The Human Factors and Aging Laboratory at the Georgia Institute of Technology is oriented toward developing a fundamental understanding of psychological constructs such as cognition, perception, and attention. We are committed to bringing that fundamental knowledge to bear on design issues important to the quality and safety of technologies.

Our research also emphasizes the positive aspects of aging and explores opportunities for continued independence of older adults. One way to support older adults in their daily living is by understanding how interactions with complex technologies may differ as a function of age, and incorporating this knowledge into the design of systems.
From the Directors...
Connections….Collaborations….and Contributions

The theme for our newsletter this year is to highlight our collaborative efforts. The Human Factors and Aging Laboratory has been a part of the Center for Research and Education on Aging and Technology Enhancement (www.create-center.org) since 1999. CREATE is a consortium of three universities: University of Miami (Director: Sara Czaja, Principal Investigator: Joe Sharit); Florida State University (Principal Investigators: Neil Charness & Wally Boot); and Georgia Institute of Technology (Principal Investigators: Wendy Rogers & Dan Fisk). The current instantiation is known as CREATE III: CREATE I was 1999-2004, CREATE II was 2004-2009, and CREATE III will be funded through 2014. We are funded as a program project from the National Institute on Aging which is one of the National Institutes of Health. Being a part of CREATE has been a wonderful opportunity for the Human Factors and Aging Laboratory. We have worked closely with, and learned a lot from, our colleagues at UM and FSU. Our CREATE book is being translated into Japanese by Drs. Hiro Umemuro, Ryoko Fukuda, and Nana Itoh, who we visited in December.

Another long-standing collaboration for our lab is with Deere & Company with whom we have worked since 2001. Jerry Duncan has been an excellent champion for this relationship, and more recently we have worked closely with Josh Hoffman as well. Over the years we have interacted with many Deere employees – their appreciation for our scientific contributions has been gratifying. In the last 5 years, numerous student projects have been carried out to support design-related questions of interest to Deere: 6 undergraduate senior theses, 12 Master’s theses, and 5 Ph.D. dissertations. Our students have benefited tremendously from the opportunity to develop science-based answers to practical questions; in the process they have contributed to the scientific literature through principles, guidelines, and frameworks that they have published.

A recent development is our collaboration with Charlie Kemp in the Healthcare Robotics Lab. Together we submitted a competitive proposal to a robotics company called Willow Garage to receive a PR2 robot with which to conduct research at Georgia Tech. There were nearly 100 submissions and 11 were approved; our proposal was unique in its focus on human-robot interaction with a particular emphasis on older adults and home healthcare providers. After much discussion, we named our robot GATSBII which is an acronym for the GATechServiceBotwithInteractiveIntelligence. Our goal in this collaboration is to identify the tasks for which older adults and healthcare providers would welcome assistance from a robot like GATSBII. We will be testing the functionality in the Aware Home.

More details about our collaborative activities are presented in the newsletter. We look forward to continuing and expanding our interactions in the future.

Wendy A. Rogers & Arthur (Dan) Fisk
Directors of the Human Factors & Aging Laboratory
**Award and Achievements**

**Georgia Institute of Technology President’s Fellowship**
Each year, Georgia Tech awards fellowships to a select number of doctoral students who bring exemplary levels of scholarship and innovation to the academic departments who host their study and research. *Ralph Cullen* and *Sara McBride*, were two of this year’s recipients.

![Ralph Cullen and Sara McBride](image)

**APA Early Graduate Student Award**
The purpose of the APA Early Graduate Student Research Awards program is to recognize students for conducting outstanding research early in their graduate training (i.e., research conducted within the first three years of doctoral study). *Jenay Beer* was selected for this award.

![Jenay Beer](image)

**HFES Aging Technical Group Scholarship for Students**
*Cara Bailey Fausset* received this scholarship for her contribution to research on how older adults comprehend quantitative health-related information.

