Social Soar Agents

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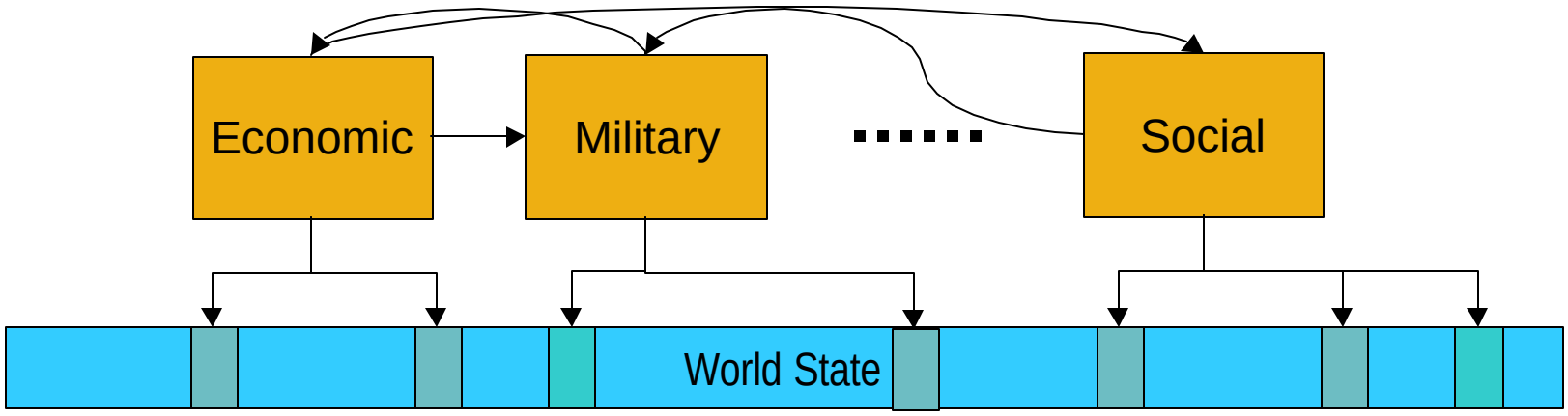
Overview

- Background
- Requirements
- Agent Definition
- Single-Agent Decision-Making
- Group Decision-Making
- Inter-Group Interaction
- Future Work
- Conclusions

Background

- "World" Simulation – models economic, social, military, and diplomatic aspects of the world at a high level of abstraction
  - GNP, military strength, domestic happiness
  - An "action" in the world is a change to a model's inputs

