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Modeling Bad TV Actors in Soar

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Émile Architecture for Social Agents

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- **Goal:** Rich believable model of human behavior for interactive (non-scripted) simulations
- **Problem:** How to get the right action, gesture, … at the right time
- **Solution(?!):** rich model of mental state and cognition
  - Goals,
  - Plans,
  - Social knowledge,
  - Emotional state,
  - ….

  Till you get old and die (or join a startup)

  And cheat like mad (backstory)

Émile Architecture for Social Agents

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- **Dream:** There are general domain-independent solutions
  - **Adding a domain-theory to domain-independent agent architecture should be easier than starting from scratch, yes? Maybe?…**
  - Aim for general solutions
    - Domain independent planning algorithm
    - Domain independent model of emotional reasoning
    - Vaguely general model of social knowledge
  - But limit the flexibility

    Bad idea:

    Maximize this 40 dimension utility function

    Good idea:

    Here's some actions and goal, pursue it ruthlessly

Review

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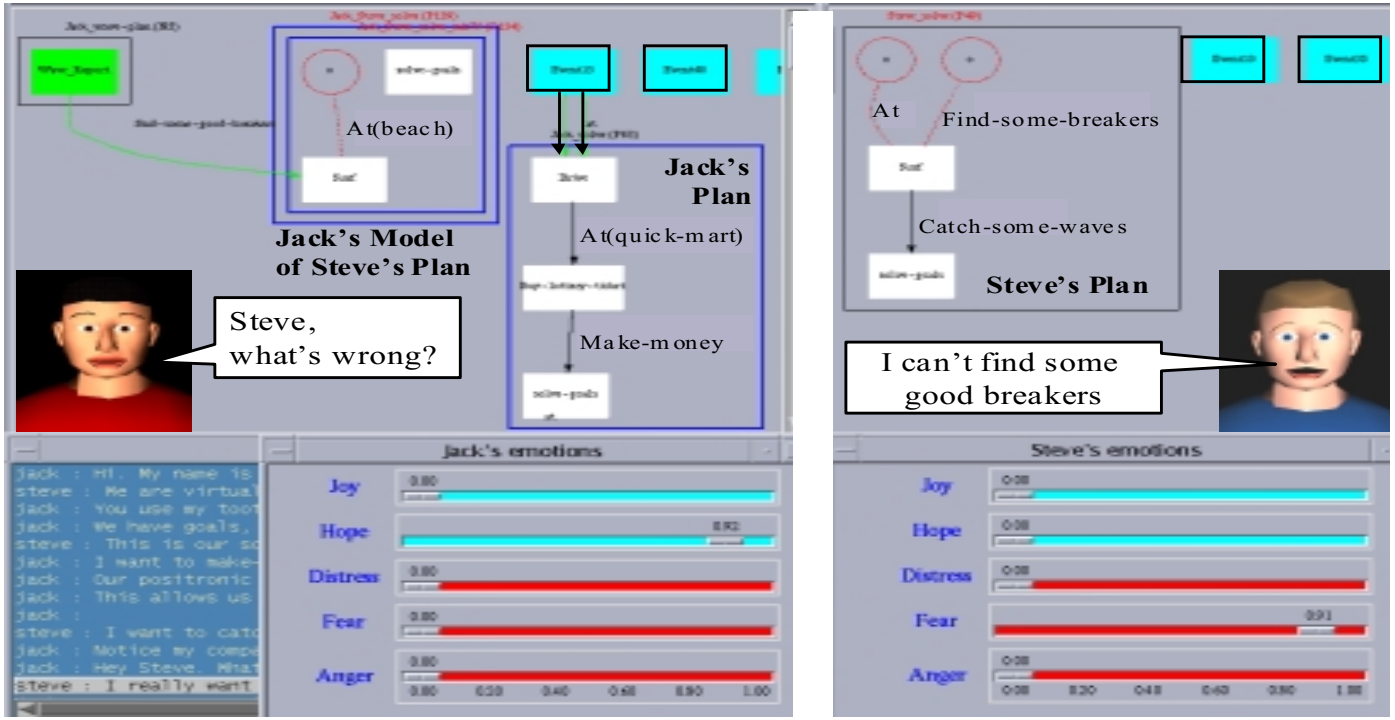
- **Focus:**
  - Socially-situated planning

    Shaping the way plans are generated and executed to fit the social context:
    - Defer to my superiors
    - Collaborate with my friends
    - Communicate socially appropriate information

  - Emotional reasoning
    - Display reasonable gestures, expressions
    - Display reasonable coping behaviors (fight vs. flight)

Example



- **Demonstration**
  - Interaction of two agents with differing personalities
  - Also illustrates social stances, communications model

