

# Visualization of Decision- Theoretic Plans

HNRS-200  
Winter 2008

# Research Team

- **Professor Alexander Dekhtyar**

Associate Professor  
Computer Science  
Cal Poly

- **Professor Judy Goldsmith**

Professor  
Computer Science  
University of Kentucky

- **Kyle Cushing**

Student  
Computer Science, BS  
Cal Poly

- **Tom Dodson**

Student  
University of Kentucky

- **Evan Hecht**

Honors Student  
Computer Science, BS  
Cal Poly

- **Joan Mazur**

Associate Professor  
College of Education  
University of Kentucky

- **Brian Oppenheim**

Honors Student  
Computer Science, BS/MS  
Minor in Mathematics  
Cal Poly

# The Problem

- Humans look for advice in situations where decisions are complex and include a vast array of possible choices and outcomes.
- Current probabilistic decision applications fail to communicate scenarios effectively with users who are not familiar with statistical theory.

# Previous Research

- This project is a continuation efforts by a group of from the University of Kentucky.
- Their efforts led to the development of a software suite called *PlanIt* .
- The current user interface was tested using students at the University of Kentucky who said that it did not provide an intuitive experience.

PlanIt - The Interactive Planner

File View Help

Start | Preferences [X] | Plan 1 [X]

### Current State

- Fairly wet recently**
- I am having a good time
- I am a teenager
- I am thirsty
- I am not tired
- Fairly thrilled recently**
- I am not hungry
- No shows recently

Edit State

### Possible Result States

| State | Probability |
|-------|-------------|
| 1     | 37.8%       |
| 2     | 25.2%       |
| 3     | 16.2%       |
| 4     | 10.8%       |
| 5     | 4.2%        |
| 6     | 2.8%        |
| 7     | 1.8%        |

Ride a water-drop ride (Suggested)

### Result State

- Very wet recently**
- I am having a good time
- I am a teenager
- I am thirsty
- I am not tired
- Very thrilled recently**
- I am not hungry
- No shows recently

← Previous
Edit Preferences
Multiple Actions
Set Goals
Forward →

Suggested Action

Ride a water-drop ride

Alternate Actions

Have a drink

# Old User Interface

# Procedures

- 1. Qualitative analysis** - used to identify the weaknesses of the current system
- 2. Brainstorming and Research** - the team brainstormed design ideas and researched the human cognition of decision making to identify goals for the new interface
- 3. Prototyping** - using the goals list and the list of flaws in the previous interface, we made models for a new interface
- 4. Discussion** - the prototypes are being discussed and critiqued for implementation later in the project

# Research Materials

**Thinking, Problem Solving, Cognition - Richard E. Mayer, 1992**

*We are using this book to understand the basics of human logic and problem solving, and how those relate to computer simulations which solve the same problems.*

**The Nature of Cognition - Robert J. Sternberg, 1999**

*This book will be critical in the development of an accurate and useful cognitive model for later parts of the project.*

# Results - Problems with the Current System

- No indication of dead end states.
- Confusing terminology/vocabulary
- Information about current/future states is hard to visualize
- State changes are hard to evaluate
- Does not allow comparison of multiple actions and results
- Action usefulness and result probability not precise

# Results - Problems with the Current System

- Action selection is hard to use/understand, and is shown after result selection when really it should happen first
- Can't see the long term result of choosing a specific action
- No easy way to go back many steps
- The system doesn't say why a state changed the way it did
- There is no indication of time progression

# Results - Goals for the New System

- Glossary
- Interface customization
- Progress/time indication
- Checkpoints for easy navigation through the plan
- Indication of most likely end result of choosing a specific path, and the number of steps to reach that result.

