MIT STEP/TEA

Constructionism

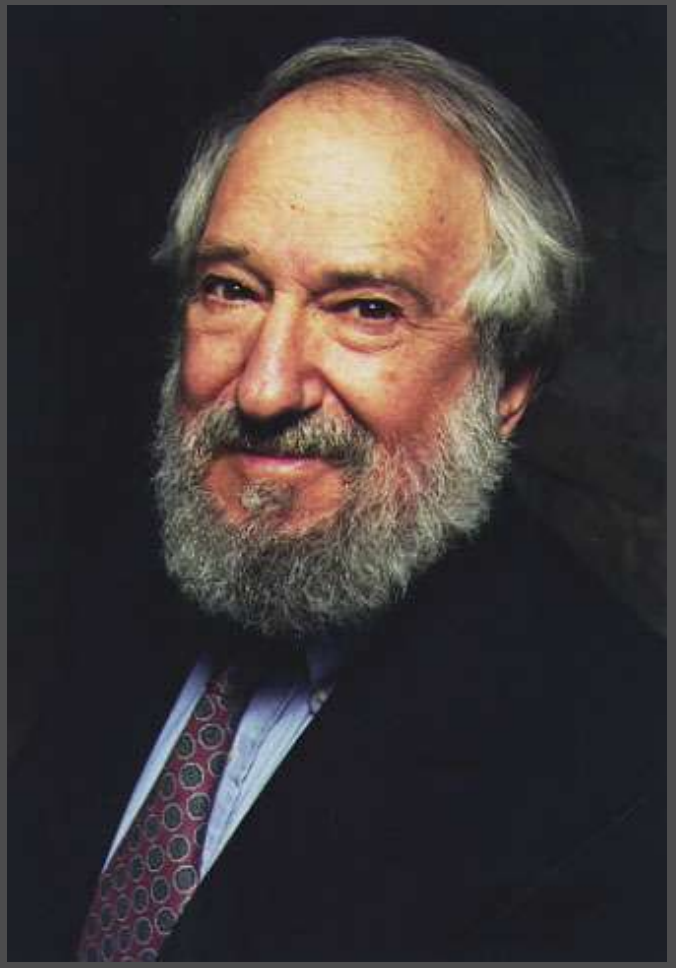
WENDY HUANG AND DANIEL WENDEL: MIT SCHELLER TEACHER EDUCATION PROGRAM (STEP)

Lesson Overview

- Lecture:
  - What is Constructionism?
  - Connections to Modeling and Computational Thinking
- Demonstration: Programming an Epidemic Model
- Summary
- Assignment

What is Constructionism?

- Seymour Papert (MIT professor) defined constructionism as "building relationships between old and new knowledge, in interactions with others, while creating artifacts of social relevance."

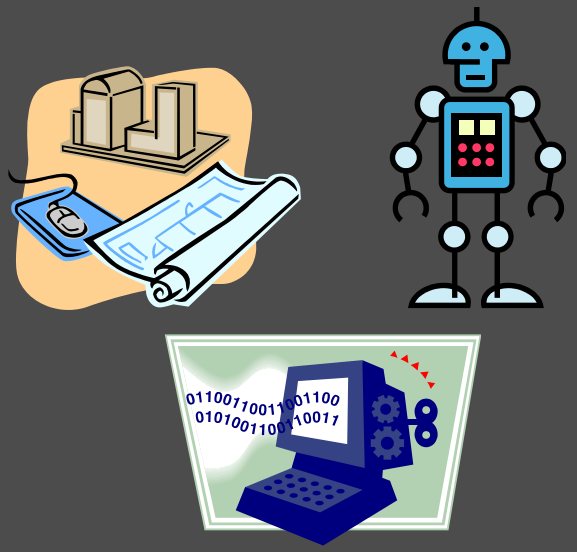


What is Constructionism?

