Representing Knowledge and Experience in RPDAgent

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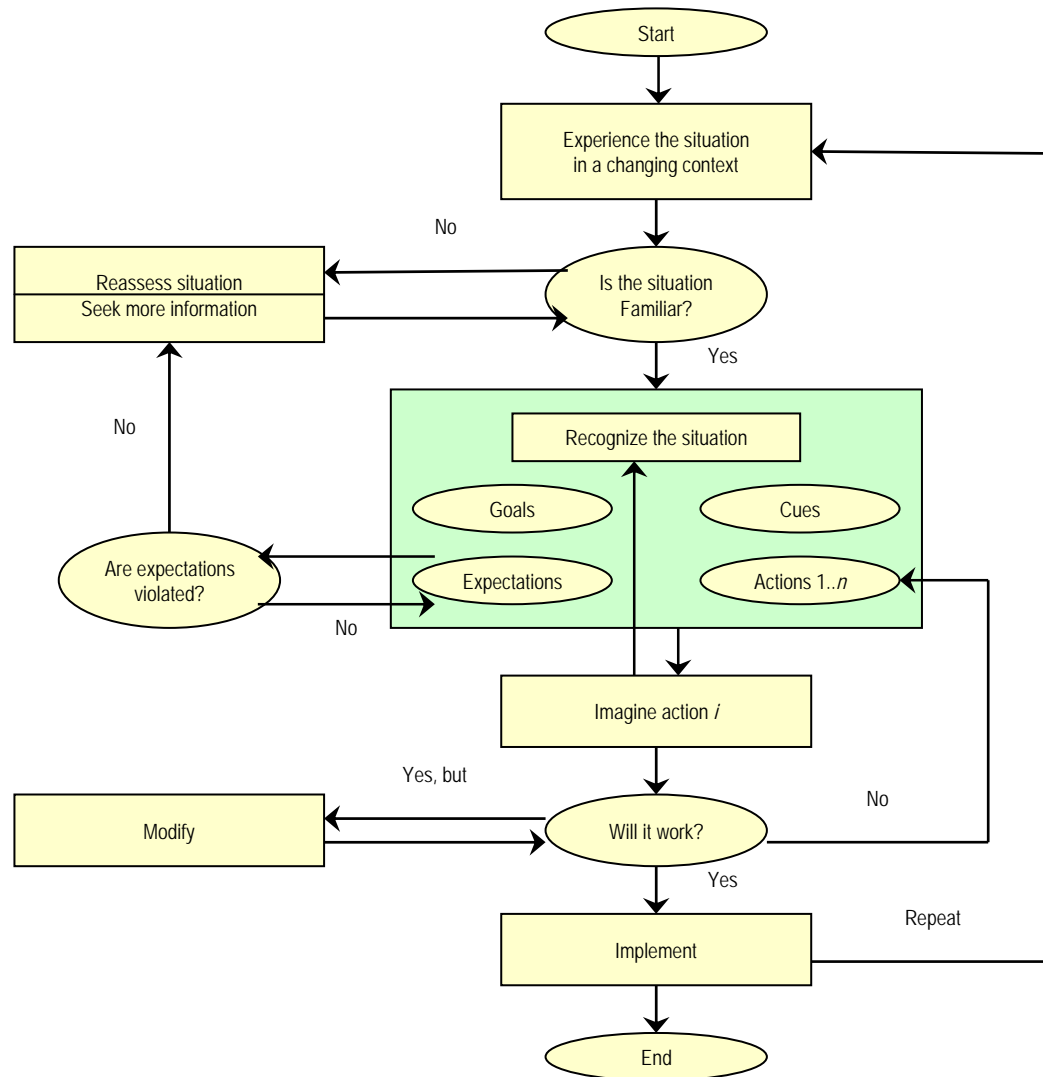
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RPDAgent

