Learn

Distribute

Advance

WADL RESEARCH CAPABILITIES:
Cognitive studies of learning systems

The WADL Co-Lab is located in the FedEx Institute of Technology (FIT) on the campus of the University of Memphis. Researchers associated with the WADL Co-Lab are faculty, researchers, post-doctoral fellows, and advanced graduate students in the Institute for Intelligent Systems (IIS). WADL Co-Lab researchers have extensive experience in research, development, and evaluation of advanced learning environments. Research foci of the WADL Co-Lab researchers are Cognitive Studies of Learning Systems and the Impact of Learning Technology in Applied Settings.

Cognitive studies of learning systems

The primary goal of this area is to provide tests of a learning system's ability to maximize the user's cognitive capacities to improve the user's learning experience. Researchers in this area are experts at conducting randomized controlled experiments to determine the effectiveness of learning technology systems. The randomized experiments allow researchers to determine if a current system is effective and suggest improvements based on current cognitive research.

Typical projects considered by this area

A study consists of an evaluation and a recommendation phase. The evaluation phase measures

- Effectiveness: What is the extent to which the material was mastered?
- Engagement: To what extent is the user satisfied in terms of overall engagement and usability of the system?

Effectiveness and engagement can be measured by

- Verbal protocol analysis of the user's learning process
- Mastery: detailed analysis of pretest and posttest learning measures tailored to the learning domain being tested.
- Engagement: Engagement measurements can range from offline self report measures from the user to online engagement measure based on non intrusive sensing technology such as body position and facial expressions.

Based on the evaluation of the data in the evaluation stage, recommendations can be made for improving the learning environments.

Examples of Current Systems

- AutoTutor - AutoTutor is a web-based computer tutor architecture that simulates the dialog moves of effective human tutors.
- HURAA - HURAA is an interactive, web-based information delivery and retrieval system that is designed to help users learn the U.S. federal policies and regulations that pertain to using human subjects in research.
- iSTART - an automated strategy trainer designed to help students become better readers via multi-media technologies.
- iDRIVE - investigates the role of deep-level reasoning questions in vicarious learning environments using non-interactive videos in middle and high schools.
- MetaTutor - an interdisciplinary project involving the design, development, and evaluation of a web-based intelligent adaptive hypermedia system to (1) model key self-regulatory processes to foster students' understanding of science and (2) to provide adaptive scaffolding during learning about complex science topics.

Research Associates

- Danielle McNamara: Cognitive Psychologist
- Art Graesser: Cognitive Psychologist
- Xiangen Hu: data mining, statistical analysis, and mathematical modeling
- Max Louwerse: Cognitive Psychologist
- Rick Dale: Learning Scientist
- Scotty Craig: Learning Scientist

WADL DEVELOPMENT CAPABILITIES:
Intelligent Tutoring Systems (ITS) for the Enhancement of Learning Content

The WADL Co-Lab is located in the FedEx Institute of Technology (FIT) on the campus of the University of Memphis. Researchers associated with the WADL Co-Lab are faculty, researchers, post-doctoral fellows, and advanced graduate students in the Institute for Intelligent Systems (IIS). IIS researchers have extensive experience in research, development, and evaluation of advanced learning environments. The WADL Co-Lab has development capabilities for natural language dialogue-based Intelligent Tutoring Systems (ITS) for the enhancement of learning content and also ePAL (Electronic personal Assistants).

Intelligent Tutoring Systems (ITS) for the enhancement of learning content

WADL Co-Lab researchers have worked on building dialogue-based intelligent tutoring systems since the mid 1990's. These systems tutor the learners using natural language conversations led by the system with questions, hints, prompts and summaries in a simulation of a real tutor. These systems can be integrated into already existing learning content to provide a just-in-time check for understanding of the material, along with scaffolded learning if needed.

Typical Intelligent Tutoring System Project

A typical use of an intelligent tutoring system to enhance learning content would include a construction phase and an evaluation phase.

