The 2011 Augmented Cognition Technical Group Business Meeting was productive. Dr. Peter Hancock from the University of Central Florida was awarded the Admiral Leland S. Kollmorgen Spirit of Innovation Award. The second Student Grant Award, which included a $500 cash prize, was given to Brian Falcone from George Mason University. Dr. Lauren Reinerman has served as the Technical Group Chair and Lt. Lee Sciarini as the Program Chair for the past two years. The Las Vegas 2011 Conference marked the fifth year in which the Augmented Cognition Technical Group was affiliated with HFES. To mark this event, the business meeting included an address from Capt. Dylan Schmorrow, one of the most influential individuals in the field of Augmented Cognition. Chris Berka, Founder of Advanced Brain Monitoring (ABM), then informed meeting attendees of the history of Electroencephalogram (EEG). The AC-TG Business Meeting this year is planned for Wednesday October 24, 2012 from 3:30-5:00PM. The two aforementioned awards will again be announced, as well as an award for the best student paper. Please nominate someone or yourself. Details are included throughout this newsletter. Nominations and votes for Program Chair, Newsletter Editor, and Student Ambassador will also be accepted.

56th Annual Meeting

The next HFES conference is October 22-26, 2012 at the Westin Waterfront in Boston, MA. The AC-TG business meeting is scheduled to be held on Wednesday, October 24, from 3:30-5:00 PM. Technical presentations are scheduled for Tuesday, October 23rd from 1:30-3:00, Wednesday, October 24th from 1:30-3:00, and Thursday, October 25th from 10:30-12:00. Please check the final HFES program for meeting locations, as well as possible changes to dates and times.
Leland S. Kollmorgen Spirit of Innovation Award Nomination

The Leland S. Kollmorgen Spirit of Innovation Award was instituted in 2007 by the HFES AC-TG in honor of Leland S. Kollmorgen, Rear Admiral, U.S. Navy (Ret.). The award recognizes exceptional scientists and engineers who have made substantial and innovative contributions to the field of Augmented Cognition. The recipient will be someone whose extensive endeavors have pushed the frontiers of discovery, innovation, and design in Augmented Cognition transcending the boundaries of human-systems computing and is a true inspiration to the HSI field.

The Leland S. Kollmorgen Spirit of Innovation Award recipient is judged not only on accomplishments in the last year, but also on a career history of efforts contributing to the advancement of the Augmented Cognition field. Other criteria for selection include: resourcefulness and dedication in promoting and accomplishing innovative human-systems computing technologies, demonstrated leadership in forming and promoting teamwork among the various disciplines represented within the Augmented Cognition field, demonstrated professionalism and integrity, and the embodiment of the spirit of innovation and collaboration.

If you are interested in nominating an individual or nominating yourself, please complete the form below and return to Lauren Reinerman-Jones (lreinerm@ist.ucf.edu) by September 28, 2012. The recipient will be honored at the 2012 HFES AC-TG Business Meeting in Boston, MA.

Nominator Information:

___________________________
Your Name

___________________________
Your Affiliation

___________________________
Your Email

___________________________
Years of Affiliation with HFES and Aug Cog

Nominee Information (If Different from Above):

___________________________
Nominee Name

___________________________
Nominee Affiliation

___________________________
Nominee Email

___________________________
Years of Affiliation with HFES and Aug Cog

Please summarize in 1-2 paragraphs why this person embodies the spirit of this award, including contributions, collaborations, and other honors received pertaining to the field of Augmented Cognition.
Student Research Grant Opportunity and Request for Reviewers

Joe McDonald, Student Ambassador, AC-TG

The HFES Augmented Cognition Technical Group (AC-TG) is soliciting proposals for the student Grant Program. This program supports student research in the application of human factors in Augmented Cognition. Student affiliate HFES members from various universities across the country and around the world are invited to participate.

The program is open to all HFES student members and Augmented Cognition International Student Affiliates. We offer financial support for research expenses including, but not limited to, purchase of research materials, paying participants, partial payment for equipment, etc. This year, the ACTG will offer one award of $500. Each submitted proposal will be evaluated on the following criteria:

- Clarity in presentation of ideas
- Clarity of research methods and methodology appropriateness
- Relevance of project to current psychological theory
- Project’s potential to advance research in a specified area (theoretical and practical)
- Budget match for scope and requirements of the research

Submission Process
To have the grant proposal considered for the ACTG-SGP, the following information needs to be submitted:

**Cover Letter**
Include the following information:
- Name and Current mailing address
- Telephone number and e-mail address
- Area of research
- University Affiliation
- Full name(s) of other(s) involved in the project

