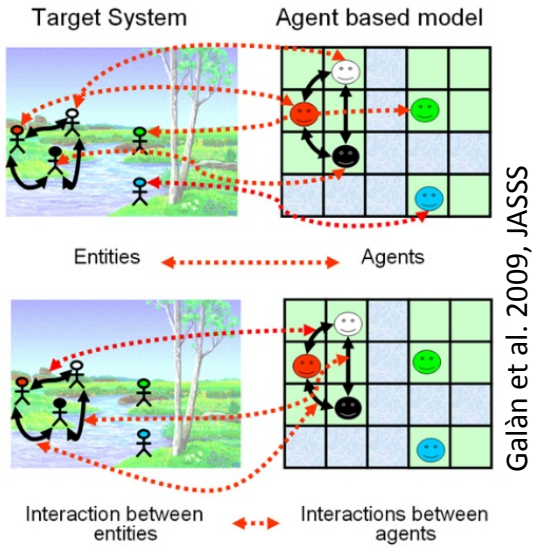
Agent-based modelling with NetLogo
2-day workshop, 14.-15.10, Bogor



Galàn et al. 2009, JASSS

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Agent-based model

What is an agend-based model?

- Agent-based
- Model

‚Model' is a general term used in different contexts

→ Before talking about ABMs, we need to understand what makes a model a model

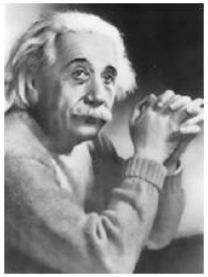
Modelling in general

What is a model?

A simplified, purposeful representation of reality

Cut off anything unessential!

ALWAYS first define a purpose or question for your model!



Albert Einstein:
A model should be as simple as possible, but no simpler.

Modelling in general

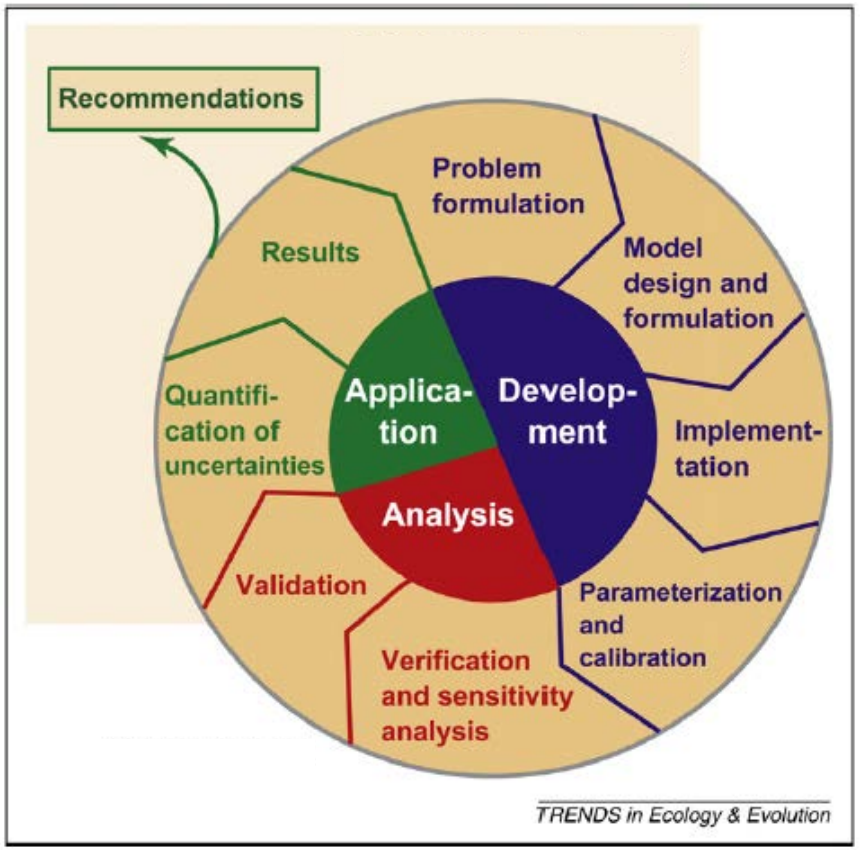
General model purposes

- Understanding
- Forecasting/predicting
- Demonstration/communication

Model complexity might differ depending on purpose!

