Human Systems Integration

Human Factors Engineering and Human Systems Integration

The overall goal of most system development programs is to understand and deliver effective capabilities to the end user. Achieving this goal is often hampered by the unexpected addition of requirements, often related to the physical and cognitive capabilities of the users that were not clearly stated when planning the program. CAE's Human Factors Engineering and Human Systems Integration (HFE/HSI) team integrates the user into the system development process for both training and operational systems. By fully accounting for user-oriented requirements, system development programs meet more of their objectives and have more successful implementations, while experiencing decreased user error and better mission performance.

CAE's HFE/HSI experts take responsibility for specifying user requirements to govern the design of the interfaces between the system and the user, whatever they may be. They apply detailed knowledge of user physical dimensions, as well as physical and cognitive capabilities and limitations, to designing the system. Their engagement with the user and stakeholder populations maintains focus on these viewpoints throughout the system development process to ensure requirements are met and overall system performance is maximised.

CAE's HFE/HSI experts operate within the systems engineering process, and are involved at all phases of the system design lifecycle: analysis, design, test, and evaluation.

Analysis

Successful system development programs require a full understanding of the problem space in order to develop a comprehensive and viable solution. User needs comprise a significant portion of this problem space. CAE's HFE/HSI analysis processes include:

- Analysis of the missions, functions and tasks that a system must perform
- Link Analysis
- Use Case Development
- Mission Scenario Development
- User Engagement through interviews, focus groups, questionnaires, surveys, observation
- Literature Review
- Accident/incident/error analysis
- Technology Reviews
- User Modeling and Simulation
- User Requirements Specification
- Development of Measures of Performance (MOPs) and Measures of Effectiveness (MOEs)
- Customization requirements for Commercial- and Military-Off-The-Shelf (C/MOTS) acquisitions

Design

Modern technology systems are complicated. Assigning responsibility for specifying the user interface to the engineer who will build it means dividing attention and effort between two significantly different activities. Optimal job performance relies on effective specification of all user touch-points. CAE's HFE/HSI team comprehensively specifies user interfaces including:

- Job and work design
- Display layout
- Information architecture (modality, content, presentation)
- Decision support
- Automation support
- Allocation of function between user and system
- Function and task ordering on the controls and displays
- Anthropometric design
- Workspace layout and arrangement
- Hardware (i.e. controls, displays, desks, seats) layout and physical design
- Environmental design
- System responsiveness
- Ancillary support functions
- Aesthetics (e.g. colour, form)
- Mock-ups and wire frames, low-fidelity prototypes and interactivity demonstrators
- Customisation of C/MOTS designs (to suit anthropometrics, cultural stereotypes and cognitive processes)

Test & Evaluation

New systems fail more often due to user dissatisfaction, rather than a failure to meet technical requirements. CAE's HFE/HSI team manages this critical hurdle by integrating user and stakeholder needs and requirements at the analysis phase. The development team embodies these requirements into the system design and implementation.

This approach produces results during test and evaluation when customer stakeholders see the benefits come to life. Measures of performance and measures of effectiveness are collected during user performance in representative mission scenarios to demonstrate compliance with stated user and system performance requirements. CAE's HFE/HSI team plans and executes user-focused test and evaluation activities including:

- Iterative user testing during design
- Heuristic evaluation
- Low fidelity prototyping
- High-fidelity simulation
- Individual, small team, large team and collective evaluations
- Requirement compliance
- Acceptance test plan development
- Factory and site acceptance testing
- Requirements traceability to design
- Preparation of test reports and similar to satisfy certifying and accepting authorities (e.g. Federal agencies, safety regulators, etc.)

Benefits

A deliberate and appropriate HFE/HSI program complementing the system development lifecycle will increase the likelihood of success of the program by providing:

- Return on Investment: invest 2-4 percent of program budget on HFE/HSI, and expect to receive 40-60 times that investment in lifecycle cost savings in maintenance, manpower, support, and a reduction in equipment unavailability and loss;
- Improved operational performance;
- Condensed training time;
- Reduced employee absenteeism and attrition;
- Minimized rework due to customer dissatisfaction;
- Efficient achievement of certification/acceptance requirements.

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