14

Human-Computer Interaction

Systems Analysis and Design, 8e
Kendall & Kendall
Learning Objectives

• Understand human-computer interaction.
• Design a variety of user interfaces.
• Design effective dialog for HCI.
• Understand the importance of user feedback.
Learning Objectives (Continued)

• Articulate HCI implications for designing ecommerce Web sites.

• Formulate queries that permit users to search the Web.
Human-Computer Interaction

- Awareness of HCI
- Existence of HCI in organizational settings
- Need to master the concepts surrounding HCI
- Guidelines for usability
Major Topics

- Understanding human-computer interaction
- Fit
- TAM
- Designing for cognitive styles of individual users
- Physical considerations in HCI design
- User interfaces
- Dialog design
- Feedback
- Queries
Understanding Human-Computer Interaction

• Knowledge about the interplay among users, tasks, task contexts, IT, and the environments in which the systems are used comprises the basis of human-computer interaction.
Fit

• The “fit” between the HCl elements of the human, the computer, and the task that needs to be performed leads to performance and well-being.
The “Fit” among the Human, Computer, and Task Affects Performance and Well-Being (Figure 14.1)
Task

• Complex tasks that require human, system, and task interaction are supported by ecommerce and Web systems, ERP systems, and wireless systems inside and outside of the organization.

• Can be structured and routine or ill-defined and without apparent structure.
Performance

- A combination of the efficiency involved in performing a task and the quality of the work that is produced by the task
Well-Being

• Concern for a human’s overall comfort, safety, and health
• Psychological attitudes are also important.
The Technology Acceptance Model (TAM) and Attitude

• A way for analysts to organize their thinking about whether users will accept and use information technology
• Can be used to shape training after a system has been developed
• Can be used to garner user reactions to prototypes
• Examines perceived usefulness and perceived ease of use
The Technology Acceptance Model (TAM) and Attitude (Continued)

- Attitudes
  - Satisfaction
  - Anxiety
  - Enjoyment
  - Playfulness
Usability

• A way for designers to evaluate the systems and interfaces they create with an eye toward addressing as many HCI concerns as thoroughly as possible

• Usability standards

• Usability heuristics
Designing for Cognitive Styles of Individual Users

• Making sure data is made available in different forms
  • Tables
  • Graphs
  • Text
  • Different times
Pivot Tables

• Allows a user to arrange data in a table in any way they choose
• Gives users greater control over how they look at data in different ways within a table
A Pivot Table Template Can Make It Easier for Users to See Information Displayed in Different Ways (Figure 14.3)
Visual Analysis of Databases

• Support visual thinking.
• Extend the user’s cognitive capabilities.
• Increase the changes of making an appropriate decision.
When Different Graphs or Tables Are Displayed on the Same Page, It Resembles a Dashboard (Figure 14.7)
Physical Considerations in HCI Design

• Vision
• Hearing
• Touch
An individual with a disability is a person who:

- Has a physical or mental impairment that substantially limits one or more major life activities
- Has a record of such impairment
- Is regarded as having such an impairment
The HCI Approach to Systems Design Emphasizes the Fit among the Human, Computer, and Task (Figure 14.8)

Guidelines for the HCI Approach to Systems Design

- Examine the task to be done and consider the fit among the human, computer, and task.
- Identify what obstacles exist for users in their attempts to accomplish their assigned tasks.
- Keep in mind the perceived usefulness and perceived ease of use from TAM.
- Consider usability. Examine the usage environment by creating use case scenarios that depict what is going on between users and the technology.
- Use the information you have gained beforehand to figure out the physical and organizational environmental characteristics. Design with prototyping to accommodate diverse users and users with disabilities.
Interface Design Objectives

- Match the user interface to the task.
- Make the user interface efficient.
- Provide appropriate feedback to users.
- Generate usable queries.
- Improve productivity of computer users.
Types of User Interfaces

• Natural-language interfaces
• Question-and-answer interfaces
• Menus
• Form-fill interfaces
• Command-language interfaces
• Graphical User Interfaces (GUIs)
• Web interfaces
Natural-Language Interfaces

- Permit users to interact with the computer in their everyday or “natural” language.