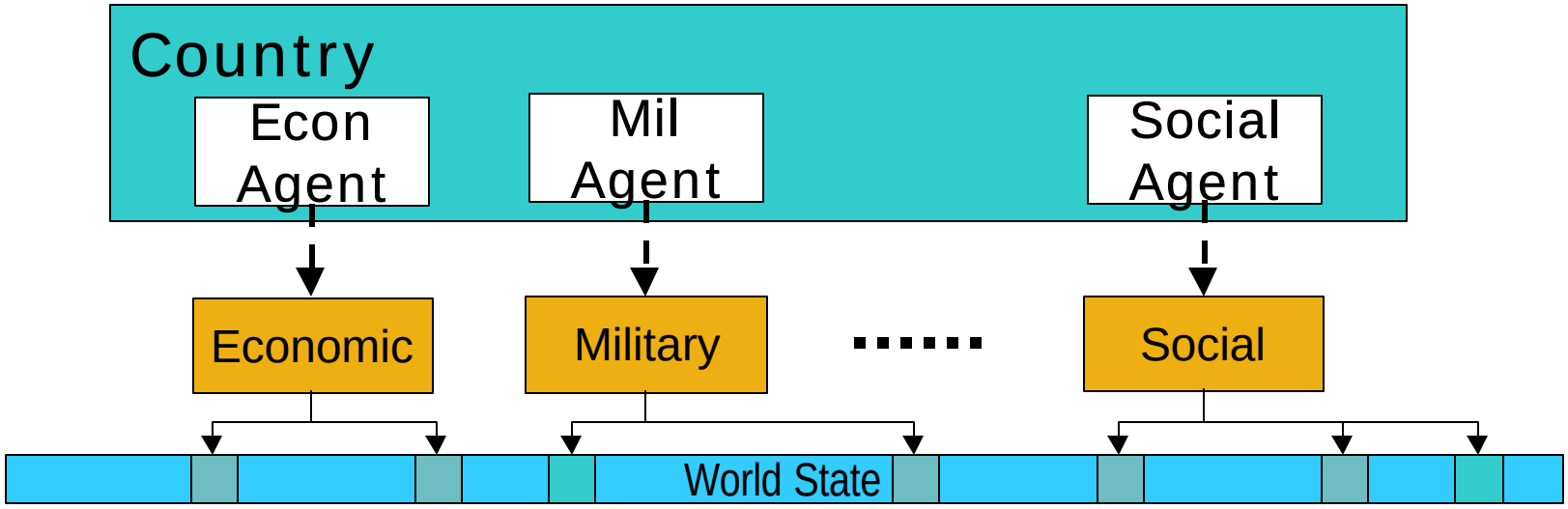


Agent Requirements

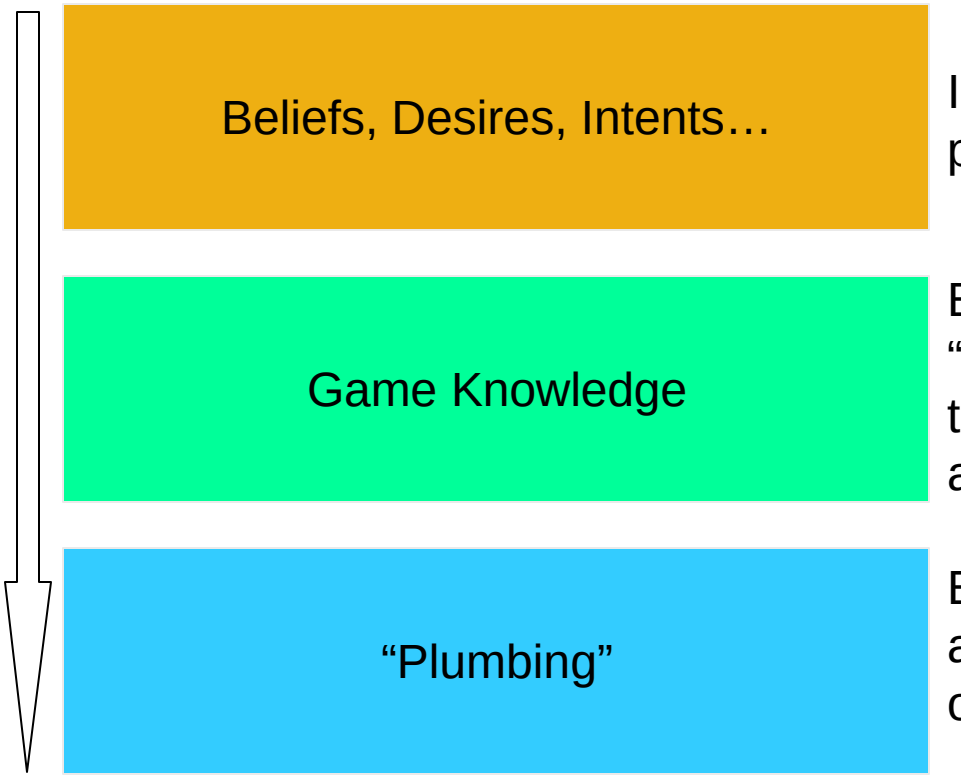
- Multiple agents acting as a group (analogous to a “country”)
- Agents performing different roles within a group
- Interactions between groups
- Behavior tailorable to different situations and scenarios by non-programmers
- Explainable behavior

Agents

- Agents perform various (aggregate) roles within the context of a country: military leadership, economic leadership, society, diplomacy, etc.



Agent Composition



Individual agent definitions – preferences, goals, beliefs, etc.

Behaviors for how to deal with the “game” – applying effects of actions to mental states, data elaborations, action definitions, etc.

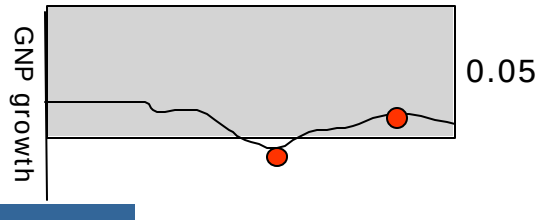
Behaviors for how to interact within a group, planning, keeping track of own history, etc.

Detour: BDI Agents

- Beliefs, Desires, Intents
  - “mental attitudes…representing the information, motivational, and deliberative states of the agent” (Rao and Georgeff, 1995)
  - Desires = Goals
  - Intents = Plans
  - Beliefs = everything else

BDi ?

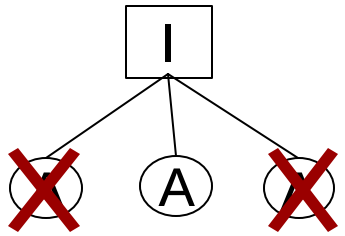
Goals



- Goals are an agent's desires with respect to the world state variables (e.g., Propaganda, GNP).

- EXAMPLE: Economic agent has the goal of keeping GNP growth above 5%

Action Preferences



- Filter for actions
- Reject an action if there is no belief that the action can help the situation

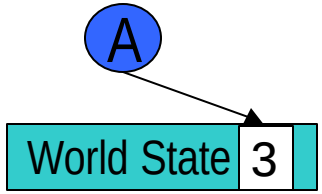
- EXAMPLE: If the issue is that GDP is too low, then we can reject the action of moving troops because that has no effect on GDP.

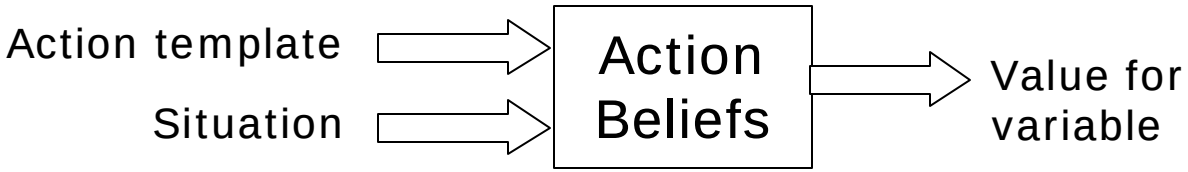
Beliefs

- Encode an agent's understanding of how the world works, what is good and bad, and what are reasonable actions to take
  - Action Beliefs
  - Cause & Effect Beliefs
  - Judgment Beliefs

(Data Transformation + Description)

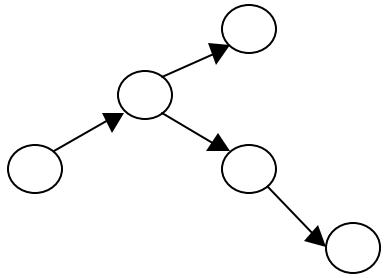
Action Beliefs





- Action beliefs provide a value for an action given a situation.
- Value calculated from
  - effect strength (how much the variable effects another variable)
  - effect type (inverse/direct),
  - action target (how close to aim to the goal value).
- EXAMPLE: Military agent may increase its Aggressiveness Level to match opponent's.

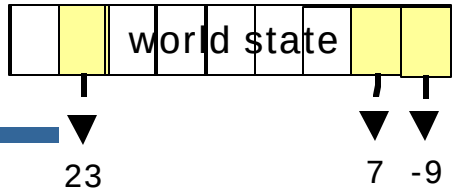
Cause & Effect Beliefs



- Variable X effects variable Y
- Action's effect is projected into the future
- Many of these per agent to understand the world

- EXAMPLE: The Society agent may believe that increasing Education Spending has a direct effect on Society's Happiness.

