Fully Automated Simulation Forces (FAFs): A Grand Challenge for Military Training

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1. Introduction

Military simulation systems have continued to grow in complexity over the past decades, in response to heightened demand for improved representation of all facets of military operations. However, this increase in functionality has come at a cost in the training realm - the need for increased manning of response cells and opposing force (OPFOR) cells in training exercises, in order to operate these simulations. This trend is likely to continue with the arrival of the next generation of military training simulation in JSIMS.

In order to improve the usability and affordability of such systems, one of the central goals of future M&S training should be to reduce the footprint of manned response cells by creating fully-automated simulation forces (FASF) that can replace many of the tasks currently done by human operators. However, the use of fully-automated simulations should not come at the price of reduced capability. To state a new benchmark for synthetic forces: The training audience should not be able to distinguish between an OPFOR cell which is utilizing a FASF and one which utilizes a semi-automated force (SAF) or manned simulation. We submit that achieving this new benchmark should be one of the central Grand Challenges for future M&S.

2. Potential Payoff

There are significant benefits to be gained by solving such a problem. While the heavy footprint of manned simulation response cells in most staff-level training events provides the necessary fidelity and realism to the training audience, it comes at an expensive price. In operational Theaters where simulation operators ("pucksters") must be brought in to operate the simulations and act as role players, the costs of putting on such large computer-aided exercises (CAXs) are quite expensive. Such requirements for human manning of the simulation also limit the abilty to support more training applications where use of response cells is not generally feasbile, such as ship-board training or in-theater mission rehearsal.

3. Technical Challenges

There are several significant technical hurdles that must be overcome, in order to be able to develop and field FAFs.

3.1 Human Behavioral Representation

The HBR problem in a staff-level training exercise is at least two-fold. First, representation of subordinate friendly units must be performed. In the case of a Division-level CAX, this would generally require the representation of units at battalion and below. HBR requirements for representing subordinate units would include the ability of such units to reason and take action with respect to their own tactical situation.

Opposing Force (OPFOR), or "Red" response cells have slightly different requirements for HBR. In this case, the simulation must be able to represent the potential reasoning that a particular enemy might use in a conflict – a potentially much more complex M&S requirement than just representing reasoning of blue subordinate forces. In addition, that reasoning would have to be tailored to the training objectives that wish to be fostered by the Commander. If OPFOR behaviors occur that do not support the overall training objectives of the exercise, then such uses of FAFs will not be readily performed.

3.2 C4I-Simulation Automation

One of the biggest technical hurdles involved in automating response cells would be in developing the means for simulations to directly interpret command and

control messages and orders generated by C4I systems. In current staff-level training exercises, one of the key roles of the response cell is to receive transmissions from the training audience (operations orders, Air Tasking Order, fragmentary order, etc.) and perform the manual interpretation of that C4I message for the simulation. The opposite is also true – simulations must be able to automatically generate a robust set of real C4I messages that appear to be "real" to the training audience (or at least appear to have been generated by a human simulation operator).

3.3 Voice Communications

To make the experience truly automated the addition of emulated voice communications between simulation and training audience would need to be added. This would be necessary in instances where a member of the training audience passes information via phone or radio to other commanders. This would require the ability of a simulation to understand and interpret the voice communications, as well as generate the appropriate responses.

4. Measuring Success

A good question to ask at this point might be "how good does the simulation have to be?" In this instance, fidelity and realism need only be good enough to "fool" the training audience into thinking that an actual manned response cell is in place. A potential test that could be employed might be to fully-automate portions of either an OPFOR or Blue response cell and try to see if the training audience can determine which is manned and which is automated. This might lead to a kind of military training Turing Test in which the underlying behavior of the computer simulation need only be representative of a human that is traditionally operating the simulation.

5. The Road Ahead

The two major hurdles toward achieving this Grand Challenge are the ability to represent human behavior of commanders (both friendly and enemy) and the ability to automate the C4I-simulation interfaces involved. It is suggested that the focus of research toward this problem be oriented toward these areas. In addition, an approach which advocates the gradual "scaling-up" of automation from lower echelons (platoon and company) to higher ones (brigade and battalion) should be employed.

6. Summary

We submit that pursuit of this problem meets the criteria of a Grand Challenge for Modeling and Simulation. First of all, while it is technically a very challenging endeavor, we do not believe it is unrealistic or infeasible. Some of the major technical hurdles (order interpretation and representation of blue response cells) should be realizable within the next decade. Secondly, developing a FAF is certainly an interdisciplinary problem - requiring the mobilization of technologies that range from machine learning and cognitive modeling to improvements in distributed parallel computing architectures and real-time network information transport. Its success as a Grand Challenge can be directly measured through the application of such FAFs into training exercises, in which the participants will attempt to distinguish manned OPFORs from automated. And finally, the fielding of such capability will have a profound impact on the M&S community.

Author Biographies

ZACH FURNESS is currently the Project Lead in support of the Defense Modeling and Simulation Office (DMSO) within the MITRE Corporation. His primary role at DMSO is the oversight and execution of the C4I-Simulation interoperability program. Mr. Furness is also the Technical Working Group (TWG) chair for the M&S TWG within the DII COE Architecture Oversight Group (AOG). Prior to supporting DMSO, Mr. Furness led the MITRE Systems Engineering team that supported the development, integration, and testing of the Joint Training Confederation (JTC). He joined MITRE in 1990, after received a Master's degree in Electrical Engineering from Virginia Tech. He also holds a Bachelor's degree in Physics, also from Virginia Tech.

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