- Built upon Piaget's theory of constructivism

Constructionism and Education

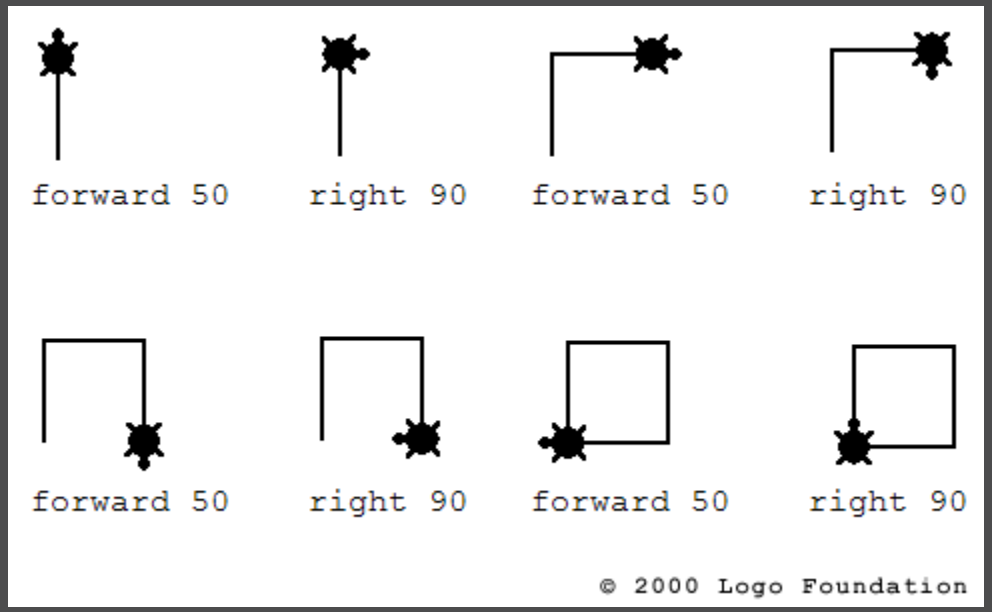
- Learning is constructed in the interactions between teacher and students as they engage in design and discussion of learning artifacts.



Artifacts = “Objects-to-think-with”

Constructionism and Education

- Example: LOGO



Constructionism and Modeling

- Computer models are a type of “objects-to-think-with”.

- Using models allows learners to manipulate mathematical and scientific objects and conduct inquiry in new ways.

- Modifying and creating models engage students in a design process to produce shareable “objects-to-think-with.”

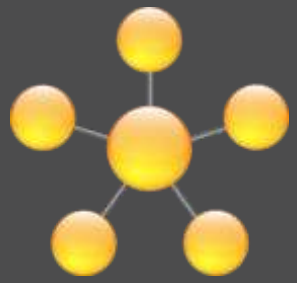
Agent-based Model Design Process

- What is the system or process you want to model?
- What are the features of interest to model?
- How will the model visualize these features?
- Who or what are the agents?
- How do the agents behave and interact with each other or the environment?
- What tool will you use to build and test the model?

