



## Chapter 5 - Direct Manipulation and Virtual Environment



# Introduction

- Positive feelings associated with good user interfaces
  - Mastery of the interface
  - Competence in performing tasks
  - Ease in learning the system originally and in assimilating advanced features
  - Confidence in the capacity to retain mastery over time
  - Enjoyment in using the system
  - Eagerness to show the system off to novices
  - Desire to explore more powerful aspects of the system



## Examples of Direct-Manipulation Systems

### **Command line vs. display editors and word processors**

- Training times with display editors are much less than line editors
- Line editors are generally more flexible and powerful
- The advances of WYSIWYG word processors:
  - Display a full page of text
  - Display of the document in the form that it will appear when the final printing is done
  - Show cursor action
  - Control cursor motion through physically obvious and intuitively natural means
  - Use of labeled icon for actions
  - Display of the results of an action immediately
  - Provide rapid response and display
  - Offer easily reversible actions

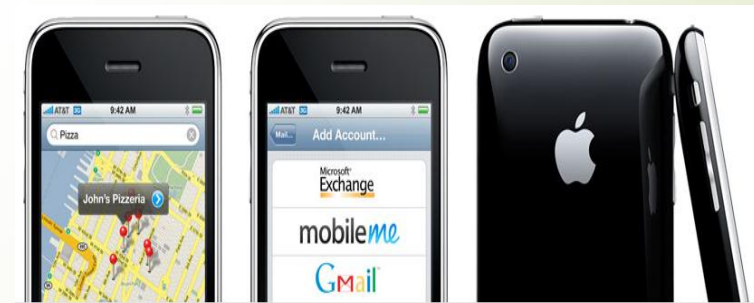
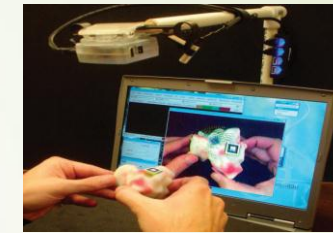


# Examples of Direct-Manipulation Systems

## The VisiCalc spreadsheet and its descendants

- VisiCalc users delighted in watching the program propagate changes across the screen.
- In some cases, spatial representations provide a better model of reality
- Successful spatial data-management systems depend on choosing appropriate:
  - Icons
  - Graphical representations
  - Natural and comprehensible data layouts
- Spreadsheet
- spatial data management
- Video games
- *Guitar Hero* video game
- Computer-aided design
- Office automation
- management dashboard for a retail store

# Continuing evolution of Direct-Manipulation Systems





## Problems with direct manipulation

- Spatial or visual representations can be too spread out
- High-level flowcharts and database-schema can become confusing
- Designs may force valuable information off of the screen
- Users must learn the graphical representations
- The visual representation may be misleading
- Typing commands with the keyboard may be faster



# Principles of Direct Manipulation

1. Continuous representations of the objects and actions of interest with meaningful visual metaphors.
2. Physical actions or presses of labeled buttons, instead of complex syntax.
3. Rapid, incremental, reversible actions whose effects on the objects of interest are visible immediately.



# 3D Interfaces

- “Pure” 3D interfaces have strong utility in some contexts, e.g., medical, architectural, product design. In other situations, more constrained interaction may actually be preferable to simplify interactions - movements, actions
- “Enhanced” interfaces, better than reality, can help reduce the limitations of the real-world, e.g., providing simultaneous views, flying through the objects ie. Enable superhuman capabilities
- First person games
- Avatars in multiplayer 3-D worlds







# 3D Interfaces

## Features for effective 3D

- Use occlusion, shadows, perspective, and other 3D techniques carefully.
- Minimize the number of navigation steps for users to accomplish their tasks.
- Keep text readable.
- Avoid unnecessary visual clutter, distraction, contrast shifts, and reflections.
- Simplify user movement.
- Prevent errors.
- Simplify object movement
- Organize groups of items in aligned structures to allow rapid visual search.
- Enable users to construct visual groups to support spatial recall.