Modelling cycle

- Modelling is an iterative process



Schmolke et al. 2010

Agent-based models

...are models in which individuals are represented explicitly

- Individuals are unique and different
- Individuals interact locally
- Individuals show adaptive behaviour

Typically, one is interested in how higer level dynamics emerge from low level characteristics

Agent-based models

- Individuals can be: animals, plants, humans, institutions, objects, groups of these
- Agent-based models (ABM) = individual-based models (IBM) = multi-agent models
- ABM makes sense, if at least one of these
  - Individual variability
  - Local interactions
  - Adaptive behavior

  is **essential** for the question

Agent-based models

Example: Fish schools / bird flocks

Agent-based models

Example: Fish schools / bird flocks

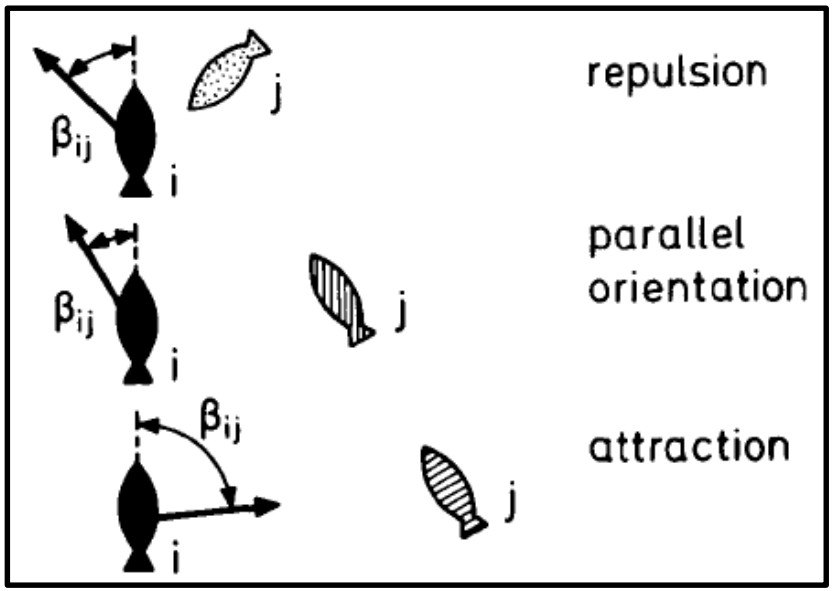
How do these movement patterns emerge?

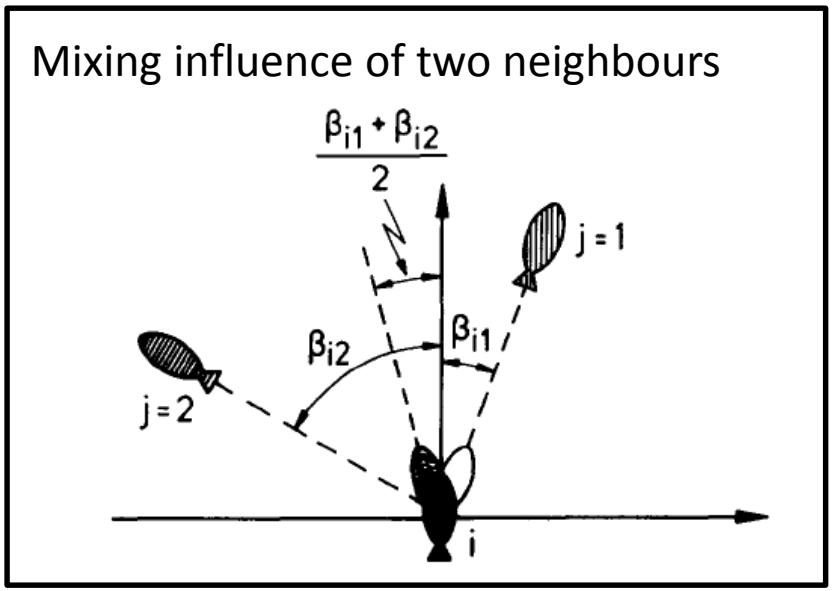
- Many individuals
- Local interaction
- Adaptive behaviour
- Very difficult to analytically describe this system, but easy to simulate emerging patterns with an ABM