- ## What is RPDAgent
  - A computational model of decision making.
  - It is based on the cognitive model called Recognition-Primed Decision Making.
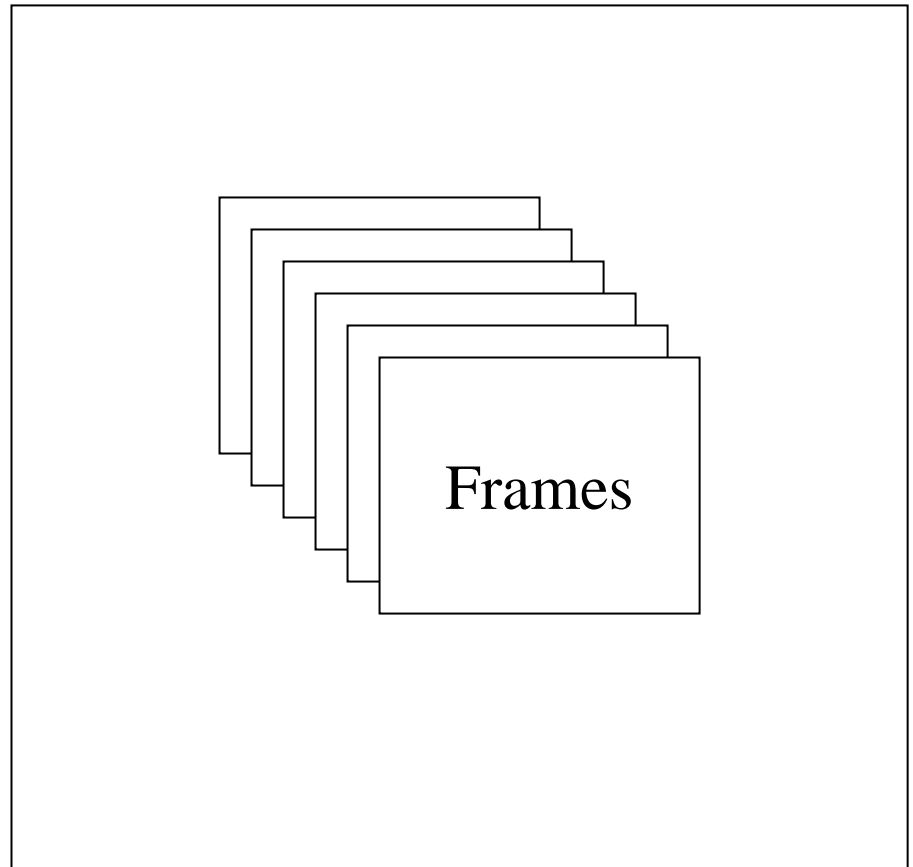 - Implemented as a multiagent system simulation

RPDAgent

RPD Model

RPDAgent

- Key to RPDAgent functionality is experience representation approach.

- Each past experience is represented by one frame.
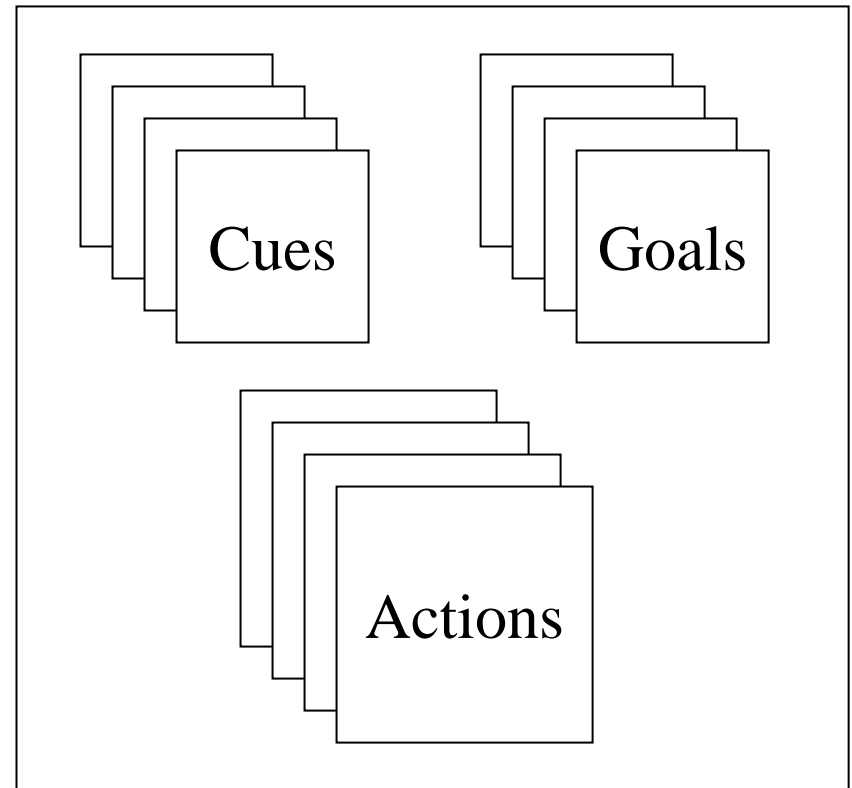
Total experience

