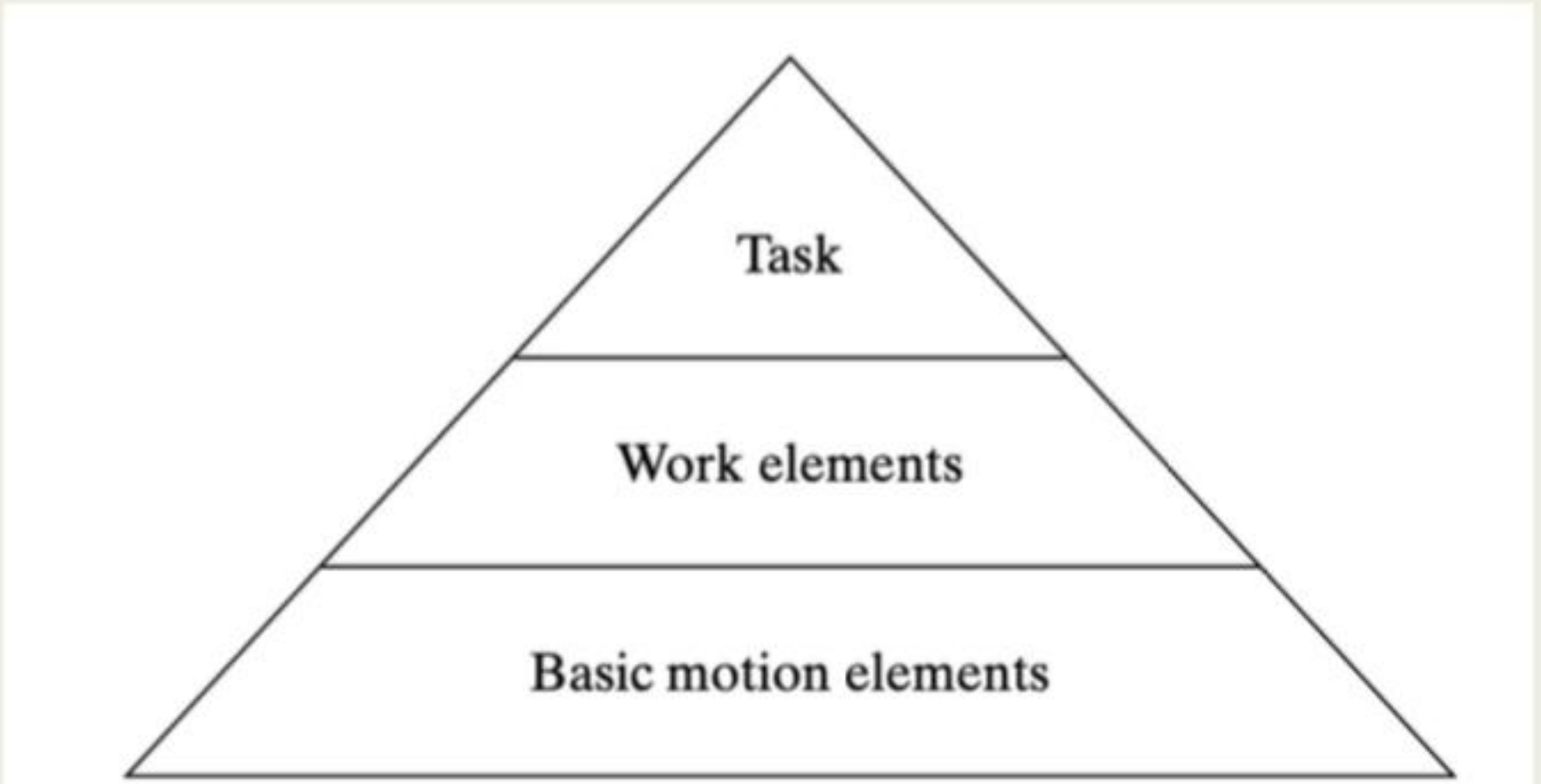
The nature of work

- The pyramidal structure of a task. Each task consists of multiple work elements, which in turn consist of multiple basic motion elements.



From brief to most detailed:
Task, work element, basic motion element

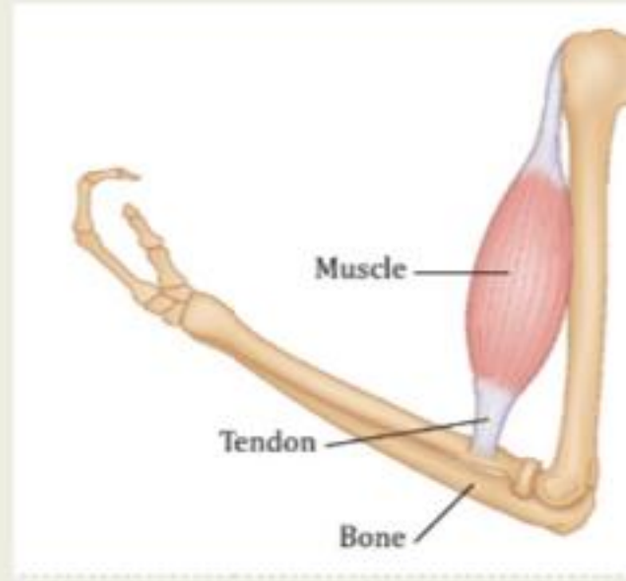
What Human Factors Is Not

- *Human factors is not just common sense:* Knowing how large to make letters on a sign to be read at a specific distance or selecting an audible warning that can be heard and distinguished from other alarms is not determined by simple common sense. Knowing how long it will take pilots to respond to a warning light or buzzer is also not just common sense. Given the number of human factors deficiencies in the things we use, if human factors is based on just common sense, then we must conclude that common sense is not very common.

