



Grand Challenges

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GRAND TECHNOLOGY CHALLENGE **Provide a Teacher for Every Learner. Scalable, Learner Centered Networks**

- ◆ networked and face-to-face communities of learners composed of peers, teachers, mentors, domain experts, avatars, and “cognitive” tutors that collectively approach the effectiveness of a one-on-one human tutor.
- ◆ Tap into rich, universally accessible digital libraries with books, articles, music, paintings, primary source material, data sets, and 3-D representations of cultural and natural landmarks.
- ◆ Learners learn at their own pace and in their own style and receive continuous, customized, and meaningful feedback and assessment.
- ◆ Learn anytime, anywhere—an advantage that is particularly important for adults struggling to balance the competing demands of work and family.

“Grand Research Challenges in Information Systems, Computing Research Association, Washington, DC (2003)”



“Lesser Challenges” Distributed Pedagogy and Learner Models

- ♦ **Rich modeling of learner knowledge (epistemological)**
- ♦ **Rich modeling of cognitive structures**
- ♦ **Connections between epistemologies and cognitive structures**
- ♦ **Pedagogy tied to learner knowledge and cognitive structures**
- ♦ **Effective models of learner interactions given learner knowledge and cognitive levels**

(Quantification of Zone of Proximal Development)



Semantic Analysis of Text and Language

- ♦ **Provides tools for interfacing humans and text and language resources**
- ♦ **Need advances in LSA and associated text clustering and summarization**
- ♦ **Need advances in knowledge linking algorithms**
- ♦ **Need advances in semantic understanding in general domains.**

(Natural language understanding – a holy grail of AI)



Intelligent Knowledge Management

- ♦ **Processes and designs that can be captured and reused**
 - ♦ **Visualizations and other knowledge presentation techniques**
 - ♦ **Knowledge indexing and searching algorithms**
 - ♦ **Understanding of visual scenes – classroom video interpretation + others**
- (Knowledge management and utilization over complex, multimedia domains)**



User Modeling and Assessment of Learning

- ♦ **Accepted taxonomies of desirable knowledge and skills leading to models of content, competency, and pedagogy**
- ♦ **Better automatic measurements of ongoing learning**
- ♦ **Better architectures to support assessment**
- ♦ **Individualization of assessment – e.g. reflect the multidimensionality of human learning**