Constructing Training Demonstrations

Dan Fu, Randy Jensen, Alex Davis
Stottler Henke Associates, Inc.
951 Mariners Island Blvd, #360
San Mateo, CA 94404
(650) 931-2700
{fu,jensen,davis}@stottlerhenke.com

Roy M. Elam Jr.
Directorate, Training, Doctrine, and Combat Development,
Training Development Division, New Systems Training Branch
Fort Knox, KY 40121
(502) 624-5828
roy.elamjr@us.army.mil

Abstract—Demonstrations have been favored by the Army as a complement to more traditional training materials because they accelerate learning, stimulate interest, and communicate better than text. Unfortunately, demonstrations have received little attention in the research literature and there is little consensus on what constitutes a good demonstration. We describe two parallel avenues of research towards the rapid construction of effective demonstrations. The first avenue's goals are to: clearly articulate the nature and purpose of demonstration; compare related areas of research to identify factors influencing demonstration effectiveness; and define a set of component capabilities, guidelines and best practices for creating effective demonstrations. The results inform the second avenue's investigation of how a demonstration authoring toolset can be constructed from existing virtual training environments using 3-D multiplayer gaming technologies. Together these avenues inform our effort to create demonstrations for Army curricula. [1] [2]

TABLE OF CONTENTS

1. INTRODUCTION

The use of demonstrations in Army training environments is pervasive. While most will agree that live demonstrations are the most effective way to convey information to warfighters, this conjecture has never been proven. What's needed is a framework that can taxonomize training demonstrations, and prescribe ways to measure the usefulness of any given demonstration. Moreover, such a metric would suggest ways to improve existing demonstrations, or how one might devise future demonstrations. As we consider these metrics, there are two important developments in education. First, traditional teaching methods in a classroom have seen changes in recent years with the growing popularity of distance learning. Whole degrees can be earned online. The second important development is the use of virtual environments, such as Second Life, where layman participants can customize avatars and environments. Educational classes can be held in the simulated world. Together, these two developments suggest that demonstrations can be constructed in the virtual world. The benefits are many, such as reductions in development time, online dissemination, and lessening production cost.

In this paper we describe ongoing efforts to (1) create an instructional framework in which demonstrations can be measured, (2) explore the use of virtual environments by investigating technology platforms, and (3) combine results of the first two to construct effective virtual demonstrations. For the instructional framework, Rosen et al. [20] have been conducting research in organizational psychology. The psychology literature has established that virtual or constructive environments can accelerate the learning process by illustrating correct behaviors, establishing a shared mental model of team behavior, and supporting such advanced techniques as cross training [22]. Demonstrations have been considered only within a broader training context. Demonstrations by themselves have received little attention with little to no agreement on what makes a demonstration effective. Our second effort is technology investigation, which examines and evaluates approaches and platforms to be employed for demonstrations, such as film, video, computer-based training, videogames, and simulations [10]. The third effort seeks to combine the earlier two. Here we will discuss the construction of a team demonstration using guidelines from the psychology literature along with a 3-D virtual environment technology platform. Altogether these efforts make up a demonstration authoring system called RADX: Rapid Authoring of Demonstrations for eXperience.

The rest of this paper is organized as follows. We describe the theoretical basis for demonstrations. This includes an analysis of the relevant literature with demonstration-oriented elements called out. We then characterize the space of technology platforms with a focus on 3-D game engines. With these two pieces of work in mind, we examine team training applications for breaching operations.

2. THE NATURE OF DEMONSTRATION

In this section we summarize the nature and purpose of demonstration. See [20][21] for an expanded version. Training is the systematic acquisition of the knowledge, skill, and attitude (KSA) competencies targeted for acquisition. Generally training consists of five core elements: the provision of information (e.g., classroom

1

[1] 978-1-4244-2622-5/09/$25.00 ©2009 IEEE.
[2] IEEEAC paper #1338, Version 2, Updated January 16, 2009

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE **16 JAN 2009**	2. REPORT TYPE	3. DATES COVERED **00-00-2009 to 00-00-2009**
4. TITLE AND SUBTITLE **Constructing Training Demonstrations**		5a. CONTRACT NUMBER
		5b. GRANT NUMBER
		5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)		5d. PROJECT NUMBER
		5e. TASK NUMBER
		5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Stottler Henke Associates Inc,951 Mariners Island Blvd #360,San Mateo,CA,94404**		8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR’S ACRONYM(S)
		11. SPONSOR/MONITOR’S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
Proceedings IEEE Aerospace Conference, Big Sky, MT, 7-14 Mar 2009