Agent-based models

Example: Fish schools / bird flocks

- Movement rules for individuals

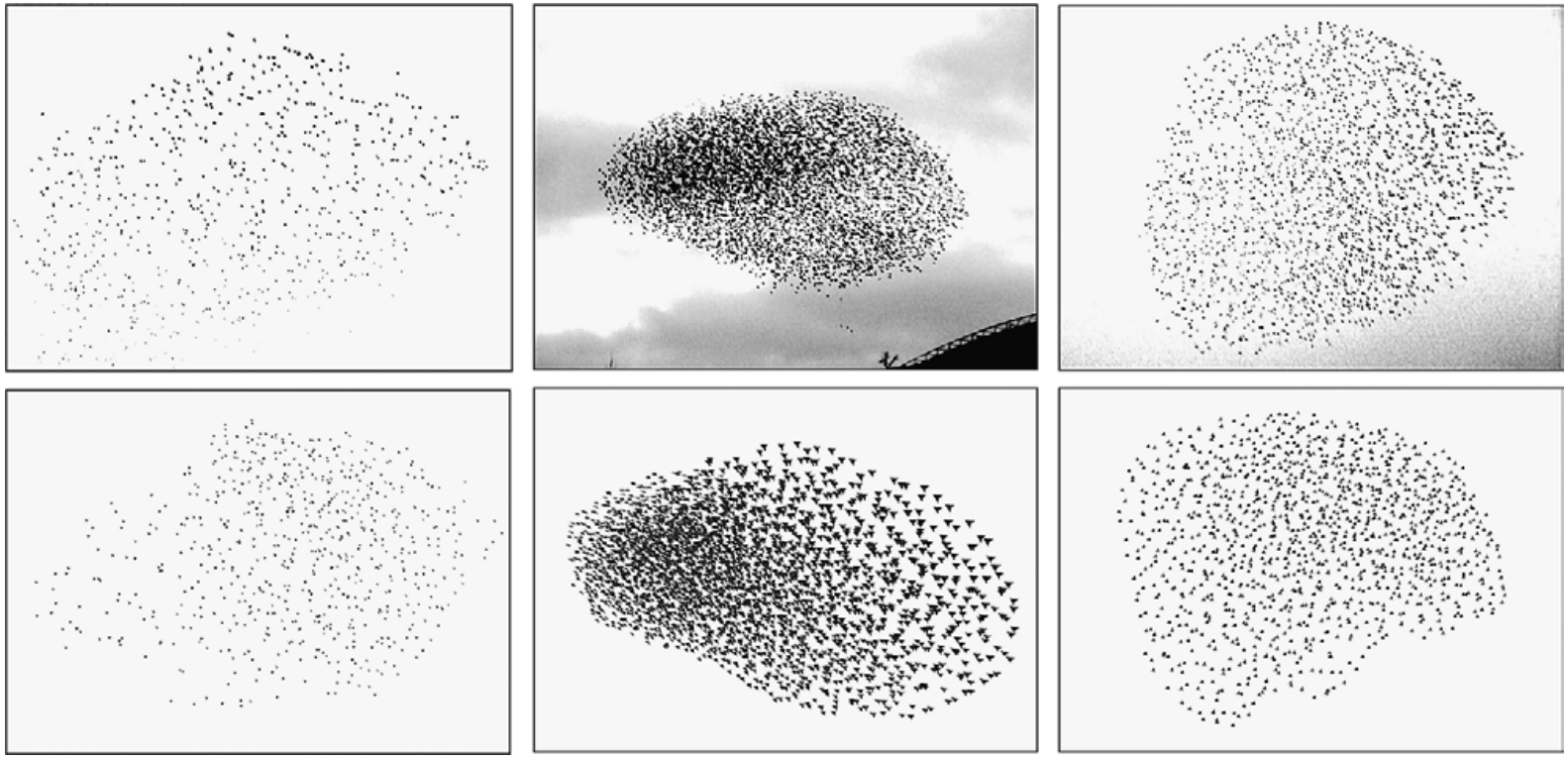




Huth and Wissel, Ecological Modelling 1994

Agent-based models

Example: Fish schools / bird flocks