- Implementation problems and extraordinary demand on computing resources have so far kept natural-language interfaces to a minimum.
Question-and-Answer Interfaces

- The computer displays a question to the user on the display.
- The user enters an answer.
- The computer acts on that input information in a preprogrammed manner.
- Users unfamiliar with applications may find question-and-answer interfaces the most comfortable.
Menus

- Provides the user with an onscreen list of available selections
- Not hardware dependent
- Can be put aside until the user wants to use them
- Can be nested within one another to lead a user through options in a program
- GUI menus
- Object menu
Form-Fill Interfaces (Input/Output Forms)

• Onscreen forms or Web-based forms displaying fields containing data items or parameters that need to be communicated to the user

• Advantage
  • The filled-in form provides excellent documentation.

• Disadvantage
  • Users experienced with the system or application may become impatient.
An Example of the Form-Fill Interface from Form Flow by Jetform (Figure 14.12)
Command-Language Interfaces

- Allows the user to control the application with a series of keystrokes, commands, phrases, or some sequence of these
- Affords the user more flexibility and control
- Require memorization of syntax rules
- May be an obstacle for inexperienced users
Graphical User Interfaces

• Provide users constant feedback on task accomplishment
• An appropriate model of reality or an acceptable conceptual model of the representation must be invented
Other User Interfaces

- Pointing devices
- Touch-sensitive screens, also called touch screens or touch pads
- Speech recognition and synthesis
Speech Recognition and Synthesis

- The user speaks to the computer, and the system is able to recognize an individual’s vocal signals, convert them, and store the input.
- Continuous speech systems
- Speaker independence
Using software such as Dragon NaturallySpeaking by Nuance, a user can speak commands to their computer. In this example, the user corrects a word by pulling up a menu of alternative words that sound the same.
Evaluating Interfaces

- Training period for users should be acceptably short.
- Users early in their training should be able to enter commands without thinking about them, or referring to a help menu or manual.
- The interface should be seamless so that errors are few, and those that do occur are not occurring because of poor design.
- Time that users and the system need to bounce back from errors should be short.
- Infrequent users should be able to relearn the system quickly.
Guidelines for Dialog Design

• Meaningful communication
• Minimal user action
• Standard operation and consistency
Meaningful Communication

• The system should present information clearly to the user.
• Users with less skill with a computer require more communication.
• Easy to use help screens
Minimal User Action

- Keying codes instead of whole words
- Entering data that are not already stored on files
- Supplying the editing characters
- Using default values for fields on entry screens
- Designing an inquiry, change, or delete program so that the user needs to enter only the first few characters of a name or item description
Minimal User Action (Continued)

• Providing keystrokes for selecting pull-down menu options
• Use radio buttons and drop-down lists to control displays of new Web pages or to change Web forms
• Provide cursor control for Web forms and other displays so the cursor moves to the next field when the right number of characters has been entered
Standard Operation and Consistency

- Locating titles, date, time, and operator and feedback messages in the same places on all displays
- Exiting each program by the same key or menu option
- Canceling a transaction in a consistent way
- Obtaining help in a standardized way
- Standardizing the colors used for all displays or Web pages
Standard Operation and Consistency (Continued)

- Standardizing the use of icons for similar operations when using graphical user interface
- Using consistent terminology in a display or Web site
- Providing a consistent way to navigate through the dialog
- Using consistent font alignment, size, and color on a Web page
Feedback for Users

- All systems require feedback to monitor and change behavior.
- Feedback compares current behavior with predetermined goals and gives back information describing the gap between actual and intended performance.
Types of Feedback

- Acknowledging acceptance of input
- Recognizing that input is in the correct form
- Notifying that input is not in the correct form
- Explaining a delay in processing
- Acknowledging that a request is completed
- Notifying that a request was not completed
- Offering the user more detailed feedback
Including Feedback in Design

• Can be a powerful reinforcer of users’ learning processes.
• Serve to improve user performance with the system.
• Increase their motivation to produce.
• Improve the fit among the user, task, and the technology.
A Variety of Help Options

- Pressing a function key, such as F1
- A GUI pull-down menu
- Context-sensitive help
- Icon mouse hover help
- Wizards
- Online help or help lines
- Software forums
Soliciting Feedback from Ecommerce Web Site Customers

- Launch the user’s email program.
- Take users to a blank message template when they click on “feedback”.
Easy Navigation for Ecommerce Web Sites (One-Click Navigation)

- Creating a rollover menu
- Building a collection of hierarchical links
- Placing a site map on the home page and emphasizing the link to it
- Placing a navigational bar on every inside page that repeats the categories used on the entry screen
Easy Navigation for Ecommerce Web Sites (Other Considerations)

- Search function
- Creating flexibility
- Creating for users with different cognitive processing, or interests
- Keeping the customers on the Web site
Mashups

- Combine two or more application programming interfaces (API).
- An API is a small set of programs and protocols.
- A building block approach to building Web sites
Designing Queries

- Help reduce users’ time spent in querying the database.
- Help them find the data they want.
- Result in a smoother user experience overall.
Query Types

• Query Type 1
  • What is the value of a specified attribute for a particular entity?

