

Engineering Design ENGR 13x2

Human Factors

Agenda

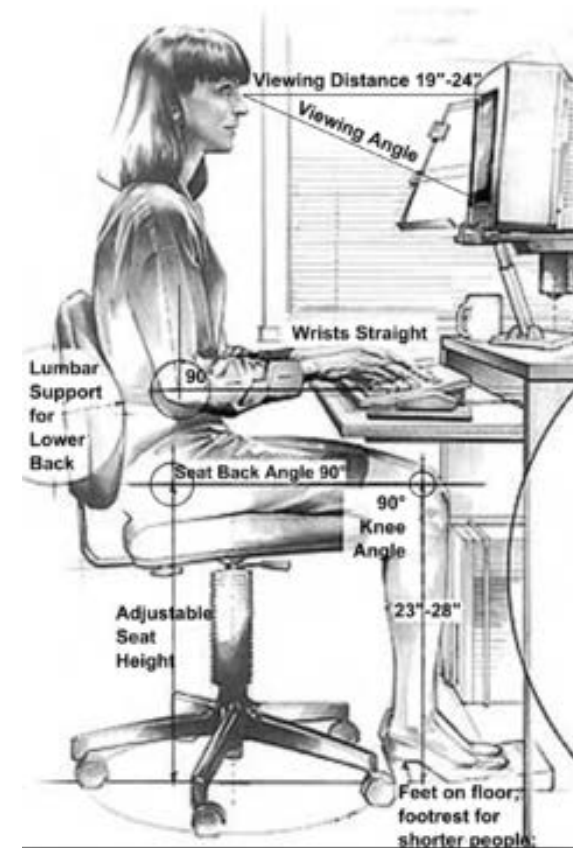
- Human Factors
 - Ergonomics
 - Cognition
- The Human-Machine Interface
 - Understanding
 - Operation
 - Maintenance

Human Factors in Design

- Human factors are critical in design
 - Good product design just “feels right”
 - Bad product design is confusing, frustrating, and sometimes painful
- Good design combines
 - Ergonomics
 - Cognition

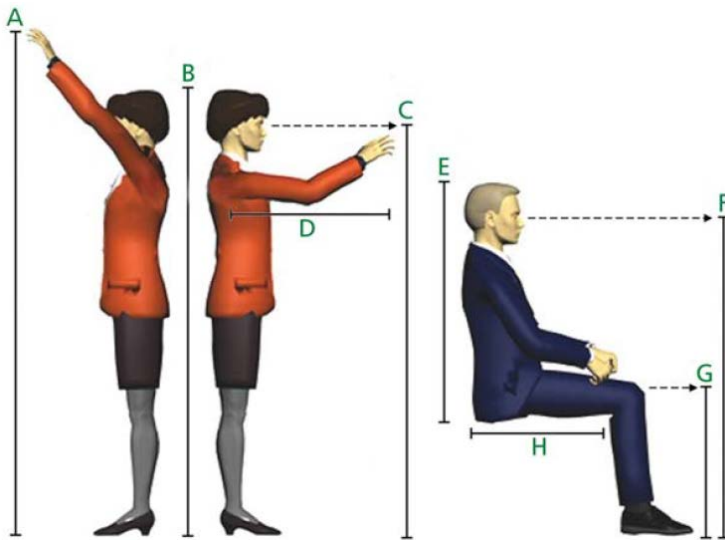
Ergonomics

- The science of how the body interacts with machines
 - Focuses on the size, weight, and placement of control devices that interact with the human body
- Goal: Prevent repetitive strain injuries and musculoskeletal disorders that develop over time
- Multidisciplinary field, including
 - Physiology
 - Engineering
 - Psychology
 - Anthropometry
 - Biomechanics



