Graphical User Interface Design

*CIS*2750*

Advanced Computing Techniques

Introduction

Graphics have revolutionized user interface design. Properly used it can effectively utilize a person's information processing abilities and allow for faster interaction with computer systems.

The Importance of Good Interface Design

- The user interface may be the only contact that the user has with the system.
  - The interface is the system designer's way of **representing** the system to the user; this is called a **conceptual model.**
  - If the interface is confusing, then the user may choose **not** to use the system at all or will use it **incorrectly.**
  - At the very least, a **frustrating** interface can cause stress and discomfort.
  - A well-designed interface can **increase** productivity.

The Importance of Good Interface Design

A study by Tullis in 1983 showed that redesigning inquiry screens reduced decision-making time by approximately 40% which equaled a savings of 79 person-years in the system under study.

A Little Bit of History

- The first interfaces were designed for the convenience of the *computer*
  - keyboard input
  - text-based screen or paper output
  - human-computer dialogs styles included
    - command language
    - question and answer
    - menu selection
    - form fill-in

DEC PDP-1 Replica

$120K in 1960

A Little Bit of History - 1970

- Computer graphics had appeared by the 1960's.
- Few design guidelines
- Driven by hardware issues
  - many fields with cryptic captions
  - visually cluttered
  - user had to rely on memory for commands
  - ambiguous messages requiring a manual

IBM 3270

Early ’70s to ‘80s, very widely used “thin client” to connect to IBM 360 mainframe

Courtesy:
eltamiz.com

screenshot →


JK Enterprises Bank
ACCOUNT INQUIRY
NUMBER: 000002
NAME: MEGAN PAGE
ADDRESS: 2 CONCORD SQ, BOSTON
PHONE: 617-3456
DATE: 03-17-10
AMOUNT: $4500.50
COMMENT: NICE GIRL
PRESS ENTER TO CONTINUE
MA a
09/034

“Hall of Fame”