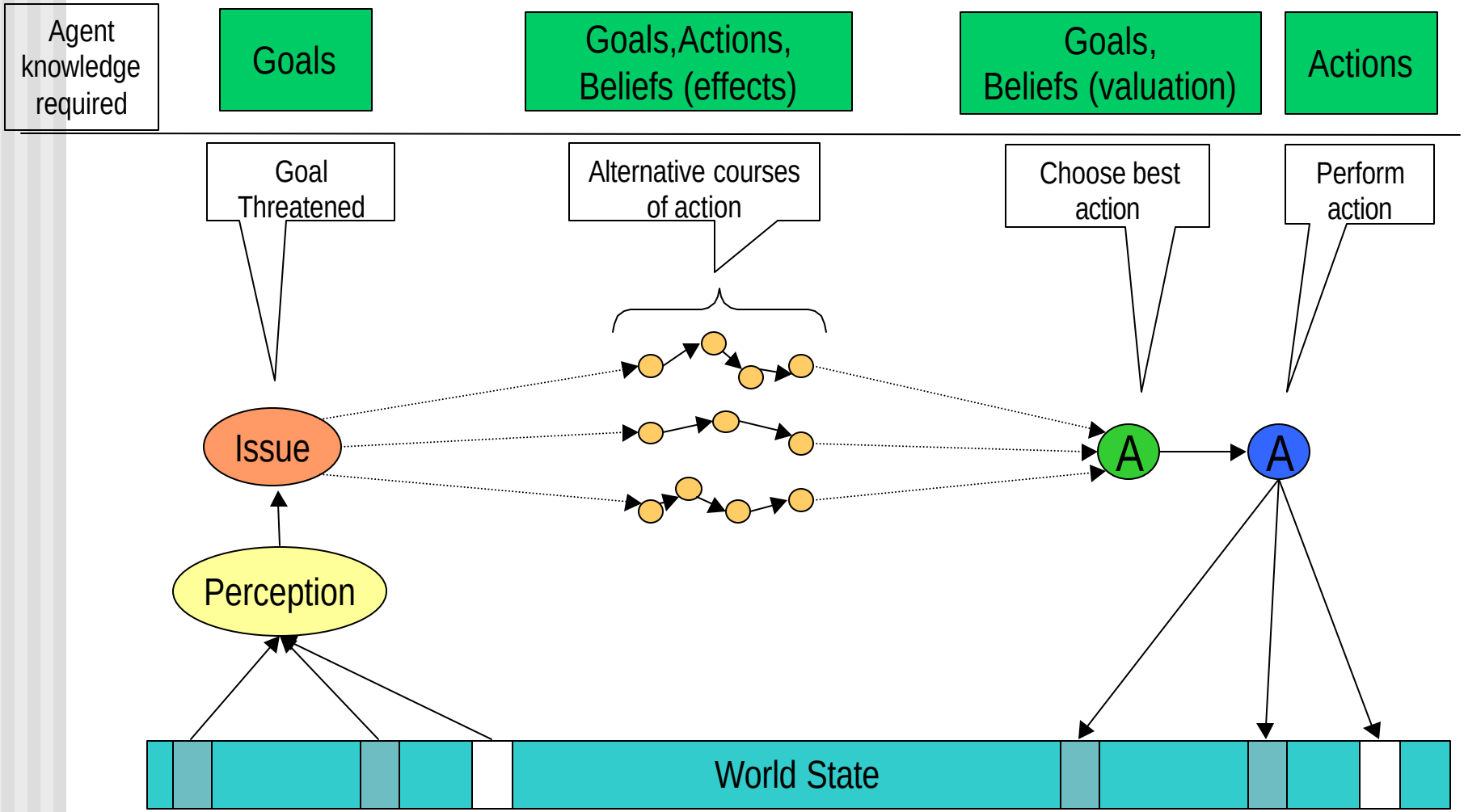
Judgment Beliefs



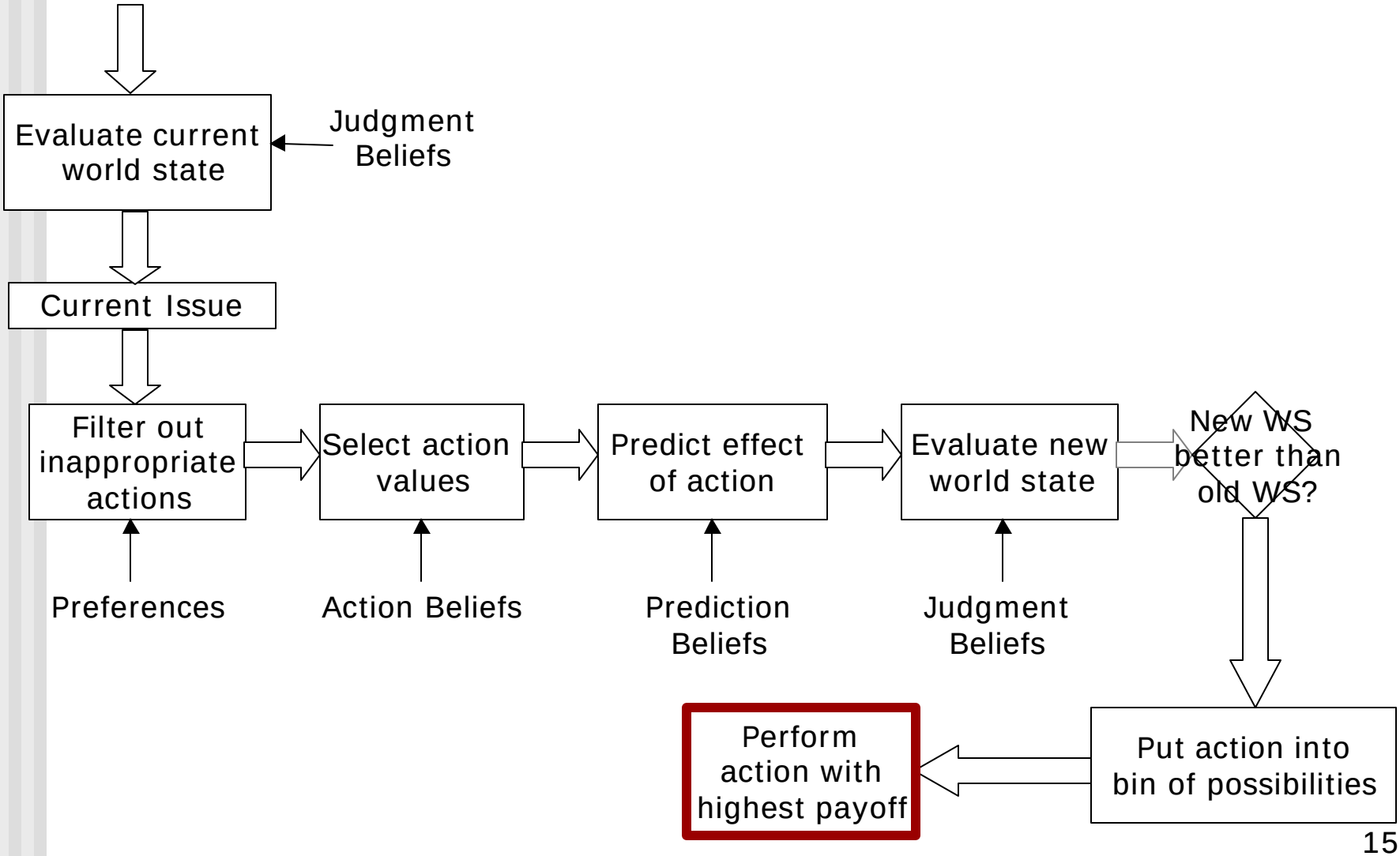
- Selectively compare the (current or projected) world state to the agent's goals
- Can make judgments about anyone's actions

