Artificial Intelligence Models for hSITE
Theme 1

University of Waterloo
David R. Cheriton School of Computer Science
Supervisor: Prof. Robin Cohen

Students: Hyunggu Jung (Masters), John Champaign (PhD), Joshua Gorner (Masters)

Current Projects related to hSITE

- Hyunggu Jung
  - Masters student
  - modeling bother cost
  - reasoning about interaction
  - AI areas of user modeling, decision theoretic reasoning, intelligent interaction

Current Projects (continued)

- John Champaign
  - PhD student
  - intelligent tutoring systems
  - content derived from corpus of texts
  - peer-based assistance (social networks)

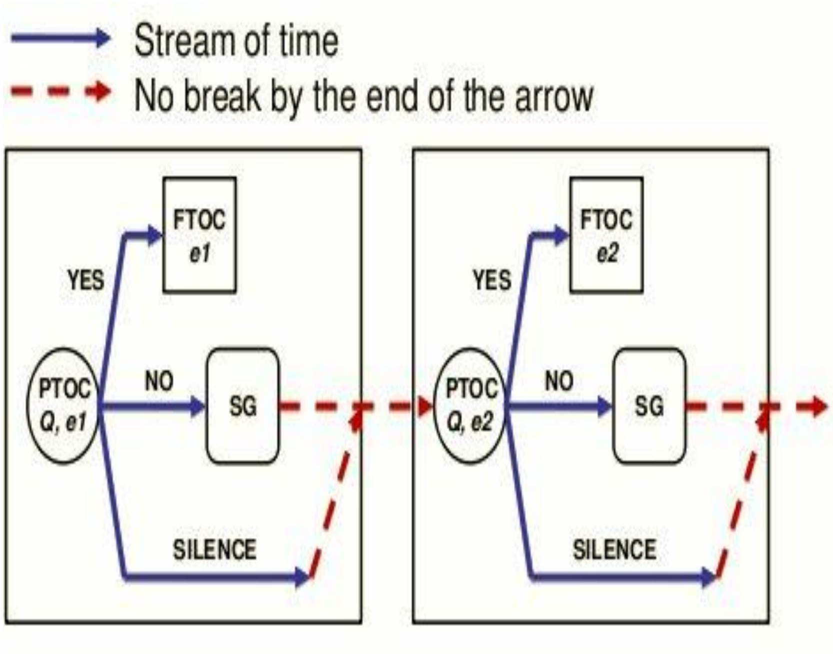
Current Projects (continued)

- Joshua Gorner
  - Masters student
  - modeling trust in multiagent systems
  - social networks of advisors: ideal size

Summary

- Jung: right person, right time; emergency room settings (critical care)
- Champaign: right information, right people; homecare settings
- Gorner: right people; homecare, decision making

Hybrid Transfer-of-Control (HTOC) Model



Visual Representation of strategy with the FTOCs and PTOCs; each world occupies one square

- Focus on one question:
  "Can you take over decision making?"
- Reasoning about
  Partial transfers of control (PTOCs)
  - Questions

  Full transfers of control (FTOCs)
  - Decision making

Decision Making

$$EU\ (s) = \Sigma_{LNl}[P(LN_l) \times (EQ(LN_l) - W(T_{LNl}) - BC_{LNl})]$$

- Focus on current patient which expert to ask
- Generate possible strategies
  - Find optimal strategy: best quality, least bother
  - Strategy regeneration: update parameter values

User Modeling

User_Unwillingness_Factor

= Attention_State_Factor + Lack_of_Expertise_Factor

Init = User_Unwillingness_Factor

x Attention_State_Factor x TOC_Base_Bother_Cost

BST (BotherSoFar)

$=\Sigma_{toc \in PastTOC} \text{TOC\_Base\_Bother\_Cost}(toc) \times \beta^{t(toc)}$

BotherCost(BC)

= Init + BC_Inc_Fn(BSF, User_Unwillingness_Factor)

Task Criticality (TC)

Task Criticality	High			Med			Low		
Lack_of_Expertise_Factor	Low	Med	High	Low	Med	High	Low	Med	High
Weight	10%	0%	-10%	5%	5%	-5%	0%	0%	0%

- Task criticality of the patient
- Enable the expected quality of a decision to be weighted more heavily in the overall calculation of expected utility when the case at hand is very critical

