

*ANSI/HFES 200*

# HUMAN FACTORS ENGINEERING OF SOFTWARE USER INTERFACES



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## Preface

The Human Factors and Ergonomics Society Human Factors Engineering of Software User Interfaces (known as "HFES/ANSI 200") American National Standard represents the culmination of many years of effort from an extraordinarily talented and tenacious group of leading human factors professionals.

ANSI/HFES is a major landmark in the field of human-computer interaction (HCI).

Recognition is due first and foremost to the editors of the four major technical sections constituting the standard: Professor Greg Vanderheiden, Dr. James Williams, Professor Daryle Gardner-Bonneau, and Dr. Aaron

The four technical sections of the standard were authored by exceptional editors who defined design guidelines capturing human-computer-interaction-based research findings, established best practices, and consensus of international experts. This standard is a remarkable achievement particularly because of its meticulous harmonization with international efforts in the International Organization for Standardization (ISO), and the accompanying wide-ranging issues that had to be addressed and resolved.

The editors...

### **Gregg Vanderheiden**

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**Daryle Gardner-Bonneau** - Principal, Bonneau and Associates." I am also an Adjunct Associate Professor of Speech Pathology and Audiology at Western Michigan

University. My ANSI-related standards activities are: Member, Human Engineering Committee, Association for the Advancement of Medical Instrumentation (AAMI) - was involved in the development of ANSI/AAMI HE-74 and am currently involved in the development of ANSI/AAMI HE-75 (human engineering process standard and guidelines for the design of medical devices, respectively). With respect to ISO, my activities consist of the following: Chair, U.S. TAG to TC159 - Ergonomics; U.S. Expert to ISO TC159 WG2 - Ergonomic Requirements for People with Special Needs; U.S. Expert to ISO TC159 SC4 WG5 - Software Ergonomics and Human-Computer Dialogues; U.S. Expert to ISO TC159 SC5 WG5 - Environments for People with Special Requirements.

**James Williams** is Principal Ergonomist for Synergetic Applications, a consultancy specializing in software ergonomics. Dr. Williams has been in technical and management positions in various areas of human performance for over 40 years. He has been involved with ANSI and ISO standards for the last 20 years and chairs the US Technical Advisory Groups to ISO TC159/SC1 and SC4. In addition, he is the Deputy Convener of TC159/SC4/WG1 and a member of SC4 Working Groups 5 and 6. Dr. Williams has been involved with the HFES 200 Committee since its beginning and is editor of Part 3 and a contributor to Part 2.

ANSI/HFES 200 is nothing less than a monumental effort from an extraordinarily dedicated and talented group of human factors professionals who contributed tens of thousands of hours of volunteer efforts over a period of more than 15 years. HFES 200 was initially established in 1986 to explore the prospects for developing a set of software user interface design requirements and recommendations rigorously based on empirical evidence and established best practices, and which could be consistently verified through usability testing methods. John Karat chaired the committee from 1986 until 1994 and provided outstanding leadership to facilitate the committee's formative contributions to ISO standards activities in Software Ergonomics (ISO TC 159 "Ergonomics"/SC4 "Displays and Controls"/WG5 "Human System Interaction").

The members of this committee created the formative user interface design recommendations and requirements that comprised the foundation of the International Organization for Standardization (ISO) standards for Dialog Techniques, Visual Presentation, Direct Manipulation, and others. Perhaps more important, the active participation and contributions from this committee to ISO software ergonomics standards efforts firmly established the critical importance of rigorous methodologies and objective, empirical research to substantiate human-computer interaction standards.

There are many members of the HFES 200 Committee who have delivered sustained contributions to this important national and international effort for many years. I would like to use this opportunity to recognize several key individuals whose contributions

have exerted a formative influence on the development of software ergonomics standards.

Jim Williams has consistently delivered major contributions to HFES 200 and other standards activities for over 15 years, and he continues to serve as editor of Part 3: Interaction Techniques. This document addresses a major area of human-computer interaction by providing hundreds of design recommendations for a wide range of interaction methods including: visual menus, command languages, direct manipulation, user guidance, dialog boxes and forms, and others. HFES 200 developed documents in each of these topic areas, and each of these individual documents reflects a major effort in itself with scores of references and many committee reviews. Jim Williams has contributed enormously to the HFES 200 effort, as well as other HFES, ANSI, and ISO standards activities, by leading the development of the Interaction Techniques document originally developed in this committee and eventually established as the very first ISO standard in the area of Software Ergonomics and User Interfaces. Jim put in nothing less than a heroic effort in conducting exhaustive literature research, documenting hundreds of supporting empirical studies and citations, and enduring endlessly grueling reviews both nationally and internationally for many, many years. He deserves an ultra-marathon medal!

