cis20.2 design and implementation of software applications II spring 2008 session # III.1 intelligent systems 1

#### topics:

- fundamental issues in intelligent systems
- what is artificial intelligence (AI)?
- different views of AI

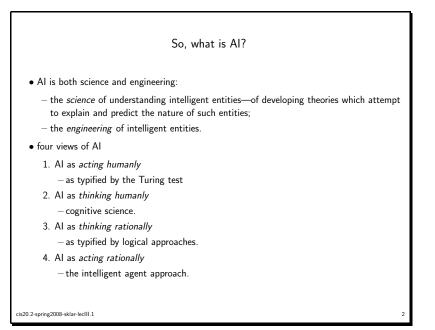
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## acting humanly

- A problem that has greatly troubled AI researchers: when can we count a machine as being intelligent?
- Most famous response due to Alan Turing, British mathematician and computing pioneer—The Turing Test:

Human interrogates entity via teletype for 5 minutes. If, after 5 minutes, human cannot tell whether entity is human or machine, then the entity must be counted as intelligent.

- No program has yet passed Turing test! (Annual Loebner competition & prize.)
- A program that succeeded would need to be capable of:
  - natural language understanding & generation;
  - knowledge representation;
  - learning;
  - automated reasoning.
- Note no *visual* or *aural* component to basic Turing test—augmented test involves video & audio feed to entity.

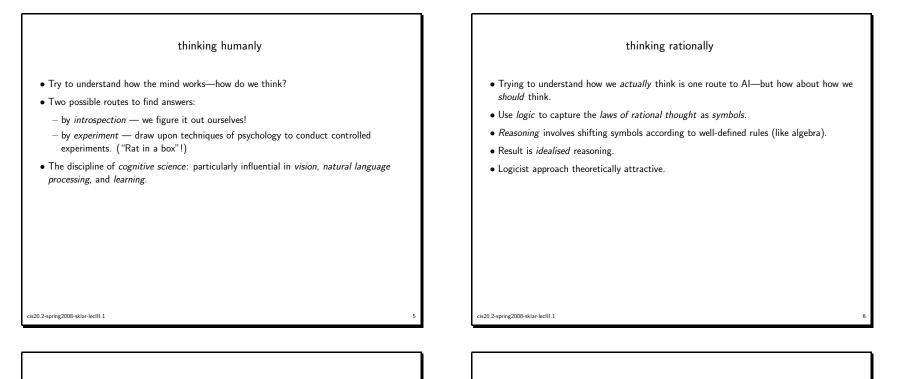


# Searle's Chinese Room (another test)

- you have a computer in a room that reads Chinese characters as input, follows a program and outputs (other) Chinese characters
- suppose this computer does this so well that it passes the Turing test (convinces a human Chinese speaker that it is talking to another human Chinese speaker)
- does the computer understand Chinese?
- suppose Searle is in the room, and he uses a dictionary to translate the input characters from Chinese to English; he then constructs his answer to the question, translates that back into Chinese and delivers the output—*does Searle understand Chinese*?
- of course not
- and this is Searle's argument: the computer doesn't understand it either, because all it is doing is translating words (symbols) from one language (representation) to another

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• Lots of problems:

- transduction how to map the environment to symbolic representation;
- representation how to represent real world phenomena (time, space, ...) symbolically;
- reasoning how to do symbolic manipulation
- tractability so it can be done by real computers within our life time
- We are still a long way from solving these problems.
- In general logic-based approaches are unpopular in AI at the moment.

### acting rationally

- Acting rationally = acting to achieve one's goals, given one's beliefs.
- An *agent* is a system that perceives and acts; intelligent agent is one that acts rationally w.r.t. the goals we delegate to it.
- Emphasis shifts from designing *theoretically best* decision making procedure to best decision making procedure possible in circumstances.
- Logic may be used in the service of finding the best action not an end in itself.

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- Achieving *perfect* rationality making the best decision theoretically possible is not usually possible, due to *limited resources*:
  - limited time;
  - limited computational power;
  - limited memory;
  - $\mbox{ limited or uncertain information about environment.}$
- The trick is to do the best with what you've got!
- This is easier than doing perfectly, but still tough.

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# differing views of AI

- connectionist:
  - intelligence is the result of emergent behaviors that are the result of a network of interconnected simple units
  - neural networks, perceptrons
  - Rumelhart and McClelland (1970-80's)
  - McCulloch and and Pitts (Princeton, 1940's)
- logic:
  - intelligence is enacted by resolving and unifying logic statements; "deduction"
  - $-\ensuremath{\mathsf{early}}$  rules, that later became the basis for symbolic AI
  - McCarthy (Stanford, 1950's and onward)
- symbolic:
  - intelligence is represented in a computer by explicit structures that symbolize different bits of knowledge and activities; explicit rules control intelligent behavior
  - Newell and Simon (CMU, 1950's and onward)

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