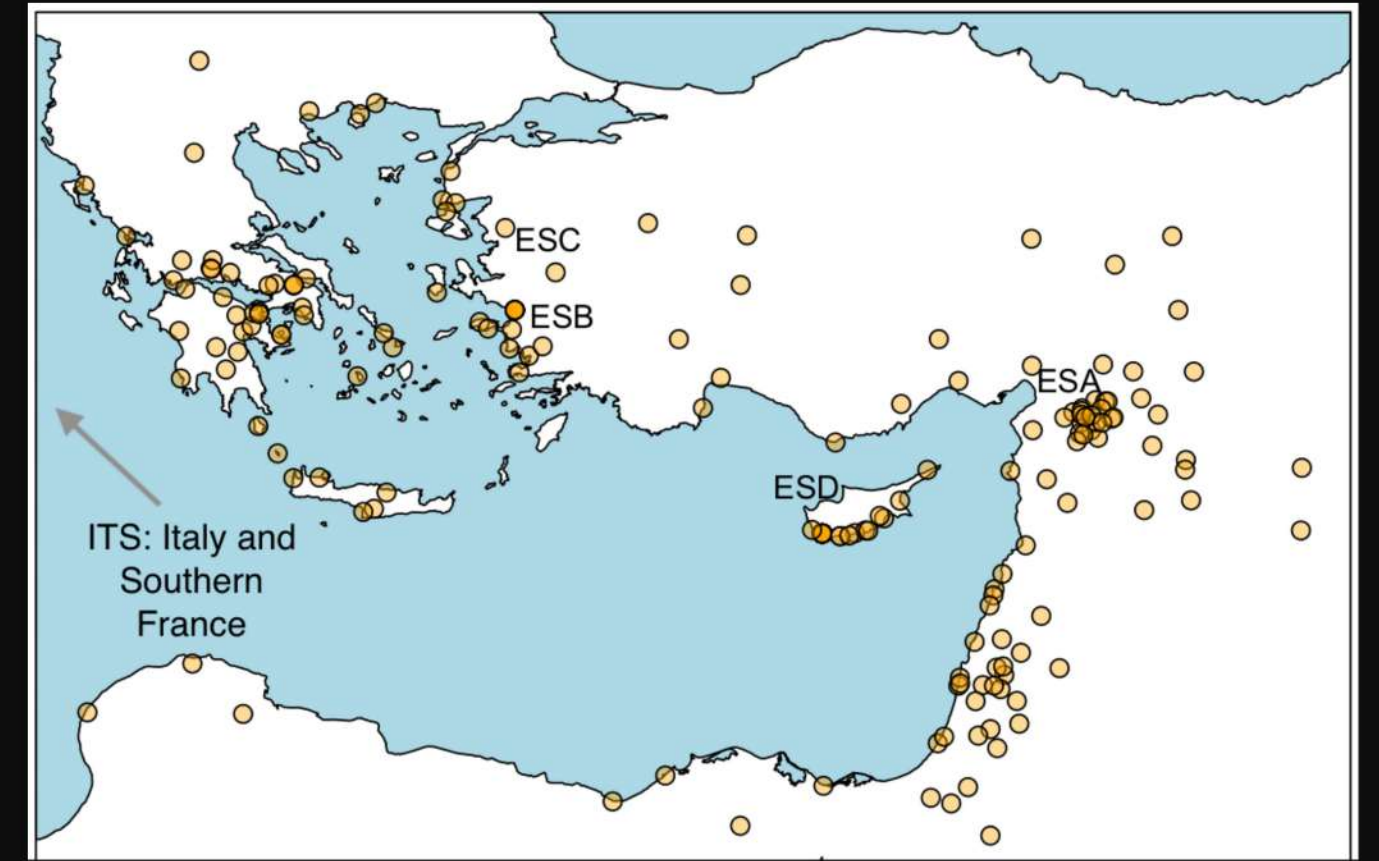## POTTERY CURVES
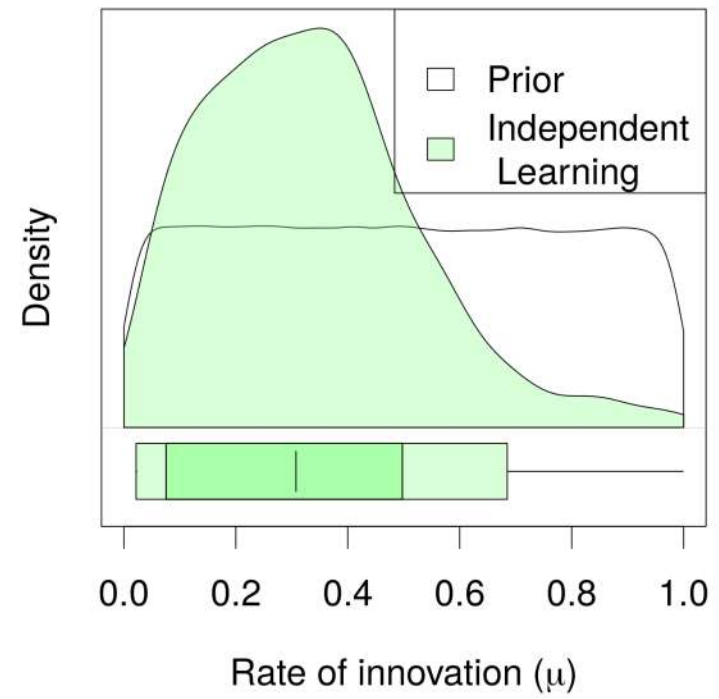