**Letter from Faculty Sponsor**
This letter should describe:
- The amount of faculty involvement in the project
- An assessment of the student’s capabilities in completing the project
- The degree of independence exhibited by the student in developing the research idea

**Proposal Narrative**
Complete a typewritten (single-spaced, no more than 4 pages) project description summarizing the purpose and methodology of the proposed project. This summary should include the research project’s title (without author’s name) at the top of each page and must include text on the following:
- A synopsis of previous related research
- A short description of the theoretical implications of the research
- A short description of the practical implications of the research
- Specific objectives of the current project
- Clearly stated hypothesis or set of hypotheses (if relevant)
- Proposed methodology
- Budget (budget justification explaining costs and why the proposed expenditures are necessary)

Send the above materials to Joe McDonald at joseph.d.mcdonald@gmail.com by September 28, 2012. The winner of the award will be announced at the HFES meeting in October. Any questions regarding the program or awards can be directed to Joe McDonald at joseph.d.mcdonald@gmail.com.
Alternative means of communication are being sought to supplement explicit operator control and teleoperation of unmanned assets. Current military operations’ standards for human-robot interaction (HRI) have been limited to direct control or teleoperation of an unmanned system. The burden of demand has thus fallen solely on the operator, hindering human-robot team performance. To decrease the cognitive load required from operators, real-time multimodal communications must be implemented to reduce some of the traditional control demand.

A robot must be able to respond to a dynamic environment to truly behave as an independent member of a mixed-initiative team. The robotic ally’s decision-making to aid in human-robot team performance will be improved by providing it with the human teammate’s current cognitive/emotional state through physiological assessment. Physiological measurement devices can record state response in real-time and advanced classification frameworks can be developed to form a closed-loop system to augment robot behavior.

Three incrementally-developed studies are planned. The first experiment will result in the validation of multiple experimental tasks capable of manipulating distinct components of operator workload as equated by performance on those tasks. The ACTIVE Lab’s MIX testbed is utilized to simulate tasks required for operational interaction with a robot. Participants are required to perform tasks designed to manipulate their workload level. The threat detection (TD) task involves monitoring a video feed from a robot and reporting any potential threats. The change detection (CD) task involves monitoring an aerial map and reporting entity changes. The second experiment will use the task manipulations that yield distinct workload differences to develop real-time metrics of operator workload using physiological measures including EEG, ECG, TCD, fNIR, and eye tracking. Within the literature, it has been found that alpha levels of the brain may indicate changes in operator workload. Heart rate and heart rate variability have also been used to classify workload. The third experiment will use these metrics to provide an additional level of implicit communication from the operator to the robotic system, altering the behavior of the robotic system in real-time. Such a system will support the robot’s ability to react to their human teammates’ needs as they change throughout a dynamic operational environment, improving the performance of the team as a whole.

It is important to first establish the impact of the manipulations on operator workload and performance. These manipulations will aid in the development of a physiological classification system to communicate operator state to other team members, including robotic assets with the goal of reducing the workload of the operator. This research extends beyond human-robot teams to understanding cognitive state and any other application for a physiologically driven closed-loop systems.
Google Developers Explore Re-engineering Their Brains

Advanced Brain Monitoring and Intific Software were recently invited to debut their latest collaboration -- NeuroStorm -- at the 2012 Google I/O Developers Conference in San Francisco. A result of two ongoing Defense Advanced Research Projects Agency (DARPA) efforts, the capabilities needed for the simple yet powerful NeuroStorm game represent a new platform for future BCI research. Educational, industrial and defense sector developers can now build complex real-time neuro-adaptive scenarios, experiences and games through precision syncing of ABM wireless-EEG systems' outputs via Intific’s NeuroBridge software. The NeuroStorm game itself was a rapid-prototype for dynamic, brain-in-the-loop games and represents a revolution in what can be achieved quickly in neuroscience applications.

Before the Google I/O After Hours Party began, Google Co-Founder Sergey Brin stopped by to try the NeuroStorm game for himself. Brin experienced the immediate responsiveness of the real-time neuroadaptive shooter-on-rails as individualized concentration metrics immediately impacted game speed and difficulty. Google’s invitation to participate in the conference was a demonstration of the growing interest in neurotechnologies by non-neuroscientists, consumer-minded developers and the general public at large. The debut proved to be a popular showcase where over 130+ enthusiastic game developers and party goers got to play, compete and learn how well they can control their physiology when it counts.

