Tutorials
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I/ITSEC Tutorials are designed to serve three purposes:
- Provide foundational educational material, including material essential to prepare for Certification as a Modeling and Simulation Professional (CMSP).
- Serve as a refresher and more advanced learning opportunity for those seeking to maintain their certification.
- Bring topics of special interest in Training, Simulation and Education to I/ITSEC attendees.

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LEGEND (one or more of the following may appear on this page). The number in parentheses following Tutorial Title is the ID tracking number.
- 📚 Nominated for Best Tutorial Award
- 🏛 International Author
- 🎯 Game-related Subject Matter
Technology-mediated solutions for learning, instruction, and assessment are often intended for use by schoolhouses or formal training programs. Few address informal learning or self-paced “learning in the wild.” This tutorial addresses this gap by discussing transmedia learning design specifically for informal learning and by offering open source software approaches to unobtrusively track learner progress. Transmedia learning is social, story-driven, unfolds across multiple media, and designed to promote self-directed engagement. The first section of the tutorial defines and describes how and why transmedia learning can be a game-changer for training and education. The second section explores the design and development of a “Warrior-Athlete” transmedia learning ecosystem, a use case shared by the Services, VA, NATO, industry, and Federal Government alike. Strategies for the use of massively open online course (MOOC) platforms, mobile apps, social media, videos, machinima, virtual environments, and games are provided. The third section demonstrates open source software for tracking engagement in transmedia learning ecosystems such as the experience API, learning record store, analytics dashboard, competency frameworks, and a game/collaborative 3D virtual environment. No prerequisite knowledge is required. Program managers, researchers, designers, and developers who are interested in 1) transmedia storytelling to engage learners, and 2) the design and implementation of transmedia learning ecosystems will take away practical strategies, resources, tools, and software for their own use.

**Presenter**

ELAINE M. RAYBOURN, Ph.D., is a Principal Member of the Technical Staff in Cognitive Science & Systems at Sandia National Laboratories and a European Research Consortium for Informatics and Mathematics (ERCIM) Fellow who has worked in research laboratories in Germany, England, and France. Elaine is on assignment to the Advanced Distributed Learning Initiative, Office of the Assistant Secretary of Defense (Readiness). As a social scientist, her greatest passion involves designing immersive experiences that present opportunities to hone intercultural communication competence, self-awareness, and adaptability. To that end she led the development of an award-winning Government game. She serves on several editorial boards including Interactive Technology and Smart Education, Journal of Game-based Learning, and Simulation & Gaming. She conducts research on transmedia learning, next generation learning ecosystems, and the anthropology of next generation learners’ interactions with future technology. Elaine is a recipient of the Department of the Army Award for Patriotic Civilian Service.

The High-Level Architecture (HLA) is the leading international standard for simulation interoperability. It originated in the defense communities but is increasingly used in other domains. This tutorial gives an introduction to the HLA standard. It describes the requirements for interoperability, flexibility, composability and reuse and how HLA meets them. It also describes the new features of the most recent version: HLA Evolved (IEEE-1516-2010) and the road ahead. Finally it provides some recent experiences of the use of HLA in NATO M&S groups as well as an overview of recent evolution of Federation Object Models for military platform simulation. This tutorial is intended for all audiences; however, some familiarity with basic principles of distributed computing is recommended.

**Presenters**

BJÖRN MÖLLER is the vice president and co-founder of Pitch Technologies, the leading supplier of tools for the High-Level Architecture (HLA). He leads the strategic development of Pitch HLA products. He serves on several HLA standards and working groups and has a wide international contact network in simulation interoperability. He has twenty years of experience in high-tech R&D companies, with an international profile in areas such as modeling and simulation, artificial intelligence and Web-based collaboration. He is currently serving as the chair of the SISO RPR FOM Product Development Group and the vice chair of the SISO HLA Evolved Product Support Group.

ROBERT LUTZ is a principal staff scientist at The Johns Hopkins University Applied Physics Laboratory in Laurel, MD. His background includes 35 years of practical experience in the development, use, and management of models and simulations across all phases of the DoD systems acquisition process. He currently serves as the Airspace Integration Modeling and Simulation (M&S) lead for the Navy’s Triton Program and has led the development of several M&S standards (IEEE 1516.2, IEEE 1516.3, IEEE 1730). Mr. Lutz also serves as the Chair of the Simulation Interoperability Standards Organization (SISO) Board of Directors, serves on the Tutorial Board and Fellows Committee at the Interservice/Industry Training, Simulation and Education Conference (I/ITSEC), and is a guest lecturer on M&S-related topics in The Johns Hopkins University Whiting School of Engineering.
This tutorial has been designed by a team of subject matter experts to prepare attendees to understand the scope of I/ITSEC presentations and demonstrations. It provides definitions of widely-used technical terms, while explaining the range and types of models and simulations that are commonly applied in the M&S domain. The tutorial reviews major simulation architectures (HLA, TENA, DIS), the basics of instructional design, a description of the major standards and best practices available for use across the M&S problem space, and a brief presentation of resources that can provide further information. The tutorial introduces topics that are examined more extensively in other tutorials.

