



**Office of Naval Research**  
*S&T to Support Training and Training*  
*Technologies*  
*Program Officer*  
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# Mission



Provide Sailors and Marines with the mission critical competencies essential to waging war and winning the Nation's battles through continuous training and education centered on the learning strengths of the individual at affordable cost



# S&T to Support Training and Training Technology



## Science

- Learning/Memory
- Language Learning
- Individual Differences
- Perception/Attention
  - Working Memory
  - Visual Attention
- Perceptual Learning
- Brain Plasticity

## Technologies

- Cognitive Task Analysis
- Web-based Training System
- Web-based Authoring Tools
- Simulations, Games,  
Simulations/Games
- Assessment Tools for Dynamic  
Simulations
- Language Tutor/Speech  
Recognition/Eye Tracking
- ICAI Authoring Tools



# S&T to Support Training and Training Technology



- **MURI Brain Plasticity and Perceptual Learning(6.1)**
- **Tutorial Dialogues (6.1)**
- **Instructional Strategies (6.2)**
- **Human Performance and Assessment for Distributed Training(6.3)**
- **Human Performance and Assessment (6.3)**
- **Debriefing Distributed Simulation-Based Exercises (6.3)**
- **Training Guidelines (6.3)**



## 6.2 Instructional Strategies



### Research objectives:

**Number of unresolved instructional strategy questions, many with cost-effectiveness dimension –**

- Tailored feedback based on refined diagnosis vs. mere reteaching
- Student control vs. didactic system control
- Direct instruction vs. Socratic hinting
- Value of adaptation to student preferences for visual, verbal
- Disembodied pedagogical expertise vs. embodied instructional agents
- Value of adapting agent characteristics to student
- Added value of natural language interaction
- Fine-grained vs. coarse student models (now being addressed by SBIR)
- **Intelligent tutors provide a controlled lab for research: behavior of human instructors is hard to control**
- **Developing tutoring strategies for on-going, dynamic tasks such as instrument flying, AEGIS anti-air warfare, shipboard damage control is primary current emphasis**
- **Newest direction – tools to facilitate building natural language dialog systems for intelligent tutors**



# Recent Successes



- **USMC Coaches Course Toolset on Combat Rifle Marksmanship**  
**USMC Weapons Training Battalion (WTBN)**
- **Cognitive Tutors( Algebra) effect size 1.5**
- **Reading Tutor effect size .75 increase reading level 6<sup>th</sup> to 8<sup>th</sup> grade.**
- **Guidelines (USC/RSOE) on ADL website (<http://adlnet.org/index.cfm?fuseaction=DLGuid>) NKO and TRADOC**
- **Tutorial strategies for COVE and DCM simulations (SWOS)**
- **REDEEM authoring tool to add intelligence to CBT wraparound program enables developers to specify adaptive instructional strategies effect size .59**



# NETC Transition



## *Web-Based Course Design Guidelines*

- Audience: Military Designers and Developers (including contractors)
- Work with guidelines and case studies drawn from the ONR research
- Gain an understanding of common mistakes and best practices in implementing distance learning programs
- Use a guided case comparison method inspired by work of Gentner (under ONR funding)
- Understand how to use and apply the guideline



# SWOS



- VESUB Simulator for training skill of bringing submarines into harbor -- has transitioned to 6.4 customer support
- COVE Conning Officer's Virtual Environment adds artificially intelligent coaching to VE simulator, demonstrated with underway replenishment application.
- DMCS damage control virtual environment adds intelligent coaching to simulator using (tutorial dialogues) an artificial that coaches in natural language.



# Navy Training Center Great Lakes



Adopted Cognitive task analysis, used to determining the cognitive processes used to carry out critical tasks, in the past has been a major bottleneck in both cognitive engineering of systems and development of effective training systems for tasks with significant unobservable cognitive aspects.



# S&T To Support Training and Training Technology



- **Research on the Effects of Dynamic Environments on Cognitive Skills, PI. Dr. Daphne Bavelier, University of Rochester( FY04-05 to study video games as a training media)**
- **Acquisition of Long-Term Memory as a Means for Skilled Performers to Maintain Situation Awareness Under Stress, PI K. Anders Ericsson Florida State University( FY04-05 to study LTM strategies on situational awareness under stress)**
- **Automated Team Communication Analysis Toolkit, PI: Dr. Peter Foltz and Dr. Adrienne Lee, NMSU( FY04-05 to develop tools for providing automated real time AAR to teams)**



# Authoring Tools:

## Making Intelligent Tutoring Accessible



- Cognitive Analysis Tool (ONR)
  - Aids analysis for Anderson-style models
- IMTS/RIDES (Air Force/ONR)
  - device, other simulations
  - automated maintenance tutor generation
- Virtual Environment Authoring (ONR/AF)
  - to be integrated with RIDES
- Anderson Tutor Toolkit (ONR)



# S&T to Support Training Technology

## Automated Team Communication Analysis Toolkit

Foundation for additional work and potential and applications

- Identified and validated a range of tools and techniques
- Integration with modeling techniques
- Adapted to more robust toolset integrated into training systems for:
  - Detecting individual and team errors and knowledge gaps
  - Predicting cognitive workload,
  - Predicting overall team performance,
  - Predicting failures in team process,
  - Monitoring group dynamics.
  - Detecting appropriate and inappropriate contexts for the mission.
  - Generate automated AARs



# Skill Decay Research

## Research objectives:

Investigate the comparative effectiveness of specified factors in terms of skill acquisition, retention, and reacquisition in a complex command-and-control task environment for both individuals and teams

- practice schedules (massed vs. distributed)
- rehearsal protocols (voluntary, mandatory, & non-rehearsal)

## Results:

**massed condition resulted in higher performance on acquisition** but also displayed a higher amount of skill loss than distributed protocol

- distributed condition did not display any skill loss
- however, protocols did not differ in terms of transfer and reacquisition
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# Tactical Language Trainer



## Objectives:

- Design an ITS for language training for multiple Middle Eastern language (s)
  - Identify a *tactical* subset of language for the soldier not the linguist (e.g., caveman Arabic)
    - Language includes gestures, culture
    - 80 hrs to train the ordinary warrior (SOCOM)
  - Develop tools to track learner focus and engagement and generate proactive help
  - Tools to manage interactive story simulations to achieve instructional objectives.

## Technical Approach

- Focus on skills needed to accomplish specific missions and tasks
- Students memorize signs & symbols, practice skills, take practice test in simulated environment, interacting With computer-generated characters.
- Its provides automated response/feedback to student errors
- Development teams includes education, language, SME's mission, and cultural experts in system design and evaluation.

Provide mission related ITS language trainer to Support SOCOM units conducting joint missions In southeast Asia.  
Provide authoring tools for ITS language training ( e.g., Pashtun)

## Accomplishments / Transfers / Transitions

- Stand-alone deployed ITS for language training (e.g. classical Arabic)
- ITS tools for development of (new ) language training  
6/04 Joint SOCOM, Ft Bragg  
Dr. Lewis Johnson  
Col. John Donnelly , SOCOM USA