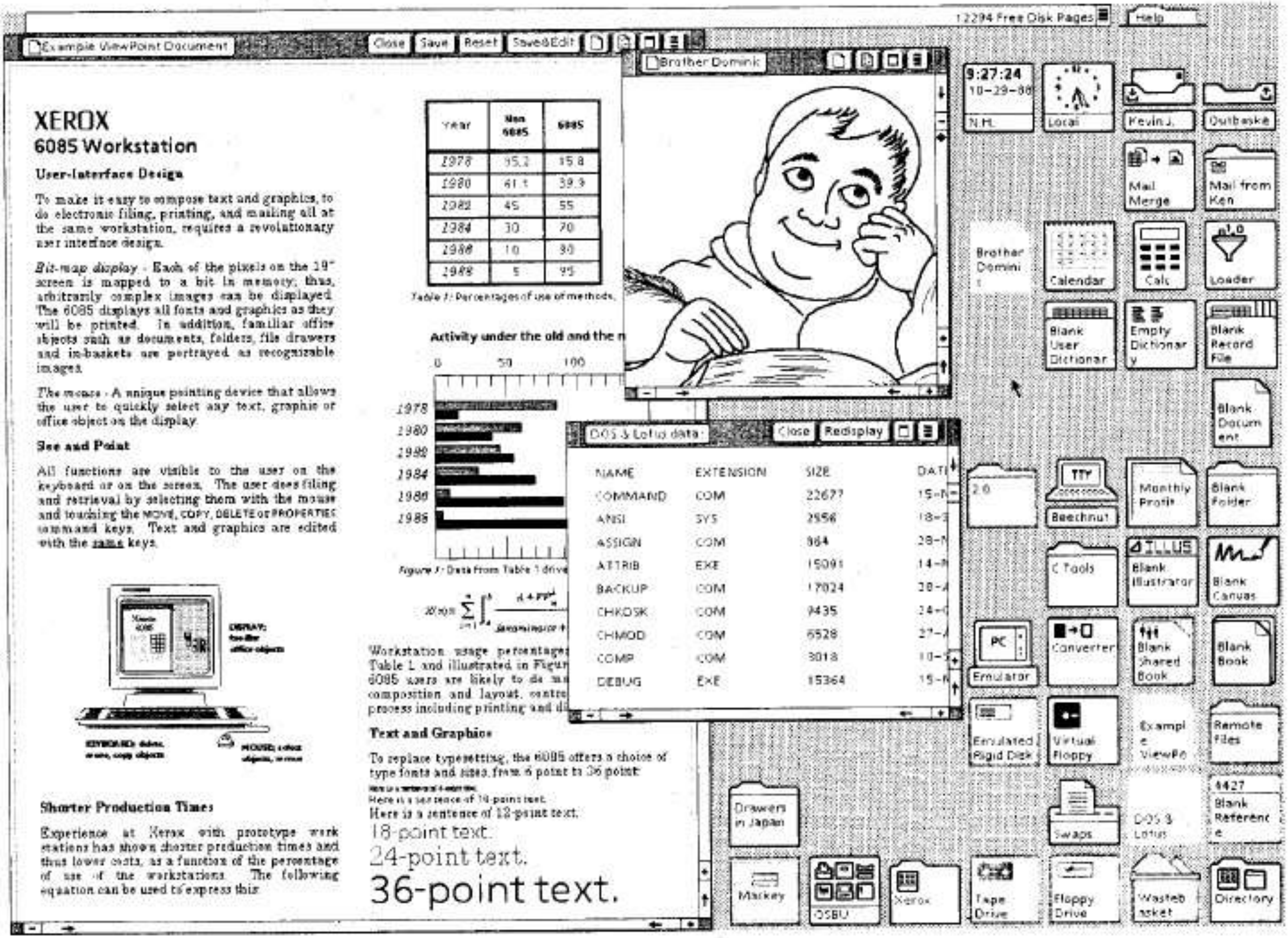
- In the 1970's, Xerox Labs developed Altus and STAR and introduced mouse pointing and selecting.
  - Xerox never successfully marketed their advances.
  - Apple and its Macintosh computer introduced the graphical user interface to the mass market.

Xerox STAR

Retailed for
$16,595 in 1981

Courtesy:
digibarn.com

screenshot →



12294 Free Disk Pages
Help
Example ViewPoint Document
Close
Save
Reset
Save&Edit
XEROX
6085 Workstation
User-Interface Design
To make it easy to compose text and graphics, to do electronic filing, printing, and mailing all at the same workstation, requires a revolutionary user interface design.
Bit-map display - Each of the pixels on the 19" screen is mapped to a bit in memory; thus, arbitrarily complex images can be displayed. The 6085 displays all fonts and graphics as they will be printed. In addition, familiar office objects such as documents, folders, file drawers and in-baskets are portrayed as recognizable images.
The mouse - A unique pointing device that allows the user to quickly select any text, graphic or office object on the display.
See and Point
All functions are visible to the user on the keyboard or on the screen. The user does filing and retrieval by selecting them with the mouse and touching the MOVE, COPY, DELETE or PROPERTIES command keys. Text and graphics are edited with the same keys.
Shorter Production Times
Experience at Xerox with prototype workstations has shown shorter production times and thus lower costs, as a function of the percentage of use of the workstations. The following equation can be used to express this:
Year
Non 6085
6085
1978
1980
1982
1984
1986
1988
Table 1: Percentages of use of methods.
Activity under the old and the n
Figure 1: Data from Table 1 drive
Workstation usage percentage
Table 1 and illustrated in Figur
6085 users are likely to do m
composition and layout, contr
process including printing and di
Text and Graphics
To replace typesetting, the 6085 offers a choice of type fonts and sizes, from 6 point to 36 point:
Here is a sentence of 10-point text.
Here is a sentence of 12-point text.
18-point text.
24-point text.
36-point text.
Brother Dominik
DOS 3 Lotus data
Close
Redisplay
NAME
EXTENSION
SIZE
COMMAND
COM
ANSI
SYS
ASSIGN
COM
ATTRIB
EXE
BACKUP
COM
CHKDSK
COM
CHMOD
COM
COMP
COM
DEBUG
EXE
9:27:24
N.H.
Local
Kevin J.
Outbaske
Mail Merge
Mail from Ken
Brother Domini
Calendar
Calc
Loader
Blank User Dictionar
Empty Dictionar y
Blank Record File
Blank Docum ent
2.0
TTY
Beechnut
Monthly Profit
Blank Folder
C Tools
Blank Illustrator
Blank Canvas
PC
Emulator
Converter
Blank Shared Book
Blank Book
Emulated Rigid Disk
Virtual Floppy
Example ViewPo
Remote Files
Drawers in Japan
Swaps
DOS 3 Lotus
Blank Referenc e
Mackey
OSBU
Xerox
Tape Drive
Floppy Drive
Wasteb asket
Directory

