

Course: Common Sense Reasoning

# 1. Introduction to Common Sense Reasoning

Martin Molina



# There are difficult tasks to be done by machines

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- Read a book
- Summarize a movie
- Translate poetry
- Manipulate objects in an uncontrolled environment
- ...

# Example

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Paul tried to call George on the phone,  
but he was not available.

- a) He = Paul
- b) He = George

It is difficult to determine the value of the pronoun  
“he” without knowing the meaning of the action  
“calling on the phone”

# Two well-known truths about computers

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[Davis, 2012]



- a) Computers are great and amazing and a lot of fun to deal with
- b) Computers are stupid and frustrating and it can be a huge amount of work to get what you want out of them

Ernest Davis  
New York University

# A machine that truly learns by itself requires common sense knowledge

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[Minsky, 2000]

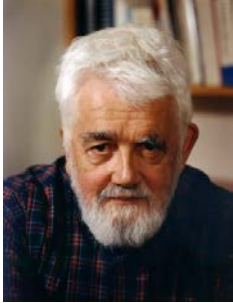


Marvin Lee Minsky  
(1927, 2016)  
MIT

The trouble with computers today is they're always starting from scratch. To make them more worth dealing with, we'll have to aim toward supplying them commonsense knowledge.

# Common sense reasoning was an initial goal in AI

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John McCarthy  
MIT and Stanford University, USA  
(1968): “Programs with common sense”



Patrick John Hayes  
Institute for Human and Machine Cognition, Florida  
(1978) : “The Naive Physics Manifesto”



Douglas B. Lenat  
President and CEO of Cycorp  
(1984): “The CYC project”

# Common sense reasoning is an active line of research

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Henry Lieberman (MIT)  
(2004) “Common sense for interactive applications”



Erik T. Mueller (IBM)  
(2006) “The event calculus reasoner”



Ernest Davis (NYU)  
(2008) “Common sense physical reasoning: pouring liquids”



Benjamin Johnston (UT)  
(2010) “Practical artificial commonsense”

# What is common sense?

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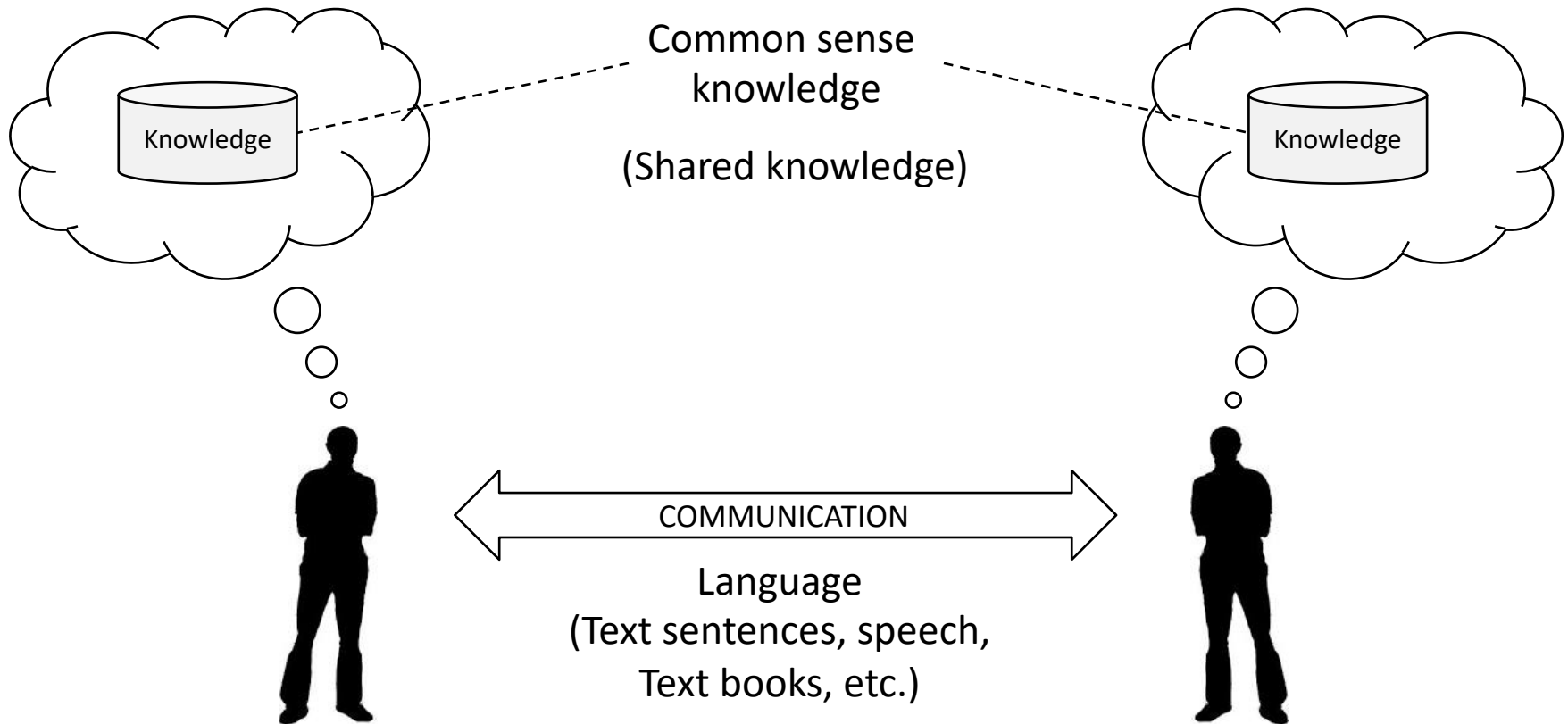
[Lieberman, 2004]

