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Soldier-Centered Design Tools: Recent Developments, Challenges, and Paths Forward

By John K. Hawley, John F. Lockett, & Laurel E. Allender

In this article, we discuss recent human systems integration (HSI) tool development work and applications within the Future Combat Systems (FCS) program at the U.S. Army Research Laboratory’s (ARL) Human Research and Engineering Directorate (HRED). The goal of this program is to develop a set of tools applicable to individual platforms and system of systems (groups of systems working together) operability analyses and skilled manpower analysis and forecasting for emerging Army systems.

Background

From its inception in the mid-1980s as the Army’s HSI initiative, MANPRINT (Manpower and Personnel Integration) has subsumed two human performance-related thrusts: operability and supportability. Operability addresses the viability of a conceptual system, including the soldiers who will use it, and typically has a single-system focus. Supportability looks at associated manpower, personnel, and training requirements and the service’s ability to meet these requirements.

Increasing rates of technological change and changes in the world scene have altered the traditional landscape of systems acquisition. System and doctrinal complexity have increased dramatically. The standard operating procedures of warfare (in other words, the rules of warfare) are increasingly dynamic and situation dependent. Old ways of understanding organization are no longer dependable. Moreover, new technology and doctrinal concepts such as network-centric warfare require new organizational forms to deliver promised performance. For example, an M1 Abrams tank could replace an M60 tank, and the organization will remain an armored unit. But when a mechanized brigade is upgraded into a Stryker Brigade Combat Team, or later into an FCS-equipped unit of action, the resulting organization is not a mechanized brigade in the traditional sense. The combat team now has different personnel requirements, capabilities, and vulnerabilities and must be led in very different ways to achieve its intended performance. It can be argued that we now field new teams as well as new systems in the traditional sense.

The changing world faced by concept and materiel developers directly affects the HSI arena. We can no longer be preoccupied with single-platform usability and supportability. Rather, we must address the human performance demands inherent in systems

of systems in which interaction effects begin to dominate. (Such systems-of-systems concerns might include understanding the complex interactions across combat platforms and among suites of communications sensors, processors, relays, and their operators.) Similarly, our former supportability analyses must now deal with the dynamic viability of support components and their potential costs. Addressing this latter issue requires us to address organizations as systems and be able to model major functional slices of units.

Recent HSI tool development work sponsored by ARL is particularly important in understanding the focus of these organizational concerns. Central to this work is ARL’s flagship task network modeling tool, IMPRINT (Improved Performance Research Integration Tool), and several complementary modeling capabilities, including C3TRACE (Command, Control, and Communications: Techniques for the Reliable Assessment of Concept Execution) and the IMPRINT Maintenance Model (IMM).

ARL’s HSI Tool Set

IMPRINT. IMPRINT is arguably the most powerful of the Army’s HSI tools developed over the past two decades. It is a Windows-based, dynamic, stochastic, discrete event-modeling framework. When certain assumptions hold – that is, when the system of interest can be adequately described by task activities and networked sequencing, when dynamic processes and random variability are of interest, and when any continuous tasks can be fairly transformed into discrete tasks – then IMPRINT is an appropriate tool to use to represent and analyze soldier-system performance. As a system design and acquisition support tool, IMPRINT can be used to help set realistic system requirements, to identify soldier-driven constraints on system design, and to evaluate the capability of available manpower and personnel to effectively operate and maintain a system under environmental stressors. IMPRINT is also used to target human performance concerns in system acquisition, to estimate user-centered requirements early, and to make those estimates count in the decision-making process.

As a result of congressional interest in HSI tools, collaboration in the Department of Defense (DoD), and the need to model system-of-systems-level performance, IMPRINT capability has grown dramatically over the past several years. Among other

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(continued from page 1)

improvements, it now incorporates capability derived from the Air Force's Combat Automation Requirements Testbed program. As a result, IMPRINT users can develop models of human performance and integrate them with models of military weapons systems via external model calls using communication protocols such as those specified in higher-level architecture. For example, the Air Force used an IMPRINT pilot model to control a simulated F-16 fighter through external model calls. When simulated pilot actions were called for, these inputs were obtained externally from the IMPRINT pilot model shadowing the F-16 simulation. The two models work collaboratively using specified communications protocols; IMPRINT models can "talk" to other IMPRINT models, simulations, or simulators. Similar to human-in-the-loop simulations, we can now have IMPRINT-in-the-loop simulations.

