Modelling Hunter-Gatherer Mobility in Agent-Based Simulations

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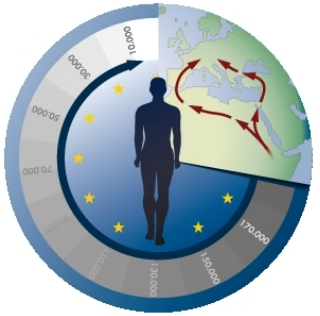
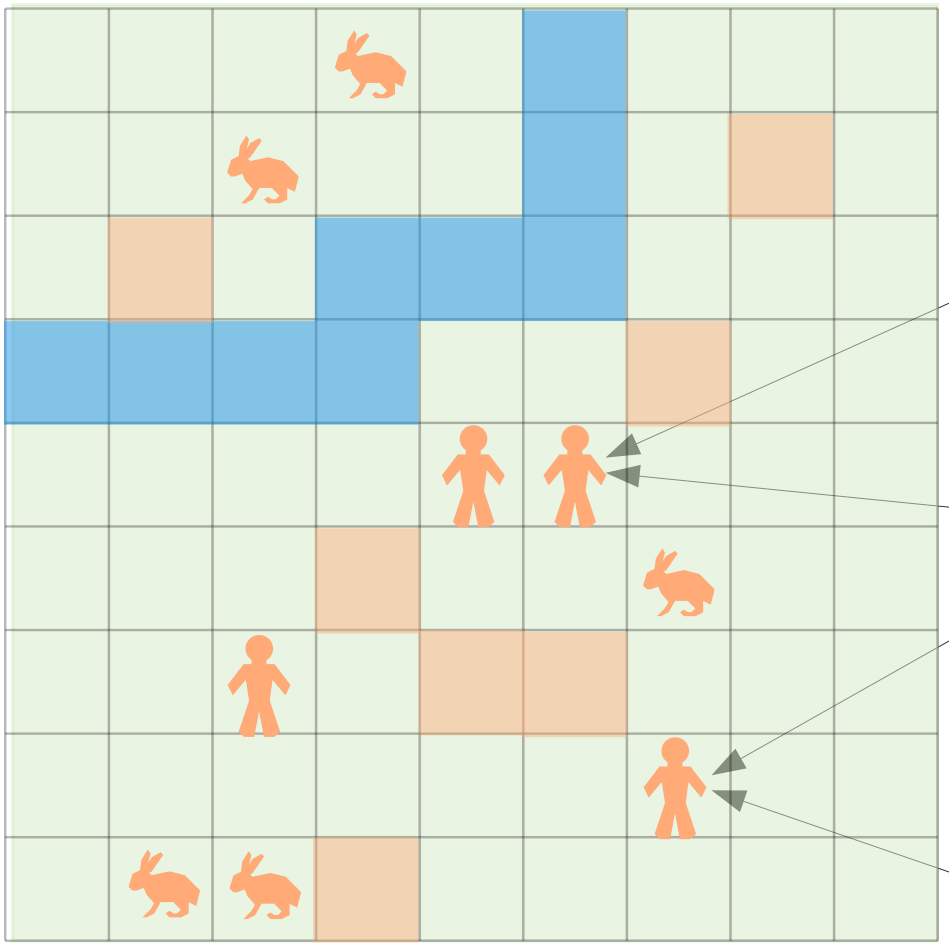


Research topics of agent-based simulations with hunter-gatherers

- Possibility of certain land-use scenarios
- Effectiveness of different foraging strategies
- Features of mobility strategies
- General mechanisms and features of dispersal
- Interpretation of stone raw-material usage seen in forager archaeological sites
- Evaluation and extension of Optimal Foraging Theory
- Extinction of hominin groups
- Evolution of altruistic behaviors
- Evolution of culture

