The Road to Virtual Squads

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Problem
Military simulation technology in the computer gaming industry has surpassed contemporary government funded modeling and simulation development in the past decade. The application of this technology back to military training is compelling. One specific application area of interest is in the training of squad leaders. The ability of squad leaders to learn from unique decision making skills of highly effective squad leaders is limited with current methods, since the decision making logic is not easily representable in training material. Adaptivity of squad decision patterns based on scenarios is also not addressed well with current methods. Application of gaming technologies coupled with robust behavior capture offers potential in this area. Capture of these unwritten effective strategies and representation in non-player characters in “serious” games provides a mechanism for transfer of high quality expertise from experienced leaders to new leaders. For this to succeed, first the behavior of the virtual squad members and the interactions between a human squad leader and the virtual squad must be realistic.

Goals and Objectives
Lockheed Martin is researching gaming as a means to capture squad member behavior in a complex urban environment that can then be reused for multiple purposes including representation as expert NPCs in the game. The ultimate use of this may be either standard training or to provide the squad leader with just-in-time training, possible on a handheld device, as he begins a mission. It will also be possible (although not a primary objective of this effort) to wrap the NPC so that it can participate in other gaming and simulation environments. The goal of the research is to provide capabilities to capture “expert” behaviors, and utilize these to implement more effective training environments for squad members initially and squad leaders subsequently.

Technical Approach
Our overall approach will be to instrument a squad type game with behavior capture mechanisms enhanced with context capture features. Features of strategy based squad games and first person shooter games will be combined, resulting in an effective game environment for experimentation and capture of squad behaviors, including mission understanding and execution, and tasking by the squad leader. The captured behaviors will be instantiated in the game as a non-player character for further analysis and tuning.
The research will be conducted from both the behavior capture and the representation points of view. Initial experiments will demonstrate that behaviors can indeed be improved through the addition of contextual and tasking information. An appropriate existing game will be used in which 9 players, acting as a squad with a squad leader, perform a mission of interest. The initial demonstration goal will be to leverage current or emerging AI middleware technologies to capture the behavior of a squad member, and implement it as an NPC character (replacing that human player). Improvement approaches for the captured behaviors will then be investigated based on one of the following key aspects to improving the utility of games for squad leader and squad member training:

- **Behavior Capture**: representation of contextually enhanced captured behaviors in non-player characters
- **Game Enhancements**: combining the best features of squad level and first person shooter games
- **Enhance Core NPC behaviors**: use known squad team behaviors and scene recognition to improve default behavior

**Behavior Capture**: Significant effort in behavior capture is already being expended by such researchers as Tolga Konik at Stanford University and commercial gaming technology companies like “Artificial Contender” SDK by TruSoft. Our hypothesis is that these approaches provide a good base capability which can be enhanced by expanding the representations to include context (both environmental and organizational). We will leverage these behavior capture technologies and existing games, and focus research on additional data collection and representation techniques in order to augment the captured behaviors with context and intent. Multi-modal techniques will be employed to enhance the information recorded during game play including verbal reporting, peer observation, after action review opportunities and other LM technologies. Semantic content of these observations will be merged with the relevant captured behaviors to determine what additional information improves the realism of the behavior of a squad member.

**Game Enhancements**: Several genres of military games already exist. Squad-based strategy games focus on teaching squad leaders to think, providing the squad leader player a strategic view of the world and allow him to task the individual fire teams in the squad while free from the burden of managing weapons, radios, etc. First person shooter games are more tactical and put the squad leader in the game. Although control of the fire teams is available in this type of game, usually through keyboard shortcuts, players rarely have the extra physical and cognitive bandwidth to take advantage of this feature.

Merging these gaming approaches for training will improve the realism of the squad members’ individual and team behaviors. Simulated pre-mission briefing using a John Madden-like interface and in-mission tasking of the NPC squad members using voice commands will provide the squad leader a more realistic experience, preventing the him
from being overloaded by the artificiality of game play and allowing him to focus on his responsibilities in the field.

**Enhance Core NPC behaviors:** Current behavior capture techniques tend to rely entirely on captured behavior. However, there are already known behaviors that every squad member has learned and are well articulated in field manuals. By filling in unaddressed situations with field manual behaviors, better behaviors may be built more quickly, while also improving default behaviors. In addition, we will investigate improvements in the NPCs situational awareness capabilities to take advantage of the additional contextual information coming from the game.

We will test the newly developed behavior in an NPC in the target gaming environment. Test scenarios will be developed and executed to compare performance of the enhanced behavior and the original version developed with conventional behavior capture methods. We will develop both soft and hard metrics to evaluate the behaviors, including realism, responsiveness, richness of behavior, etc.

**Previous Experience**
Lockheed Martin ATL has significant experience in military simulation technology with JSAF, and OneSAF as well as game technology experience through partnership relationships with commercial game developers and university partners. These include
University of Michigan, and Artifact Entertainment (MMPG), and Jason Robar Inc. For the DARPA M&DC2 program, LM ATL also developed individual combatant and squad behaviors for insertion in OOTB, and supported multiple simulation experiments.