

## ESE 608 – Spring’07

“Knowledge Based Systems and Engineering Design” will focus on

# INTELLIGENT AND ANIMATED

## SOFTWARE AGENTS:

### A NEW TOOL FOR SYSTEMS SCIENCE

**CLASSROOM: Towne 305, Moore 100C**

**Prof. Barry G. Silverman**

**251 Towne Bldg, Tues. 4:30-7:30 PM**

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This course will begin with an introduction to virtual reality personas and web-based agents, including their usage to assist, train, and entertain people wherever digital interfaces exist (on the web, in e-commerce, in games, in kitchen appliances, on your dashboard, etc.). What makes an agent rational? emotionally appealing? entertaining? We will explore mathematical theories of rationality and behavior, including those from cognitive, behavioral, and decision science. We will then progress into human behavior literature, personality and individual differences studies, and intelligent and emotive agent designs. We will examine various types of agents such as web shopping agents, emotive agents, personal support agents, chatterbots, mobile agents, virtual reality personas, game-based adversaries, pedagogical agent coaches, and multi-agent societies. Finally, students will learn principles about animation, simulated social interaction, speech generation, knowledge representation, agent planning and reasoning, agent communication languages, testing of the use of agent-based systems, and methodologies/toolbenches for engineering of systems of intelligent and emotive agents.

Date	Topic	Assignment
<b>Part I</b>		
1/9	<u>1) Course overview</u> <ul style="list-style-type: none"><li>• Overview this semester, Agents Defined</li><li>• Overview of Hierarchies of Reservoirs, The Sims</li><li>• PMFserv Integrated Development Environment</li><li>• Lab 2 (Emotion/GSP) &amp; Lab 3 (Affords) – 2.5 Hrs</li></ul>	
1/16	<u>2) Performance. Moderator Functions: Mind-Body Duality</u> <ul style="list-style-type: none"><li>• Basic PMF Theory: Inverted U Shape</li><li>• Reservoirs/Stomach/Injury (calorie counting)</li><li>• Janis &amp; Mann’s Conflict Theory (Coping Styles)</li><li>• Impact of Stress on Perception &amp; Decision Making</li><li>• HANDS ON LAB #1 (home assignment)</li></ul>	Lab 1 Select PMF abstracts Gillis & Hursh Janis & Mann Project Abstract
1/23	<u>3) Archetype Creation: Knowledge Engineering</u> <ul style="list-style-type: none"><li>• Cognitive Appraisal theory &amp; OCC Model</li><li>• Modeling Culture via GSP Trees: Leader-Follower</li><li>• Discuss Archetype Engineering/Culture Modeling</li></ul>	Lab 1 Exercise Due <a href="#">Presence Pt. 1</a> OCC Abstract Damasio Abstr.

	<ul style="list-style-type: none"> <li>• Lab 2/3 Exercise</li> </ul>	
1/30	<u>4) Emotion &amp; Culture Modeling – Part II</u> <ul style="list-style-type: none"> <li>• Guidelines for Agent Social Interaction</li> <li>• Leader-Follower Relations, Valence/Trust/Agency</li> <li>• Custom Rules/Perceptual Types</li> <li>• Python Scripting Lab #4</li> <li>• HANDS ON LAB (home assignment: author P-types on resource tanks and custom rules)</li> </ul>	Lab 2/3 Exer's Due <a href="#">Presence Pt.2</a> Crusades Abstract: Eidelson(followers) Hermann(leaders)
2/06	<u>5) Decision Layer of Agent Cognition</u> <ul style="list-style-type: none"> <li>• Axioms of Rationality vs. Bounded Rationality</li> <li>• Reactive Model – Subjective Utility (1-step ahead)</li> <li>• Deliberative Planning – Transition Nets</li> <li>• Other Models of Decision Layer (Prospect, RPD, etc.)</li> <li>• Knowledge Engineering Lab #5 (2 hours)</li> <li>• SPECIALIST MEETINGS</li> </ul>	Python Lab4 Due Abstracts: Petri-Nets Prospect Theory RPD-CBR Camerer, BGT
<b>Part II</b>		
2/13	<u>6) Knowledge Representations &amp; Standards Part II</u> <ul style="list-style-type: none"> <li>• State space, Problem Reduction, OO, Semantic Nets</li> <li>• Logic and Rules</li> <li>• Payoff Tables &amp; Utility, Decision Trees &amp; Influence</li> <li>• Demos of InsurgiSim, CrowdSim</li> <li>• Ontologic Engineering/XML/RDF/DAML-OIL</li> <li>• MIDTERM #1 - Assigned</li> </ul>	KE exercises Due Project Plan Due FactionSim#1
2/20	7) MIDTERM – no class	Midterm
2/27	<u>8) Game Agents, Aesthetics, and Companion Agents</u> <ul style="list-style-type: none"> <li>• Design of Games and Game AI</li> <li>• Mechanics for Gameplay</li> <li>• Evaluation of Agents in Games &amp; Measurement Issues</li> <li>• Lab 6 (in-class game design and repair)</li> </ul>	Midterm Due FactionSim #2 <a href="#">Gamasutra</a>
3/6	BREAK WEEK	
3/13 & 3/20	<u>9 &amp; 10) RPGs and World Diplomacy Game</u> <ul style="list-style-type: none"> <li>• World Diplomacy Game – Athena's Prism</li> <li>• AI for World Leaders             <ul style="list-style-type: none"> <li>• Deliberative/Multi-Step Plans</li> <li>• Contracts/Speech Act Theory (ACL, KQML)</li> <li>• Model of Mind/Gaming of Others</li> </ul> </li> <li>• Design of Experiments &amp; Monte Carlo Simulation</li> <li>• Hands On Lab with FactionSim and BigWig©</li> </ul>	<a href="#">Athena Game</a> <a href="#">Athena AI</a>
3/27 & 4/03	<u>11 &amp; 12) Cellular Automata, Agent Swarms, &amp; Artificial Life</u> <ul style="list-style-type: none"> <li>• Theory of Evolution and Punctuated Equilibria</li> <li>• Artificial Life and Game of Life (<a href="#">NetLogo</a>)</li> </ul>	Lab 7 assigned week 11, due week 12