IMPRINT has grown so complex that it was necessary to package it as two separate products: IMPRINT Standard and IMPRINT Pro. IMPRINT Standard is tailored to entry-level users with routine analysis questions. IMPRINT Pro will be designed for expert-level users with some programming background and an interest in modeling workload theory, goal-oriented behavior, system of systems, and joint service applications. Menu items, underlying human performance algorithms, and data have been structured to facilitate DoD-wide use of IMPRINT Pro.

Collaboration with the Navy's Systems Engineering Acquisition and Personnel Integration program resulted in the relation of operator knowledge, skills, and abilities from the SkillsNET taxonomy (a standardized characterization of what a person must be able to know and do to perform a job and the personal attributes he or she must bring to the training or job setting) to task attributes modeled in IMPRINT. Combined with existing IMPRINT personnel predictions, the matching ensures that trade-offs among system design, personnel, and manpower can be quantified.

C3TRACE. The Army's future soldiers will be the centerpiece of a networked system. For this concept to become a reality and not another case of information and cognitive overload, HSI analyses must broaden from an examination of the soldier-system interface to the soldier-information interface. The name of this modeling and analysis tool, C3TRACE, captures the following intent: to be able to trace the flow of communications through a

unit's command and control (C2) structure in proposed future force concepts. The tool provides an environment for evaluating the effects of different configurations of soldiers and information technology on performance.

C3TRACE can represent any organizational level, the people assigned to it, the tasks and functions they will perform, and the communications patterns within and outside the organization – all as a function of the frequency, criticality, and quality of incoming information. C3TRACE can be used to identify communication bottlenecks, workload peaks, and decision-making vulnerabilities so that the combined effectiveness of a proposed configuration can be assessed and changes to the organizational structure or information technology design recommended.

IMM. The IMM was designed to predict the maintenance personnel hours by Military Occupational Specialty (MOS) needed to attain acceptable levels of system availability. Its application provides insight into issues such as the number of soldiers needed per MOS to meet system availability requirements, subsystems that are high drivers for maintenance, the sensitivity of maintenance personnel hour requirements to failure rates of individual components, the impact of maintenance organizational staffing levels, and the impact of system-sparing procedures.

The IMM is a sortie-oriented model. Systems with a stated reliability and maintainability profile are "sent" on missions defined by a scenario. As a consequence of mission-related usage, these systems require both scheduled and unscheduled maintenance. Maintenance requirements trigger a set of demands on the repair system: the parts inventory and the manpower pool. The time to return a system to service depends on factors such as spare parts and manpower availability, location, mean times to repair, and diagnostic support capabilities. In essence, the IMM permits users to explore the relationship between a system's support structures and operational availability under a specified mission scenario.

Future Combat Systems Applications

IMPRINT. The focus of the Army Research Laboratory's IMPRINT work within the Future Combat Systems program has been the combat vehicle crew size problem. Current requirements for FCS combat vehicles call for them to be C-130 aircraft-deployable, which means the FCS combat vehicle's weight and size must not exceed what can be safely loaded aboard a C-130 cargo plane. This requirement places serious restrictions on the size and weight of FCS vehicles, and one way to reduce size and weight is to use fewer crew members. HRED is working with the FCS program manager to determine the minimum number of crew members necessary to provide an operationally capable platform, to balance deployability concerns with crew workload and potential effectiveness.

One of the recently completed FCS applications was a crew size analysis for a high-technology armored combat vehicle, with control of unmanned assets as a new crew function. We are addressing crew size and functionality requirements necessary to support operations on the move using next-generation C2 vehicles.

C3TRACE. Current applications of C3TRACE include an evaluation of FCS staff structure concepts at the company level and below (consisting of about 160 soldiers). Under the emerging FCS concept, it is assumed that technology enhancements will enable the "push-down" of responsibilities to lower-level units.



Bulletin

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The objective of these analyses is to determine how to use technology to support the information-processing demands associated with new operational concepts at the company level in the absence of a dedicated support staff.