A Little Bit of History - 1980

- Guidelines for screen designs
- Less clutter
- Less reliance on user's memory
  - concepts such as grouping and alignment of elements
  - meaningful captions
  - commands listed on screen
  - use of function keys
  - clearer messages

A Little Bit of History - 1990

- Greater and more effective use of graphics
- Even less reliance on user's memory
  - borders visually enhance groupings
  - buttons and menus replace function keys
  - different font sizes and types
  - colour

Now: Graphics for the masses!

What enabled the sudden shift?

Chief hardware advances:

1. Cheap RAM
   - graphics buffers are memory hogs
2. Success of raster graphics (vs. vector)
   - display (CRT) could be like cheap TV
3. CPUs both fast *and* cheap
   - calculations for drawing & rendering fonts

All thanks to integrated circuit technology!

Characteristics of a GUI

A user interface is a collection of techniques and mechanisms that allow a user to interact with a system.

- **Graphical**
  - primary interaction mechanism is a pointing device.

Characteristics of a GUI

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- **Objects**
  - the user interacts with a collection of elements called objects which are always visible to the user and are used to perform tasks.

Characteristics of a GUI

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- **Actions**
  - the user performs actions on objects such as accessing and modifying by pointing, selecting and manipulating.

Direct Manipulation

- *Direct* manipulation systems have the following characteristics
  - the system is portrayed as an **extension** of the real world
  - there is **continuous visibility** of objects and actions
  - actions are **rapid** and **incremental** with a **visible** display of results
  - incremental actions are easily **reversible**

Indirect Manipulation

- *Indirect* manipulation uses words and text (typing instead of pointing)
  - not all concepts can be represented graphically
  - space in the interface may be limited

Most GUI's are a combination of direct and indirect manipulation. When each type of manipulation *should* be used is still not understood entirely.

Advantages of GUIs

- **Symbols** are easy to recognize and fast to learn.
  - **Colour** is important for classifying objects.
- **Symbols** can aid in problem solving.
- Casual users can remember **symbols** more easily than words.
- Visual and spatial cues can be utilized to provide more information in a natural way.
  - This, of course, excludes the visually-impaired.

Advantages of GUIs

- Some types of error situations can be avoided because they are *not allowed to occur* through input.
- Reduces the need for typing skills.
  - Pointing skills are needed instead and this is not trivial for all types of users (the elderly, persons with limited fine motor control).
- Immediate feedback allows for a better conceptual model of the system for the user.

Advantages of GUIs

- More attractive than other interfaces and thus encourages more interaction and exploration.
- Symbols have the potential to be much more universal than natural language text.
  - There are still cultural differences in the interpretation of symbols and colours, thus the need to consider the consequences of internationalism are not entirely eliminated.
  - There are many fewer symbols than words, so not everything can be expressed as a symbol.

Coming Next

- Disadvantages of GUIs
- Characteristics of GUIs
- Specific GUI design principles