

## UNIT – 5

### Aspects of Design

#### Unit-05/Lecture-01

**Aesthetics Consideration** relate to our emotions. Since aesthetic emotions are spontaneous and develop beneath our level of consciousness, they satisfy one of our basic human needs. Visual aesthetic values can be considered as a hierarchy of human responses to visual motivation. At the bottom level of the ladder is order of visual forms, their simplicity, and clarity—our visual neatness. These values are derived from our need to recognize and understand objects. **Aesthetic appeal in product design** relate better to symmetric shapes with closed boundaries. Visual observation is enhanced by the repetition of visual elements related by similarity of shape, position, or color. Another visual characteristic to enhance Observation is homogeneity, or the standardization of shapes. **For example:** we relate much more readily to a square shape with its equal angles than to a trapezoid. Designing products so that they consist of well-recognized geometric shapes greatly facilitates visual perception. Also, reducing the number of design elements and bunch them into more compact shapes support recognition

The **highest level of the visual aesthesis** ladder deals with the group of aesthetic values derived from the prevailing fashion, taste, or culture. These are the class of values usually associated with styling. There is a close link between these values and the state of available technology.

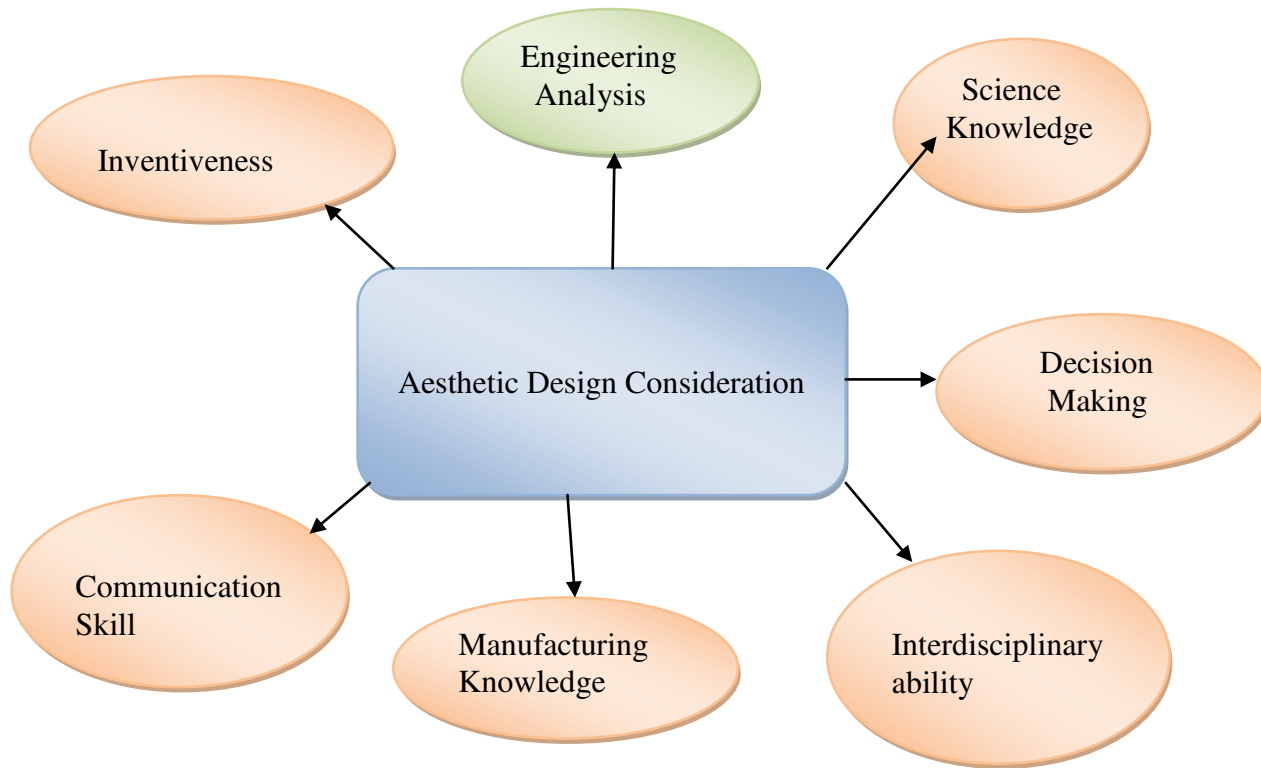
**For example:** the advent of steel beams and columns made the high-rise building a possibility, and high-strength steel wire made possible the graceful suspension bridge.

A strong driver of prevailing visual taste traditionally has been the influence of people in positions of power and wealth. In today's society this is most likely to be the influence of media stars. Another strong influence is the human need and search for newness. Engineered systems contain many components, and for each a material must be selected. The automobile is our most familiar engineering system and one that exhibits major changes in the materials used for its construction.

#### **Product Aesthetic Criterion:**

- a) **Unity:** A product should appear as a one complete unit, if there are any separate elements, they should arrange in the most logical way. There should not be anything missing and at the same time there should not be superfluous or surprise element in the design.
- b) **Order:** all components of the order should be in recognizable pattern and in a repetitive manner; however, care should be taken to prevent monotony in design.

## Aesthetic Consideration in Design:



- 1) **Inventiveness:** ability to think and analyze or discover new sparking ideas or concept for archiving a goal.
- 2) **Engineering Analysis:** Ability to analyze a given component, system or process using Engineering or scientific principles in order to quickly solve a meaningful solution
- 3) **Engineering Science Knowledge:** should have a technical knowledge in a particular discipline
- 4) **Interdisciplinary ability:** able to deal confidentially with basic problems.
- 5) **Decision Making:** able to make decisions in the event of disciplinary with full grasp of all the factors involved.
- 6) **Manufacturing Knowledge:** should have a knowledge of old and new manufacturing process.
- 7) **Communication skill:** A design is explanation of an object and instruction for its production. It will exist to the extent .it is expressed in the available modes of communication .the best way to communicate a design is through drawings, which is a universal language of designer

**DESIGN IN INDUSTRIES:** Industrial design is a process deals with uniting factors as technology, marketing, sales, recycling, and disposal to create the balance between the commercial, **Immaterial** and **aesthetic** value of product .the word industrial design relates to an industrial production technology. Industrial design is a creative process which integrates the physical qualities of a product with **aesthetic (Concerned with beauty)** considerations. Design is both the result as end product and the process which creates the result

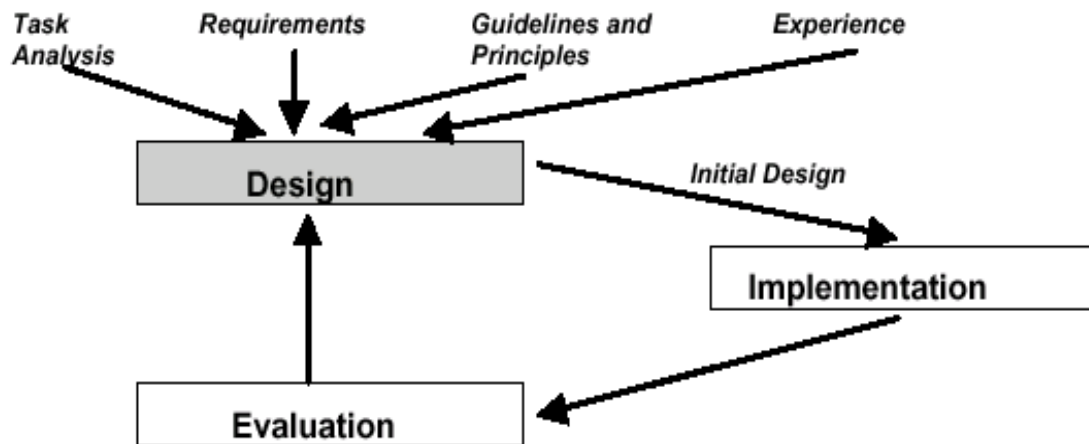
## Unit-05/Lecture-02

### USER CENTRED DESIGN

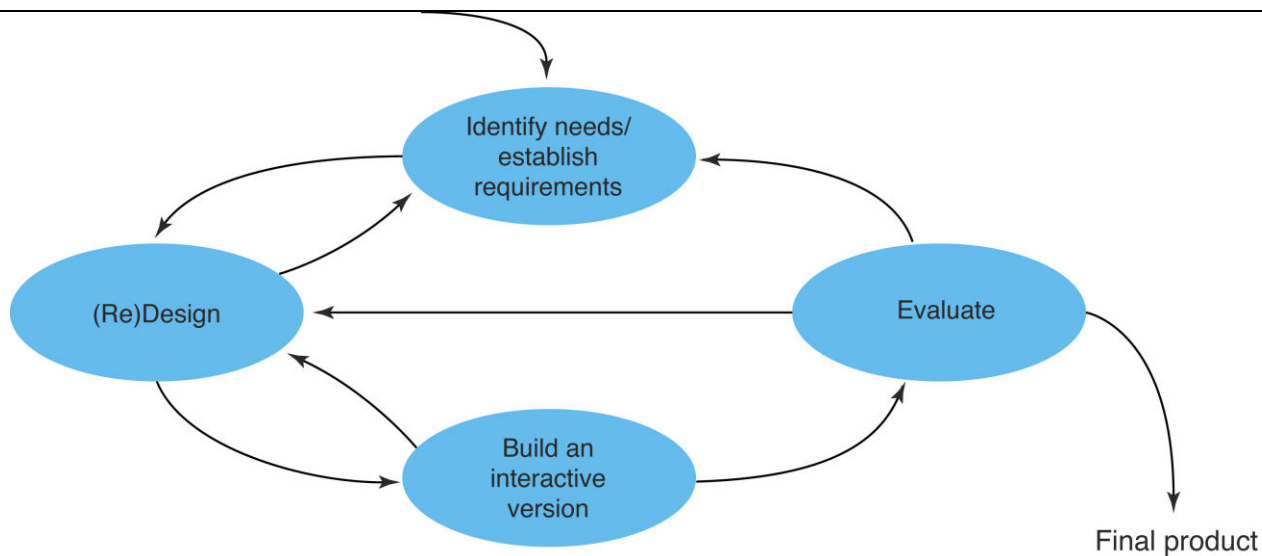
**User Centred Design/ User Friendly Design:** The quality of interaction between the person who uses the product to achieve actual work and the product itself is the primary goal of user-centered design.

**User centered design four basic** suggestions on how a design should be:

- 1) Make it easy to determine what actions are possible at any moment.
- 2) Make things visible, including the conceptual model of the system, the alternative actions, and the results of actions.
- 3) Make it easy to evaluate the current state of the system.
- 4) Follow natural mappings between intentions and the required actions; between actions and the resulting effect; and between the information that is visible and the interpretation of the system state



**Role of designer:** These recommendations place the user at the center of the design. The **role of the designer** is to facilitate the task for the user and to make sure that the user is able to make use of the product as intended and with a minimum effort to learn how to use it. Norman noted that the long awkward, jumbled manuals that accompany products are not user-centered. He suggests that the products should be accompanied by a small brochure that can be read very quickly and draws on the user's knowledge of the world. Telling designers that products should be intuitive is not enough; some design principles are needed to guide the design.



