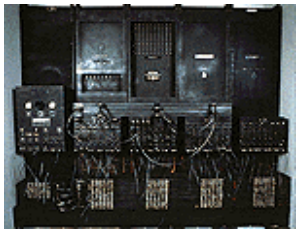
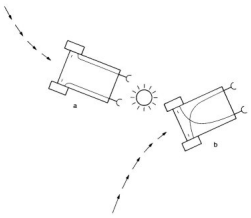

Enigma Machine


ENIAC


Braintenberg Vehicles


Ghengis

Enigma Machine: German cipher machine. The picture shows a 3 rotor model, http://www.chss.montclair.edu/~pererat/mcpu.htm.
ENIAC: Electrical Numerical Integrator and Computer, Smithsonian Photo #90-7164B, Laurie Minor-Penland, http://photo2.si.edu/infoage/infoage.html.
Braitenberg Vehicles: These simple autonomous agents were introduced as a thought experiement challenging symbol system models of intelligence.
GHENGIS: Ghengis is an autonomous "animat" designed for research on insect mobility, http://www.ai.mit.edu/projects/genghis/genghis.html.

The Possibility of Artificial Intelligence, WINTER2011

Phil321e: F 1:00 – 4:20

Professor William Seeley, 75 Campus Avenue, rm 202
Office Hours: W: 10-11/F 12-1 & by appointment
wseeley@bates.edu

Course Description:

What are minds? Are minds like computers? If so, how much is a computer like a mind? Is it possible for a machine or a computer to think? If it were possible, what would these thoughts be like? Would they be just like ours? Could machines feel emotions or make genuinely moral choices? Do these questions have any bearing on the possibility of artificial intelligence? Before we can answer these questions we must first come to an agreement on what it is to be a thinker at all. It was once thought that thinking was what set human beings from the rest of the universe. Today we send autonomous robots to far away planets to do our research and cognitive scientists regularly use computer simulations and animal models to help them understand intelligent behavior. In this course we will examine and evaluate some contemporary concepts and issues in philosophy, psychology, and computer science that are critical to both research in artificial intelligence and discussions of the computational theory of mind. The topics covered will include: intentionality, representation, consciousness, rationality, the traditional symbol system model for intelligence, and behavior based alternatives associated with work on the development of autonomous agents in robotics and artificial life.

Course Goals:

The goals of this course are threefold. We will try to come to an understanding of what artificial intelligence is, and more importantly what it is not, as a research program in psychology and computer science. In this context we will evaluate the validity of several philosophical problems associated with artificial intelligence. This debate will be used to evaluate the traditional symbol system model for AI and introduce contemporary behavior based alternatives. Along the way we will evaluate, challenge, and develop our own common sense assumptions about the nature of intelligence.

** This seminar will be of interest to students with some background in cognitive science (e.g. students who have taken courses like Philosophy of Mind, Cognitive Psychology, Sensation and Perception, Brain Matters, Animal Learning, Physiological Psychology, or Formal Logic). However, the course does not presuppose any prior specialized knowledge of philosophy, psychology, or computer science.

Texts:

- *Mind Design II*, ed. John Haugeland (Cambridge, MA: MIT Press, 1997). ***(MD)***
- *Vehicles: Experiments in Synthetic Psychology*, Valentino Braitenberg (Cambridge, MA: MIT Press, 1986). ***(BV)***
- Electronic resources: online resources & pdf files on Lyceum ***(L)***.

Requirements:

- A ***3 page analysis paper*** due early in the semester (10%).
- A ***6 page paper*** on an assigned topic due at the midterm (25%).
- Artificial neural networks exercises: ***a set of online connectionist simulation exercises*** (5%).
- ***Mobile robotics exercises and team projects***: hands-on experience with autonomous agents (20%).
- A ***12 page final paper*** on a topic of your choosing (40%). Topics must be cleared by me before the end of week 10.
- ***Class participation*** (including attendance) is worth an additional +/-(10%) of your grade.

The Possibility of Artificial Intelligence: syllabus

Schedule of Readings:

Week 1 : Introduction: What is AI?

Haugeland:	The Saga of the Modern Mind ***(L)***
Intelligent By Design:	http://www.pbs.org/saf/1303/features/AI.htm
ELIZA	http://www.manifestation.com/neurotoys/eliza.php3
Robocup	http://www.robocup.org/

Week 2: Minds, Patterns, and Representations

Dennett:	True Believers: The Intentional Strategy and Why It Works (***MD)***
Turing:	Computing Machinery & Intelligence ***(MD)***

Week 3: The Symbol System Hypothesis or Good Old Fashioned Artificial Intelligence (GOFAI)

Marr	*Vision* (excerpt) ***(L)***
Haugeland	What is Mind Design ***(MD)***
Newell & Simon	Computer Science as Empirical Enquiry: Symbols & Search" ***(MD)***

Week 4: AI at an Impasse?