Ergonomics - *Factors to consider in design*

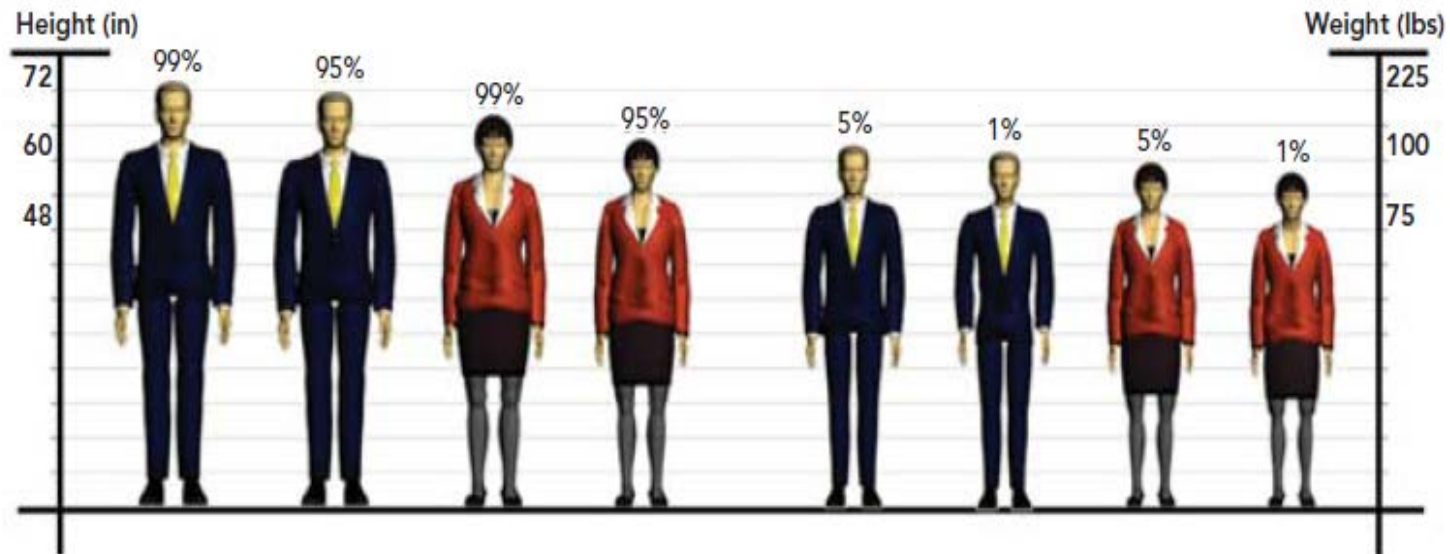
- Anthropometric data
 - Statistics on height, arm length, joint location, gait, finger spacing, eye level, etc.



Measurement	Letter	Female	Male
Standing Overhead Reach	A	74.9" – 86.8"	81.2" – 93.7"
Standing Height	B	60.2" – 68.4"	64.8" – 73.5"
Standing Eye Height	C	56.9" – 65.0"	61.4" – 69.8"
Standing Forward Reach	D	30.8" – 36.1"	33.8" – 39.5"
Sitting Height	E	31.3" – 35.8"	33.6" – 38.3"
Sitting Eye Height	F	42.6" – 48.8"	46.3" – 52.6"
Sitting Knee Height	G	19.8" – 23.2"	21.4" – 25.0"
Seat Depth	H	16.9" – 20.4"	17.7" – 21.1"

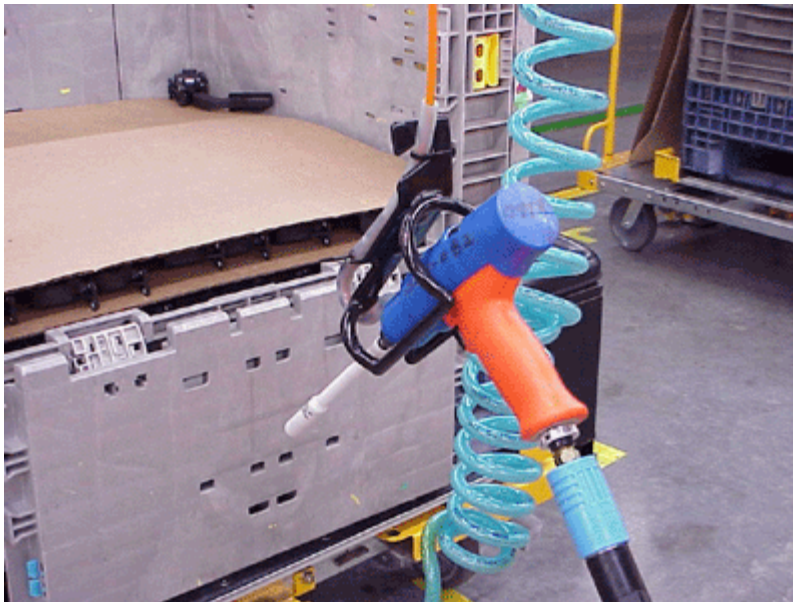
Ergonomics - *Factors to consider in design*