**Principle of design:** Norman (1988) suggested that the following **seven principles of design** are essential for facilitating the designer's task:

1. **Use both knowledge in the world and knowledge in the head:** By building conceptual models, write manuals that are easily understood and that are written before the design is implemented.
2. **Simplify the structure of tasks:** Make sure not to overload the short-term memory, or the long term memory of the user. On average the user is able to remember five things at a time. Make sure the task is consistent and provide mental aids for easy recovery of information from long-term memory. Make sure the user has control over the task.
3. **Make things visible:** bridge the gulfs of Execution and Evaluation. The user should be able to figure out the use of an object by seeing the right buttons or devices for executing an operation.
4. **Get the mappings right:** One way to make things understandable is to use graphics.
5. **Exploit the power of constraints:** both natural and artificial, in order to give the user the feel that there is one thing to do.
6. **Design for error:** Plan for any possible error that can be made, this way the user will be allowed the option of recovery from any possible error made.
7. When all else fails, **standardize**. Create an international standard if something cannot be designed without arbitrary mappings

### How to Involve Users in Design?

It is necessary to think carefully about who is a user and how to involve users in the design process. Obviously users are the people who will use the final product or to accomplish a task or goal. But there are other users as well. The people who manage the users have needs and expectations too. What about those persons who are affected in some way by the use of the object or use the products and/or services of the object? Shouldn't their needs and expectations be taken into consideration in the design process?

**Eason (1987) identified three types of users:** primary, secondary, and tertiary.

**Primary users** are those persons who actually use the object

**Secondary users** are those who will occasionally use the object or those who use it through an intermediary

**Tertiary users** are persons who will be affected by the use of the object or make decisions about its purchase.

The **successful design of a product** must take into account the wide range of users of the object. Not everyone who is a stake holder needs to be represented on a design team, but the effect of the object on them must be considered. Once the stakeholders have been identified and a thorough investigation of their needs has been **conducted by performing tasks and needs analyses, designers can develop alternative design solutions to be evaluated by the users.** These design solutions can be simple paper and pencil drawings in the beginning phase of the process. **Listening to users** discuss the alternative designs can amplify designers understanding of the intended purpose of the object and may provide information that does not come out of initial interviews, observations, and needs analysis. As the design cycle progresses, prototypes (limited versions of the product/artifact) can be produced and user tested. At this point, designers should pay close attention to the evaluations by the users as they will help identify measurable usability criteria. Measurable usability **criteria address issues related to the effectiveness, efficiency, safety, utility, learn ability and memo ability (how long it takes to remember to perform the most common tasks) of the product/object** and users' subjective satisfaction with it. You can see how difficult it would be for designers to know or imagine all the usability criteria that are important to the users. It is only through feedback collected in an interactive iterative process involving users that products can be refined.

### **Usability Testing**

Usability testing, according to Dumas & Redish (1993), aims to achieve the following five goals, to:

- improve the product's usability
- involve real users in the testing
- give the users real tasks to accomplish
- enable testers to observe and record the actions of the participants
- enable testers analyze the data obtained and make changes accordingly

**Before product implementation, paper mock-ups of screen displays can be tested in order**

To assess the wording and layout. Many techniques are employed in usability testing, including:

- **Think aloud techniques** in which the user is asked to clear all the steps of his / her actions.
- **Videotaping** is valuable to review what the participants did, and to show designers where the problems are in their designs.
- **Interviews and user satisfaction questionnaires** enable designers to evaluate the user's likes and dislikes about the design and to gain a deeper understanding of any problems.

Typically the **tests require typical users** to perform typical standardized tasks in a typical task environment so that the following data can be collected:

- **Time for users to learn a specific function**
- **Speed of task performance**
- **Type and rate of errors by users**
- **User retention of commands over time**
- **Subjective user satisfaction**

After the product is released, it is also recommended that evaluation be continued. The most frequent method of evaluation is interviews and focus groups. Both provide valuable information about user satisfaction and any problems with the functionality that might need rethinking. Data logging may also be performed.

### **Advantages and Disadvantages of User-Centered Design:**

**The major advantage of the user centered design approach** is that a deeper understanding of the psychological, organizational, social and ergonomic factors that affect the use of computer technology emerges from the involvement of the users at every stage of the design and evaluation of the product. The involvement of users assures that the product will be suitable for its intended purpose in the environment in which it will be used. This approach leads to the development of products that are more effective, efficient, and safe. It also helps designers manage user's expectations about a new product. When users have been involved in the design of a product, they know from an early stage what to expect from a product and they feel that their ideas and suggestions have been taken into account during the process. This leads to a sense of ownership for the final product that often results in higher customer satisfaction and smoother integration of the product into the environment. If the design is not user-centered; it could lead to ill-thought out designs. When users' expectations are not met, they may get frustrated or even angry.

**The major disadvantage to user centered design** is that it can be quite costly. It takes time to gather data from and about users especially if you seek to understand the environment in which they will be using the products. The process requires resources, both financial and human. User-centered design

teams generally

Benefit from including persons from different disciplines, particularly psychologists, sociologists and anthropologists whose job it is to understand users needs and communicate them to the technical developers in the team. The downside of this approach is that members of the team have to learn to communicate effectively and to respect each other's contributions and expertise. This can be time consuming and hence adds costs to the process. Management may question whether this added value is worth the cost, particularly if delivery dates are threatened

<b>Advantages</b>	<b>Disadvantages</b>
Products are more efficient, effective, and safe	It is more costly.
Assists in managing users' expectations and levels of satisfaction with the product.	It takes more time
Users develop a sense of ownership for the product	May require the involvement of additional design team members (i. e. ethnographers, usability experts) and wide range of stakeholders
Products require less redesign and integrate into the environment more quickly	May be difficult to translate some types of data into design
The collaborative process generated more creative design solutions to problems	The product may be too specific for more general use, thus not readily transferable to other clients; thus more costly

### **Key aspects of user-centered design:**

- \* Early focus on users, tasks and environment
- \* The active involvement of users
- \* An appropriate allocation of function between user and system
- \* Iterative design whereby a prototype is designed, tested and modified
- \* Multi-disciplinary design teams

## Unit-05/Lecture-03

### MATERIAL SELECTION

#### Material selection:

These **trends in materials selection** reflect the great effort that is being made to decrease the fuel consumption of cars by downsizing the designs and adopting weight-saving materials. Prior to 1975, **steel and cast iron comprised about 78 percent of the weight of a car**, with aluminum and **plastics** each at **Slightly less than 5 percent**. Today, ferrous materials comprise about 57 percent of the total weight, with plastics at about 20 percent and aluminum at about 8 percent. Aluminum is in an ongoing battle with steel to take over the structural frame and part of the sheet panels. Complex and severe service conditions can be economically withstood only by combining several materials in a single component. The surface hardening of gears and other automotive components by carburizing or nitriding is a good example. Here the high hardness, strength, and wear resistance of high-carbon steel is produced in the surface layers of ductile and tougher low-carbon steel.

**An excellent example** of a complex materials system used in a severe environment is the exhaust valve in an internal-combustion engine. Valve materials must have excellent corrosion- and oxidation-resistance properties to resist “burning” at the service temperature range of 1350 to 1700°F.

#### They must have

- (1) sufficient high-temperature fatigue strength and creep resistance to resist failure
- (2) Suitable hot hardness to resist wear and abrasion.

**Materials and the manufacturing processes** that convert them into useful parts underlie all of engineering design. There are **over 100,000 engineering materials** to choose from. The typical design engineer should have ready access to information on 30 to 60 materials, depending on the range of application deals with it. The recognition of the importance of materials selection in design has increased in recent years. Concurrent engineering practices have brought materials specialists into the design process at an earlier stage. The importance given to quality and cost aspects of manufacturing in present-day product design has emphasized the fact that materials and manufacturing are closely linked in determining final product performance. Moreover, the pressures of worldwide competition have increased the level of automation in manufacturing to the point where material costs comprise 60 percent or more of the cost for most products. Finally, the extensive activity in materials science worldwide has created a variety of new materials and focused our attention on the competition between



**Six broad classes of materials: metals, polymers, elastomers, ceramics, glasses, and composites.** Thus, the range of materials available to the engineer is much broader than ever before. This presents the opportunity for innovation in design by utilizing these materials to provide **greater performance at lower cost**. Achieving these benefits requires a rational process for materials selection **An incorrectly chosen material can lead not only to failure of the part but also to excessive life-cycle cost**. Selecting the best material for a part involves more than choosing both a material that has the properties to provide the necessary performance in service and the processing methods used to create the finished part. A poorly chosen material can add to manufacturing cost. Properties of the material can be enhanced or diminished by processing, and that may affect the service performance of the part. Faced with the large number of combinations of materials and processes from which to choose, the materials selection task can only be done effectively by applying simplification and systemization. As design proceeds from concept design, to configuration and parametric design (embodiment design), and to detail design, the material and process selection becomes more detailed. The task is to determine whether each design concept will be made from metal, plastics, ceramic, composite, or wood, and to narrow it to a group of materials within that material family. The required precision of property data is rather low. Materials are selected on the basis of four general criteria: Performance characteristics (properties)

Processing (manufacturing) characteristics Environmental profile Business considerations. The material properties required in a part usually are formalized through specifications. Sometimes this is done by listing the material designation, AISI 4140 steel— **for example:** on the detail drawing of the part, along with processing instructions, such as the heat treatment temperatures and times. In this case the designer depends on generally accepted specifications established through organizations such as the **Society of Automotive Engineers (SAE), ASTM, or ISO to give the requirements on chemical composition, grain size, surface finish, and other material descriptors**. Many of the products that engineers are developing today are the result of new technology. Much of the technology explosion started with the invention of the digital computer and transistor in the 1940s and their subsequent development through the 1950s and 1960s. The transistor evolved into micro-integrated circuits, which allowed the computer to shrink in size and cost, becoming the desktop computer we know today. Combining the computer with communications systems and protocols like optical fiber communications gave us the Internet and cheap, dependable worldwide communications. At no other time in history have several breakthrough technologies combined to so substantially change the world we live in. Yet, if the pace of technology development continues to accelerate, the future will see even greater change.

## VISUAL MERCHANDISING

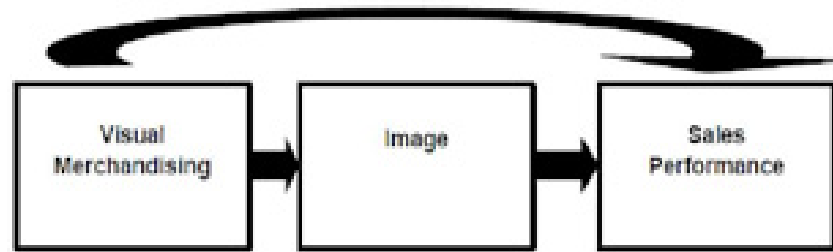
**Visual merchandising:** **Visual Merchandising** is termed as the art of displaying merchandise in a manner that is appealing to the eyes of the customer. It sets the context of the merchandise in an aesthetically pleasing fashion, presenting them in a way that would convert the window shoppers into prospects and ultimately buyers of the product.<sup>55</sup> But it is little different from the real art, the main **principle of visual merchandising** is that it is intended to increase sales, which is not the case with a "real" art. Visual merchandising is the activity and business of developing the floor plans and three-dimensional displays in order to maximize sales. Both goods and services can be displayed to highlight their features and benefits. The purpose of such visual merchandising is to attract, engage, and motivate the customer towards making a purchase

### VISUAL MERCHANDISING ---AESTHETIC APPEAL TO CUSTOMERS.

In an age of globalizations, average consumers today are very demanding when it comes to the layout and aesthetics of any establishment they visit. They want to be attracted and motivated to enter a shop or stall and in that moment of decision-making rests the difference between a prospect and a sale for retailers. Successful retailing businesses always wish to create a distinct and consistent image in the customers mind. Visual merchandiser can help create that positive customer image that leads to successful sales. Visual merchandising therefore has become a critical aspect of retailing and retailers are increasingly looking toward creating a unique environment that is aesthetically pleasing as well as being cost effective. Here, technology comes into play with its capabilities to attract as well as provide information on consumer behavioral patterns. Also in modern retailing, attaining leadership and building a store image in the customer's mind requires a great deal of skill and planning. A Store brand has to break through the clutter and make an impression on the customer's mind to eventually convert the coordinated entity of the store that's in the customer's mind into a particular image. Image can be described as the overall look of a store and the series of mental picture and feelings it evokes in the beholder. Image is the foundation of all retailing efforts. Studies indicate that a retailer has roughly seven seconds to capture the attention of a passing customer. Visual merchandising makes it possible by grabbing the customers' attention and making a positive impression in those precious few seconds as he is aware of the rules of perception. The researcher would like to clear the **Rules of perception**

- Every potential purchase starts with a first impression.
- The initial contact with the customer will determine
  - i) How long he will stay
  - ii) His inclination to buy

iii) Created a positive or negative feeling towards the shop/brand.