IMM. Recent applications of the IMM have addressed maintenance issues within the Stryker BCT. The modeling results, based on preliminary operational test data, indicated several potential areas of maintenance overload that could be addressed by adding maintainers or redistributing the maintenance workload. Our continuing work will better translate traditional maintenance workload metrics such as mean times to repair and maintenance manhours into maintenance force structure requirements.

The IMM permits analysts to better determine the required size and composition of a maintenance work group by considering potential work settings and areas of operation.

Conclusion

The Army Research Laboratory is not in the business of designing weapons platforms or developing unit designs for new systems. Our role is to assess the viability of proposed platform concepts and organizational designs from a human-performance perspective and recommend options. Concept and system developers must understand the downstream consequences of system design and force structure decisions before committing to a choice that may not provide desired operational capabilities. Further, obtaining early and accurate estimates of skilled manpower requirements will also provide the Army with a valid basis for forecasting personnel and training costs and highlighting potential affordability problems.

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IEA

IEA Fellow Nominations Open

The International Ergonomics Association (IEA) invites HFES members to recommend candidates for the IEA Fellow Award. The IEA Fellowship was created to recognize extraordinary or sustained, superior accomplishments of an individual to the ergonomics profession or discipline at an international level. To be considered for the award, nominees must meet two eligibility criteria: (a) international service (including such activities as service to IEA, an extensive publication record in international journals, international consulting, or service to the United Nations and similar organizations) and (2) membership in an IEA federated (e.g., HFES) or affiliated society for at least 10 years. A list of past recipients can be found at the IEA Web site, <http://www.iea.cc>. The deadline for submissions is *May 15, 2005*.

If you would like to recommend an HFES member for this award, please contact Executive Director Lynn Strother (lynn@hfes.org) as soon as possible.

Human Factors on CD-ROM

Members and subscribers who opted for the online version of *Human Factors* last year were recently mailed a CD-ROM containing the papers from the 2004 volume in PDF format. The CD is complimentary for online subscribers. We have 160 copies left and are offering them for purchase, even if you already have this volume in print or were an online subscriber. The cost is \$90 for members and \$230 for nonmembers.

The CD-ROM, originally intended merely for archival purposes, might be considered as an additional delivery format if it is well received. The CD is different from both the print and online versions of the journal. Unlike the print version, it does not include the Editorial Board page and end-of-volume indexes. Unlike the online version, references are not linked. However, you can do keyword searches of the journal content on the CD.

Please send orders with payment (check payable to Human Factors and Ergonomics Society, MasterCard, VISA, or American Express) to HFES, P.O. Box 1369, Santa Monica, CA 90406, 310/394-1811, fax 310/394-2410, membership@hfes.org.

Online *Human Factors* Moves to New Hosting Service

Effective with the Spring 2005 issue of *Human Factors: The Journal of the Human Factors and Ergonomics Society*, members will be able to access the online version from our new vendor, Ingenta. The spring issue will be posted in late April.

This change of vendors has three advantages:

- *Easier access:* Use the same username and login ID (membership number or custom password) that you now use to access the members-only area of the HFES Web site. When you log in with your HFES username and login ID, you will be immediately recognized as an authenticated user.
- *Better communication with members:* You will receive all notifications about newly available issues directly from HFES. This may help to avoid previous difficulties with spam filtering.
- *Embedded reference linking:* Each paper's reference list is included in the PDF file with the rest of the paper, not in a separate list. Reference links are also embedded in the PDF file.

ERRATUM

In the March issue of the *HFES Bulletin* (Volume 48, Number 3), an incorrect address was given for the HFES Book Drive. Books may be donated to HFES Book Drive Coordinator Michael Curtis, University of Central Florida, Team Performance Lab, 3100 Technology Prkwy., Ste. 100, Orlando, FL, 32826, 407/921-3561, m_curtis@earthlink.net.

Cognition in Context Submissions Sought

HFES's new *Journal of Cognitive Engineering and Decision Making* invites submissions for the Cognition in Context track.

Researchers whose work could be considered cognitive field research now have a continuing opportunity to publish in a peer-reviewed outlet. Papers in the Cognition in Context track will appear in every issue of the new journal. The track will highlight empirical studies and conceptual analyses that grapple with the hard-to-define, difficult-to-study, and sometimes unique realities that confront humans as they attempt to conduct cognitive work in complex environments. This includes studies of domain-embedded knowledge and reasoning using methods of cognitive task analyses, ethnomethodology, historiography, cognitive work analyses, and knowledge elicitation.

