

Introduction to
Agent-Based Modeling
for Social Scientists
DAY 1

with your host:

Aaron L Bramson



Aaron Bramson

Perpetual Student

- Undergrad at University of Florida
 - B.A. Philosophy
 - B.S. Economics: Business School
- 2 Years in Econ PhD at Boston Univ
- M.S. in Mathematics from Northeastern
- Joint PhD at Univeristy of Michigan
 - Complex Systems Certificate
 - Political Science
 - Philosophy

Gainfully Employed

- Research Scientist at Lockheed Martin
- Importer of Traditional Japanese Shoes
- Worked as consultant in AI
- Occasional Musician and Photographer



WHO IS THIS GUY?

CONTENTS

What Are Agent-Based Models

- Brief History of Complex Systems and ABM
- Various Flavors of Agent-Based Models

What are ABMs made of?

- Various Flavors of Agent-Based Models (review)
- Components of all Agent-Based Models
- Model specific ABM components
- How to compare the value of different components
- Benefits and Limitations of Agent-Based Models

Survey of ABM packages

- Do it Yourself from Scratch (C++, Java, etc.)
- Comparison of Swarm, AnyLogic, Ascape, NetLogo, and RePast
- Comparing NetLogo and RePast
- Analyze the Rabbit, Grass, Weeds Model
- Identify Lever Points in the Cooperation Model

CONTENTS

Before you Begin Building a Model...

- Can it be done in NetLogo?
- Find Code to Steal
- Locate Sources of Help (Internet and Human)

Practical Guide to Building NetLogo Models

- Simplicity or Speed
- Planning Algorithms before Writing Them
- Reuse as much code as possible (but not more)
- Tons of Examples and Explanations

Exercises and Applications

- Students will build models to develop skill and comfort
- Guided construction of a chosen model

CONTENTS

Advanced Techniques and Extensions in Netlogo

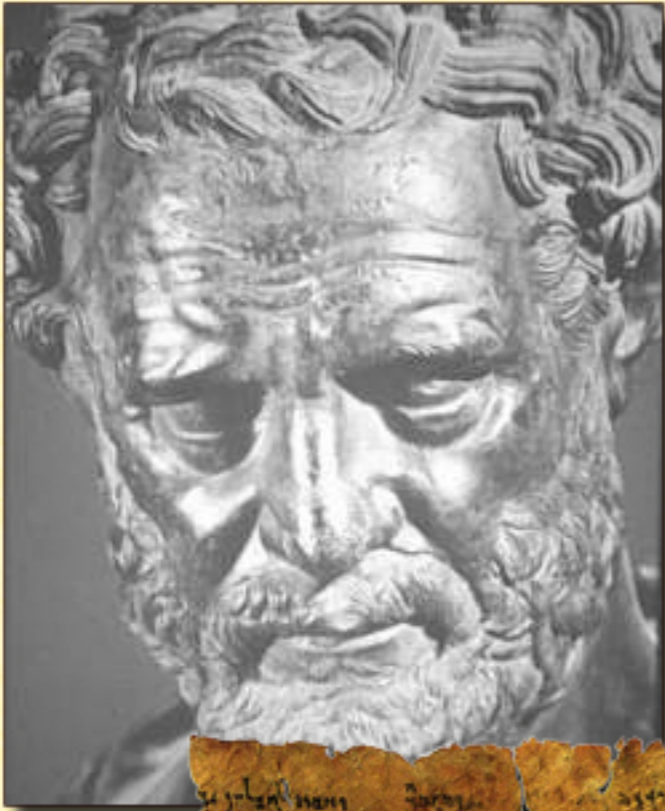
- NetLogo 3D
- Shapes Editor, Dynamical Systems, Behavior Space
- Networks, Functions, and Famous Kludges
- Java Extensions and Import & Exporting

Dealing with Data

- Batch Runs and Post Processing
- Metrics, Measures, and Modeling Magic
- The Folly of Statistics
- Are Your Results Viciously Built into the Model?

Developing and Working on Projects

- Finding a Good Base Model
- Planning the Development Stages
- Work, Work, Work. Get 'er done!

