



Human Behavior Modeling

Modeling Human Behavior in Simulated Conflict

Featuring: MOVES Associate Professor Chris Darken



The free play mode of BASE-IT. The user is able to issue commands to soldiers and explore outcomes.

Real Marines and Soldiers understand what is going on in their environment, including what is likely to occur in the near future, and especially where threats may come from. Providing simulated combatants with that same understanding is one of the key goals of Chris Darken's research program. He's involved in a variety of projects that all center on the common denominator of modeling human behavior as accurately as possible in simulations. Below, Chris takes time to highlight some of the important work he's involved in within the MOVES Institute.

Project Focus

My main focus is the detailed computational models of individuals involved in a conflict. The appropriate level of detail varies by application. Modeling of human behavior is the common denominator, but some applications require modeling of cognitive and perceptual processes in addition to the resulting behavior. Two of my larger projects this past year have been modeling Marine fireteams for the behavior synthesis portion of the ONR-funded BASE-IT project and modeling search for human targets in urban environments for TRAC Monterey.

Modeling Objectives

BASE-IT needs behavior modeling to support its training modes (both open ended free play and more focused training). When the user gives a simulated fireteam a command, our behavior models take over and execute it. Hostile entities are completely controlled by behavior models. More realistic search modeling is part of a larger Army effort to improve search and target acquisition models where they have been found to be lacking, especially in urban environments. Warfare and security are fundamentally about human cognition and behavior. Weaponry and operational concepts change relatively quickly, but the principles of human psychology are invariant, at least for practical purposes. Inadequate human modeling is a serious prob-

lem for training applications, like the part of BASE-IT I am working on, because it limits what can be efficiently trained. For analysis applications of the sort that concern TRAC Monterey, the main concern is that the outcomes of a simulation and thus the resulting analysis might be compromised by unrealistic behavior.

Techniques & Software

Both projects are setting a new and higher bar for the detailed modeling of the threat environment of the simulated human. The modeling techniques we are developing are quite general and could be applied in almost any constructive or virtual simulation. Given the enthusiastic response we've seen so far, I expect to see our work applied, emulated, and extended very widely. As far as applications to develop the simulations, we use the Delta3D game/simulation engine extensively. The main BASE-IT application deliverable uses Delta. For search and target acquisition studies, we use Delta to build an experimental stimulus that is exposed to human subjects and also to prototype models of the resulting behavior.

Project Next Steps

Better models for the core human behavior involved in kinetic operations is a long-term (Continued on Page 6)

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**The 9th Annual
MOVES Research Summit
will be held at NPS
July 21-23, 2009**

Keynote Speaker: Dr. John Tangney
*Division Director of the
Human and Bioengineered Systems Division at
the Office of Naval Research*

Research Summit Highlights Include:

- **Keynote Speaker: Dr. John Tangney of ONR**
- **Presentations & Breakout Sessions**
- **Networking Reception with M&S Colleagues**
- **Research Demonstration Night with Professors and Students**

Contact Holly Hatlo, hehatlo@nps.edu, in order to register for the conference.

Don't Miss it!

WHERE TACTICAL MEETS TECHNICAL

Director's Corner: A word from CDR Sullivan

Research Summit

We're pleased to see such a diverse group of registrants this year, reflecting a full spectrum of sponsors, military professionals, academic colleagues and corporate partners. Given our unique capabilities and ambitious goals, the Research Summit is a great opportunity to showcase our research and align our research agenda with our sponsors and associates in the fields of M&S and VE. Thanks in advance to all the participants who have signed up and will be joining us in the important conversation this year. A chief part of the Research Summit this year is the Curriculum Review Working Group. The curriculum review is a significant team effort by Mathias Kölsch and Duane Davis working with Army, Navy, and Marine Corps sponsors. Many thanks for their work to ensure that our academic programs meet sponsor's needs for effective innovators, leaders and managers of next generation

M&S/VE technology.