This track will afford researchers in diverse disciplines a venue for publishing studies in which the research involves considerations of ecological representativeness or salience. At the same time, research can have broader implications for theory (epistemological utility and generality). The track will also give researchers in many disciplines a place to publish methodological investigations – conceptual and empirical evaluations of methods for the study of cognitive work in context – and a place to publish theoretical analyses, including notions of systems, emergence, macrocognition, and complexity.

Studies of cognitive work in context can focus on situation awareness, problem finding, re-planning, uncertainty management, sensemaking, expertise, adaptation, coordination, metacognition, and other macrocognitive functions. Research conducted for a variety of purposes is appropriate, not limited to the development of human-centered, user-centered, or decision-centered technologies and training methods.

The Cognition in Context track seeks reports on domains including but not limited to aviation, air traffic control, process control, transportation, manufacturing systems, maintenance and diagnostic systems, system design, medical and emergency services, teleoperations and supervisory control, command and control, and military systems.

For more information about the Cognition in Context track of the *Journal of Cognitive Engineering and Decision Making*, contact Robert R. Hoffman at rhoffman@ihmc.us. All manuscripts should be submitted electronically to Editor in Chief Mica R. Endsley at cedm.journal@satechnologies.com.

Upcoming issues of the *HFES Bulletin* will feature calls for the other two tracks of the *Journal of Cognitive Engineering and Decision Making*. Design of Cognitive Systems track editor David D. Woods may be reached at woods.2@osu.edu. David B. Kaber, editor of the Studies in Simulations and Synthetic Environments track, may be contacted at dbkaber@unity.ncsu.edu. ☒

On-Line Human Factors Awareness Course

The Federal Aviation Administration (FAA) has developed an on-line Human Factors Awareness Course that can be accessed at <http://www.bf.faa.gov/Webtraining/index.htm>. The purpose of this 10-module course is to introduce human factors concepts and methods, specifically to product team members supporting system acquisitions. The goal is to foster an understanding of the role and contribution of human factors research and engineering in system design, development, and implementation. The course is available to the public and is being used by some organizations and universities in introductory human factors courses. ☒

ANNUAL MEETING

Call for Student Volunteers

The HFES 49th Annual Meeting Host Committee invites full-time students to serve as student volunteers for the HFES 49th Annual Meeting in Orlando, September 26–30, 2005. Student volunteers perform many essential functions and help to ensure that the annual meeting runs smoothly.

To volunteer, please send the following information to the address below:

- Complete contact information: address, telephone, and e-mail address
- Your department, university, and current course load (must be full-time according to your university's definition)
- Your first, second, and third choices from the list of key areas given below
- Anticipated date of arrival at and departure from the meeting.

Address requests to Director of Member Services Carlos de Falla, HFES, P.O. Box 1369, Santa Monica, CA 90406-1369, 310/394-1811, fax 310/394-2410, carlos@hfes.org.

Help is needed in the following key areas: **workshops** (September 26), the **On-Site Job Fair at HFES Placement Center** (September 26–29), the **registration desk** (September 26–29), **daily on-site newsletter** (September 26–28), and **poster sessions** (September 27–29).

You may request assignments in specific areas, and every effort will be made to ensure you receive your first or second choice. About 60 student volunteers are needed. A limited number of reduced-rate hotel rooms will be available, so early student volunteer signups and annual meeting registration are strongly encouraged. (The early registration deadline is *August 26, 2005*.) Volunteer slots are limited and will be accepted on a first-come, first-served basis.

First preference will be given to HFES Student Affiliate members. Assignments will be made and instructions sent prior to the

ANNUAL MEETING, cont.

meeting. A student volunteer room will be available at the headquarters hotel for checking in for assignments, networking with other students, and obtaining signatures for completed work.

Students who volunteer for eight hours will receive a reimbursement of the full registration fee, and those who volunteer for four hours will be reimbursed half the registration fee. Refunds are processed after the meeting.