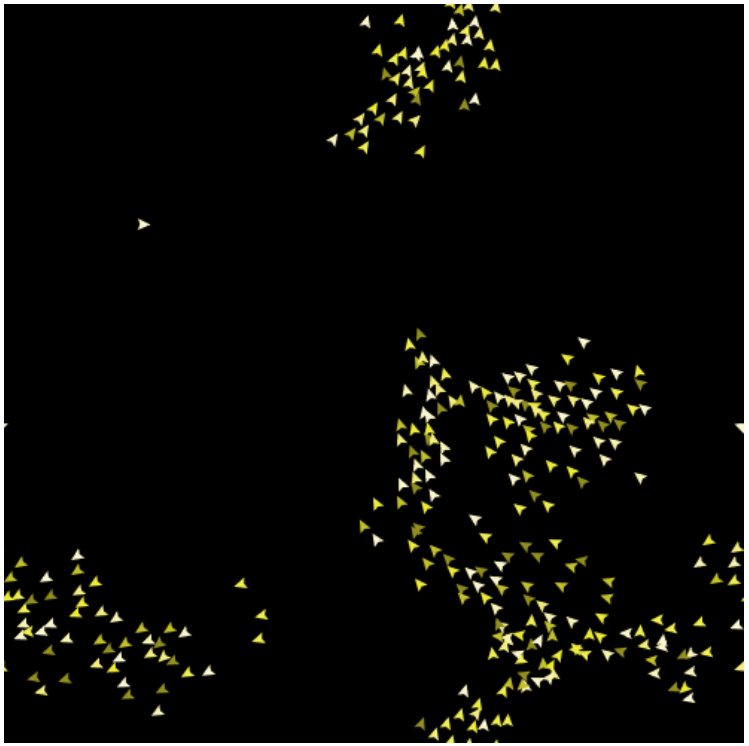
Reality

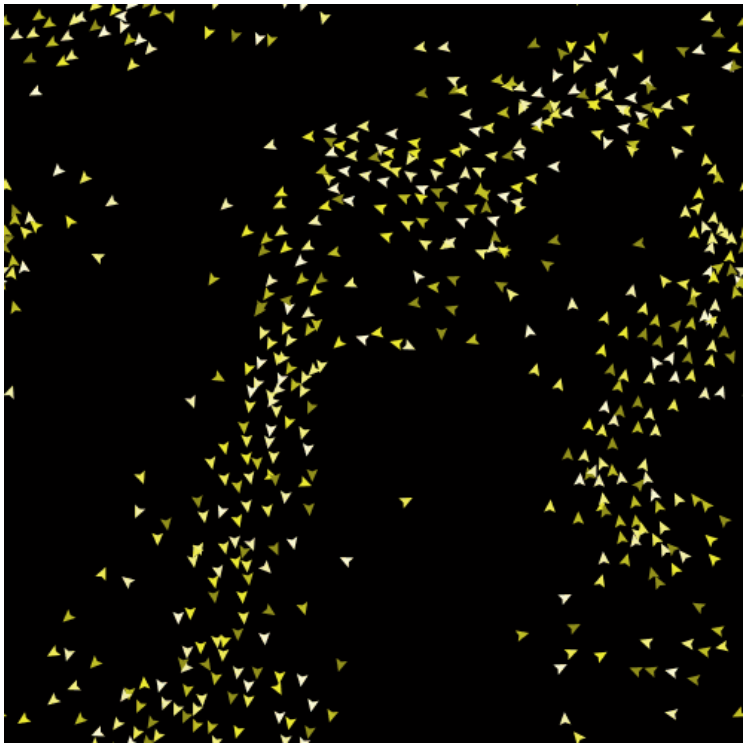
Model output

Hildenbrandt et al. 2010, Behavioral Ecology

Agent-based models

Example: Fish schools / bird flocks





NetLogo: Flocking model, Uri Wilensky (~50 lines of code)