

## ICT Workshop on Intelligent Lifelong Learning Companions

### Overview of working groups

October 2-3, 2008

Marina del Rey, CA

#### Overview

From 3:45 – 6:00 on Thursday we will split up into small discussion groups to focus on key sub-areas that feed into the lifelong learning companion vision. On Friday from 2:30-5:00, group leaders will present summaries of these discussions and receive questions/comments from the entire group.

#### Goals of the working groups:

The overarching goal of the working groups is leverage attendee expertise to paint the bigger picture: to identify what's out there, who's doing it, and where we think things should be moving. In each area, working groups should *try* to address the following questions:

1. What are the most salient findings and/or results that feed most directly into the ILCC vision?  
What do we know now?
2. What ongoing research are you aware of that holds the greatest potential for promoting lifelong learning? Who is doing it and where is it happening?
3. What are the key unknowns and open questions? What research needs to be initiated to address these gaps? What contributions are feasible and how much time might be needed?

During the breakout meetings, group leaders are asked to create slides representing the group thoughts, conclusions, and disagreements. Groups are encouraged to use examples from The Diamond Age or elsewhere to illustrate their ideas. On Friday, the slides will be used for the reports back to the whole group and made available on the ILCC website (<http://projects.ict.usc.edu/companion>).

#### Locations and Participants

Working group	Location	Participants
Human learning & requirements	6 <sup>th</sup> floor small conf room	Abell, Belanich*, Goldberg, Hill, Raybourn, & VanLehn
Assessment & learner modeling	6 <sup>th</sup> floor large conf room	Durlach*, Greer, Kay, Lane, McCalla & Psotka
Implementation, interoperability, & scaling	1 <sup>st</sup> floor board room	Bauer, Gomboc, Johnson, Roberts*, Rosenberg, Smith, & Sosnovsky
Communication & relationship building	4 <sup>th</sup> floor conf room	Bickmore, Gratch, Marsella, Ogan, Sidner, & Traum
Guidance, experience, & assistance	3 <sup>rd</sup> floor large conf room	Gordon*, Fischer, Hausmann, Niehaus, Rich, Riedl, & Swartout

\* group leader (creates slides during breakout group discussion & leads discussion on Friday)

**Human Learning & requirements:** Any technology that seeks to promote learning should be developed in a way that is consistent with what learning science research tells us about the cognitive, affective, and social processes involved with learning. Research in the learning sciences also suggests what the requirements of a lifelong learning companion should be by identifying the good things that good learners do and the bad things that poor learners do. In the case of supporting learning over extended periods of time, issues such as retention, memory decay, retrieval fluency, motivation, collaboration, and self-directed learning play prominent roles. Ultimately, it is hoped that understanding of these learning processes can be used to determine what learners need, when they need it, and how they need it presented.

**Assessment & learner modeling:** A prerequisite for providing individual learning support is to maintain an estimate of the learner's knowledge, competence, skills, motivation, interests, etc. – i.e., a learner model. Such estimates evolve from assessments of learning, diagnoses of problems, as well as a variety of other kinds of evidence. Learner models are typically used as input for pedagogical decision making, and, in the case of computer-based systems, can be opened for inspection by the learner to support self-assessment and increase motivation. To support learner modeling over extended periods of time (weeks, months, years), *persistence* and *flexibility* (at least) increase in importance. Persistence is key because beliefs about learners need to be maintained indefinitely, and flexibility because of the differences between domains and knowledge being modeled, as well as the variety of ways the model might be used to individualize instruction.

**Implementation, interoperability, & scaling:** The realities of building an intelligent lifelong learning companion could very well be the most challenging hurdle of all. The huge number of systems, courses, instructional materials, and social influences that bombard a learner are both motivation for building a learning companion in the first place, but also intensely challenging to manage automatically. Intelligent tutoring systems have made great strides in isolated learning contexts, including supporting learning over semester-long periods in a single subject. However, the leap to supporting multiple subjects and integrating modeling techniques across domains and over time (both in modeling expert knowledge and student learning) represent major hurdles. In addition, the reasoning required by a lifelong learning companion, as Minsky et. al (2004) have discussed, imposes further demands on the representation of knowledge and scaling up of any kind of tutoring or assistive technology.

**Communication & relationship building:** It's difficult to imagine a lifelong learning companion being successful without effective methods of communicating with or "getting to know" the learner. The links between communication, being understood (in both directions), and building a sustainable relationship is the focus of this working group. These are general problems that researchers in dialogue systems and embodied agents are addressing. Interacting with a learner, especially novices, may impose additional barriers on these already complex problems. For example, it is often difficult to establish common ground with learners when they lack the necessary background knowledge to comprehend an utterance. Also, *how* feedback is delivered can have a profound impact on a learner's confidence and general feelings about an intelligent agent. This working group should focus on the link between communicative actions, emotional states, and learning, and discuss their impact on learning over the long haul.

**Guidance, experience, & assistance:** Most generally, when it comes to providing support for a learner, three basic decisions must be made: (1) *what* knowledge is needed by the learner, (2) *when* to intervene or provide help, and (3) *how* to go about it. Deciding *what* can come from a variety of places, such as a curriculum, a student model, or even the learner him/her-self (in the case of self-directed learning). Deciding *when* is more complex. When a system decides to act *unsolicited*, it is basically making a claim that the student needs something now and will provide it unilaterally. On the other hand, learners often do *not* know what is best for them nor when they need help (they are classic poor self-assessors), so clearly a lifelong learning companion would need this ability. Real risks exist when explicit help is provided when it is not wanted or needed, for example. Finally, deciding *how* to provide support is quite possibly the most complex question of the three. Approaches as simple as pointing the learner to a resource (e.g., a book or class), to helping the learner accomplish a needed task, or as complex as configuring and managing an *experience* that targets a knowledge gap and provides a memorable, interactive narrative (such as those imagined in *The Diamond Age*). This working group should focus on these questions, the demands of these activities on a lifelong learner model, and the AI-power necessary to pull them off.