Lecture - 1

Introduction

What is डिज़ाइन (Design)??

Anything that is NOT by accident is by DESIGN

- GOAL oriented
- Creative
- Problem - Solving

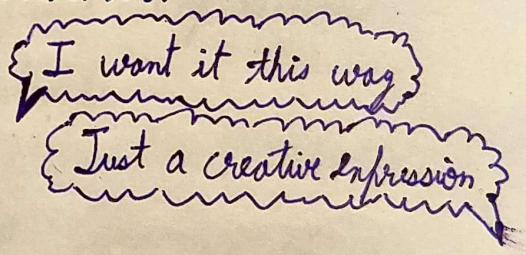
Design is not just what it looks and feels like. Design is how it works.

How it works

- ☆ Creative Problem Solving
- ☆ Helps develop a vision / out of the box ideas
- ☆ Inclusivity
- ☆ Systematic Thinking

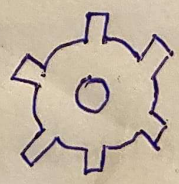
Misconceptions about design

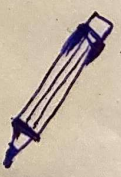
- × Decoration
- × Whimsical
- × Abstract Art



⇒ Objectives of DIP course

- Intro to design process
- Prototyping trades and skill development
- Safety standards
- Journey of a product
- Understanding material properties
- Iterative and creative problem solving
- Design tools and methods





Innovation

Background

- Natural Evolution in animals
  - → Using tools
  - → Communication
  - → Storage of food
  - → Controlling environment
- Industrial Revolution
- Evolution of products over time
- Discoveries / Inventions

Human Nature

- → Want for better quality of life
- → Improving the environment around
- → Increasing efficiency and effective use of resources
- → Desire for improved social life

Need? OR Want? ⇒ Consumerism

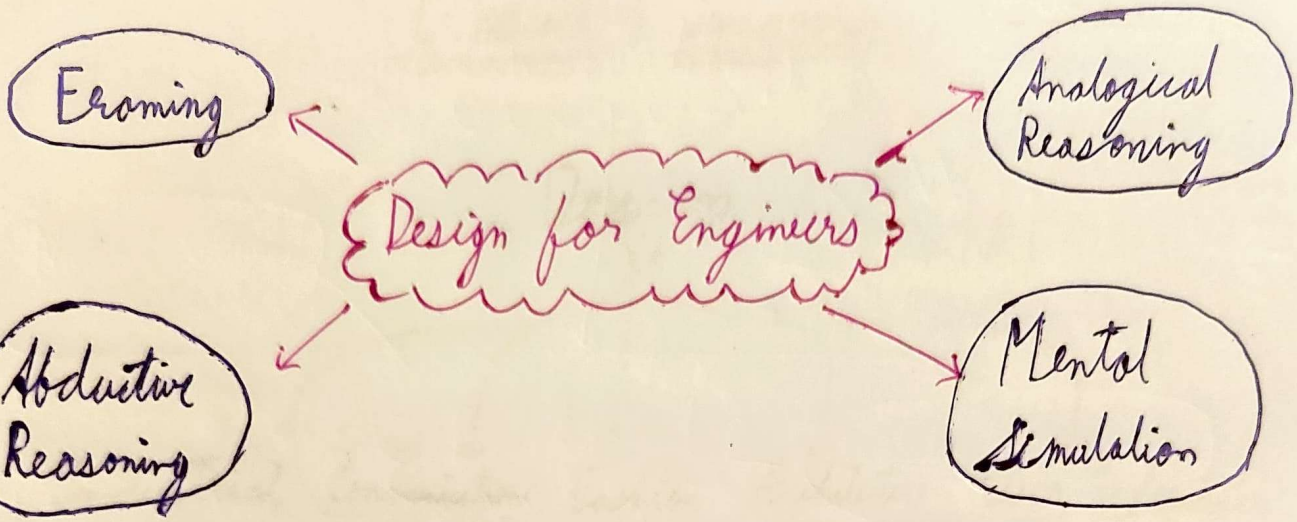
Design as a profession

Role of an engineer

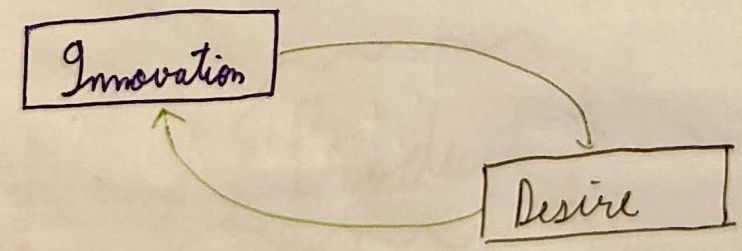
- → To ensure manufacturability and assembly
- → To design transfer of energies
- → Technical simulations and testing

Role of a designer

- → To develop usability and aesthetics
- → To ensure marketability
- → Visualizing new concepts and application of technology.