	<ul style="list-style-type: none"> <li>Cellular Automata and Game Theory</li> <li>ACASA-CA – Terrorism Event Spin</li> <li>Consumer Buyer Behavior and Marketing Exposures</li> </ul>	
4/10	<u>13) Heart Sense Game and the AESOP Generator (R. Weaver)</u> <ul style="list-style-type: none"> <li>Digital Casts &amp; Role Playing Games</li> <li>Narratology as a Game Mechanic</li> <li>Edutainment &amp; Heart Sense Game – Demo</li> <li>AESOP Status Review</li> <li>Hands On Lab with AESOP/HSG</li> </ul>	<a href="#">AESOP</a> <a href="#">ICVS</a>
4/17	14) QUIZ	Evaluation topic
4/24	15) Reading Period	
5/1	16) Project Presentations	Paper/PPT/Code

### **Readings**

Presence 1- Silverman, BG, Johns, M, Cornwell, J, O'Brien, K, "Human Behavior Models for Agents in Simulators and Games: Part I – Enabling Science with PMFserv," April 2006, 15:2, 139-162.

Presence 2- Silverman, BG, Johns, M, Cornwell, J, O'Brien, K, "Human Behavior Models for Agents in Simulators and Games: Part II – Gamebots for a Foreign Culture," PRESENCE , April, 2006, 15:2,163-185.

FactionSim#1 - Silverman, BG, Bharathy, GK, Nye, B, Eidelson,R, "Modeling Factions for 'Effects Based Operations': Part I – Leader and Follower Behaviors", Tech Report avail from the authors (subm for publ. 2006).

FactionSim#2 - Silverman, BG, Bharathy, GK, Nye, B, Smith, T, "Modeling Factions for 'Effects Based Operations': Part II – Behavioral Game Theory", Tech Report avail from the authors (submitted for publ. 2006).

**Silverman'03** – Tech Report on PMFserv, January 2003. Download from [http://www.seas.upenn.edu/~barryg/PMFserv\\_2003\\_revisions.doc](http://www.seas.upenn.edu/~barryg/PMFserv_2003_revisions.doc)

**Silverman'01** – Sect. 3.2 of Tech Report from Summer'01. Download from <http://www.seas.upenn.edu/~barryg/TechRpt.pdf>

PMF '**Abstracts**' are usually in the various Course Documents Folders. If any are missing, they are to be downloaded from the following file (open it and find the relevant abstract such as for physiological factors, Janis & Mann, OCC, Damasio, etc.) : <http://www.seas.upenn.edu/~barryg/PMFset.zip>

### **Other Readings in Course Document Folders:**

Gillis & Hursh from CGF Conf. Proceedings

Elliott's Affective Reasoner

Bradshaw et al., Agents for the Masses, IEEE Expert Mag

Camerer, BGT – Unifying Econ and Psych

### **Scenario Project Description**

Students in the course, working in teams of about 2 or 3 each, will construct an intelligent animated agent (PMFserv and FactionSim environment to be provided by instructor). Each team should grapple with: scenario conceptualization, PMF parameter levels/stressors for the scenario, modeling the cultural values and emotive behavior of scenario participants, semantic markup of world (affordances), and what-if analysis of the results. Thus there will be a given baseline scenario in the simulator for the PMFserv microworld. Together a team should construct one type of agent that will formulate beliefs about objects, situations, and other agents' intentions, derive action plans, and interact intelligently with (against) the agents of other teams. Each agent will have a visible persona and inspectable reasoning processes.

### **Illustrative What-If Problems (Past Scenario Projects)**

- Skill level differences of agents (green, seasoned, burnt out)
- Impact of chanting on crowd behavior
- Impact of non-lethal weapons on agent PMFs
- Individual differences in terms of stress tolerance
- Cultural impacts upon behavior and personality
- Soccer Hooligans and Crowd Scenes
- Factional Fighting and Insurgency in Iraq

**PLAN:** Up to 5 pages (max) bounding the scenario what if questions, PMF factors to include, cultural value sets and emotive states to cull from the literature, affordance programming effort, and other tasks to complete the scenario study. Also, the plan should include schedule, assigned tasks, and risks that need to be overcome.

**FINAL PAPER/PRESENTATION:** up to 25-page typed report (single space, 12 point, 1" margins), Powerpoint, & demo. The result should describe the agent type created and tie it into the literature reviewed.

### **Grading**

Midterm	20%
Quiz	15%
Class Participation	10%
Homework/Labs	25%
Scenario Project (plan, final paper, code, presentation)	30%

### **NOTE:**

All homeworks (labs, cases, and plan) must be on time -- 10% per day loss in grade for each day late, no credit if 1 week late. Midterms and Scenario Project lose 1% of grade per day late.