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Task Description:	Project Goals: Our overall objective is to develop novel, context-sensitive, and customized onboard training techniques that can be adapted to different tasks and crewmembers, with ability to address both refresher training (for re-acquisition of expert performance) and just-in-time training (for tasks that have not been specifically trained previously, but require the integration of existing astronaut skills). To achieve this objective, we propose to test the hypothesis that multimedia training which is customized for the crewmember can be more efficient than traditional, generic format training for the same measured effectiveness. The project will begin with the development of two tasks that represent typical complex and critical activities that are carried out by astronauts in space relatively infrequently. We will develop a set of training materials that follow the NASA style of briefings, procedures and hands-on practice. Once these tasks are developed, we will conduct an experiment with human subjects to determine if customized, self-made video training materials prove to be better refresher training materials than the generic materials that would typically be used by crewmembers. Subjects will receive initial training and their baseline performance evaluated. After a period of about 6 months, subjects will return to the lab, review the refresher training materials, and be re-evaluated on how well they have retained or re-acquired their task skills. A second experiment will be conducted using the same two representative tasks, but will examine if the customized training materials developed in the first experiment could be used as just-in-time training materials for a new group of subjects with basic training, but no specific training in the given task. In both experiments, we also examine the correlation of subject learning styles with the content of the training materials, to determine whether learning style is a useful characterization for developing customized orient. The results of this research proje
Rationale for HRP Directed Research:	:
Research Impact/Earth Benefits:	Human exploration of space, especially with reduced real-time ground support due to increased distance from the Earth, will require training capabilities to support autonomous reacquisition of skills. Inadequate states of training are commonly related to skill-based errors such as task execution mistakes. Even in the highly trained military aviation environment, more than half of accidents in a multi-year meta-analysis have been shown to be associated with skill-based errors, and human error in general is widely accepted to contribute to 70% to 80% of all aviation accidents. This research will lead to the reduction of the likelihood of such errors and accidents due to inadequate training. The reduction in error-likelihood directly supports the mitigation of the Human Research Program's Risk of Performance Errors Due to Training Deficiencies. Development, maintenance, and re-acquisition of expertise is central to many types of human endeavor, especially safety-critical ones such as this may thus be broadly applicable outside the world of human spaceflight.
Task Progress:	The first year of the project has focused on the refresher training experiments (Part A of the project), in which subjects are trained in an astronaut-similar task, self-produce a refresher video at the peak of expertise, and return 6 months later to perform the task again using only the refresher video as training. The University of California (UC) Davis task is complex electro-mechanical system repair, and the Massachusetts Institute of Technology (MIT) task is manually control of a space robotic arm. In the first year, the UC Davis section of the research team hired two undergraduate research assistants and two graduate research assistants to help develop the test facilities and tool station, select the mechanical system to be used for the repair task, develop procedures, write subject protocols and instructions, apply for UC Davis Institutional Review Board (IRB) approval, and identify video equipment and tools to purchase. In selecting the repair task, one of the drivers was that the equipment could be put into operation for testing after subject repair. After considering a variety of candidates (air compressor, water pump, cooling system pump, four-barrel carburetor, aircraft magneto, etc), we settled on a gas-powered electrical generator with its integration of mechanical and electrical systems, plus modern design and repair manuals to work from. Also during this first year, the MIT side of the team hired a graduate research assistant, and a freshman undergraduate student. Lynn Geiger (the GRA) traveled to NASA Johnson Space Center (JSC) in August 2014 to participate in a 1 week Generic Robotics Training (GRT) course set up by the Robotics Training Group. We developed an experimental protocol for pilot testing of our customized refresher training materials including videos and evaluation turbics. Subjects will be trained to perform two specific robotics tasks and their performance measured to establish a baseline. Training consists of 4 3-hour sessions over three days. To date, 2 pilot subjects were test
Bibliography Type:	Description: (Last Updated: 04/23/2025)