![Cara Bailey Fausset](image)

**HFES Student Member with Honors**
*Ralph Cullen* was awarded HFES Student Member with Honors at this year’s Annual Meeting in San Francisco.

![Ralph Cullen](image)

**Paul M. Fitts Education Award**
*Wendy Rogers* received the Paul M. Fitts Education Award presented at the HFES meeting in San Francisco.

![Wendy Rogers](image)
Awards and Achievements (cont.)

Laboratory Personnel Updates
_Tracy Mitzner_ received a promotion to the position of Associate Director of the Human Factors and Aging Laboratory.

Proposed Master’s Thesis
- Ralph Cullen
- Cory-Ann Smarr

Defended Master’s Thesis
- Jenay Beer
- Sara McBride

Defended Doctoral Dissertation
- Anne Adams

Lab members are also active in the Georgia Tech HFES (Human Factors and Ergonomics Society) Student Chapter. The chapter received Outstanding Student Chapter Award: Gold Level for 2009-2010
**Recent Publications**


Recent Publications (cont.)


![J. S. Coon Building in snow!](photo by Wang-Chin Tsai)
Research Spotlights
Project: Personal Robotics for the Home

Team Members: Jenay Beer, Tracy Mitzner, Akanksha Prakash, Cory-Ann Smarr, Megan Springman

Robotics. It is a term that often brings to mind science fiction representations of intelligent machines (e.g., Rosie from the Jetsons). Modern technological advancements are making the everyday use of robotics into a very real possibility. Currently available home-based robots assist with cleaning (e.g., the robotic vacuum cleaner Roomba), and entertainment (e.g., Aibo the robotic dog). More advanced robots are under development. Such robots may assist with complex daily activities or even health care (e.g., Nursebot). Although robots are beginning to be applied in home and health care settings, there are many open questions regarding robots designed for human use. For example, there is a need to understand how people want to interact with robots, and what tasks robots should perform.

Psychology has much to contribute to the success of robots designed for human use. The study of the successful interaction between people and robots is a growing area of research known as human-robot interaction (HRI). HRI is a multi-disciplinary area receiving collaborative attention of psychology, engineering, and computer science. A current effort by researchers is developing intuitive and natural interaction between robots and humans. Psychology can investigate many aspects of HRI, such as acceptance of robots in the home environment, perceived usefulness of the robot, and how robotics can help certain groups, such as older adults or home health care providers.

Robotics has the potential to enable older adults to maintain their independence. Older adults may be faced with situations in which there is a mismatch between the demands of their daily environment and their capabilities. There is great potential for robotics to support the needs of older adults – either by direct assistance, or by supporting the activities of professional caregivers (e.g., nurses or physical therapists) who work in the homes of older adults.

How is the Human Factors and Aging Laboratory contributing to the field of HRI, particularly pertaining to older adults? We are conducting research to investigate the use of home-based personal robotics. In June 2010, our lab and the Healthcare Robotics Laboratory (also located at Georgia Tech) were awarded an advanced robot called the Personal Robot 2 (PR2) developed by the robotics company Willow Garage. The PR2 is a humanoid robot, with arms, grippers for hands, a head, torso, and wheels for mobility. Over the next two years, we will be investigating how a robot, such as the PR2, can be used in the home. Rather than
try to guess what seniors want, we will work with older adults to better understand their needs and preferences for robot assistance. We will be conducting focus groups and interviews to (1) identify the needs of older adults and caregivers that might be assisted by the robot; and (2) determine the factors that may facilitate or hinder older adults’ acceptance of the robot.

The interdisciplinary collaboration between two very different labs makes our research plan unique. The Human Factors and Aging Laboratory will focus on HRI, and understanding what people want to use robots for. Our lab has a considerable amount of experience researching the design and use of technology for older adults. The Healthcare Robotics Laboratory will be leading software development; that is, they develop software the robot uses to perform actions and tasks. The Healthcare Robotics Laboratory has extensive background in the design of assistive robots to help people with severe motor impairments. Both labs will work toward the development of capabilities for the PR2, with an emphasis on home care for older adults.

