

DTIC Current Awareness: July 2003

Calfee, S. H. (2003). *Autonomous Agent-Based Simulation of an AEGIS Cruiser Combat Information Center Performing Battle Group Air Defense Commander Operations*. Monterey, CA: Naval Postgraduate School. (DTIC No. ADA414842)

<http://handle.dtic.mil/100.2/ADA414842>

Abstract: The AEGIS Cruiser Air-Defense Simulation is a program that models the operations of a Combat Information Center (CIC) team performing the ADC duties in a battle group using Multi-Agent System (MAS) technology implemented in the Java programming language. Set in the Arabian Gulf region, the simulation is a top-view, dynamic, graphics-driven software implementation that provides a picture of the CIC team grappling with a challenging, complex problem. Conceived primarily as a system to assist ships, waterfront training teams, and battle group staffs in ADC training and doctrine formulation, the simulation was designed to gain insight and understanding into the numerous factors (skills, experience, fatigue, aircraft numbers, weather, etc.) that influence the performance of the overall CIC team and watchstanders. The program explores the team's performance under abnormal or high intensity/stress situations by simulating their mental processes, decision-making aspects, communications patterns, and cognitive attributes. Everything in the scenario is logged, which allows for the reconstruction of interesting events (i.e. watchstander mistakes, chain-of-error analysis) for use in post-scenario training as well as the creation of new, more focused themes for actual CIC team scenarios. The simulation also tracks various watchstander and CIC team performance metrics for review by the user.

Cooke, J. A. (2003). *Manpower Requirements Determination in the Institutional Army*. Carlisle Barracks, PA: Army War College. (DTIC No. ADA414538)

<http://handle.dtic.mil/100.2/ADA414538>

Abstract: Unlike the program used to determine manpower requirements for the Army's war-fighting forces, which is doctrine based, reliable, and responsive to changes in strategic direction, the workload based manpower requirements determination program of the institutional Army has been declared a material weakness. This paper examines the history of the institutional Army's program in an attempt to identify key problems and makes recommendations to make the program more responsive to the Army's strategic decision process.

Ito, M. A., Sharp, M. A., Johnson, R. F., Merullo, D. J. and Mello, R. P. (1999). *Rifle Shooting Accuracy During Recovery from Fatiguing Exercise (Report No. P00-73)*. Natick, MA: Army Research Institute of Environmental Medicine, Military Performance Division. (DTIC No. ADA414374)

<http://handle.dtic.mil/100.2/ADA414374>

Abstract: The effect of aerobic exercise on rifle shooting accuracy was studied in a repeated measures design. Nine men (22.5 +/-5.7 yrs.) and 3 women (21.0 +/-4.4 yrs.) active duty soldiers were tested. The volunteers were randomly subjected to 2 types of exercise until voluntary exhaustion: marching with backpack loads and running on a treadmill. Each exercise type had 3 randomly assigned exercise levels for a total of 6 exercise conditions (running at 70%, 80%, and 90% of VO₂max, and marching with a 23.3kg, 35.2kg, and 48.8kg backpack load). Pre and post-exercise shooting accuracy was assessed by means of the Rapid Firing Test (RFT) conducted on a Weaponeer M16 Marksmanship Simulator using a standing, sandbag supported firing position. The RFT consists of shooting at a series of 6 sets of 12 pop-up targets randomly introduced for 2 seconds each at simulated distances of 175m and 300m. Each RFT series started immediately after exercise and ended within 13 minutes post exercise. Running and load carriage exercises each had a significant effect on shooting accuracy immediately following exercise. The number of hits dropped from 7.3 +/- 1.43 to 5.4 +/-1.27 for running $F(5,55)=4.7, p<0.05$, and from 8.5 +/-1.68 to 6.8 +/- 2.09 for load carriage $F(5,55)=4.6, p<0.05$. Shooting accuracy returned to pre-exercise levels by the 2nd set of RFT (at 1.5 minutes post exercise). Conclusion: The results demonstrate that fit soldiers can rapidly recover shooting accuracy following intense exercise. Human performance researchers should consider the quick post exercise (or work activity) recovery response when assessing exercise-induced changes in psychomotor performance, such as rifle shooting.