Minsky:	A Framework for Representing Knowledge ***(MD)***
Dennett:	Cognitive Wheels ***(L)***
Dreyfus:	From Micro Worlds to Knowledge: AI at an Impasse ***(MD)***
Searle:	Minds, Brains, & Programs ***(MD)***

Week 5: Connectionism

Rumelhart:	The Architecture of Mind: A Connectionist Approach ***(MD)***
Smolensky	Connectionist Modeling: Neural Computation / Mental Connections ***(MD)***
Churchland:	On the Nature of Theories (excerpt) ***(MD)***

Week 6: Challenges to Connectionist Models

Fodor & Pylyshyn:	Connectionism and Cognitive Architecture: A Critical Analysis ***(MD)***
Clark	The Presence of a Symbol ***(MD)***

Week 7: Heideggerian AI

Clark	Robotics and Artificial Life ***(L)***
Dreyfus	Why Heideggerian AI failed and How Fixing It Would Require Making It More Heideggerian ***(L)***
Agre & Chapman	Pengi: An Implementation of a Theory of Activity ***(L)***

Week 8: Intelligence Without Representation

Braitenberg	*Vehicles" Experiments in Synthetic Psychology* ***(BV)***
Brooks	Intelligence without Representation ***(MD)***
Webb	A Spiking Neuron Controller for Cricket Phonotaxis ***(L)***

Week 9: Building Vehicles and Creatures

Hogg, Martin, & Resnick	Braitenberg Creatures ***(L)***
Pfeifer & Scheier	Embodied Cognitive Science: Basic Concepts ***(L)***

Week 10: Representations Reconsidered

Kirsch	Today the Earwig, Tomorrow Man? ***(L)***
Markman & Dietrich	In Defense of Representation ***(L)***

Week 11: Embodied Cognition and Artificial Life: Reconsidering The Chinese Room and the Frame Problem

Taddeo & Floridi	Solving the Symbol Grounding Problem ***(L)***
Sims	Evolving 3D Morphology and Behavior by Competition ***(L)***

Week 12: Dynamic Systems Approaches

Clark:	Dynamics ***(L)***
van Gelder:	Dynamics & Cognition ***(MD)***
Wheeler	From Robots to Rothko: The Bringing Forth of Worlds ***(L)***

Some Miscellaneous Notes and Guidelines:

Moral behavior is the grounds for, and the framework of, a healthy society. In this regard it is each of our responsibility as an individual within the community of our classroom to act responsibly. This includes following the rules and guidelines set out by Bates College for academic behavior. Plagiarism is a serious matter. It goes without saying that each of you is expected to do his or her own work and to cite EVERY text that is used to prepare a paper for this class. As a general rule, I ask that you not use the internet for your research except as assigned in class.

This is a seminar. This means that the content of the course, and our progress through the syllabus, should ideally be student driven. I have designed the course to allow us some flexibility so that we can spend more time on issues of interest to the class. I reserve the right to make changes to the syllabus as we go along in order to accommodate our interests as they emerge in class discussions. I will also occasionally upload supplementary materials to *Lyceum* for students interested in pursuing particular issues beyond class discussion.

The Possibility of Artificial Intelligence: syllabus

ASSIGNMENTS:

Paper Topic #1 (3-page paper): The purpose of an ***analysis paper*** is for you to evaluate a standard argument in the literature. This is not an opinion paper. The method of philosophy is critical analysis. We are interested in understanding the reasons behind values and beliefs, or better, the reasons that provide rational support for the beliefs that we hold. These reasons, if good, ought to provide logical support for our values and beliefs. In the following paper you should: identify the theoretical problem at hand; rehearse the standard argument for the position identified; and evaluate whether these reasons genuinely support that position. The first step identifies the problem space that you are addressing. The second step should have the form of a ***rational reconstruction***. In a rational reconstruction one does their best to give an argument a fair shake. You should do your best to make the standard argument as plausible as you can. The final step is to respond. Your response should identify a step in the standard argument that you find to be in error. The key here is that you are not arguing for the truth or falsity of the target position per se. Rather you are arguing that the reasoning offered does not suffice to establish that position as a conclusion.

a: Evaluate either *the systems reply* or *the robot reply* to the Chinese Room Argument?

b: What is *the frame problem* and is it a valid objection to the symbol system approach?