Social Knowledge

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- **Social State**
  - **Relationships (friend, enemy, boss)**
  - **Obligations (IOU an answer to your question)**
  - **Common knowledge (I know that you know…)**
- **Social Actions**
  - **Speech Acts (inform, request,…)**
  - **Planning Stances (be rude w.r.t. Jack's plans)**
- **Social Rules**
  - Associate actions with state

Example Social Rules

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- IF I have a plan that is *relevant* to another plan
  AND the other plan is owned by a friend
  AND the friend doesn't know my relevant plan
  AND the friend isn't threatening my plans
  THEN tell the friend the plan

- defReflex help-friend {
  :when {(<s> ^plan.plan-objs.plan <?plan>
  ^agent-name <me>
  ^relationships.<me>.friend <?agent>)
  (<?plan> ^relevant-to <?other-plan>)
  (<?other-plan> ^owner <?agent>)
  -(<?plan> ^known-by <?agent>)
  -(<?plan> ^threanted-by-plan.owner <?agent>)}
  :do {(cmd1: send-plan{?plan ?agent FACILLITATE})}}

Example Social Rules

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- IF My personality is FAIR
  AND My plan threatens your plan
  AND I don't have an obligation to fix my plan
  AND You don't have and obligation to fix your plan
  THEN Inform you of the conflict

- IF I have a goal
  AND the goal is active
  AND I don't have a plan for the goal
  THEN Create a new plan structure
  Populate the plan with the goal
  Allow the planner to modify the plan

Emotions

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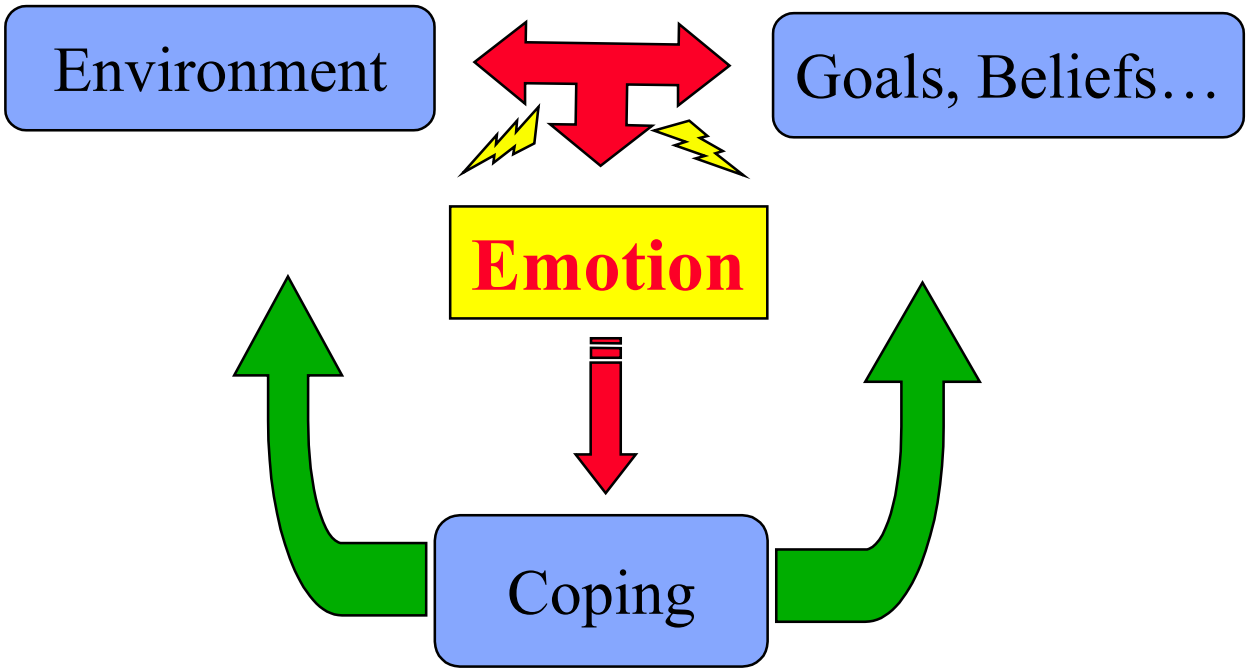
- **Emotional Appraisal Models (Lazarus, Cox, Wells)**

  Appraisal is relation between environment and goals



The Power of Plans

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- **Plans mediate this relationship**
- **Planning algorithms help infer contextual info**
  - Detect planning threats or opportunities
  - Reason about probability of goal attainment
  - Reason about the importance of subgoals
  - Context changes as "think things through"
- **Emotions as a form of plan evaluation**
  - Emotions side-effect of generating and executing plans