Current Growth Initiatives

We have the privilege of welcoming three new members to our team. Please join me in welcoming LCDR Paul O'Connor to the MOVES Institute. He will be joining MOVES as our new Deputy Director for the duration of his tour at NPS over the next two years. Our appreciation goes to the OR department (where Paul will retain his teaching duties) and HSI faculty for allowing Paul to work as MOVES Deputy. LCDR O'Connor is a native of Scotland and brings to the table a solid background in the field of Psychology and Training/Evaluation of Human Performance. He's already played a significant role in the preparation and organization of the Research Summit, and we're grateful for his efforts. Just to keep things interesting, we've got another Paul on board, CAPT Paul R. Chatelier (MSC), USN (Ret). He's been involved in a supportive role with MOVES for

several years as our Board of Advisors Liaison, but will now function more specifically as Senior Advisor on Human Sciences Research and Technology Strategy. The third addition is Dr. Bob Wisher. He's the former Director of Advanced Distributed Learning (ADL). Dr. Wisher will be coming on staff as a Research Professor. His expertise in ADL will play a crucial role in propelling MOVES toward reaching a strategic goal of making quality education accessible to M&S students in remote locations. Dr. Wisher will be coordinating ADL outreach efforts from his post on the East Coast.

I look forward to meeting many of you at the Research Summit next week.



CDR Joe Sullivan, Director of the MOVES Institute at NPS.

"The MOVES Institute has helped me support efficient training of warfighters and support the decision making of Commanders in the field."

*-LTC Joerg Wellbrink,
German Armed Forces*



Where Are They Now? Alumni Update

Featuring: LTC Joerg Wellbrink, German Armed Forces

MOVES Alumnus LTC Joerg Wellbrink, German Armed Forces, has the privilege of stating that he received the very first Ph.D. degree from the MOVES Institute in Sept-



MOVES Alumnus LTC Joerg Wellbrink, German Armed Forces, while on tour of duty as OR Analyst in Afghanistan in 2007.

ember 2003. LTC Wellbrink's thesis was on Modeling Human Performance as a Complex Adaptive System. He is now back in Koblenz, Germany spending time with his five children, volunteering as a worship leader at his church and basking in the natural beauty of his hometown (famous for the intersection of two rivers, the Moselle and the Rhine River). LTC Wellbrink is currently working with the German Ministry of Defense (BONN) in a branch that is responsible for the modernization of German Armed Forces IT. He serves as the Deputy Department Head for communication systems, platforms and networks. His role within BONN includes working on the migration toward the new internet protocol 6 (IPv6) for the German Armed Forces. He also contributes to the procurement of new communications systems (i.e. satellite communication systems) and networks. "One major problem in my business is the lack of a system's view for an entire IT system that includes applications platforms, networks and communication systems. It is very difficult to procure new systems, migrate old ones and to foresee the consequences of problems in projects for the system. Fortunately the background in networking from the MOVES curriculum helps me better understand what to do, and more importantly, what not to do!" explains LTC Wellbrink. When LTC Wellbrink graduated from MOVES, he was able to put his newly acquired

modeling and simulation (M&S) skills to use immediately, "When I returned to serve in the German Armed Forces, M&S was only used for training and education. However, when I was deployed as an analyst to Afghanistan, we had a breakthrough using M&S and Operations Research in the field. Together with my team we successfully convinced our Commanding Officers of the value added by M&S specialists. Among other things, we built a 3D model of the camp and its surroundings. We then used shading algorithms to reveal the so-called "dead spots" (areas where our sensors didn't have a line of sight). This model was used to improve the protection of the camp. This achievement opened a lot of doors for M&S specialist personnel. The German Armed Forces now recognizes MOVES and OR graduates as valuable experts and benefit greatly from their skills. M&S specialists are particularly useful offering their skills during deployment; Commanding Officers find their help to be a valuable asset on the field." LTC Wellbrink had a very constructive time during his education at the MOVES Institute, "For me, the MOVES Institute is exceptional in (*Continued Pg. 6*)

Congratulations to Dr. McCauley

MOVES would like to congratulate Dr. Mike McCauley for being counted among the top 5% of NPS faculty in this year's Schiefflin Teaching Excellence Award Poll. Dr. McCauley was among a select few who were nominated by NPS students and alumni as outstanding professors. Dr. McCauley's dissertation students have produced first-rate results, and his master's students have also excelled extraordinarily. It is a privilege to have Dr. McCauley at the MOVES Institute; the diligent work he has contributed to his research and to his students is truly commendable.

Chris McClernon, one of Dr. McCauley's graduate students comments: "Professor McCauley's passion for education and research is only surpassed by his compassion for his students. He tirelessly entertains even the simplest of questions with a rare breadth and depth of knowledge.



MOVES 2009 alumnus MAJ Chris McClernon with his thesis advisors, Dr. Mike McCauley and Dr. Bill Becker. Chris's thesis topic was "Stress Effects on Transfer from Virtual Environment Flight Training to Stressful Flight Environments."