Frames

RPDAgent

- **Frame**
  - A data structure to hold information about a person's environment.
  - In RPDAgent, frames contain sets of cues, goals, and actions that describe an experience.
 - One frame for each unique experience.

Frame

RPDAgent

- **Cues**
  - Key elements of a decision on which the decision maker focuses.
  - Help decision maker focus on important information and filter out the unimportant to prevent information overload.
  - Often an aggregation of several lower level physical or mental environmental variables.
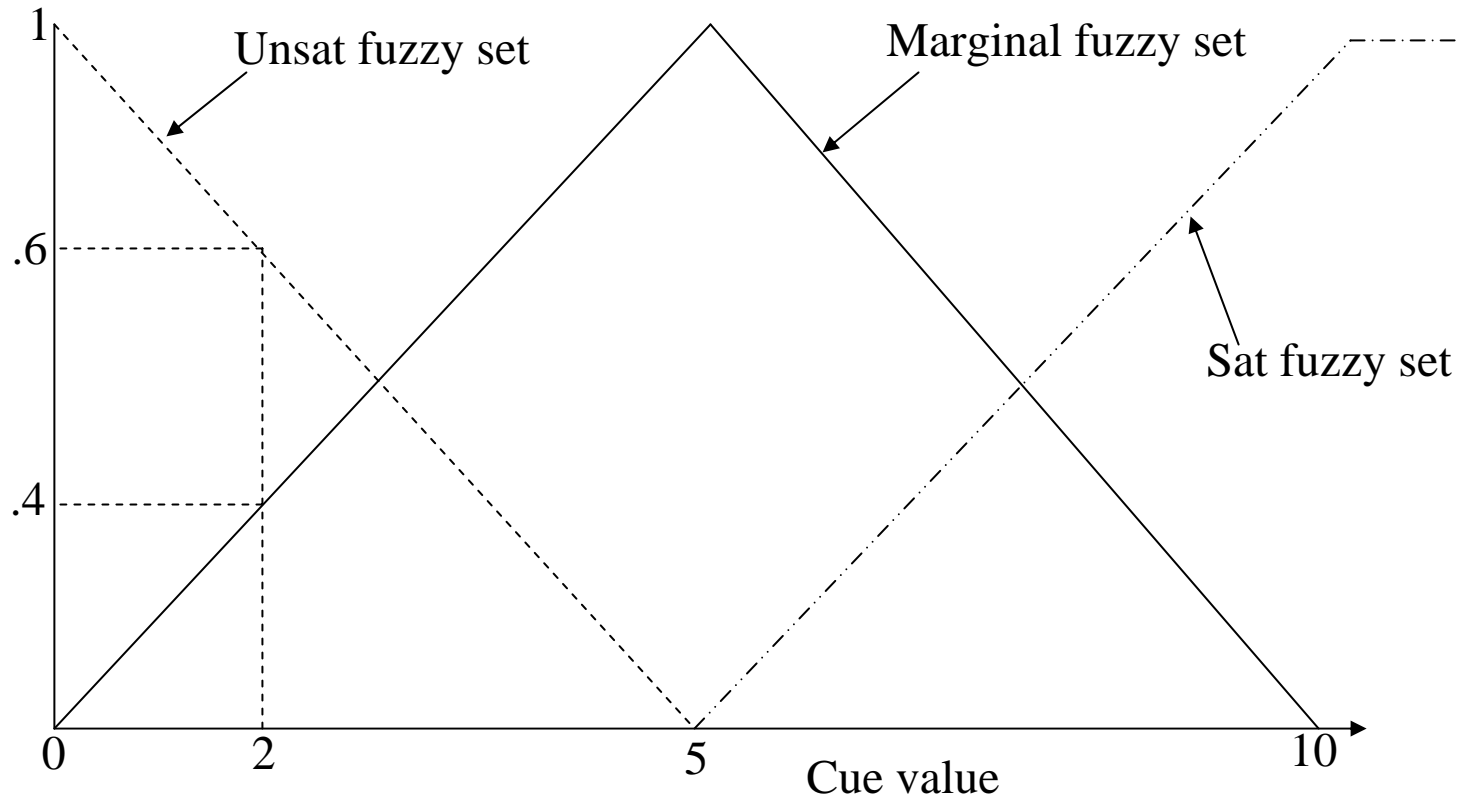 - Internal interpretation of decision maker's external environment.

