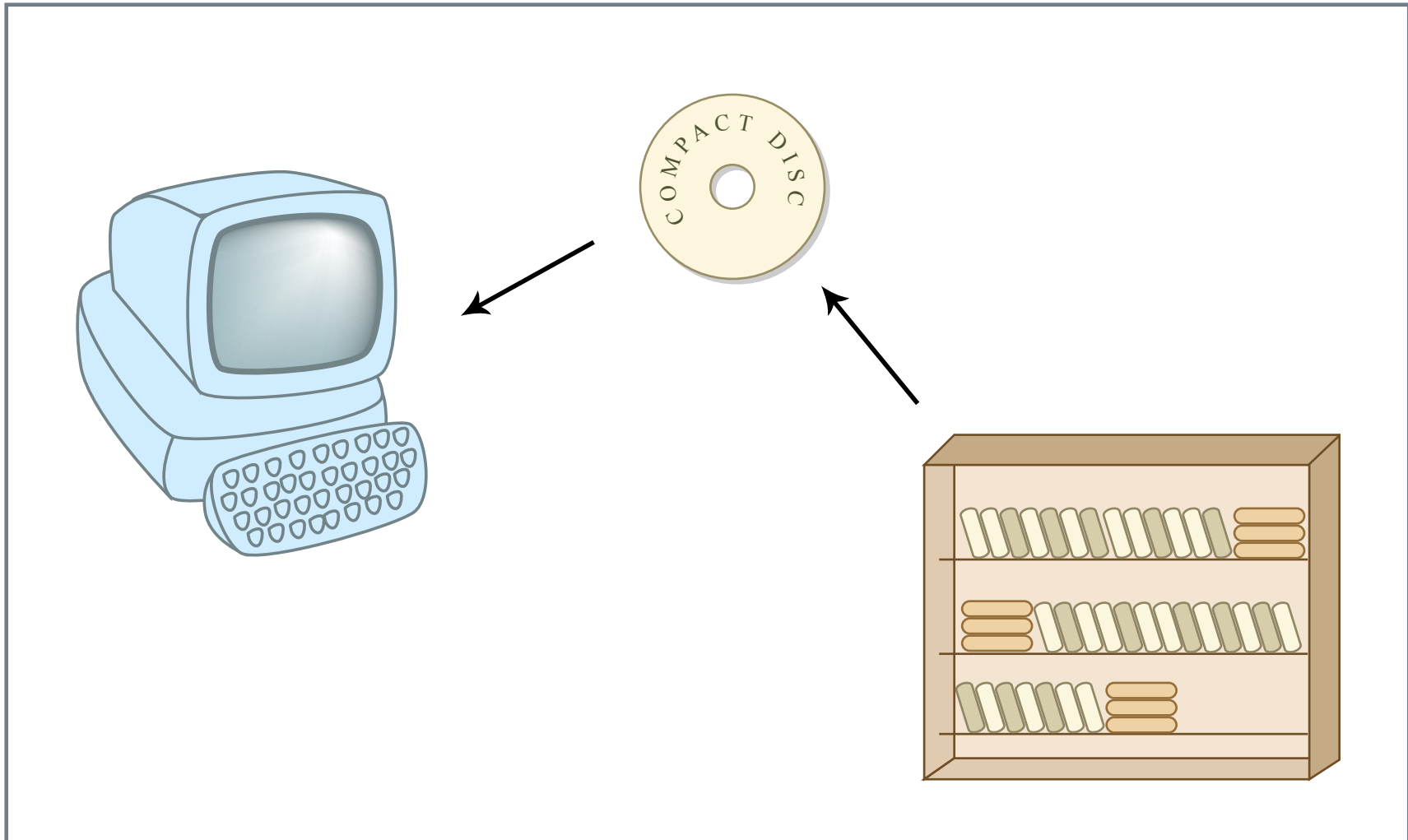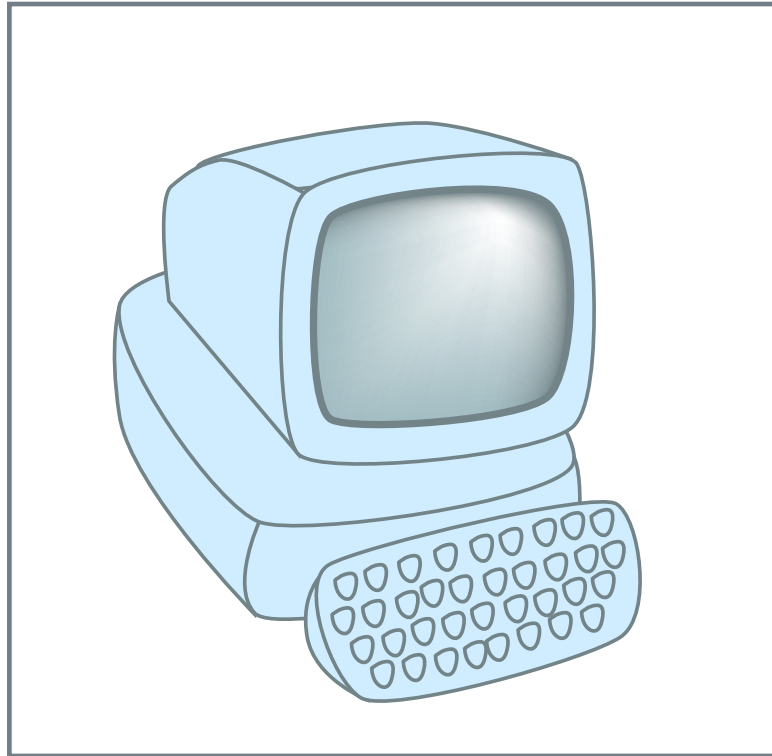# Pragmatic Knowledge Acquisition

