COLLEGE OF
COMPUTER STUDIES

QUEZON CITY
UNIVERSITY

WEEK 8
Interaction Devices in HCI

Learning Outcomes

- Illustrate the different interaction devices people use nowadays
- Determine the design to be considered in each devices

Interaction Devices in HCI

- Progress in speed and storage has been matched by improvements in input/output devices
  - QWERTY keyboard will remain primary device for text input
  - But even it is evolving to accommodate changes in technology
- Pointing devices provide freedom from the keyboard
  - Mouse and touchscreen
- Innovations in pointing devices
  - Eye-trackers
  - DataGloves
  - Haptic or force-feedback devices
  - Further reducing the interaction gap between human and computer
    - Provide alternatives to disabled users
    - Brain-controlled mouse movement
    - Implanted input devices

- Speech recognition is still improving
- Increasing emphasis on speech store-and-forward
- Non-speech auditory interfaces
- Speech generation
- Highly varied range of display devices
  - Small LCDs on digital cameras and mobile devices
  - Wall-sized (or larger) high resolution displays
- Additional topics
  - Multimodal interfaces that combine several modes of input and output
    - Simultaneous modes have had limited application
    - Bigger payoff to switch between modes depending on need
  - Context-aware computing
    - Useful in mobile computing when a device is aware of the context of its environment
    - Provides information about surrounding places, objects, or other devices

Keyboards and Keypads

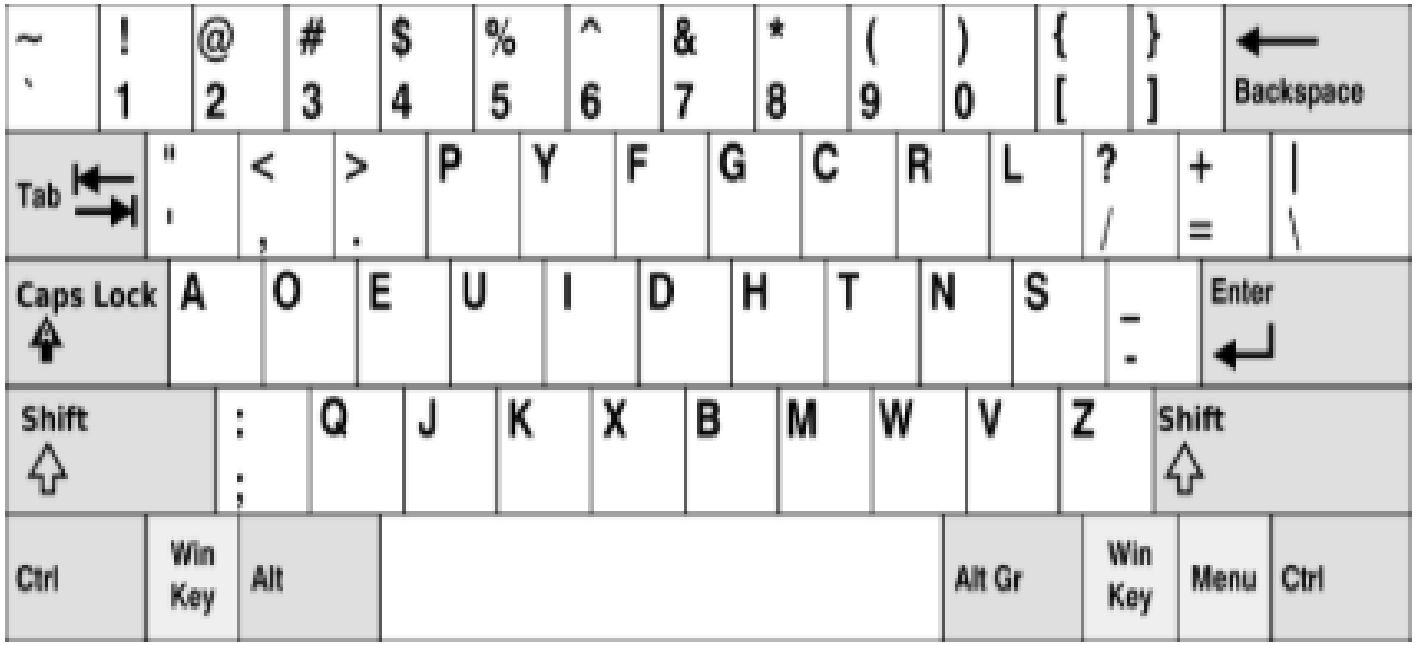
- Speed of input
  - Traditional keyboards allow only one key press at a time
  - Higher rate of data entry possible if multiple keys are pressed simultaneously
    - The piano keyboard allows several finger presses at once and recognizes different pressures and durations
    - Chording – chords represent several characters or entire words
- Keyboard size and packaging influence user satisfaction and usability
  - One-handed keyboards
    - Useful for manipulating physical objects
    - Or when user's tasks require simultaneous data entry
  - Tiny keyboards
    - Acceptable for limited text entry