Eric Bergman pioneered a major new area of standards activity by writing the first HFES standards document specifically focused on Accessibility of Software User Interfaces. Eric compiled a wide range of results from research and other material to create a comprehensive set of design recommendations and requirements for Software Accessibility that ultimately became an ISO standard, and which continues to serve as the foundations for the current HFES 200 version. Shawn Henry contributed important extensions and refinements to Software Accessibility before it was distributed for review by an ANSI Canvass Committee in 2000. Paul Reed served as editor for the comments received during the Canvass review. Due to procedural issues, Software Accessibility was unfortunately not approved as an ANSI standard in 2001.

Daryle Gardner-Bonneau has also expanded HFES standards in a new direction by completing the specifications for HFES 200 Part 4: Voice Input/Output and Telephony. She worked with a sub-group of telecommunications professionals to derive design recommendations reflecting research results and best practices for IVR, and it is expected that this effort will be expanded in the future to address Voice Input/Output and Auditory Codes in the future.

Arnie Lund addressed an important domain of user interface design by providing comprehensive design recommendations for Visual Presentation and Use of Color. An extensive and wide-ranging effort to review relevant literature on the use of color in user interface design resulted in highly innovative design guidance. Beth Marshburn served as editor as this material was reviewed by the committee. Harry Blanchard is currently

serving as the editor for this material and we plan to include this material in the next version of HFES 200 under the ANSI Canvass Method.

Evelyn Williams provided major contributions with the initial versions of User Guidance (later completed by Jim Williams) and the complete Dialog Boxes and Forms sections of Part 3, and assiduously reviewed large quantities of research that reflected the latest developments in the area.

Pamela Jamar, Pat Billingsley, and Karen Rafnel provided a key contribution in the area of Menu Behavior and Appearance, and their work became an important element in ISO standards as well as being incorporated in the current version of HFES 200.

Elizabeth Buie, with a keen instinct for linguistic rigor and meticulous precision, tackled the difficult challenge of creating a Glossary and Definitions section that spanned a very broad range of technical areas and perspectives. She aptly handled the difficult position of being in "no man's land" while various section editors pleaded their case for having their definition version used. Her efforts resulted in an exhaustive and consistent set of terms across the broad expanse of material in HFES 200.

Andrew Cohill and John Karat developed a Design Process specification that addressed a user-centered approach to interface design in the system development life cycle that served as a key influential contribution to ISO Software Ergonomics activities. John Karat also provided critical leadership for the HFES 200 Committee from 1987 through 1994 and ensured that efforts were appropriately focused contributions to key ISO standards activities.

I would also like to acknowledge the extended and ongoing support of HFES Executive Director Lynn Strother, the Technical Standards Committee Chairs Claire Gordon, Bob Beaton, and Ken Holdaway, and the members of the HFES Executive Council over the years.

Contributors to journal papers published about the HFES 200 Committee software ergonomics standards efforts include: Elizabeth Buie, Daryle Gardner-Bonneau, James Carter, Jeff Fox, Ken Holdaway, Arnie Lund, Eric Bergman, Ken Holdaway, Scott Isensee, and Jim Williams.

Current active members of the committee include: Eric Bergman, Harry Blanchard, Elizabeth Buie, Daryle Gardner-Bonneau, James Carter (with his uniquely Canadian perspective), Shawn Henry, Scott Isensee, Arnie Lund, Paul Reed, Evelyn Williams, and Jim Williams. For the past several years, Harry Blanchard has served as Co-Chair, Daryle Gardner-Bonneau has served as Secretary, and Evelyn Williams has served as Librarian.

Previous members of the committee who provided important contributions to our standards document and activities include: Gary Beck, Pat Billingsley, Andrew Cohill, Thom Foote-Lennox, Jeff Fox, Shawn Henry, Ken Holdaway, Pamela Jamar, John Karat, Beth Marshburn, Jackie Schrier, and Karen Rafnel.