• Query Type 2
  • What entity has a specified value for a particular attribute?

• Query Type 3
  • What attribute(s) has (have) a specified value for a particular entity?
Query Types (Continued)

• **Query Type 4**
  - List all the values for all the attributes for a particular entity.

• **Query Type 5**
  - List all entities that have a specified value for all attributes.

• **Query Type 6**
  - List all the attributes that have a specified value for all entities.
It Is Possible to Perform Six Basic Types of Queries on a Table that Contains Entities, Attributes, and Values (Figure 14.19)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>72845</td>
<td>Waters</td>
<td>Outside Sales</td>
<td>S</td>
<td>48,960</td>
<td>51,400</td>
<td>49,050</td>
<td>52,900</td>
</tr>
<tr>
<td>72888</td>
<td>Dryne</td>
<td>Outside Sales</td>
<td>S</td>
<td>42,200</td>
<td>44,700</td>
<td>48,020</td>
<td>50,580</td>
</tr>
<tr>
<td>73712</td>
<td>Fawcett</td>
<td>Distribution</td>
<td>H</td>
<td>43,500</td>
<td>45,500</td>
<td>46,780</td>
<td>47,100</td>
</tr>
<tr>
<td>80345</td>
<td>Well, Jr.</td>
<td>Marketing</td>
<td>S</td>
<td>65,000</td>
<td>71,000</td>
<td>75,000</td>
<td>78,000</td>
</tr>
<tr>
<td>84672</td>
<td>Piper</td>
<td>Maintenance</td>
<td>H</td>
<td>40,560</td>
<td>42,340</td>
<td>43,520</td>
<td>44,910</td>
</tr>
<tr>
<td>9760</td>
<td>Acquia</td>
<td>Accounting</td>
<td>H</td>
<td>38,755</td>
<td>40,040</td>
<td>41,380</td>
<td>42,540</td>
</tr>
</tbody>
</table>

The years are the attributes.
The employee numbers are the entities.
The salaries are the values.
Query Notation

V is value, E is entity, A is attributes, variables in parentheses are given:

• Query type 1: \( V \leftarrow (E, A) \)
• Query type 2: \( E \leftarrow (V, A) \)
• Query type 3: \( A \leftarrow (V, E) \)
• Query type 4: all \( V \leftarrow (E, \text{all } A) \)
• Query type 5: all \( E \leftarrow (V, \text{all } A) \)
• Query type 6: all \( A \leftarrow (V, \text{all } E) \)
Building More Complex Queries

- **Arithmetic operations are performed first:**
  - Exponentiation
  - Either multiplication or division
  - Addition or subtraction

- **Comparative operations are performed:**
  - GT, LT, and others

- **Boolean operations are performed:**
  - First AND and then OR
Query Methods

• Query By Example (QBE)—the database fields are selected and displayed in a grid, and requested query values are either entered in the field area or below the field.

• Structured Query Language (SQL)—uses a series of words and commands to select the rows and columns that should be displayed in the resulting table.
Query By Example Using Microsoft Access (Figure 14.21)
Structured Query Language (SQL) for the CUSTOMER NAME Parameter Query (Figure 14.23)

```
SELECT DISTINCTROW
    Customer.[Customer Number],
    Customer.[Customer Name],
    Customer.City,
    Customer.Telephone
FROM Customer
WHERE (((Customer.[Customer Name])
Like ([Enter a partial Customer Name] & "*")))
```
Summary

- Human-computer interaction (HCI)
- User interfaces
  - TAM
  - Usability
  - HCI approach
Summary (Continued)

- Designing the user interface
  - Natural language
  - Question-and-answer
  - Menus
  - Form-fill and Web-based form-fill
  - Graphical User Interfaces
  - The mouse
  - Lightpens
  - The stylus
  - Touch-sensitive screens
  - Voice recognition systems
Summary (Continued)

• **Designing user feedback**
  • Let users know if their input is being accepted.
  • If input is or is not in the correct form.
  • If processing is going on.
  • If requests can or cannot be processed.
  • If more detailed information is available and how to get it.
Summary (Continued)

• Designing ecommerce Web site feedback
  • Rollover menus
  • Hierarchical displays of links
  • Site maps
  • Navigation bars

• Queries
  • Six basic types