The tutorial is designed to be technically focused and is not intended to overview management or governance of M&S within the US DoD.

**Presenters**

**JAMES E. COOLAHAN, Ph.D.**, is the Chief Technology Officer of Coolahan Associates, LLC, having retired from full-time employment at the Johns Hopkins University Applied Physics Laboratory (JHU/APL) in December 2012 after 40 years of service. He currently chairs the M&S Committee of the Systems Engineering Division of the National Defense Industrial Association, and teaches courses in M&S for Systems Engineering in the JHU Engineering for Professionals M.S. program. He holds B.S. and M.S. degrees in aerospace engineering from the University of Notre Dame and the Catholic University of America, respectively, and M.S. and Ph.D. degrees in computer science from JHU and the University of Maryland, respectively.

**S. K. NUMRICH, Ph.D., CMSP**, holds an AB, MA and Ph.D. in physics and worked as a research physicist at the Naval Research Laboratory plying her trade in a variety of fields including underwater sound in the Arctic (yes, aboard ship), fluid-structure interactions, parallel processing, modeling and simulation and virtual reality. Upon leaving government service, Dr. Numrich has joined IDA.

**ROBERT RICHBOURG, Ph.D.**, is a member of the Research Staff at the Institute for Defense Analyses. He is a retired Army officer who holds a B.S. in Mathematics, and M.S. and Ph.D. in Computer Science. In his last active duty assignment, he was an Academy Professor and Director of the Artificial Intelligence Center at the United States Military Academy, West Point. He is the 2015 Chair of the I/ITSEC Tutorial Board.

**FRANK MULLEN** is a senior scientist at SimVentions and was previously an associate director at the DoD M&S Coordination Office (DMSOCO), helping develop the Defense M&S Catalog. He gained over twenty five years of defense related engineering and management experience at the Charles Stark Draper Laboratory, specializing in integrated circuits and microwave devices, and contributed to development of tactical and strategic guidance systems. On active and reserve duty, he served afloat and ashore, deployed to the Mideast, and spent four years on the Pentagon’s Joint Staff. He retired as a captain after thirty years of service. Mr. Mullen is a graduate of the US Coast Guard Academy, the U.S. Naval War College, Defense Acquisition University, and the California Institute of Technology. He holds degrees in electrical engineering and physics.

Reuse of M&S assets including models, simulations, data, architectures, designs, and requirements (collectively referred to as M&S assets hereafter) is critical to providing cost-effective M&S solutions. The first step in reuse is to understand what assets exist, and then to have mechanisms to access them. However, most M&S practitioners and managers are largely unaware of the wealth of existing M&S assets or where to find them. Significant advances have been made recently to more effectively support discovery and reuse of assets across the M&S enterprise, both within the U.S. DoD and internationally. Following sound industry practices and DoD guidance, we have migrated to a set of federated discovery and access mechanisms. Tutorial attendees will learn what types of M&S assets can be discovered, how and where to search for them, and how to access them. Attendees will also learn how they can make their own assets available to others for reuse. The tutorial will begin with the motivation and business case for M&S asset reuse, and then through descriptions and demonstrations, show how M&S assets can be discovered and accessed.
Natural language interactions can increase engagement in online training, simulation, and performance support environments. Avatars that give prompts, hints, and feedback can be used with great effect as non-player characters (NPC’s) in games and simulations or as tutors in intelligent tutoring systems. In these applications, the avatars have traditionally interacted with and responded to learners using pre-encoded dialogue trees or templates. This results in unnatural sounding dialogue and limits the ability of the avatar to respond when the learner wanders off topic or changes the subject. Today, however, it is possible to build dialogue engines that process spoken input and respond in surprisingly natural and intelligent ways. This tutorial is an introduction to the current capabilities of dialogue engines, their implementation, and their use in training environments. Topics include the AI behind chat bots, selecting a dialogue engine, building a library of domain knowledge, training-the-trainers for virtual tutors, matching technology to training goals, and incorporating chat into training and simulation. This tutorial provides insights into how these technologies work and demonstrates ways to leverage open source products and native browser functionality to start making your training talk with learners.

Presenters
ROBBY ROBSON, Ph.D., began developing web-based learning content and management systems in 1995 and has led multiple Department of Defense and National Science Foundation projects that have applied emerging technologies to learning, education, and training. He has published extensively in areas ranging from mathematics to web-based learning and standards development. Dr. Robson chaired the IEEE Learning Technology Standards Committee from 2000 to 2008 and co-founded Eduworks Corporation in 2001 where he has guided research, services, and product development and serves as CEO. He holds a doctorate in mathematics from Stanford University and has held leadership posts in both academia and industry.