Human systems

- Each of these systems contains a sometimes overlapping set of subsystems. For example, people can use their fingers to read Braille (as sensors) and type (as effectors).
- The components of systems and subsystems are intricately interfaced throughout the body. For example, the skeletal and muscular subsystems contain nerves and sensors, as well as muscles and bone, and are controlled by the central processor.
- The circulatory system, an important component of the body's support system, similarly connects with the effector system through veins and arteries that supply the muscles with nutriments..

THE EXTREMITIES



- Bones in the extremities are structured like pipes, with closed ends near the joints. Muscles are attached to the bones by tendons. A bone depression or protrusion is normally present at the spot where the tendon attaches. The surface layers of a bone are hard and dense and tend to be smooth except for roughened areas where ligaments and tendons are attached. Several small holes allow arteries, veins, and nerves to pass into the soft and spongy interior of the bone.
- Joints occur at the locations where bones come together. Joints tend to be complex structures, made from many different materials besides bone. Within a joint, ligaments and muscles hold the bones together. Most ligaments and tendons are made from inelastic *collagen fibers*. Some joints, especially in the spine, are held together by stretchable ligaments made from elastic fibers.
- The contact surfaces of bones in a joint are normally covered with a thin, smooth, and very slippery layer of collagen fibers, referred to as *cartilage*. This cartilage layer acts as a shock absorber and also helps minimize friction forces.

Dr. Shah

THE EXTREMITIES

- Joint Types:
  - *Joints at the ends of the fingers, knee joints, and elbow joints are known as hinge joints. Hinge joints have inelastic ligaments stretching down each side that prevent sideways movements. Other joints are less restrictive.*
  - *Gliding joints allow two-dimensional movement at articulations in the wrists and ankles.*
  - *The saddle joint found at the base of the thumb also allows two-dimensional movement.*
  - *The hip and shoulder joints are examples of spherical joints (or ball and socket joints) .Since the hip joint is a large ball and socket joint that is deep within the pelvis, it can carry heavy loads over a small range of movement.*
  - *The shoulder joint is smaller and not nearly as deep within the shoulder bone, so it cannot take as great a load, although it has a greater range of movement than the hip joint.*

Dr. Shah

THE UPPER EXTRIMITY

- The single *humerus* bone of the upper arm connects to the *scapula* in the shoulder. The forearm has two bones, the *radius* and *ulna*, which connect the elbow to the *carpal* bones of the wrist. Note that the bone on the outside of the wrist is the ulna.
- The radius is interior to the ulna. The lower part shows bones of the wrist and hand. *Gliding joints* are found where the carpal bones articulate with each other and with the radius.

THE HUMAN SYSTEM

Spring 2024

Dr. Shahd Obeidat

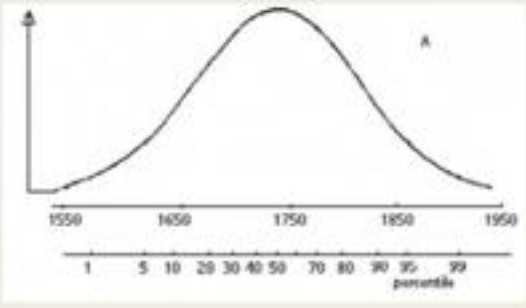
ANTHROPOMETRY

- The study of body sizes and other associated characteristics is generally referred to as *anthropometry*.
- While the term typically refers to static space dimensions, such as length, width, and shape, other important anthropometric measurements include the weights
- Anthropometric measurements are essential when designing devices and/or systems to fit the users or employees.
- For example, almost everyone would expect doors in building to be well above 6 feet (1.83 m) tall, because we are well aware that many people exceed 6 feet in height. But how large should the diameter of a screwdriver handle be, if you want the human hand, including fingers and the thumb, to surround the circumference? Or suppose that you are designing eye-glasses and you want the hinges outboard of the glass frames to be slightly smaller than the width of the human head just above the ears. What size do you need? Clearly, people who design products for the human body need to know something about the wide variety of body sizes.

Dr. Shahd Obeidat

PREDICTING THE STATURE OF PEOPLE

- People from a specified population vary in height from person to person following a normal distribution.
- The latter figure shows a bell-shaped curve obtained when the stature of British men (in millimeters) was plotted versus the relative frequency of each height for the population. Below that bell curve is a percentile scale, ranging from the first percentile to 99th percentile. These two points correspond to heights of approximately 1,575 mm and 1,900 mm. The median (50th percentile height) is about 1,743 mm.



Dr. Shahd Obeidat

The Structure of the Eye

- The iris is composed of nearly totally opaque (not transparent) layers, which are connected to muscles that open and close the iris to change the size of the eye's pupil from about 3 mm to about 6.5 mm.
- These actions by the iris control the amount of light entering the eyes by opening the pupil to its largest diameter when light levels are low, and closing the pupil to its smallest diameter when light levels are high.
- It takes about 3 to 4 seconds for these changes to occur. Both pupils respond even if only one eye is exposed to a brighter light.

The Structure of the Eye

- The eye is roughly a sphere of about 2.5 cm in diameter. The outer layer, or sclera, sometimes known as the whites of the eye, covers around 85% of the outer eye surface.
- The cornea is located at the very front of the eye. The cornea is about 1 mm thick and consists of five transparent layers. Since the cornea protrudes from the eyeball, it creates what is called the corneal bulge.
- Directly behind the cornea lies the anterior chamber, which is filled with a saline solution called the aqueous humor.
- At the rear of this chamber are the iris and the lens.