## Guidelines for inclusion of enhanced 3D features:

- Provide overviews so users can see the big picture
- Allow tele operation
- Offer X-ray vision so users can see into or beyond objects.
- Provide history keeping
- Permit rich user actions on objects
- Enable remote collaboration
- Give users control over explanatory text and let users select for details on demand.
- Offer tools to select, mark, and measure. Implement dynamic queries to rapidly filter out unneeded items.
- Support semantic zooming and movement
- Enable landmarks to show themselves even at a distance
- Allow multiple coordinated views
- Develop novel 3D icons to represent concepts that are more recognizable and memorable.



# Teleoperation

- Two “parents”: direct manipulation in personal computers and process control in complex environments
- Physical operation is remote
- Complicating factors in the architecture of remote environments:
  - Time delays
    - transmission delays
    - operation delays
  - Incomplete feedback
  - Feedback from multiple sources
  - Unanticipated interferences



# Virtual and Augmented Reality

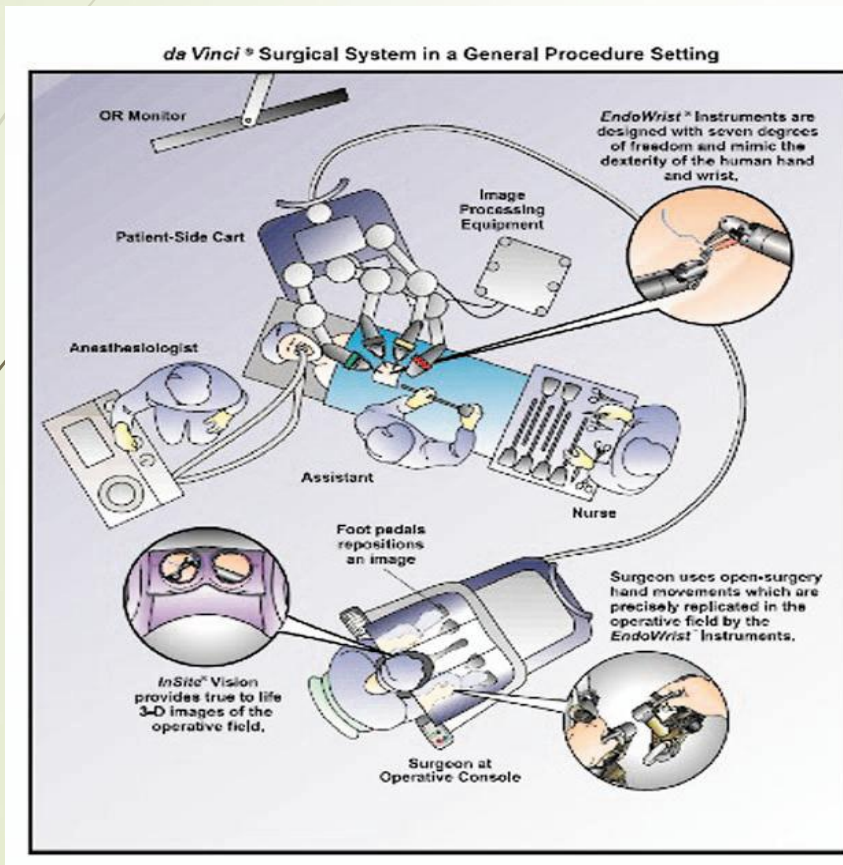
- Virtual reality breaks the physical limitations of space and allow users to act as though they were somewhere else
- Augmented reality shows the real world with an overlay of additional overlay
- Situational awareness shows information about the real world that surrounds you by tracking your movements in a computer model
- Augmented reality is an important variant
  - Enables users to see the real world with an overlay of additional interaction.

➤ Successful virtual environments depend on the smooth integration of:

- Visual Display
- Head position sensing
- Hand-position sensing
- Force feedback
- Sound input and output
- Other sensations
- Cooperative and competitive virtual reality



# Impact of this technology in our everyday lives





## ➤ What Is AR?

Almost any person with a smartphone can get access to augmented reality, making it more efficient than VR as a branding and gaming tool. AR morphs the mundane, physical world into a colorful, visual one by projecting virtual pictures and characters through a phone's camera or video viewer. Augmented reality is merely adding to the user's real-life experience.


