Honors Research Presentation
Visualized Decision Making and Planning

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The Team

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Motivation

- How can we use computers to help humans make complex decisions?

- Components of computer aided decision making:
  1. algorithms (this has been done)
  2. visualizing/presenting to the user (this is where we come in)
Example of Planning - Student Advising

- Students **decide** each quarter what classes to take
- Students receive grades each quarter as **outcomes** of classes
Survey Time!

Students only. (Sorry Professors.)
Example of Planning - Student Advising

- Current advice is usually of the form "Take this, this, this, this, and that" such as on flow charts.

- Could we give better advice by considering which classes a student has taken and what grade they received in each?
Example of Planning - Student Advising

<table>
<thead>
<tr>
<th></th>
<th>Calculus I</th>
<th>Intro to Computer Science</th>
<th>Computer Networks</th>
<th>Intro to Databases</th>
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</thead>
<tbody>
<tr>
<td>Brian</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Jen</td>
<td>B+</td>
<td>A-</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>Shannon</td>
<td>C</td>
<td>C-</td>
<td>F</td>
<td>D+</td>
</tr>
<tr>
<td>Alex</td>
<td>B</td>
<td>A</td>
<td>B-</td>
<td>C</td>
</tr>
</tbody>
</table>
Developing Advice

How do humans decide what advice to give? We use:

- **desirability of outcome** - how desirable (or undesirable) is it to be in a given situation; based on user preferences and goals

- **likelihood of outcome** - the likelihood that taking a given action will lead to a given outcome

In our system:

\[
\text{likelihood} = \text{probability} \quad \text{desirability} = \text{utility}
\]
Definitions - Plans and Policies

- **plan** - a linear sequence of actions to take
- **policy** - a description of the actions you should take in each possible situation
An Example Policy

Take Artificial Intelligence. If you do well, take data mining, otherwise, take the SE sequence.
Example of Planning - Student Advising

How many possibilities do we need to account for?

**Conservative Estimate**

4 classes/quarter * 3 quarters/year * 4 years = 48 classes

Possibilities Class Outcomes (13 of them):
Not Taken, A, A-, B+, B, B-, C+, C, C-, D+, D, D-, F

So, $13^{48}$ is a **lower bound** for the number of possible situations!

Humans can't handle that many possibilities, but **computers can**!
The Million Dollar Question

How do we visually and interactively present information about plans and policies to users?
Project Workflow/Status

- Develop Goals/Cognitive Model
- Critique Old System
- Brainstorm for new System
- Design Backend API
- Implement Backend API
- Test and Fix Backend API
- Design New Interfaces
- Implement New Interfaces
- Test and Fix Interfaces
- Perform Experiments
- Analyze Results

We are Here
Cognitive Model

How do humans think about planning?

- **State** - What is my situation?
- **Actions** - What can I do from here?
  - What **should** I do from here?
- **Results** - How will my situation change if I take a certain action?
  - likelihood
  - desirability
Old Interface

Current State
- Not wet recently
- I am having a good time
- I am a teenager
- I am not thirsty
- I am tired
- Slightly thrilled recently
- I am not hungry
- No shows recently

Possible Result States
- 25.2%
- 2.8%
- 37.8%
- 10.8%
- 4.2%
- 1.2%
- 16.2%
- 1.8%

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

Suggested Action
- Rest for a while

Alternate Actions
- Ride a water-drop ride
New "Traditional" Interface
New "Explosion" Interface
New "Time Machine" Interface
Evaluating our Work

We want to know, objectively and subjectively:

- what is (not) useful
- what does (not) match user's cognitive model
- what is (not) improved in the newer interfaces from the original interface
More Information

Visit our project wiki at
http://wiki.csc.calpoly.edu/planit
Questions?