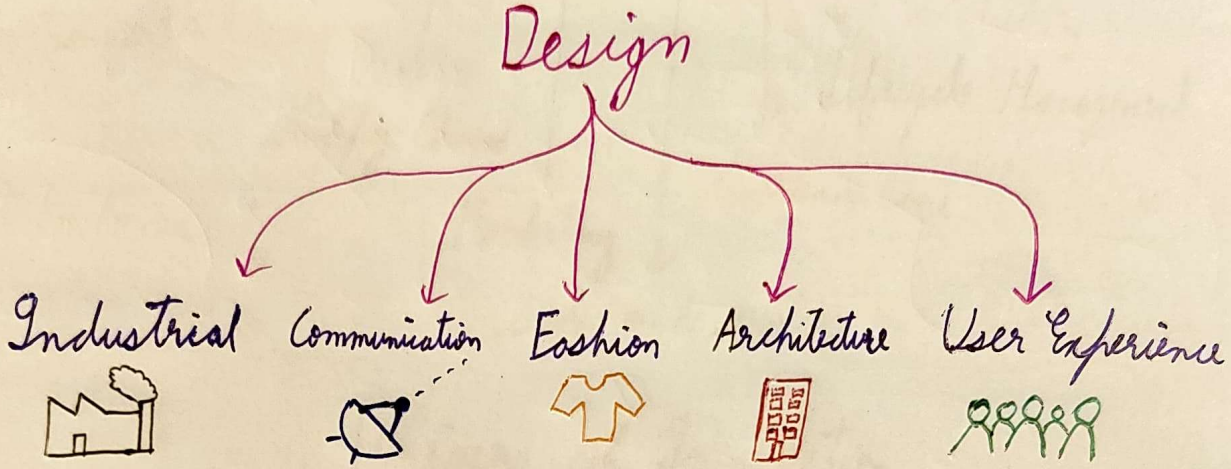
Industrial Design → "Industrial Design is a strategic problem-solving process that drives innovation, builds bussiness success and leads to a better quality of life through innovative products, systems, services and experiences.



Learnings : 1) What the term design actually means
2) Innovation in design
3) Design for engineers is an invaluable skill