- Everyday knowledge about the world that is too obvious to say
  - Things fall down, not up
  - You can use a string to pull, but not push
  - A wedding has a bride and a groom
  - If you are hungry, you can go to a restaurant to eat
- And the ability to use it



# Common sense plays an important role in communication

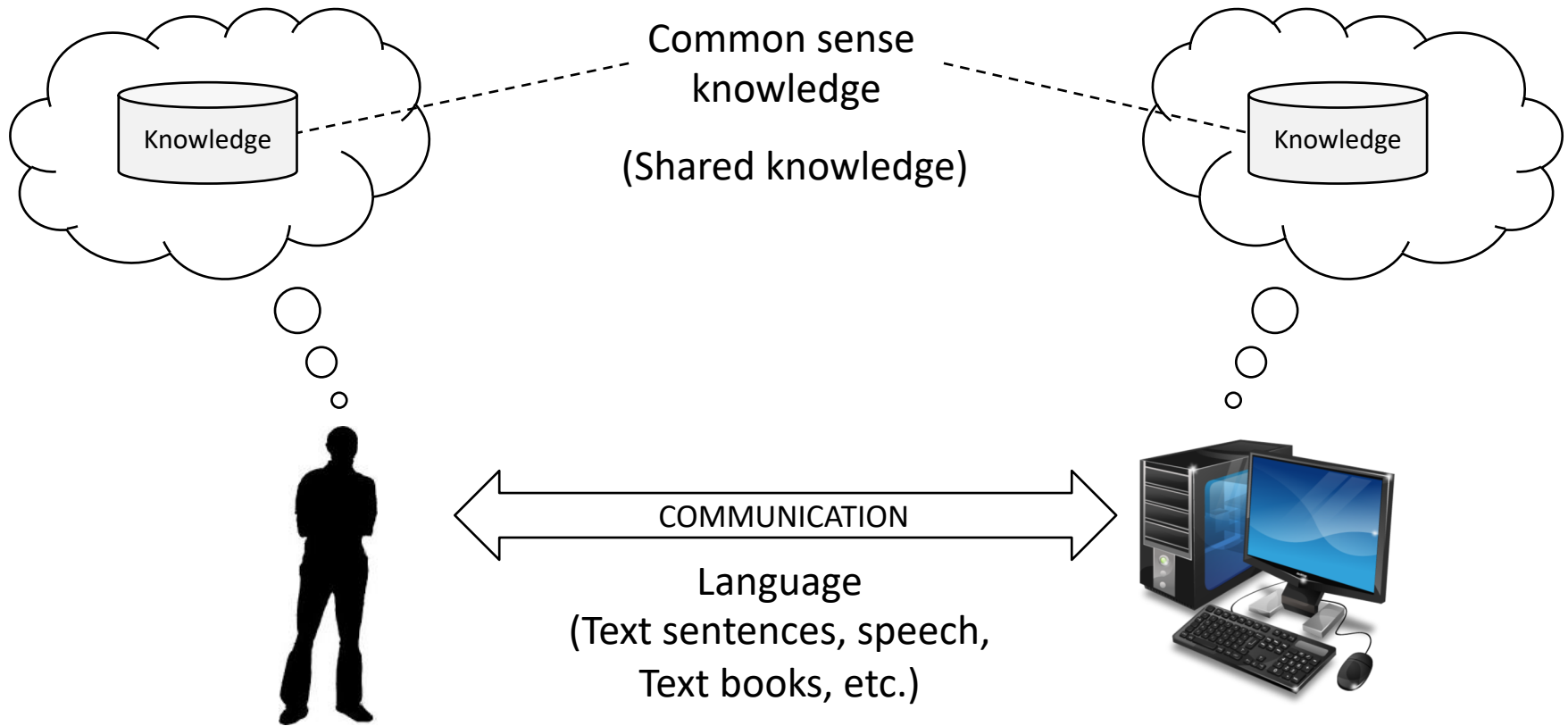
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Common knowledge reduces the amount of information to communicate  
(It is not necessary to communicate the information assumed by both agents)

# Common sense can simplify the communication with machines

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# Why is it difficult to be used by machines?

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- Large amount of knowledge
  - Reasoning about the world requires a large amount of knowledge [Mueller, 2006]
- Implicit knowledge difficult to be acquired
  - Much of our commonsense knowledge information has never been recorded at all because it has always seemed so obvious we never thought of describing it [Minsky, 2000]
- Reasoning is complex
  - Vagueness, plausibility, contingencies, assumptions, exceptional cases, logical paradoxes, etc. [Lieberman et al., 2004]

# There has been significant progress in common sense reasoning in AI

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- Theoretical approaches
  - Logic based models
  - Physical reasoning
- Large knowledge bases
  - Manual acquisition methods
  - Automatic acquisition methods
- Semantic technologies
  - Ontology languages and upper ontologies
- Applications
  - Natural language, mobile phones, etc.

# Common sense is about broad and shallow knowledge

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- Knowledge of expert systems
  - Highly specialized
  - Narrow domain
- Common sense knowledge
  - Shallow
  - Broad spectrum (different domains)

# What are the challenges of common sense reasoning?

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- How to simulate human reasoning?
  - Find efficient ways to reason with common sense knowledge considering default reasoning, indirect effects, low of inertia, continuous change, etc.
- How to build knowledge bases?
  - Formalize commonsense knowledge (objects, actions, time, space, beliefs, etc.) using multiple representation methods
  - Acquire huge amounts of common sense knowledge (collective, automatic, etc.)



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### ORGANIZATION

Commonsense Reasoning is a non-profit organization dedicated to furthering and promoting research in the field of formal commonsense reasoning.

Its primary activities are:

- organizing the biennial international Commonsense Symposium, the premier forum for researchers to share and disseminate technical advances in the field of formal commonsense reasoning
- advancing progress in the development of formal models for commonsense reasoning through education and publication

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