ABS in a nutshell

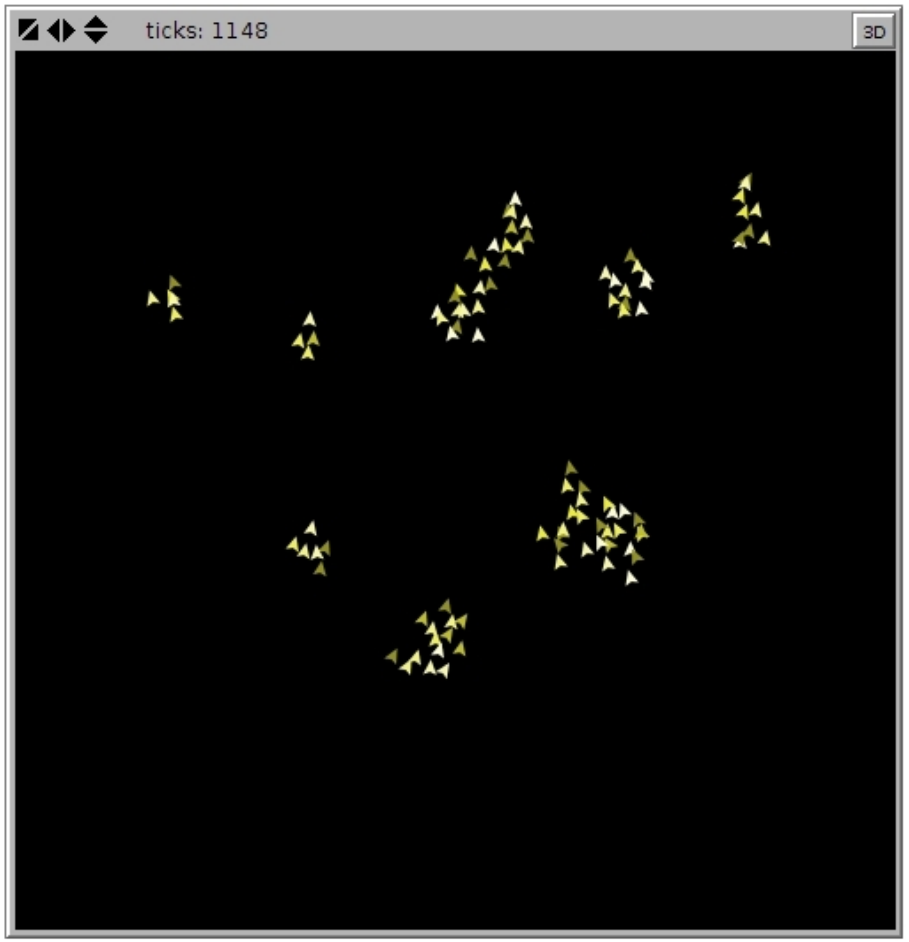


Attributes
energy: 60
age: 30
sex: male
…

Behavior Rules
go to next resource patch
copy best-behavior
…

Attributes
energy: 80
age: 27
sex: female
…

Example: Flocking



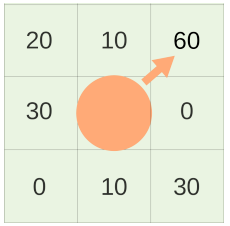
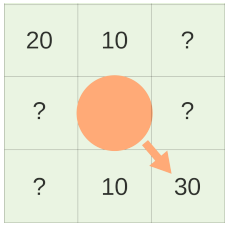
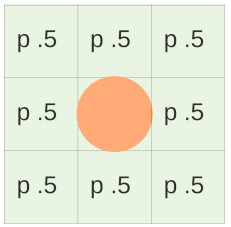
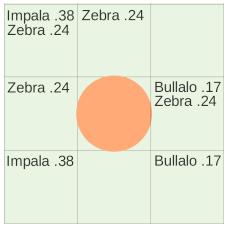
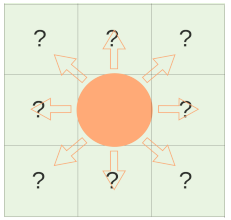
Wilensky, U. (1998). NetLogo Flocking model. http://ccl.northwestern.edu/netlogo/models/Flocking. Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.

Simple rules – complex outcomes

- **Alignment** means that an agent tends to turn so that it is moving in the same direction that nearby agents are moving.
- **Separation** means that an agent will turn to avoid another agent which gets too close.
- **Cohesion** means that a agent will move towards other nearby agents (unless another bird is too close).

Reynolds, C. W. (1987) Flocks, Herds, and Schools: A Distributed Behavioral Model, in Computer Graphics, 21(4) (SIGGRAPH '87 Conference Proceedings) pages 25-34.