Keyboard Layouts

- In the 1870s Christopher Latham Shole's design for typewriter key layout became successful
  - Clever placement of letters that slowed down users
  - Placed frequently used letter pairs far apart to increase finger travel distance

Dvorak layout

It increased speed and reduced errors
Despite these improvements the perceived benefit did not outweigh the effort to learn a new, nonstandard interfaces



ABCDE style

- Keys laid out in alphabetical order
- Designed to be easier to locate keys yet studies have shown no real advantage

- Number pads
  - Issues arise because of 2 different standards
    - Telephone uses 1-2-3 keys on top
    - Calculator uses 7-8-9 keys on top
- Keyboard ergonomics
  - Awkward wrist and hand placement
- Users with disabilities
  - Keyless keyboards
  - Reliance on pointing devices to select keys
  - Large menus with fixed choices
  - Dasher – predicts probable characters and words as users make their selections in a continuous 2D stream of choices

Keys

- Tested standards slightly concave surface
- Matte finish to reduce glare
- 40 to 125 grams of force with 1 to 40 millimeter of key travel
  - Provides suitable feedback to the user
- Light click when key has been depressed far enough
  - Tactile and audible feedback important in touch typing
  - Lack of tactile response limit the use of virtual, membrane, or cloth keyboards
- Certain keys should be larger than others
  - Space bar, Enter key, Shift key, Ctrl key
- Some keys should clearly indicate their state
- Caps lock and Num lock

- Cursor movement keys
  - Placement is important for rapid and error-free movement
    - Inverted-T arrangement for using three middle fingers
    - Cross arrangement
    - 8 key arrangement for diagonal movement
    - Reassign letters keys to movement keys for games in order to minimize finger movement
- Usability
  - Large print keys for the visually impaired
  - Adjustable key auto-repeat that can be slowed for very young users, older users, and users with motor impairments

Mobile Devices

- Most laptops have full-sized keyboards
- Phones provide text and email functionality and a small QWERTY keyboard
  - Mechanical or virtual
  - Up to 60 wpm w/ mechanical
- Predictive techniques
  - T9 and LetterWise
  - Useful in multi-tap systems that require users to hit a number key multiple times to specify a letter
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- Handwriting on a touch sensitive surfaceCharacter recognition can be error-prone
- Gestural data entry of simplified character sets
  - Graffiti on Palm devices
  - Requires training to learn the unistrokes
- Shorthand gesturing on a keyboard using shapes that match tapping patterns
- Usability
  - Can benefit Japanese and Chinese
  - Disadvantage for users with disabilities, very young users, and older users that lack motor control

Pointing Devices

- It is often convenient to point at and select items.
- Pointing devices, a direct manipulation with benefits such as:
  - Avoid learning commands
  - Reduce typographic errors with a keyboard.
  - Keep attention on the display
- Results
  - Faster performance
  - Fewer errors
  - Easier learning
  - Higher satisfaction
  - Important for small devices and large wall displays to make keyboard interaction less practical.

Pointing Tasks Seven types of interaction

- **Select** - choose from a set of items, used in traditional menu selection, the identification of objects of interest.
- **Position** –Users choose a point in a one-, two- , three- or higher dimensional space. May be used to create a drawing, to place a new window or drag a block of text.
- **Orient** - Choose a direction in a one-, two-, or higher dimensional space. May rotate a symbol on screen or indicate a direction of motion.

- **Path** - Rapidly perform a series of positioning and orientation operations. Such as a curving line in a drawing program.
- **Quantify**- Users specify a numerical value. Usually a one-dimensional selection of an integer or real values to set parameter
- **Gesture**- Indicate an action to perform by executing a simple gesture, such as a swipe motion to the left or right to turn a page.
- **Text** – Users enter, move, and edit text in a two dimensional space. The pointing deice indicates the location of an insertion, deletion, or change