Kardos, M. and Chapman, T. (2003). *Constrained Planning and Wargame Performance in Military and Civilian Teams (Report No. DSTO-GD-0352)*. Salisbury, Australia: Defence Science and Technology Organization, Systems Sciences Lab. (DTIC No. ADA414451)

<http://handle.dtic.mil/100.2/ADA414451>

Abstract: The TLCAC study, conducted during January 2001, involved two military and three civilian teams conducting planning activities under time constraint and fighting a battle with a designated enemy using the Janus wargame. This report outlines the planning behaviours observed in military and civilian participants, and briefly discusses their possible relation(s) with the wargame outcomes. It is concluded that the current behavioural results show a stronger association with the Recognition Planning Model than the military appreciation process,

indicating a need for further work in the area and a consideration of the foundation model of planning used.

Mills, V. (2002). *The Effects of Information Technology on Intra-Human Communication in the Workplace (Report No. DSTO-GD-0347)*. Salisbury, Australia: Defence Science and Technology Organisation, Systems Sciences Lab. (DTIC No. ADA414916)

<http://handle.dtic.mil/100.2/ADA414916>

Abstract: The aim of this report is to summarize key aspects of human interaction that may be affected by the introduction of the Battlefield Command Support System (BCSS) to the Australian Army. Specific areas of analysis include the social nature of knowledge, implicit communication processes, and team processes. There is also discussion of common misperceptions regarding the promise of computers, and successful and unsuccessful methods of introducing new technology in relation to human interaction. It is concluded that successful design and integration of BCSS requires a deep understanding of the implicit aspects of human behavior, and the contribution of the social fabric. A series of suggestions on how this could be achieved is provided.

Mulgund, S., Stokes, J., Turieo, M. and Devine, M. (2002). *Human/Machine Interface Modalities for Soldier Systems Technologies (Report No. 71950-00)*. Cambridge, MA: TIAZ LLC. (DTIC No. ADA414918)

<http://handle.dtic.mil/100.2/ADA414918>

Abstract: The Army's Objective Force Warrior program seeks to create a lightweight overwhelmingly lethal fully integrated individual combat system. This includes weapon, head-to-toe individual protection, networked communications, soldier-worn power sources, and enhanced human performance. Achieving this objective will in part entail the development of soldier-centric human/machine interfaces (HMIs) that optimize cognitive fightability. Such optimization is possible only if these HMIs are designed in such a way that takes into account the nature of human information processing and cognition. This in turn depends on understanding how best to use the senses by which humans perceive their environment and the means by which they can affect it; i.e., the modalities for human/machine interaction. Traditional approaches to HMI design have centered on the use of visual displays and manual inputs, but these do not take advantage of the full range of means by which humans can perceive and interact with their environment. This report reviews the literature on human/machine interface modalities. It also provides guidelines for system designers to consider when

choosing which modalities should be considered in a system intended to augment human cognitive performance.

Nafarrete, R. B. (2003). *Factors Affecting Organizational Performance NRD San Diego FY 1997-2000: A Systems Analysis*. Monterey, CA: Naval Postgraduate School. (DTIC No. ADA415015)

<http://handle.dtic.mil/100.2/ADA415015>

Abstract: This thesis is a descriptive, comparative organizational analysis of Navy Recruiting District, San Diego during two time periods: Fiscal years 1997-1998 and 1999-2000. The purpose of this study was to determine those factors affecting organizational performance in the primary area of Enlisted Recruiting production of the district in both time periods using a systems analysis. Based on model comparisons, document reviews, interviews, and personal communications with the leaders, supervisors and recruiters of NRD San Diego, analysis indicates that the district of FY97-98 was ill-equipped in strategy, resources and processes to perform effectively in a more demanding environment. The heightened goal requirements and increased number of recruiting personnel placed on all recruiting districts between 1997 and 1998 exposed NRD San Diego's system weaknesses, resulting in lower indicators of successful performance. The FY99-00 district appeared to handle change better including higher indicators of successful performance such as process improvements, energetic leadership, flattened communication and work flow structures and a well-defined direction. The district's enlisted production performance improved from 1997 to 2000.