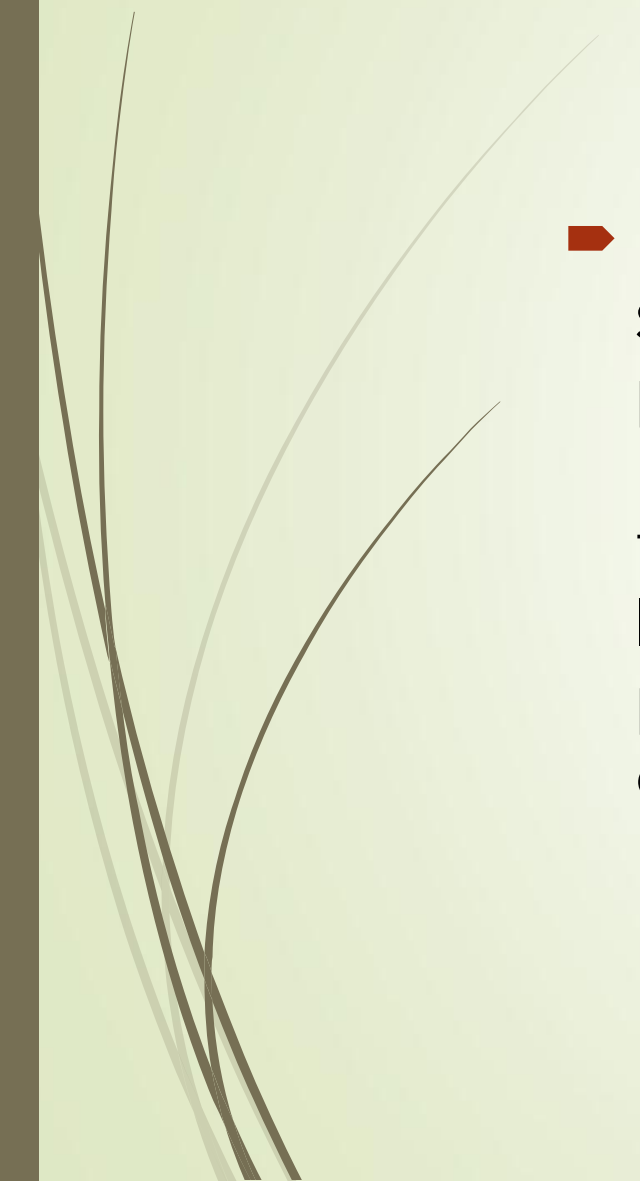
smart glasses," are transparent, letting you see everything in front of you as if you are wearing a weak pair of sunglasses. AR adds to reality, projecting information on top of what you're already seeing.

## ➤ What Is VR?

Virtual reality takes these same components to another level by producing an entirely computer-generated simulation of an alternate world. These immersive simulations can create almost any visual or place imaginable for the player using special equipment such as computers, sensors, headsets, and gloves.

VR headsets completely take over your vision to give you the impression that you're somewhere else. the Oculus Quest headsets are opaque, blocking out your surroundings when you wear them. If you put them on when they're turned off, you might think you're blindfolded.



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- ▶ For both games and apps, virtual reality supersedes your surroundings, taking you to other places. Where you are physically doesn't matter. In games, you might sit in the cockpit of a star fighter. In apps, you might virtually tour distant locations as if you were there. There are tons of possibilities in VR, and they all involve replacing everything around you with something else.

- **IKEA** has developed The Place App, which allows shoppers to use **augmented reality** with their smartphone camera to place furniture items into their homes so they can visualize exactly how the item will look in their setting.
- **Warby Parker's** customers can use **AR** to try on glasses from the comfort of their homes, so they can pick out the perfect frames.
- **BMW's** augmented reality experiences allow car shoppers to go into showrooms and customize cars with different colors or styles using their tablets or phones. Or they can put on **virtual reality goggles** and experience what it's like to drive the cars, so they understand their options and can make the perfect choice for their new vehicle.
- **Apple** brought their physical retail stores home during the pandemic using AR technology to showcase their products. Shoppers can use AR Quick Look for new iPhone or iMac models, so you can see what they look like in your space or in your hand.
- **Harley Davidson** has developed a unique mobile app for its customers that allows them to view a motorcycle in-store using **AR**

### **The Difference Between the Two -**

- AR uses a real-world setting while VR is completely virtual
- AR users can control their presence in the real world; VR users are controlled by the system
- VR requires a headset device, but AR can be accessed with a smartphone
- AR enhances both the virtual and real world while VR only enhances a fictional reality