### **PRINCIPLES OF VISUAL MERCHANDISING:**

**There are 5 principles of Visual merchandising**

#### **1. Clarity**

- The company's image
- The structure of store
- The offering
- Merchandise

**2. Authority:** To display with authority is to show and tell the customer that the company believes in the merchandise that is being sold, this is attained by ensuring that the shop floor looks neat, clean, adequately stocked, well- coordinated.

**3. Discipline:** Ensuring presentation norms are being followed for. e.g. Merchandise should not touch the floor; there is a minimum of 4ft of circulation space for each fixture.

**4. Diversity:** The ability of merchandising various products in the same area, for e.g. coordinating top wear/ bottom wear/ accessories in focal point/ high point or on a wall and yet the display is harmonious

**5. Flexibility:** Mixing merchandise and having different display configurations.

### **History of visual merchandising:**

When the huge nineteenth century dry goods establishments like Marshall Field & Co. shifted their business from wholesale to retail, the visual display of goods became necessary to attract the general consumers. The store windows were often used to attractively display the store's merchandise. Over time, the design aesthetic used in window displays moved indoors and became part of the overall interior store design, eventually reducing the use of display windows in many suburban malls. In the twentieth century, well-known artists such as Salvador Dalí and Andy Warhol created window displays. In the beginning of twenty-first century visual merchandising is forming as a science. Nowadays, Visual Merchandising became one of the major tools of business promotion which is widely used to attract customers and increase sales.

**Concept of visual merchandising:** Visual merchandising is the activity and profession of developing the

floor plans and three-dimensional displays in order to maximise sales. Both goods and services can be displayed to highlight their features and benefits.

**Visual Merchandiser job:** Visual merchandisers (also known as window dressers or display assistants) use their design skills to help promote the image, products and services of retail businesses and other organisations. They create eye-catching product displays and store layouts and design to attract customers and encourage them to buy.

**Visual image in the marketing:** Visual marketing is the discipline studying the relationship between an object, the context it is placed in and its relevant image. Representing a disciplinary link between economy, **visual** perception laws and cognitive psychology, the subject mainly applies to businesses such as fashion and design.

**Functional of visual merchandiser:** The logical aspect of VISUAL MERCHANDISER attends to the customer's convenience and understands customer psychology. **VISUAL MERCHANDISER is Aesthetic:** The visual appeal of a display through the choice of colors, the use of props, the light focus etc. gives an aesthetic value to the display. However, it's important to realize that the aesthetic aspect gets a shopper's attention; it is the functionality of a display will convert a potential buyer into a customer. Functionality of VISUAL MERCHANDISER supports sales as it is easier for the shopper to locate the desired merchandise. It saves the shoppers time and take the stress out of shopping. It also helps in easier self-selection. Aesthetic aspect increase sales as it guide customers on fashion, new arrivals, and trends. It helps in coordinating and accessorizing and also builds the add-on sales.

**Role of a merchandiser:** Retail **merchandiser: Job** description. **Merchandisers** are responsible for ensuring that products appear in the right store, or on a website, at the appropriate time and in the correct quantities. This involves working closely with the buying teams to accurately forecast trends, plan stock levels and monitor performance. **VISUAL DISPLAY ARTISTS are unsung heroes in the beauty industry. They take a concept or idea and translate that into an exciting and sometimes breathtaking in-store experience - one delights and engages consumers of all ages.** In today's scenario where there is stiff competition according to researcher a person who desire to attract guests to a place of business in order to sell its merchandise is a visual merchandiser.

There are different names given to **Visual Merchandisers** some stores call them Display People. Others are called Sign Makers. But, they do one and the same thing: Make the store attractive for customers. The presence of his role is felt when one get to see those beautiful windows, or signs announcing a sale in a store. A Visual Merchandising Department also has a hierarchy, like any other job. The head is usually called Visual Merchandising Director or Display Director. Sometimes, he or she is called Vice President-

Visual Merchandising, depending on the hierarchy system in the company.

**Visual Merchandiser:** Display designers and Visual merchandisers use their design skills to promote the image, products and services of businesses and other organizations.

**The work involves:**

- Researching to get an understanding of what are needed, and coming up with design ideas.
- For visual merchandisers, sourcing elements such as lighting, props and accessories.
- For some jobs, installing and dismantling displays, making the most of the space available, working within a budget and meeting deadlines.

**Visual merchandisers create imaginative, eye-catching displays of goods in retail stores.**

**They aim to attract the attention of the customers and encourage them to buy.** Their task can include:

- researching lifestyle and design trends and making sure designs will appeal to the target audience
- working with other members of the design, marketing and buying team to develop themes and color schemes for displays- e.g. Christmas, Valentine's Day, sales and special promotions
- sketching design and developing floor plans, making the most of the space available
- taking direction from head office on corporate schemes
- sourcing material, such as props and lighting
- installing and dismantling displays
- preparing visual merchandising packs, including plans and photographs, for other stores in the chain, to make sure all displays present a consistent image
- Visiting branches to train and brief staff on arranging displays.

**Purpose of a visual merchandiser:** Both goods or services can be displayed to highlight their features and benefits. The **purpose** of such **visual merchandising** is to attract, engage, and motivate the customer towards making a purchase. **Visual merchandising** commonly occurs in retail spaces such as retail stores and trade shows.



## Benefits of Visual Merchandising

All types of retail stores can benefit from visual merchandising. Some of the key benefits include:

**Reflects your brand** – A good visual merchandising display stays in-line with the company's overall brand. For example, a franchise business might want all its franchisees to have the same promotional displays. It gives a business a sense of identity and brand consistency.

**Engages the shoppers** – An attractive and welcoming store creates a positive first impression. It encourages people to come into the store, and can help guide them in finding the right product for their needs. Visual merchandising helps create a positive shopping experience for customers so that they will be more likely to return for future visits.

**Grow sales** – When done effectively, visual merchandising can increase sales by directing people to the products they want or need. It can also help them discover new products and solutions. A nicely dressed mannequin can encourage a person to seek out an outfit and accessories that they may not have originally been looking for.

## Disadvantages of visual merchandising:

Whether you are selling clothes, hardware, electronics, food, or anything else, a professional visual merchandiser can be an important asset to your team. They can help your retail business get the results you want.

Maximizing profit is one of the basic goals of business, which prompts many business owners to seek revenues in areas that may be outside of their primary business models. Merchandising is the creation and promotion of goods for sale at retail, which is a common way businesses attempt to bring in additional revenue. While merchandising can produce profit, it can also have some significant drawbacks.

**Cost:** One of the main disadvantages of merchandising is the cost associated with creating products to sell at retail and the cost of getting such products on store shelves and promoting them. Small business owners often do not have extra money to commit toward new projects and programs outside of the main focus of the business, so merchandising may not be financially feasible for some companies. For example, a small film production company might not have the resources to produce retail products like action figures of characters in its films.

**Customer Base:** One of the most important parts of building a successful small business is to grow a loyal customer base that demands the products or services that the company offers. If a company does not have a well-established base of customers, there may not be a significant amount of demand for merchandise associated with the company.

**Risk:** Any new project or program a company undertakes carries the inherent risk of failure. If the amount of revenue generated from merchandise sales does not exceed the costs of producing and promoting the merchandise, the merchandising operation will result in losses. A small business may be better served by committing its funds toward developing its core business concept than attempting to branch out into selling merchandise.

**Considerations:** In some cases, business owners may license the right to produce and sell products associated with its intellectual property to other companies. For example, a small film production company might allow a larger firm to create and sell action figures of characters in its films. In this case, the company that licenses the rights to sell products may take on costs of production and promotion, but the film production company will not receive all of the profits realized from the merchandising campaign.

## Unit-05/Lecture 05

### ERGONOMICS

**ERGONOMICS:** The word “**ergonomics**” is derived from an Ancient Greek word meaning “**rules or study of work**”. It is also referred to as human factors (in design). Ergonomics is concerned with appropriate design for people - the design of systems, processes, equipment and environments so that tasks and activities required of them are within their limitations but also make the best use of their capabilities. Therefore the focus of the design is on the person or a group of people. This is often termed “user-centred design”.

**Ergonomics is a science;** it is an accurate, user-centred approach to research and design. It is also a philosophy and a way of thinking. It is applied widely in areas such as aviation and other transport systems, sport, education, public facilities, the home, recreational equipment and facilities and in the workplace generally. In fact, the whole community benefits from ergonomics design. Ergonomics considers the whole work system, and the effects of the system on human and system performance. Ergonomics has three domain areas: Physical ergonomics, Cognitive ergonomics and Organisational ergonomics.

### **History of Ergonomics**

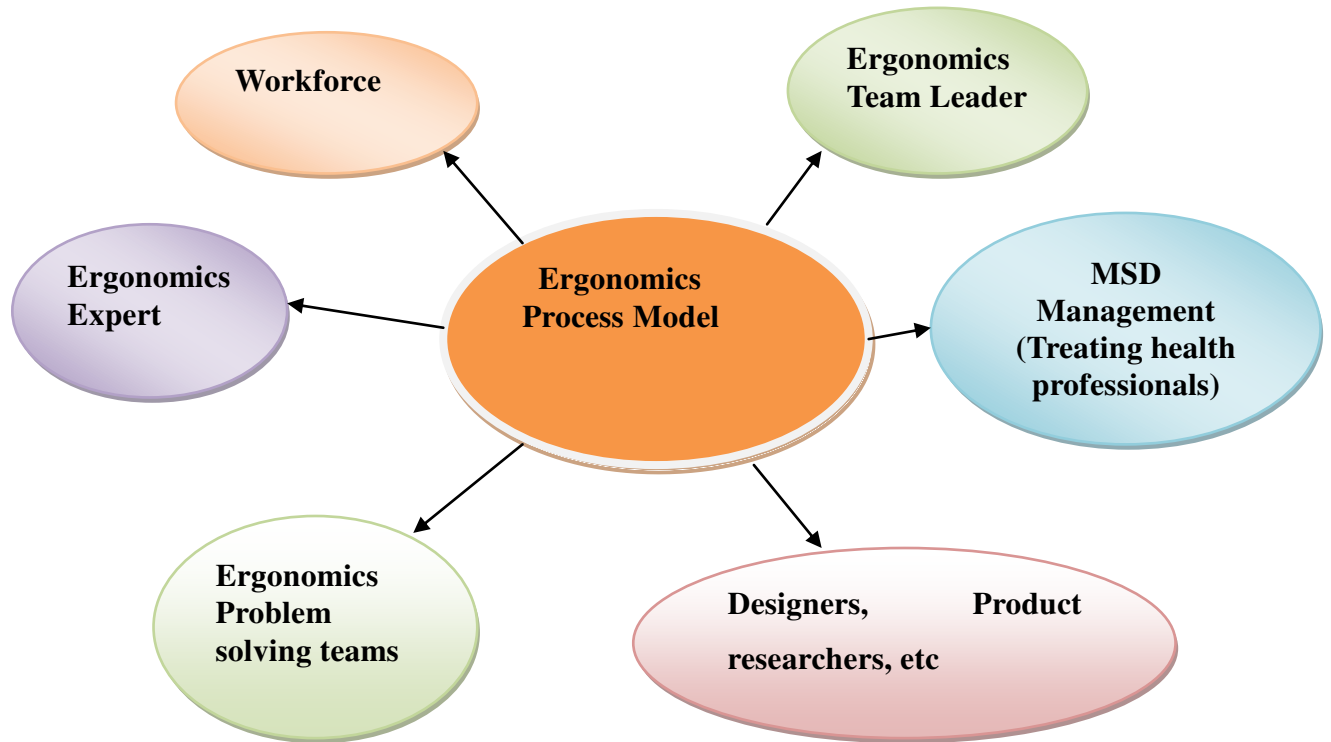
Ergonomics in the United Kingdom arose out of World War 2 when scientists were asked to determine the capabilities of the soldier in order to maximise efficiency of the fighting man (Pheasant, 1991). In the United States, ergonomics arose out of psychology and cognitive function in the aviation industry and was termed “human factors”. Today these terms are used interchangeably. Since the industrial revolution, work has turned away from its agricultural base to city-based work environments. Further changes have occurred in recent times with an increase of females in paid employment, an increasing age of workers, an internationalisation of the workforce and an increased trend to contract or outsource work. All of these changes have implications for design of equipment and work systems, and a role for ergonomics.