14. ABSTRACT
see report

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**9**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

lectures), demonstration (e.g., live demonstrations, video recorded examples of task performance), practice (e.g., simulation, guided on-the-job performance), feedback (e.g., results analysis), and remediation (i.e., the selection of future training [23]). This section forwards a conceptual definition of a demonstration and a review of the theoretical basis underlying the use of demonstrations for training. Guidelines for developing effective demonstrations are summarized.

Although an exact and widely accepted definition of a demonstration is currently lacking [26], demonstration-based training can be understood as a learner's observation of task performance, components of task performance (i.e., part-task performance) either in real time or through some form of recorded or computer generated medium, or characteristics of the task environment that have been targeted for acquisition. Demonstrations are often an example of task performance; however, demonstrations are rightfully thought of as engineered experiences where learners are prompted to actively process the informational content of the example, and to systematically and reliably acquire targeted KSA's and transfer them to the work environment. In this vein, we propose a working definition of demonstration: "A demonstration is a strategically crafted, dynamic example of partial or whole task performance or of characteristics of the task environment intended to increase the learner's performance by illustrating (with modeling, simulation, or any visualization approach) the enactment of knowledge, skills, and attitudes (KSA's) targeted for skill acquisition."

Demonstrations vary in terms of information, physical characteristics, and the learner's activities prior to, during and after the example of task performance. We distinguish between an example, which is the observational component of the demonstration, and the demonstration, which is the entirety of the example plus additional activities and information provided. In the following section we review the theoretical literature pertinent to designing effective demonstrations.

Theoretical Basis for Demonstration-based Training

Learning through observation has been one of the fundamental means of acquiring knowledge and skills in both systematic and informal training. This section briefly reviews two of the research traditions in behavioral science that form the cornerstones of our understanding of demonstration-based training: observational learning and behavior modeling training.

Observational Learning

Bandura [2] describes four observational learning processes:

(1) attention (whereby people must actively process what they are observing in order to learn),

(2) retention (wherein what is observed must be stored symbolically in order to affect future behavior),

(3) production (whereby the stored symbolic knowledge must be reconverted into overt actions), and

(4) motivation (whereby the perceived consequences of performing the observed behavior must be favorable enough to strengthen the likelihood of future performance).

This theory has received much empirical attention with the majority of research conducted under the general observational learning heading tending to involve lower level motor tasks. Hence, the generalizability of the empirical findings from these studies to types of complex tasks trained by organizations is suspect. Still, Bandura's observational learning theory remains the most widely researched and applied.

Behavioral Modeling Training

Behavioral modeling training (BMT) is one of the most extensively used training methods available to modern organizations [25]. BMT is based on Bandura's social learning theory [13]. Utilizing the model provided by social learning theory, BMT includes processes such as modeling, a retention process, behavioral rehearsal, feedback, and methods of training transfer to encourage the greatest transfer of training possible [8][16]. Specifically, during BMT:

(1) trainees are given a list of well-defined skills and facts to be learned during training,

(2) during training models and visual aids are used to illustrate effective behaviors and skills,

(3) trainees are provided ample opportunities to practice newly learned skills,

(4) trainees are provided feedback and social reinforcement by trainers and other trainees, and

(5) trainers and the organization utilize many methods to promote transfer of training [7].

Using all these methods, behavioral modeling training has proven to be an effective training tool in developing skills, resulting in high transfer of training. Additionally, BMT has been tested and found effective in a number of scenarios including training technical and interpersonal skills.

A Typology of Demonstrations

We have created a typology of demonstrations shown in Figure 1. It represents classes of features that can be included within a demonstration. Any one demonstration may (and likely will) have features from more than one category. This framework organizes the space of possibilities and provides a common language for discussing demonstrations.

There are two types of knowledge: procedural and strategic. Procedural knowledge is “how-to” knowledge; it involves knowledge about the sequences of actions involved in task performance. It is a rehearsed and static sequence of behaviors performed to reach a task goal, such as performing a “stack” as part of a forced entry sequence. Strategic knowledge is “how-to-know-when-to-do-what” knowledge [15] and is generally associated with problem solving. Strategic knowledge involves learning aspects of the task that are not specific to one context, such as deciding when to initiate communication during an operation.

