

Data Visualization for Test and Evaluation: Challenges, Opportunities and Emerging Technologies

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ABSTRACT

This paper will examine the special data visualization needs and challenges presented by Test and Evaluation (T&E). The rapid and insightful analysis of the masses of data collected during the test and evaluation cycles has become one of the grand challenges of this community. Other communities provide guidance in handling these gargantuan data sets. 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 to those performing the tests and evaluations. The authors assert that newly developed capabilities utilizing these same capabilities can and should be implemented to assure the T&E analysts 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 the authors' 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 or T&E 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 analytic solutions and alternative conclusions and communicate the relative likelihood of future performance, durability and safety, all without swamping the users with too much data. The Test and Evaluation community is also faced with the need to convey the insights contained in the data in enlightening and compelling ways to both analysts and end-users of the subject technologies being tested and evaluated. 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 test results. The paper concludes with recommended approaches for studying, evaluating and implementing the most promising techniques and technologies.

ABOUT THE AUTHORS

PHILIP AMBURN is an Adjunct Lecturer in the Computer Science Department of the University of Arizona. Prior to that, he was a Research Assistant Professor at Mississippi State University and also had taught as an Adjunct Faculty member at the Air Force Institute of Technology (AFIT). After AFIT, he worked at Wright-Patterson AFB in Ohio for SAIC as the Forces Modeling and Simulation on-site advisor in Programming Environment and Training for the High Performance Computing Modernization Program. His research interests are constructive and virtual simulation, interactive 3D graphics, and visualization. He retired as a Lieutenant Colonel from the United States Air Force. Dr. Amburn received a BS degree in Physics from Emporia State University, (formerly Kansas State Teachers College), his MS CS degree from AFIT, and his Ph.D. degree in Computer Science from the University of North Carolina, Chapel Hill.

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