- EXAMPLE: The Economic agent believes that keeping GNP growth steady is good.

Single Agent Decision-Making

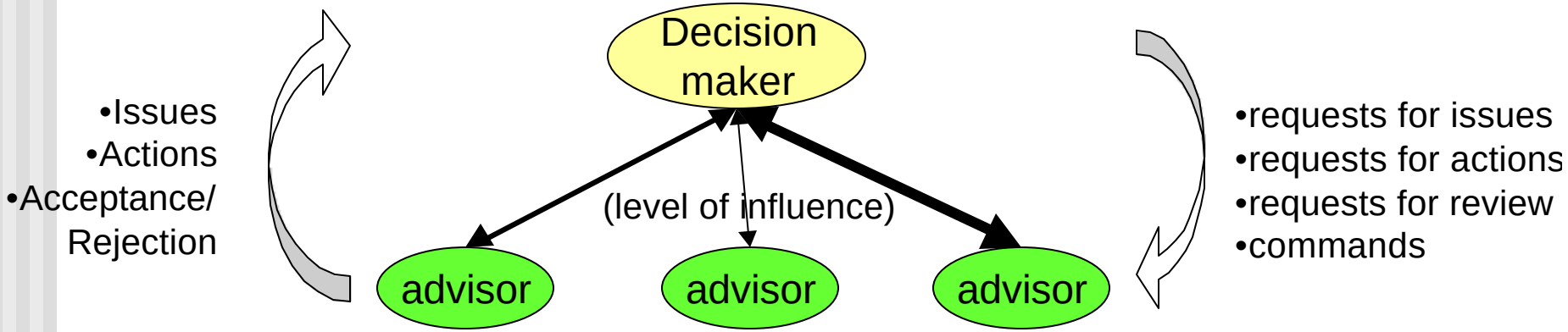


Planning


Evaluate current world state
Judgment Beliefs
Current Issue
Filter out inappropriate actions
Select action values
Predict effect of action
Evaluate new world state
New WS better than old WS?
Preferences
Action Beliefs
Prediction Beliefs
Judgment Beliefs
Perform action with highest payoff
Put action into bin of possibilities

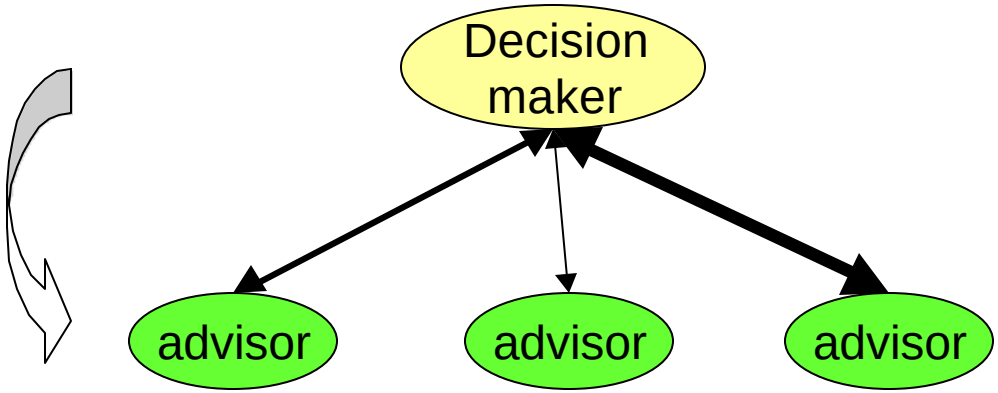
Group Decision-Making Process

- "Manager model" – single decision-maker with advisors
  - Anyone can propose issues and actions
  - Decision-maker has final say on what happens

