



Training Forum

# Efficient Development of Large-Scale Military Training Environments using a Multi-Player Game

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September 20, 2005



# Overview

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# Background: Gorman's Gambit

- Inspired by comments by General Paul Gorman (ret.)
- Basic thesis: Training on teams skills can be taught using...
  - ...Commercial Off-the-Shelf (COTS) games
  - ...non-operational settings
- Goals:
  - Evaluate utility of COTS games for large-scale military training
  - Identify development issues that need to be addressed going forward
- Additional goals: Demonstrate rapid development and re-use of training content.
- Examine use of “modestly massive” Multi-Player Game (MPG)
  - 40+ users interacting in virtual environment
  - Roles are differentiated

## Background: DARWARS

*“DARWARS seeks to transform military training by providing continuously available, on demand, mission-level training for all forces at all echelons.”* (<http://www.darwars.com/>)

- Users distributed globally
- Minimal equipment requirements
- Largely simulation-based
- Diverse training opportunities
- Interoperability between training systems
- Training, not just practice
- Individuals, Teams, and Teams-of-Teams

# Levels of Success Desired

- ★ • **Level 1: “Participation”** - Can we get there (military personnel simultaneously using a MPG for training)?
  - Validates that the technical and logistic infrastructure is adequate to allow virtual exercises to occur.
- ★ • **Level 2: “Subjective Relevance”** - Do players perceive that they are using and learning teamwork skills within the game.
  - Provides evidence that training may be occurring.
- ★ • **Level 3: “Transparency”** - Can we figure out what’s going on (measure training performance)?
  - Allows for pedagogical development of a system.
- ? • **Level 4: “Confirmation”** - Can we correlate subjective experiences with objective measures (do analyses of observations corroborate perceptions)?
  - Internally validates the functioning of the training in the environment.
- **Level 5: “Transfer”** - Is there transference of teamwork skills to other tasks (can we measure the training impact)?
  - Proves the system effective at accomplishing its mission.

# Teamwork Skills

<b>The Big Five Core Components of Teamwork</b>
1. Team Leadership -- The ability to direct and coordinate the activities of other team members, assess team performance, assign tasks, develop team skills , motivate team members, plan and organize, and establish a positive atmosphere.
2. Performance Monitoring -- The ability to develop common understandings of the team environment and apply appropriate task strategies and processes in order to accurately monitor the teammate performance.
3. Backup Behavior -- Ability to anticipate other team member's needs through accurate knowledge about their responsibilities. Includes the ability to shift workload among members to achieve balance during high periods of workload or pressure.
4. Adaptability -- Ability to adjust strategies based on information gathered from the environment through the use of compensatory behavior and reallocation of intra-team resources; altering a course of action or team repertoire in response to changing conditions (internal or external).
5. Team/Collective Orientation -- Propensity to take other's behavior into account during group interaction and the belief in the importance of team goal's over individual member's goals.
<b>Enabling Skills</b>
A. Closed Loop Communication -- The practice of confirming receipt and understanding of others' communications. This practice builds trust in the communication skills, knowledge, and intent of others and ensures that information is accurately conveyed.
B. Team mental models -- The ability to accurately represent the capabilities of others, their responsibilities, and their perception of the state of the world.

Salas, Sims, & Burke (2004)

# Game Properties

- Game selected: Neverwinter Nights™ (NWN)
- Fantasy setting - a la *Lord of the Rings*
- Role-Playing Game
  - Players assume the roles of fictional characters (Avatars)
  - Through their avatars, players interact with each other and with Non-Player Characters (NPCs)
  - Differentiated roles
  - Modern military analogs for fantasy roles
- Scenario Authoring Tools
  - Enable rapid design of new game scenarios
- Moderately massive
  - up to 64 players

Fantasy	Military
Rogue	Scout
Cleric	Medic
Ogre	Tank
Archer	Artillery

# Development Methodology and Challenges

- Approach: Rapid prototyping followed by pilot testing in each phase
- Phase I: Develop basic scenario
  - Issues/Challenges
    - Strongly scripted design v.s. Weakly scripted design
      - Onus of complexity placed on developer v.s. players
      - Use of NPCs, confederates
    - Segregated communication channels
    - Evaluate measurement tools built-in to game
    - Differentiate roles and capabilities of avatars
- Phase II: Improve scenario effectiveness
  - Issues/Challenges
    - Tutorial time and effectiveness (learning to use the game and avatar)
    - Methods for user collaboration (in-person v.s. on-line)
    - Incorporate Voice-over-IP (VoIP) capability
    - Improve balance in avatar capabilities
- Phase III: Improve mission design
  - Issues/Challenges
    - Differentiated roles for squads
    - Multiple sets of mission objectives