ELAINE KELSEY is a software engineer at Eduworks focusing on development of conversational dialogue agents for intelligent tutoring systems, natural language processing and semantic analysis. She has developed multi-cultural interfaces for global software deployments; designed algorithms for improving cost pool allocation in financial planning and analysis software for global nonprofit organizations; and worked on the integration of idiomatic and dialectal forms in natural language translation. Elaine speaks eight languages and has a B.S. in Computer Science from Oregon State University, a B.A. in Scandinavian Languages and B.S. in Cell and Molecular Biology from the University of Washington, and a MPH from Tulane University.

Computer graphics hardware has come a long way. Modern games provide unprecedented levels of visual quality that often surpasses the quality of existing visual simulation systems. Trying to bring modern effects into older systems faces several challenges: a need for new hardware, new software and new assets. The last one is especially problematic, as in many cases it represents the bulk of the required effort. For modernizing an existing visual environment in the face of budget constraints it can be impossible to argue for a full set of new assets. The goal of this tutorial is to introduce methods for developers and maintainers of existing visual environments to add modern graphics effects without needing to fully rebuild existing assets. The core element is the ability to freely program the current graphics hardware using so-called shaders. Effects like per-pixel lighting, bump and normal maps, forward and deferred shading as well as shadows and image effects like motion blur, screen-space ambient occlusion for soft shadows and others can be added with no or limited modeling effort. The Unity development framework will be used to demonstrate fast experimentation and present outlines on how to integrate the described effects into custom software using libraries like OpenGL.

Presenters
DIRK REINERS, Ph.D., is an Associate Professor in the Department of Information Science at the University of Arkansas at Little Rock. His research focuses on interactive 3D graphics and Virtual Reality applications development and making high-quality, high-speed graphics usable. He has an MS and a Ph.D. in Computer Science from the Technical University Darmstadt and has worked for more than 10 years in applied research at Fraunhofer IGD before joining academia at Iowa State University, The University of Louisiana at Lafayette and now at UALR. He is the project lead for the OpenSG Open Source scene graph project.

CARSTEN NEUMANN is a Senior Research Scientist in computer graphics and visualization at the Emerging Analytics Center at the University of Arkansas at Little Rock. He has been working on a variety of applications of Virtual Reality for the last 10 years and is a lead developer of the OpenSG Open Source scene graph project. He has an M.S. in Mathematics from the Technical University Darmstadt.

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★ Nominated for Best Tutorial Award  ❅ International Author  ♦ Game-related Subject Matter
The military has long recognized having a successful team requires more than assembling individuals who are highly competent in their jobs. Successful teams require both taskwork and teamwork skills in order to effectively coordinate in an adaptive manner (Salas et al., 1992). This awareness has caused the military to invest heavily in team training. Over the last thirty years much has been learned. Recently, there has been a renewed interest in the use/creation of intelligent tutoring systems (ITS) for teams which can be adapted to multiple training situations. From a technological standpoint much can be leveraged from the work on intelligent tutors for individuals; however, teams are more than the individual sum of their parts (i.e., members). The purpose of this tutorial will be to highlight the process of working through the complexity involved and offering scientifically-grounded best practices which illustrate a way ahead in building an ITS for teams. Best practices and principles will be extracted from the scientific literature and the authors’ combined experience (over 25 years) in conducting research on military teams. Discussions will cover the lifecycle of development – e.g., learning goals/content, scenario development, and measurement/evaluation.

**Presenters**

**C. SHAWN BURKE, Ph.D.**, is an Associate Professor (Research) at the Institute for Simulation and Training and the University of Central Florida. Her expertise includes teams and their leadership, team adaptability, team training, measurement, evaluation, and team effectiveness.

**ROBERT A. SOTTILARE, Ph.D.**, leads adaptive training research within the US Army Research Laboratory focusing on automated authoring, automated instructional management, and evaluation tools and methods for intelligent tutoring systems.

**EDUARDO SALAS, Ph.D.**, is a Professor of Psychology at Rice University. His expertise includes helping organizations on fostering teamwork, the design and implementation of team training strategies, facilitating training effectiveness, and the design of learning and simulation-based environments.

**JOAN JOHNSTON, Ph.D.**, has been a U.S. Military research psychologist for 25 years. Her current research focus is on training effectiveness with an emphasis on training transfer. Dr. Johnston’s areas of expertise include training and decision support systems for tactical decision making under stress, team performance and team training technologies, and embedded and distributed simulation-based training.