Display Educational Materials

During the HFES 49th Annual Meeting, representatives of graduate and undergraduate programs in human factors/ergonomics are invited to display brochures, applications, and other materials at an exhibit booth hosted by the HFES Education Technical Group and the Student Affairs Committee. The booth will not be staffed, but program representatives who wish to be present during exhibit hours may do so (limited to four people in the booth at any given time). HFES will provide a DVD player and monitor for those who wish to run DVDs or CDs promoting their programs.

The exhibit will be open on Tuesday, September 27, from 3:00 to 6:00 p.m.; on Wednesday, September 28, 9:00 a.m. to 6:00 p.m.; and on Thursday, September 29, 9:00 a.m. to 2:30 p.m. Any leftover materials must be picked up during teardown hours (Thursday, 3:30–8:30 p.m.). For further information, contact Nancy J. Stone, Creighton University, 402/280-2146, nstone@creighton.edu. ☒

STUDENT VIEWS

Call for Student Award Applications

The Student Affairs Committee is pleased to have an opportunity to recognize the accomplishments of our students. Student members of HFES are a tremendous asset to the Society. We are fortunate to have such talented, upcoming professionals as colleagues. In order to apply for these awards, students or chapters must send a completed application and supporting materials (four copies) to the address listed at the end of this article.

Student Member with Honors

This designation honors students who have made an outstanding contribution to the discipline and/or HFES during their tenure as a student. Six distinguished students—Timothy Nichols, Melanie Diez, Sandra Kay Garrett, Michelle Evonne Harper, Sherri Rehfeld, and Anne Collins McLaughlin—received this designation in 2004. Students must be HFES members and may apply for this award when applying for membership, or they may send an application when they have met the following eligibility requirements:

- Class standing of junior or senior for an undergraduate, or any graduate student
- GPA of 3.75 or its equivalent for graduate students (as evidenced by a transcript)

- GPA of 3.50 or its equivalent for undergraduate students (as evidenced by a transcript)
- Student membership in HFES or application pending
- Successful completion of at least one human factors-related course with a grade of A or its equivalent (as evidenced by a transcript or letter from the instructor)
- Two letters of recommendation, at least one of which must be from a Full Member of HFES

In addition, at least two of the following conditions must be met:

- A human factors-related presentation at a regional, national, or international meeting (provide photocopy from program or letter from adviser)
- Evidence of design contribution (e.g., award, patent, letter from supervisor)
- Publication of human factors work in an approved journal (e.g., *Human Factors*, *Ergonomics in Design*, *Applied Ergonomics*, or any other journal approved by the awards committee)
- Significant service to HFES at the Society-wide or local chapter level (provide letter from committee chair or officer of the group)

Outstanding Student Chapter Awards

This award honors student chapters that have made an outstanding contribution to the discipline, HFES, their campus, and/or their communities in a particular year. Up to three student chapters may be honored each year. Three exemplary student chapters received the award in 2004: Georgia Institute of Technology, Old Dominion University, and University of Central Florida Student Chapters.

Examples of outstanding contributions include

- Significant increase in membership or numerous chapter activities, such as colloquia and field trips
- Service to the community, such as sponsoring a design competition at a local high school or involvement in a career day
- Participating in a design competition, developing a product, or conducting a research project
- Service to HFES at the Society-wide or local chapter level
- Notable electronic presence (e.g., innovative use of a Web site)

In order to apply for these awards, chapters must provide supporting materials (four copies), including letters of recommendation, a written description of the activities of the student chapter, and other materials that will support the application, such as brochures, announcements, images, DVDs, or videos. Note that any one chapter may only receive the award for three consecutive years. After that, the chapter must “sit out” for one year.

The deadline for applications for both student honors designation and student chapter awards is *June 3, 2005*. For further information or to request an application for Student Member with Honors or the Outstanding Student Chapter Award, contact Anthony Andre, Student Affairs Committee Cochair, Interface Analysis Associates, 16275 Monterey St., Ste. S, Morgan Hill, CA 95037, 408/782-6006, andre@interface-analysis.com. ☒

IEA Congress 2006

The International Ergonomics Association (IEA) welcomes submissions to its triennial meeting, the 16th World Congress in Ergonomics, to be held in Maastricht, Netherlands, July 10–14, 2006. IEA invites all people who are interested in human factors/ergonomics and those working in a related area to propose a presentation. The 2006 IEA Congress seeks to achieve interaction between the research and application of ergonomics, in particular an interaction between theory and practice, and universities and companies, scientists, engineers, and managers. Practitioners are also encouraged to present case studies and practical experiences.