There are two high level categories concerning the types of activities and information provided in the demonstration. First, passive demonstrations do not require any activity on the part of the learner outside of the act of observing. These are by far the most frequently encountered demonstrations in day to day life and training programs. Passive demonstrations rely entirely on the content of the example and sometimes guiding information to focus the attention of the learner, but do not incorporate any directions that require action (behavioral or cognitive) on the part of the learner. Active demonstrations impose demands on the learners outside of passively observing an example of task performance. They require the learner to engage in activities designed to increase the retention of knowledge and transfer of skill. Table 1 summarizes the six categories of demonstrations. Other than guided vs. unguided, the types are not mutually exclusive, and so a demonstration can be both active-preparatory and active-retrospective for example.

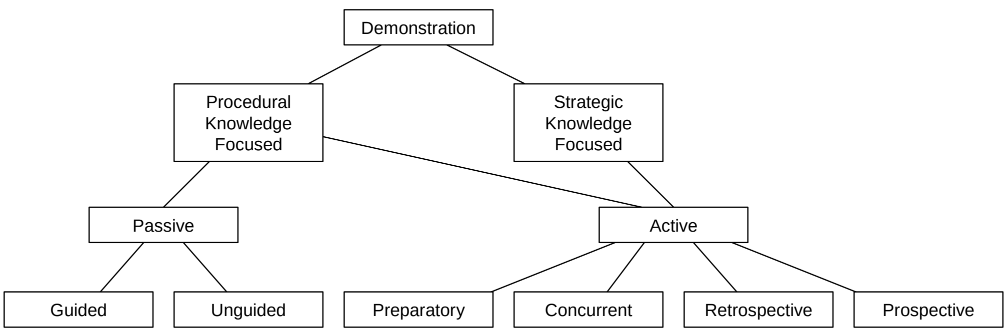

Figure 1: Typology of Demonstrations for Simulation-based Training [24]

Table 1: Description of demonstration types (adapted from [24])

Demonstration Type	Description	Example features	Citations
Passive-unguided	Learners given no requirements or information outside of that present in the example of task performance or task environment characteristics	N/A	[1][3][4][19]
Passive-guided	Learners are given pre-demonstration information intended to increase learning	Attentional advice, provision of learning points	[7][14]
Active-preparatory	Learners engage in activities (designed to orient and focus the learner) before viewing the example for the observation experience to come before viewing the example	instruction on self-regulatory skills for observation, goal setting, and perceived self-efficacy	[5][12]
Active-concurrent	Learners engage in activities during observation of example	note taking, perspective taking	[18]
Active-retrospective	Learners engage in activities after viewing the demonstration designed to focus attention on salient aspects of performance	symbolic mental rehearsal, learner-generated learning points	[6][13]
Active-prospective	Learners engage in activities after observing the example that focus the learner on how it can be applied to other contexts	goal setting exercises, the generation of practice scenarios by the learners	[17][25]

3. PLATFORMS AND TECHNOLOGIES

In this section we examine the types of game technologies and link them to demonstration. Fu, Jensen, and Hinkelman [10] categorize technologies along two dimensions: depiction and plurality (see Table 2). The most popular depiction is 3-D, which makes the visualization as realistic as possible, as opposed to 2-D. Plurality refers to the number of participants: single player, multiplayer, or massively multiplayer. Using these two dimensions, we now highlight the most popular combinations.

2-D Single Player Games depict a point of view either from overhead or from the side. 2-D depictions could be most useful for "big picture" understanding, such as training coordination among teammates. 2-D game engines, compared to others, offer the lowest amount of fidelity. Their use for demonstration-based training is limited.

Table 2: Basic categories of game engines

		DEPICTION	
		2-D	**3-D**
PLURALITY	**Single**	Avatar in a 2-D environment. The perspective is an overhead or side view.	The player's avatar operates in a 3-D environment. First-person shooters and real-time strategy games are common.
	Multiplayer	Multiple players control an avatar in the 2-D world. Typically an extension of single player. Much less common.	Typically less constructive than the 3-D single player games as there are human players.
	Massively Multiplayer	A small handful exist as free games. Several commercial 3-D based systems have ancillary 2-D views as well.	Similar to 3-D multiplayer except players can number in the thousands with persistent worlds.