More than a great mentor, advisor, and professor, Dr McCauley is a great person." When asked about his teaching method and what he enjoys about being a professor with MOVES, Dr. McCauley shared: "When teaching I try to bridge the gap between theory and application. Most of our students have served in the field, with their lives on the line. I try to focus on application (*Continued on Pg. 6*)

Congratulations to MAJ McClernon

Congratulations to MOVES Ph.D. graduate MAJ Chris McClernon. He is the recipient of the Spring Quarter AY09 competitive Air Force Association Award for Outstanding U.S. Air Force student. Throughout his time at MOVES, MAJ McClernon has been recognized as a tremendously positive student; focused, diligent, thorough and always willing to offer assistance wherever needed. We will greatly miss his presence at the MOVES Institute, and wish him well in all future endeavors. Dr. McCauley, Chris's thesis advisor, describes Chris McClernon: Chris McClernon is an exceptional scholar and researcher, a motorcycle racer, pilot, husband, father, and a fine human being. His dissertation research was extraordinary. I do not know another person who could have secured the loan of a new aircraft (*Continued on Pg. 6*)

MOVES Faculty Provide Instruction to Senior Army M&S Professionals

By: Curt Blais

The Naval Postgraduate School recently hosted an Advanced Simulation Course for senior-level U.S. Army Modeling and Simulation professionals. Twenty officers and civilians from diverse organizations within the Army attended the two-week course conducted from May 11 to May 22. The course was organized and led by Professor Gene Paulo of the NPS Systems Engineering Department. The course development, conduct, and evaluation were sponsored by Mr. Gary Dahl of the Army Modeling and Simulation Office (AMSO). Several members of the MOVES faculty participated in the instruction:

On the first day of the course, Assistant Professor Mathias Kölsch presented an overview of the M&S Body of Knowledge and MOVES curriculum. He returned on May 21 and 22 to present current trends and challenges in M&S technology, primarily focusing on application of new sensor technologies and hosting a set of demonstrations of MOVES projects by various faculty and students.

On the second day of the course, Research Associate Curtis Blais presented and led discussions on basic M&S concepts, Department of Defense (DoD) M&S governance, emerging DoD tools, and Verification, Validation, and Accreditation (VV&A) standards. He also returned on May 21 to present current challenges and approaches in modeling Irregular Warfare.

On May 21, Research Associate Don McGregor presented M&S networking standards, including Distributed Interactive Simulation (DIS), High Level Architecture (HLA), and Test and Training Enabling Architecture (TENA). He also described technologies supporting compression of Extensible Markup Language (XML) documents and use of massively multi-player online games in DoD.



Instructors and Students from the Senior Army M&S Professional Course
MOVES faculty pictured here include Research Associate Curtis Blais, first row, far right, and Associate Professor Mathias Kolsch, second row, far right (not shown: Associate Professor Chris Darken and Research Associate Don McGregor). MOVES graduates pictured here include COL Steven French, top row, third from left; LTC Craig Unrath, first row, far left; LTC Jason Jones, first row, second from left; and MAJ Glenn Hodges, first row, third from right.

On May 21, Associate Professor Chris Darken presented research challenges in human behavior modeling, including a description of current research in visual target acquisition and knowledge retention in complex natural environments such as urban areas.

Join Us for the MOVES 9th Annual Research Summit!



WHERE TACTICAL MEETS TECHNICAL

MOVES 9th Annual Research Summit July 21-23, 2009

Keynote Speaker:

- Dr. John Tangney,
Division Director of the Human and Bioengineered Systems Division at the Office of Naval Research
- Presentations
- Breakout Sessions
- Research Demonstration Night

Topics include:

Human Systems and Training
Cognitive Agents and Adaptive Systems
Computer Gaming, Visual Simulation, Augmented Reality
Next Generation Simulation for Analysis and Training
Web-Based Simulation and Interoperability
Education for Modeling & Simulation Professionals



Agenda

Tuesday, July 21st

- Meetings and Presentations during the day (8am-4:30pm)
- Evening Reception (4:30pm)

Wednesday, July 22nd

- Meetings and presentations during the day (8am-4:30pm)
- Demo Night of faculty and student projects (4:30-6pm)

Thursday, July 23rd

- Meetings and presentations during the day (8am-11:00am)

Please check the MOVES Institute website for the full agenda:
<http://www.movesinstitute.org/events.html>

NPS Colleagues and Students are encouraged to attend.
Email Holly Hatlo, hehatlo@nps.edu, to sign up!