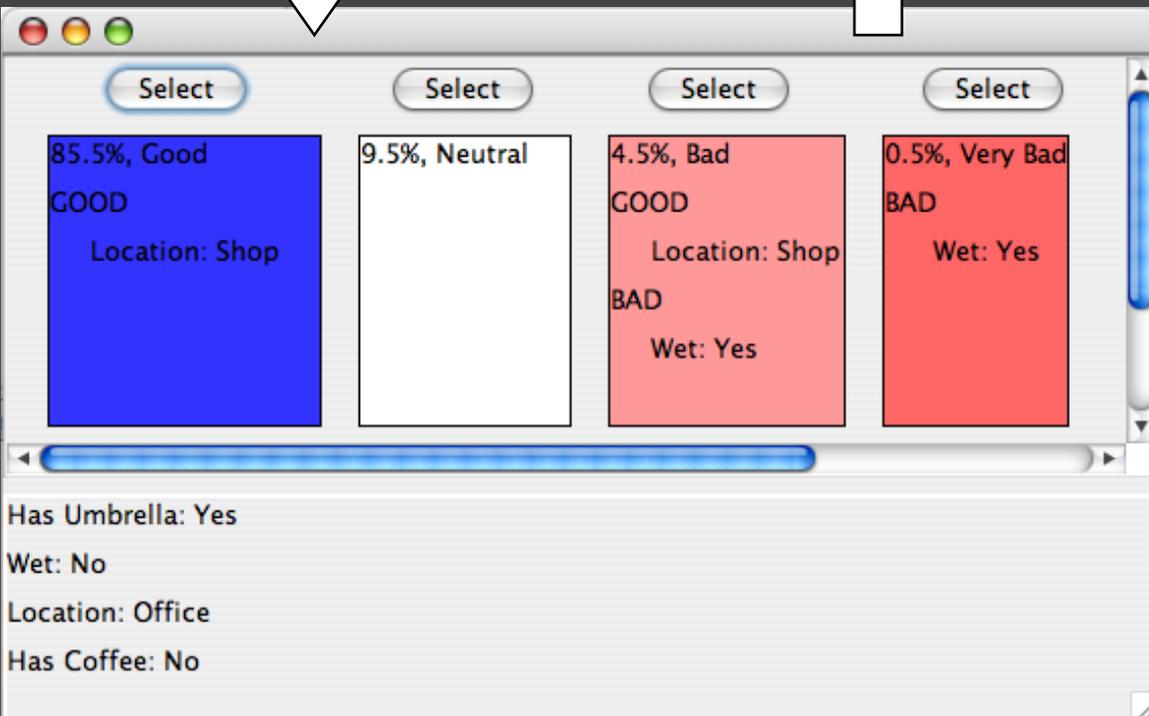
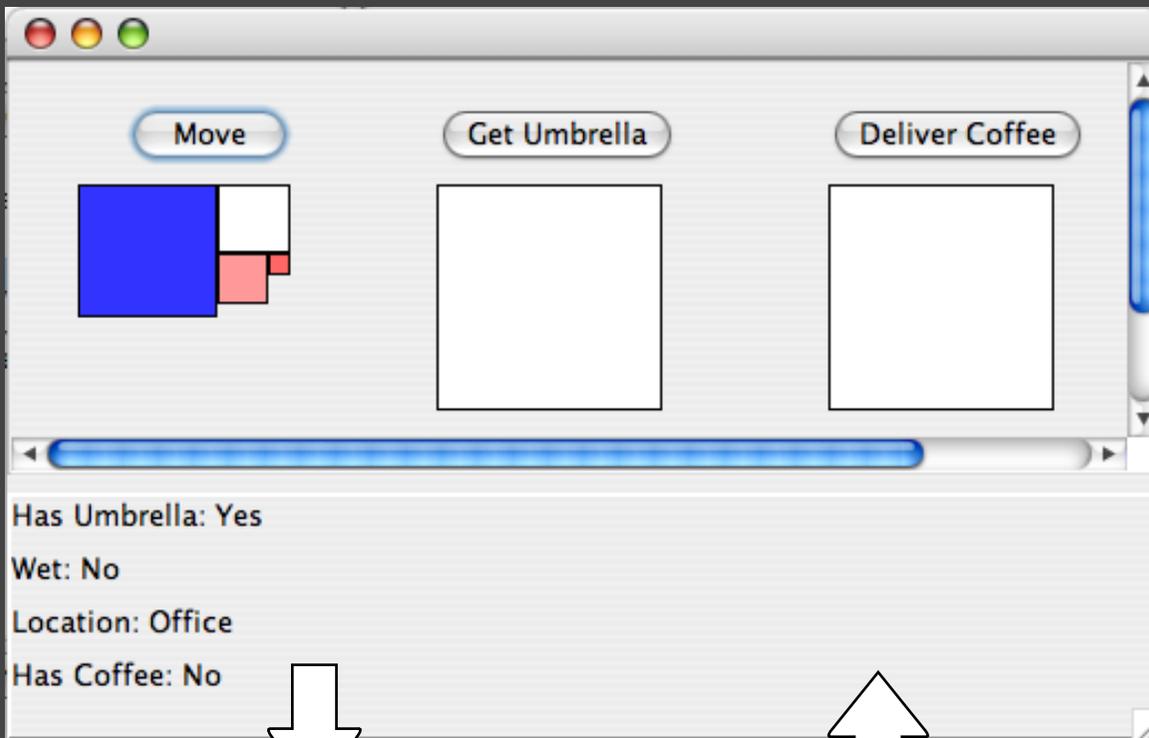
# Results - Goals for the New System

