Visualization and Large-Scale Battlespace Simulations: Challenges, Opportunities and Emerging Technologies

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Abstract

This paper examines the special data visualization needs and challenges presented by large-scale battlespace simulations. The authors draw on their experience in visualization, high-performance computing, and military operations both in academic research and as active duty military officers and intelligence analysts. They identify, characterize and analyze this set of problems and their amenability to emerging techniques and technologies. Battlespace simulations are traditionally classified as tools that can be used to provide training, analysis and evaluation, but they have recently been advanced as having a potential for "look-ahead" capabilities. As the ability of systems to more reliably predict future conditions improves, this use is expected to increase in prevalence and in importance. Within the last decade, intelligent agent simulations have been enabled by high-performance computing to reach levels exceeding ten million entities (individual personnel, vehicles, weapons systems, etc.). These large-scale simulations create incredibly large sets of data in very short periods of time. Managing this data is a field of research of its own, but optimally exploiting this flood of data is even more challenging. With mission success and personnel lives at stake, the pressures on the military leadership are intense, so this problem is both vital and fraught with potential break-downs in the computer/human interface. The authors assert that, while the high-performance computers have created this problem, newly developed capabilities utilizing these same assets can and should be implemented to assure the warfighters are given the information they need most, when they need it, and in a form that will have the best chance of producing the correct outcome. The paper will recount and allude to historical samples of the difficulty in effectively conveying information up and down the chain of command, supporting the notion that these problems are neither unique to simulation nor are they issues that can be ignored when solutions are at hand. Special emphasis will be put on new ways to convey the range of alternatives and relative likelihood of predictions produced by the use of intelligence and analysis, all without burdening or swamping the users with too much data. The paper concludes with a recommended approach for studying, evaluating and implementing the promising techniques and technologies.

V. References

Logan, W. B., (2013), *The Weather on D-Day*, retrieved from internet on 11 December 2014, from https://medium.com/history-and-politics/the-weather-on-d-day-85ea0491a14f