The impact of quality instructors (teachers, trainers, coaches, and educators) can’t be understated. Research findings reveal that “…the most important factor affecting student learning is the teacher” (Sanders, Wright, & Horn, 1997, p. 61), and typical results show that a one standard deviation increase in teacher quality raises student outcomes by approximately .20-.24 standard deviations (Rockoff, 2004). When discussing instructional technologies, the message is much the same: Their delivery and interaction methods have a profound effect on learner outcomes.

This tutorial summarizes the existing research on instructor effectiveness, and it translates those concepts into a military setting. Attendees will leave with a clear argument for defending the value and return on investment of instructor development, and they’ll gain a practical, actionable set of instructional strategies, tactics, and assessment methods to begin using immediately with human teachers and trainers as well as instructional technologies and training simulations.

**Presenter**

**SAE SCHATZ, Ph.D.**, currently serves as the Director of the Advanced Distributed Learning (ADL) Initiative, a research and development unit overseen by the Office of the Assistant Secretary of Defense (Readiness). Before joining ADL, she worked in industry, as the chief scientist for MESH Solutions LLC, and before that in academia, as an Assistant Professor at the University of Central Florida. During her time as a technical performer, Sae contributed to a variety of science and technology efforts for agencies such as the Office of Naval Research, Army Research Lab, Marine Corps Training and Education Command, and Special Operations Command, and she’s earned accolades for this work. In 2010, for instance, Sae led the team who received an NTSA Modeling & Simulation Award for Training, and she has received the I/ITSEC best paper award twice: first in 2012 for her work on the Marine Corps’ Making Good Instructors Great and again in 2014 for work on Joint Blended Learning.
The Test and Training Enabling Architecture (TENA) and the Joint Mission Environment Test Capability (JMETC) program provide an advanced set of interoperability software, interfaces, and connectivity for use in joint distributed testing and training. This tutorial will provide information about how TENA works and why it is important to the test and training communities, with some comparison to other interoperability architectures. TENA provides testers and trainers software such as the TENA Middleware—a high-performance, real-time, low-latency communication infrastructure that is used by training range instrumentation software and tools during execution of a range training event. The standard TENA Object Models provide data definitions for common range entities and thus enables semantic interoperability among training range applications. The TENA tools, utilities, and gateways assist in creating and managing an integration of range resources. The current version of the TENA Middleware, Release 6.0.4, is being used by the range community for testing, training, evaluation, and feedback and is being used in major exercises in the present.

JMETC has created a persistent test and evaluation capability throughout the US DoD, connecting many test ranges together, and including a bridge to the Joint Training and Experimentation Network (JTEN); a set of TENA-compliant software middleware, interfaces, tools, and databases; and a process for creating large distributed test events. The combination of TENA and JMETC gives testers and trainers unprecedented power to craft a joint distributed mission environment that forges the future for innovative testing and training.

Presenter
EDWARD T. POWELL, Ph.D., is a lead architect for the Test and Training Enabling Architecture. After receiving his Ph.D. in Astrophysics from Princeton University, he worked for the Lawrence Livermore National Laboratory performing simulation-based analysis. He moved to SAIC (now Leidos) in 1994, and participated as lead architect in some of the most complex distributed simulation programs in DoD, including the Joint Precision Strike Demonstration (JPSD), the Synthetic Theater of War (STOW) and the Joint Simulation System (JSIMS). He then worked in the intelligence community for two years on architectures for integrating large-scale diverse ISR systems. He has been the lead architect for TENA for over twelve years, and is currently working on expanding the applicability of TENA, and integrating TENA with broader DoD-wide Data Management systems.

Distributed simulation technologies have changed the way the DoD does RD&E, training, analysis, and testing. These technologies and associated standards have been in use for 20 years and have been documented in many forums. However, a critical element that has not been widely documented is the processes and tools required to execute a large multi-architecture distributed event. There are organizations that do these types of events very well, but the only way for the new practitioner to learn these skills is to be a member of one of these teams.

This tutorial provides a guide to the planning and execution of a large multi-architecture distributed event. This guide will include the steps to planning and executing an event including design of the simulation architecture, planning integration spirals, scenario development and rehearsal, conduct of the event, data collection and analysis. While the steps described in this tutorial are applicable to all large distributed events, special emphasis will be placed on multi-architecture based events. An example will be provided showing how to select architectures and object models. This tutorial is applicable to anyone involved in the development a large test event. The material will be applicable to simulation architects, analysts, scenario developers, simulation users, and managers.