The IEA 2006 program includes plenary papers, technical session papers, symposium papers, posters, interactive workshops, master classes, and discussion panels in all areas of ergonomics or human factors, including aspects of health and safety, organizational design and management, participative design, education and certification, skills in ergonomics, and management topics. The application of ergonomics knowledge and of research results will get full attention as well. Authors may submit more than one proposal, although the review process includes a check on the added value of a second proposal in the case of comparable topics.

Authors may submit four types of proposals: scientific, including research and review papers or posters; technical, case study papers and application papers or posters; special interactive sessions such as panels, workshops, roundtables, or hands-on activities; and symposia, one or several sessions on a specific theme, either scientific, technical, or a mix of both. Proposals for any other format of presentation, or for an interactive activity are welcome.

All proposals and full papers should be submitted electronically. Abstracts cannot be submitted by e-mail; authors unable to submit in a digital format may fax proposals to +31-433-619-020. The deadline for submitting abstracts is *October 1, 2005*. The due date for posters is *January 1, 2006*. For more information about the 2006 IEA Congress, go to <http://www.iea2006.org>.

Driver-Centered Design Papers Sought

The *International Journal of Human-Computer Studies* invites submissions for a special issue on driver-centered design. The special issue will explore the foundations of a new driver-centered design paradigm.

In recent years, driver support systems have become commonplace in cars. Intelligent driver support systems (IDSS) are intended to enhance driving by providing continuous feedback and control augmentation instead of taking control over the driver to perform subtasks. In this perspective, IDSSs have to be integrated with the driver's cognitive processes. This evolution calls for a paradigm shift whereby the design and evaluation process is grounded on the key component of an IDSS: the driver. Understanding and formalizing the driver's behavior, perception, and sensemaking is obligatory to design intelligent vehicles that respond in relevant ways according to the driver's perspective. Many complementary

approaches and disciplines capture knowledge of drivers' needs for technological design. For instance, they may make use of simulators and statistical validation, or explore the variety of real-world situations by using ethnographic techniques.

The journal is seeking the following topics within an interdisciplinary framework: theoretical frameworks, experimental setup, technical tools for observation and analysis, the capture of cognitive processes and the specification of contextual needs, acceptability of a new system, and technology interaction and integration.

Original papers presenting unpublished material related but not restricted to these topics are invited for submission. Manuscripts should not exceed 8000 words. The deadline for all submissions is *August 1, 2005*.

For more details about the special issue, go to <http://hci.ucsd.edu/idss/specialissue.htm>.



CALENDAR

Announcement deadlines: 1st day of the month prior to the desired issue; for events or deadlines within the first 3 weeks of a month, send information at least 2 months in advance. Items are published according to space availability.

HFES Houston Chapter 2nd Annual One-Day Conference, May 6, 2005, Houston, TX. Andrew Muddimer, muddimer2@houston.oilfield.slb.com, hhfes@houstonhfes.org, <http://www.houstonhfes.org/conference2005/index.html>.

American Occupational Therapy Association 85th Annual Conference and Expo, May 12–15, 2005, Long Beach, CA. AOTA, 4720 Montgomery Ln., Bethesda, MD 20814-3425, 301/652-6611 x 2715, fax 301/652-3218, <http://www.aota.org>.

149th Meeting of the Acoustical Society of America, May 16–20, 2005, Vancouver, BC, Canada. Acoustical Society of America, asa@aip.org, <http://asa.aip.org/meetings.html>.

Society for Information Display International Symposium, May 22–27, 2005, Boston, MA. Bill Klein, Society for Information Display, 610 S. 2nd St., San Jose, CA 95112, 212/460-8090x204, wklein@pcm411.com, <http://www.sid.org/conf/sid2005/sid2005.html>.