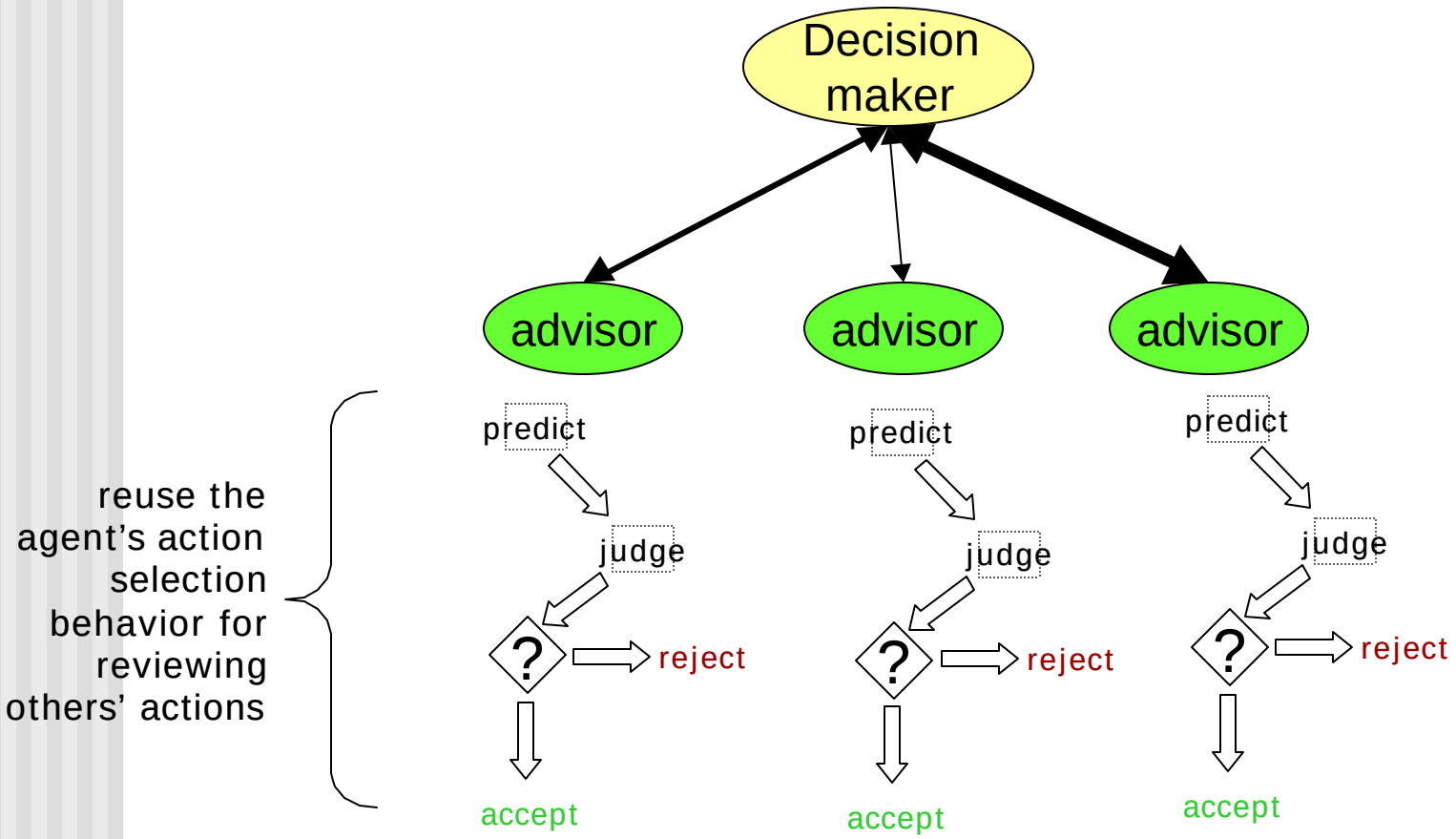


Action Review

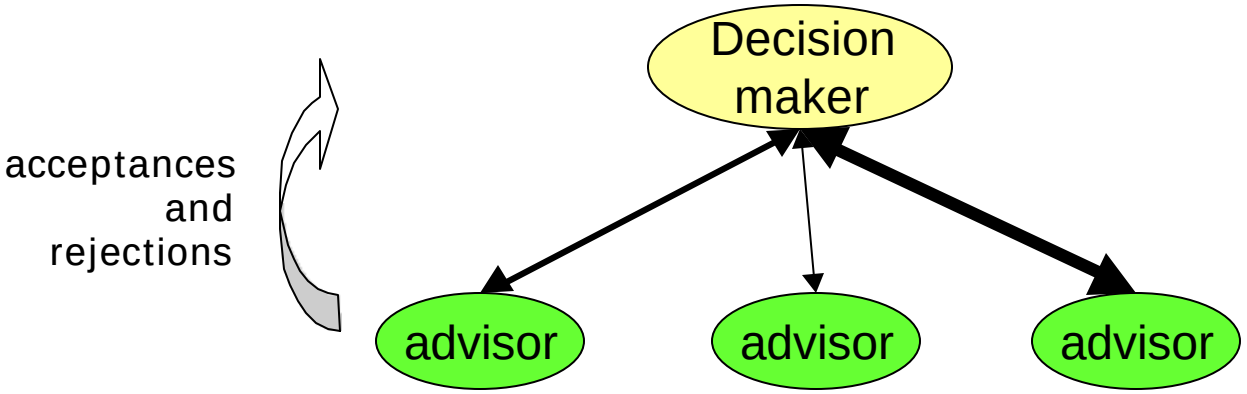
requests for
action review



Action Review

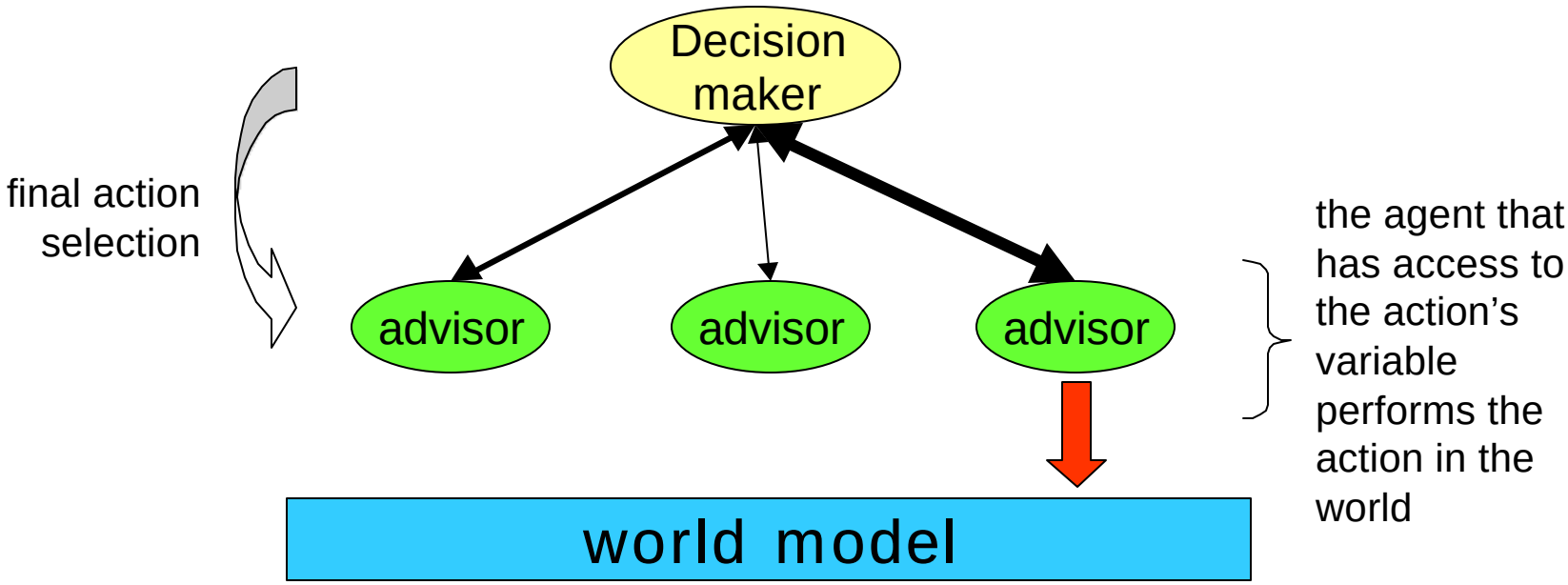