Due Date: Week 5

Connectionist Modeling Assignment: Work through the online exercises in the section on Artificial Neural Networks on the *CCSI* website. The purpose of this set of assignments is to reinforce our class work and familiarize you with the structure of connectionist architectures. You will be required to hand in print-outs of the simulations you construct to verify that you have done the exercises.

http://www.mind.ilstu.edu/curriculum/artificial_neural_net/intro_neural_nets.php?modGUI=239&compGUI=1286&itemGUI=2251

Due Date: Week 6

Midterm Assignment: Write a 6 page paper on one of the two topics. Your paper should be double-spaced in 12 point font with 1" margins. The purpose of this paper is twofold: a) identify & evaluate a standard argument in the literature; and b) demonstrate that you can synthesize the diverse range of material covered in the first half of the semester into a coherent position.

a) Are connectionist models of AI genuinely alternatives to GOFAI (symbol system) models? Make sure in your answer to discuss Marr's three levels of analysis, differences between connectionist and GOFAI architectures, and the role played by linguistic behavior in evaluations of both types of models.

b) Why does Dreyfus argue that AI is at an impasse? Is he right? Make sure to address issues surrounding the idea of 'salience' in natural and artificial systems in your answer.

Due date: Week 7

Robot Derby: We will divide ourselves into teams and work through a range of simple robotics exercises in class using the Lego NXT system. These exercises are derived from Valentino Braitenberg's book *Vehicles* and the Braitenberg Creatures described in Hogg, Martin, & Resnick (1991). The goal is to explore the power (and shortcomings) of behavior based animat approaches to AI using our robots to model some simple intelligent and cooperative behavior. Out of class teams will work independently on these projects and we will gather during the exam period for a robot derby to display our solutions.

A-Life Exercises: Schedule permitting, we will work through some simulation exercises in conjunction with the readings on artificial evolution (week 11). Researchers who embrace embodied cognition argue that evolution solves the symbol grounding claim in natural organisms. The goal of these exercises is to a) explore the power of artificial evolution as a research tool in AI and b) evaluate the claim that evolutionary explanations of symbol grounding dissolve difficulties associated with Searle's Chinese Room argument and the frame problem.

Final paper: There is no final exam; your final paper (12 double spaced pages) is due on the scheduled exam date; you must clear your topic with me by Week 10.

The Possibility of Artificial Intelligence: syllabus

Bibliography:

Topic 1: Introduction: What is AI?

- John Haugeland, “Introduction,” *Artificial Intelligence: The Very Idea* (Cambridge, MA: MIT Press, 1989), 1-12.
- John Haugeland, “The Saga of the Modern Mind,” *Artificial Intelligence: The Very Idea* (Cambridge, MA: MIT Press, 1989), 15-44.

Supplemental:

- Jack Copeland, “Some Dazzling Exhibits," *Artificial Intelligence* (Malden, MA: Blackwell Publishers, 1993), 11-32.

Topic 2: The Symbol System Hypothesis or Good Old Fashioned Artificial Intelligence (GOFAI)

- Daniel Dennett, "True Believers: The Intentional Strategy and Why It Works," in ed. John Haugeland *Mind Design II* (Cambridge, MA: MIT Press, 1997), 57-80.
- Alan Turing, “Computing Machinery & Intelligence,” in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997), 29-56.
- David Marr, *Vision* (New York: W. H. Freeman and Company, 1982), 19-31.
- John Haugeland, “What Is Mind Design?” in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997), 1-28.
- Allen Newell & Herbert A. Simon, “Computer Science as Empirical Enquiry: Symbols & Search,” in ed. John Haugeland, *Mind Design II*, (Cambridge, MA: MIT Press, 1997), 81-110.
- Marvin Minsky, “A Framework for Representing Knowledge,” in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997), 111-142.
- Daniel Dennett, “ Cognitive Wheels: The Frame Problem of AI, “repreinted in ed. Margaret A Boden, *the Philosophy of Artificial Intelligence* (New York: Oxford University Press, 1990), 177-170.
- Hubert l. Dreyfus, “From Micro-Worlds to Knowledge: AI at an Impasse,” in ed. in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997)
- John Searle, “Minds, Brains, & Programs,” in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997), 183-204.