Model Design Example

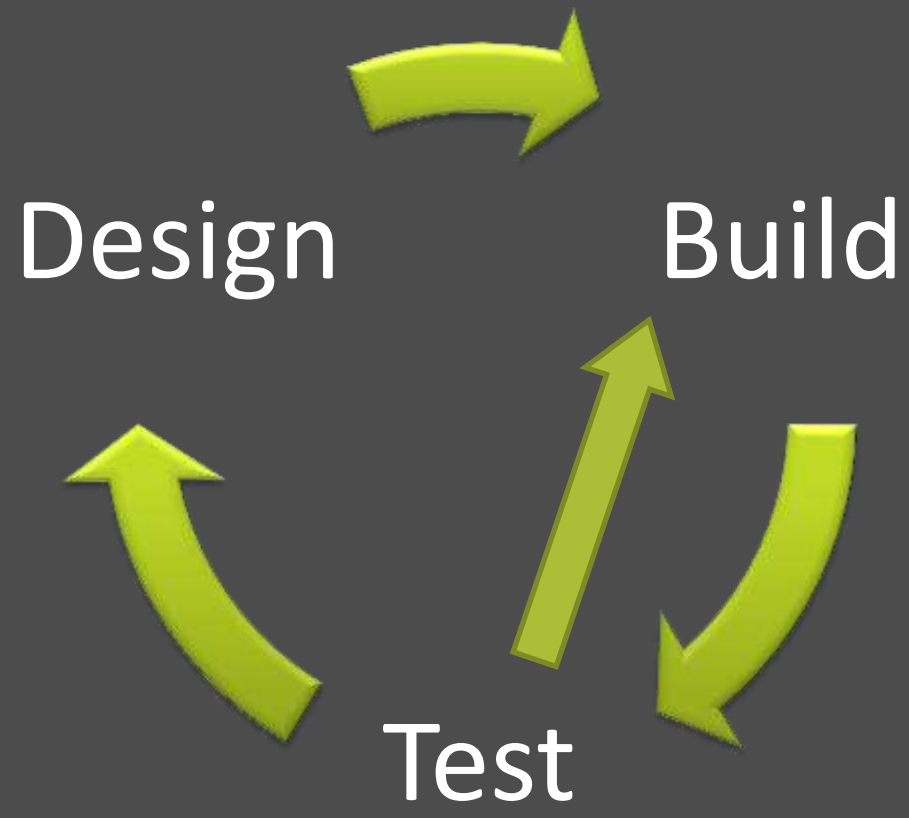
- What is the system or process you want to model?
  - Epidemic: spread of a disease through a population
- What are the features of interest to model?
  - Starting numbers of sick and healthy agents
  - Population density
  - Track numbers of healthy and sick agents
- How will the model visualize these features?
  - Colors (red = sick; green = healthy)
- Who or what are the agents?
  - Individuals that make up a population; can be healthy or sick
- How do the agents behave and interact with each other or the environment?
  - Agents move around randomly
  - Sick agents spread disease through contact
- What tool will you use to build and test the model?
  - Toolblox!

Modeling and Computational Thinking



COMPUTATIONAL THINKING: Programming

Modeling and CT are Iterative Processes

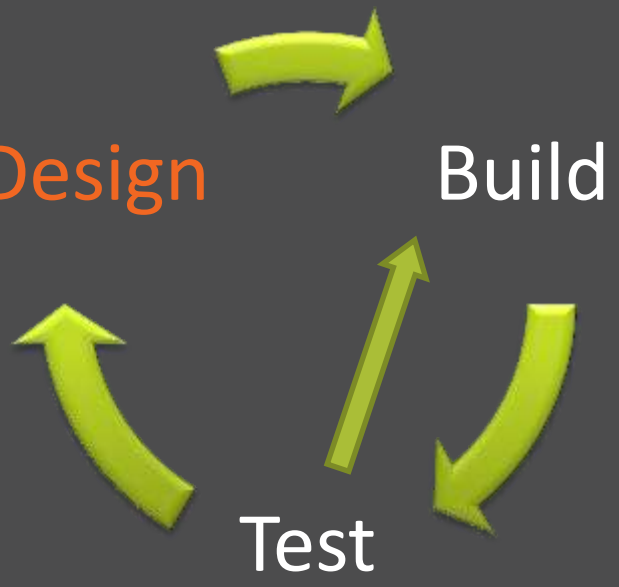


Assignment Demonstration

- You will use Toolblox to program a model that simulates the spread of a disease through a population. You will also design and program at least one model extension.
- Demonstrate how to build epidemic model