### **Scope of Ergonomics and Systems of Work**

Ergonomists and designers take into account a wide range of human factors and consider biological, physical and psychological characteristics as well as the needs of people - how they see, hear, understand, make decisions and take action. They also consider individual differences including those that occur due to age, fitness/health, or disability and how these may alter people’s responses and behaviours. As there are many factors to be considered in ergonomics, a range of people are involved in its research and application. Specialist Ergonomists usually have university qualifications in ergonomics and related fields and can come from a range of disciplines such as physiology, psychology, engineering, physiotherapy, occupational therapy, medicine, industrial design, architecture, occupational health and safety (OHS), industrial relations and management. In order to address ergonomics issues at workplaces, Ergonomists interact and consult



with designers, engineers, managers and the end users of any system, the workforce and individual workers.



### Aims, Objectives and Benefits of Ergonomics

The overall aim of ergonomics is to promote efficiency and productivity and ensure that the capacities of the human in the system are not exceeded. The word “**optimum**” is often used in ergonomics and refers to the balancing of the needs of people with real-life limitations such as the availability of solutions, their feasibility and costs. Successful solutions depend on solving the real, rather than the apparent problems. This in turn requires careful observation and analysis. Ergonomics problems and solutions may not transfer exactly from one country, region or industry to another – they have a social context. Although the basic human characteristics are the same they take on local differences for a range of reasons – geographical, social, economic or historical. It can be described as „the way we do things around here” and relate to the culture of a country, region, industry and/or company. Consequently, ergonomics issues should be identified and addressed locally because each set of circumstances is different. Importing solutions without reference to local issues and resources may fail.

In terms of cost benefits the advantage of ergonomics changes is that they will make the job faster, easier, safer and enhance productivity. It is important to assess the benefits in the short, medium and long term, as expensive equipment and process changes may take some time to take effect.

**When analysing work and how it can be improved from an ergonomics point of view there are five**

### **elements that need to be addressed:**

1. **The worker:** the human element of the workplace. Employees have a range of characteristics that need to be considered including physical and cognitive capacities; experience and skills; education and training; age; sex; personality; health; residual disabilities. An individual's personal needs and aspirations are also considered.
2. **Job/task design:** what the employee is required to do and what they actually do. It includes job content; work demands; restrictions and time requirements such as deadlines; individual's control over workload including decision latitude, working with other employees; and responsibilities of the job.
3. **Work environment:** the buildings, work areas and spaces; lighting, noise, the thermal environment.
4. **Equipment design:** the hardware of the workplace. It is part of ergonomics that most people recognise and includes electronic and mobile equipment, protective clothing, furniture and tools.
5. **Work organisation:** the broader context of the organisation and the work and how this affects individuals. It includes patterns of work; peaks and troughs in workload, shift work; consultation; inefficiencies or organisational difficulties; rest and work breaks; teamwork; how the work is organised and why; the workplace culture; as well as the broader economic and social influences.

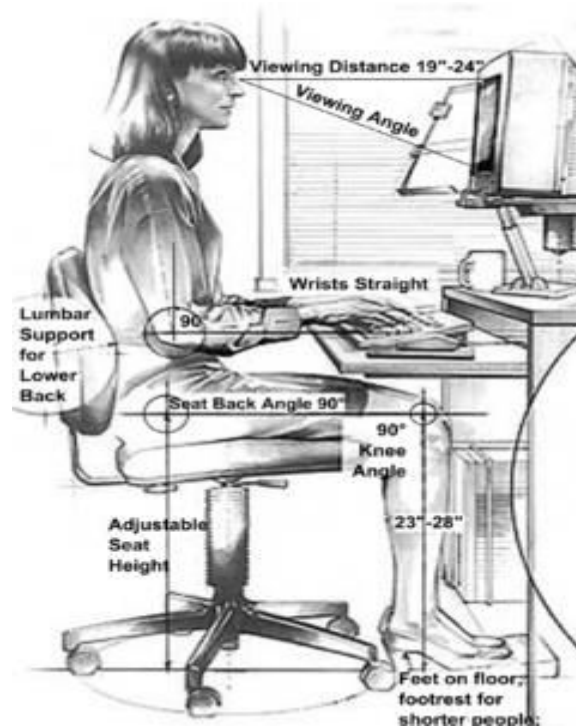
### **Ergonomics at the Design Stage**

Design of equipment, workplaces and systems of work require design to ergonomic specifications as well as the production of the output. Ergonomics is about designing for the user population, but also to consider the potential population that may access the workplace. A good example of this is the consideration of wheelchair users when designing door widths and accommodating the needs of the ageing workforce given the foreseen increase in older workers in employment into the future. Workplaces, equipment and work environments that are designed for a greater range of people to use provide greater flexibility in terms of who can effectively operate in that environment. In other words, we need to design for the greatest percentage of the population. However, even with the best design process, unforeseen issues may arise. To overcome this, the process of trials, mock-ups or prototypes is undertaken in order to consult with the user group and make modifications based on the feedback.

### **ERGONOMICS METHODS & TECHNIQUES**

This topic describes methods which can be used to facilitate good ergonomics practice; as well as methods to identify and investigate poor ergonomics practice and improve the work system and its elements to promote human comfort and productivity.

### **WORK DESIGN**



## 1 Allocation of Functions

When designing an overall system or process, the design team need to decide on the best way to allocate system functions, jobs and tasks to human or automated components. To do this effectively, the design team needs to understand the capabilities of humans and machines and allocate components effectively. This process is known as sociotechnical allocations

## Ergonomic Principles in the Design of Work Systems

The 6 phases outlined in the standard are:

### 1. Formulation of goals (requirements analysis).

Identification of relevant ergonomic issues through studies, or statistics, focus groups etc.

### 2. Analysis and allocation of functions

Determining the technical and human capabilities and limitations.

### 3. Design concept

Carry out a hierarchical task analysis (see next section); conduct simulation, scale model mock-ups, user trials and interview/discussion.

### 4. Detailed design

Design of work organisation; jobs; work tasks; work environment; equipment (hardware and software); and design of workspace/workstation.

### 5. Realisation, implementation and validation

Planned, documented, staged introduction of new system with adequate and appropriate consultation/training with the user group; ensure system is „validated“ – ie that it is working well and does not cause any ergonomic issues for the users.

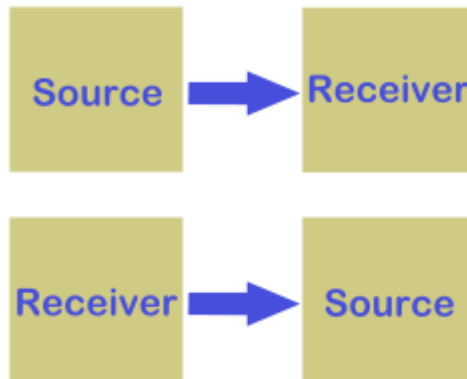
**6. Evaluation**

Review whole process (steps 1-6) to use as a learning experience for the organisation. Evaluation should include the 3 categories of worker health, safety and performance as outlined in the table below.

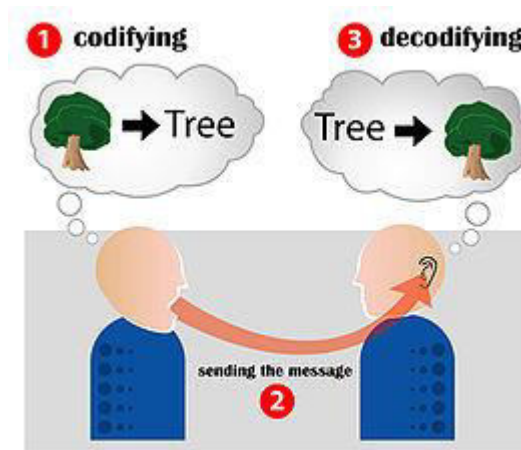
**Unit 01/ lecture-6**

## EVALUTION IN COMMUNICATION

**Communication** from Latin *commūnicāre*, meaning “**to share**” is the purposeful activity of information exchange between two or more participants in order to convey or receive the proposed meanings through a shared system of signs and semiotic rules. The basic steps of communication are the forming of communicative intent, message composition, message encoding, and transmission of signal, reception of signal, message decoding and finally explanation of the message by the recipient.

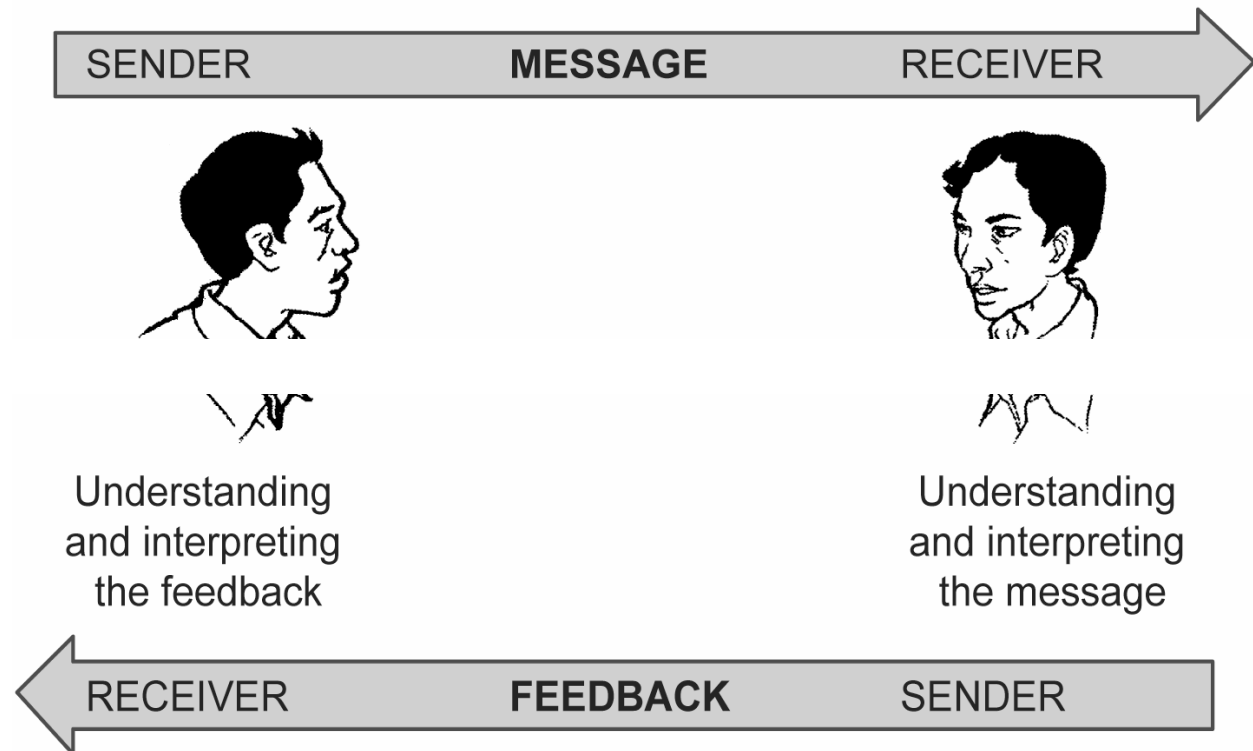


**HISTORY OF COMMUNICATION:** The first major model for communication was introduced by Claude Shannon and Warren Weaver for Bell Laboratories in 1949. The original model was designed to mirror the functioning of radio and telephone technologies. Their initial model consisted of three primary parts: sender, channel, and receiver. The sender was the part of a telephone a person spoke into, the channel was the telephone itself, and the receiver was the part of the phone where one could hear the other person. Shannon and Weaver also recognized that often there is static that interferes with one listening to a telephone conversation, which they deemed noise.