3-D Single Player Games display the virtual environment by rendering it from parameters and descriptions of 3-D objects. It assumes the player is the only person operating in the environment, and that anything else independently moving is controlled by artificial means. The engine may support many "cameras" or viewpoints within the environment, such as first person, tethered, overhead, or a user-controllable point of view. It may support display of several cameras simultaneously on one screen. There are three major genres: first-person shooter (FPS), real-time strategy (RTS), and role-playing game (RPG). Briefly, FPS depicts a first-person point of view. Emphasis is on real-time shooting ability. RTS depicts scenes from an overhead, angled perspective. The player will control several units from above. RPG is similar to RTS, but there is no real-time component.

3-D Multiplayer Games increase the number of human players involved. One might think of multi-player as the same as single player except that the control for avatars is supplanted by real human control.

3-D Massively Multiplayer Online Games (MMOG) are similar to 3-D multiplayer except on a bigger scale. They feature a huge virtual world, potentially as big as the earth, where one may explore and meet other avatars and objects. Unlike the multiplayer games whose participants assemble temporarily and then disperse when the game round concludes, MMOG's retain history in the virtual world: the world changes and so do the avatars in it.

Guidelines for Developing Effective Demonstrations

Much of the existing training research concerns tasks that are more abstract and simple rather than the types of tasks the Army generally choose to train. Still, we were able to gather general principles in the form of seven preliminary and empirically based guidelines as shown in Table 3 (see [21] for additional information).

Table 3: Suggested guidelines

Guideline
1. The KSA's targeted for demonstration-based training must be perceivable by the learner.
2. Direct the learner's attention to the cues relevant to learning.
3. Use instructional narratives to make covert aspects of performance accessible to learners.
4. Utilize mixed models, as opposed to positive-only models, to display both positive and negative behaviors and outcomes.
5. Show the consequences of behaviors.
6. Instruct learners to create their own scenarios in which to rehearse behaviors.
7. Instruct learners to symbolically or mentally rehearse behaviors and skills before rehearsing them.

4. Example Use Case

In this section we describe an example use case currently underway. It is composed of (1) existing curricula at the Army's Armor School at Fort Knox, Kentucky; (2) a comparison of demonstration approaches; and (3) a use case involving breaching operations.

Armor School Training

The Armor School's mission is to educate and train Soldiers in the art and science of Mounted Maneuver Warfare which includes the control of tanks, armored infantry carriers, artillery, and so forth. The school implements curricula that range from simple individual tasks to complex collective tasks. There are many competencies that Soldiers are expected to gain while attending courses at the Armor School but the most important outcome is that Soldiers become agile and adaptable leaders.

Leadership courses conducted at the Armor School's Noncommissioned Officers Academy uses a Small Group Instruction method for content delivery. PowerPoint slides are developed and used to help guide the instruction. The advantage of this type of instruction is it allows the instructor the opportunity to facilitate discussions (e.g., active-concurrent, active-prospective) that provide a basis for active learning. The Soldiers are able to share their experiences with their peers and the instructor is able to bridge these experiences to a learning objective. Through the sharing of experiences critical reflection (e.g., active-retrospective) occurs and provides a means for Soldiers to become agile and adaptable.

In addition to the discussions that take place in the classroom the instructors present demonstrations on competencies such as command and control of maneuver elements and offensive and defensive operations. To accomplish the demonstration, the instructor uses a 3-D model terrain board and micro armor (miniature vehicles that can be easily moved) and walks the students through the process of accomplishing tasks associated with the competencies. The Soldiers are allowed to practice the tasks and then assessed using the terrain board.

There are both advantages and disadvantages associated with the Armor School's terrain board-based demonstration technique. The biggest advantage is that Soldiers are able to learn with their peers by vocally sharing their experiences in the field. In addition, the demonstration resources required to "move" vehicles are minimal in the scope of a live training event where vast amounts of land, fuel and personnel are required. Soldiers are able to practice each task as many times as they need to become proficient in the task while receiving immediate feedback from their peers as well as their instructor.

The disadvantages of the demonstration and practice model described above are that the students are provided with only a 2-D "bird's eye view" of the vehicle movement. In addition, only one Soldier at a time can "move" vehicles while the other Soldiers are passive observers. There is a lag time that occurs in the demonstration and the practice because a student must physically pick up and move his "micro armor" vehicles among check points. The lag time and passiveness diminish the realism of this training and does not immerse the Soldier into the training.