# Measures

- Teamwork Measures
  - Task performance
  - Communications volume, direction, & content
- Observation Methods
  - Experimenters monitor game play and note behaviors indicative of effective teamwork
  - Bounded set of behaviors for ease of recording
- Questionnaire and Interviews
  - Focused questions to glean subjective impressions

# Measures

- **Observer In-Game Evaluation Forms**

- Human observers “over-the-shoulder” and via Dungeon Master class

#	Time	Participants Involved	Description of Event	Teamwork Skills Exhibited			Comment
				Skill Shown	Y/N	Quality (1-5)	
1	08:00	Team A Archer and Team B Tank	Tank and Archer engage in battle. Archer calls up squad members for back up. Squad confirms message receipt, arrives and destroys Tank.	Monitoring	Y	3	
				Back-up	Y	4	
				Coordination	Y	3	
				Comm – Push	Y	5	
				Comm – Pull	N	n/a	
				Other... Closed Loop Comms	Y	5	

- **Post-Exercise Questionnaire**

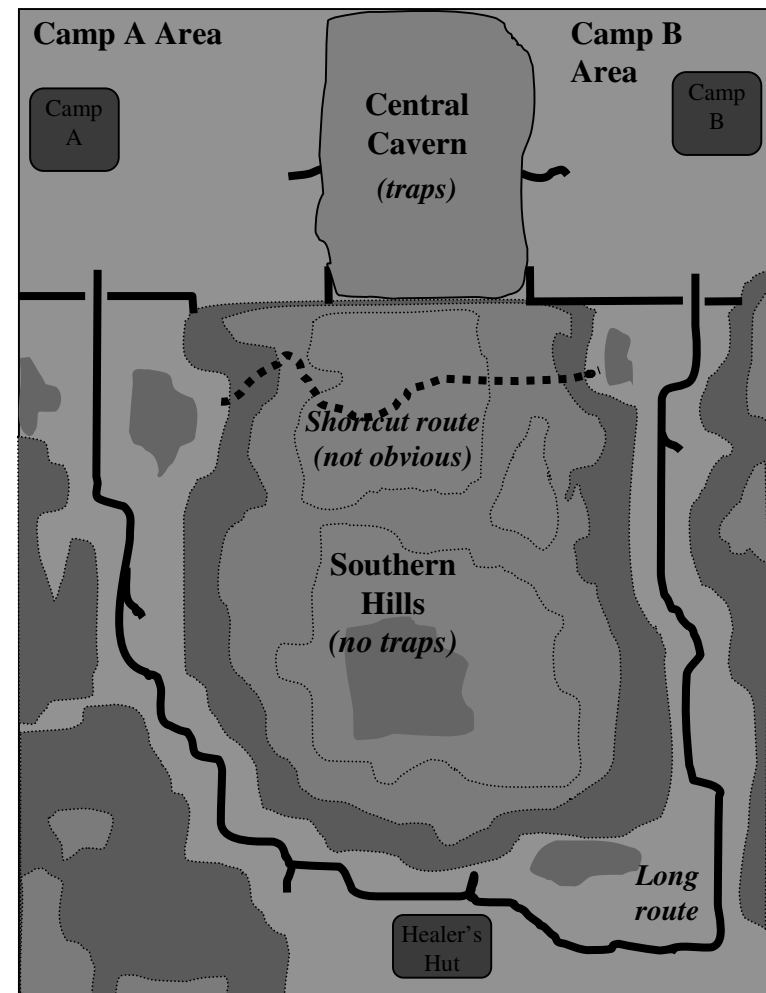
- Anonymous (by avatar name only)
- 21 questions, 7-point scale, some open-ended questions
- Game experience (e.g., stressful)
- Character knowledge
- Team interactions
- Self and team assessment
- Situational awareness of self and team
- Practical applications of the game as a learning tool.