Presenter
MICHAEL J. O’CONNOR, CMSP, is a Senior Program Manager at Trideum Corporation. Mr. O’Connor has more than 25 years’ experience in Modeling and Simulation (M&S). He has been a key participant in the development of distributed modeling and simulation standards, including IEEE 1278 and IEEE 1516. He has held many positions in the community, including Chairman of the SISO Standards Activities Committee and Chairman of the SISO Executive Committee. He served as the chair of the I/ITSEC Simulation Subcommittee. Mr. O’Connor currently supports the technical integration of the “Always On – On Demand” program. He has led the development of multiple simulations using DIS, HLA, and TENA. Mr. O’Connor has led the technical integration of several large multi-architecture distributed events including the Multi-Served Distributed Event (MSDE) in 2005 that used DIS, HLA, and TENA. MSDE included over 20 sites and included organizations from the Army, Navy, and Air Force. He holds a bachelor’s degree in Computer Engineering from Auburn University, and a master of science in Computer Science from the University of Alabama in Huntsville.
Simulation conceptual modeling is a critical step in simulation development frequently overlooked in the rush to demonstrate program progress. A simulation conceptual model is an abstraction from either the existing or a notional physical world that serves as a frame of reference for further simulation development by documenting simulation-independent views of important entities and their key actions and interactions. A simulation conceptual model describes what the simulation will represent, the assumptions limiting those representations, and other capabilities needed to satisfy the stakeholder’s requirements. It bridges between these requirements, and simulation design. This tutorial will present the theory and application of simulation conceptual modeling as documented during the research done by the NATO MSG 058 and SISO SCM SG/SSG/PDG. In addition, Use Cases that have been drawn from previous conference presentations will be presented to illustrate how conceptual modeling has been performed. Additional work is necessary to mature the state-of-the-art of simulation conceptual modeling before a recommended practices guide could be standardized. This tutorial has been created to continue the maturation of the simulation conceptual modeling best practices.

**Presenter**

**JAKE BORAH, CMSP,** was a Senior Member of Technical Staff for AEGIS Technologies Group, Inc. He has been assigned as Project Manager or Technical Lead on several projects that require a high degree of modeling and simulation expertise and a capability to integrate leading edge technology into ongoing processes. His most recent conceptual modeling has been for the Air Force Modeling and Simulation Training Toolkit (AFMSTT). He has frequently supported US and Canadian government sponsored military simulation projects because of his mastery of the M&S technology, and expertise in High Level Architecture federation development. He is a Charter Certified Modeling and Simulation Professional (CMSP). He is a recognized expert and a prominent member of the worldwide M&S community as reflected by his contributions to the Simulation Interoperability and Standards Organization (SISO) workshops and products. He has taught M&S classes and given tutorials in academic, government and industrial forums throughout the world from Asia to Europe during the last 18 years. He graduated from the United States Air Force Academy in 1974 and possesses a Master of Aeronautical Science degree from Embry-Riddle Aeronautical University.

Recent developments have enabled advanced interaction so that users can more realistically interact with serious games in virtual environments. Unfortunately, it is complex to allow users to fully interact through speech, particularly in areas where the task is unconstrained and performed under adverse conditions. As such, speech has been often neglected as a modality that can enhance the naturalness of interacting with virtual training systems. Furthermore, user-based evaluations of speech interfaces are intrinsically difficult. Recent research indicates there are several interesting areas and approaches that could improve the design and implementation of training systems.

This tutorial will explain how Automatic Speech Recognition and Speech Synthesis work; the challenges in enabling speech as a modality for hands-free interaction; some usability issues in speech-based interaction systems; opportunities for researchers and developers to enhance system interactivity by enabling speech, and how to enable speech-based interaction within immersive, mixed-reality environments. The tutorial is intended for developers interested in implementing speech recognition in interactive applications, as well as for researchers dedicated to developing methods and systems that allow humans to naturally interact with technology.

**Presenters**

**COSMIN MUNTEANU, Ph.D.,** is an Assistant Professor at the Institute for Communication, Culture, Information, and Technology (University of Toronto at Mississauga). Until 2014 he was a Research Officer with the National Research Council of Canada. His area of expertise is at the intersection of Automatic Speech Recognition (ASR) and Human-Computer Interaction (HCI), having extensively studied imperfect speech recognition systems, and designed and evaluated systems that improve humans’ interaction with immersive technologies through speech and natural language (such as advanced learning systems and mixed reality training simulators). His interests include speech and natural language interaction for mobile devices, mixed reality systems, learning technologies for marginalized users, and assistive technologies. He has authored numerous publications in HCI, ASR, and Computational Linguistics.

