

SCHEDULE & ABSTRACTS

Thursday, October 2, 2008

- 8:00 - 9:00** Check-in & breakfast
- 8:45 - 9:00** "This is the CCT" (VR Theatre)
- 9:00 - 9:30** Workshop overview & objectives
H. Chad Lane, USC ICT
- 9:30 - 10:15** Long-term human-computer relationships
Tim Bickmore, Northeastern University
- 10:15 - 10:30** break
- 10:30 - 11:15** Lifelong Learning Companions: Intelligent Computational Agents for Intelligent Human Lifelong Learners
Gerhard Fischer, University of Colorado
- 11:15 - 12:00** Lifelong learner modelling: scrutability, control, reflection, augmented cognition
Judy Kay, University of Sydney
- 12:00 - 12:45** lunch (at ICT)
- 12:45 - 2:00** Socially Aware Pedagogical Agents: Steps to Building a Life-Long Learning Companion
Gord McCalla & Jim Greer, University of Saskatchewan
- 2:00 - 2:15** break
- 2:15 - 3:00** Teaching, Learning, Doing and Conversing: How They Fit Together
Charles Rich, Worcester Polytechnic Institute
- 3:00 - 3:30** Lifelong Learning Companions: Pedagogical Requirements
Millie Abell, U.S. Army Headquarters Training and Doctrine Command (TRADOC)
- 3:30 - 3:45** break

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- 3:45 - 6:00** breakout groups
- » *Human Learning & Requirements (6th floor small conference room)*
 - » *Assessment & Learning Modeling (6th floor large conference room)*
 - » *Implementation, Interoperability, & Scaling (1st floor board room)*
 - » *Communication & Relationship Building (4th floor conference room)*
 - » *Guidance, Experience, & Assistance (3rd floor large conference room)*
- 6:00 - 6:30** shuttle to dinner – meet in the first floor foyer at 6pm
- 6:30 - 8:30** dinner at The Organic Panificio
4211 Admiralty Way, Marina del Rey, CA

Friday, October 3, 2008

- 8:00 - 9:00** breakfast
- 9:00 - 9:45** Long-Term Game-Based Learning for Communicative Proficiency
W. Lewis Johnson, Alelo, Inc.
- 9:45 - 10:30** Creating Rapport with Virtual Agents
Jon Gratch, USC ICT
- 10:30 - 10:45** break
- 10:45 - 11:30** Low-fidelity simulations for assessment
Joseph Psotka, U.S. Army Research Institute for the Behavioral and Social Sciences
- 11:30 - 12:00** Is the Primer feasible? A discussion of Neal Stephenson's *The Diamond Age*
H. Chad Lane, USC ICT
- 12:00 - 12:45** lunch
- 12:45 - 1:30** Bootstrapped Learning Creating an Electronic Student that learns from Natural Instruction: a report from the project
Candy Sidner, BAE Systems Advanced Information Technologies
- 1:30 - 2:15** Implications of the interaction plateau for lifelong learning companions
Kurt VanLehn, Arizona State University
- 2:15 - 2:30** break
- 2:30 - 5:30** Group reports, discussion, & wrap-up
 » *Human Learning & Requirements (group leader: Jim Belanich, ARI)*
 » *Assessment & Learning Modeling (group leader: Paula Durlach, ARI)*
 » *Implementation, Interoperability, & Scaling (group leader: Eric Roberts, ADL)*
 » *Communication & Relationship Building (group leader: TBD)*
 » *Guidance, Experience, & Assistance (group leader: Andrew Gordon, ICT)*
- 5:30 - 7:00** no-host social at Shanghai Red's (the bar area is to the right after you enter)
- 7:00 - 9:00** dinner at Shanghai Red's
 13813 Fiji Way, Marina del Rey, CA

ABSTRACTS

Thursday, October 2, 2008

9:30 - 10:15

Long-term human-computer relationships

Tim Bickmore, Northeastern University

Several studies have confirmed what most of us intuitively know: that quality of personal relationships in the learning environment has a significant impact on student motivation, academic effort, and, ultimately, learning. Thus, to be effective, pedagogical agents need to be designed with the social and relational skills to build and maintain social bonds with students, especially if the collaboration will occur over long periods of time. In this talk I'll give an overview of recent work in building embodied conversational agents that are designed with these skills for education and counseling applications, mostly in the healthcare domain, along with future plans and implications for building lifelong learning companions.

