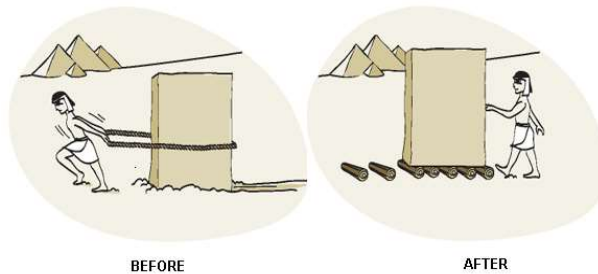


IENG112/MANE112
Introduction to Industrial & Management Engineering

Lecture
Introduction to Ergonomics

Ergonomics Defined

- Early 1700's, Ramazzini's study of ill-effects of poor posture & poorly designed tools on the health of workers



What Is Ergonomics?



Ergon – work
Nomos – laws of

Ergonomics is the laws of work that define the limits to human capability.

What Is Ergonomics?

Ergonomics is the science of improving employee performance and well-being in relation to the

- » job tasks,
- » equipment, and
- » the environment.

Ergonomics is...

- » a continuous improvement effort to design the workplace for what people do well, and design against what people don't do well.



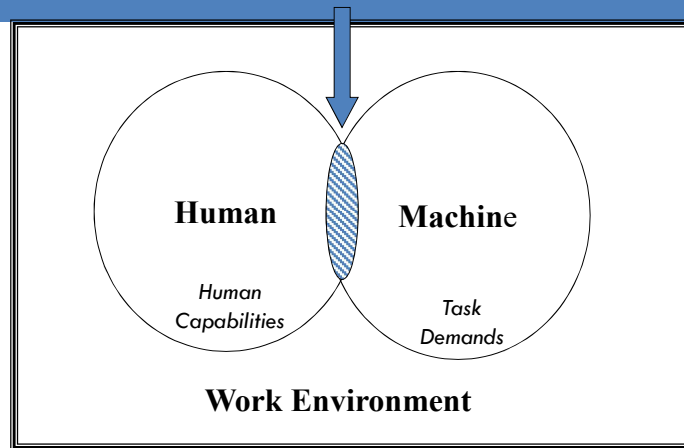
The Focus of Ergonomics

- The focus is on the **interaction** between the person and the machine and the design of the interface between the two.
- Improved machine performance that increased the psychological or physical stress on workers or damaged the local environment would not constitute improved performance of the total work system or better attainment of its goals.

The Focus of Ergonomics (cont.)

- When faced with **productivity** problems, *engineers* might call for better *machines*, *personnel management* might call for *better-trained people*
- *Ergonomists* call for a better interface and *better interaction* between the user and the machine – better task design.

Ergonomics



Utmost Goal: “Humanization” of Work

↓
Design with “E & E”: Ease and Efficiency”

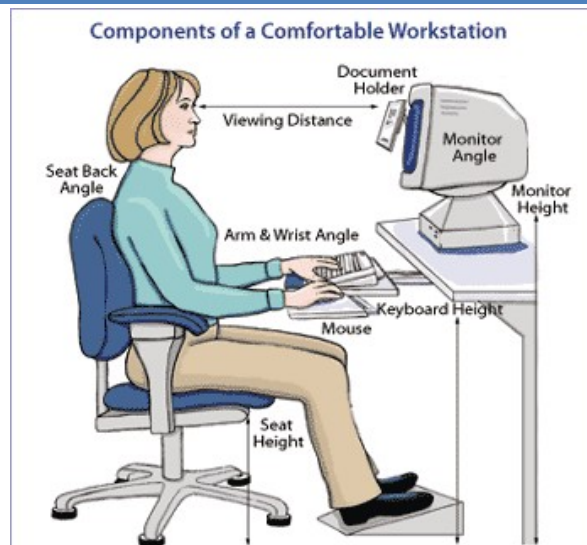
Who is a human operator?

- Skilled professional using a complex machine in an artificial environment
- Customer who has purchased a new equipment
- Child sitting in a classroom
- Disabled person in a wheel chair

DEFINITIONS OF ERGONOMICS

- Ergonomics is a means of improving working conditions and reducing illness at work
- Ergonomics attempts to 'Fit the Job to the Man' rather than 'Fit the Man to the Job'
- Ergonomics is concerned with the design of systems in which people carry out work
- Ergonomics optimizes Efficiency, Health, Safety and Comfort of people through better designs of products and work places

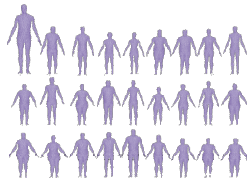
Components of a Comfortable Workstation



Ergonomics considers human operators variability

An automobile design has to consider

- ▣ Range of physical size and strengths of users
- ▣ Seats are comfortable
- ▣ Controls readily identifiable and within easy reach
- ▣ Clear visibility front and rear
- ▣ Easily read internal instruments
- ▣ Ease of entry and egress



Domains of Ergonomics

- ▣ **Physical**
(repetitive movements, layout, health, safety)
- ▣ **Cognitive**
(mental workload, decision making, HCI, and work stress)
- ▣ **Organizational**
(communication, teamwork, work design, and telework)

