INFORMATION PRESENTATION

Human Research Program - Space Human Factors and Habilitability
Space Human Factors Engineering Project

PURPOSE

The goal of the Information Presentation Directed Research Project (IPD) is to address design questions related to the presentation of information to the crew on flight vehicles, surface landers and habitats, and during extra-vehicular activities (EVA). Designers of displays and controls for exploration missions must be prepared to select the text formats, label styles, alarms, electronic procedure designs, and cursor control devices that provide for optimal crew performance on exploration tasks. The major areas of operation, and in some cases, the Information Presentation DRP are: 1) Controls, 2) Displays, 3) Procedures, and 4) EVA Operations.

AUTHORS

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CONTROLS – Cursor Control

The unique environmental conditions encountered by crewmembers on space missions (vibration, variable gravity, vacuum requiring pressurised suits) translate into special design requirements for crew interaction with information presented on computer displays. Cursor control devices (CCDs) must be specially designed to function under the variable, harsh conditions of space.

Partners with Stakeholders: The cursor control device work described below has fed and supplemented concurrent work on Orion cursor control and device selection. Results of these studies have led to Orion device down selection, and software developed for this effort is being used for Orion cursor control device evaluations.

Test battery (Status – beta complete; revisions in work)

One of the first goals of the IPD project was to develop a computerized test battery that could be used to evaluate a number of different types of cursor control devices. The test battery provides a standard methodology for measurement, and will be of use in any researcher interested in evaluating cursor control devices.

A collection of 12 tasks measuring C&P capabilities and dragging and targeting with standard manual components.

PROCEDURES

• An Electronic Procedure Viewer (EPV) is one of the most operationally critical interfaces for next-generation crewed space vehicles, particularly for mission fault isolation and recovery operations.

• We recently completed a human-in-the-loop evaluation of two fault management concepts, i.e. BESS where the EPV is functionally integrated with an Advanced Caution and Warning (CAW) System, and another less advanced concept (ELSI) with no functional connections between the EPV and the CAW System.

• ELSI Fault Management Display: at the outset of procedure navigation:
  • Participants made fault diagnoses by integrating information from CAW fault messages (over left section of display); color-coded diagnostic indications on system summary display (upper right section of display); and list of system faults in EPV.
  • Fault management display shows the point where participant has diagnosed a fault and is asking to work procedure through the EPV.
  • Blue "(Current State)" line is one of many cues to help operator navigate through the steps in the procedure checklist.

• BESS Fault Management Display at the outset of Procedure Navigation:
  • Advanced Caution and Warning System interfaces in "Root Cause List" where automated fault diagnosis is provided.
  • Magenta box highlights system component associated with automated diagnosis.
  • Component names are available for verification of automated diagnosis adequate.
  • Fault management display shows the point where participant has accepted and selected the automated diagnosis, which has automatically brought up the appropriate checklist in the EPV.
  • Number of steps reduced compared to ELSI due to automated checks for sensor failures.

DISPLAYS - Label orientation

Display designers sometimes have to use vertical text when real estate is limited. The goal of this work was to examine the impact of different styles of vertically oriented text using short words, acronyms, and abbreviations.

Results

1) Participants could read the horizontally oriented text faster than the rotated and marquee text.

Scan Patterns:

There appears to be a difference in scan patterns for rotated text. There is a noticeable drop in the percentage of the time that participants look at the rotated text compared to the other text orientations.

Next Steps

• Additional studies need to be done to further evaluate vertical text styles, incorporating more complex displays, additional practice, and time pressure.

DISPLAYS - Label alignment

Vehicle displays are often made up of many columns of labeled data values. Design direction on alignment of these columns of data varies in the literature. The goal of this study was to experimentally compare various types of label alignment.

Results

1) Wrapped labels are responded to more slowly than unwrapped labels.

2) There was a small advantage for data-aligned labels.

In addition to investigating the amount of time to respond to each type of label alignment, performance was also measured by the number of correctly and incorrectly read labels.

Next Steps

• Additional studies need to be done to further evaluate label alignment, incorporating more complex displays, additional practice, and time pressure.

EV A OPERATIONS

Working in an extravehicular, life support environment presents great challenges in terms of displays, controls, and suit informatics, especially in the harsh lunar environment. This is a new suite for FY19.

Work will be performed in the areas of:

• Display design
• InsideHandler and the mouse control during glove operations
• Inside eys and auditory displays