**GERALD PENN, Ph.D.,** is a Professor of Computer Science at the University of Toronto. His area of expertise is in the study of human languages, both from a mathematical and computational perspective. Dr. Penn is one of the leading scholars in Computational Linguistics, with significant contributions to the formal study of natural languages. His publications cover many areas, from Theoretical Linguistics, to Mathematics, and to Automatic Speech Recognition, as well as Human-Computer Interaction.
The human visual system naturally processes information in three dimensions, yet the majority of simulation and training applications utilize two-dimensional display technology. Three-dimensional displays introduce significant benefits to human performance, including reduction in cognitive load, improved spatial understanding, improved processing time, greater knowledge gains, and improved student perceptions on learning. These improvements exist in diverse subject areas, including medical diagnosis, navigation, imagery analysis, and geospatial visualization. Based on these proven benefits, the use of 3D display technologies for training and simulation has the potential for significant beneficial results.

Within this tutorial, the basics of 3D perception, including the human visual system and depth cues, are explained. The presentation then covers current 3D display technologies, including the functionality of different displays and the depth cues they present. The presenter will discuss the beneficial impacts 3D displays have on human performance. The tutorial will cover areas of simulation and training suitable for 3D display technology, and will discuss ongoing research in those areas. This tutorial is designed for those interested in understanding more about 3D displays, their potential benefits, and application areas in training and simulation. Engineers, project managers, researchers, and scientists should attend. No prior exposure to 3D display technology is required.

Presenter
MATTHEW HACKETT is a research engineer for the Medical Simulation Research Branch of the Army Research Laboratory, Simulation and Training Technology Center. He manages a variety of projects including medical hologram, virtual patients, and medical serious games. Mr. Hackett received his Bachelor of Science in Computer Engineering from the University of Central Florida and his Masters of Science in Biomedical Engineering from the University of Florida. He is currently pursuing his Ph.D. in Modeling and Simulation at the University of Central Florida.

The term Fidelity is formally defined as “the accuracy of the representation when compared to the real world”. This notion typically demands that the customer and simulator (or system) designer iterate to specify the required hardware and software characteristics to meet the stated training objectives. Fidelity, as it relates to cost, certainly speaks to why simulators have been vastly underutilized in civilian training. Often times, the simulation Fidelity present is governed not by what is required, but by the financial limitations of the training organization in question. This necessitates that the customer prioritize their requirements, which ultimately results in compromise and trade-offs.

Accordingly, the primary goal of this Tutorial is to introduce the notion of Fidelity in simulation-based training, and explore how its determination requires a systematic process of informed decision-making. We will summarize techniques for establishing preferences and priorities based on Fidelity needs, and offer guidelines for optimizing related trade-off decisions for training system acquisition. As the centerpiece of this Tutorial, we will highlight three Case Studies (of advancing complexity), both to demonstrate the specific techniques presented in this Tutorial, and to justify the critical need for appropriately specified simulation technology in both civilian and military training applications.

Presenter
KEVIN HULME, Ph.D., received his Ph.D. from the Department of Mechanical and Aerospace Engineering at the University at Buffalo in 2000, where his area of expertise was multidisciplinary analysis and optimization of complex systems. For the past decade, Dr. Hulme has served as the technical lead of the Motion Simulation Laboratory at the Center for Engineering Design and Applied Simulation at the University at Buffalo. He and his research team focus on the custom design and development of ground vehicle simulations for applications in: clinical research, education and training, and next-generation transportation and safety studies.
There are increasing requirements for automated reasoning abilities across the broad spectrum of modeling and simulation, as well as in battlefield information and control systems. Additionally, the cognitive capabilities that have been developed and tested in simulation are migrating to real-world systems. Cognitive systems represent a maturing computational approach to intelligence that can provide robust, scalable, and adaptive decision making. This tutorial provides an introduction to cognitive systems, concentrating on production system computation and high-level design of human-like reasoning systems. We draw examples and comparisons from existing cognitive systems, focusing on the tradeoffs between cognitive and non-cognitive modeling approaches. The tutorial content does not require any specialized knowledge, but some experience with software engineering or behavior modeling can be helpful. Attendees will learn to recognize problems that suggest cognitively based solutions, and they will be better able to assess risks, costs, and benefits of different approaches. This tutorial is targeted toward developers interested in cognitive approaches to software engineering, as well as customers who have problems that may be amenable to a cognitive approach.

**Presenters**

**RANDOLPH M. JONES, Ph.D.**, Senior Artificial Intelligence Engineer at SoarTech, is a leading developer of knowledge-rich intelligent agent software. He has been principal investigator for a variety of advanced R&D projects for ONR, ARI, DMSO, DARPA and other agencies. He has previously held positions at Colby College, the University of Michigan, the University of Pittsburgh, and Carnegie Mellon University. His areas of research include computational models of human learning and problem solving, executable psychological models, and full-spectrum intelligent behavior models. He earned a B.S. in Mathematics and Computer Science at UCLA, and M.S. and Ph.D. degrees from the University of California, Irvine.