Emotions as Evaluators

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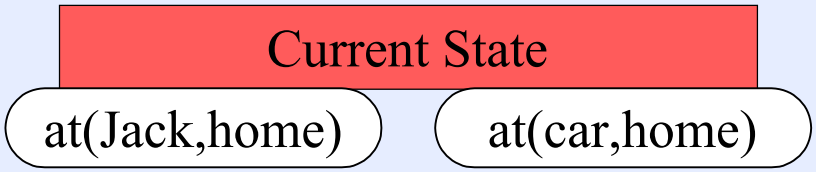
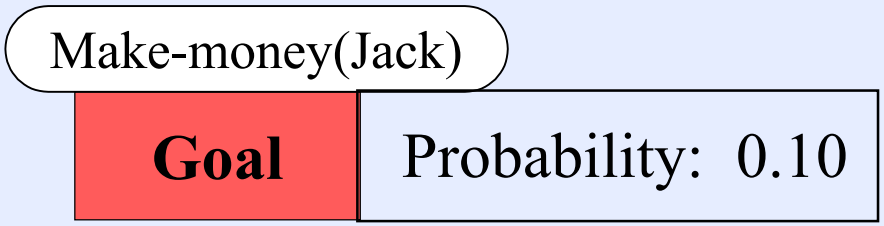
- **Evaluation involves:**
  - Causal structure: how are goals achieved or threatened
  - Utility model: how important are different goals?
  - Probability model: how likely is goal attainment?
  - Social norms: does plan satisfy social constraints?

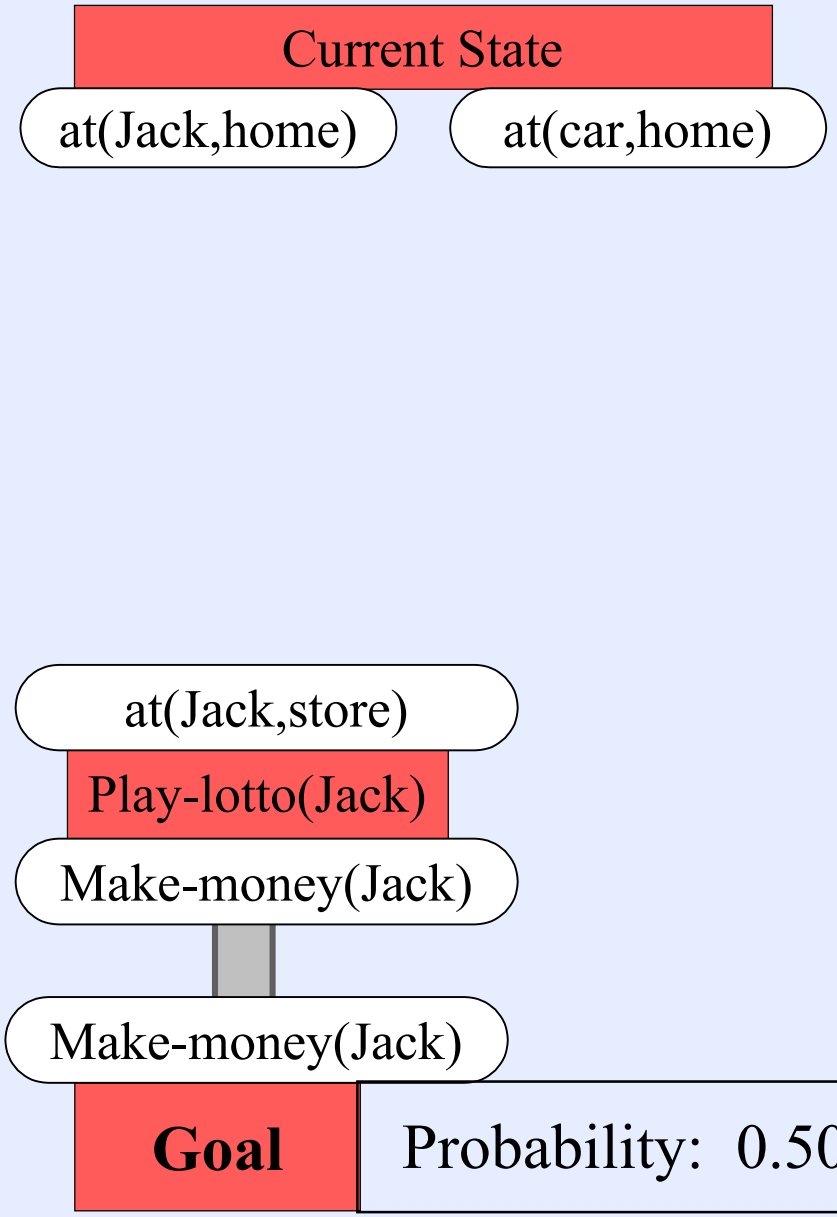
- **Evaluation Domain-independent**
  - Appraisal rules:
    - Evaluate syntax of plans
    - Propagate probabilities and utilities