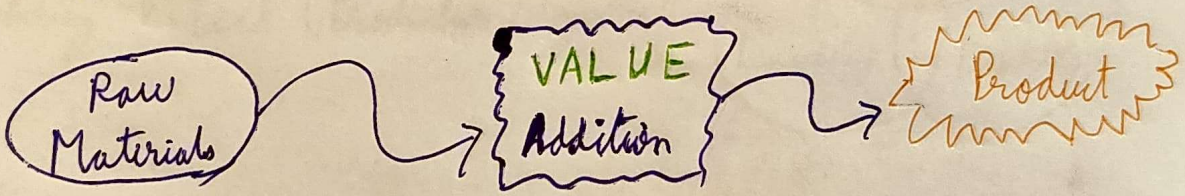
Product & Innovation

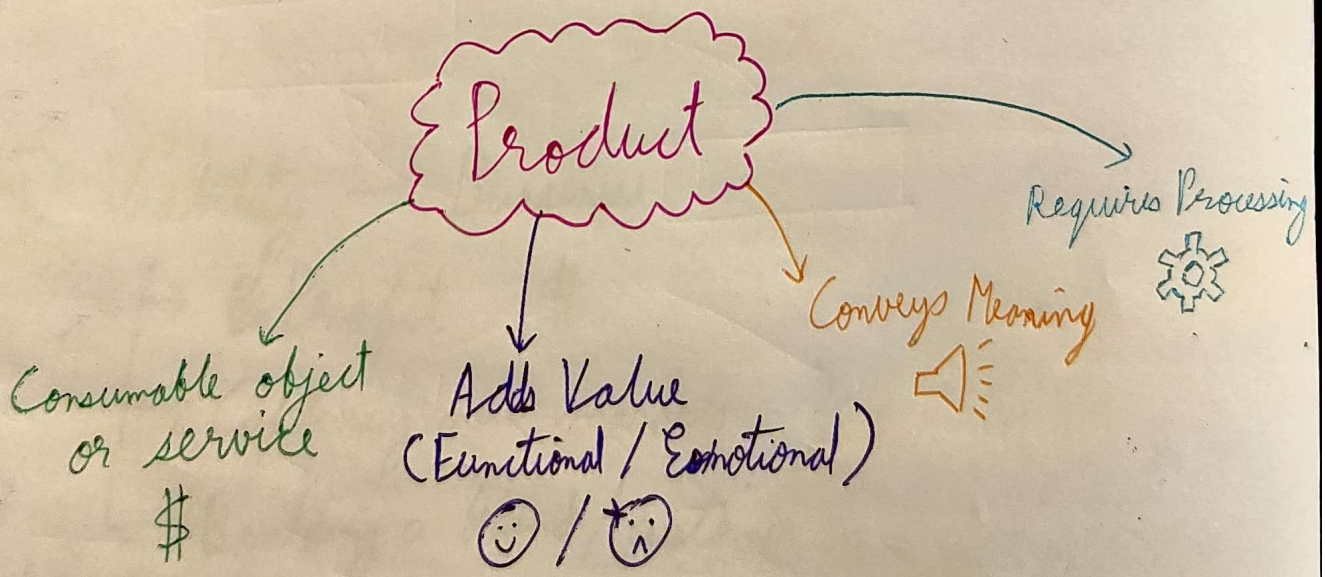
Lecture - 2



⇒ What is a product?

Raw Material ⟶ NOT a product on its own.



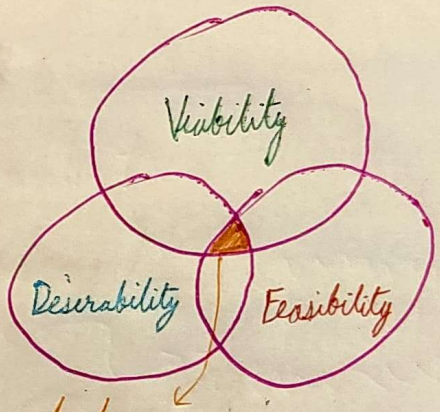


Evolution of Products

- Environment & Accessories
- Statutory requirements
- Supply Chains
- Lifecycle Management
- Marketing
- Customer Care
- Sales and services

Drivers of Innovation

Viability → Bussiness (Finance / Manage)
Desirability → People (Human / Social)
Feasability → Tech (Production / Logistics)



Successful Innovation

① Viability → Bussiness

- → ~~Bs~~ Profit $
- → Capturing new markets
- → Building a brand / customer base ☆

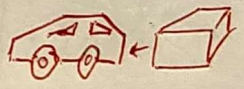
⇒ Needs a "unique selling proposition" (USP)

② Desirability → People

- → Usage related features ✓
- → Ergonomics 
- → Emotional connect 
- → Cultural and social needs

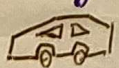
⇒ Needs great experience

③ Feasibility → Technology

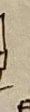
- → Engineered details 
- → Manufacturing (material/manufacturing) 
- → Assembly & quality control 
- → Inventory/Packaging/Transport 

⇒ Need to fullfit 'material' constraints)