Action Review

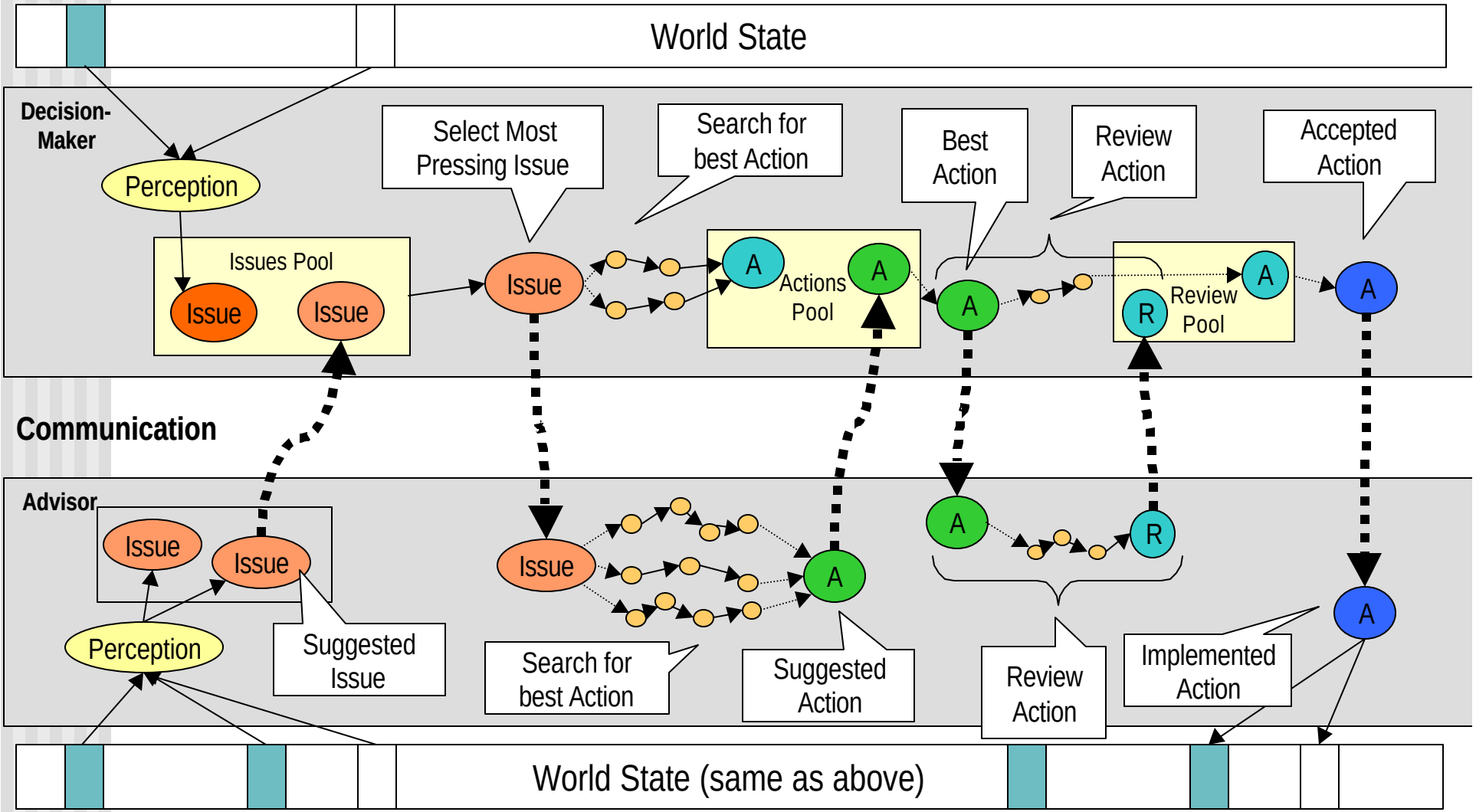


Use players' influences to determine best move at the time. Currently uses a weighted sum of the advisor's confidence in the action…