Supplemental:

- Herbert A. Simon, *The Sciences of theArtificial, 3rd Edition* (Cambridge, MA: MIT Press, 1996).
- Jack Copeland, “A Hard Look at the Facts,” *Artificial Intelligence* (Malden, MA: Blackwell Publishers, 1993), 83-120.
- Daniel Dennett, "Cognitive Wheels: The Frame Problem of AI," in ed. Hookway, C , *Minds, Machines, and Evolution: Philosophical Studies* (Cambridge, UK. Cambridge University Press, 1984) 147-170.
- Jack Copeland, “The Chinese Room from a Logical Point of View,” in eds. John Preston & Mark Bishop, *Views into the Chinese Room* (New York: Oxford University Press, 2002), 109-122.

Topic 6: Connectionism

- David Rumelhart, ”The Architecture of Mind: A Connectionist Approach,” in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997), 205-232.
- Paul Smolensky, “ Connectionist Modeling: Neural Computation / Mental Connections,” in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997), 233-250.
- Paul Churchland, “On the Nature of Theories: A Neurocomputational Perspective,” in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997), 251-292.
- Jerry Fodor & Zenon Pylyshyn, "Connectionism and Cognitive Architecture: A Critical Analysis," in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997), 309-350.
- Andy Clark, “The Presence of a Symbol,” in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997), 377-393.

Online Simulations/Exercises:

- CCSI Artificial Neural Networks: http://www.mind.ilstu.edu/curriculum/artificial_neural_net/intro_neural_nets.php?modGUI=239&compGUI=1286&itemGUI=2251

Supplemental:

- Jack Copeland, “AI’s Fresh Start: Parallel Distributed Processing,” *Artificial Intelligence* (Malden, MA: Blackwell Publishers, 1993), 207-249.

The Possibility of Artificial Intelligence: syllabus

Topic 7: Challenges to the Traditional Model

Heideggerian AI:

- Andy Clark, "Robotics & Artificial Life," *Mindware* (Cambridge, MA: MIT Press, 2001), 103-119.
- Hubert L. Dreyfus, "Why Heideggerian AI Failed and How Fixing it Would Require Making it More Heideggerian," *Philosophical Psychology* 20(2), 2007, 247-268.
- Phillip E. Agre & David Chapman, "Pengi: An Implementation of a Theory of Activity," *Proceedings of American Association of Artificial Intelligence* 6, 1987, 268-272.

Supplemental:

- Beth Preston, "Heidegger and Artificial Intelligence," *Philosophy and Phenomenological Research*,53(1), 1993, 43-69.
- Michael Wheeler, *Reconstructing the Cognitive World: The Next Step* (Cambridge, MA: MIT Press, 2005).

Intelligence without Representation

- Valentino Braitenberg, *Vehicles: Experiments in Synthetic Psychology* (Cambridge, MA: MIT Press, 1984), 1-83
- Rodney Brooks, "Intelligence without Representation," in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997), 395-420.
- Barbara Webb, A Spiking Neuron Controller for Cricket Phonotaxis," in eds. Barbara Webb and Thomas R. Consi, *Biorobotics: Methods and Applications* (Cambridge, MA: MIT Press, 2001), 3-20.
- Mitchel Resnick, "Learning About Life," *Artificial Life* 1(1-2),1994, 229-241.
- David W. Hogg, Fred Martin, and Mitchel Resnick, "Braitenberg Creatures," *Epistemology and Learning Group Memo 13*, MIT Media Lab, 1991.
- Rolf Pfeifer and Christian Scheier, "Embodied Cognitive Science: Basic Concepts," *Understanding Intelligence* (Cambridge, MA: MIT Press, 1999), 81-138.
- David Kirsch, "Today the Earwig, Tomorrow Man?" *Artificial Intelligence* 47, 1991, 161-184.
- Arthur Markman & Eric Dietrich, "In Defense of Representation," *Cognitive Psychology*, 40, 2000, 138-171.

Supplemental:

- Maja J. Matarić, *The Robotics Primer*, Cambridge, MA: MIT Press.
- Rolf Pfeifer, Max Lungarella, and Fumiya Lida, "Self-organization, Embodiment, and Robotics," *Science* 318, 2007: 1088-1093.
- Arthur Markman & Eric Dietrich, "Extending the Classical View of Representation," *Trends in Cognitive Science*, 4(12), 470-475.

