Cog. psyc – artificial intelligence – ch. 15 facts

Artificial IntelligenceBroadly defined as that branch of computer science that deals with the development of computers (hardware) and computer programs (software) that emulate human cognitive functions

Historical Computing Devices- Abacus, 6th century BC

- Pebble counting machine, 450 BC
- First calculator, 1633
- Multiplication/division machine, 1670s
- Analytic engine = first computer, early 1800s
- First modern computer, 1940s
- Interest in programs behaving " intelligently", 1956

Early AIJohniacs (1958): serial processors created by John von Neumann

McCulloch & Pitts (1940s) determined that depending on threshold, a neuron will fire or not [on or off]; these on/off neurons are called McCulloch-Pitts neurons and could be seen as a logic device

Rosenblatt builds a perceptron consisting of a three-level heirarchy emulating the sensory, associative, & motor pattern of humans

Brain v. MindIn comparing humans to computers, the brain would be the equivalent of hardware and the " mind" (processing unit) would be software

Sequential v. Parallel Processing ModelComputers generally process information serially, while brains process information in parallel

Processing power increases dramatically over the serial method when using parallel; more likely to get information because signals branch out in every direction

von Newmann class of computers which has one central processor that processes information sequentially.

Hillis's connection machine (1987) which solves problems by breaking them down and then processing them at once in parallel.

Weak v. Strong AIWeak AI: using AI as a tool to understand cognition; few opponents, importance is widely acknowledged

Strong AI: properly programmed computer has a " mind" capable of understanding; refuted by John Searle, highly protested

The Turing TestThe test involving communication between a human who asks questions and an unknown language-using entitiy, with the human's task being to distinguish the output as human or nonhuman.
(In order for a computer to fool us into thinking that it is a human, it must be able to understand and generate a response that effectively mimics an important form of cognition (From human or computer?) - The ultimate determinant of whether or not a machine truly has artificial intelligence.)

Perception & AIIn order to mimic perceptual mannerisms, computer must have some sort of sensing capacity

- Line analysis: use templates to identify line edges; great number of templates required for simple pattern recognition

- Pattern recognition: optical readers, alphanumeric recognition systems; DYSTAL (dynamically stable associative learning)

- Recognition of complex objects/faces

ELIZA, PARRY, & NETtalkChallenged by the Turing test, programs were designed to respond to real language queries in a way that was indistinguishable from human response

ELIZA: written by Joseph Weizenbaum (1966); DOCTOR takes a role similar to a psychiatrist

PARRY: simulated a paranoid patient; created by Colby, Hilf, Weber & Kraemer (1972)

NETtalk: based on a neural net; developed by Sejnowski (1987); reads letters & pronounces them out loud

AI & LanguageComputers are successful at memory for words, ability to produce meaningful sentences, and ability to pronounce letters - but not successful at understanding

Problem Solving/Game PlayingComputers are successful at completing complex puzzles, solving theorems, and playing games such as chess

RobotsDevices capable of performing human tasks or behaving in a human manner; carry out a variety of cognitive activities; used extensively by NASA

computer simulation" Intelligent" machines that model human thought. (Because it nearly impossible to tell where AI leaves off and computer

science begins, the widely accepted term AI is used in this chapter to embrace all forms of cmputer-produced output that would be considered intelligent if produced by a human.)

ELIZAOne of the first conversational computer programs to simulate intelligence. (Weizenbaum). (Example: the specific program called DOCTOR, where this program takes on the role of a psychiatrist. The computer's responses are stereotyped. The human capacity for knowledge about feelings, tendencies, group dynamics, and so on figures into what, for lack of a better word, we call understanding. This program lacks it.)

John von NewmanHungarian mathematician designed the computer " architecture" in common use today. These computers patterned after his design are sometimes called " Johniacs" or serial processors, meaning that electrical impulses are processed in series, or in sequence. Long lag time required by computers to " think" or " digest" can be explained by serial processors solving problems bit by bit (or byte by byte), in a stepwise fashion. He also suggested the possibility of designing a computer that mimicked the human brain - not only in function but also in structure.

Donald O. HebbEarly researcher in neurocognition whose seminal ideas are frequently used in connectionistic models. " Neurons that fire together, wire together."

John SearleA philosopher with UC Berkeley who distinguishes between two forms of AI:
1. weak AI: which can be used as a tool (heuristic) in the investigation (studying) of human cognition;

2. strong AI: which asserts that a properly programmed computer can create a " mind" capable of understanding.

He also considered the " Chinese room" principle arguing that machines can perform complex functions without understanding the meaning of the output (data in - data out). Human minds have intentionality or " the property of mental states and events by which the mind is directed at objects and states of affairs in the world." Computer thinking (electronic) and human thinking (organic) are not alike.

Alan TuringDevised a test involving communication between a human who asks questions and an unknown language-using entitiy, with the human's task being to distinguish the output as human or nonhuman.

Hebb's Rule" Neurons that fire together, wire together" (the strength of two neurons increase when they are simultaneously activated). Perceptrons (computers that crudly imitated the brain's organization that were created to learn to classify shapes) capable of " learning" because they behave in a way similar to McCulloch-Pitts neuron and obey Hebb's theory.

The Chinese room1. A hypothetical situation used to test the existence of strong artificial intelligence that extends beyond the simple desmonstration of machine intelligence to actual thinking and understanding taking place within the machine.

2. It demonstrates evidence (data in - data out) against beliefs in strong AI arguing that machines can perform complex functions without understanding the meaning of the output.

3. Critics like Searle argue that machines can perform complex functions

without understanding the meaning of the output (data in - data out). Human minds have intentionality or " the property of mental states and events by which the mind is directed at objects and states of affairs in the world." Computer thinking (electronic) and human thinking (organic) are not alike.