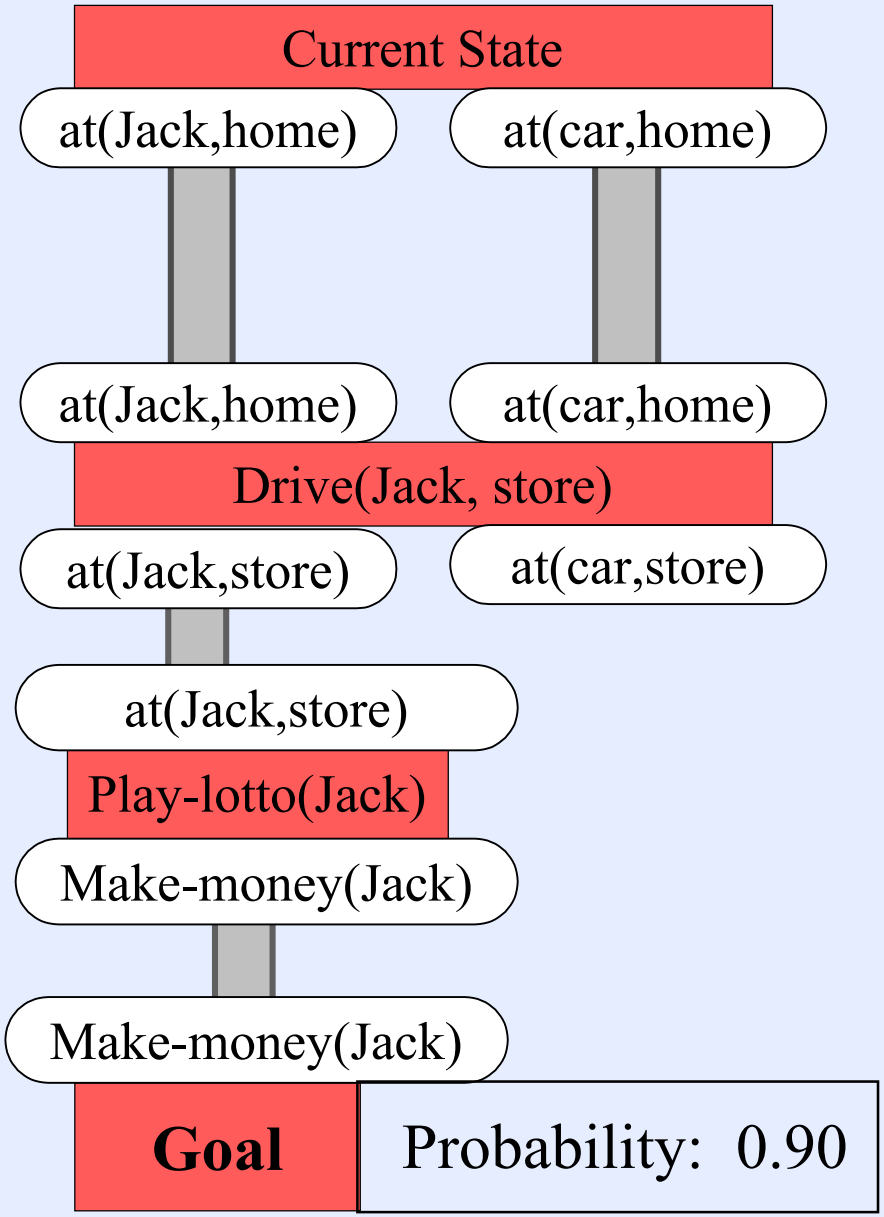


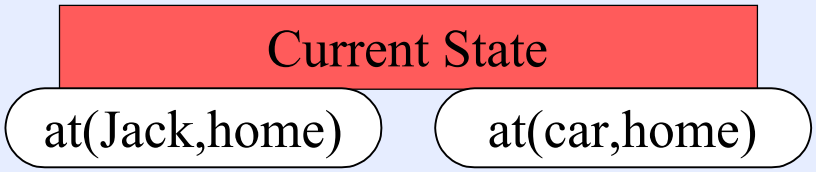
Probabilities propagate from the leaves of plan (I-support)

- Goals and preconditions have *a priori* probabilities



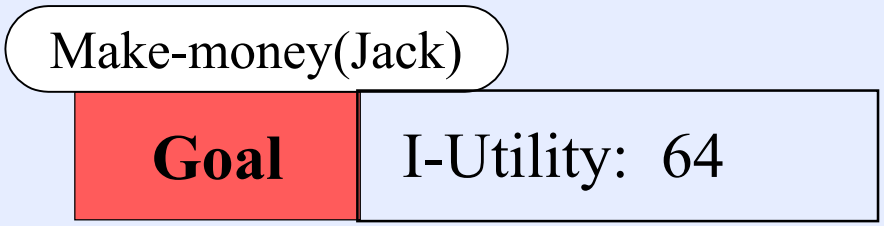

Current State
at(Jack,home)
at(car,home)
at(Jack,store)
Play-lotto(Jack)
Make-money(Jack)
Make-money(Jack)
Goal
Probability: 0.50

