Advanced Search: STRIPS and Property Space representation
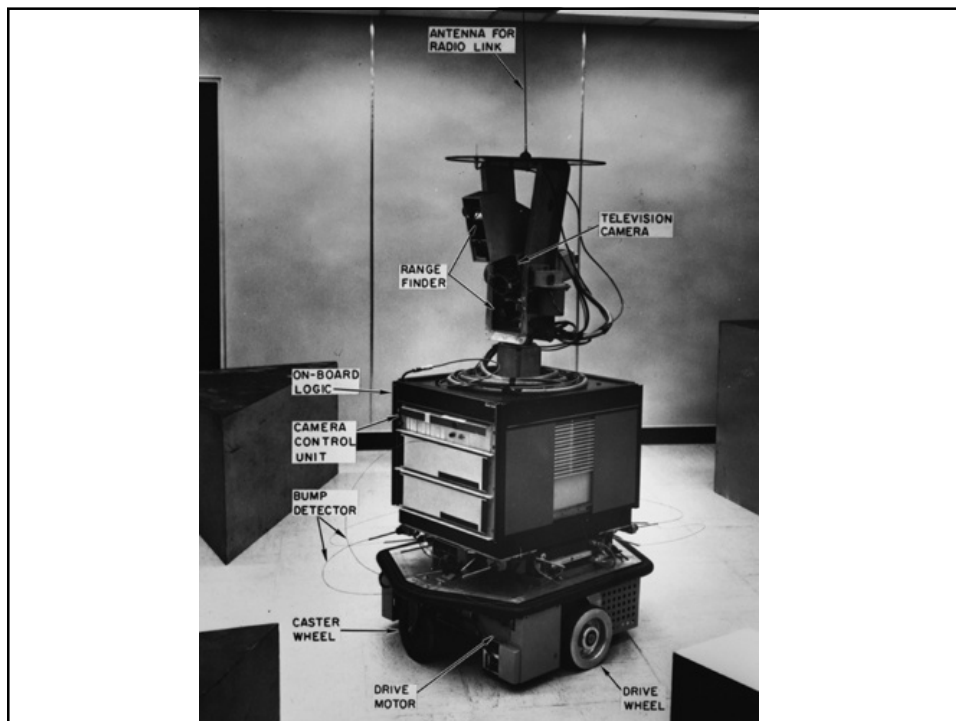
Advanced Search Topic

Property Space Representation

- Reasoning about sets of states in lieu of individual states
  - Relevance
  - Computational tractability
  - Conditional applicability

Property Space Representation

- Literals as properties identifying a subset of the set of all states S
  - Relevance can now be context-specific to the property being considered
  - So, properties are **partitions**
  - Intersection denotes arbitrary subsets

Property Space Representation

- Planning/Search transforms to reasoning about properties
  - How do actions impact properties describing current conditions of the world?
  - Challenge example: Making French Toast

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- A simplified property-based planning representation and solver
- <P, O, I, G>
  - P   properties or conditions
  - O   operators of form <preconditions, postconditions>
  - I   initial conditions (initial state set)
  - G   goal conditions (goal state set)
- BlocksWorld example on board
- Extensions: variable introduction

Shakey.. the movie
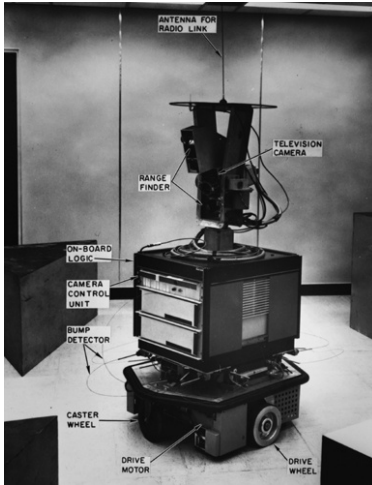
Shakey

HARDWARE

    2-wheel differential drive with two casters

    whiskers, camera, optical rangefinder

    transmission of TV signal off-board

    computer!

Shakey

5 layers:

    1) robot – PDP-15

    2) LowLevelActions: (LISP) (roll) (tilt) (iristo)

    3) Intermediate Level Actions (push) (go to) – contain error-handling to some degree!

    4) STRIPS planner: construction of sequences of ILA's

    5) PLANEX (plan executor)

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- Limitations? (discussion)
- Property Space representation revisited: explicit uncertainty management has become more prevalent, but properties have power!

Example in Blocks World

- Literals that describe partitions of state space:
  - Table(a)   block a is touching the table
  - On(a,b)   block a is on top directly of b
  - Clear(b)   block b has no blocks atop it

  Example of an initial condition:
     <table(a), on(b,a), clear(b)>

Blocks world: operators

- Actions are defined in terms of transformation of properties, or literals.
- stack(a,b) – stack a onto the top of b
- This only works under certain conditions because of the robot's "limitations" so:
  - Preconditions for stack(a,b)
    - table(a), clear(b), clear(a)
  - Postconditions for stack(a,b)
    - on(a,b), not (table(a)), not(clear(b))