Technology Platform Opportunity

Given the terrain board-based method for demonstrations, potential visualization and manipulation technologies are applicable here. Considering platforms, there could be straightforward depictions of the terrain in both an overhead view using a 2-D map and a virtual 3-D environment. We identify seven potential advantages:

(1) Instructor-controlled viewpoint. The instructor can adopt camera viewpoints ranging from bird's eye view, to behind-vehicle, to first person.

(2) Varying time. The instructor can control the passage of time. It's then possible to demonstrate movement in real-time, faster than real-time, slow motion, or reverse.

(3) Both instructors and trainees can operate or move assets within the demonstration, either by simulated "driving" of the vehicles, or simply shift objects in the 3-D world with ease.

(4) The instructor and trainee are not necessarily co-located; i.e., that demonstrations can be broadcast. This brings up the possibility of distance learning.

(5) Demonstrations can be recorded for later (unlimited) playback, using standard media (video capture) or within the virtual world.

(6) Cross-training is possible for team instruction where trainees are able to view perspectives of other teammates.

(7) Terrain can be switched quickly. Rather than employ a single terrain with varying vehicles, a completely different terrain can be used easily; e.g., switching from desert to urban terrain.

Implementing a demonstration in a virtual environment has the potential to improve the instruction of the current model and diminish the disadvantages outlined earlier. In this next section we consider a particular portion of the Armor School curriculum for construction of a demonstration.

Breaching Use Case

Breaching is the employment of a combination of tactics, techniques, and procedures to project combat power to the far side of an obstacle. Obstacles are any obstructions that stop, delay, divert, or restrict movement. They are usually covered by observation and enhanced by direct or indirect fires.

Conducting a breaching exercise for an Armor platoon is complex and requires a specific process to reach the desired outcome. In order to conduct a breaching exercise several teams must maneuver in tandem and each element must be able to do their specific task without error. Breaching operations usually entail the coordinated efforts of three task organized elements:

(1) The support force- employed to suppress identified and characterized enemy elements that are overwatching the obstacle. The support force uses direct and indirect fires to accomplish its mission.

(2) The breach force- creates and proofs a lane through the obstacle, allowing the assault force to secure the far side of the obstacle.

(3) The assault force- moves through the cleared obstacle to secure the far side of the obstacle allowing other elements to maneuver through the obstacle.

Teaching this exercise in a live environment requires a vast amount of resources including vehicle, fuel, Observer Controller personnel, and land. It also requires personnel to pose as the opposition force in order to make the exercise realistic. In order to practice this exercise and allow each student an opportunity to act as a leader for each element would is very time consuming. The obstacle must be reconstructed for each iteration while students reset back to a starting point for each iteration. An After Action Review (AAR) can be conducted each time, but the exercise must be filmed and there must be a facility available to view the film and to conduct an AAR. This will add to the already extensive resources required for this type of learning activity.

To reduce the resources required to conduct a live demonstration and exercise, training developers at the Armor School develop PowerPoint slides that describe the functions of each of the teams associated with a breach exercise. Students move to the 3-D terrain board and are talked through the exercise using the micro-armor as mentioned earlier. In this setting all of the students are not engaged as only one student at a time will conduct the exercise. Thus, for one student there is training while the rest are passively guided. The exercise requires little resources and students are permitted to offer feedback to each other (active concurrent) as the exercise is being conducted. The disadvantage of using a terrain board is it is not as engaging as a live event and the students see the task from only a bird's eye view perspective.

If the facilitator had a virtual demonstration tool that permitted the same engagement opportunity as a live exercise and eliminated the resources required of a live exercise, it would provide a more efficient way of allowing students to experience a complex maneuver such as a breaching exercise. Through a role playing demonstration, each student would be able to be the leader of each of the breaching forces required to effectively conduct a breaching exercise. In addition, the students while role playing a Tank Commander, would see the exercise from the Tank Commander's hatch, hastening acquisition of strategic knowledge. This would allow the Tank Commander to gain experiences and facilitate the agile adaptable leader concept. The facilitator and students could provide constructive (retrospective) feedback to each other and learn from each other's experiences.