The challenging and diligent work completed by this committee has formed the basis for the content of the ISO Software Ergonomics standards today and, perhaps more importantly, established the importance of having a rigorous methodology for defining, prioritizing, and implementing software ergonomics standards.

It has been a tremendous privilege and honor, not to mention just a lot of plain fun, to work with such a talented, distinguished, and good-humored group of professionals, and it has been an outstanding opportunity for us all to contribute to the improvement of the quality of user experiences both nationally and internationally.

With kindest regards,  
Paul Reed  
HFES 200 Chair

*ANSI/HFES 200*

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**PART 1: INTRODUCTION**



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# 1 Introduction to the HFES 200 Project

The Human Factors and Ergonomics Society undertook the HFES 200 project following extensive participation in the development of international standards through the International Organization for Standardization (ISO). HFES 200 committee members were primary contributors of material to the ISO standards development efforts. Central principles driving the HFES 200 Committee's contributions to ISO were the use of user interface design guidance based on robust empirical findings and established, proven industry practices. The objective of the HFES 200 standard is to consolidate available design guidance to provide design recommendations that will lead to usability benefits such as increased ease of learning and ease of use of software, and accessibility benefits such as increased compatibility of assistive technology with available Operating System software.

The HFES 200 Software User Interface standard consists of five parts:

- HFES 200.1: Introduction
- HFES 200.2: Accessibility
- HFES 200.3: Interaction Techniques
- HFES 200.4: Interactive Voice Response (IVR)
- HFES 200.5: Visual Presentation and Use of Color

A primary objective of HFES 200 Part 3 and Part 5 is to be compatible with ISO 9241, Parts 12 through 17, which provide software user interface design recommendations for dialog techniques, such as menus and direct manipulation, and for presentation of information. Only a small fraction of the ISO recommendations have changed significantly in content. Appendix B in Part 3 and Part 5 identifies the disposition of every corresponding ISO recommendation as each is treated in HFES 200.

HFES 200 Part 2: Accessibility and Part 4: Interactive Voice Response consist of new material that has not been published previously, whereas Part 3: Interaction Techniques and Part 5: Visual Presentation and Use of Color incorporate material from approved International Organization for Standardization (ISO) 9241 (1996–1998) Part 12 through Part 17.

The goal of this introduction is to:

- a) Outline the content of the HFES 200 parts,
- b) Explain the relationships among the individual parts of HFES 200, and
- c) Provide guidance on the relevance of individual parts to the development process — that is, to help readers understand when and how to use the parts of HFES 200.

The ultimate beneficiaries of HFES 200 are the end users of software. It was the needs of these users that motivated the recommendations in HFES 200. The application of this standard is intended to provide user interfaces that are more usable, accessible, and consistent and that enable greater productivity and satisfaction.

## **2 Scope of HFES 200**

The scope of HFES 200 is primarily focused on user interaction with software for personal, business, and educational use, most commonly implemented on a desktop PC or terminal (e.g., see ANSI/HFS 100-1988). Most of the recommendations in this standard also apply to home and mobile computing and to interactive voice response applications. Many of the recommendations may also apply to other interactive software.

Although the recommendations in this standard do not definitively address areas such as high-risk applications, nuclear power plant control room environments, alarm/security applications, process control, and entertainment, many of the recommendations in HFES 200 can be used to improve the quality of software applications in these environments. Developers in these areas are advised to obtain guidance from more directly applicable standards or guideline documents.

This standard does not address system or software design processes. For guidance on the role of software ergonomics in the system/software design process, please refer to ISO 9241 Part 11, Guidance on Usability, and to ISO 13407, Human-Centred Design for Interactive Systems (1997).

## **3 Organization of HFES 200**

The specification or design of human-computer interaction (also known as human-computer dialogues) should be driven by an understanding of the requirements of the users, their tasks, and the business functions to be performed. Many trade-offs typically need to be evaluated, including technology drivers and constraints. There are usually several technology and design options, and the final choice may be influenced by the desire for consistency (e.g., with existing practices or across a range of systems). Decisions about the overall suitability of a software user interface can be assisted by reference to standards containing general principles of dialogue design, such as ISO 9241 Part 10. Specific recommendations for dialogue design techniques are addressed in HFES 200 Part 3, Interaction Techniques.

The recommendations in this standard explain how each recommendation should be applied. Individual recommendations should be evaluated for their applicability and, if