Distinguishing this BCI from others were the scientifically validated concentration metrics driving the EEG recognition software. Chris Berka and the Advanced Brain Monitoring research team studied the cognition of over 300 subjects to identify the psychophysiological parameters most correlated with peak performance. They then developed a closed-loop, real-time EEG/ECG recognition algorithm that was implemented in the NeuroStorm game and elsewhere. The findings from those developmental studies were recently published in The International Journal of Sports & Society and set the stage for future application possibilities.
Florida Hospital is making its first steps toward implementing Brain Computer Interface (BCI) research in clinical settings. Approved research study protocol allows BCI testing both non-invasively (from scalp electrodes) and invasively (from intracranial grids in epilepsy surgery candidates, who are undergoing clinically indicated invasive seizure monitoring). Dr. Ki Lee, MD (Medical Director of Epilepsy Program at Florida Hospital for Children) and Dr. Milena Korostenskaja, PhD (Head of Functional Brain Mapping and BCI Lab, or FBM-BCI Lab) are conducting this study.

From August 2011 until August 2012, FBM-BCI Lab together with Center for Pediatric Research and Comprehensive Pediatric Epilepsy Center at Florida Hospital for Children implemented unique BCI-based real-time functional mapping of eloquent cortex (language, sensory and motor) in epilepsy surgery candidates. This was done with collaboration from Dr. Gerwin Schalk and Peter Brunner from Wadsworth Center.

Moreover, in August 2012, FBM-BCI Lab implemented its very own non-invasive P300 Visual Speller Brain-Computer Interface (BCI) in healthy volunteers. P300 Visual Speller is a type of BCI system, which allows its user to communicate with the external world (most often to spell letters/words) by using only his/her own brain activity. The next step in this development is to see if this P300 Visual Speller would benefit currently residing at Florida Hospital 11-yo patient with locked-in syndrome, who lost the ability to control his muscles except for ocular ones because of the recent injury. Although much of the BCI technology is still in its infancy, the possibility of the P300 Visual Speller to enhance the communication ability in disabled individuals has already shown promise, therefore, it is important for neuroscientists and engineers to continue to strive to overcome the current challenges and improve the practicality of these systems.

FBM-BCI Lab is also planning on introducing another type of BCI system at Florida Hospital – steady-state visual evoked potential-controlled (SSVEP) BCI, which is often used for robot control (and can be used for controlling wheelchairs). Both P300 Visual Speller and SSVEP-based BCI systems will be implemented in invasive clinical settings in the Fall of 2012 with assistance from biomedical engineer Christoph Kapeller coming to Florida Hospital from gtech company, Austria. Invasive BCIs allow one of a kind possibility to use the signal recorded directly from the surface of the brain for external device control. These BCI systems are known to be faster, more accurate and efficient than non-invasive BCIs. FBM-BCI Lab is welcoming everybody interested in BCI research to visit Florida Hospital and observe BCI implementation, discuss BCI research project, approaches as well as establish possible collaboration. FBM-BCI Lab also hopes to develop successful collaboration with the Institute for Simulation and Training, University of Central Florida.

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Nuclear Power Plant (NPP) designs are evaluated by Nuclear Regulatory Commission reviewers to meet minimal safety requirements. As a part of the evaluation process, the reviewers examine whether NPP human-system interface (HSI) is designed with consideration of human factors engineering. A detailed evaluation is particularly critical when new technologies and designs are proposed to be used in NPP HSI. For example, new HSIs will use digital instrument panels instead of analog instrument panels to display the processes occurring at the plant. Also, a variety of NPP control functions such as routine testing, off-normal event diagnosis and other functions that are typically performed by NPP operators will be automated. While these technologies are intended to improve human performance, research is necessary to ensure their implementation does not negatively impact NPP safety.

The ACTIVE lab at the Institute for Simulation and Training was named the Nuclear Regulatory Commission Human Performance Test Facility. The lab is currently housing a computer-based NPP simulator to perform human-in-the-loop experimentation such as establishing NPP operation baselines and comparisons of workload, situation awareness, teamwork, and performance for various scenarios and HSI configurations. A variety of physiological equipment will be used including electroencephalogram (EEG), electrocardiogram (ECG), transcranial doppler sonography (TCD), functional near-infrared oximetry (fNIR), and eye-tracking to provide real-time assessment of operator performance and states. The results from this research will provide insights on the impact of new technologies and designs on human performance in terms of NPP operational safety and error reduction. Furthermore, the knowledge accumulated will be used for developing the guidelines for assessing such technologies in the future.
On May 10-11, 2012 the Florida Hospital for Children in Orlando, FL together with g.tech company (Austria) hosted a two-day conference and workshop titled “Solving the Mystery of How the Brain Works: Decoding and Encoding Brain Signals Using Brain Computer Interface (BCI)”. It was attended by researchers from around the world and became first BCI conference held in Orlando.