Table 4 summarizes the three demonstration approaches—live, terrain board-based, and virtual. For completeness, "live" is included though it is used sparingly by the Armor School. The rows are the various factors discussed.

Table 4: Comparison of Armor School demonstration approaches

	Live Demonstration	Terrain Board Demonstration	Virtual Demonstration
Viewing Perspective	Real, situated, tactical	Model, 2-D bird's eye view	Both 2-D bird's eye and 3-D tactical views, either instructor- or trainee-driven
Resources	Live use of real assets	Small-scale model terrain construction	Computer-based terrain construction
Scene Arrangement	Longest, involving physical placement	Fast, requiring placement of micro armor assets	Fast, virtual world placement of assets
Time Efficiency	Real-time	Faster than real-time	Faster than real-time
Shared Experience	Yes (team – no)	Yes	Potentially yes
Repeatable	Yes, requires moving assets, role players	Yes, requires moving assets	Yes - with simulation control
Stimuli	Real life	Abstraction	Life like + abstraction
Feedback	Delayed	Immediate	Immediate with playback
Team Training Capable	Yes - limited cross-training	Yes - limited cross-training	Yes
Distribution	No - All participants must be present	No - All participants must be present	Potentially yes

CONCLUSION

This paper forwards two threads of investigation: an instructional framework, and virtual technologies. These were considered in an Armor School use case where we contrasted the current terrain board-based technology with virtual technology.

ACKNOWLEDGEMENTS

This work was funded and sponsored by the US Army Research Institute under the SBIR program. Opinions expressed are those of the authors and do not necessarily represent an official position of the Department of the Army or the Army Research Institute.

REFERENCES

[1] Austin, S., & Laurence, M. (1992). An empirical study of the SyberVision golf videotape. Perceptual and Motor Skills, 74(3, pt 1), 875-881.

[2] Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Rockville, MD: National Institutes of Mental Health.

[3] Berry, D. C. (1991). The role of action in implicit learning. The Quarterly journal of experimental psychology, 43(4), 881-906.

[4] Blandin, Y. & Proteau, L. (2000). On the cognitive basis of observational learning: Development of mechanisms for the detection and correction of errors. The Quarterly Journal of Experimental Psychology A, Volume 53, Number 3, 1 August 2000, 846-867.

[5] Cumming, J., Clark, S.E., Ste-Marie, D.M., McCullagh, P., & Hall, C. (2005). The functions of observational learning questionnaire (FOLQ). Psychology of sport and exercise, 6, 517-537.

[6] Davis, F.D., & Yi, M.Y. (2004). Improving computer skill training: behavior modeling, symbolic mental rehearsal, and the role of knowledge structures. Journal of Applied Psychology, 89(3), 509-523.

[7] Decker, P. J. & Nathan, B. R. (1985). Behavior modeling training: Principles and applications. New York: Praeger.

[8] Doo, M. Y. (2005). The effects of presentation format for behavior modeling of interpersonal skills in online instruction. Journal of Educational Multimedia and Hypermedia, 14(3), 213-235.

[9] FM 7-1 (2003). Battle Focused Training. Washington, DC: Department of the Army.

[10] Fu, D., Jensen, R., & Hinkelman, E. (2008). “Evaluating Game Technologies for Training,” IEEE Aerospace Conference.

[11] Fu, D., Jensen, R., Salas, E., Lampton, D., & Kusumoto, L. (2008). Constructing Virtual Training Demonstrations. Proceedings of the Industry/Interservice, Training, Simulation & Education Conference (I/ITSEC 2008).

[12] Hard, B. M., Lozano, S. C., & Tversky, B. (2006). Hierarchical encoding: Translating perception into action. Journal of Experimental Psychology: General, 135, 588-608.

[13] Hogan, P. M., Hakel, M.D., & Decker, P.J. (1986). Effects of trainee-generated versus trainer-provided rule codes on generalization in behavior-modeling training. Journal of Applied Psychology, 71(3), 469-473.

[14] Jentsch, F., Bowers, C., & Salas, E. (2001). What determines whether observers recognize targeted behaviors in modeling displays? Human Factors, 43(3), 496-507.

[15] Kontogiannis, T., & Shepherd, A. (1999). Training conditions and strategic aspects of skill transfer in a simulated process control task. Human-Computer Interaction, 14, 355-393.