Oeltjen, C. L. (2003). *A Comparison of Computational Cognitive Models: Agent-Based Systems Versus Rule-Based Architectures*. Monterey, CA: Naval Postgraduate School, Modeling Virtual Environments and Simulation. (DTIC No. ADA415186)

<http://handle.dtic.mil/100.2/ADA415186>

Abstract: Increased operational costs and reductions in force size are two of the major factors driving the need for improved computer simulations within the military community. Human performance models are used in various aspects of simulation, including the control of computer-generated forces, as tactical decision aides, in intelligent tutoring systems, and in new system design. This research compares two categories of human performance models: multi-agent systems and rule-based architectures. Each model has its own strengths and weaknesses and is best suited for certain applications. Complex military simulations need human performance models that take advantage of the

strengths of more than one type of model. This study compares the implementation and performance of these two models, and demonstrates the need for hybrid systems that employ the best aspects of each for a given situation. The thesis is organized as follows: Chapter II discusses the background of naturalistic decision making and provides overviews of the following computational cognitive architectures: Adaptive Control of Thought-Rational (ACT-R); Soar; COGnition as a NETwork of Tasks (COGNET); Java Expert System Shell (JESS); Operator Model ARchitecture (OMAR); Micro Saint; Neural Networks; and Agent-Based Systems. In Chapter III, the two models are applied to the decision making problems of the Officer of the Deck onboard a submarine as he maneuvers the vessel to carry out the assigned mission. His highest goals are to avoid running aground, to avoid colliding with another vessel or stationary navigation hazard, to remain within the assigned operating area boundaries, and when these safety goals are met, to carry out the assigned mission. Chapter IV discusses the application of the agent-based model to the problem, and chapter V discusses the application of the rule-based model to the problem. Chapter VI compares the two models. Chapter VII provides conclusions and recommendations for future work.

O'Toole, A. J. (2003). *Person Identification from Video with Multiple Biometric Cues: Benchmarks for Human and Machine Performance (Report No. TR-6300261)*. Dallas, TX: Texas University at Dallas, Richardson School of Human Development. (DTIC No. ADA415169)

<http://handle.dtic.mil/100.2/ADA415169>

Abstract: We have compiled a database of images and videos that includes images and videos of approximately 300 human participants. Duplicate sets of images and videos taken from 1 week to 6 months after the first set are available for approximately 200 of these people. The images include 9 standard "mug shot poses". The videos include head rotations, dynamic facial expressions, facial speech clips, and 3 whole-body gait clips. Experiments have been completed comparing the effects of several types of facial motion on face recognition, the effects of face familiarity on recognition from video clips taken at a distance, and on the effects of attention on recognition of moving faces. The results of these studies provide insight into the way motion can facilitate or interfere with the encoding of the invariant face and body features that support recognition.

Rostad, R. J., Rash, C. E., Briley, J. K., Mora, J. C. and Crowley, J. S. (2003). *Analysis of Head Motion in Rotary-Wing Flight Using Various Helmet-Mounted Display Configurations (Part I. Azimuth) (Report No. USAARL-2003-07)*. Fort Rucker, AL: Army Aeromedical Research Lab. (DTIC No. ADA414823)

<http://handle.dtic.mil/100.2/ADA414823>

Abstract: In spite of an immense increase in interest in helmet-mounted displays (HMDs) over the past two decades, there have been few studies on head motion while using HMDs in operational flight Rotary-wing flights conducted using a number of HMD configurations have resulted in a head position database that will be useful in filling this void. Azimuth head position data have been analyzed for a slalom flight maneuver for four visual environments: good visual environment (daytime, unaided), night vision goggles, HMD with thermal imagery, and HMD with thermal imagery and symbology. The major thread throughout these analyses was that the pilots exhibited greatest head motion for the NVG environment. The two HMD configurations (TIO and RWS) were very similar in exhibited head motion, not indicating any significant differences between the TIO FLIR imagery alone and the RWS FLIR imagery plus symbology. Based on this analysis of the head azimuth position data, it is concluded that the interquartile range IQR (or some other IQR) dispersion statistic is a good discriminator between the head position distributions for the four visual environments. For all subjects, the IQR for the night vision goggle visual environment was larger than for the other three visual environments. Likewise, the IQR for good visual environment was always the second largest. The IQR values for thermal imaging only and rotary wing symbology, the most closely related visual environments, vie for third and fourth ranking.