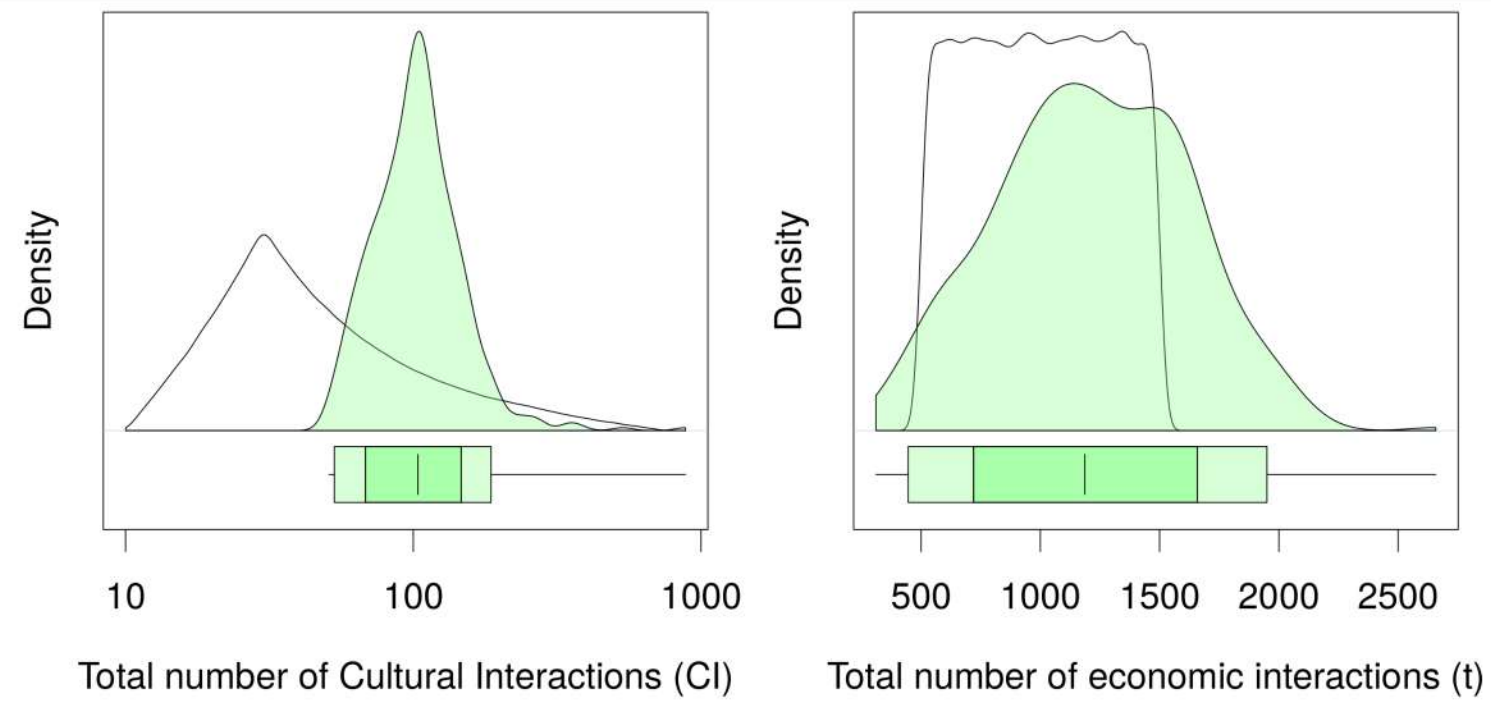
The pottery curves are a function of distance and the capacity of intermediate markers.