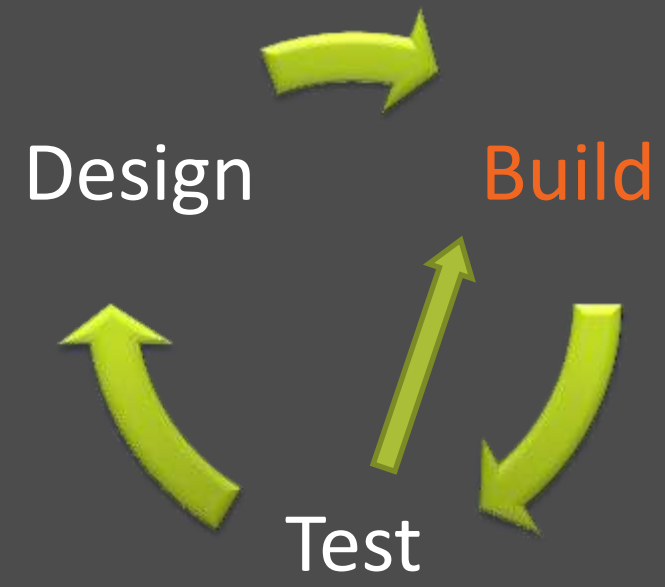
Iteration: Revising the Model

- Iterate within model designing process
  - What if agents can recover?
  - What if some agents are immune?
  - What if agents who recover *become* immune?

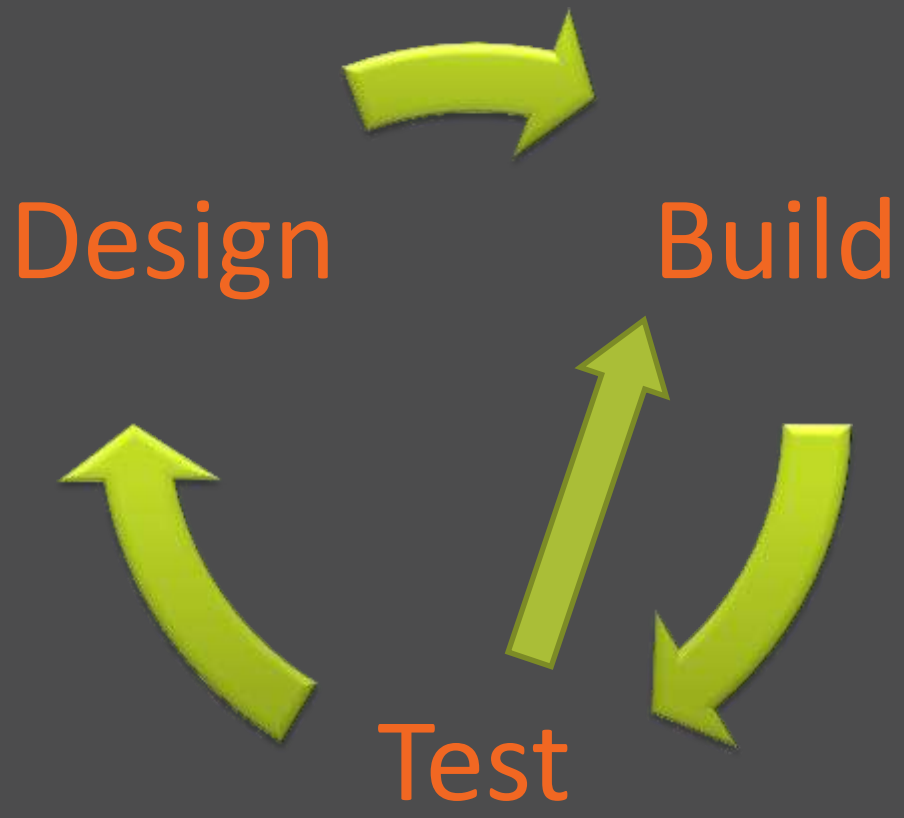


Iteration: Revising the Model

- Iterate within model building process
  - How should agents recover?
  - How do we define recovery rules for a population where different agents take different amounts of time to recover?



Iterate as much as you can



Summary

- Constructionism = theory of knowledge building
- Modeling = one expression of constructionism
- Design process → make mental model more explicit
- Computational thinking → construct model as computer artifact
- Use – Modify – Create progression
- How to program a model in Toolblox

Assignment

- Read article “Constructionism”
  - In Moodle forum, answer question: How would you convince a teacher that constructionism is important for teaching and learning? What examples would you give?
- Program an Epidemic model in Toolblox
  - Follow directions on Epidemic programming tutorial
  - Choose or invent one extension to program
  - If needed, ask for programming help via a Moodle forum or scheduled live chat
  - Write a reflection about the activity and provide a link to your Toolblox epidemic model with extension in the Moodle forum.

Thanks!

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