Taking Flight in Hawaii

Featuring: Dr. Bill Becker

In May, Dr. Bill Becker found himself in Oahu, Hawaii. However, the purpose of his visit wasn't to enjoy a tropical vacation. Rather, Dr. Becker spent many long hours observing and participating in the Unmanned Air Vehicle School, RAVEN B course at the Marine Corps Base at Kaneohe Bay. The training was designated for 1st Battalion, 3rd Regiment (1/3) Marines. There were 12 students during the course, along with Dr. Becker and other Naval Research Laboratory participants. The objectives of the training were to teach the 1/3 Marines how to fly, maintain and combat uses for the UAV. Dr. Becker's work at MOVES involves adapting simulation to fill training gaps in already existing programs. While he was participating in the UAV training, Dr. Becker was taking note of how adding simulated training could the diversity of skills that could be practiced, "By adding simulation, training of skills that marines would only learn in the field, could now

be taught and practiced *before* going to the field, saving time and damaged aircrafts." Now that he's back on the Monterey Peninsula, Dr. Becker is ironing out the specific details of the training paradigm that need to be addressed. He believes simulation training in the following areas could be applied to the UAV training program: learning to observe targets on the ground, night flying, and flying in foul weather conditions, among other things. The program is funded by the Office of Naval Research (ONR). ONR is working to add advanced features to the simulation suite of the Marine Corps DVTE (Deployable Virtual Training Environment) laptop based training system.

Dr. Becker can be reached at:
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A Marine prepares to launch an Unmanned Air Vehicle (UAV) in Kaneohe Bay, Oahu, Hawaii.

Sign Up Today for the 9th Annual MOVES Research Summit!

— Don't Miss Out On This Strategic Collaboration Opportunity! —

Summer Well Spent: Student Interns at MOVES

Featuring: Marina Noguiera

Each Summer, the MOVES Institute hosts student interns for a variety of jobs within the department. It's a mixture of high school and college students who are eager to gain insight and firsthand experience working in a professional academic setting.



MOVES intern Marina Noguiera works on programming two of Dr. Becker's SumoBots.

The students are placed under the guidance of faculty members based on their skill and interest. Such is the case for intern Marina Noguiera, a sophomore at York High. She was assigned to help Dr. Bill Becker when it was discovered that Marina had an interest in biology with an eye toward the medical field. It just so happens that many of Dr. Becker's projects tie in with physiological training of military personnel. Additionally, Dr. Becker is an expert in artillery and robotics. Marina's primary responsibility has been to assemble and program small robots for an upcoming target practice venture. "The robots I have been building are called SumoBots. They are supposed to fight each other, but right now we want them to be able to interact with one another. Eventually, they will be moving targets once they are programmed and all the sensors are working properly," shares Marina. So far it's been an exciting learning experience for Marina. "I'm really happy that I was placed at MOVES. I have been learning the basics of how to program the robots and I have gained more experience with circuits. I've also learned some troubleshooting skills that have been helpful when the robots aren't operating the way we planned." Not only is Marina

gaining hands-on skills with the SumoBots, she's had the opportunity to work one-on-one and dialogue with Dr. Becker about his projects, as well as interact with other MOVES professors and staff.

MOVES is currently employing the following interns: **Shannon O'Halloran** (Senior, Political Science major at University of Chicago); **Eric Helmick** (Sophomore, General Studies major at Monterey Peninsula College; interest in pursuing a degree in English); **Marek Kapolka** (Junior, Computer Science major at San José State University); **Hector Zhu** (Senior, Computer Engineering major at California Polytechnic State University, San Luis Obispo); **Noah Lloyd-Edelman** (Sophomore, Computer Science major, Japanese minor at Cal State University Monterey Bay); **Derek Davidson** (Freshman, Secondary Education major at Baylor University); **Kathryn Harkins** (Senior, Monterey High School; interest in pursuing a degree in marine biology, art and photography); **Zack Nissen** (Freshman, Computer Science major at University of California Santa Cruz; interested in Engineering/Video Game Design) and **Trevor Daunt** (Sophomore, University of Santa Barbara, interest in pursuing a degree in Economics/Engineering).