- **Post-Exercise After Action Review**

- Likes and dislikes of the game
- Team challenges
- Teamwork examples
- Strategies and adaptations, successful and unsuccessful
- Game relation to Army tactics and training needs
- Comparison to other MPGs

# Scenario Design

- Three game-familiarization tutorials
  - Buttonology
  - Individual avatar skills
  - Working as a squad
- “Platoon v.s. Platoon” Capture-the-Flag missions
  - 20 players per side
  - Home camps
  - “Hidden” camp
- Simple design, complex results
  - Hierarchical communications
  - Avatar-specific skills and resources
  - Death isn’t permanent
  - Some traps
  - Some NPCs



# Avatars and Command Structure

- Platoon Leader
  - Moderate combat ability
  - Moderate speed
- Squad Leader
  - Moderate combat ability
  - Moderate speed
- Archer
  - Long-range weapons support
  - Moderate close-range combat abilities
- Artillery
  - Short and long-range attacks
  - Low physical combat ability
  - High resistance to spells.
- Medic
  - Very low combat ability
  - Resurrection and healing
  - High speed.
- Scout
  - Moderate combat ability
  - High speed
  - Reconnaissance, stealth, trap setting, detection and disarming
- Tank
  - Powerful combat ability
  - Slow speed
- Command Structure



# Event Details

- Held at Fort Benning, GA on December 15-16, 2004
  - First Day: Game Familiarization (4 hours)
  - Second Day: Main Exercise (6 hours)
- Participants were 40 Infantrymen
  - Regularly used in testing and evaluation
  - Most were in the same Infantry platoon
  - Between 19 and 33 years of age (M= 23.6 years)
  - With 1.5 to 174 months of experience (M= 51.2 months)
- Three successive missions. Each mission involved:
  - Strategizing (15 min)
  - Execution (30 min)
  - Debriefing (15 min)
- Varying Mission Goals
  - Mission 1: VoIP, Possession of most flags at end of 30 minutes
  - Mission 2: Text, Possession of flags for longest total duration
  - Mission 3: VoIP, Possession of most flags at end of 30 minutes
- After Action Review (30 min)



# Lessons Learned

1. Teamwork skills can be observed in MPGs.
  - 115+ examples of specific teamwork skills were extracted from exercise.
  - Skill and resource limitations successfully encouraged teamwork.
  - Observers noted an improvement in quality of teamwork (coordination, communication, monitoring, backup) over successive missions.
  
2. Any game-based training system must be robust.
  - Must allow for flexibility: Distributed, game-based military training will involve wide varieties of technology, changing numbers of participants, and resourceful soldiers.
  - Must guard against user or environmental factors that affect training value.
  - e.g., AAR responses indicated high frustration levels when opponent team members were able to take advantage of software vulnerabilities.
    - Avoiding respawning
    - Eavesdropping on enemy text communications

# Lessons Learned

3. Rapid scenario and avatar authoring is critical for training effectiveness and operational acceptance.
  - Local trainers must be given the ability to tailor and control their own scenarios to complement their local training.
  - e.g., NWN's ease of authoring was very useful during the exercise.
    - Improved Platoon Leader avatar
    - Added GPS capability
    - Fixed small error with door
  
4. Targeted scenario design is critical for training effectiveness and operational acceptance.
  - Existing gaming technology may provide venue for occasionally practicing of specific skills.
  - But, for training, scenarios must be tailored to exercise specific skills.
  - e.g., the Gorman's Gambit scenario effectively:
    - Emphasized infantry-specific ground-based interaction
    - Defined specific missions that encouraged teamwork
    - Manipulated resource and skill distribution