Artificial Life

- Mariarosaria Taddeo and Luciano Floridi, "Solving the Symbol Grounding Problem: Fifteen Years of Research," *Journal of Experimental and Theoretical Artificial Intelligence* 17(4), 2005: 419 - 445
- Karl Sims, "Evolving 3D Morphology and Behavior by Competition," in eds. Rodney Brooks and Patti Maes, *Artificial Life IV Proceedings* (Cambridge, MA: MIT Press, 1994), 28-39.

Supplemental:

- Randall Beer, "A Dynamical Systems Perspective on Agent-Environment Interactions," *Artificial Intelligence* 72, 1995: 173-215.
- Karl Sims, "Evolving Virtual Creatures," *Computer Graphics* 28, 1994: 15-34.
- Martin H. Fischer, and Rolf A. Zwaan (eds.), Grounding Cognition in Perception and Action: Special Issue, *Quarterly Journal of Experimental Psychology* 61(6), 2008: 825-957
- Angelo Canjelosi, "Grounding Language in Action and Perception: From Cognitive Agents to Humanoid Robots, *Physics of Life Reviews* 7, 2010.
- Paul Vogt, "The Physical Symbol Grounding Problem," *Cognitive Systems Research* 3(3), 2002: 429-457.

Dynamic Systems Approaches:

- Andy Clark, "Chapter 7: "Dynamics," *Mindware* (Cambridge, MA: MIT Press, 2001),120-139.
- Timothy van Gelder, "Dynamics & Cognition," in ed. John Haugeland, *Mind Design II* (Cambridge, MA: MIT Press, 1997), 421-450.
- Michael Wheeler, "From Robots to Rothko: The Bringing Forth of Worlds, "in ed. Margaret A. Boden, *The Philosophy of Artificial Life* (New York: Oxford University Press, 1996), 209-236.

Supplemental:

- Randall Beer, "Dynamical Approaches to Cognitive Science," Trends in Cognitive Science 4(3), 2000: 91-99.

The Possibility of Artificial Intelligence: syllabus

Week	Readings		Assignments
01/14	Haugeland Intelligent By Design: ELIZA Robocup **SUPPLEMENTAL**	The Saga of the Modern Mind ***(L)*** http://www.pbs.org/saf/1303/features/AI.htm http://www.manifestation.com/neurotoys/eliza.php3 http://www.robocup.org/ Copeland, Some Dazzling Exhibits ***(L)***	
01/21	Dennett Turing	True Believers ***(MD)*** Computing Machinery & Intelligence ***(MD)***	**1 page opinion piece: What is intelligence & why don't ELIZA or KISMET have it?**
01/28	Marr Haugeland Newell & Simon	*Vision* (excerpt: 21-29) ***(L)*** What is Mind Design ***(MD)*** Computer Science as Empirical Enquiry ***(MD)***	
02/04	Minsky Dennett Dreyfus Searle **SUPPLEMENTAL**:	A Framework for Representing Knowledge ***(MD)*** Cognitive Wheels ***(L)*** From Micro-Worlds to Knowledge ***(MD)*** Minds, Brains, Programs ***(MD)*** Copeland, A Hard Look at the Facts ***(L)*** Copeland, The Chinese Room from a Logical Point of View *(L)*	
02/11	Rumelhart Smolensky Churchland **SUPPLEMENTAL**:	The Architecture of Mind ***(MD)*** Connectionist Modeling ***(MD*** On the Nature of Theories (excerpt: 257-280) **(MD)** [Connectionist Modeling Exercises] Copeland, AI's Fresh Start ***(L)***	**Paper #1 Due: The Chinese Room**
02/18	Fodor & Pylyshyn Clark	Connectionism & Cognitive Architecture (***MD)*** The Presence of a Symbol ***(MD)***	**Connectionist modeling: online exercises**
03/04	Clark Webb Dreyfus Agre & Chapman **SUPPLEMENTAL:**	Robotics & A-Life ***(L)*** A Spiking Neuron Controller for Cricket Phonotaxis ***(L)*** Why Heideggerian AI Failed and…Fixing It ***(L)*** Pengi: An Implementation… ***(L)*** Preston, Heidegger and Artificial Intelligence ***(L)*** Wheeler, Reconstructing the Cognitive World, Ch. 5 ***(L)***	**Paper #2 Due: Connectionism, Implementation or …**
03/11	Braitenberg Brooks	*Vehicles (*1-83*)* ***(BV)*** Intelligence without Representation ***(MD)*** [Hands on Robotics Exercises: Vehicles 1 - 3]	
03/18	Vehicles Workshop: Hogg, Martin, Resnick Pfeifer and Scheier **SUPPLEMEMTAL**	[Building Vehicles & Creatures] Braitenberg Creatures ***(L)*** Embodied Cognitive Science: Basic Concepts ***(L)*** Resnick, Learning about Life ***(L)*** Matarić, *The Robotics Primer* (***reserve)*** Pfeifer et al, Self-Organization, Embodiment, & Bio-Inspired Robots ***(L)***	**Vehicles 1-5: Mobile Robotics Exercises**
03/25	Kirsch Markman & Dietrich **SUPPLEMENTAL:**	Today the Earwig, Tomorrow Man? ***(L)*** In Defense of Representation ***(L)*** Markman & Dietrich, "Extending Classical Views…" ***(L)*** Bechtel & Mundale, "Representations: From Neural…" ***(L)***	**Mobile Robotics Team Meetings**
04/01	Taddeo & Floridi, Sims **SUPPLEMENTAL**:	Solving the Symbol Grounding Problem ***(L)*** Evolving 3D Morphology & Behavior by Competition ***(L)*** [Artificial Evolution Simulation Exercises] Sims, Evolving Virtual Creatures ***(L)*** Beer, A Dynamical Systems Perspective on…***(L)*** Fischer and Zwaan, *Grounding Cognition* ***(electronic journal)***	**Artificial Evolution: online exercises** **Mobile Robotics Team Meetings**