BCI is an exciting, cutting-edge field that lies at the intersection of neuroscience, cognitive engineering, and medicine. The future for BCI is unlimited with applications as diverse as rehabilitation, human factors, neurosurgery, space science, training, and even computer gaming. It may prove to be a defining technology for the 21st Century. Dr. Milena Korostenskaja, Ph.D. (Head of Functional Brain Mapping and Brain Computer Interface Lab at Florida Hospital for Children) along with Ki Hyeong Lee, M.D. (Medical Director of Florida Hospital for Children’s Comprehensive Pediatric Epilepsy Center), are actively investigating the use of BCI methods for identifying functional brain areas prior to neurosurgery. They presented their work during a poster presentation session, which was held in addition to keynote lectures and workshops.

The keynote speaker was the renowned BCI scientist Gerwin Schalk, Ph.D., Professor of Neurology at the Albany Medical College and Research Scientist at the New York State Dept. of Health’s Wadsworth Center. Other speakers were Christoph Guger, Ph.D., CEO of g.tec, a BCI technology company headquartered in Schiedlberg, Austria, and Wei Wang, M.D., Ph.D., Assistant Director of the Human Rehabilitation and Neural Engineering Lab of the University of Pittsburg.

Because of the success of this year’s conference, Florida Hospital for Children will be hosting it again in March 2013. Functional Brain Mapping and Brain Computer Interface Lab invites everybody interested in this event to participate!

There were three winners of the poster session with broad topic of neuroscience research:

1st Place: Marlaine M. Monroig, Jeffrey S. Bedwell, Ph.D.
Dept. of Psychology
University of Central Florida

Association between Positive Health Behaviors and Psychological Distress
Examined the statistical relationships between a broad range of health behaviors (as measured by the Health Behavior Checklist) and psychological distress (as measured by the Brief Symptom Inventory). Results showed that participants reporting more overall psychological distress also reported that they engaged in fewer positive health behaviors across all health behavior subtypes.

2nd Place: Ujwal Chaudhary, Micheal Hall, Jean Gonzalez, Leonard Elbaum, Martha Bloyer, Anuradha Godavarty
Depts. of Biomedical Engineering and Physical Therapy
Florida International University

Motor Response Investigation in Individual(s) with Cerebral Palsy Using Near Infrared Spectroscopy
Near infrared spectroscopy (NIRS) was used to investigate the change in the optical signals in the pre- and anterior-frontal region of the brain of individuals with cerebral palsy in response to a ball throwing task. The preliminary results suggest differences between subjects with cerebral palsy and healthy controls in regards to the dominance feature of the brain during the task but not so during the rest period.

3rd Place: Julian Abich IV
ACTIVE Lab, Institute for Simulation and Training
University of Central Florida

Physiological Driven Robot Behavior
Three incrementally-developed studies were described to measure the cognitive workload of operators in Human-Robot Interaction (HRI). Preliminary analysis of workload ratings shows a main effect for event rate when threat detection and change detection tasks were completed independently. Main effects were also found for event rates when both tasks were completed simultaneously. Further analysis is underway.
A Brain-Computer Interface (BCI) is a tool for reading and interpreting signals recorded directly from the user’s brain. Most brain-computer interfaces (BCI) are based on one of three types of electroencephalogram (EEG) signals: P300s, steady-state visually evoked potentials (SSVEPs), and event-related desynchronization (ERD). EEG is typically recorded non-invasively using active or passive electrodes mounted on the human scalp. In recent years, a variety of different BCIs for communication and control applications were developed [1].

For example, after suffering a more severe disease like spinal cord injury or stroke patients are often not able to interact or even communicate with their environment anymore, especially at the beginning of their rehabilitation. Brain-computer interfaces (BCIs) thereby temporarily substitute lost communication channels by enabling the patient to stay contact with friends or people outside the rehabilitation facility, by participating in games like Second Life [2], World of Warcraft and others where they may appear as healthy persons.

A quite new and promising idea within this context is to utilize BCIs as a tool for stroke rehabilitation. Thereby the BCI detects the user’s movement intention and provides online feedback by means of controlling a simple cursor on the screen, real a hand-orthosis [4] or the hands of a virtual human avatar [5]. Beyond this Guger Technologies (g.tec) is together with its project partners investigating extended brain body interfaces for full embodiment of paralyzed patients within robotic and virtual avatars [5].

Over the past years efforts were made to establish standardized interfaces to tightly integrate the BCI with various applications, devices, systems and services. A generic application interface enables the attached applications to define, control and update the stimulation and feedback sequences presented to the user and to receive the user’s intentions and the tasks and actions to be executed by the avatar.