- Construction phase: The construction phase augments learning content: by incorporating existing course content into a dynamic tutoring system.
- Evaluation phase: After the system is created an evaluation phase would test the effectiveness of the system using randomized experimental designs.

Examples of Current Systems

- ARIES - web-based computer tutoring system based on the AutoTutor architecture that uses an alien invasion game scenario to teach critical thinking skills.
- AutoTutor - a web-based computer tutor architecture that simulates the dialog moves of effective human tutors.
- CircSysWeb: a web-based research tool and learning environment to study and foster students' self-regulated learning about the circulatory system
- MetaTutor - a web-based intelligent adaptive hypermedia system to (1) model key self-regulatory processes to foster students' understanding of science and (2) to provide adaptive scaffolding during learning about complex science topics.

Research Associates

- Xiangen Hu: Cognitive Psychologist
- Roger Azevedo: Learning Scientist
- Art Graesser: Cognitive Psychologist
- Max Louwerse: Computational Linguist/cognitive Psychologist
- Danielle McNamara: Cognitive Psychologist
- Zhiqiang Cai: Software Specialist

WADL DEVELOPMENT CAPABILITIES:
ePAL: Electronic Personal Assistants

The WADL Co-Lab is located in the FedEx Institute of Technology (FIT) on the campus of the University of Memphis. Researchers associated with the WADL Co-Lab are faculty, researchers, post-doctoral fellows, and advanced graduate students in the Institute for Intelligent Systems (IIS). IIS researchers have extensive experience in research, development, and evaluation of advanced learning environments. The WADL Co-Lab has development capabilities for natural language dialogue-based Intelligent Tutoring Systems (ITS) for the enhancement of learning content and also ePAL (Electronic personal Assistants).

ePAL: Electronic Personal Assistants

Electronic personal Assistants ePAL are systems that help to augment computerized tasks. An ePAL can be created to help the user in two ways. It can guide a user to perform a task and recommend what to do next. For example, while a user is browsing an internet search, ePAL can give advice on how similar the information on a link is to information on a previously viewed page or to learning objectives. ePAL can help perform a task after being given a specific criterion or requirements by the user. An ePAL of this type was created to help the US Navy fill open positions with sailors based on the sailor's qualifications and desires. After the sailors tell the systems about their skills and preferences, ePAL returns a list of open positions that meet their needs.

Examples of Current Systems

- GenoSAP - A navy-funded project to explore the possibility of using genetic algorithms to solve complex assignment problems.
- IDA (Intelligent Distribution Agent) - an intelligent software agent developed for personnel work for the US Navy. The IDA technology is the basis for a functional integrative model of human and animal cognition.

Associates

- Dipankar Dasgupta: Computer scientist
- Stan Franklin: Computer Scientist
- Art Graesser: Cognitive scientist

Learn

Distribute

Advance

WADL SERVICE CAPABILITIES:
Text Analysis Using Computational Linguistics Tools

The WADL Co-Lab is located in the FedEx Institute of Technology (FIT) on the campus of the University of Memphis. Researchers associated with the WADL Co-Lab are faculty, researchers, post-doctoral fellows, and advanced graduate students in the Institute for Intelligent Systems (IIS). IIS researchers have extensive experience in research, development, and evaluation of advanced learning environments. The WADL Co-Lab provides unique services in the areas of program usability in the form of usability analysis for learning environments and text analysis using computational linguistics tools.

Text Analysis Using Computational Linguistics Tools

The computational linguistics tools service area in the WADL Co-Lab has researchers with expertise in text and discourse comprehension methods. The primary goal of this area is to provide services to organizations and researchers on the readability and comprehension of written information. These services include analyzing written content (e.g. WebPages, brochures or questionnaires) and offering recommendations for making the content more comprehendible to a target audience.

Typical Text Analysis using Computational Linguistics Tools

A typical use of the computational linguistic tools for text analysis would consist of evaluating the conceptual and linguistic content of the text and recommending changes when needed. The evaluation phase measures:

- Comprehension: How well should the target audience understand the current materials?
- Relevance: How relevant is the learning material to the learning objectives of the course?
- Learner resonance: How well does the material match the background, experiences, and profile of the learner?