Importance of Ergonomics

□ **Economic Value**

- Reduction of costs by preventing work related problems
- Health care costs for treatment
- Costs associated with loss of labor
- Companies can improve efficiency, worker productivity and cost reduction
- Ergonomically designed products deliver benefits to customers and edge out competition
 - Special situations – short vs. tall, overweight, handicapped, elderly, pregnant women

Importance of Ergonomics

□ **Social Value**

- Human well being, safety, health and comfort
- Reduces accidents at work, at home, etc. by reducing human error
- Improves relationship between operators and equipment
- Decreases absence from work
 - Diseases of musculoskeletal system (LBP)
 - Psychological illnesses (stress)
- User friendly products

Methods Analysis

- **Methods Analysis**
 - Analyzing how a job gets done
 - It begins with an analysis of the overall operation
 - It then moves from general to specific details of the job concentrating on
 - Workplace arrangement
 - Movement of workers and/or materials

The Need for Methods Analysis

- The need for methods analysis can arise from a variety of sources
 - Changes in tools and equipment
 - Changes in product design or introduction of new products
 - Changes in materials and procedures
 - Government regulations or contractual agreements
 - Accidents or quality problems



Methods Analysis Procedure















1. Identify the operation to be studied, and gather relevant data
2. Discuss the job with the operator and supervisor to get their input
3. Study and document the present methods
4. Analyze the job
5. Install the new methods
6. Follow up implementation to assure improvements have been achieved

Guidelines for Selecting a Job to Study

- Consider jobs that:
 - Have a high labor content
 - Are done frequently
 - Are unsafe, tiring, unpleasant, and/or noisy
 - Are designated as problems
 - Quality problems
 - Processing bottlenecks
 - etc.

Analyzing the Job: Flow Process Charts

Process Chart Symbols

Sym	Name	Action		Examples
	Operation	Adds Value		Saw, Cut, Paint, Solder, Package
	Transport	Moves Some Distance		Convey, Fork Truck, OTR Truck
	Inspect	Check For Defects		Visual Inspect, Dimension Inspect
	Delay	Temporary Delay/Hold		WIP Hold, Queue
	Storage	Formal Warehousing		Warehouse or Tracked Storage Location
	Handle	Transfer Or Sort		Re-Package, Transfer To Conveyor
	Decide	Make A Decision		Approve/Deny Purchase

Analyzing the Job: Flow Process Charts

□ Flow process chart

- Chart used to examine the overall sequence of an operation by focusing on movements of the operator or flow of materials

FLOW PROCESS CHART Task : Selling Hamburgers

No	Activity Type	Oper.	Insp.	Move	Delay	Store	Time mins	Dist metres
1	Enquire customer needs	●					0.03	
2	Receive customer order	●					0.15	
3	Key order into EPDS	●					0.10	
4	Put tray into counter	●					0.05	
5	Go to burger rack	●		⇒			0.06	4.5
6	Pick up burgers	●					0.18	
7	Bring burgers to counter	●		⇒			0.06	4.5
8	Put burgers onto tray	●					0.03	
9	Go to drinks machine	●		⇒			0.04	3
10	Fill cups with drink	●					0.08	
11	Bring drinks to counter	●		⇒			0.04	3
12	Put drinks onto tray	●					0.03	
13	Go to fries machine	●		⇒			0.06	4.5
14	Fill carton with fries	●					0.18	
15	Bring fries to counter	●		⇒			0.06	4.5
16	Put fries onto tray	●					0.03	
17	Check order complete	●					0.07	
18	Advise customer of cost	●					0.05	
19	Collect cash	●					0.10	
20	Give change	●					0.08	
21	Thank customer	●					0.02	
	TOTAL	14	1	6	0	0	1.50	24

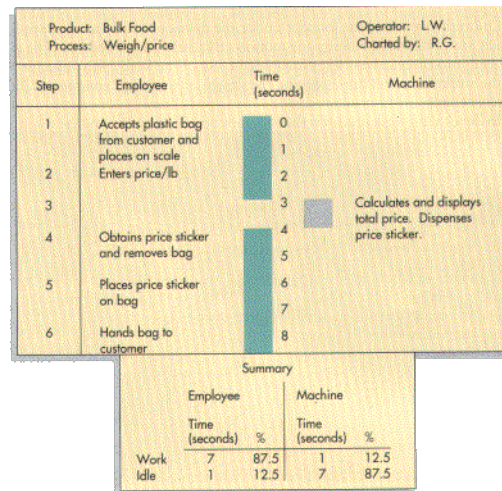
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Analyzing the Job: Worker-Machine Chart

□ Worker machine chart

- ▣ Chart used to determine portions of a work cycle during which an operator and equipment are busy or idle



Benefits of ergonomics

- Productivity
- Product quality
- Safety
- Health
- Reliability
- Job satisfaction
- Personal development

Useful Links

- <http://www.ilo.org/>
- <http://www.cdc.gov/niosh/about/>
- <https://www.osha.gov/>