TS DISTRIBUTION IN THE ROMAN EAST

The interactions between traders & markets in the Roman East were limited and the information flow was very low.

Three super-powers of ABM

(16)

—————

THE END OF SCIENCE BY AUTHORITY

1

Model definition is intuitive:
 - easy to understand dynamics
 - familiar entities - important for multidisciplinary projects

2

Enables us to capture emergent phenomena:
 - weakening of standard axioms (full rationality, global knowledge, etc)
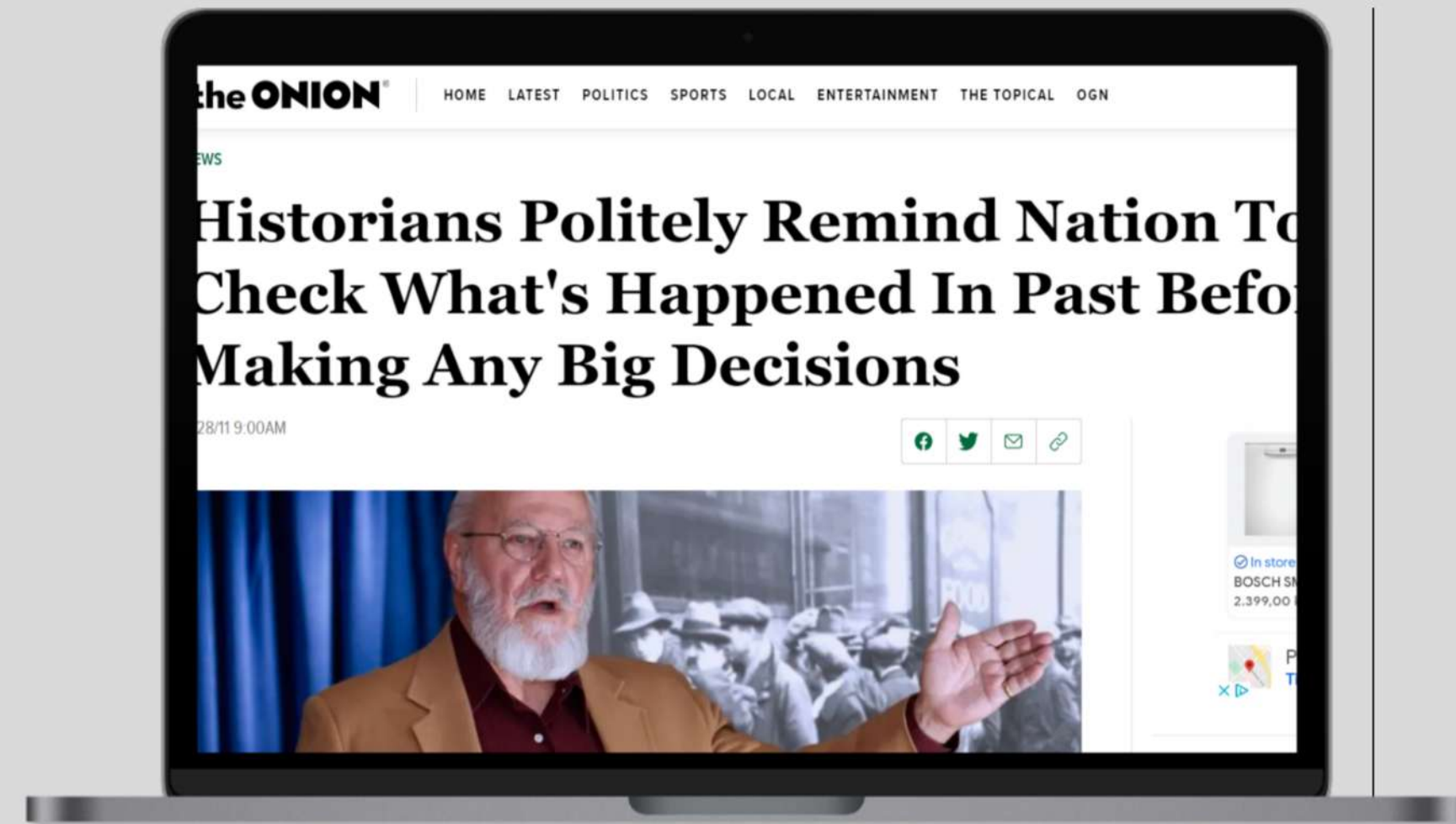 - communication, adaptation, evolution