The human-robot interaction research will help ensure that the software development is closely connected to everyday needs – needs older adults tell us about. In turn, the software development research will provide capabilities that both inform and enable cutting-edge studies of HRI. The robot will spend some of its time in a our residential laboratory which is a two-story house on the Georgia Tech campus, called the Aware Home. This will enable older adults to work with the robot in a home environment, and will give the software developers a good place to test their software.

The field of HRI is relatively young. In our opinion, the potential for psychology to make an impact on the development and design of future robotics is profound. Our goal is to aid designers in creating better home-based robots. Research in psychology and robotics has the promise of accelerating the development of assistive personal robotics for older adults in the home, and assisting them in maintaining their independence longer.

Want to learn more? Healthcare Robotics Lab: http://www.hsi.gatech.edu/hrl/
About the PR2 project: http://www.willowgarage.com/blog/2010/06/07/spotlight-georgia-tech
Project: Collaboration with Deere & Company
Team members: Anne Adams, Jenay Beer, Ralph Cullen, Sara McBride, Daniel Serrano-Baquero, Cory-Ann Smarr

The Human Factors and Aging Laboratory and Deere & Company have been collaborating since 2001. This collaboration is a model of a long-term successful collaboration between industry and academia. We have contributed scientific research to help answer design and training questions at Deere. In the process, our students have obtained invaluable experience working on challenging problems.

Surprising to some is the range and complexity of the products developed by Deere & Company. In addition to their well-known agricultural equipment, Deere is an international leader in construction, forestry, commercial, golf, and residential equipment as well. Their products use advanced digital technology (such as GPS systems, computer displays, and sensing technologies). With humans as operators of these systems, it is critical for Deere to attend to good human factors design.

Human factors issues relevant to design for Deere products include: interface design for efficient interaction; attentional constraints and mental workload; task control; training; human-automation interaction; and acceptance of technology. Some of the initial research conducted in the Human Factors and Aging Laboratory related to the design of input devices. We were able to provide principles for design to guide selection of devices (touch screen vs. rotary encoder) as well as for screen layouts for text entry on a virtual keyboard. The projects described below illustrate the range of our current efforts.

Knowledge Engineering in a Grove

To improve on existing designs, it is valuable to have an in-depth understanding of how experienced operators use the current product. This involves assessing what operators do; their processes of performing tasks; the knowledge they have about the equipment and the environment; decisions they make and the factors that influence those decisions; and how operators communicate in the larger context of the organization around them.
Capturing all of this information is a challenge that can be met through a process called knowledge engineering. This process involves defining goals for the project, interviewing subject matter experts such as dealers, and then interviewing the operators themselves. The details of the operator interviews provide the basis for developing representations of the processes involved in the task (of mowing in this case); the knowledge operators have; the range and complexity of decisions they make; and communication needs and challenges. Together these data can guide the development of new product designs as well as improve the training of new operators.

**Training Task Analysis**

A critical first step in many human factors assessments is conducting a task analysis which provides in-depth information about tasks that a user has to perform. For example, consider an operator using a mower in a grove – one task involves turning at the end of a row of trees. This task requires planning, execution, and making adjustments to the equipment so as not to damage any trees or veer into a ditch. A task analysis would identify each sequence of the task; the information available to the operator; the perceptual, motor, and cognitive demands; and the potential for errors.

Given the importance of task analysis to many aspects of design, it is a valuable skill for engineers and designers to have. However, learning how to conduct a task analysis is not trivial, and best practices for training task analysis are not well-documented but much needed. In our research we have identified the skills involved in conducting a functional task analysis, which aims to represent a task in terms of its goals and subgoals.