Cue

Environmental Variables
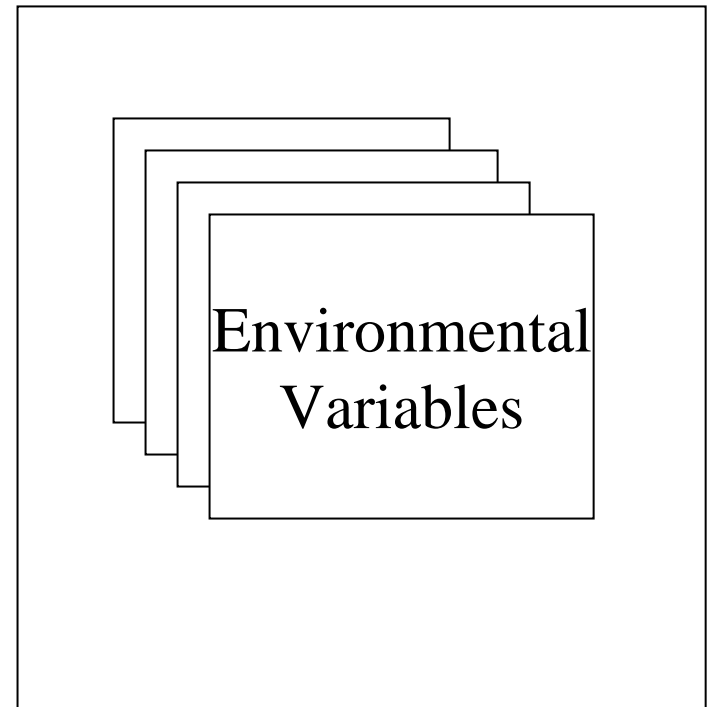
RPDAgent

- Creating internal representation of external environment
  - Calculate cue values by summing associated environmental variable values for all available actions.
  - Convert cue values to a fuzzy interpretation.

Cue	Env. Var.	Description	Value
Hydrography	Reef	None	2
		Partial	1*
		Full	0
	Water depth	Shallow	2
		Moderate	1
		Deep	0*
	Anchorage	None	0*
		Yes	2
	Tides	Small	2
		Moderate	1*
		Large	0
	Currents	Light	2
		Moderate	1
		Severe	0*

RPDAgent

Result is an internal interpretation of each cue.