8th South East Asian Ergonomics Society Conference and 12th Indonesian Physiological Society Congress, May 23–25, 2005, Sanur, Bali, Indonesia. SEAS + IPS 2005 Secretariat, I. G. N. Susila and P. G. Adiatmika, Dept. of Physiology, Udayana U., Medical School, Jalan PB Sudirman, Denpasar 80323, Bali, Indonesia, +62-361-226132, fax +62-361-226132, iaifbali@yahoo.com.

American Industrial Hygiene Conference and Expo, May 23–25, 2005, Anaheim, CA. AIHA, 2700 Prosperity Ave., Suite 250, Fairfax, VA 22031, 703/849-8888, fax 703/207-3561, <http://www.aiba.org/aibce05/aibce.htm>.

International Conference on Computer-Aided Ergonomics, Human Factors, and Safety, May 25–28, 2005, Košice, Slovakia. <http://www.tuke.sk/caes/>.

Human Factors and Ergonomics Society 49th Annual Meeting, September 26–30, 2005, Orlando, FL. info@hfes.org, <http://hfes.org/Meetings/05annualmeeting.html>.

★ Indicates new listing.



SHORT COURSES

Putting Ergonomics into Practice, April 26–29, 2005, Columbus, Ohio. Ohio State University Ergonomics Short Course, Institute for Ergonomics, 210 Baker Systems, 1971 Neil Ave., Columbus, OH 43210, <http://osuergo.eng.ohio-state.edu/Institute/index.htm>.

Third Annual Cognitive Systems: Human Cognitive Models in System Design Workshop, July 6–8, 2005, Santa Fe, NM. Sidney Holman, 505/844-7854, spholma@sandia.gov, http://www.sandia.gov/cog.systems/cognitive_workshop/index.htm.

Summer 2005 Human Factors Engineering Short Course, July 25–29, 2005, and August 1–5, 2005, Ann Arbor, MI. Paul Green, University of Michigan, 2901 Baxter Rd., Ann Arbor, MI 48109-2150, 734/763-3795, pagreen@umich.edu, <http://cpd.engin.umich.edu/>.

Human Factors Engineering and Patient Safety – Part I and Part II, August 29 – September 2, 2005, Madison, Wisconsin. Carla Alvarado, Center for Quality and Productivity Improvement, College of Engineering, University of Wisconsin, 610 Walnut St., Madison, WI 53726, 608/263-2678, calvarado@cqpi.engr.wisc.edu, <http://www.fpm.wisc.edu/seips/courses/coursehome.html>. ☒

RECENT TITLES FROM HFES:

Guidelines for Using Anthropometric Data in Product Design by the HFES 300 Committee

This is the first document to present a global approach to anthropometry, extending from the use of averages and percentiles to methods appropriate for more complex designs, such as multivariate analysis. Basic and advanced methodologies to properly apply anthropometric data are described, their advantages and disadvantages are explained, and illustrative examples are provided. 76 pp., 8.5 x 11", paperback, \$75 members, \$85 nonmembers, searchable PDF on CD-ROM, \$50 HFES members, \$60 nonmembers.



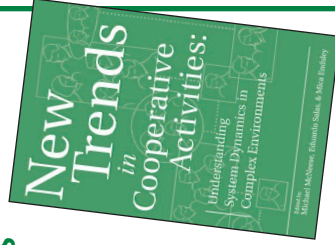
Humans and Automation: System Design and Research Issues by Thomas B. Sheridan

This book provides a historical context for human factors and automation and then describes how the two domains interact to ensure a system in which the human and machine operate with efficiency and safety. Includes appendices and an index. 278 pp., 5.5 x 8.5", paperback, \$42.95 HFES members, \$49.95 nonmembers.



New Trends in Cooperative Activities: Understanding System Dynamics in Complex Environments edited by Michael D. McNeese, Eduardo Salas, & Mica Endsley

In this multiperspective collection of original work, the editors have accomplished their aim to "foster a meeting of the minds of researchers and practitioners who have dreams about new visions of cooperative work and about the consequent support systems that are possible to enhance and improve cooperative work in dynamic ways." 17 chapters plus index. 328 pp., 7 x 10", paperback, \$45 HFES members, \$60 nonmembers.



Bulletin

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49th Annual Meeting Dates To Note

April 25: Instructions for proceedings paper prep available at hfes.org.

June 13: Proceedings papers due.
View the tentative session schedule at hfes.org.

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