6.871 - Lecture 12

Outline

- The intent of this lecture
- The longstanding dream
- What do we mean "learn"?
- What this lecture is not about
- The nature of the task
- Predictable difficulties
- Pragmatics of debriefing

The Dream: Version 1

Figure by MIT OCW.

The Dream: Version 2

Figure by MIT OCW.

Modes of Learning

- Learning by being programmed
- Learning by being told
- Learning from selected examples
- Learning from unselected examples
- Learning by discovery

Learning by Being Programmed

$$\sqrt{2.00 \ \ 00 \ \ 00}$$

What This Lecture Is Not About

- The variety of machine learning techniques:
  - PAC learning
  - Neural nets
  - ID-3
  - Genetic algorithms
  - Nearest neighbor
  - Knowledge discovery and data mining
  - …

What This Lecture Is Not About

- The variety of cognitive science oriented techniques:
  - Multi-dimensional scaling
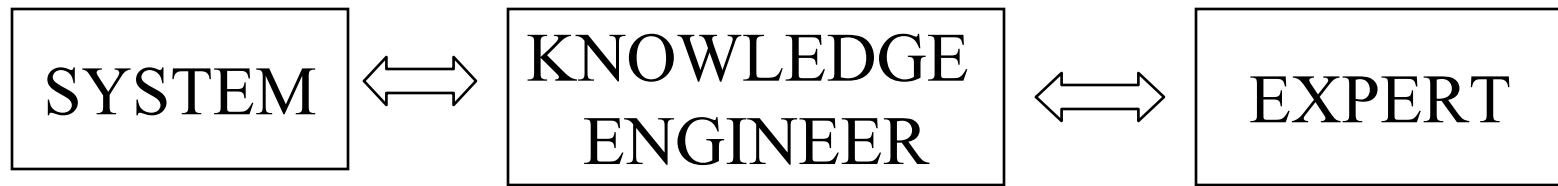 - Personal construct theory
  - Ordered Trees from Recall
  - …