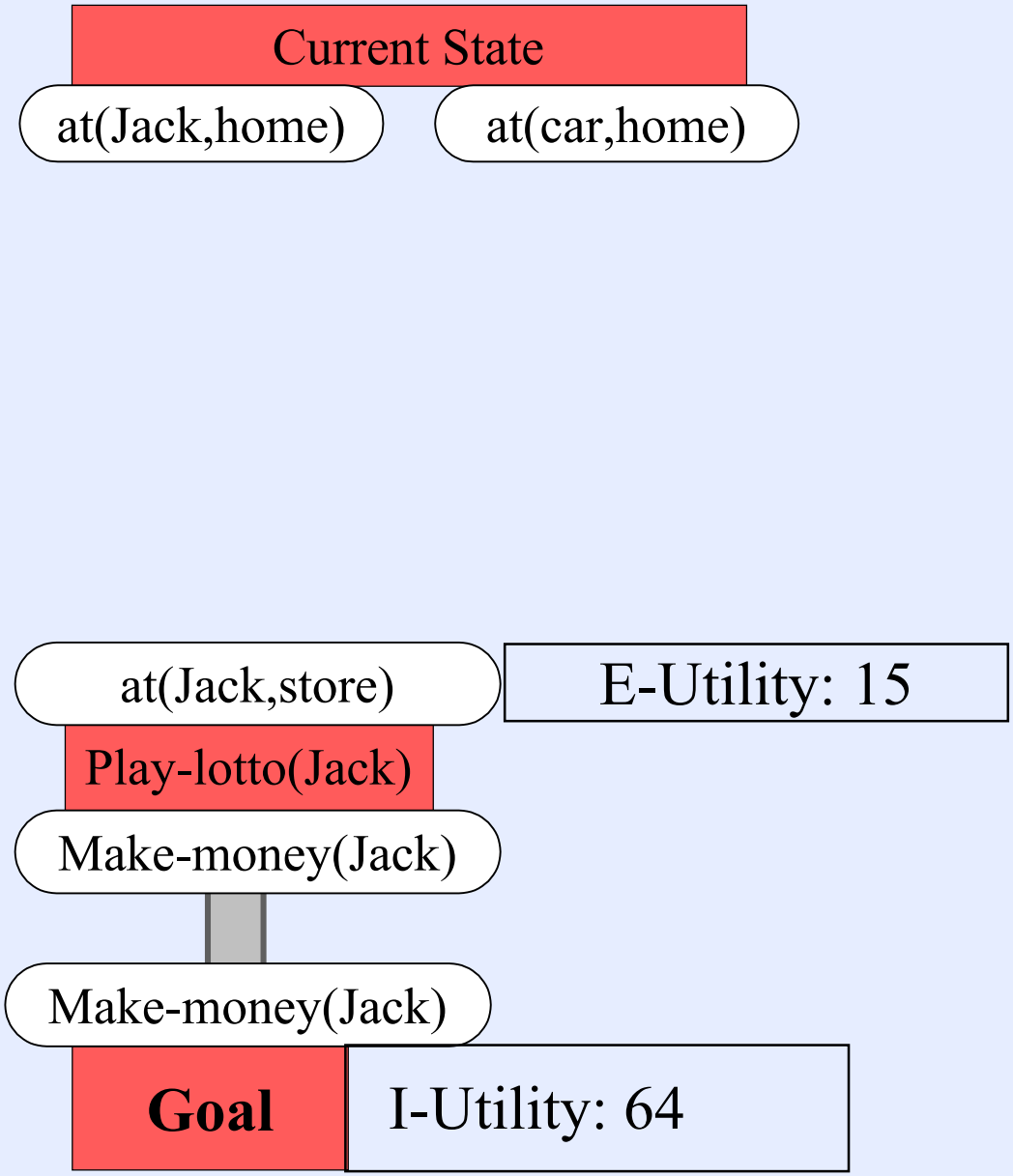

Current State
at(Jack,home)
at(car,home)
at(Jack,home)
at(car,home)
Drive(Jack, store)
at(Jack,store)
at(car,store)
at(Jack,store)
Play-lotto(Jack)
Make-money(Jack)
Make-money(Jack)
Goal
Probability: 0.90