Modeling agent movements

sensing	Moore neighborhood	movement
perfect knowledge		directed to optimal patch
partial knowledge		sometimes random, sometimes directed, but not necessarily optimal; agents learn
stochastic knowledge – general		p optimal and (1-p) random
stochastic knowledge – resource specific		sometimes random, sometimes directed, but not necessarily optimal
no knowledge		random movement

Random Search Strategies

simple random (Brownean)

correlated random

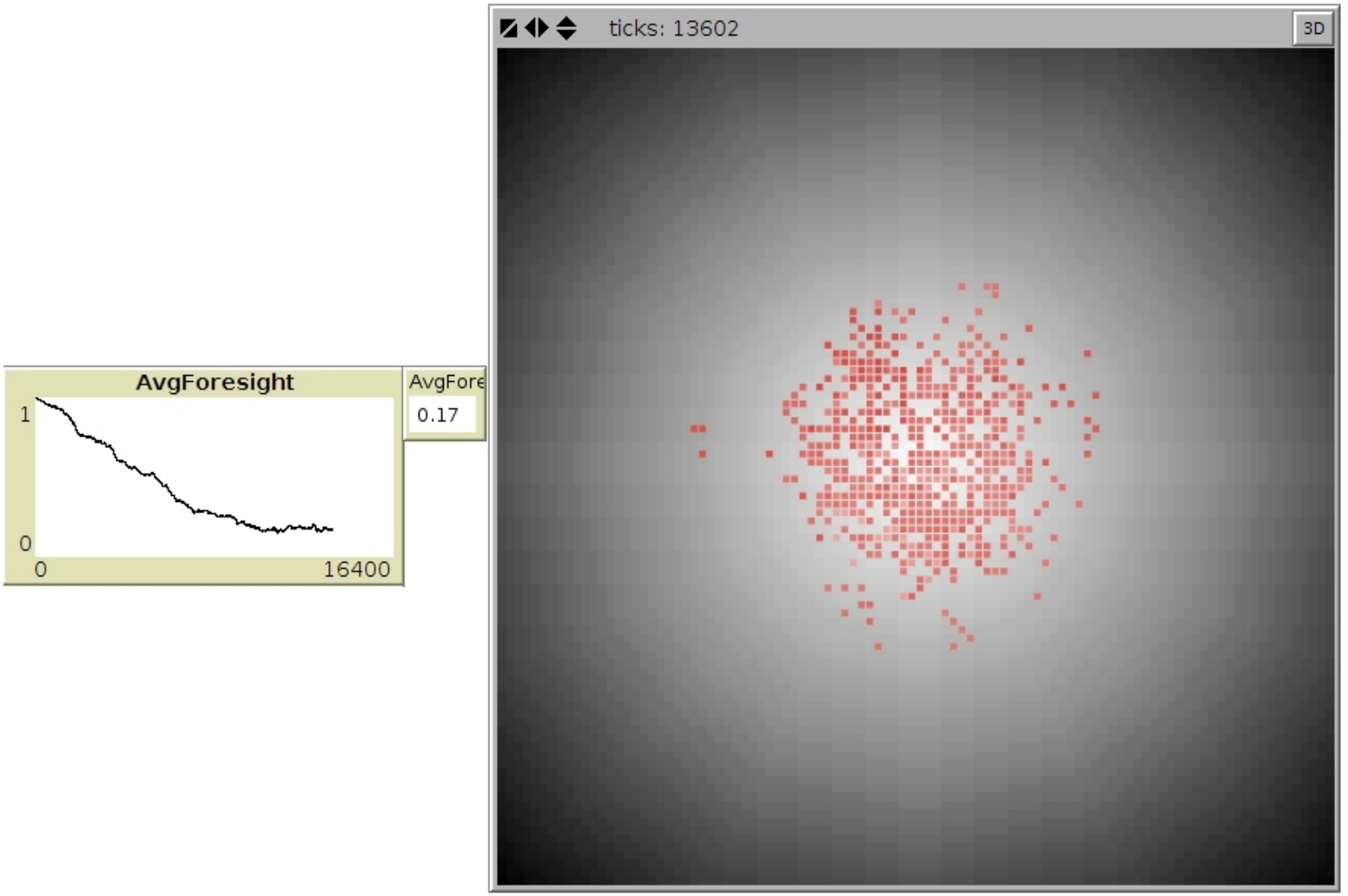
Lévy flight

Learning

- **Individual learning**: agents learn from their own experience
- **Social learning**: agents imitate other agents or are taught by others
- **Evolutionary learning**: the population of agents learns, because some agents die and are replaced by better ones

Gilbert, Nigel 2008: Agent-Based Models. Quantitative Applications in the Social Sciences. SAGE.

Example: The Role of Spatial Foresight



Wren, Colin D., Julian Z. Xue, Andre Costopoulos, and Ariane Burke 2014: The Role of Spatial Foresight in Models of Hominin Dispersal. Journal of Human Evolution 69(0): 70–78.

Thanks for your attention

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