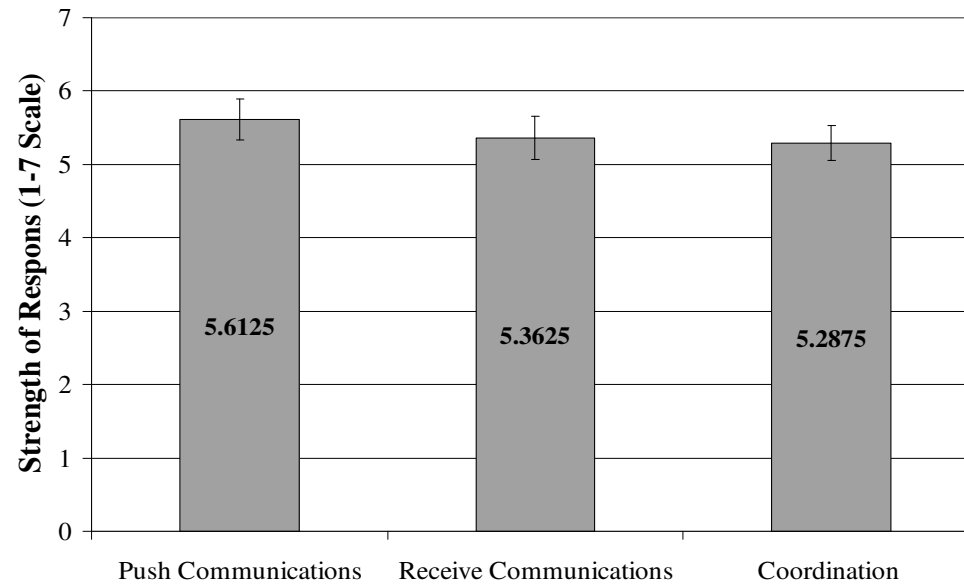
# Lessons Learned

5. Ease of conducting and maintaining a game session are critical for successful participation.
  - Complications in starting a session or correcting technical problems will affect level of user participation and “immersion”.
  - e.g., Mission start-up was quick and painless.
  - e.g., Successfully resolved several problems quickly during exercise.
  
6. Using gaming technology for training purposes requires additional assessment tools.
  - COTS games do not have all the components critical for effective training.
  - Effective training requires tools for observation, in-game metrics of performance and tools for AAR.

# Lessons Learned

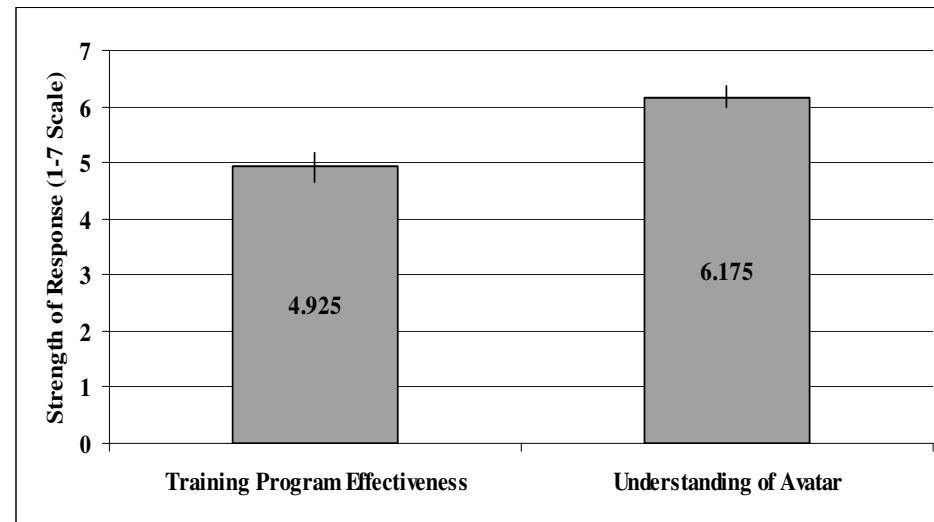
## 7. Training superiority can be obtained by carefully controlling level of fidelity.

- Specify the training goals to be met and then select game or simulation environment that reflects real-world characteristics to an appropriate degree.
- e.g., A component of teamwork skills is communication and coordination.
  - Attempted to provide adequate and realistic communication capability.
  - Participants highly rated all aspects of communication.



# Lessons Learned

8. Training on the simulator interface is critical, as is training on avatar roles and skills.
- Participants rated the effectiveness of game training as moderate to high.



9. Low operational realism has both benefits and drawbacks.
- As predicted: Fantasy setting allowed exhibition of teamwork behaviors.
  - Participants drew parallels with the military (e.g., flying goblins = UAVs).
    - 80% of the soldiers reported verbally in the AAR that they saw similarities between a game environment and a military environment.
  - However, fantasy setting made buy-in from military participants difficult.
    - 43% of soldiers indicated in the AAR that the game had poor realism.

# Conclusions

- Gorman's Gambit was a success: Teamwork may be elicited and observed within an MPG.
  - Participation ✓
  - Subjective Relevance (perception of teamwork) ✓
  - Transparency (measuring teamwork) ✓
  - Confirmation (observations corroborate perceptions) ✓
- Authoring capability of COTS games enables rapid prototyping
- Game scenarios may be reused for different sets of mission objectives
- Existing MPG Role-Playing Games may be well-suited for supporting military training.
- But,
  - Existing COTS MPG technologies do not provide the proper assessment capabilities for teamwork training.
  - Participants' perception of training utility varied

## **Acknowledgements:**

**DARPA PM: Ralph Chatham**

**Participating soldiers at Fort Benning, GA**

**Team from Aptima, Inc.: Shawn Weil, Tad Brunye, Jason Sidman,  
Frederick Diedrich and Lisa Spahr**

**Team from Advance Design Information: Harold F. O'Neil and Richard  
Wainess**

**DARWARS PI: Bruce Roberts**