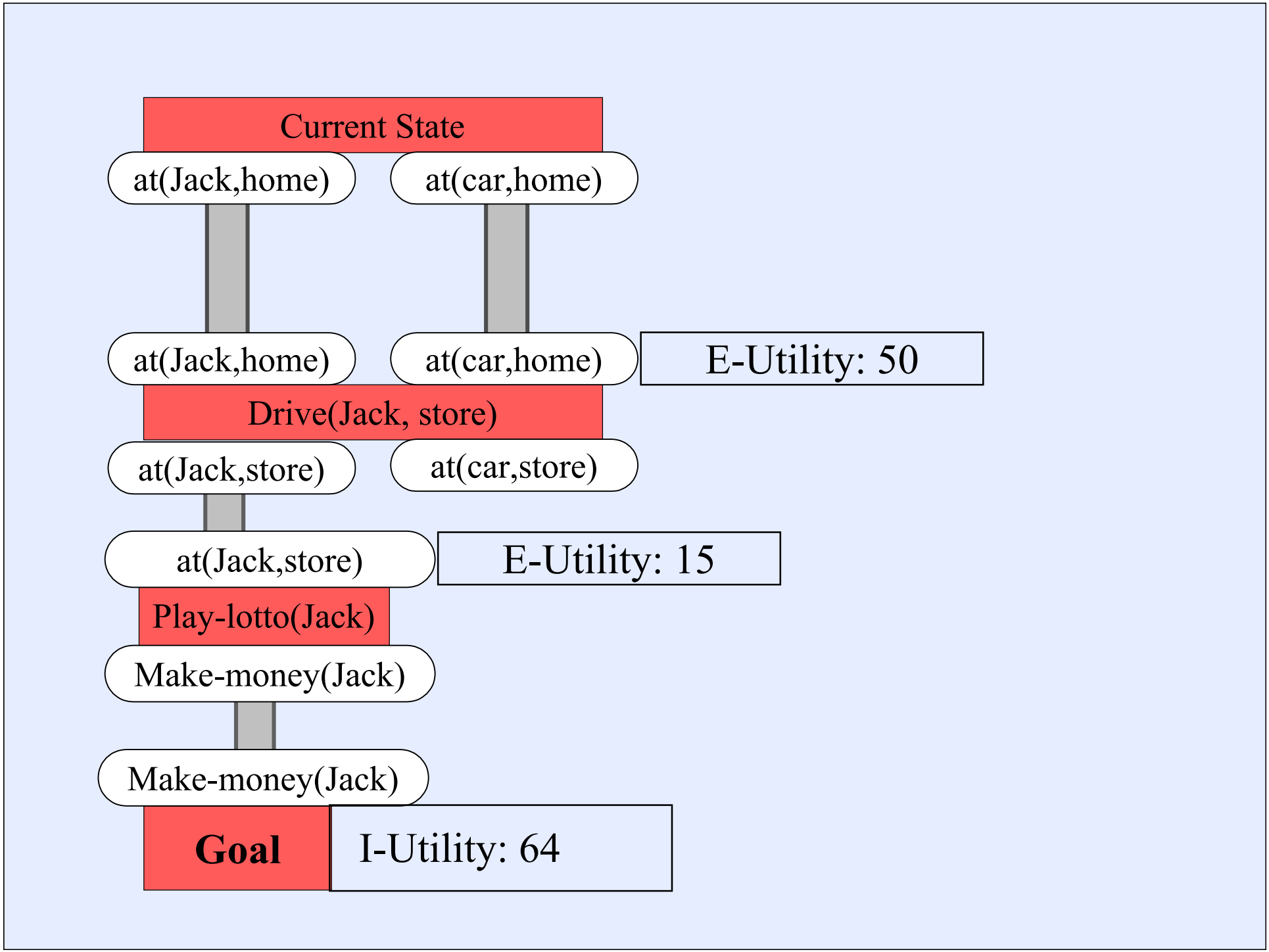


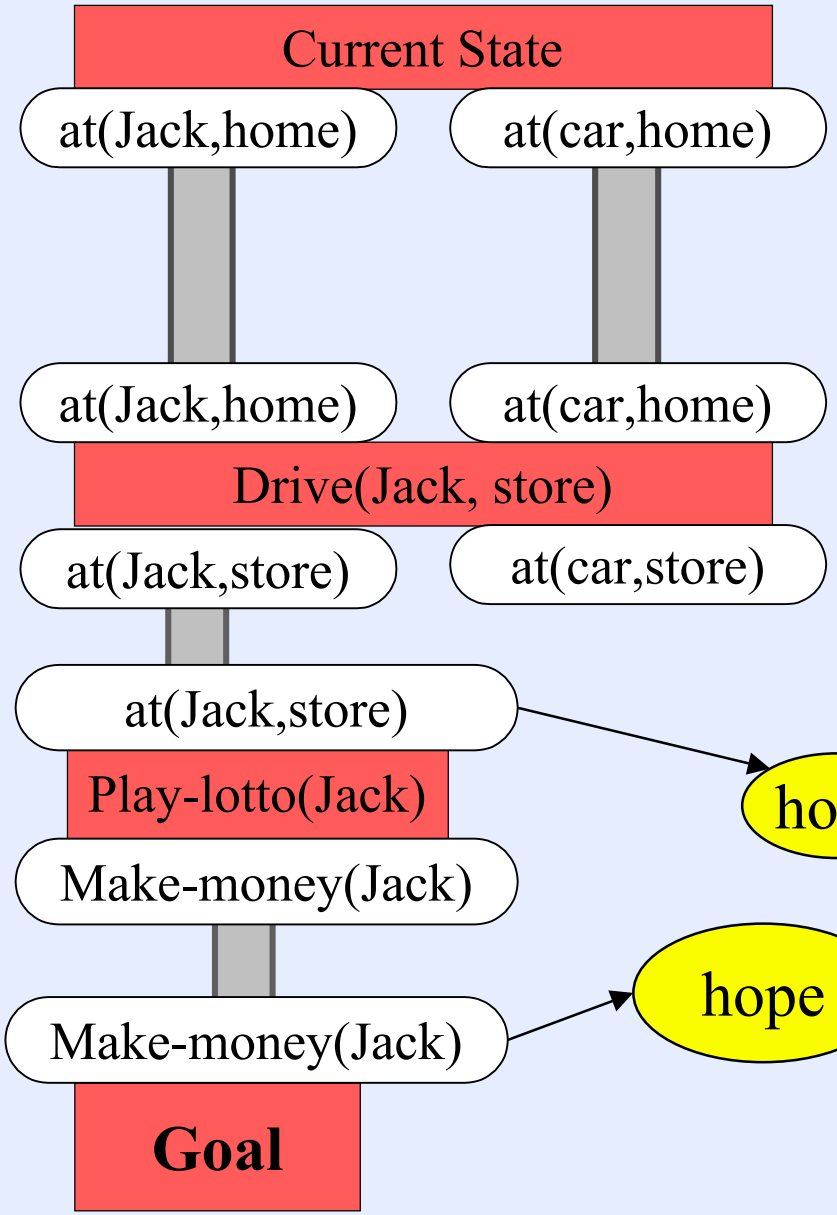
Utilities propagate from the root (I-support)

- Goals and preconditions have *intrinsic utility*
- Subgoals inherit *extrinsic utility*