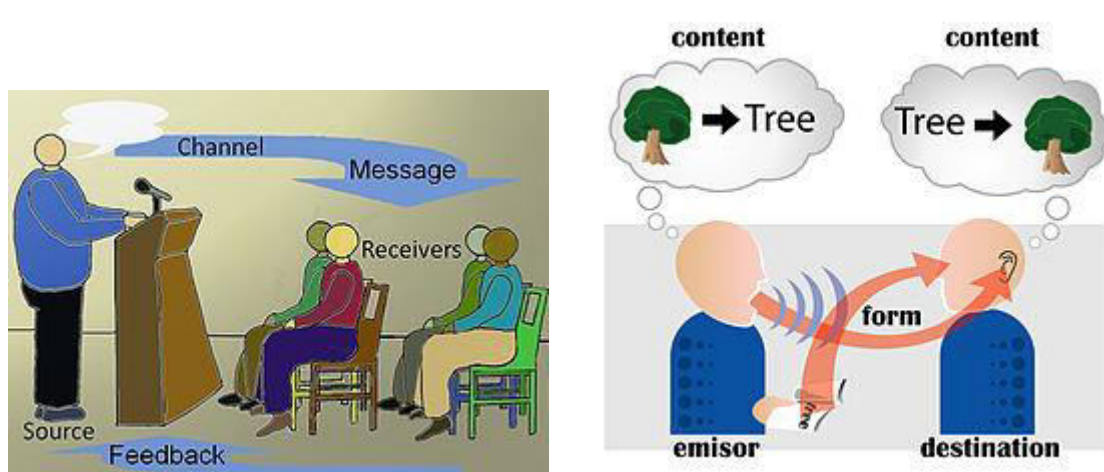
**Communication is simply the act of transferring information from one place to another.**

Although this is a simple definition, when we think about how we may communicate the subject becomes a lot more complex. There are various categories of communication and more than one may occur at any time.



**The different categories of communication are:**

A) **Spoken or Verbal Communication:** face-to-face, telephone, radio or television and other media.



B) **Non-Verbal Communication:** body language, gestures, how we dress or act - even our scent.

C) **Written Communication:** letters, e-mails, books, magazines, the Internet or via other media.

Written communication is sending a message by the use of symbols that are understood by both the sender and receiver of the message. If you are reading the transcript of this lesson, you are engaged in written communication. While managers spend most of their time communicating with their subordinates and upper managers in a face-to-face setting, they also spend a good deal of time writing memos, letters, e-mails and reports. **Written communication** refers to messages that are transmitted to receivers in writing.

**Advantages of written communication include:**

- 1) **Immediacy and economical feasibility** - A manager can communicate a message quickly to individuals despite their geographical location. Email is less expensive than long-distance phone calls and certainly less than travel expenses, especially when a message needs to be conveyed to a large group.
- 2) **Efficiency and accuracy** - Written communication allows for reflection, affording a manager the opportunity to refine a message for correctness.
- 3) **Flexibility** - A manager can send a message and the receiver can review it at the time that is convenient for them.

D) **Body language** is a form of nonverbal communication that can be used to send a message. You can often tell if your boss is pleased or upset simply by looking at his facial expressions, posture and gestures. For example, a flushed face may mean embarrassment; a clinched fist may indicate anger; and the rolling of one's eyes may signal disbelief or annoyance messages.

E) **Visualizations**: graphs and charts, maps, logos and other visualizations can communicate Verbal communication is simply sending a message through a spoken language that is understood by both the sender and receiver of the message. Examples of verbal communications include face-to-face talking, listening to a lecture or seminar, and listening to a television program. In fact, if you are listening to this lesson, you are engaged in a verbal form of communication.

**Below are some possible problem areas that may turn out to be barriers to effective communication:**

(a) **Status/Role**: The sender and receiver of a message may be of equal status within a hierarchy (e.g. managers in an organization) or they may be at different levels (e.g. manager/employee, lecturer/student, business owner/clients). This difference in status sometimes affects the effectiveness of the Communication process.

**(b) Cultural Differences**

Cultural differences, both within or outside the organization (for example, inter-departmental dealings and

communication with outside organizations or ethnic minorities) may impede the communication process.

**Choice of Communication Channels** Before you choose your communication channel, you should ask yourself whether the channel is appropriate for a particular purpose and the person/receiver you have in mind. Sending messages via inappropriate channels can send out wrong signals and end up creating confusion.

#### **(d) Length of Communication**

The length of the message also affects the communication process. You need to be sure that it serves the purpose and is appropriate for the receiver. Is the message too long or too brief?

#### **(e) Use of Language**

Poor choice of words or weak sentence structure also hampers communication. The same goes for inappropriate punctuation. The two sentences below illustrate clearly how different placement of punctuation can change the entire meaning of a sentence:

#### **(f) Disabilities**

Disabilities such as impaired sight, dyslexia and poor mental health can also be barriers to good communication, and should be taken into consideration when evaluating the effectiveness of the communication process. You may need to use hearing aids, sign language, magnifying systems, and symbols to alleviate problems caused by disabilities.

#### **(g) Known or Unknown Receiver**

Whether the receiver is known or unknown to you also plays a major role in determining the effectiveness of your communication. A known receiver may be better able to understand your message despite having insufficient information as both of you probably has common experiences and shared schemata. An unknown receiver, on the other hand, may require more information and time to decode the message.

#### **(h) Individual Perceptions/Attitudes/Personalities**

Sometimes, the method of communication needs to take into consideration the receivers personality traits, age and preferred style. The elderly and children, for example, have different communication needs and preferences when compared to young adults. Is the receiver of your message a visual, auditory, Or kinesthetic sort of person? How do you think they will react to your message? Can you adapt your communication style to suit theirs?

## **COMMUNICATION AND ITS IMPORTANCE:**



There are various means of communication. People communicate with each other by writing letters, sending telegrams, radio, T.V., computer technology, newspapers, magazines and pamphlets; messages can be sent by telegram, facsimile machine (FAX) and E-mail (Electronic mail) for business trade and other services. E-mail has emerged as the fastest means of communication and is almost free. It is also important to know that the choice of a particular means of communication depends on purposes.

Now, let us classify different means of communication into two groups:

1. Means of Personal Communication

2. Means of Mass Communication

**1. Means of Personal Communication:** We classify means of personal communication into two parts:

(i) Postal Service

(ii) Telephone Service

**(i) Postal Service:** Postal service is a very old means of communication. Though letter writing is not that popular any longer, it is still important even today. Indian Postal Network is the largest in the world. In 2001, India had 1,55,000 post offices providing different services like – letters, money orders, parcels, postal saving schemes, etc.

**(ii) Telephone Service:** It has emerged as one of the most important and widely used means of communication in today's world. It is quick and affordable, serving our need seamlessly.

**2. Means of Mass Communication:** The means by which information can be communicated to a very large number of people are called Media or Mass Communication, such as radio, television, newspaper, cinema, books, magazines, traditional folk modes and satellite communication.

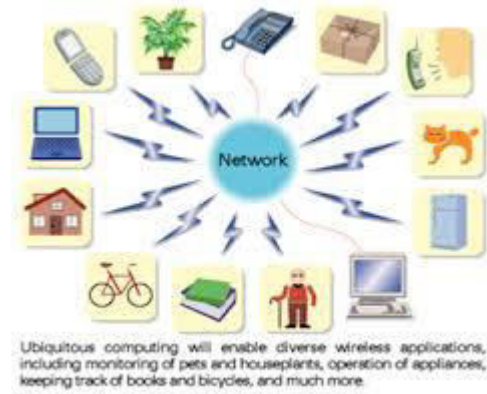
**(i) Radio:** Radio transmission in India started in 1927 from Mumbai and Kolkata to entertain, educate and apprise the people of the country with important information. Today the program of All India Radio (AIR) is available to 90% parts of the country to 98.8% of our people.

**(ii) Television:** The national television transmission service of India started in 1959 is one of the biggest ground transmission organizations of the world. Today, 87% of population can watch it. Television program telecast by National, Regional and local Doordarshan and a large number of private channels are available for education, information and recreation.

**(iii) Computer (Information Technology):** Today, computer has become the basis of communication and economic development as it is used everywhere from homes, offices to shops, hospitals, railways, airports, banks, educational institutions, etc.

### **Newer communication Technology**

In recent years, there is revolution of new technology that has helped people in much better way such as:



- (a) **Internet:** It provides access to several kinds of information. It connects all types of computers across the world to obtain information at the click of a button.
- (b) **Video Conferencing:** People sitting at far off places can talk and express their views with the help of telecommunication and computer.
- (c) **E-Commerce:** Facility available for sale and purchase of goods through internet and fax.
- (d) **Internet Telephony:** It is software program me who makes a computer to work like telephone. This facility has reduced the call rates drastically.
- (e) **E-Mail:** It is a method of sending letters or information through internet to anyone in the world in the blink of an eye.
- (f) **Tele-Medicine:** Using this technology, doctors can advise his patients sitting at a distance of thousands of kilometers from them. Thus, scientific advancement and technology has revolutionized the system of Communication and brought people very close to each other, to be in touch all the time and making the world a global village.

## Unit -05/Lecture 08

### EVALUTION IN TRANSPORTATION

#### TRANSPORT AND COMMUNICATION –LIFELINES OF A COUNTRY:

Transport and means of communication are integral part of our life today. Can we imagine our life without <http://www.rgpvonline.com> <http://www.a2zsubjects.com>

them? Just imagine if one day you come to know that all the modern means of transport and communication have been stopped due to unavailability of fuel. Also imagine the problems you are going to face!


Circle the vehicles used for water transportation.



		
Helicopter	Bicycle	Yacht
		
Truck	Sailboat	Bus
		
Tractor	Police car	Rowboat

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<b>3500BC</b> First wheels on carts are invented - the first wheeled vehicles in history. Other early wheeled vehicles include the chariot. 	<b>3500BC</b> River boats are invented - ships with oars. 	<b>2000BC</b> Horses are domesticated and used for transportation. 	<b>312BC</b> One of the earliest paved roads, the Appian Way, is built. The Romans eventually built over 50,000 miles of paved roads. 	<b>181-234AD</b> The wheelbarrow is invented. 	<b>852</b> Adnan bin Malik invents a sailing machine. 
<b>1620</b> Cornelius Drebbel invents the first submarine, a human-sized submarine. 	<b>1662</b> Blaise Pascal invents a horse-drawn public bus which has a regular route, schedule, and fare system. 	<b>1783</b> First steamboat is demonstrated by Jacques Claude Fournoy de Jouffroy d'Alville - a public wheel steamboat. 	<b>1783</b> Joseph Montgolfier and Jacques Montgolfier launch the first hot air balloon. 	<b>1814</b> George Stephenson built the first practical steam-powered railway locomotive. 	<b>1835</b> Karl Benz builds the world's first practical automobile to be powered by an internal combustion engine. 
<b>1899</b> Ferdinand von Zeppelin builds the first successful airship. 	<b>1903</b> Orville and Wilbur Wright fly the first motor-driven airplane. 	<b>1903</b> Henry Ford develops the assembly line method of automobile manufacturing. 	<b>1940</b> Modern helicopters invented. 	<b>1947</b> First supersonic flight. 	<b>1956</b> Hovercraft invented. 
<b>1957</b> First flight of the Boeing 707, the first commercially successful jet airliner. 	<b>1961</b> Yuriy Gagarin, the first man, orbits Earth. 	<b>1964</b> Bullet train transportation invented. 	<b>1976</b> Concorde makes the world's first commercial passenger-carrying supersonic flight. 	<b>1981</b> First flight of the space shuttle. 	<b>2004</b> First commercial high-speed Maglev Train starts operation between Shanghai and its airport. 

