Data Entry Devices

Introduction
- Keyboard entry devices are superior to other devices such as knobs, levers, and thumb wheels.
- Speed and accuracy are dependent on the quality of data given to the operator, based on the following criteria:
  - The operator is familiar with the format of the information to be entered
  - Upper- and lowercase characters are used for written text
  - Long messages or strings of digits are entered as chunks
  - Messages of the 10 numbers presented in random order are not entered more rapidly than those of the full 26 letters

Data Entry Devices

Chord versus Sequential Keyboards
- Chord keyboards require activation of one or more keys simultaneously (stenotype machines or pianos)
- Sequential keyboards are the standard type, where there is a specific key for each character
- Chord keyboards are very good for one-handed data entry
- Chord keyboards are much harder to learn, but tend to be faster.
- There is no particular need for general-purpose chord keyboards, as sequential keyboards fulfill most requirements
- For special situations, chord keyboards can be superior

Data Entry Devices

Alphabetic Keyboards
- QWERTY keyboards were designed to slow the typing process
- The best alternative was the Dvorak keyboard (Figure 11-19)
- QWERTY is entrenched in our present society, and is unlikely to change

Data Entry Devices

Numeric Keyboards
- There are two primary numeric keypads in use today:
  - Calculator Layout
  - Telephone Layout
- The only differences between the two is for occasional users, who will do better with the telephone layout

Data Entry Devices

Membrane Keypads
- Used in the consumer market, in microwaves, for example
- Consist of contacts separated by a thin non-conductive layer
- Key travel is virtually nonexistent
- To reduce accidental activation, often more force is required
- The contact areas are often difficult to locate
- With practice, the keypads become easier to use
- Three feedback procedures were used to aid the user:
  - Auditory tone, for activation
  - Embossing, for finger-position
  - Snap domes, to provide both forms of feedback

Data Entry Devices

Split and tilted keyboards
- Normal keyboards require the hands bend outward (Figure 11-22)
- This can lead to tenosynovitis and eventually CTS
- People become accustomed to the designs quickly, and prefer them

Handwritten and Gestural Data Entry
- The technology has become possible for computers to translate handwriting into computer text
- At present, it is slow and more error-prone
- Gestural inputs have been used for text-editing tasks
- When successfully implemented, gestural inputs are faster than those with a keyboard
Cursor Positioning Devices

Introduction
- Widespread computer use has made these devices necessary

Touch Screen
- Use a screen overlay which is interrupted when the screen is touched
- Easy to learn, but not very accurate
- Parallax becomes a problem, reducing the effectiveness of the pad
- Figure 11-25 defines good pad sizes

Light Pen
- The pen is pressed on the screen, and reads the CRT scanning beam
- Pointing resolution is better than with the touch screen

Graphics Tablet
- Position of tablet reduces arm fatigue over a touch screen
- Digitizing Tablets offer the benefits of a light pen without the fatigue problem
- Two types of positioning:
  - Relative positioning
  - Absolute positioning
- Absolute pointing is faster and more accurate with a small gain
- Figure 11-26 shows this relationship
- A lead-lag compensation system gives better speeds with only slightly higher error rates

Mouse
- A mouse is easy and fast to use, and it is a relative positioning system
- A clear space near the computer is required to operate it

Other Cursor Positioning Devices
- Keyboards
- Joysticks
- Trackballs

Comparison of Cursor Positioning Devices

- There is a tradeoff between accuracy and speed (Table 11-5)
- The selection of the best device must take into account the relative importance between speed and accuracy
- The mouse was found to be the fastest and most accurate in a text-editing task
- In another task, the mouse and trackball were found to be the best
- Such features as C/R ratio, physical size, and feedback have not yet been systematically investigated

Special Control Devices

Introduction
- New devices are replacing standard control devices

Teleoperators
- Teleoperators are remotely controlled devices that augment the physical skills of the operator
- Today they are used for handling dangerous materials or working in hostile environments
- Human Factors considerations
  - Lack of physical feedback
  - Deny visual access
  - Often lack binocular vision
  - Time delays for large separations
  - Design of controls for complex effector