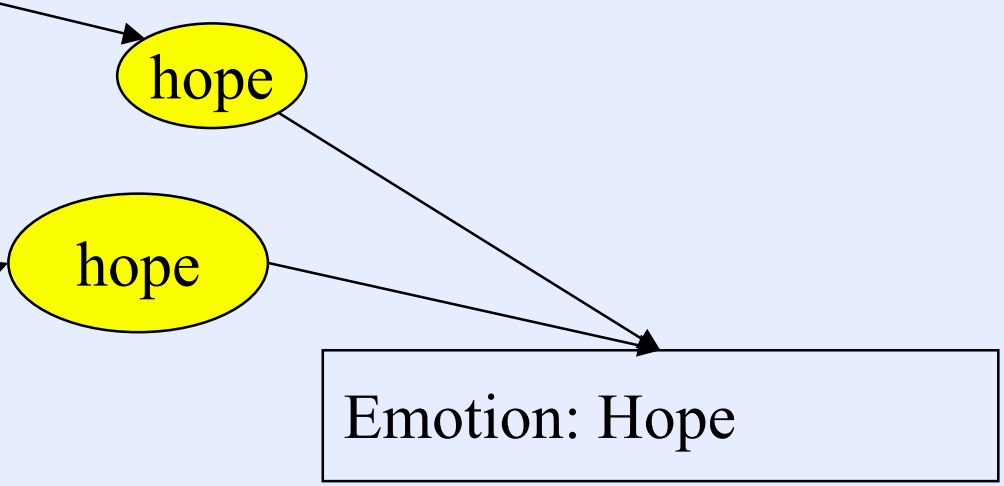

Current State
at(Jack,home)
at(car,home)
at(Jack,store)
E-Utility: 15
Play-lotto(Jack)
Make-money(Jack)
Make-money(Jack)
Goal
I-Utility: 64