Action Review



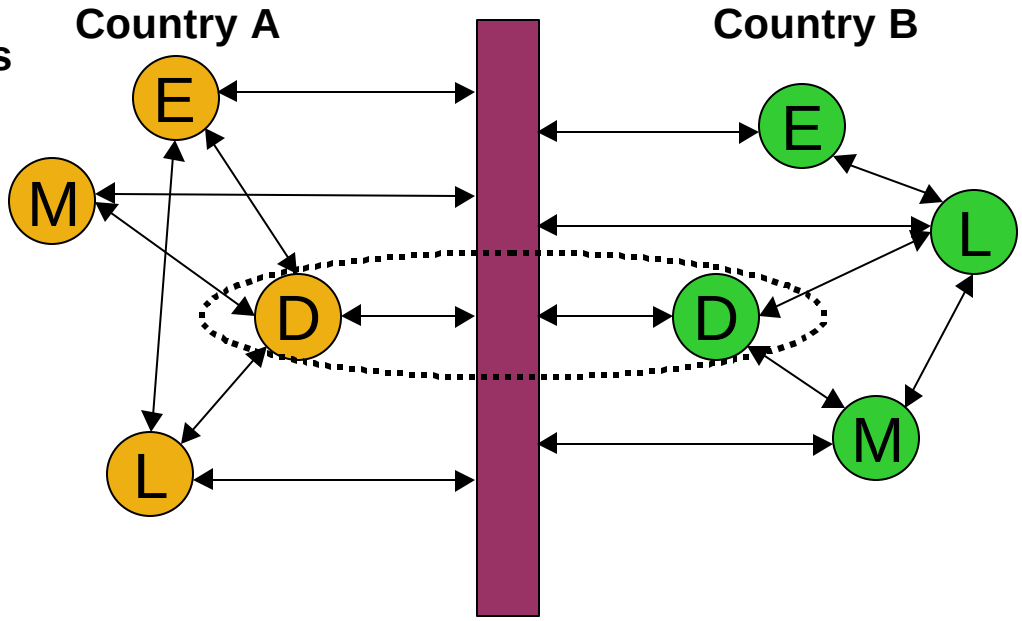
Group Decision-Making



Group Interaction

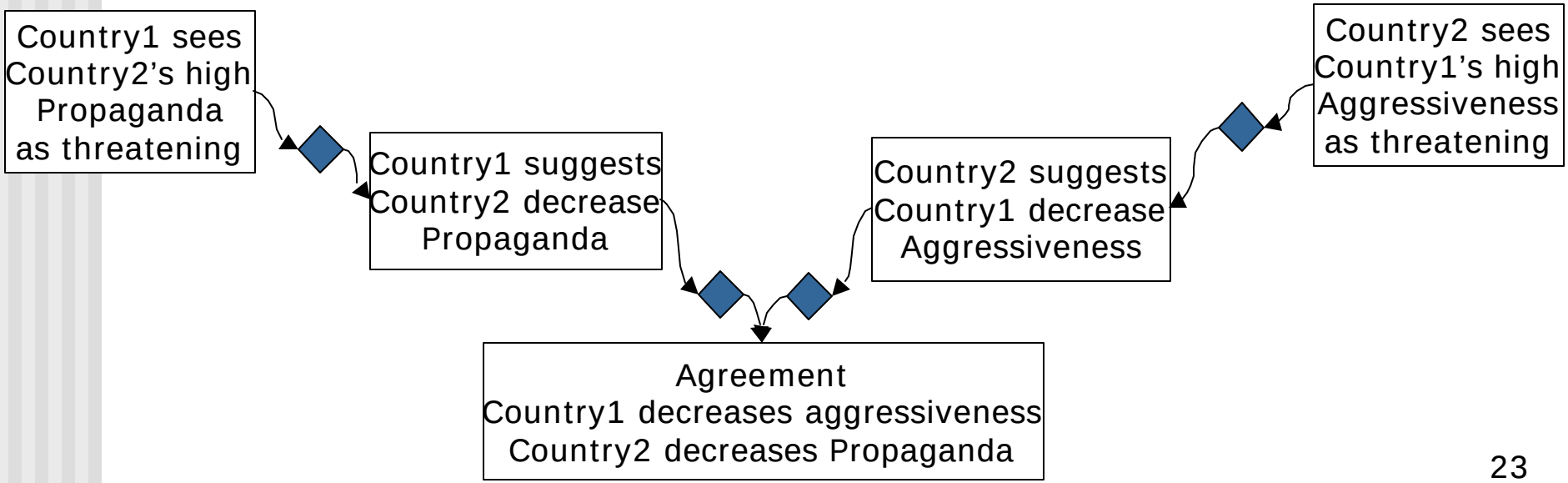
Types of Group Interaction Interactions

Explicit	**Diplomatic exchanges**
Implicit	■**Tariffs** ■**Blockades** ■**Military Posturing** ■**Propaganda**