- Have all information accessible, but hide less useful information until the user asks for it
- Goals to determine which end results are acceptable
- Preferences to determine which goal results are better
- Possible evaluation of multiple actions sequentially and/or simultaneously (to be determined next quarter)

Form - [Preview]

| Past   | Present  | Future   |
|--|--|--|
| <p><b>GPA:</b> 3.2<br/> <b>Quarters Completed:</b> 2</p> <p><b>Milestones:</b><br/> <b>GE A1:</b> Not Complete<br/> <b>GE A2:</b> Complete<br/> <b>GE A3:</b> Not Complete<br/> <b>GE B1:</b> Not Complete<br/> <b>GE B2:</b> Not Complete<br/> <b>GE B3:</b> Complete<br/> <b>GWR:</b> Not Complete<br/> <b>USCP:</b> Complete<br/> <b>Technical Electives:</b> Not Complete<br/> <b>Support Electives:</b> Not Complete<br/> <b>Major Coursework:</b> Not Complete</p> | <div style="border: 1px solid gray; padding: 5px; margin-bottom: 5px;"> <input checked="" type="checkbox"/> CPE-101<br/> <input type="checkbox"/> CPE-102<br/> <input type="checkbox"/> CPE-103<br/> <input checked="" type="checkbox"/> GE A1<br/> <input type="checkbox"/> GE A2<br/> <input type="checkbox"/> GE A3         </div> <div style="border: 1px solid gray; padding: 5px;"> <div style="display: flex; border-bottom: 1px solid gray; margin-bottom: 5px;"> <span style="border: 1px solid gray; padding: 2px 5px; margin-right: 5px;">CPE-101</span> <span style="border: 1px solid gray; padding: 2px 5px; margin-right: 5px;">GE A1</span> </div> <div style="background-color: #f0f0f0; height: 150px; width: 100%;"></div> </div> | <p><b>Quarters Remaining:</b> 10<br/> <b>Expected Degree:</b> Computer Science, B.S.<br/> <b>Flexibility:</b> Moderate<br/> <b>Average Units/Quarter:</b> 15.3</p> |
| <div style="border: 1px solid gray; padding: 5px; width: 100%; height: 100%;"></div>   | <div style="border: 1px solid gray; padding: 5px; width: 100%; height: 100%;"></div>   | <div style="border: 1px solid gray; padding: 5px; width: 100%; height: 100%;"></div>   |
| <div style="border: 1px solid gray; padding: 5px; width: 100%; height: 100%;"></div>   | <div style="border: 1px solid gray; padding: 5px; width: 100%; height: 100%;"></div>   | <div style="border: 1px solid gray; padding: 5px; width: 100%; height: 100%;"></div>   |

# Brian's User Interface Concept



# Evan's User Interface Concept

# The Future

- This project will continue into next quarter.
- The focus of Spring Quarter work will be initial implementation of prototype designs produced this quarter.
- These implementations will be tested and experimented with. The results of these tests will help the research team refine the interface and improve the overall quality of the software.
- We hope to be able to publish our results in an AI journal.

# Questions and Answers