We studied two groups of participants with different levels of task analysis experience. One group of participants included professionals with experience conducting task analyses. The goal was to understand how experienced task analysts analyze a task, and the characteristics of the resulting task analysis products. The second group was novices with no task analysis experience who received only brief training. The goal was to understand the challenges involved in learning task analysis.

The participants’ task analyses were characterized in terms of breadth and depth, subgoals identified, and versatility of the analysis. Novices’ performance improved after brief training; however, more training is needed for specific aspects such as identifying higher-level subgoals. Points of conceptual confusion were identified along with common procedural errors. Professionals used both a breadth-first and a depth-first approach, and most often employed ‘what’ questions to guide their analysis during the study. These data yielded a set of guidelines for training task analysis methods.
Human-Automation Interaction

Advances in technology have increased performance, safety, and comfort across many domains. An influential technological innovation has been automation. Automation is when technology performs a task that a human used to do; for example, cruise control in an automobile is a form of automation that controls the speed of the vehicle. Automation has revolutionized how individuals perform tasks in a wide array of domains including: health care, transportation, the home, and in contexts where Deere & Company products are used.

Understanding the dynamics between humans and the automated systems has been a focus of our research. All factors in the equation (i.e., the human, automation, and task environment) must be considered in the design and implementation of any automated system. Understanding how people use automation in different circumstances can inform the design of automated systems. For example, do people tend to rely on automation more when they are in a high workload situation? Do younger and older adults rely on automation differently?

In one study we found that as a person’s workload increased, task performance suffered, and they tended to use the automation more often to get the task done. This might not be problematic if the automated system were 100% reliable but few of them are perfect. If a person were to follow the automation’s instructions when it was wrong, negative consequences could result. The study also revealed some differences in the way younger and older adults used the automation. For instance, older adults tended to depend on the automation more, overall. These data provide insights into how people interact with automation. Understanding how workload and age influence automation use has implications for design as well as for training individuals to interact with automated systems.

Deere & Company website: www.deere.com
Visiting Researcher: Wang-Chin Tsai

I am a PhD student coming from the Graduate School of Design, National Yunlin University of Science and Technology in Taiwan. My research interests are focused on product interface design and instructional material design for older adults. I am sponsored by the National Science Council for a one-year visiting program in the Human Factors and Aging Laboratory at Georgia Tech. The directors, Dr. Fisk and Dr. Rogers, provide abundant learning resources and a wonderful environment for me to understand aging research techniques to strengthen my research foundation. I am participating in several lab projects including research on chronic pain issues for older adults, interface knowledge engineering research, and practical interview/focus group skills with older adults. The lab members also share their insight, experience, and perspectives on my research ideas. Studying in the Human Factors and Aging Laboratory has been very valuable in broadening my experiences in the aging research field. Thank you all!

Research Topic:
User Interface Knowledge Requirements for Older Adults
Along with Dr. Wendy Rogers, Dr. Tracy Mitzner and Dr. Anne Adams, I am discussing interface knowledge requirements for older adults on several technological products and trying to develop a framework to identify needed knowledge for inexperienced older adults during the technology interaction process.

Awards:
Recipient of 2010 National Science Council doctoral research fellowship
Each year, the National Science Council in Taiwan selects a number of doctoral students to support their school intuition, international conference costs and travel expenses.

Other Accomplishments:
I was invited by the editor of Ideas Magazine in Taiwan to be a 2-year column writer (2011-2012) to introduce everyday technology for older adults. It is imperative to help older adults better understand basic technology concepts. Many older adults are willing to interact with technology. Also, older adults can find out about the benefits of technology and further increase their quality of life.

Recent Publications:

Research in Brief

Age-Related Differences in Recognizing Emotions in the Virtual iCat

Cory-Ann Smarr is investigating if motion influences how younger and older adults recognize emotive facial expressions displayed by a virtual agent, or character on a screen.