10:30 - 11:15

Lifelong Learning Companions: Intelligent Computational Agents for Intelligent Human Lifelong Learners

Gerhard Fischer, University of Colorado

The rationale and desirability to have lifelong learning companions is grounded in the limitations of the unaided individual human mind. Inspired by and based on an analysis of *human* lifelong learning companions, this presentation will identify capabilities of computational agents serving as lifelong learning companions including teaching, critiquing, reminding, prompting, finding relevant information, contextualizing information, and doing parts of activities. The presentation will provide a rationale why and how both humans and computational agents need to learn. Requirements will be derived and articulated contributing to a framework for building *computational* lifelong learning companions. The framework will be illustrated by a variety of *prototype systems* that we have developed and assessed in our research. Their feasibility and usefulness as building blocks for building lifelong learning companions will be discussed.

Thursday, October 2, 2008

11:15 - 12:00

Lifelong learner modelling: scrutability, control, reflection, augmented cognition

Judy Kay, University of Sydney

This talk presents a vision for a lifelong learner model, as a first class software citizen, with independent value, as well as its core role for the personalised teaching characterised in the Primer of Stephenson's Diamond Age. The lifelong learner model will be created from the huge amount of information that is available about each of us, from our digital foot prints. Currently, much of this information is trapped in diverse silos of databases on various machines as well as within many applications. All of these sources of information about the learner should be seen as their property and the evidence that can inform their learner model. As an independent entity, that lifelong learner model has the potential to provide learners with more control and responsibility for their own learning, supporting reflection and building metacognition skills, especially as a basis for planning and monitoring learning.

This talk will discuss the key technical challenges my group has been tackling in building such lifelong learner models. These are at three main levels: representation, systems and human-computer interaction. At the foundation is a representation for the learner model, whose core design goals include: flexibility of interpretation, depending on the context; power to model both the on-going acquisition of knowledge, and forgetting; effective modelling of other learner attributes relevant to learning; modelling that links to all the digital artifacts the learner has encountered; ability to link with learner choices, for example to delegate remembering as a form of augmented cognition; all, designed with care to ensure that the learner can scrutinise and control the model. One dimension of the learner modelling representation must deal with ontological issues and the tensions between standards, flexibility and pragmatics so that the lifelong learner model can integrate gracefully with the range of learning contexts, such as classroom learning group learning activities, private study and just-in-time learning. At a very different level, we have been tackling the systems issues of scalability and robustness for large and growing models as well as distribution of partial learner models across devices and within a pervasive computing environment, with issues of reliability, reasonable behaviour under disconnected operation and attention to issues of privacy, security and user control over these. Another key is our exploration of user interfaces that are essential to support scrutiny, control as well management of privacy and its flip-side, sharing. These are central to supporting communication and co-ordination with co-learners, mentors, tutors, advisors, be they humans, machines or combinations of these.

Thursday, October 2, 2008

12:45 - 2:00

Socially Aware Pedagogical Agents: Steps to Building a Life-Long Learning Companion

Gord McCalla & Jim Greer, University of Saskatchewan

Creating an adaptive system with the capabilities of the Primer that supported Nell in Stephenson's Diamond Age novel is an AI-complete problem. The full realization of the Primer is thus something that can only happen after AI is solved -- not an immediate likelihood. However, it is our contention that a "socially aware" agent that takes into account the many people involved in teaching and learning can be useful today. Moreover, it should also be possible to incrementally improve the usefulness of such an agent such that, over a long time, it could even asymptotically approach the effectiveness of the Primer. The key is that the agent doesn't have to do everything itself, but can take advantage of the social environment in which it is embedded to support it while at the same time supporting the people in that social environment.

Our initial research into socially aware agents began over a decade ago in the iHelp system, where simple personal agents could find "ready, willing, and able" helpers (other learners or teachers) to help learners to resolve impasses. Minimally informed user models sufficed to allow at least rudimentary matching of skills to needs, and even if this matching wasn't perfect, at least a learner got some sort of feedback when he or she needed help. Moreover, during the help session both helper and helpee could enhance their understanding of the domain, as well as improve their teaching and learning skills. This simple idea has led us and our students and colleagues in the ARIES lab into a wide range of further research: supporting the help session itself (i.e. supporting human-human interaction); "active" learner modeling that accesses heterogeneous knowledge sources about learners as needed to achieve particular pedagogical goals; alternative agent negotiation paradigms that allow one agent to bargain with another agent over a wide range of issues; educational data mining to track fine-grained learner behavior and make sense of learner affective, social, and domain competencies ("the ecological approach"); e-portfolios to inform learner models; Bayes-networks to capture interdependencies in the learner models; preservation of privacy in systems with lots of information being kept about learners and teachers; ways of motivating learners to participate in the social community; methodologies to support recommendation of learning material to learners; open modeling to support reflection; and more. While by no means an integrated set of projects, this research pushes forward our understanding of how to support learners as they learn, both from content sources but also from other humans.

