TO ERR IS HUMAN
Optimizing Performance of Mixed Human/Robotic Teams

If you are assembling a team of humans and robots to accomplish a specific objective, what are the right ways to partition tasks, who is in charge under what circumstances, and what psychological factors are involved? Addressing these questions in a five-year, Air Force Office of Scientific Research-funded project, a team of mathematicians, cognitive and social psychologists, and engineers—including Professors John Baillieul (ECE, ME, SE) and David Castanon (ECE, SE)—is conducting several experiments to improve joint human/robot decision-making. Potential applications include air force missions involving cooperation between human controllers and unmanned aerial vehicles (UAVs) in unpredictable, hostile environments.

One set of experiments explores decision-making in reconnaissance simulations in which human controllers collaborate with sensor-based robots to measure pollutant concentration levels, such as radiation fallout after a nuclear accident. The controllers direct mobile platforms (UAVs or underwater vehicles) equipped with sensor-based control algorithms to detect various substances and their concentrations.

“If you just let people know the clock is running and they have to explore as much territory as possible and report back as much detail as possible, how will they trade off the level of detail against the amount of time that they have to acquire information?” says Baillieul. “Working with the robots, they have to decide when is enough enough, and when is it time to gather information somewhere else.”

In a second set of experiments on communication through action, computer-assisted video cameras deconstruct the movements of salsa dancers.

“We’d like to understand exactly how you can automate/predict the motion evolution in dance and competitive sports,” Baillieul explains, “and how to write simple computer programs to enable mobile robots to react appropriately to the motions and gestures they were seeing on the part of human team members.”
Mobile Khepera III robots emulate the motions of salsa dancers in experiments focused on communication through action.