Attention Allocation in a Multiple-Task Environment

The way people allocate their attention to different tasks in a multiple-task environment may be affected by the reliability of the automation that intends to aid them. Ralph Cullen is assessing attention allocation strategies in different contexts.

Computer Preferences and Usage Patterns

Tracy Mitzner and John Burnett are exploring older adults’ perceptions regarding the usability and usefulness of computers. Moreover, they are examining the influence of technology experience on these perceptions.

First Impressions about Human-like Robots

Akanksha Prakash is currently designing a study to understand how young and older adults’ initial perceptions of a robot are influenced by its appearance and task context.

How Users’ Knowledge of the Automation Affects Trust in Automation

Chiu Shun Dan is assessing how people interpret the functions and errors of a system, and how knowledge about automation affects trust in automation.

How Younger and Older Adults Comprehend Quantitative Health-Related Information

Cara Bailey Fausset is investigating comprehension of quantitative data in a health-related context (health numeracy) and the role of age-related differences.

Human-Automation Interaction: Understanding Error Prevention and Management

Although errors committed by humans have been examined extensively, the role of errors in a human’s interaction with automation is not well understood. Sara McBride is investigating this issue to determine how we may be able to support the prevention and management of errors in human-automation interactions.

Human-Automation Trust

Katherine Olson is investigating how older adults develop the system knowledge they need for interacting with automated systems. She is also investigating whether the accuracy of their system knowledge influences their interactions with automated systems.
Research in Brief (cont.)

Home Healthcare Providers: A Needs Assessment
Tracy Mitzner, Jenay Beer, Sara McBride, and Megan Springman are examining human factors issues faced by home healthcare providers, and identifying the need for human factors interventions (including future technology, equipment, training, materials, etc.) to ease the challenges and difficulties related to daily caregiving.

Recognition of Social Agent’s Facial Expressions
Agents, such as virtual characters or robots, are often required to demonstrate some social capability, such as facial expression. Jenay Beer is investigating older and younger adults’ recognition of static facial expressions displayed by virtual agents, synthetic humans, and humans.

Technology Acceptance
There are multiple ongoing projects related to understanding technology acceptance predictors:

- John Burnett is exploring variables that influence Perceived Ease of Use, in an effort to better define and understand why individuals choose to accept technologies.

- Katherine Olson is investigating older adults’ frequency of technology use in multiple technology domains.

- Tracy Mitzner, Jenay Beer, Cory Smarr and Akanksha Prakash are assessing acceptance issues related to personal robots for older adults and home caregivers.

Undergraduate Corner

We would like to recognize the hard work of all of our undergraduate research assistants for the year 2010-2011: Hillary Smith, Jordan Hartley, Kathryn Mashni, Kristin Coleman, Matthew Morris, Meredith Harney, Michael Morgan, Minsun Park, Ryan Daugherty, and Sarah Johnston.

Sarah Johnston has received a GT President’s Undergraduate Research Award. Her research topic is “Task Challenges Experienced by Home Health Care Providers”. Sarah hopes to develop insight into factors that contribute to challenges experienced in home health care tasks. The information gained could be used during training of home health care providers and to improve techniques and supports in this area.

Two of our previous undergraduate students, Sarah Felipe and Alan Poole, had their senior thesis research presented at the Human Factors and Ergonomics Society Conference 2010. Their research topics were “Training novices on hierarchical task analysis”, and “Errors in disclosure and computer mediated systems”, respectively.
Laboratory alumni Rich Pak and Anne McLaughlin have written a book entitled “Designing Displays for Older Adults”. This is part of the Human Factors and Aging Series by CRC Press edited by Wendy A. Rogers and Arthur D. Fisk. Available at the CRC press website: http://www.crcpress.com

Newest Members of the Human Factors and Aging Laboratory:

Chui Shun Dan  Akanksha Prakash  Megan Springman

Lab Babies: Human & Furry

www.hfaging.org