**Meaning of transportation:** Transport refers to the activity that facilitates physical movement of goods as well as individuals from one place to another. In business, it is considered as an auxiliary to trade, that means, it supports trade and industry in carrying raw materials to the place of production and distributing finished products for consumption. Individuals or business firms that engage

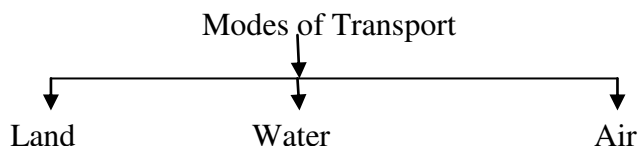
### The Role of Transport and Communication

Transport facilitates trade and commerce by carrying goods from the areas of production to that of

consumption. Goods from the areas that have surplus are shifted to those areas which are deficient in those items. Movement of people from one place to another place in search of job, education and emergency through transport facility. Communication keeps us informed about the world's events and trends. It brings in positive changes in the life of the people and thereby enhancing their economic conditions.

## THE MODES OF TRANSPORT

The modes of transport on which the countries depend for connecting people, growth and development are as under:



**A) Land Transport can be broadly divided into two types:**

### 1. Roadways

### 2. Railways

**1. Roadways:** Roads are most commonly used means of transport. Roads play an important role in connecting people and also in ensuring socio-economic growth of a country as under:



- Roads provide door to door service by means of a rickshaw, car, bicycle, bus, scooter or a truck.
- The construction, repair and maintenance cost is less than other means of transport.
- It is the cheapest and the most convenient mode of transportation for a few people and relatively smaller amount of goods over shorter distances.
- It is through roads that we reach railway stations, airports and seaports.
- Perishable goods like milk, fruits and vegetables are quickly carried from nearby villages to the cities or metropolis or to other destinations.
- Roads connect rural areas to the urban areas and can be constructed in all types of terrains like hills, deserts, mountain and plateaus.

### Advantages of Road transport

Road transport has the following advantages.

- (i) It is a relatively cheaper mode of transport as compared to other modes.
- (ii) Perishable goods can be transported at a faster speed by road carriers over a short distance.
- (iii) It is a flexible mode of transport as loading and unloading is possible at any destination. It provides door-to-door service.

(iv) It helps people to travel and carry goods from one place to another, in places which are not connected by other means of transport like hilly areas.

### **Limitations of Road transport**

It has the following limitations.

- (i) Due to limited carrying capacity road transport is not economical for long distance transportation of goods.
- (ii) Transportation of heavy goods or goods in bulk by road involves high cost.

**2. Railways:** This is for our convenience and quick movement of passengers and freights. Such an act causes inconvenience to the passengers, loss of millions of rupees, and affects business. This is the cheapest transport by which thousands of people can travel together from one corner of the country to another for the purpose of education, business, site seeing, pilgrimage or visiting friends or relatives.

- People of all income groups can travel by train as it has different types of coaches like General, Sleeper and AC chair car.
- It carries country's largest amount of bulky goods like coal, cement, food grains, fertilizer, petroleum, automobiles etc. from mines to industries and from industries to the areas of consumption.



- ❖ Indian Railways started in 1853 from Bombay to Thane covering a distance of 34 km.
- ❖ At present, Indian Railway network is the largest in Asia and the fourth largest in the world with the length of more than 64000 kms.
- ❖ It is the largest government undertaking employing 1.6 million people and a separate budget is presented for it.
- ❖ It has been divided into 16 zones for better administration and management of work.

### **Advantages of Rail transport**

- (i) It is a convenient mode of transport for travelling long distances.
- (ii) It is relatively faster than road transport.
- (iii) It is suitable for carrying heavy goods in large quantities over long distances.
- (iv) Its operation is less affected by adverse weather conditions like rain, floods, fog, etc.

### **Limitations of Railway transport**

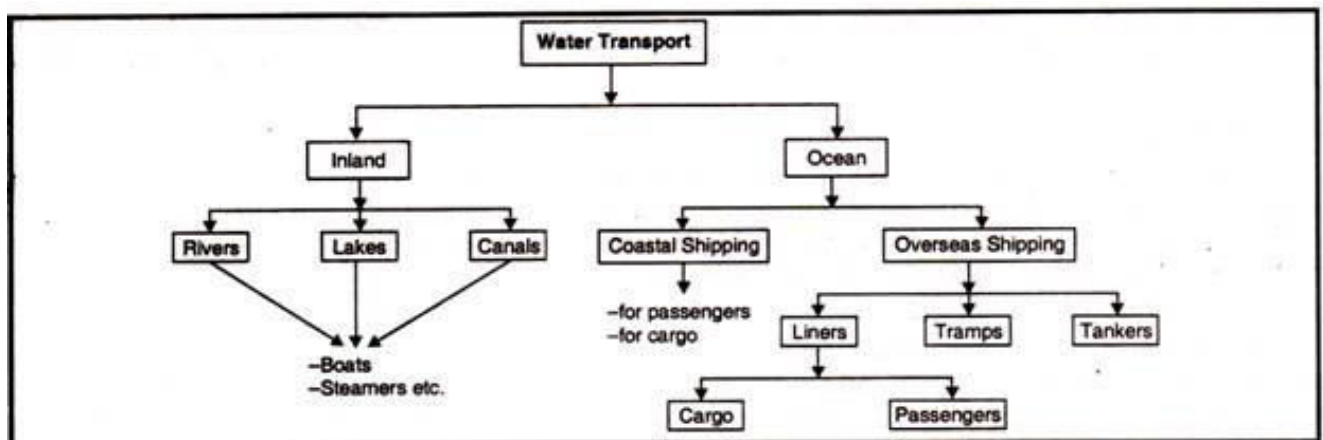
- (i) It is relatively expensive for carrying goods and passengers over short distances.
- (ii) It is not available in remote parts of the country.
- (iii) It provides service according to fixed time schedule and is not flexible for loading or unloading of goods at any place.
- (iv) It involves heavy losses of life as well as goods in case of accident.



**B) Water Transport:** Water transport is the process of moving people, goods, etc. by barge, boat, ship or sailboat over a sea, ocean, lake, canal, river, etc. This category does not include articles on the transport of **water** for the purpose of consuming the **water**.

Have you ever wondered why people in ancient times settled down near the rivers?

How was trading possible between far off lands? Yes, it was through rivers and seas. From olden days till now waterways had been an important means of transportation.



### HISTORY OF WATER TRANSPORTATION:

- Historically, societies have always located near water, due partly to the fact that water enables more efficient travel compared to going over land. Waterways are critically important to the

transportation of people and goods throughout the world. The complex network of connections between coastal ports, inland ports, rail, air, and truck routes forms a foundation of material economic wealth worldwide.

- Within the United States, waterways have been developed and integrated into a world-class transportation system that has been instrumental in the country's economic development. Today, there are more than 17,700 kilometers of commercially important navigation channels in the lower 48 states.

Advantages of water transportation:

- 1. Less Maintenance Cost:** Maintenance cost in rail and road transport is quite high but maintenance cost of water transport is quite less.
- 2. Cheap:** The transport channel is quite cheap as compared rail and road Transport.
- 3. Useful for Bulky Goods:** Heavy and bulky goods can be transported easily at little cost through water transport.
- 4. Useful during Natural Calamities:** During natural calamities like flood and rains, when rail and road transport is disrupted, relief operations can be operated through water transport.
- 5. Helpful in Defence:** Development of shipping is essential for the defence of the country also. It is also called second line of defence.
- 6. Important for Foreign Trade:** Water transport plays important role in foreign trade. India's foreign trade is mainly dependent on water transport.

Disadvantages:

- 1. Slow:** Speed of Inland water transport is very slow and therefore this mode of transport is unsuitable where time is an important factor.
- 2. Limited Area of Operation:** It can be used only in a limited area which is served by deep canals and rivers.
- 3. Seasonal Character:** Rivers and canals cannot be operated for transportation throughout the year as water may freeze during winter or water level may go very much down during summer.
- 4. Unreliable:** The inland water transport by rivers is unreliable. Sometimes the river changes its course which causes dislocation in the normal route of the trade.

**5. Unsuitable for Small Business:** Inland water transport by rivers and canals is not suitable for small traders, as it takes normally a longer time to carry goods from one place to another through this form of transport.

**6. More Risky:** Water transport is more risky as compared to other means because there is always danger of sinking ships or boats.

**C) Air Transport:** Do you wish to fly like a bird? By airways, you can reach at the destination quickly and without encounter any cringe traffic. Our modern day airplane was designed by the Wright Brothers in 1903. Air transport in India began in 1911. Today it is one of the important means of transportation like roadways and railways. India has facilities of both domestic as well as international airways. Let us discuss its importance in the modern age.



- ❖ Air transport is considering that world is becoming a global village. It is the fastest means of transport and one can reach the destination in a few hours covering the distance of hundreds of kilometers.
- ❖ It is free from surface hindrances such as inaccessible mountains, dense forests, marshy lands or flooded areas.
- ❖ It is most important due to its utility in national defence.
- ❖ It also connects countries of different continents making earth a global village.
- ❖ It is suitable for transporting fruits, vegetables or high value goods like costly drugs and sophisticated machines in desired time frame.
- ❖ It is very useful at the time of natural or any other calamities for saving people or supplying goods of their basic requirements immediately.

#### **Advantages of Air transport**

- It is the fastest mode of transport. (not an advantage)
- It is very useful in transporting goods and passengers to the area, which are not accessible by any other means.



- It is the most convenient mode of transport during natural calamities.
- It provides vital support to the national security and defence.

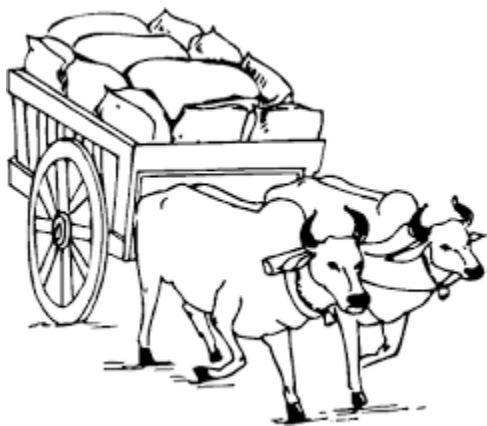
### Limitations of air transport

- It is relatively more expensive mode of transport.
- It is not suitable for transporting heavy and bulky goods.
- It is affected by adverse weather conditions.
- It is not suitable for short distance travel.
- In case of accidents, it results in heavy losses of goods, property and life.

### TRANSPORT EVALUTE FROM BULLOCK CART TO LEAR JETS:

**BULLOCK CART:** A **bullock cart** or **ox cart** is a two-wheeled or four-wheeled vehicle pulled by oxen (draught cattle). It is a means of transportation used since ancient times in many parts of the world. They are still used today where modern vehicles are too expensive or the infrastructure does not favour them.