3

Individual agency at the heart:
 - heterogeneous population
 - local circumstances

The challenges ahead

- The post-pandemic world

- Climate change & resource exhaustion

- Conflict, migration & culture clash

History is simply
one damned thing after
another.

- Winston Churchill

the ONION   HOME LATEST POLITICS SPORTS LOCAL ENTERTAINMENT THE TOPICAL OGN

EWS

Historians Politely Remind Nation To Check What's Happened In Past Befo Making Any Big Decisions

28/11 9:00AM

Get in touch

Photo by Elissar Haidar on Unsplash

@IZA_ROMANOWSKA

IROMANOWSKA@AIAS.AU.DK

Get the book, it's awesome!
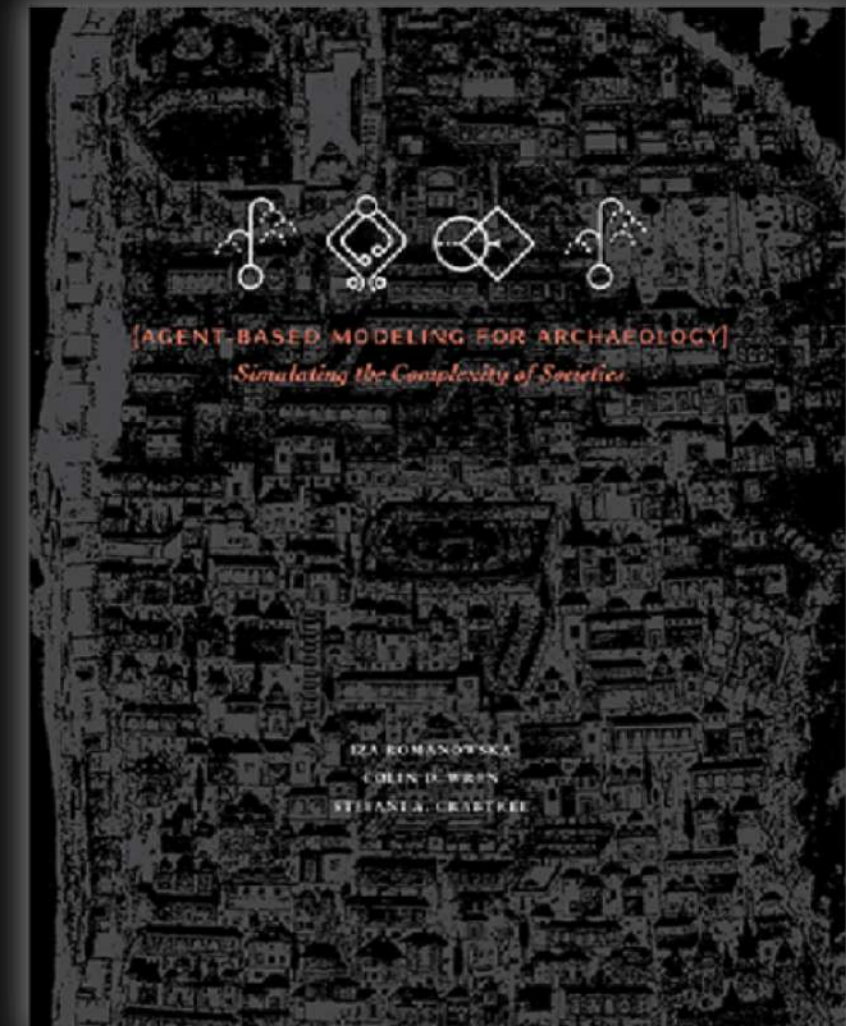
[AGENT-BASED MODELING FOR ARCHAEOLOGY]
Simulating the Complexity of Societies