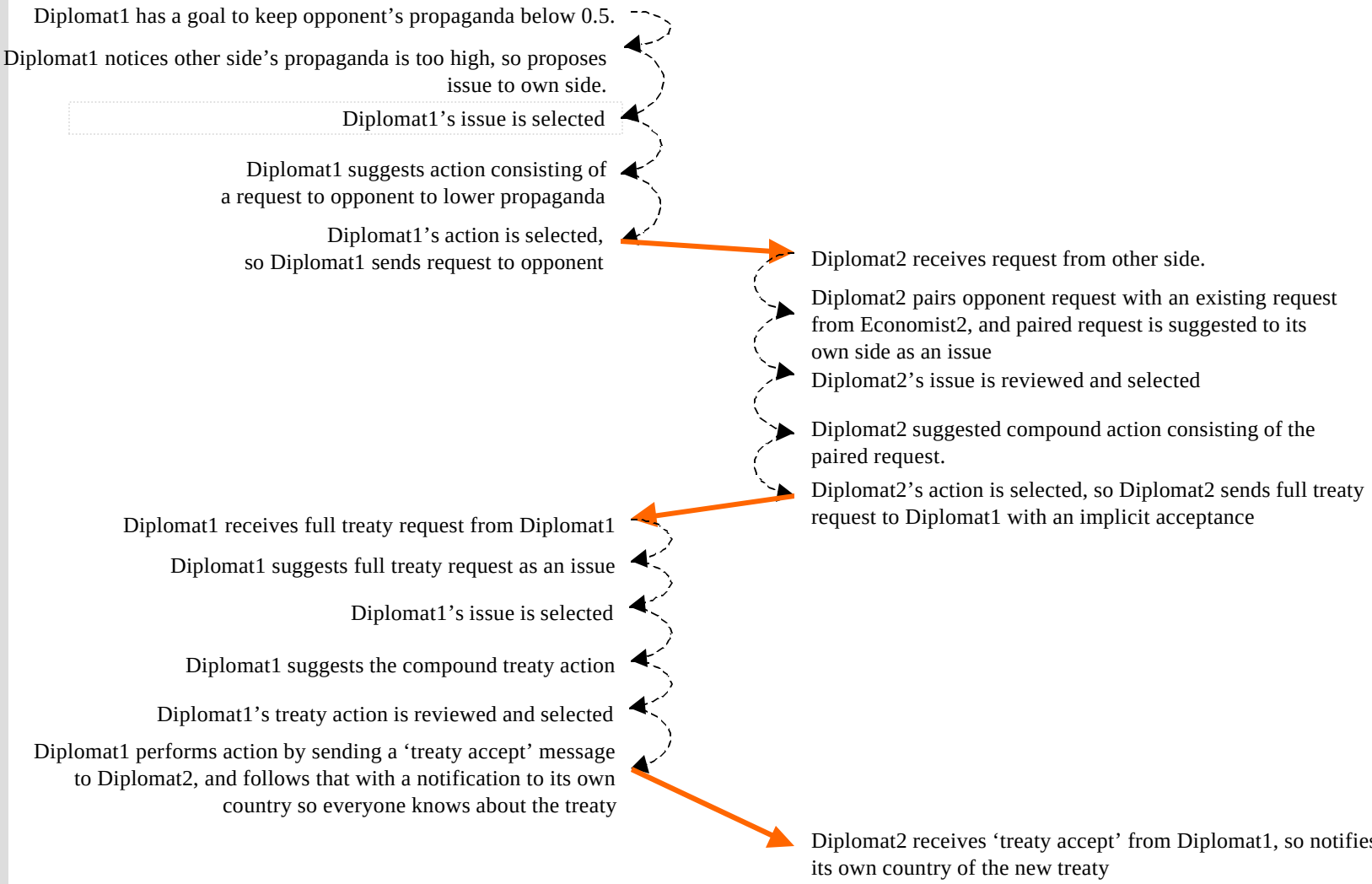


Agreements

- Allows one side to influence behavior of the other
- Cast as action for opponent to perform
  - Reuse existing behaviors for action suggestion and review



Agreements (detail)



Explainable Behavior

Details for Action Proposal by society-agent on Turn 1

Issues:
Leaning away from a Democracy

Actions:
Request to set Education to 20.05

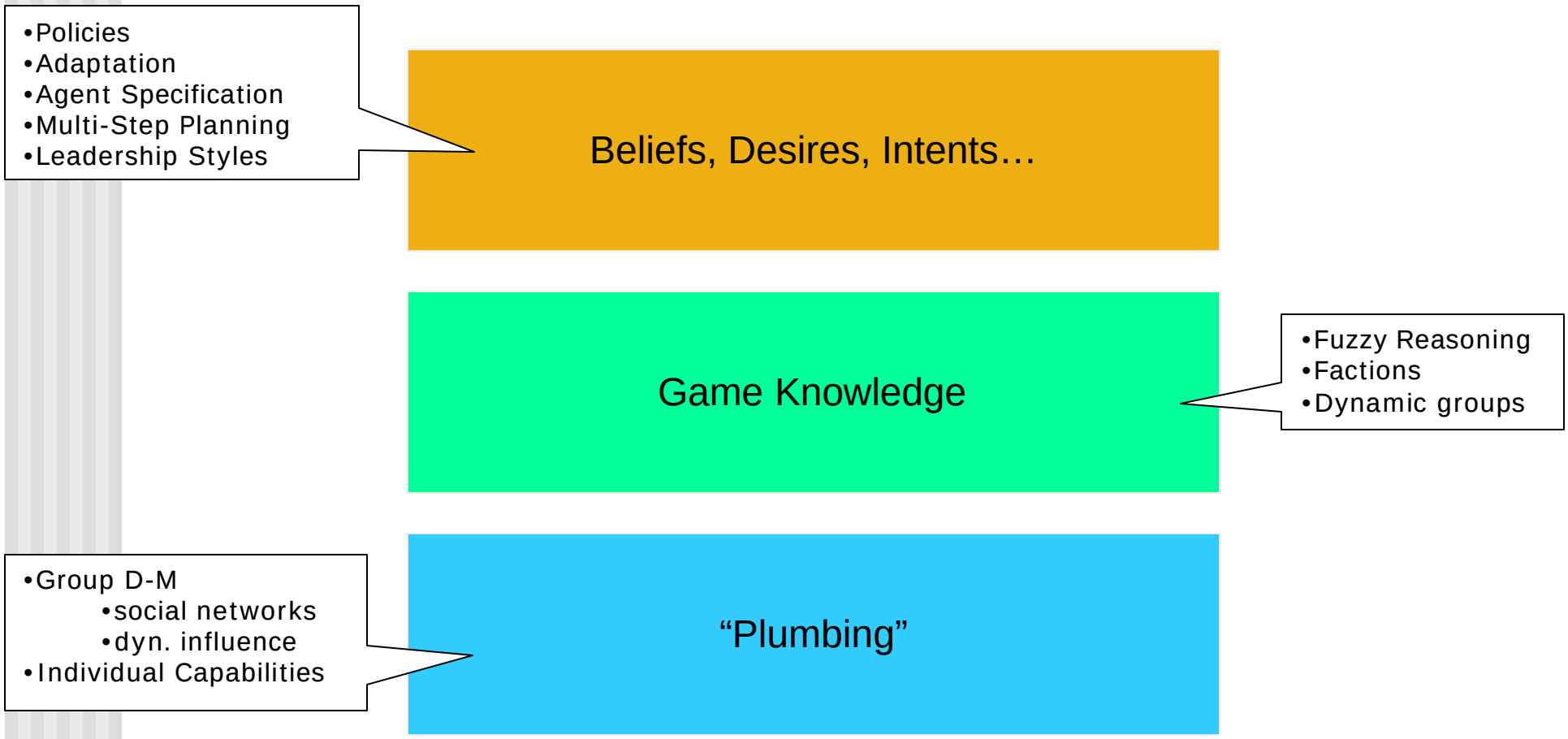
Action Beliefs:
Increase education to lower dictatorship. Revisit issue in 5 turns.

Prediction Beliefs:
Changing Education will effect Democracy_Dictatorship inversely
Changing Education will effect Constitutional_and_Policy_Goodwill directly
Choosing an action to change Education will change the Education.

Judgement Beliefs:
Remaining a democracy is good

Other Beliefs:
Reject action: Constitutional_and_Policy_Goodwill-treaty.
Reject an action if we know there is no belief that the action can help situation.

Future Work


•Policies
•Adaptation
•Agent Specification
•Multi-Step Planning
•Leadership Styles
Beliefs, Desires, Intents…
Game Knowledge
•Fuzzy Reasoning
•Factions
•Dynamic groups
•Group D-M
•social networks
•dyn. influence
•Individual Capabilities
“Plumbing”

Conclusions

- Can build (a particular kind of) agents without writing Soar productions
- Interesting first cut at a model of group decision-making
- Agents sometimes produce surprising behavior, but it's explainable via annotations