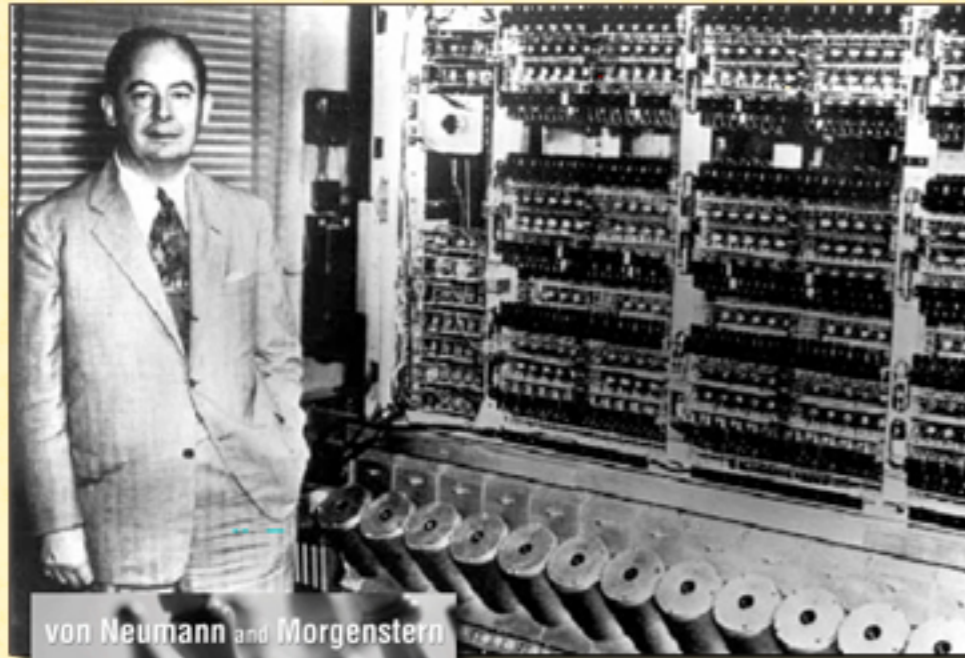


Democritus

- Grandfather of Complex Systems
- Natural Philosopher 460-370 B.C.E.
- Co-Founder of Atomist Theory
- Very little first-hand work is known; most information is from second-hand accounts and may be bunk