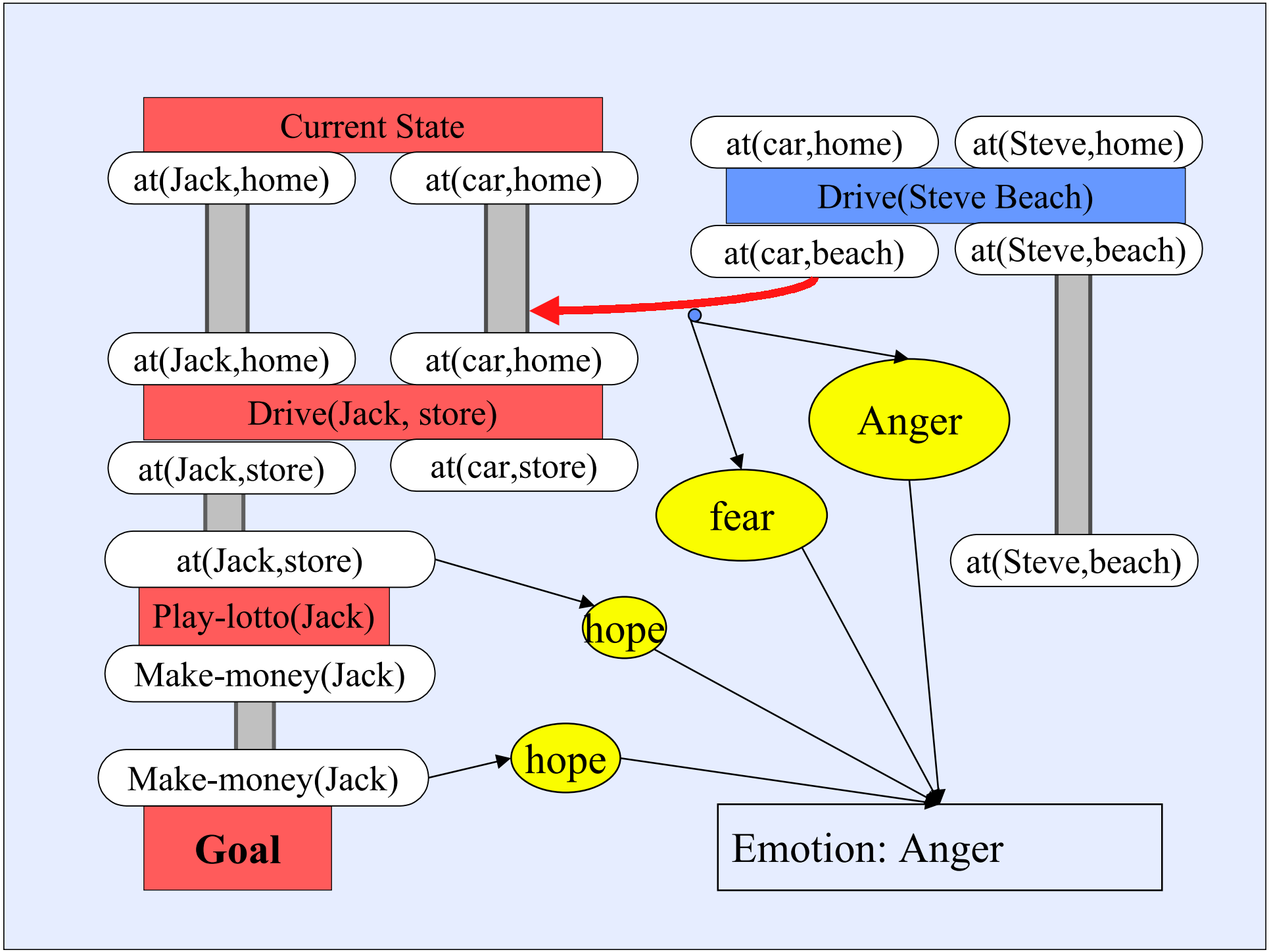

Current State
at(Jack,home)
at(car,home)
at(Jack,home)
at(car,home)
E-Utility: 50
Drive(Jack, store)
at(Jack,store)
at(car,store)
at(Jack,store)
E-Utility: 15
Play-lotto(Jack)
Make-money(Jack)
Make-money(Jack)
Goal
I-Utility: 64



Appraisal rules

- Compute type & intensity
  - Structure
  - Probability
  - Utility




Current State
at(Jack,home)
at(car,home)
at(car,home)
Drive(Steve Beach)
at(Steve,home)
at(car,beach)
at(Steve,beach)
at(Jack,home)
at(car,home)
Drive(Jack, store)
Anger
at(Jack,store)
at(car,store)
fear
at(Jack,store)
at(Steve,beach)
Play-lotto(Jack)
hope
Make-money(Jack)
Make-money(Jack)
hope
Goal
Emotion: Anger

Effects of Emotion

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- **Drive Behavior**
  - Expressions, Gestures
- **Focus Cognitive Resources**
  - Attack most intense plan flaws
- **Act as social cue**
- **Guide Perception**
  - Randy Hill

Conclusion

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- **Nuggets**
  - All that infrastructure does provide leverage
  - Sometimes it does something surprising that looks good
  - Soar makes it easy to slather on more layers

- **Coal**
  - Lots and lots of infrastructure to support simple behavior
  - Not terribly robust
  - Relying on TCL for things I wish the architecture supported