Further, a remote BCI stimulation and feedback library module was developed [5]. This BCoverlay module can be used to augment the user interface of any openGL based application for displaying visual stimuli and feedback generated by the BCI. The UDP protocol based network connection between the BCoverlay and the BCI system allows users event to control applications and services running on a distant system.

Acknowledgement
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References
The successful exchange of meaningful information is a hallmark of effective communication. Early studies showed that communication is dynamic during social interactions like teamwork, with cyclic exchanges having both synchronous and lead-lag relationships. It is now widely appreciated that within the context of coordinated team activity these linkages and synchronizations extend beyond speech to include gestural, postural, functional, and physiologic systems.

It is not surprising that neurophysiologic events are the underpinnings of these dynamics, yet it is only recently that their evolving dynamics in real-world teamwork settings have begun to be modeled. This has been due in part to the lack of portable and robust neurophysiologic monitoring systems. Equally important has been the need to extend neurophysiologic studies of teams from the relatively short and controlled environments with individuals performing repetitive tasks, to continuous monitoring in real-world settings with tasks lasting hours.

For electroencephalography (EEG), two complementary approaches are guiding these studies. The first seeks to establish linkages between specific neuromarkers and different behavioral, cognitive or emotional states; the phi complex that distinguishes states of social coordination is an example. Unlike the P300 & N400 EEG signatures that appear and disappear in response to many stimuli, biomarkers like the phi complex exist at a higher level of abstraction and are more targeted to subsets of behaviors. Such biomarkers may not be precise analogs of the multiple ways that can be used to describe interactions or aspects of cognition but are close enough approximations to be useful for better understanding the dynamics of teamwork.

The application of such previously defined EEG neuromarkers for Engagement (EEG-E) or Workload (EEG-WL) has been the approach used by Stevens et al to investigate team neurodynamics in diverse settings like Submarine Piloting and Navigation and high school science problem solving. Here symbolic representations are constructed of the levels of EEG-E expressed by each team member at each point in time as they perform their task. One symbol for instance may represent times when all team members have high EEG-E, another symbol would represent when all team members were low; other symbols represent combinations of EEG-E between these poles. They have shown that the second-by-second sequence of symbols that arise during teamwork contains structure and information relating to team performance, much in the way that words in a sentence or the codons in nucleic acids convey information. Importantly, the degree of mix (or entropy) of these symbols at different points in time helps identify ‘interesting periods’ of team organization that can be related to team experience, task-related events and communications. These studies will be presented at this year’s HFES meeting in a presentation titled ‘Charting Neurodynamic Eddies in the Temporal Flows of Teamwork’.

In alignment with the ecological theory of teamwork proposed by Cooke, Gorman, & Rowe (2009) the team neurodynamics modeled by this...
The Emergence of team Neurodynamics, cont.

approach are complex in a dynamical sense. Also at this year’s HFES 56th annual meeting a Discussion Panel led by Dr. Nancy Cooke will discuss ‘Modeling the Complex Dynamics of Teamwork from Team Cognition to Neurophysiology’ to begin an integration of the ideas and methods of teamwork complexity to the systems and time scales over which team training / performance occur (Figure 1).

The future for team neurodynamics seems bright as it is possible to envisage libraries of EEG (and other) biomarkers that broadly represent the range of cognitions, emotions, and social behaviors that would be differentially represented in military, commerce and educational teams. Integrated models of these measures may help better understand, at multiple systems and levels, what it means for a team to be ‘in the groove’ or ‘out of synch’.


2011–2012 AC-TG Officers

- **AC-TG Chair**: Lauren Reinerman-Jones, Ph.D.
- **AC-TG Program Chair**: Lee Sciarini, Ph.D.
- **AC-TG Newsletter Editor**: Grant Taylor, Ph.D.
- **AC-TG Assistant Newsletter Editor**: Avonie Parchment
- **AC-TG Student Ambassador**: Joe McDonald

**Contact Information:**

**AC-TG Newsletter Submissions:**
- E-mail [actg@ist.ucf.edu](mailto:actg@ist.ucf.edu) if you have content you would like to submit to the AC-TG newsletter.

**AC-TG ListServe:**
- E-mail the AugCog listserv at [hfes-actg@hfes.org](mailto:hfes-actg@hfes.org) with anything you would like to share with the community such as job announcements, funding opportunities, scholarships, questions, etc.

**AC-TG Website:**
- Also, be sure to check out our updated website at [www.augmentedcognition.org/actg.htm](http://www.augmentedcognition.org/actg.htm)

**AC-TG Group on Linkedin:**