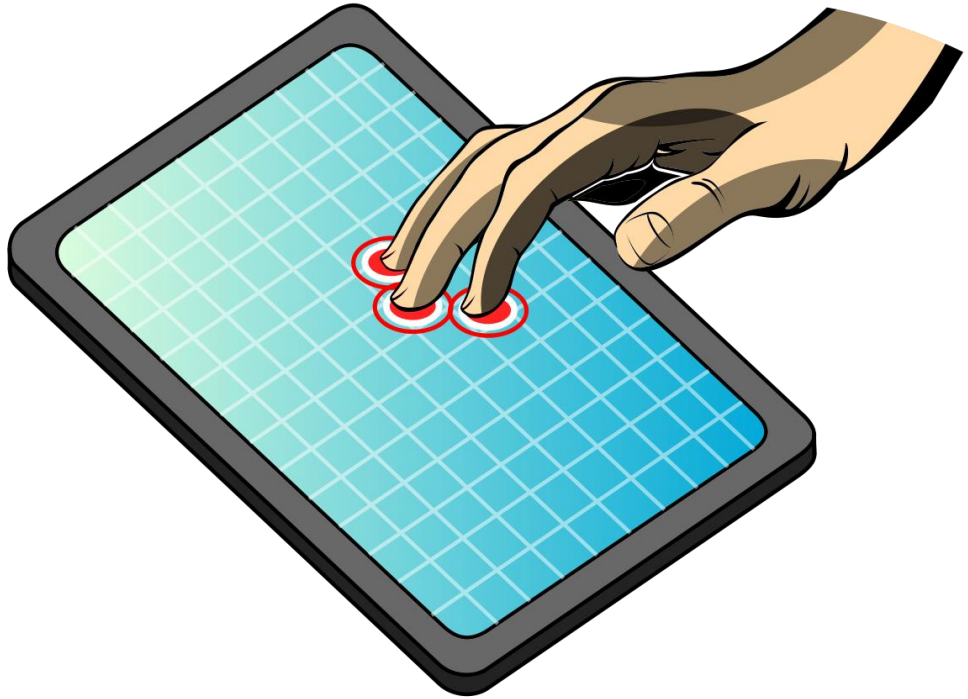
Types of Devices

- **Direct control device**: Easy to learn and use, but hand my obscure display
  - Lightpen, touch screens, stylus
- **Indirect control**: Takes users time to learn
  - Mouse, trackball, joystick
- **Non standard devices and strategies**: used for special purposes
  - Multitouch tables and display, eye-trackers, sensors, foot controls, digital paper

Other Devices

Multiple touch touchscreens:

- Allows users to use both hands or multiple fingers, allows multiple users to work together on a shared surface.



Bimanual input:

- Can facilitate multitasking or compound tasks
- Non-dominant hand sets a frame of reference in which the dominate hand operates in a more precise fashion. Non-dominant hand selects actions while the dominant hand selects the objects of the operation.

Eye trackers

- Gaze detecting controllers that use video camera image recognition of the pupil position to give 1 or 2 degree accuracy.
- Problems occur since every gaze has the potential to activate an unintended command. Combining eye tracking with manual input is one way to address the problem

Paper and Digital pens:

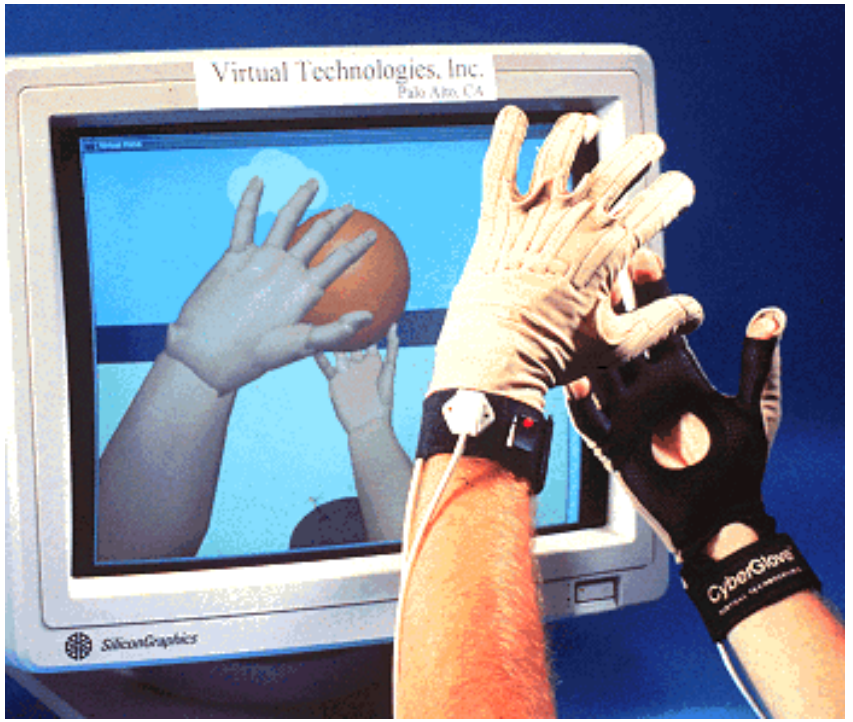
- Using special paper and a digital pen that has a small camera in its tip that records pen strokes drawn on a special paper printed with a unique pattern that identifies the location of each stroke

Sensors:

- Are added to handheld devices can enrich the interaction with the devices themselves. Example, the accelerometers in the iPhones that can detect changes in the devices orientation, causing the display to switch between portrait and landscape.

Data Gloves

- Made of sleek black spandex with attached fiber optic sensors to measure angles of finger joints.
- This allows for commands such as closed fist, open hand, middle finger and so on.
- Attractive to game developers and virtual reality devotees.



The End.