The Possibility of Artificial Intelligence: syllabus

Week	Readings		Assignments
04/08	Clark van Gelder Wheeler **SUPPLEMENTAL**:	Dynamics ***(L)*** Dynamics & Cognition ***(MD)*** From Robots to Rothko ***(L)*** Beer, Dynamical Approaches to Cognitive Science ***(L)***	**Mobile Robotics Team Meetings**
	Robot Derby Rodeo:	Exam Period	

ONLINE RESOURCES AND SUPPLEMENTAL LINKS:

The Mind Project: http://www.mind.ilstu.edu/

Connectionism:
http://www.mind.ilstu.edu/curriculum/modOverview.php?modGUI=76

CCSI Artificial Neural Networks (for simulation exercises):
http://www.mind.ilstu.edu/curriculum/artificial_neural_net/intro_neural_nets.php?modGUI=239&compGUI=1286&itemGUI=2251

Turing Machines:
http://www.mind.ilstu.edu/curriculum/turing_machines/symbolic_models.php?modGUI=240&compGUI=1145&itemGUI=1951

The Turing Test:
http://www.mind.ilstu.edu/curriculum/modOverview.php?modGUI=211

The Chinese Room:
http://www.mind.ilstu.edu/curriculum/modOverview.php?modGUI=203

Lego Robots:
http://www.mind.ilstu.edu/curriculum/modOverview.php?modGUI=226
http://www.mind.ilstu.edu/curriculum/modOverview.php?modGUI=223

Connectionist Modeling (online exercises & resources):

Connectionist Models of Cognition, Simon Dennis and Devin McCauley
http://www.itee.uq.edu.au/~cogs2010/cmc/

tLearn (Exercises in connectionist modeling by Jeffery Elman)
http://crl.ucsd.edu/innate/tlearn.html

Braitenberg Simulator:

http://kovan.ceng.metu.edu.tr/~ilke/Braitenberg/BraitenbergEN/Vehicles.html

Retired Animats:

http://www.ai.mit.edu/projects/humanoid-robotics-group/retired-robots/retired-robots.html

Karl Sims: Evolved Virtual Creatures (demo video)

http://www.archive.org/details/sims_evolved_virtual_creatures_1994

NAO Robots (for viewing amusement alone):

http://www.youtube.com/watch?v=4t1NWH6G1f0

A-Life Artificial Evolution Simulations:

Swimbots:
http://www.swimbots.com/

Framsticks:
http://www.framsticks.com/

Yobotics Simulation Construction Set (Walkers-MIT Leg Laboratory)
http://www.ai.mit.edu/projects/leglab/robots/robots.html

A Braightenberg Vehicle at Sheffield:
http://mindhacks.com/2010/06/23/the-scientific-method-lego-robots-edition/

Natural Born Robots (PBS)
http://vsx.onstreammedia.com/vsx/pbssaf/search/PBSPlayer?assetId=67997&ccstart=0&pt=0&preview=&entire=yes

RobotC
http://blog.electricbricks.com/en/2010/04/tutorial-braitenberg-robotc-nxt-lego-11/

LeJOS
http://blog.electricbricks.com/en/category/lejos/