Used especially for carrying goods, the bullock cart is pulled by one or several oxen (bullocks). The cart (also known as a jinker) is attached to a bullock team by a special chain attached to yokes, but a rope may also be used for one or two animals. The driver and any other passengers sit on the front of the cart, while load is placed in the back. Traditionally the cargo was usually agrarian goods and load.



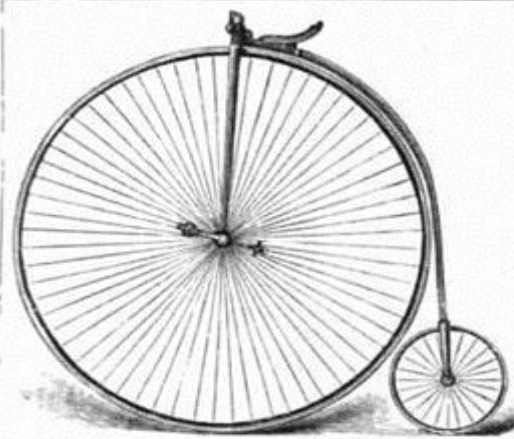
**BICYCLE:** A **bicycle**, often called a **bike** or **cycle**, is a human-powered, pedal-driven, single-track vehicle, having two wheels attached to a frame, one behind the other. A bicycle rider is called a cyclist, or bicyclist.



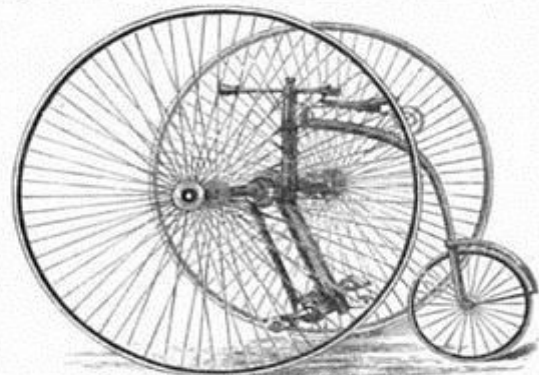
**History of the bicycle:** Vehicles for human transport that have two wheels and require balancing by the rider date back to the early 19th century. The first means of transport making use of two wheels arranged consecutively, and thus the archetype of the bicycle, was the German *draisine* dating back to 1817. The term *bicycle* was coined in France in the 1860s.

They are the principal means of transportation in many regions. They also provide a popular form of recreation, and have been adapted for use as children's toys, general fitness, military and police applications, courier services, and bicycle racing. The bicycle's invention has had an enormous effect on society, both in terms of culture and of advancing modern industrial methods. Several components that eventually played a key role in the development of the automobile were initially invented for use in the bicycle, including ball bearings, pneumatic tires, chain-driven sprockets, and tension-spoked wheels

## VELOCIPÈDE.



6. Renn-Bicycle „Invincible“.



13. Humber-Tricycle.



10. Manipel.



12. Sicherheits-Bicycle „Rover“.



8. Saal-Bicycle.



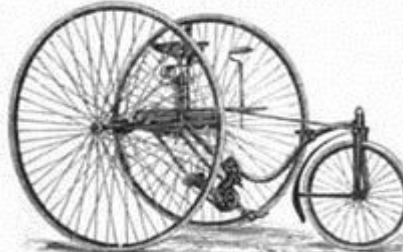
3. Touren-Bicycle „Leipzig“.



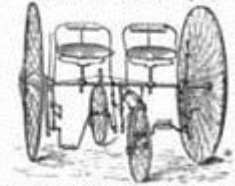
11. Reitmaschine nach Freiherrn von Drais.



2. Tandem-Tricycle von Humber u. Comp.



1. Touren-Tricycle „Invincible“.



5. „Sociable“ für 2 Personen, verwandelbar in ein Tricycle.



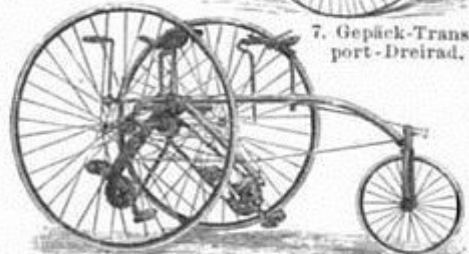
9. Otto-Bicycle.



4. Monocycle.



7. Gepäck-Transport-Dreirad.



14. Renn-Tandem-Tricycle „Invincible“.

Brockhaus Conversations-Lexikon. 13. Aufl.

Zu Artikel: Velociped.

### Advantages of bicycle:

- 1) **It's easier to finance a new bicycle than a new car.** Thanks to the recession, auto loans are hard to find these days — even if you have good credit. But for the price of a single car payment, you can buy a well-made bicycle that should outlast most cars. Add a few hundred dollars more for rain gear, lights and accessories, and you have all-weather, anytime transportation.
- 2) **A bicycle has a tiny manufacturing footprint when compared to a car.** All manufactured goods have environmental impact, but bicycles can be produced for a fraction of the materials, energy and shipping costs of a car.
- 3) **Bicycles produce no meaningful pollution when in operation.** Bikes don't have tailpipes belching poisonous fumes into the atmosphere. They also eliminate the oil, fuel and hydraulic fluids dripped by automobiles onto the road surface — which means less toxic runoff into local waterways.
- 4) **Bikes save taxpayers money by reducing road wear.** A 20-pound bicycle is a lot less rough on the pavement than a two-ton sedan. Every bicycle on the road amounts to money saved patching potholes and resurfacing city streets.
- 5) **Bicycles are an effective alternative to a second car.** Perhaps you're not in a position to adopt a bicycle as primary transportation. But bikes make great second vehicles. You can literally save thousands of dollars a year using a bicycle for workday commuting and weekend errands in households which might otherwise be forced to maintain two cars.
- 6) **Using a bike for transportation can help you lose weight and improve your overall health.** The health benefits of regular aerobic exercise are well-known. Depending on your riding style and local road conditions, you could easily burn 600 calories an hour through brisk cycling. Most bike commuters report losing 15 to 20 pounds during their first year in the saddle without changing their eating habits.
- 7) **You can store a dozen bicycles in a single automobile-sized parking place.** Parking lots have enormous environmental and financial impact, particularly in urbanized areas. The more bikes you can get on the road, the fewer parking spaces you need to build.
- 8) **Bicycles don't burn gasoline.** Fuel is cheap compared to last year, and the economic downturn is likely to keep a lid on petroleum demand for a while. But we're not producing any more oil today than we were when it was more than \$100 a barrel. A healthy bike culture will help ease pressure on supply once demand returns.

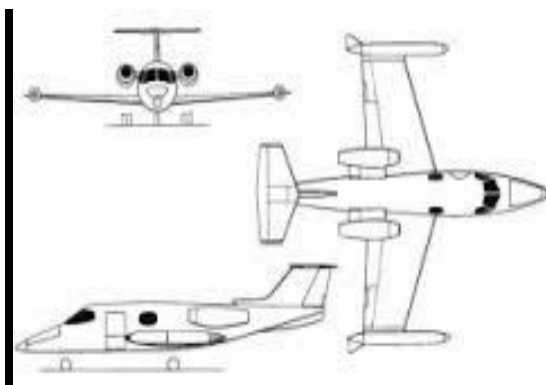
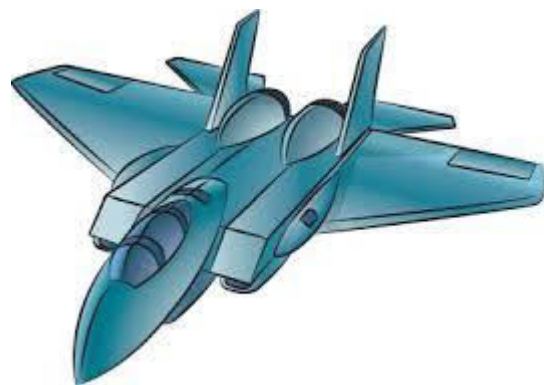
**9) Bicycling may be faster and more efficient than taking a car.** We're not talking about the crazy — and illegal — antics of New York bicycle messengers. But bikes are often faster than cars in urban areas, especially when city designers have set aside proper bike lanes. There's nothing more satisfying as a bicycle commuter than breezing past a long line of gridlocked traffic.

**10) Bikes cost much less to maintain and operate than automobiles.** You'll never throw a rod on a bicycle, and dropping a transmission on a bike usually means replacing a bent derailleur hanger or worn-out chain. Bicycles do require service, but you can learn to perform most of it yourself. Even if you have a shop do things for you, costs will be trivial compared to a car.

**11) Bicycles provide mobility for those who may not qualify or afford to drive.** Not everyone can get a driver's license (or wants one), and the cost of purchasing, insuring and maintaining a car is out of reach for a lot of people. Almost everyone can afford some sort of bike. Other than walking, bicycles are the most cost-effective transportation on the planet.

**12) Studies show that bicycle commuters are healthier, more productive, and require less time off at work.** This is why most enlightened employers are eager to accommodate commuting cyclists. Healthy workers are better workers — and that's good for the bottom line. Bikes are smart business.

**LEAR JETS:** Lear jet is an American manufacturer of business jets for civilian and military use. Founded in the late 1950s by William Powell Lear as **Swiss American Aviation Corporation**, it has been a subsidiary of Bombardier since 1990, which markets it as the "**Bombardier Learjet Family**".



**History:** Late in the day on October 7, 1963, the first Learjet\* 23 (N801L) took flight for the first time in Wichita, Kansas, just before the sun slipped below the prairie horizon. Test pilots Bob Hagan and Hank Beaird knew instantly that they had a winner. The sleek jet, with an elegant design years ahead of its time, flew like a dream. Its systems performed flawlessly and it accelerated on takeoff faster than any jet, civilian or military, they had ever flown. By the time they were ready to land, the skies were nearly dark but hundreds of headlights sparkled below at the Wichita airport. A local radio station reported that the

Learjet was making its maiden flight, and people jumped in their cars to see the sight. Many were spouses and children of Learjet employees, who had worked round the clock for months and were as invested in the jet's success as the company's founder. The crowd cheered. Grown men cried. The jet that couldn't be built was everything it was supposed to be and more. The Learjet was on its way to defining a new category of aircraft, and becoming an enduring icon of business aviation. Learjet was one of the first companies to manufacture a private, luxury aircraft. In the 1940s, with World War II still fresh in the public's mind, Lear's preliminary design was based upon an experimental American military aircraft known as the Marvel, substituting fuselage-mounted turbojet engines for ducted fan turbo shaft engines. However, that preliminary design was abandoned and the final Lear jet design was instead adapted from an abortive 1950s Swiss ground-attack fighter aircraft, the FFA P-16.

The basic structure of the Swiss P-16 aircraft was seen by Bill Lear and his team as a good starting point to the development of a business jet, and formed the **Swiss American Aircraft Corporation**, located in Altenrhein, Switzerland and staffed with design engineers from Switzerland, Germany and Britain. The aircraft was originally intended to be called the **SAAC-23**. Or at one time the 'Tina Jet'. The wing with its distinctive tip fuel tanks and landing gear of the first Learjets were little changed from those used by the fighter prototypes. Although building the first jet started in Switzerland, the tooling for building the aircraft was moved to Wichita, Kansas, in 1962. Bill Jr stated that it took too long to get anything done in Switzerland despite the cheaper labour costs. Lear Jet was in a temporary office which opened in September 1962 while the plant at Wichita's airport was under construction. On February 7, 1963 assembly of the first Learjet began. The next year, the company was renamed the **Lear Jet Corporation**.