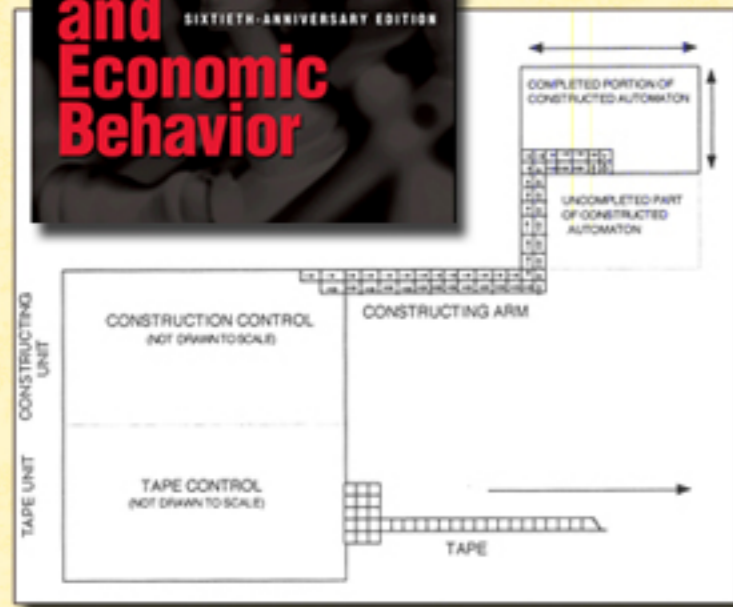


INTRODUCTION TO AGENT-BASED MODELING



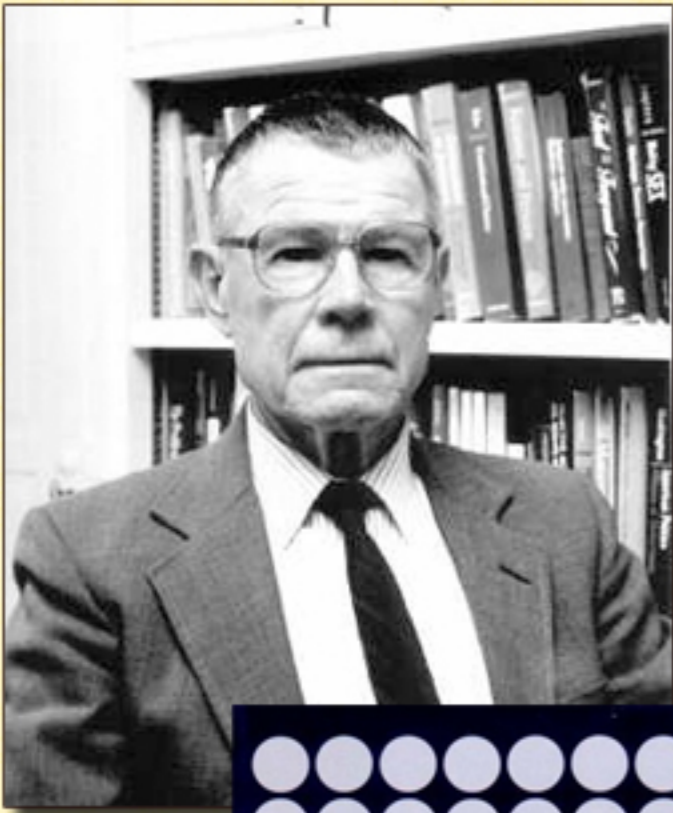
von Neumann and Morgenstern

**Theory
of Games
and
Economic
Behavior**
SIXTIETH-ANNIVERSARY EDITION



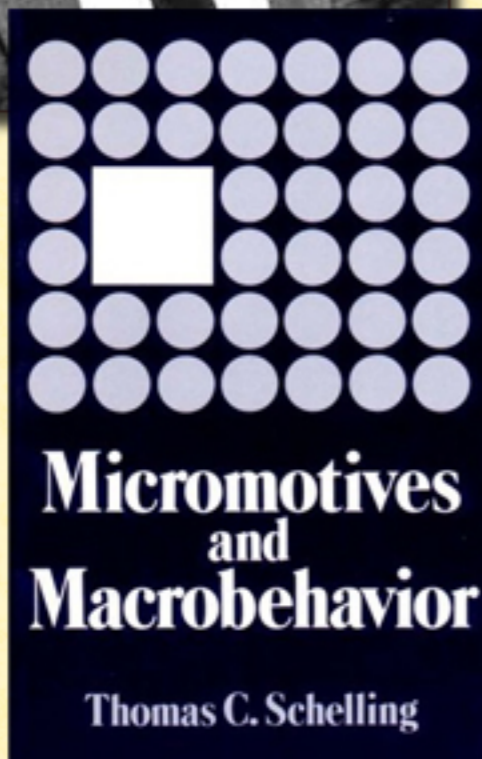
John von Neumann

- Grandfather of Agent-Based Modeling
- Hungarian born Mathematician, 1903-1957 (died of cancer)
- Invented Game Theory
- Helped Develop Atomic Bomb
- Invented the Computer
- Invented Cellular Automata
- Figured out Godel's Incompleteness Theorem before Godel (but was nice)



Thomas C. Schelling

- Father of Agent-Based Modeling
- 2005 Nobel Prize Winner in Economics for work in Game Theory
- Clearly explained and motivated bottoms-ups approach in his 1978 book *Micromotives and Macrobehavior*
- Famous Segregation (aka "Tipping") model is the first modern agent-based model





John H. Conway

- Mathematician and early adopter
- Created cellular automata model called “The Game of Life”
- Provoked strong reactions and garnered interest in ABMs
- Complex behavior from simple rules