RPDAgent

- Selection of most favorable action
  - RPD model indicates that an experienced decision maker "intuitively" knows what action is best.
  - RPDAgent must determine the most favorable action by computing an action value that is the sum of all cue values for that action.
  - Cue values and not cue fuzzy values are used because this is only an intuitive indicator of the most favorable action. It must further analyze the action to determine if it satisfies its goals.

RPDAgent

- Goal satisfaction
  - Each experience has one or more goals that must be achieved.
  - Once the most favorable action is identified, RPDAgent must use its experience to determine how well the action satisfies these goals.

| Goal	Cues	Fuzzy value	Numeric value
Accomplish mission	Beach topography	Marginal	1
	Beach hydrography	Sat	2
	Beach obstructions	Sat	2
	Beach staging area	Marginal	1
	Route to objective	Sat	2
Goal value			8

RPDAgent

- Goal satisfaction
  - If all goals are evaluated satisfactory, the action under consideration becomes the decision.
  - There are often goal conflicts that must be resolved. Humans use mental simulation to work through these conflicts.
  - RPDAgent uses agent negotiation to represent this process.

RPDAgent

- **Negotiation function**
  - Goal values of most favorable action are multiplied by a personality factor accounting for a person's tolerance for risk.
  - Fuzzifier is applied to new goal value to determine goal evaluation status.

  –Risk factor provides threshold for negotiation.

  –If negotiation is unsuccessful, next most favorable action is evaluated.

Unsat fuzzy set

Marginal fuzzy set

Sat fuzzy set

.6

.4

0   2   4   5   10   12

Goal value
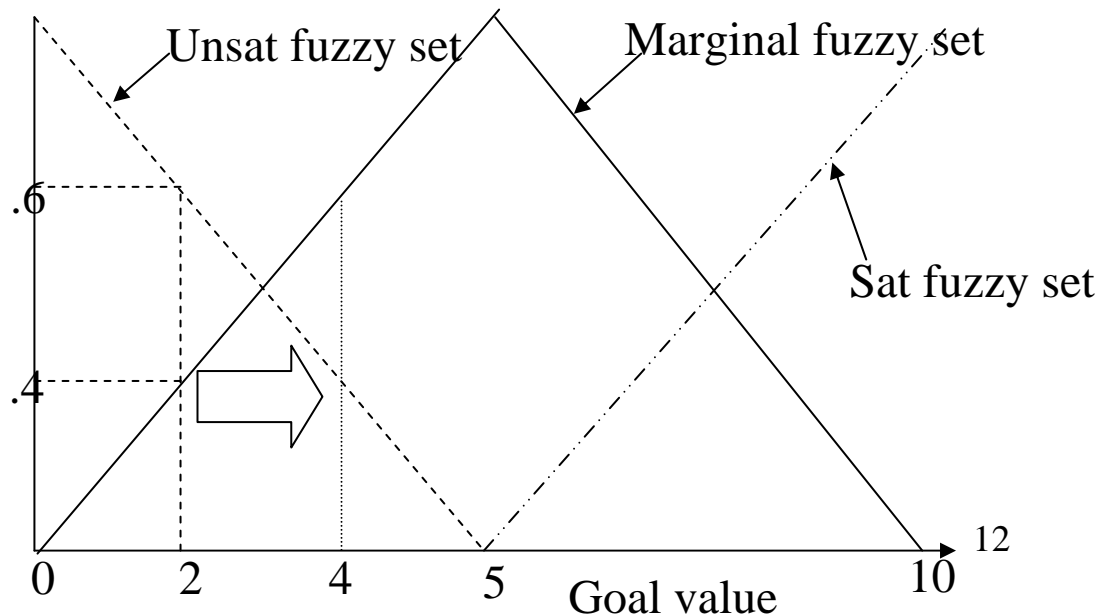
RPDAgent

- Summary of experience representation
  - The number and types of actions, cues, and goals considered.
  - The use of cues and fuzzy sets to internalize external environment.
  - The number and shape of fuzzy sets.
  - The association of specific cues to goal evaluation.
  - The use of fuzzy sets to evaluate goal accomplishment.
  - The negotiation methodology.