DEFINING THE USER INTERFACE

- User interface, design is a subset of a field of study called human-computer interaction (HCI).
- Human-computer interaction is the study, planning, and design of how people and computers work together so that a person's needs are satisfied in the most effective way.
- HCI designers must consider a variety of factors:
    - o What people want and expect, physical limitations and abilities people possess,
    - o How information processing systems work,
    - o What people find enjoyable and attractive.
    - o Technical characteristics and limitations of the computer hardware and software must also be considered.
- The user interface is to the part of a computer and its software that people can see, hear, touch, talk to, or otherwise understand or direct.
- The user interface has essentially two components: input and output.
- Input is how a person communicates his / her needs to the computer.
    - o Some common input components are the keyboard, mouse, trackball, one's finger, and one's voice.
- Output is how the computer conveys the results of its computations and requirements to the user.
    - o Today, the most common computer output mechanism is the display screen, followed by mechanisms that take advantage of a person's auditory capabilities: voice and sound.
- The use of the human senses of smell and touch output in interface design still remain largely unexplored.
- Proper interface design will provide a mix of well-designed input and output mechanisms that satisfy the user's needs, capabilities, and limitations in the most effective way possible.
- The best interface is one that it not noticed, one that permits the user to focus on the information and task at hand, not the mechanisms used to present the information and perform the task.

The user interface

- User interfaces should be designed to match the skills experience and expectations of its anticipated users.

- System users often judge a system by its interface rather than its functionality.
- A poorly designed interface can cause a user to make catastrophic errors.
- Poor user interface design is the reason why so many software systems are never used.

Human factors in interface design

- Limited short-term memory
    - People can instantaneously remember about 7 items of information. If you present more than this, they are more liable to make mistakes.
- People make mistakes
    - When people make mistakes and systems go wrong, inappropriate alarms and messages can increase stress and hence the likelihood of more mistakes.
- People are different
    - People have a wide range of physical capabilities. Designers should not just design for their own capabilities.
- People have different interaction preferences
    - Some like pictures, some like text.

PRINCIPLES OF USER INTERFACE DESIGN

• An interface must really be just an extension of a person. This means that the system and its software must reflect a person's capabilities and respond to his or her specific needs.

• It should be useful, accomplishing some business objectives faster and more efficiently than the previously used method or tool did.

• It must also be easy to learn, for people want to do, not learn to do.

• Finally, the system must be easy and fun to use, evoking a sense of pleasure and accomplishment not tedium and frustration.

• The interface itself should serve as both a connector and a separator

• A connector in that it ties the user to the power of the computer, and a separator in that it minimizes the possibility of the participants damaging one another.

• While the damage the user inflicts on the computer tends to be physical (a frustrated pounding of the keyboard), the damage caused by the computer is more psychological.

• Throughout the history of the human-computer interface, various researchers and writers have attempted to define a set of general principles of interface design.

• What follows is a compilation of these principles. They reflect not only what we know today, but also what we think we know today.

• Many are based on research, others on the collective thinking of behaviorists working with user interfaces.

• These principles will continue to evolve, expand, and be refined as our experience with Gills and the Web increases.

User interface design principles

Principle	Description
User familiarity	The interface should use terms and concepts which are drawn from the experience of the people who will make most use of the system.
Consistency	The interface should be consistent in that, wherever possible, comparable operations should be activated in the same way.
Minimal surprise	Users should never be surprised by the behaviour of a system.
Recoverability	The interface should include mechanisms to allow users to recover from errors.
User guidance	The interface should provide meaningful feedback when errors occur and provide context-sensitive user help facilities.
User diversity	The interface should provide appropriate interaction facilities for different types of system user.

- User familiarity
    - The interface should be based on user-oriented terms and concepts rather than computer concepts. For example, an office system should use concepts such as letters, documents, folders etc. rather than directories, file identifiers, etc.
- Consistency
    - The system should display an appropriate level of consistency. Commands and menus should have the same format, command punctuation should be similar, etc.

- Minimal surprise
    - If a command operates in a known way, the user should be able to predict the operation of comparable commands
- Recoverability
    - The system should provide some resilience to user errors and allow the user to recover from errors. This might include an undo facility, confirmation of destructive actions, 'soft' deletes, etc.
- User guidance
    - Some user guidance such as help systems, on-line manuals, etc. should be supplied
- User diversity
    - Interaction facilities for different types of user should be supported. For example, some users have seeing difficulties and so larger text should be available

Design issues in UIs

- Two problems must be addressed in interactive systems design
    - How should information from the user be provided to the computer system?
    - How should information from the computer system be presented to the user?
- User interaction and information presentation may be integrated through a coherent framework such as a user interface metaphor.

General Design Issues

Main emphasis in design of Multimedia User Interfaces (MUI) is multimedia presentation. The general issues to be considered are:

- To determine the appropriate information content to be communicated.
- To represent the essential characteristics of the information.
- To represent the communication intent.
- To choose the proper media for information presentation.
- To coordinate different media and assembling techniques within a presentation.

- To provide interactive exploration of the information presented.

Interaction styles

- Direct manipulation
- Menu selection
- Form fill-in
- Command language
- Natural language

Interaction styles

Interaction style	Main advantages	Main disadvantages	Application examples
Direct manipulation	Fast and intuitive interaction Easy to learn	May be hard to implement. Only suitable where there is a visual metaphor for tasks and objects.	Video games CAD systems
Menu selection	Avoids user error Little typing required	Slow for experienced users. Can become complex if many menu options.	Most general-purpose systems
Form fill-in	Simple data entry Easy to learn Checkable	Takes up a lot of screen space. Causes problems where user options do not match the form fields.	Stock control, Personal loan processing
Command language	Powerful and flexible	Hard to learn. Poor error management.	Operating systems, Command and control systems
Natural language	Accessible to casual users Easily extended	Requires more typing. Natural language understanding systems are unreliable.	Information retrieval systems

Information Characteristics forPresentation

Types (ordering information)

- **coordinates vs. amount (specify points in time, space or other domains)**
- **intervals vs. ratio (suggests the type of comparisons meaningful among elements of coordinate and amount data types)**

Relational Structures

- functional dependencies (e.g. bar chart)
- non-functional dependencies (e.g. entry in a relational database)

Multi-domain Relations

- multiple attributes of a single object set (e.g. position. colors, ...)
- multiple object sets (e.g. graphical symbols on a map)
- multiple displays (e.g. multiple windows)

Large Data Sets

- numerous attributes of collections of heterogeneous objects (e.g. presentation of semantic networks)