Joan Ryder, CHI Systems Inc.
Benjamin Bell, CHI Systems Inc.

Unmanned Cannot be Untrained: Synthetic Agents for UAV Operations Training

Operators of Unmanned Air Vehicles (UAVs) will face multiple, complex, co-occurring tasks, including mission planning, command and control, communications, payload control, and coordination with other assets. This workload is multiplied as crew complements are reduced to a single operator and as the span of control grows to multiple vehicles. Developing appropriate training and decision support tools for the operator is therefore critical, particularly for situation awareness, crew coordination, and dynamic mission replanning, which are prone to skill decay due to limited opportunities to practice such skills. Systemic barriers to UAV crew training include cost, regulated access to airspace, constraints on access to frequency bands, limited access to instrumented ranges and simulated threats, and infrequent training for emergencies and degraded operations. Thus, there is an urgent need for technologies that can afford opportunities for intelligent simulation-based training to enhance UAV controller effectiveness. This paper describes an approach for creating effective, instructor-less training systems from UAV simulations. The approach involves using virtual tutors to provide assessment, coaching, and feedback; and synthetic teammates who can interact in spoken language to support coordination training.

The virtual tutors and teammates are cognitive models of the trainee and others the trainee needs to interact with. The models can be performance models operating in the simulated environment or expertise models against which trainee performance is assessed (Ryder, Santarelli, Scolaro, Hicinbothom & Zachary, 2000). Alternatively, a model of instructional reasoning can be used as a virtual tutor. The models are created with CHI System's iGEN™ cognitive agent toolkit, which is derived from a conceptual framework for representing real-time expert decision making with multiple attention demands. iGEN™ models interact with the simulated environment (and other virtual agents or the trainee) through a library of Application Programming Interface (API) calls. Speech recognition and synthesis are also integrated using the API.

Examples will be given from three advanced training applications using cognitive agents that participate in training exercises both as synthetic players in a scenario and as intelligent tutors who monitor and provide realtime assessment, feedback, and after-action review (AAR). In EAGLE (for Electronically-Assisted Ground-based Learning Environment), a virtual tutor provided guidance and feedback for Air Vehicle Operators (AVOs) learning to land the Predator UAV in a Multi-task Trainer (Ryder, Scolaro & Stokes, 2001). SCOTT (Synthetic Cognition for Operational Team Training) used synthetic team members that interacted in spoken language for training naval aircrews in proper communications (Zachary, Santarelli, Lyons, Bergondy & Johnston, 2001). SCOTT also featured an intelligent tutor agent that recognized student utterances and provided real-time spoken feedback. STRATA (Synthetic Teammates for Realtime Anywhere Training and Assessment) incorporates two synthetic teammates interacting in spoken language for training mission and teamwork skills to naval aviators in close air support missions. A virtual tutor monitors and assesses performance for an AAR.

The capabilities we summarize are presented in a training context, though we recognize a parallel need for UAV crew decision support systems. Building on our previous work in UAV

operator decision support (Bell & Clark, 2002), we discuss the applicability of the technologies we are developing for team decision support applications.

References

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