The original Learjet 23 was a six- to eight-seater and first flew on October 7, 1963, with the first production model being delivered in October 1964. Just over a month later, Lear Jet became a publicly owned corporation. Several derived models followed, with the Model 24 first flying on February 24, 1966 and the Model 25 first flying on August 12, 1966. On September 19 of the same year, the company was renamed **Lear Jet Industries Inc.**

### **Advantages**

- 1) Compression-ignition engines have higher compression ratio which leads to being more efficient. So the aircraft range improves and on longer flights payload capacity may improve as well. Fuel consumption is usually about 30% lower.
- 2) The higher efficiency combined with the fact that Jet-A fuel is cheaper mean they have lower operating cost. Especially since in Europe the leaded avgas is heavily taxed to discourage its use for environmental concerns.
- 3) They should be a bit more reliable. A diesel engine needs high pressure fuel pump, but apparently there are fewer problems with those than there are with spark-plugs.

- 4) They are somewhat easier to operate, since they don't have separate throttle and mixture controls.
- 5) They don't suffer the problems associated with incorrect settings of those controls, namely knocking/detonation and pre-ignition.
- 6) Turbo-charging them does not carry the risk of pre-ignition and most of them are turbo-charged, so the performance does not decline as fast with density altitude.
- 7) There is lower risk of fire since jet/diesel fuel is less flammable (has higher ignition temperature).
- 8) Jet-A has much wider availability, especially in the third world, so it's easier to plan for fuel stops on a flight through say, Latin America or Africa

### **Disadvantages**

- 1) They are heavier for the same power, because they need to be made from stronger material due to the higher compression ratio and because they need to have larger cylinder volume because of lower maximal rpm. On longer flights the reduction in fuel weight often makes up for the heavier engine.
- 2) Turbo-charging comes with specific operating procedures unfamiliar to those used to normally aspirated engines and a slight lag in thrust lever (it's not a throttle) response.
- 3) As others mentioned, small airports may not have jet fuel yet. This is probably better in Europe where the pressure to phase out 100LL avgas is stronger. Some engines also use automobile diesel fuel or even either jet or diesel fuel as diesel engines is less picky about what they burn.

**FIGHTER PLANE:** A **fighter aircraft** is a military aircraft designed primarily for air-to-air combat

against other aircraft, as opposed to bombers and attack aircraft, whose main mission is to attack ground targets. The hallmarks of a fighter are its speed, manoeuvrability, and small size relative to other combat aircraft. Many fighters have secondary ground-attack capabilities, and some are designed as dual-purpose fighter-bombers; often aircraft that do not fulfil the standard definition are called fighters. This may be for political or national security reasons, for advertising purposes, or other reasons. A fighter's main purpose is to establish air superiority over a battlefield. Since World War I, achieving and maintaining air superiority has been considered essential for victory in conventional warfare. The success or failure of a belligerent's efforts to gain air supremacy hinges on several factors including the skill of its pilots, the tactical soundness of its doctrine for deploying its fighters, and the numbers and performance of those fighters. Because of the importance of air superiority, since the dawn of aerial combat armed forces have constantly competed to develop technologically superior fighters and to deploy these fighters in greater numbers, and fielding a viable fighter fleet consumes a substantial proportion of the defense budgets of modern armed forces.

**What is a fighter plane:** A **fighter aircraft** is a military **aircraft** designed primarily for air-to-air fight against other **aircraft**, as opposed to bombers and attack **aircraft**, whose main mission is to attack ground targets. The hallmarks of a **fighter** are its speed, manoeuvrability, and small size relative to other combat **aircraft**

**The Birth of the Fighter Plane: 1915.** The newly invented airplane entered World War I as an observer of enemy activity (see The Beginning of Air Warfare, **1914**). The importance of the information gathered by this new technological innovation was made evident to all the belligerents in the opening days of the conflict.

**When was the airplane first used in war:** Powered aircraft were first used in war in 1911, by the Italians against the Turks near Tripoli, but it was not until the Great War of **1914**–18 that their use became widespread. At first, aircraft were unarmed and employed for reconnaissance, serving basically as extensions of the eyes of the ground commander.

**Who made airplane:** From 1905 to 1907, the brothers developed their flying machine into the first practical fixed-wing aircraft. Although not the first to build and fly experimental aircraft, the **Wright brothers** were the first to invent aircraft controls that made fixed-wing powered flight possible

### **Aircraft History: The Evolution of Fighter Jets**

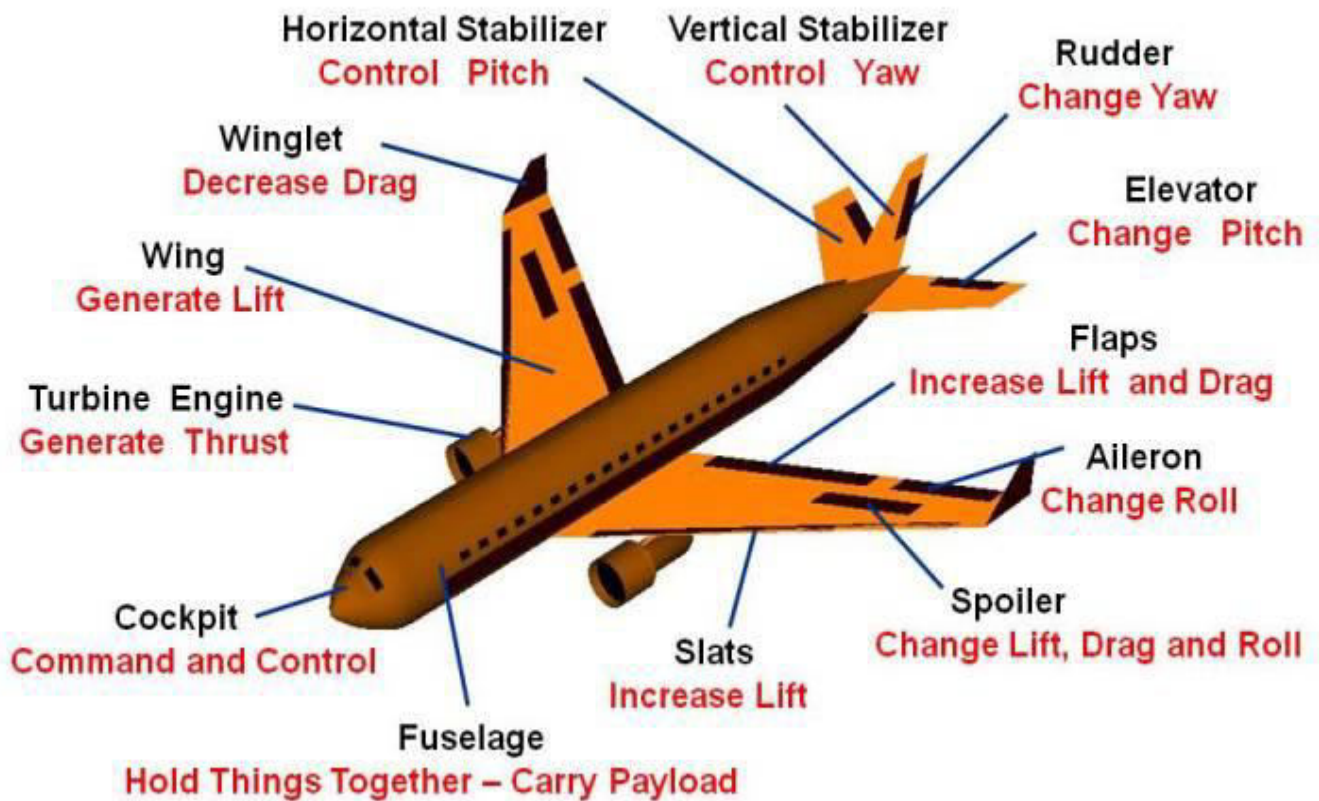


initially used during World War I but were powered by piston engines. Piston engines work by pistons moving back and forth within cylinders. Fuel entering the cylinders is ignited and the expansion of hot gases causes the crankshaft to turn, and the propellers to rotate, which thrusts the plane forward. A jet engine, however, uses direct thrust. Jet engines work by pulling air through a fan at the front. The air is compressed and combined with fuel which creates a spark. The expanding gases shot from the back of the engine and thrust the aircraft forward. The first patent for a jet engine was granted in 1932. With piston engines, advancements and performance reaching a peak, the invention of jet engines would lead the way for radical changes in fighter jets and military battle strategies.

National Aeronautics and Space Administration



## Airplane Parts and Function



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**Construction:** The key physical components, or subsystems, that define the aircraft are the **fuselage, the wings, the horizontal tail, the vertical tail, and the propulsion system.**

**The fuselage** provides working volume for passengers, cargo, and aircraft subsystems that are internal to the aircraft. The fuselage is important in terms of achieving particular flight missions, but it is not especially important from a flight performance perspective.



**The two wings** are crucial for flight, since their main purpose is to generate lift, since the wings are rigidly attached to the fuselage. This is in contrast with helicopters or other rotary wing flight vehicles that generate lift using rotating blades. **Other important flight subsystems, are the horizontal tail, the vertical tail, and the engines.**

**The horizontal and vertical tails** are rigidly attached to the fuselage as indicated. The horizontal tail provides longitudinal stability and control capability, while the vertical tail provides directional stability and control capability.

**The engines** are crucial flight subsystems, since they generate the thrust force that acts on the aircraft. Note that gliding flight occurs if the engines are turned off so that they do not generate thrust; gliders have no propulsion system. The above descriptions imply that the aircraft can be viewed as a rigid body, and this is the perspective that is taken throughout. That is, there is no relative motion between the physical aircraft subsystems such as the fuselage, the wings, and the vertical and horizontal tails. Since many forces act on these physical subsystems, the rigid body assumption is only a crude approximation. In fact, the aircraft physical structures deform under the applied forces that occur during flight. Issues of structural design and analysis are important to guarantee that the rigid body assumption is justified. This is the appropriate point to mention another important assumption that holds throughout the analysis presented subsequently. The complete aircraft, consisting of the fuselage, the wings, the horizontal and vertical tails, and all other flight subsystems, has a plane of mass symmetry that exactly bisects the aircraft. This assumption is a consequence of the design of conventional fixed-wing aircraft where, in particular, engines mounted on the fuselage or the wings are balanced to satisfy this mass symmetry assumption.

## Generation of fighter plane

### First generation :

- ⦿ Mid 1940s to mid 1950s
- ⦿ Basic avionic systems with no radars or self-protection countermeasures
- ⦿ Armed with machine guns or cannons, as well as unguided bombs and rockets
- ⦿ F-86, MiG-15 and MiG-17



**Second generation:**

- ⦿ 1950s to early 1960s

- ⦿ introduction of air-to-air radar, infrared and semi-active guided missiles, as well as radar warning receivers
- ⦿ supersonic speeds
- ⦿ F-104, F-5, MiG-19 and MiG-21



**Third Generation:**

- ⦿ Early 1960s to 1970
- ⦿ significant enhancements to the avionic suites and weapon systems
- ⦿ Doppler radar supported a 'lookdown/shoot-down' capability
- ⦿ MiG-23, F-4, and Mirage III



**Fourth generation:**



- ⦿ 1970 to late 1990s
- ⦿ Ability to both switch and swing roles between air-to-air and air-to-ground
- ⦿ Fly-by-wire and HUD systems
- ⦿ MiG-29, Su-27, F/A-18, F-15, F-16, and Mirage-2000



### **Fifth generation:**

- ⦿ 2005 to date
- ⦿ multi-spectral sensors

- ⦿ Fifth generation fighter capabilities are largely defined by their software and it will be the ongoing development of their software that will ensure they maintain their edge against evolving threats.
- ⦿ F-22 Raptor, F35-Joint Strike Fighter, the Sukhoi PAK FA



### **Sixth generation:**

- ⦿ A sixth-generation jet fighter is a conceptualized class of fighter aircraft design more advanced than the fifth-generation jet fighters
- ⦿ Frank Kendal revealed that funding for initial sixth generation fighter development would be requested in the FY 2016 budget.

Next-generation fighter efforts will initially be led by DARPA under the "Air Dominance Initiative" to develop prototype x-planes