

Data 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. 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. The authors assert that, while the high-performance computers have created this problem, newly developed capabilities utilizing these same capabilities 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. This is based on their experience in visualization, high-performance computing, large-scale simulations, and military operations both in academic research and active duty military service or intelligence analysis. The paper recounts and alludes to historical examples of the difficulties in effectively conveying information within the chain of command, supporting the notion that these problems are neither unique to simulation nor are they issues that can be ignored, especially when solutions are at hand. Special emphasis will be put on new ways to convey the range of alternatives and communicate the relative likelihood of the predictions of future conditions, dispositions and actions, all without swamping the users with too much data. A survey of associated topics like causal modeling and behavioral science insights will also be presented along with analysis as to their contribution to better exploitability of the computer-generated insights. The paper concludes with recommended approaches for studying, evaluating and implementing the most promising techniques and technologies.*