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12:45 - 2:00 McCalla & Greer (continued)

A theme in our research has been that human facilitators, be they teachers, domain-aware mentors, peer learners, community of practitioners, or general motivators will be part of the learning environment surrounding Nell. The Primer need not stand alone, but rather could be envisaged as a bridge that connects and supports the transitions from one human learning facilitator to the next. In this view, the Primer would need to be enabled to support the

learning facilitators as they move in and out of Nell's learning environment. So rather than being mentor, teacher, and friend, the Primer takes on the role of coordinator, information repository, keeper of profiles and models, learning support resource, and perhaps, part-time teacher. This is not a mere convenience to diminish the need for sophisticated AI in the Primer, but reflects the more plausible future where the learner is enveloped in an environment rich with knowledgeable colleagues. More important, and needing more AI, the Primer likely ought to take on the role of guardian or quality assurance agent, to ensure Nell is being well served by the humans in her life.

In our workshop talk we will try to flesh out the issues we believe to be vital in building socially aware agents and discuss the short term and longer term possibilities for making them effective life-long learning companions. We will draw insights from our various research projects as well as the research of others in various areas of e-learning, artificial intelligence, and user modeling. We will conclude with speculation as to how close we might be to achieving goals similar to those achieved by the Primer for learners like Nell, even if these goals are achieved by using technology mainly to support people helping other people to learn, rather than replacing these people with an AI system.

2:15 - 3:00

Teaching, Learning, Doing and Conversing: How They Fit Together

Charles Rich, Worcester Polytechnic Institute

A lifelong learning companion will require many different but highly interrelated capabilities. It will need to interact with both people and the (real and virtual) world, and be able to use these interactions to both teach and learn. One of the challenges in building such a system is therefore to develop an architecture in which different approaches and technologies in each of these areas can easily be substituted and experimented with. I believe that this kind of modularity comes from firm theoretical foundations in collaboration, discourse and knowledge representation, and will use the example of our experiences building intelligent systems using Collagen to discuss these issues in more depth.

Thursday, October 2, 2008

3:00 - 3:30

Lifelong Learning Companions: Pedagogical Requirements

Millie Abell, U.S. Army Headquarters Training and Doctrine Command (TRADOC)

The military must produce leaders capable of operating within today's rapidly changing environment, often with less time for schoolhouse instruction. For this reason, the Army is investigating strategies for efficiently educating Soldiers and leaders. This presentation discusses Merrill's "First Principles of Instruction" as a framework for designing and delivering instruction. This framework is founded on Cognitive Load Theory, which Clark, Nguyen, and Sweller (2006) consider relevant to all content, all instructional media, and all learners. The goal of Cognitive Load Theory is to acquire knowledge and skills more efficiently by not overloading the learner's working memory. To the extent that the learning companion delivers or facilitates instruction, the virtual learning companion's architects should take the First Principles of Instruction into account. Secondly, this presentation identifies and discusses mental strategies for helping learners think more deeply. To the extent that the learning companion can help instruct and provide guidance in these strategies, students will become more powerful problem solvers within the schoolhouse and within their work environments.

Friday, October 3, 2008

9:00 - 9:45

Long-Term Game-Based Learning for Communicative Proficiency

W. Lewis Johnson, Alelo, Inc.

Alelo is developing a variety of game-based learning products to develop language and cultural skills. These have been used by tens of thousands military personnel deploying overseas, and are increasingly being used by adult learners in other countries and by students at the college and high school level. In the process we make observations and collect data on how learners interact with our systems, and explore ways to optimize learning over periods of minutes, days, weeks, months, and even years.

This talk will touch on a few topics in our current research that are relevant to this workshop:

- How should scaffolding be optimally integrated into game-based learning? The pattern of scaffolding appropriate for game-based learning environments is different from that used in typical problem-based intelligent tutoring systems. Our approach is inspired by the Argyris-Schon two-loop model of learning, in which learning experiences alternate between action and reflection.
- How should scaffolding change to help learners achieve qualitative gains in expertise? Our newest versions of Tactical Iraqi and Tactical French offer both short-term programs of instruction for predeployment training as well as longer term programs aimed at achieving an intermediate level of language proficiency. Not only does scaffolding change over the course of long-term programs of instruction, but the learning performance criteria and scaffolding at the early stages of the courses must adapt to lay the foundation for the qualitative improvements in skill that learners hope to achieve at later stages.
- How should learning environments help learners to maintain skill over time, and recover from skill decay? We are now looking at how to support learners who wish to recover their language skills after periods of disuse. Skill decay and recovery are critical issues for lifelong learning systems in general, and language learning systems in particular. We are developing a model for predicting skill decay, methods for diagnosing the nature and scope of skill decay, and skill recovery training programs adapted to each learner's pattern of skill decay.