Swain, K. and Mills, V. (2003). *Implicit Communication in Novice and Expert Teams (Report No. DSTO-TN-0474)*. Salisbury, Australia: Defence Science and Technology Organisation, Systems Sciences Lab. (DTIC No. ADA414280)

<http://handle.dtic.mil/100.2/ADA414280>

Abstract: The current study aimed to pilot a methodology for measuring implicit communication processes in novice and expert teams. To achieve this, implicit communication in expert teams (civilian and military) was compared with novice teams performing the same task. Analysis showed that expert teams, or those that have worked together previously, use more implicit communication strategies to achieve team goals than novice teams, regardless of their area of expertise (military, sporting or business teams). This suggests that expert teams may be utilising shared mental models of both the roles of their teammates and how they should be working together in a group situation. The researchers conclude that the training of military teams in the roles and responsibilities of their teammates is an important issue for the Australian Defence Force. This is particularly the case where teams are physically distributed across the battlespace.

Tokgoz, A. (2003). *A Hypermedia Representation of a Taxonomy of Usability Characteristics in Virtual Environments*. Monterey, CA: Naval Postgraduate School. (DTIC No. ADA415046)

<http://handle.dtic.mil/100.2/ADA415046>

Abstract: The goal of much work in Virtual Environments (VEs) to date has been to produce innovative technology but until recently, there has been very little user-centered, usability-focused research in VEs that will turn interesting applications into usable ones. There is beginning to be at least some awareness of the need for usability engineering within the VE community. A handful of articles address usability concerns for particular parts of the VE usability space. From this point Gabbard and Hix 1997 has proposed a taxonomy about usability characteristics in VEs to help VE usability engineers and designers. This taxonomy can be used to learn characteristics of VEs or to develop usability-engineering methodologies specifically for VEs. In this study, we built hypermedia representation of the taxonomy and evaluated the effectiveness of the user interface by using scenario based formative usability engineering method that developed by Hix and Hartson 1993. First, we discussed the need for usability engineering for VEs and took a look at a proposed usability engineering methodology Gabbard and others, 1999 for VEs. Second we implemented hypermedia based web-site taxonomy and then evaluated it iteratively. Last, we added a new study to show the dynamic nature of web-site application.

Vaughan, D. S. and Bennett, W., Jr. (2002). *Toward a Unified Theory of Work: Organizational Simulations and Policy Analyses*. San Antonio, TX: McDonnell Douglas Corporation. (DTIC No. ADA414497)

<http://handle.dtic.mil/100.2/ADA414497>

Abstract: The military environment is constantly changing and restructuring. Manpower, personnel, and training (MPT) planning and management is increasingly crucial to maintaining the mission readiness of the forces. The Department of Defense needs an integrated MPT planning and management system. We believe that a unified theory of work is needed to provide a framework and to guide and focus related research and development. This unified theory of work will connect theories of human traits and states, theories of task and job characteristics, theories of job/task performance, and perhaps theories of organizational behavior. For example, Mitchell and Driskill (1986, August), in *Optimizing Integrated Personnel System Training Decisions and Development*, presented at the *State-of-the-Art Applications of Job Analysis: Integrated Personnel Systems*, a symposium conducted at the American Psychological Association convention, in Washington, DC, proposed a theory that relates training to task performance,

via a series of intervening and exogenous variables. Such a theory could be extended to encompass individual differences among workers and tasks, as well as key organizational and environmental variables. This paper explores key issues associated with a unified theory approach to MPT modeling and decision-making. Further, basic research and development needs required for such an integrated approach are highlighted and discussed.