**DYLAN SCHMORROW, Ph.D.**, Chief Scientist at SoarTech, leads the effort to build intelligent systems for defense, government, and commercial applications that emulate human decision making. He also serves as a Potomac Institute for Policy Studies Senior Fellow, Editor of the Theoretical Issues in Ergonomics Journal, and the Technical Advisor for the Applied Human Factors and Ergonomics Conference Series. He is a leading expert on national security research, technology, and policy related to information technology, medical research and human performance applications. Past service includes OSD, DARPA, NAWC, NRL, ONR, NPS, and Executive Assistant to the Chief of Naval Research. Dr. Schmorrow holds a Ph.D. in Experimental Psychology from Western Michigan University, as well as M.S. degrees in Psychology and Philosophy. He retired from the U.S. Navy as a Captain in 2013.

**DON MCGREGOR** is a research associate at the Naval Postgraduate School. He is the primary author of Open-DIS, an implementation of the Distributed Interactive Simulation protocol in Java, C++, C#, and Javascript. His research interests include web-based simulation and scalable server side architectures.

**DON BRUTZMAN, Ph.D.**, is Technical Director for 3D Visual Simulation and Networked Virtual Environments in the MOVES Institute. As an Associate Professor at the Naval Postgraduate School in Monterey California, he is a member of two Academic Groups: Undersea Warfare (UW) and Modeling, Virtual Environments and Simulation (MOVES). He is an investigator in the NPS Center for Autonomous Underwater Vehicle (AUV) Research. His research interests include underwater robotics, real-time 3D computer graphics, artificial intelligence and high performance networking. He is a member of the Institute of Electrical and Electronic Engineers (IEEE), the Association for Computing Machinery (ACM) Special Interest Group on Graphics (SIGGRAPH) and the American Association for Artificial Intelligence (AAAI).
Verification and Validation (V&V) are essential prerequisites to the credible and reliable use of a model. But what are V&V, and what is their purpose within a modeling and simulation project? What types of potential errors can occur during V&V and how can they be avoided? What methods are available to perform verification and validation in a rigorous and effective manner?

The tutorial is intended to answer these questions. It has three distinct parts. The first part motivates the need for V&V, provides definitions necessary to their understanding, and explains why all V&V methods can be understood as comparisons and how this informs their application. The second part provides guidelines for selecting V&V methods for a particular model, introduces a widely used categorization of V&V methods, defines four categories of V&V methods, and describes two or more methods from each category. Example applications of the described methods are presented. In the third part, longer case studies of V&V in practice are presented, showing how V&V methods have been applied in actual modeling and simulation projects.

Presenter
MIKEL D. PETTY, Ph.D., CMSP, is Director of the University of Alabama in Huntsville’s (UAH) Center for Modeling, Simulation, and Analysis and an Associate Professor of Computer Science. Prior to joining UAH, he was Chief Scientist at Old Dominion University’s Virginia Modeling, Analysis, and Simulation Center and Assistant Director at the University of Central Florida’s Institute for Simulation and Training. He received a Ph.D. in Computer Science from the University of Central Florida in 1997. Dr. Petty has worked in modeling and simulation research and education since 1990 in areas that include verification and validation methods, simulation interoperability and composability, simulation software frameworks, and human behavior modeling. He has published over 190 research papers and has been awarded over $16 million in research funding. He served on a National Research Council committee on modeling and simulation, is a Certified Modeling and Simulation Professional, and is an editor of the journal SIMULATION. He has served as dissertation advisor to five graduated Ph.D. students, including the first two students to complete a Ph.D. in Modeling and Simulation at Old Dominion University and the first student to complete a Ph.D. in Modeling and Simulation at UAH.

Presenters
JEREMY HUFFMAN is a founding member and partner of Huffman Riley PLLC. Mr. Huffman concentrates his practice advising U.S. and foreign clients concerning the U.S. export control laws, including the International Traffic in Arms Regulations (“ITAR”); Export Administration Regulations (“EAR”); and the Office of Foreign Assets Control (“OFAC”) regulations.

DARREN RILEY is a founding member and partner of Huffman Riley PLLC. Mr. Riley has extensive experience advising clients on matters involving U.S. export controls and government contracts issues. He counsels clients on issues related to the International Traffic in Arms Regulations, Export Administration Regulations, the regulations of the Office of Foreign Assets Control and the Foreign Corrupt Practices Act.
HTML5 turns the web into an interactive multimedia platform that does not require plug-ins and can run on any device. Because of this, it has become the standard for developing web sites, web applications, mobile applications, eBooks and, most importantly for the I/ITSEC community, interactive multimedia instruction (IMI), simulations, and games. This tutorial covers the basics of HTML5, presenting the “why,” the “how,” the “so what?” and the “wow!”. This tutorial addresses the big picture issues that are important to managers and procurement personnel as well as the details of how to code in HTML5. Attendees will learn how (and why) to use HTML5 to render cross-platform multimedia, implement interactivity, optimize the user experience, add semantic tags, and create cloud-based simulations and games. All of these topics will be illustrated with live demonstrations, and the tutorial will provide pointers to HTML5 authoring tools and other resources. The tutorial will also cover recent developments in HTML5.