Friday, October 3, 2008

9:45 - 10:30

Creating Rapport with Virtual Agents

Jon Gratch, University of Central Florida

Effective face-to-face conversations are highly interactive. Participants respond to each other, engaging in nonconscious behavioral mimicry and backchanneling feedback. Such behaviors produce a subjective sense of rapport and are correlated with effective communication, greater liking and trust, and greater influence between participants. Recent research has established the potential for virtual characters to establish rapport with humans through simple contingent nonverbal behaviors and there is growing empirical evidence that this can make agents more engaging and persuasive, promote fluent speech and reduce user frustration. I will present findings from a series of studies we have performed with the Rapport Agent on the social impact of virtual human nonverbal behavior on human users.

10:45 - 11:30

Low-fidelity simulations for assessment

Joseph Psotka, U.S. Army Research Institute for the Behavioral and Social Sciences

Assessment is a crucial component of effective training, but it is often missing in simulator-based training. Given the free play and open-endedness of simulator paradigms, effective assessment instruments are difficult to design, and often the experience itself is simply assumed to be worthwhile, especially when corroborated by self-report surveys. Yet, the lessons of Intelligent Tutoring Systems (Psotka, Massey, & Mutter, 1987; Legree, Gillis, & Orey, 1993; Orey, Park, Chanlin, Hih, Gillis, Legree, & Sanders, 1991) provide compelling evidence that accurate student modeling and interactive assessment are central to creating effective training. Our recent research suggests that low-fidelity simulations based on written scenarios contained in situational judgment tests (SJTs) can be used to assess performance in complex, ambiguous occupations (such as security occupations) that have poorly described, ill-defined domains of knowledge, attitudes, and skills (Spiro, Feltovich, Jacobson, & Coulson, 1995).

Friday, October 3, 2008

11:30 - 12:00

Is the Primer feasible? A discussion of Neal Stephenson's *The Diamond Age*

H. Chad Lane, USC ICT

Do you think we can build a Primer? The interactions of Nell with her Primer are intriguing: from the age of 4 through adulthood, Nell receives just the right instruction, at just the right times, and in just the right ways. The Primer demonstrates an understanding of her needs, desires, and life. It builds her confidence and gains her trust. It dynamically generates images and maintains a lifelong, interactive narrative that consumes Nell. It also responds to her spontaneous questions (especially in her younger years) and demonstrates neverending patience to handle follow-up questions (an enviable trait many of us parents lack!). In this discussion, I'll highlight what I see as some of the most prominent characteristics of the Primer and invite the workshop to share their own opinions.

12:45 - 1:30

Bootstrapped Learning Creating an Electronic Student that learns from Natural Instruction: a report from the project

Candy Sidner, BAE Systems Advanced Information Technologies

The Bootstrapped Learning Project, a DARPA project headed by Dan Oblinger as Program Manager, is now nearing the end of the first major phase its efforts. I will talk about the overall claims of BL and focus on the efforts of the Curriculum Team for the project, for which team I am principal investigator.

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1:30 - 2:15

Implications of the interaction plateau for lifelong learning companions

Kurt VanLehn, Arizona State University

One-on-one, face-to-face, expert human tutoring is both highly effective and highly interactive. It is often thought that the effectiveness is due to the interactivity. Perhaps this is why Neil Stephenson had his Young Ladies Illustrated Primer communicate with the learner via natural language dialogues. Science fiction is not the only field that accepts the hypothesis that increasing interactivity increases learning. The hypothesis has strongly influenced educational technology, learning theory and important decisions by schools and parents. However, only a few studies have tested it experimentally. A review of those studies found that although highly interactive tutoring was more effective than low-interaction instruction, as expected, it was not more effective than moderately interactive instruction. In particular, a widely available technology, step-based tutoring systems, was often just as effective as expert human tutors. That is, the benefits of tutorial interactivity appear to be non-linear. As interactivity increases, effectiveness plateaus. This interaction plateau is good news. It implies that lifelong learning companions, such as Stephenson's Primer, can be developed without "solving the natural language problem." On the other hand, research on human tutoring and peer collaboration suggests that domain knowledge is crucial for effectiveness. This is bad news. It suggests that we must "solve the knowledge engineering problem."