Game and simulation-based training research focuses on the design and development of frameworks for training and assessing complex performance in non-linear, 3D computer-based games and simulations.

Central to these unique frameworks is the incorporation of domain ontologies with Bayesian networks. This combination enables the framework for both 1.) identifying what cognitive constructs need to be taught, and 2.) predicting player competencies based on observed sequences of actions within the game. Current research examines the damage control domain related to firefighting and flooding aboard naval ships. The key constructs being assessed are communication, situational awareness and decision-making.

The Navy’s need for high-quality instruction and reliable assessment of complex performances necessitates the need for consistent and valid methodologies, which often include the use of games and simulations. However, assessing performance in these settings can be difficult—particularly in nonlinear simulations where more than one pathway to success or failure exists. The challenge lies not in capturing the raw data from game-play, but in interpreting what a player’s actions and decisions mean in the broader context of cognitive readiness for a particular job function or task.

The Office of Naval Research is investigating game-based training with the support of the Center for Naval Engineering in Norfolk and San Diego. A third generation damage control game/simulation is being built to assess situational awareness, communication abilities and decision-making skills. This environment challenges the player to manage a main space fire and flood casualty from the perspective of multiple roles aboard a Flight II DDG. It assesses the player’s ability to organize personnel, manage resources, follow established protocols, and coordinate containment actions across multiple events. This next-generation trainer will be used in classroom assessments as well as for practice among damage control teams aboard Navy ships.

Research Challenges and Opportunities:
- Eliciting experts’ implicit knowledge and representing it explicitly in a Bayesian network
- Contrasting various psychometric/statistical modeling approaches to determine optimal model fit and validity
- Probabilistic reporting of player abilities based on game performance

What is it?
- In game-based training, computer-based games and simulations provide instruction for trainees. These games are designed with embedded training strategy to facilitate learning. On the back-end, these simulations provide automated performance assessment tool for trainers and instructors.

How does it work?
- This assessment system relies on domain ontologies that capture the key cognitive constructs to be taught and measured. Bayesian networks are then derived from the domain ontologies and used to make probabilistic predictions of skills and abilities based on observable player actions. The system is capable of outputting multiple representations of performance, including: graphical event curves, competency summaries for individuals and teams, and Afloat Training Group criterion scoring.

What will it accomplish?
- These advanced training systems will yield insights about personnel skillsets, either individually or in a team environment, that are otherwise difficult to assess through conventional means, such as observed actions. Its automation will reduce the demands placed on instructors and human evaluators of performance.

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