Do you have a Herbie?

Why study Line Balancing?

- Will you be balancing lines after you graduate? Probably no.
- You are, however, likely to see imbalanced workloads
- These concepts will help you to understand how to create more balanced loads where people work interdependently

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Reading Rehabilitation

A Case on Organizational Layouts

Monday, October 16, 2006

Layout Planning

"Best physical arrangement of all resources that consume space within a facility"

Facility Layout

- Layout planning is determining the best physical arrangement of resources within a facility
- Process (Functional) layouts:
  - Group similar resources together
  - Emphasis is on flexibility
- Product layouts:
  - Designed to produce a specific product efficiently
  - Emphasis is on efficiency

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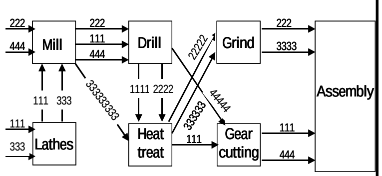
Process or Functional Layout

- Functional, Batch, & Queue
  - Equipment and/or people arranged by function
  - Customers or products can take different routes through the system
  - Arrangement is based on need for flexibility & variety
  - Parts can spend 95% waiting and 5% value added



Give me another example of a functional layout

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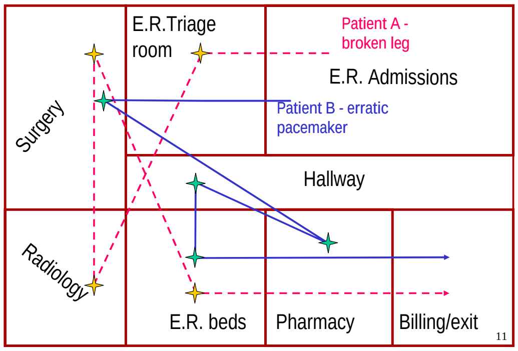
Emergency Room Layout



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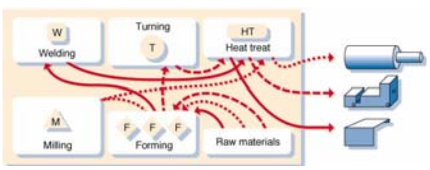
Traditional Process Layout



What type of organization would benefit most from a functional design?

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Evaluating the Functional Layout

- Flexibility or Customization?
- Lead Time?
- Quality?
- Cost?

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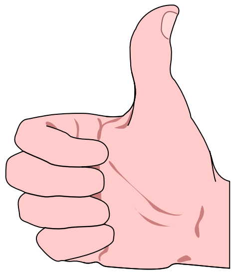
Functional-Oriented Layout Advantages

- General purpose & flexible resources
- Handles demand variability
- Lower capital intensity & automation
- Higher labor intensity



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Product-Oriented Layout

Design places departments with large flows of material or people together

Evaluating the Product Layout

- Flexibility or Customization?
- Lead Time?
- Quality?
- Cost?

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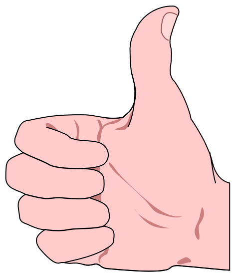
Product-Oriented Layout Advantages

- Lower variable cost per unit
- Lower material handling costs
- Lower work-in-process inventories
- Easier training & supervision



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The Manufacturing Cell

Small number of people and resources are co-located
- Small number of people
- Dedicated to a “family of parts”
- Cell is becomes the organizational unit for the purposes of control, output, measurement, and improvement.

It’s a hybrid

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Reading Rehab: Implementation Design for Pure Service

- Pros & Cons of Process vs. Product Focused Operations
  - Manufacturing Settings
  - Service Settings
- Stimulate thinking for Process Design Implementation

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In Class Questions

- Who are the Stakeholders?
- What do they want?
- How does each define quality?
- Who is the customer?

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What's Being Proposed?

- **Old Layout**
- Departmental orientation
- Poor coordination

- **Patient focused care**
- Service Lines
- Better coordination
- *Complete experience*
- Intended outcomes?

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Scenario #1
Functional Organization

- A physical therapist, e.g., can handle any type of case that enters the hospital.
- A card turned over by the deck master will represent a patient
- Establish baseline
- If we have 4 physical therapists, what patient arrival rate can we theoretically accommodate?

- Time keeper instructs deck master to turn over a card at the appropriate interval
- Physical therapist "walks" around and finishes patient session. Hands card to pile

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What the heck happened here?

How overstaffed are they?
Or are they?

Dealing with Demand Variability

- Coefficient of Variation

$$\frac{\sigma}{\mu_{demand}} = \frac{\sigma_{each\ diagnostic\ group}}{\mu_{avg\ number\ of\ admissions}}$$

- Risk Pooling
  - Increasing # of admits
  - Reduces variation
  - Reduces impact of variation
  - Sport Obermeyer – Fabric & Zippers

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New Org Outcomes

Throughput	Shorter length of stay
Output Rate	Slightly less
WIP (avg # of patients)	Much lower
Labor Utilization	Much Worse
Idle Time	Higher
Patient functioning	Slightly higher
Customer Satisfaction	97.6% vs. 91%
Patient Meetings	Staff reports less

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Plan of action for Reading Rehab

Should RRH keep service lines (cells) or should they return to a functional service organization? Can you think of other options?

Cycle Time

- The amount of time each workstation is allowed to complete its tasks

$$\text{Cycle time (seconds/unit)} = \frac{\text{available time in seconds/day}}{\text{desired output in units/day}}$$

- Limited by the bottleneck task (the longest task to be performed):

$$\text{Maximum output} = \frac{\text{available time}}{\text{bottleneck task time}}$$

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Compute Efficiency & Balance Delay

- Efficiency is the ratio of productive time to total time:

$$\text{Efficency}(\%) = \frac{\sum(\text{task times})}{(\text{number of stations})(\text{cycle time})}(100)$$

- Balance delay:

$$\text{Balance delay}(\%) = 100 - \text{Efficency}$$

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Frozen Pizza Example

- Desired output is 60 pizzas/hour
  - Cycle time is (3600 seconds/hour)/(60 units/hour)
  - Cycle time = 60 seconds/unit

Task	Description	Predecessor	Task Time
A	Roll dough	None	50
B	Place on cardboard	A	5
C	Spread sauce	B	25
D	Sprinkle cheese	C	15
E	Add pepperoni	D	12
F	Add sausage	D	10
G	Add mushrooms	D	15
H	Shrink-wrap pizza	E, F, & G	18
I	Pack in box	H	15
		Total:	**165**