Supporting the NASA Mission

Kinesthetic Cueing for Teleoperation

Operators sense of their own hand position may be used to improve their ability to control telerobots when their viewing coordinates are not aligned with their control coordinates. This phenomenon may be adapted to aid users of telerobot systems.

Background

Users of telerobot systems commonly may operate manipulators while remote cameras provide views of the worksite which are rotated with respect to the direction of command action. If the direction and position of the camera were sensed, consistent display and control actions can be achieved computationally. This remapping is, however, not always possible and users of teleoperations systems often must train to work in rotated coordinate systems. Even if a correction due to the rotation may be used, failure modes can still force users to face the rotation problem in some cases. Consequently, teleoperator users must train extensively to be able to operate using geometrically difficult viewing conditions, increasing workload, loss of manipulator dexterity, and risk of error.

Research Overview

A newly proposed technique to allow users to control a computer screen cursor in the presence of large rotational sensorimotor rearrangements has been evaluated. This technique is called "kinesthetic cueing." In present experiments kinesthetic cueing have been provided to experimental users by having them contact the cursor control device with the hand not controlling the cursor. This hand, usually the nondominant left hand, is rotated to copy the rotation, i.e., misalignment angle, with which the operator must deal. Preserving its rotated position, it is then placed in contact with the cursor control device.

Results show that the technique works for rotational misalignment about one axis. If this technique can be successfully developed, it will solve two problems associated with training users to deal with sensorimotor rearrangements. First, it could reduce or eliminate the need for adaptation training. Secondly, it could remove concern about the perceptual aftereffects of adaptation. Control devices currently investigated for use with kinesthetic cueing include trackpads, isometric joysticks, mice and graphics tablets.

Relevance to Exploration Systems

The cueing technique addresses a known difficulty in teleoperation which, if resolved, could improve operator performance and productivity.

H&RT Program Elements:

This research capability supports the following H&RT program /elements:

ASTP: Advanced Studies, Concepts, & Tools; Software, Intelligent Systems & Modeling

TMP: Advanced Space Operations

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