(Dis)Advantages of Logic-Based Agents

\+ Modular, declarative pieces

(Facilitates input, debugging, modification)

(Many uses, Introspective)

\+ Well-defined semantics

(So its use is well-defined)

\+ Very Expressive

Especially Partial Knowledge: $\neg$, $\vee$, $\exists$, . . .

? Intuitive

– Terrible when data is noisy/errorful

Inconsistency

– Can be inefficient

Remaining Issues

- Efficiency [Meta-Level]
  - Control of Reasoning

    Which clauses to resolve?
  - When/How to use Meta-Level Reasoning?
  - When to cache?

    A, A⇒B; cache B?

    A⇒B, B⇒C; cache A⇒C?

- Unsound reasoning
  - Theory Formation, Abduction, "Guessing", . . .
  - Theory Revision, Diagnosis, . . .

- How to encode World?

Encoding (Vocabulary)

- What to represent?

  Color, Location, Ownership, ...

  "Epistemological Adequacy"

- What are relevant features?

  What should be reified? ...and how?

  "Marriage between A and B is going poorly."

  "A and B were married last May."

  ? `Hu(A B poorly from-May ...)`

  vs `MarriageEvent(A B AB-M`$_1$`)`, `Began(AB-M`$_1$ `May)`

  Epistemology + Perspicuity

- How to represent it?

  `Man(John)` vs `IsA(John Man)`

  Polar vs Rectangular coördinates

  Efficiency (+ Perspicuity)

When to Use Logic-Based System

- Logic is useful if(f)
  - Need to encode and use Partial Knowledge

    $\vee$, $\neg$, $\exists$
  - Need to explain answer
  - System itself will Change

    (Especially when *modifying* existing info.)
  - Dealing w/ deterministic, discrete situation

    (World is known, state perhaps inaccessible)

- Otherwise. . .
  - If (only) answering simple "boolean" questions

    Use DataBase System!
  - If dealing with Algorithm

    eg Sort, D-o-G, Numeric Integration, . . .

    Use ALGORITHM!
  - If continuous $\Rightarrow$ probabilistic structure
  - If unknown $\Rightarrow$ learning approaches

[Perhaps incorporate these as

COMPONENTS of Logic System...]

Big Points

- Idea of SOUNDness
  - . . . ie, process is NOT arbitrary!

- Can be used. . . effectively
  - . . . To handle partial info
  - Eg: Wumpus world, Simulation, Diagnosis, . . .
  - . . . planning (over time)

- Tradeoffs
  - Sound vs Complete vs Expressive (vs Efficient)
  - . . . + discussion of implementations

Summary of Logical-Based Agents

Context: Agent must reach decision, given
prior knowledge
current percepts

As world is *inaccessible*
$\mapsto$ Must deal with partial information

As world is Known, Deterministic, Discrete:
$\mapsto$ Reason using Logic

- Semantics: What should be concluded?
  Proof: What can be computed?
  Syntax: What is looks like?
- Resolution: Sound & Complete
- Implemented Systems
  ...embodying various tradeoffs
- Planning
  ... + dealing w/ Changing World