Based on the evaluation of the data in the evaluation stage, recommendations can be made for improving the selection and pacing of textual content. Recommendations can be made on improving comprehension in areas such as reading level, text cohesion, and question quality.

- Reading level: Identify the current reading level of the text along with recommendations for adjusting the text to the reading level of specific audiences.
- Text cohesion: Identify overall cohesion of the text and identify gaps in cohesion within the text
- Question quality: Flag potential problems in questions and provided feedback to improve the wording, syntax, and semantics of the questions.

Resources

- Coh-Metrix - Using advanced technologies, Coh-Metrix will allow readers, writers, educators, and researchers to instantly gauge the difficulty of written material, based on the target audience.
- QUAID (Question Understanding Aid) - a software program designed to assist survey methodologists, social scientists, and designers of questionnaires in improving the wording, syntax, and semantics of questions.

Research Associates

- Art Graesser: Cognitive Psychologist
- Xiangen Hu: Mathematics Models of Semantic Spaces, Statistical Analysis
- Max Louwerse: Computational Linguist/cognitive Psychologist
- Danielle McNamara: Cognitive Psychologist
- Zhiqiang Cai: Software Specialist

Learn

Distribute

Advance

WADL SERVICE CAPABILITIES:
Usability Analysis for Learning Environments

The WADL Co-Lab is located in the FedEx Institute of Technology (FIT) on the campus of the University of Memphis. Researchers associated with the WADL Co-Lab are faculty, researchers, post-doctoral fellows, and advanced graduate students in the Institute for Intelligent Systems (IIS). IIS researchers have extensive experience in research, development, and evaluation of advanced learning environments. The WADL Co-Lab provides unique services in the areas of program usability in the form of usability analysis for learning environments and text analysis using computational linguistics tools.

Usability Analysis for Learning Environments (UALE)

The Usability Analysis for Learning Environments (UALE) area in the WADL Co-Lab has researchers who specialize in usability studies, using eye-tracking technologies and read-aloud protocols to evaluate learning environments online and offline. The primary goal of UALE is to provide services to organizations. These services include analyzing learning environments and offering recommendations for making those environments more user-friendly in order to enhance learning. Recommendations from UALE will be based on cognitive theories of learning as well as principles of HCI specifically tailored to learning. Faculty advisors of UALE are leading researchers in designing, developing and evaluating intelligent learning environments. Two main instruments used to evaluate the usability of learning environments are eye tracking technologies and read-aloud procedures.

Typical Usability Analysis Using Eye-tracking Devices

A typical eye tracking usability study consists of an evaluation and a recommendation phase. The evaluation phase measures

- Efficiency: How much work is accomplished per unit time?
- Effectiveness: What is the extent to which goal is accomplished?
- Satisfaction: To what extent is the user satisfied in terms of usefulness, usability, comprehensibility and aesthetics?

Based on the evaluation of the data in the evaluation stage, recommendations can be made for improving the learning environments. Efficiency, effectiveness and satisfaction can be measured for

- Screen design: eye gaze on font type, font size, colors, pictures, menus
- Reading: fixations explained by text difficulty, coherence of information, readability of information
- Cognitive workload: blinks, pupil diameter, long fixations.

Resources

The UUALE currently has four high-end eye tracking devices: Two head mounted systems (ASL-501, 504), a chinrest high-speed eye tracker (SMI Hi-Speed) and a remote eye tracker (SMI RED). All four eye trackers have been extensively used in usability studies of web content and intelligent tutoring systems. Moreover, our usability lab consists of five camcorders, high-quality speech recorders and advanced software packages to conduct the highest level of usability studies and evaluate the rich data obtained from these studies.

Research Associates

- Art Graesser: learning scientists and eye tracking
- Xiangen Hu: data mining, statistical analysis, and mathematical modeling
- Max Louwerse: learning scientists & eye tracking
- Zhiqiang Cai: Software Specialist