Interaction Devices

- Allow users to interact with computers
  - Input devices
  - Output (display) devices
- We will concentrate on input devices
  - Note that all provide some kind of output
    - Internal
      - Passive (intrinsic to device, no computer control): “feel”
      - Active (controlled by computer): E.g., vibration, force feedback
    - External: E.g., cursor motion when device used in running system
Interaction Device Categorization

- Body part used
  - hand, head, eyes,…
- Type of motion
  - linear, rotary,…
- Property sensed
  - position, angle, force, torque,…

Physical resistance

- *Isotonic* devices
  - Zero (or constant) resistance: Device moves with limb
    - Measures position, angle
    - E.g., mouse, isotonic joystick
- *Isometric* devices
  - Infinite resistance: Device does not move
    - Measures force, torque
    - E.g., isometric joystick
Interaction Device Categorization

- Physical resistance
  - Points on the isotonic $\leftrightarrow$ isometric continuum
    - Many devices fall on a continuum (e.g., TrackPoint moves slightly)
  - Elastic devices
    - Finite resistance: Increases with distance, so device movement is opposed by restoring force
    - E.g., spring-loaded joystick
  - Also, viscous (resistance increases with velocity), inertial (resistance increases with acceleration)
  - Isometric and elastic devices are self-centering
    - Can return automatically to "zero" position

- Coordinate system
  - Absolute
    - E.g., data tablet
  - Relative
    - E.g., mouse
    - "Clutching" [as in an automotive clutch]
      - Relative devices rely on clutching (engaging) & declutching (disengaging) the device to extend their range
        - Picking up (declutching) a mouse to move it to the side of the table opposite to the direction of motion before putting it down (clutching) again
        - Releasing your grip (declutching) on a rotary control before twisting the hand and gripping (clutching) it again
      - Need less space
      - Can use more comfortable space/pose

Note: Some folks use "clutching" in the opposite sense to refer to "declutching" (and do not use the term "declutching" at all), thinking of "clutching" as "grabbing to pick up" (disengaging the device)

Others use "reclutching" to refer to the process of disengaging and engaging
Interaction Device Categorization

- Granularity
  - discrete vs. continuous
- Resolution
  - Smallest change that can be measured
- Accuracy
  - Closeness to actual value
- Precision
  - Reproducibility
- Type of control
  - direct vs. indirect
    - Whether device is [direct] or is not [indirect] at the same location as what it controls in the system
- Number of DOF (Degrees of Freedom) [aka Dimensions]
  - 1/2/3 linear, 1/2/3 angular,…