A Key Hard Problem

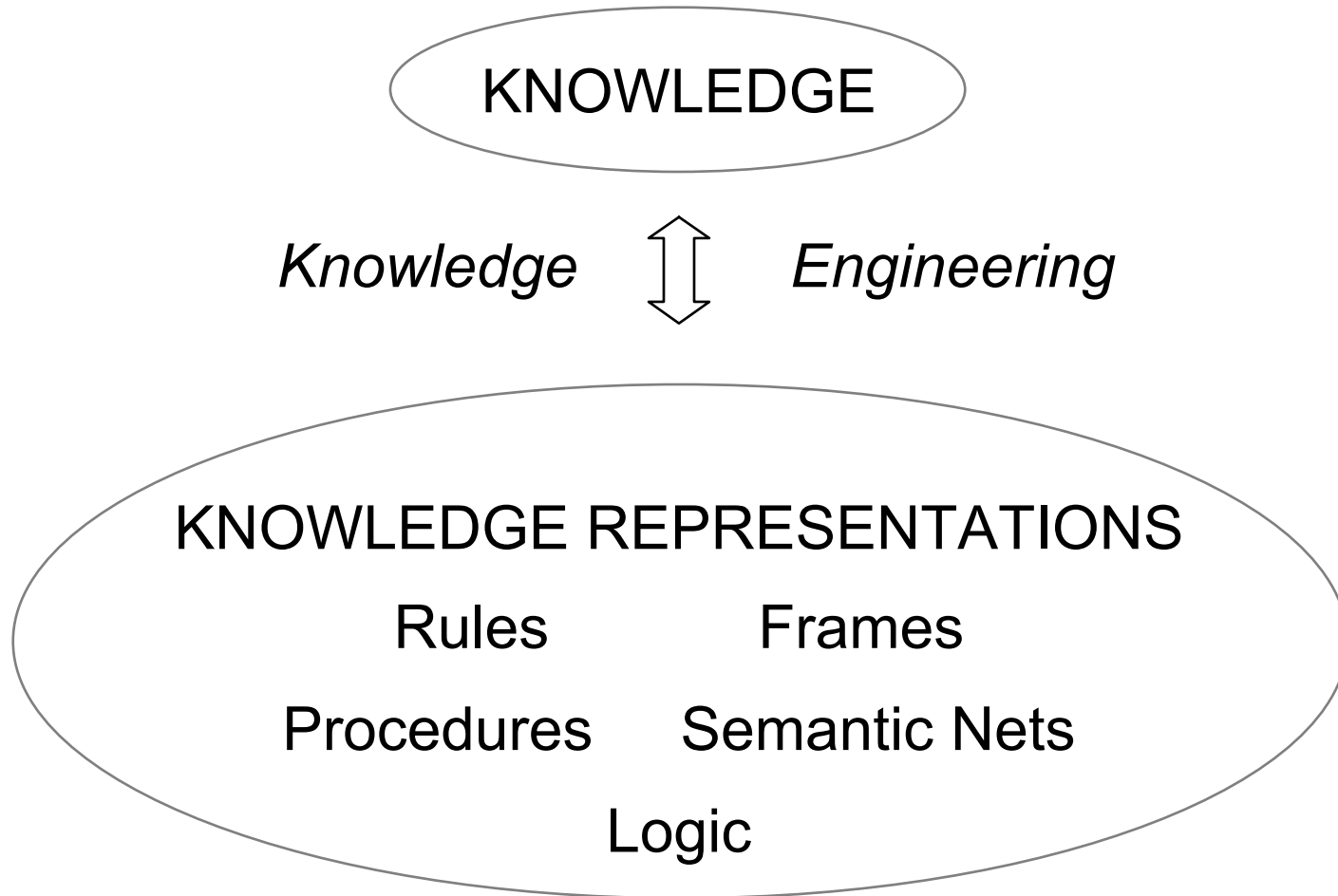CREDIT (BLAME) ASSIGNMENT

Pragmatic Techniques

- Interviews

- Observe (Record) Performance

- Protocol Analysis

Basic Interaction

SYSTEM $\Longleftrightarrow$ KNOWLEDGE ENGINEER $\Longleftrightarrow$ EXPERT

Listen
Understand
Reformulate
Explain

The Nature of the Task

KNOWLEDGE

Knowledge ⇕ *Engineering*

KNOWLEDGE REPRESENTATIONS

Rules　　　　Frames

Procedures　　Semantic Nets

Logic

Nature Of The Task

- Bridging the gap

- Building a formal a language
  - "sentences," "nouns," "verbs," …
  - rules, attributes, objects, values

- Working from both directions
  - kinds of knowledge
  - kinds of reps

Predictable Difficulties

- The expert…

  - … knows more than he says

  - … says more than he knows

  - … lies to you

  - … disagrees with other experts

Predictable Difficulties

- Knowledge engineers…

  - … rush to structure

  - … need social skills

  - … need AI skills

Getting The Knowledge: Sources

- Books
- People
  - *Finding* one
  - Finding *one*
    - Level of aspiration
  - Finding *the* one
    - Confident
    - Introspective & Reductionistic
    - Intrigued

What Representation to Use?

- Medical diagnosis
- Getting out of the supermarket

What Representation to Use?

- Medical diagnosis
- Getting out of the supermarket

ASK YOURSELF: *WHAT DO YOU KNOW?*

Then listen to the answer.

Getting The Knowledge: Debriefing

- Signing on
- Work from examples
  - dead center cases
  - marginal cases
- Errors are wonderful
  - it's easier to modify than specify
- The relevance of the computer
  - mental hygiene
  - efficiency

Getting The Knowledge: Debriefing

- Be rabidly rational and reductionistic

- Be patient

- Get interested

Getting The Knowledge: Debriefing

- Meet the expert half way:
  - learn the expert's language

- Talk your language
  - it will be infectious

- Come at hard problems from several directions

Knowledge Acquisition:Getting Started

- Determine the size and structure of the solution space
  - How many categories of answers are there?
  - How many specific choices within each category?
- Select a category, select a specific choice
- What factors suggest that choice as the correct one?
- What factors differentiate among choices in that category?

Knowledge Acquisition:Getting Started

- Notice the vocabulary in use:
  - What are attributes, objects and values?

- Notice statements like
  - "if X and Y, then the best choice is Z"

- Look for chains of reasoning

Example: Selecting an Investment

- Frank's Financial Supermarket offers 7 kinds of investments

  – stocks, index funds, bonds, commodities, mutual funds, rare coins, tax shelters

- There are

  – 1500 stocks

  – 1000 bonds

  – 15 different mutual funds

- In the mutual funds:

  – consider the tax-free money market fund

Example: Selecting an Investment

- What factors suggest that choice as the correct one?
  "If your tax bracket is 42% or higher and you need to keep the money readily at hand, then the tax-free mm fund is a good choice."

Example: Selecting an Investment

- Notice the vocabulary in use
  "If your tax bracket is 42% or higher and you need to keep the money readily at hand, then the tax-free mm fund is a good choice."

- Look for chains of reasoning

Example: Selecting an Investment

- What factors differentiate among choices in that category?
  Why the tax free mm fund instead of the tax free bond fund?