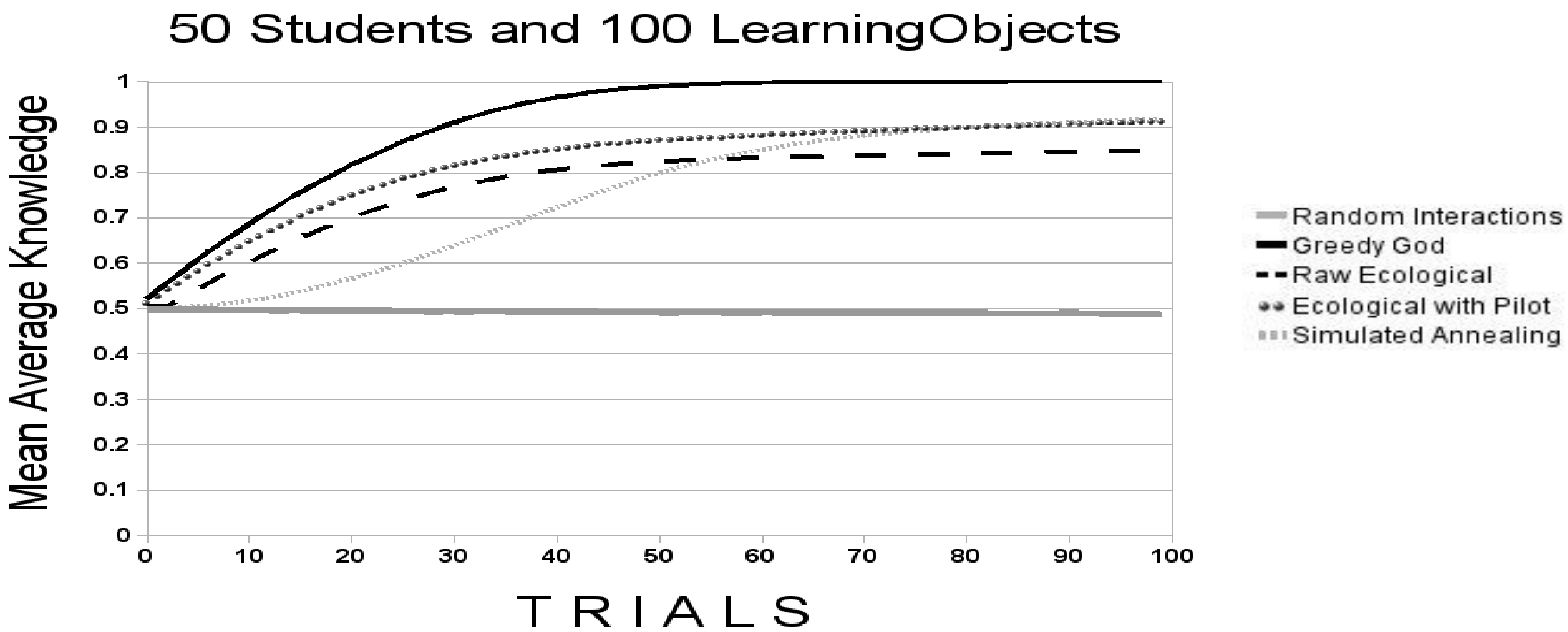
$$EU_{ei}^{d} \rightarrow EQ_{ei}^{d} + (Weight \times EQ_{ei}^{d})$$

Peer-Based Intelligent Tutoring Systems: A Corpus-Oriented Approach

- Designing effective intelligent tutoring systems
  - •Offload the time for development
  - •Peer-based approach
  - •Repository of learning objects
  - •Subproblems: curriculum sequencing, annotations, corpus development
  - •Validation through simulated students

Curriculum Sequencing

- Given a set of learning objects and a group of students, over multiple iterations, which object should be assigned to each student?
- Collaborative filtering inspired approach, where learning objects that were useful to a similar student in the past are assigned to each student



Curriculum Sequencing

$$p[a, l] = \kappa \sum_{j=1}^{n} w(a, j) v(j, l)$$

- p[a,l]: anticipated benefit to active user, *a*, from interacting with a given learning object *l*
- ∑ *: consider interactions of all previous students with the learning object l*
- *w(a,j) : how similar the student j was to the active user (A-, B+) vs (B+, D-)*
- *v(a,j) : value of the interaction to student j*
- *K : a normalizing factor*

Optimizing Advisor Network Size in a Personalized Trust-Modelling Framework

- We explore how to determine the optimal size of networks in trust modelling
- [Zhang 2009] proposed a personalized trust-modelling framework for e-commerce – how many advisors should a user have in this framework?
- We identify two methods (***max nbors*** and thresholding) that can be used to reduce network size; either may optionally be combined with advisor referrals for improved accuracy

Advisor Referrals

- If our advisor network has size *n*, we will attempt to find *n* advisors (not necessarily the same advisors!) that are qualified to report on a particular seller *s*
  - An advisor a_j is deemed to be *qualified* if the number of ratings $N_{all}^{a_j}$ for *s* is at least some minimum number N_{min}
- Regardless, weighting of advisors will always be based on the agent *b*'s own measure of trustworthiness in each selected advisor
- Should allow us to make use of the experience throughout the system while maintaining a relatively small social network for each agent

Next Steps

- Feedback from Research Community
  - Jung: UMUAI special issue on User Modeling and Healthcare
  - Champaign: ITS, EDM conferences
  - Gorner: AAMAS trust modeling workshop, Canadian AI conference

- Connections to Team 1 researchers

- Connections to Theme 2 and Theme 3
  - Jung: sensing to model patient and medical experts
  - Jung: networking delimiting set of experts
  - Champaign, Gorner: networking delimiting network of peers