(McCauley, continued from Pg. 3)

so we can make safer and better systems for our students to use. I hold a great respect for students; I view them as colleagues and professional associates. I greatly enjoy working with students, and that's why I took on 6 dissertation students at one time this past year (I've learned my lesson to never do that again! Though they all finished well and on time). Other aspects of my job that are satisfying include working with the people in this department; teaching international students (their capability and excellence in writing English astounds me. I can't imagine teaching in Greek!); and teaching distance learning students (it's very satisfying when I receive an email that one of the students was able to immediately apply what they learned in class for a new program they're working on)."

(McClernon, continued from Pg. 3)

from Travis AFB, convinced a commercial software company to modify their code, managed two Certified Flight Instructors, revised the procedures of Monterey Air Traffic Control, and collected all data from the back seat of an aircraft. Chris is the most positive person I have ever had the pleasure to work with in my four decades of experience. He has an unsurpassed combination of exceptional competence and exceptional people skills. It has been an honor to serve as his Dissertation Advisor and Committee Chair.

****Congratulations also on the new addition to MAJ McClernon's family, a healthy baby boy born on July 14, 2009!****



**Length of Service Awards for MOVES Faculty
10, 15 and 20 years of exceptional service!**

Three MOVES professors received *Length of Service Award* pins for their dedication.

Dr. Bill Becker was recognized for **10** years of service; Dr. Arnie Buss received a pin for **15** years of service; and Dr. Tony Ciavarelli was given a pin for **20** years of service. We're grateful to have these outstanding members on the MOVES team!

Left to Right: Arnie Buss, Bill Becker and Tony Ciavarelli

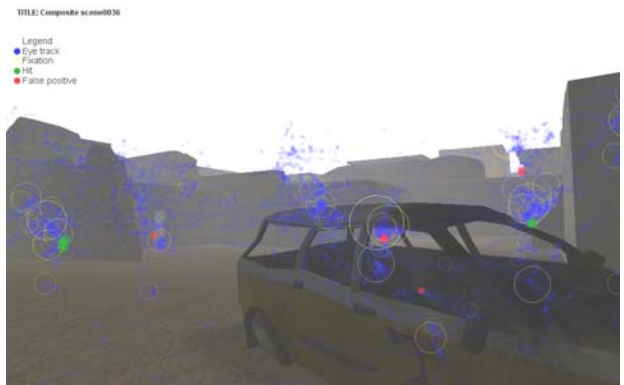
(LTC Wellbrink, continued from Pg. 2)

many ways. First, I think the multidisciplinary approach within the MOVES curriculum aids progress in problem solving and encourages personal growth. Secondly, the MOVES strategy of combining the skills of academics, industry and military is beneficial for all sides. Militarily, state-of-the-art-technology is being used for warfighters on the right problems. Academically, it helps focus research on the most critical areas. For industry, it is helpful because MOVES can better understand their customers since military personnel 'speak their language'. Lastly, I enjoyed the work climate within the Institute. Professors seemed to be truly interested in student progress and were willing to learn along with the students. This positive attitude throughout the faculty helped me shape my skills in a supportive yet challenging environment. It also helps that Monterey is the most beautiful place on earth! Overall, my experience at the MOVES Institute has had a positive impact on my career. It's helped me to support efficient training of warfighters and support the decision making of commanders in the field. And I'm grateful to say that now the skills of German MOVES and OR graduates are better utilized than ever before in the German Armed Forces IT. I am very thankful that I acquired many skills that I can utilize no matter where I serve."

Darken, Continued from Pg.1

project that we hope to continue to contribute to. On the other hand, Human Social Culture Behavior (HSCB) is an important new frontier for behavior modelers. I'm currently working on getting NPS organized to contribute to new research programs in this area. The DDR&E HSCB program objectives are to integrate and demonstrate a validated, human terrain forecasting modeling approach that enables the examination of second, third, and higher order effects of kinetic and non-kinetic actions within a theater in support of Effects Based Operations; demonstrate the feasibility of integrating HSCB process and software into strategic level conflict resolution and regional stability planning tools; and integrate and demonstrate training technologies to deliver socio-cultural understanding and skills needed for individuals and small units in current and future military operations.

If you are interested in learning more about Chris Darken's projects, please visit his webpage, <http://faculty.nps.edu/cjdarken/>.



Experimental data on multiple subjects showing where the eye dwells in the scene. Data then modeled for use to drive a software agent in a simulation.