- Anthropometric data
 - Impacts the design of everything from the seat in your car to the sink in your bathroom



- Often seems like common sense – unnoticed until the “rules” are violated

Ergonomics Examples



Cognition

- How we know and perceive the world
- Related to design – how a user learns about the device and masters its features
 - User will consider a new product easy to use when it builds upon what they learned from prior use of similar products
 - Often no time for mastering hard-to-learn features!

Cognition - *Factors to consider in design*

- Operation should be easy to learn, easy to remember, consistent
 - Borrow from similar devices
 - Use logical location of controls
 - Adhere to norms in operation or function
 - Simple, easy-to-remember sequence of steps is best
 - Complex features go unused!

Cognition Examples

Toaster



VCR



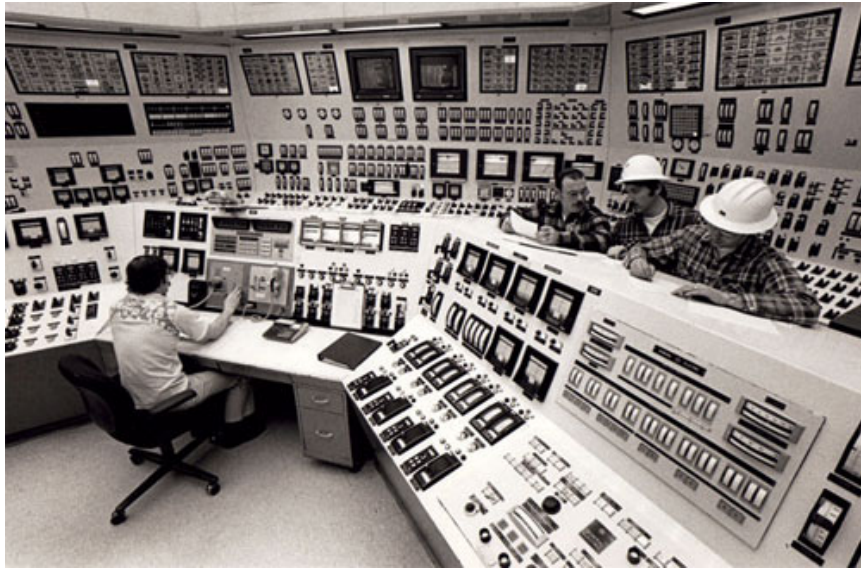
The Human-Machine Interface

- People have interacted with machines throughout history
- Designers seek to make machines easier to:
 - Understand
 - Operate
 - Maintain



Understanding

- Critical to predicting the results of actions, limits of performance, and hazards
 - What is this thing going to do when I pull this lever?
 - How fast will it go?
 - Am I going to get hurt?



Operation

- Consideration of user and environment
 - Reach
 - Visibility
 - Strength
 - Temperature, etc.
- Does it fit the user?
 - Ergonomics
 - Anthropometrics
 - Human Factors



<https://www.udacity.com/course/intro-to-the-design-of-everyday-things--design101>



Operation, cont.



Maintenance

Everything breaks eventually!!



Some things cheaper to dispose of than fix



Others must be maintained for decades



Design for Maintenance

- Access
 - Put replaceable items where they can be easily reached
 - Leave room for tool use AND observation
 - See item when removing and re-installing

<http://msis.jsc.nasa.gov/sections/section12.htm>



- Avoid need for specialized tools & use common hardware wherever practical
- Consider ultimate disposal of the item
 - Recycling or repurposing opportunities
 - Aluminum, steel, glass, many plastics
 - Avoid toxic materials if at all possible
 - Investigate biodegradable materials
 - Cornstarch and Potato Plastics





“Suspending your keyboard from the ceiling forces you to sit up straight, thus reducing fatigue.”