SFI PRESS
THE SANTA FE INSTITUTE PRESS

Today's Propositions
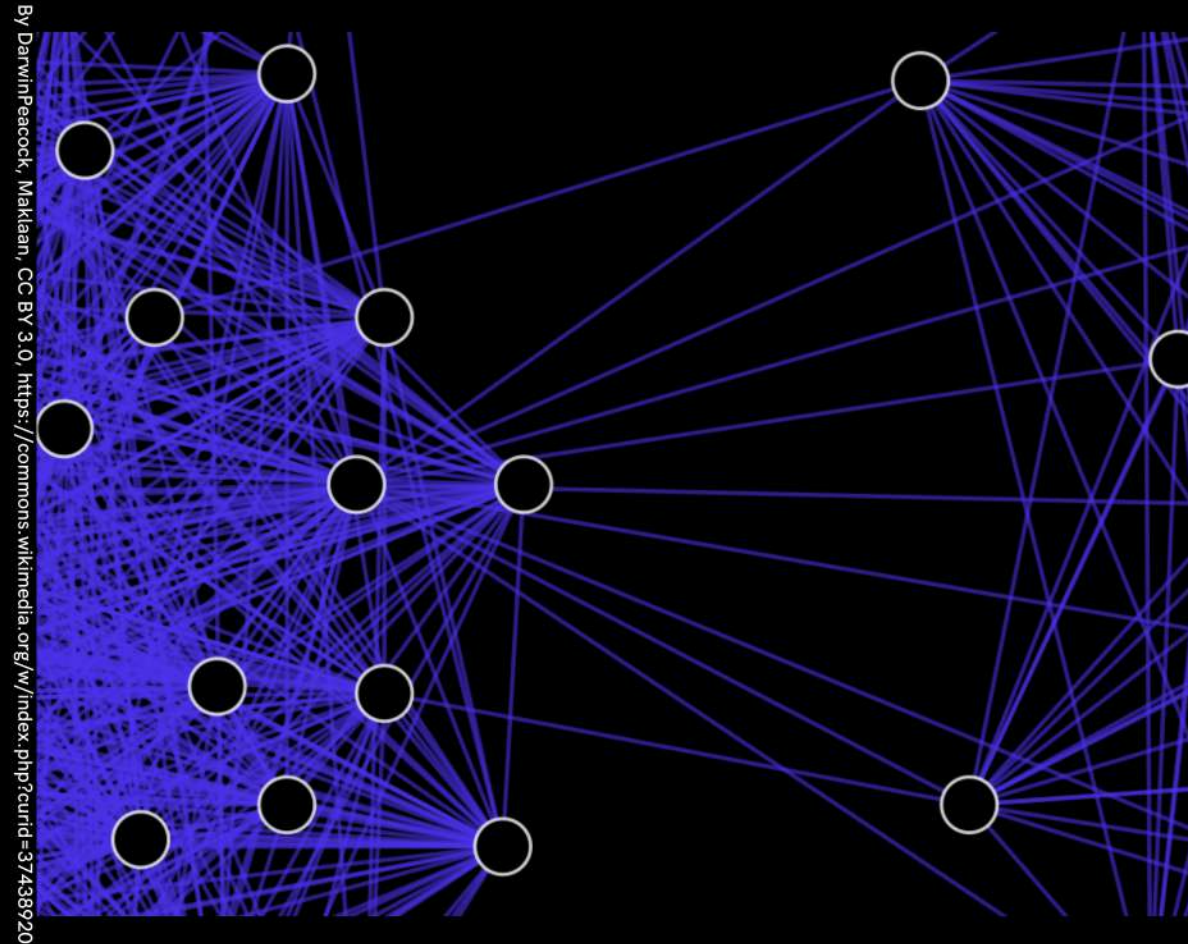
A UNIFIED THEORY OF SOCIETY IS POSSIBLE

DATA WITHOUT A MODEL IS STAMP COLLECTING

WITHOUT MODELLING WE (HUMANITIES) ARE WRITING OURSELVES INTO IRRELEVANCE