[16] Kraut, A. I. (1976). Developing managerial skills via modeling techniques: Some positive research findings- A symposium. Personnel Psychology, 29, 325-328.

[17] Latham, G.P. & Saari, L.M. (1979). Importance of supportive relationships in goal-setting. Journal of Applied Psychology, 64(2), 151-156.

[18] Lozano, S.C., Hard, B.M., & Tversky, B. (2006) Perspective-taking Promotes Action Understanding and Learning. Journal of Experimental Psychology: Human Perception and Performance, 32(6), 1405-1421.

[19] Palmiter, S. & Elkerton, J. (1993). Animated demonstrations for learning procedural computer-based tasks. Human-Computer Interaction, 8(3), 193-216.

[20] Rosen, M.A., Salas, E., & Pavlas, D. (2009). Demonstration-based Learning: Typology of Instructional Features, and Some Initial Propositions. Unpublished manuscript.

[21] Rosen, M. A., Salas, E., & Upshaw, C. L. (2007). Understanding Demonstration-based Training: A Conceptual Framework, Some Principles and Guidelines. Unpublished manuscript.

[22] Salas, E., & Cannon-Bowers, J.A. (2000). The anatomy of team training. In S. Tobias and J.D. Fletcher (Eds.), Training & Retraining (pp. 312-335). New York: Macmillan Reference.

[23] Salas, E., Priest, H. A., Wilson, K. A., & Burke, C. S. (2006). Scenario-based training: Improving military mission performance and adaptability. In C. A. C. A.B. Adler, and T.W. Britt (Eds.), Military life: The psychology of serving in peace and combat (Vol. 2: Operational Stress, pp. 32-53). Westport, CT: Praeger Security International.

[24] Salas, E., Rosen, M. A., Pavlas, D., Jensen, R., Fu, D., Ramachandran, S., Hinkelman, E. (2008). Understanding Demonstration-based Training: A Definition, Conceptual Framework, and Some Initial Guidelines. Army Research Institute Technical Report, to appear.

[25] Taylor, P. J., Russ-Eft, D.F., & Chan, D.W.L. (2005). A Meta-analytic Review of Behavior Modeling Training. Journal of Applied Psychology, 90(4), 692-709.

[26] Williams, A. M., Davids, K., & Williams, J.G. (1999). Visual perception and action in sport. London: Spon.

BIOGRAPHY

Dan Fu is a group manager at Stottler Henke Associates. He joined in 1998 and has worked on several artificial intelligence (AI) systems including AI authoring tools, wargaming toolsets, immersive training systems, and AI for simulations. He is the principal investigator for SimBionic, which enables users to graphically author entity behavior for a computer simulation or game. Dan holds a B.S. from Cornell University and a Ph.D. from the University of Chicago, both in computer science.

Randy Jensen is a group manager at Stottler Henke Associates, Inc., working in training systems since 1993. He has developed numerous Intelligent Tutoring Systems for Stottler Henke, as well as authoring tools, simulation controls, after action review tools, and assessment logic routines. He is currently leading projects to develop automated after action review for Marine Corps combined arms training, a framework for ITS interoperability with distributed learning architectures for the Joint ADL Co-Lab, and an authoring tool for virtual training demonstrations for the Army. He holds a B.S. with honors in symbolic systems from Stanford University.

Alex Davis is an AI Researcher at Stottler Henke. Mr. Davis has been a researcher, knowledge engineer, and software engineer at Stottler Henke over the last ten years. He has worked on a variety of cognitive agent architectures and training simulations, including several recent projects on the computational representation of cultural influences on human behavior, for training simulation applications. He graduated summa cum laude from the College of William and Mary in math and philosophy, and has an MS in computer science from SUNY Buffalo.

Roy Elam is an Instructional Systems Specialist for the New Systems Training Branch Training Development Division at Ft. Knox Kentucky. He has worked in the U.S. Army training field as both a Soldier and a civilian and has served in the capacity of training developer and project lead in a variety of areas at the Armor School which included the design and development of both distance and resident instruction. He has developed training strategies for the Armor School's Noncommissioned Officer Academy including the model for the implementation of DARWARS Ambush!, into the program of instruction. He is currently working on game effectiveness research with TCM Gaming and the Army Research Institute. He holds a Masters in Distance Education from the University of Maryland, University College and a M.S. in Human Resource Education from the University of Louisville.