**Presenters**

**ROBBY ROBSON, Ph.D.**, began developing web-based learning content and learning management systems in 1995 and has led multiple Department of Defense and National Science Foundation projects that have applied emerging technologies to learning, education, and training. He has published extensively in areas ranging from mathematics to web-based learning and standards development. Dr. Robson chaired the IEEE Learning Technology Standards Committee from 2000 to 2008 and co-founded Eduworks Corporation in 2001 where he has guided research, services, and product development and serves as CEO. He holds a doctorate in mathematics from Stanford University and has held leadership posts in both academia and industry.

**SHERRIE VIEIRA** is a media specialist who served honorably in the U.S. Army for four years, receiving a Joint Services Achievement medal or her work at the Medina Regional SIGINT Operations Center in San Antonio, Texas. She has a BS in digital arts from the University of Oregon and has worked at Hewlett-Packard and with the State of Oregon as well as at Eduworks. Sherrie has develop a variety of HTML5 web applications and web sites and has worked on projects converting older interactive web formats to HTML5.

The use of virtual technologies to visualize specific events on battlefields, both real and imagined, has become incredibly important in training the leaders of today and tomorrow. Reviewing an event visualization for specific lessons learned, both positive and negative, is far more effective than reading a 30 page after action review. With the advent of new abilities of video game engines, it is now possible to quickly create these event visualizations from a desktop computer with minimal training. However, as the events to be replicated deviate further from squad-based, traditional combat, it becomes increasingly difficult to utilize a game engine designed with artificial intelligence programmed to avoid certain conflicts, collisions, and movements.

This tutorial will provide an overview of the video creation process utilized by the Training Brain Operation Center’s (TBOC) SIMS organization, with a focus on specific problems encountered by scenario developers utilizing a video game engine as the visualization tool for event recreation.

This tutorial is intended for anyone interested in how a visualization request is broken down by the TBOC SIMS team into component parts, evaluated for recreation, and then filmed for use as a military training tool.

**Presenter**

**BRIAN HALL** is a former Artilleryman who spent a year in downtown Baghdad dodging indirect fire and IEDs while collecting intelligence and escorting industry officials to various Ministries. After his return and subsequent departure from the US Army, his recent experience in Iraq and computer science degree was leveraged to complement the scenario development team at TBOC SIMS. In four years there, he has developed over 60 military training videos, consisting of more than five hours of content. He also conceived, designed, and developed a virtual land navigation trainer, of which there are now 12 different terrain variants.
An organisation’s capability is delivered, almost without exception, by the team or set of teams that make up its structure. Effective team training is a significant precursor to the delivery of team performance at the level required for organisational success. The complexity of team training goes far beyond that of individual training as a consequence of both the complexity of the overall team task and its associated task environment, and the training delivery capability required to implement such training. Consequently, the front end analysis techniques required to identify team training requirements, specify training solutions and evaluate training options have to address these complexities. Team and Collective Training Needs Analysis (TCTNA) is a methodology that has been developed for the UK MOD specifically to address this front end analysis challenge.

The purpose of this tutorial is to provide an understanding of how analysis and design concepts familiar from Instructional Systems Design have been extended within TCTNA to address the complexities of team and collective training, and to demonstrate its application by means of a Maritime Force Protection Case Study. The iterative application of TCTNA to support key stages in the acquisition process will also be discussed.

This tutorial is aimed at anyone with an interest in specifying team and collective training requirements and identifying viable training solutions.

Presenters

JOHN HUDDLESTONE, Ph.D., is a Senior Research Fellow in the Human Systems Integration Group within the Engineering and Computing Faculty at Coventry University in England. A co-author of the Team and Collective Training Needs Analysis Methodology, his research interests include team training, human factors methods and aviation human factors. Current research projects include the human factors of future flight deck technologies and single pilot operations, and the team and collective training implications of future maritime unmanned systems concepts. He holds a Ph.D. in applied psychology from Cranfield University, a Master’s degree in Computing Science from Imperial College, London and BS in Education from Nottingham Trent University.

JONATHAN PIKE, is a freelance learning and development consultant currently living in Perth, Western Australia. Since 2005, while working at Human Factors departments of Cranfield University and Coventry University, he has conducted research for the UK MOD under the auspices of the Human Factors Integration Defence Technology Centre and Defence Human Capability Science and Technology Centre. A visiting researcher at Coventry University, he holds a B.S. in Biology from University College London and an M.S. in Applied Computing Technology from Middlesex University.