Types of Innovation

Sustaining
Cars 
Houses 
Chocolates 

Disruptive
Steam Engine

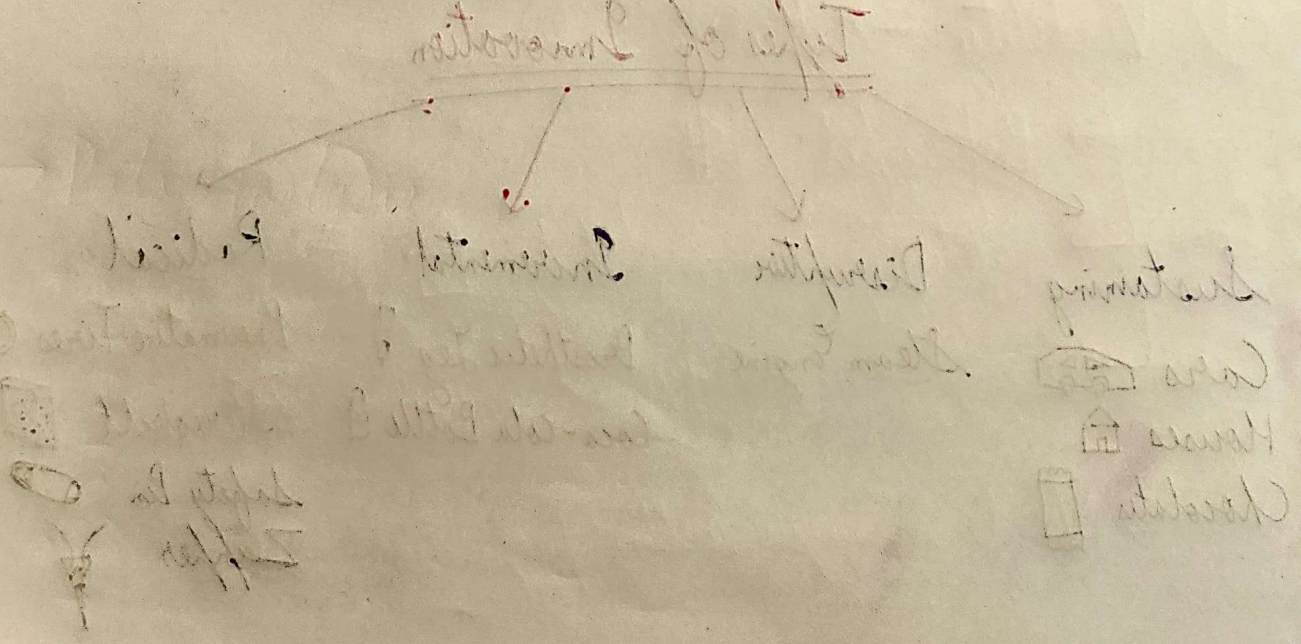
Incremental
Prosthetic Leg 
Coca-Cola Bottle 

Radical
Pneumatic Tires 
Stereobelt 
Safety Pin 
Zippers 

Learnings: 1) Production of product from raw material by value addition

2) Drivers of innovation and their importance

3) Types of innovation around us



Design Process

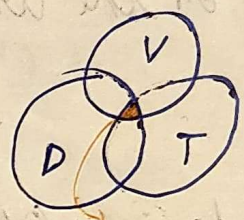
Lecture - 3

- A good product → Interacts with you
  → Participates in activities
  → Influences lifestyle

→ How to make a good product?

Aim for more than one factor:

- User (Desirability)
- Business (Viability)
- Technology (Technology)



Successful Product

USER (👤)	BUSINESS ($)	TECHNOLOGY (📱)
• Profile	• Brand	• Features
• Tasks	• Competitors	• Environment
• Ergonomics	• Selling Proposition	• Manufacturing
	• Pricing	• Evolution

☆ The main stages of design process

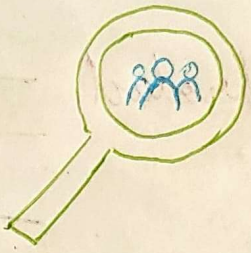
① Research (analyze and define)	Understand
② Conceptualization (sketch)	Explore
③ Implementation (develop)	Materialize

⇒ Stage One: Research (Understand)

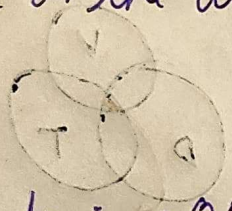
- Define the 'purpose'/need statement
- Data collection for intended users and their needs for the concerned purpose
- Existing products / technologies used for the same purpose
- Data analysis to identify design opportunities

→ Methods of data collection

- → Fly on the wall
- → Shadowing + observing, probing
- → Questionnaire / Survey
- → Desk Research
- → Focus group discussions



1. Fly on the wall → Observe & notice behaviours
   → Play detective
   → Find leads



2. Shadowing + Observing → Follow without interfering
   → Notice routines, activities, tools etc.
   → Observe the task

3. Questionnaire / Survey → User, subject expert
   → Helps established / strengthen arguments
   → Structured data

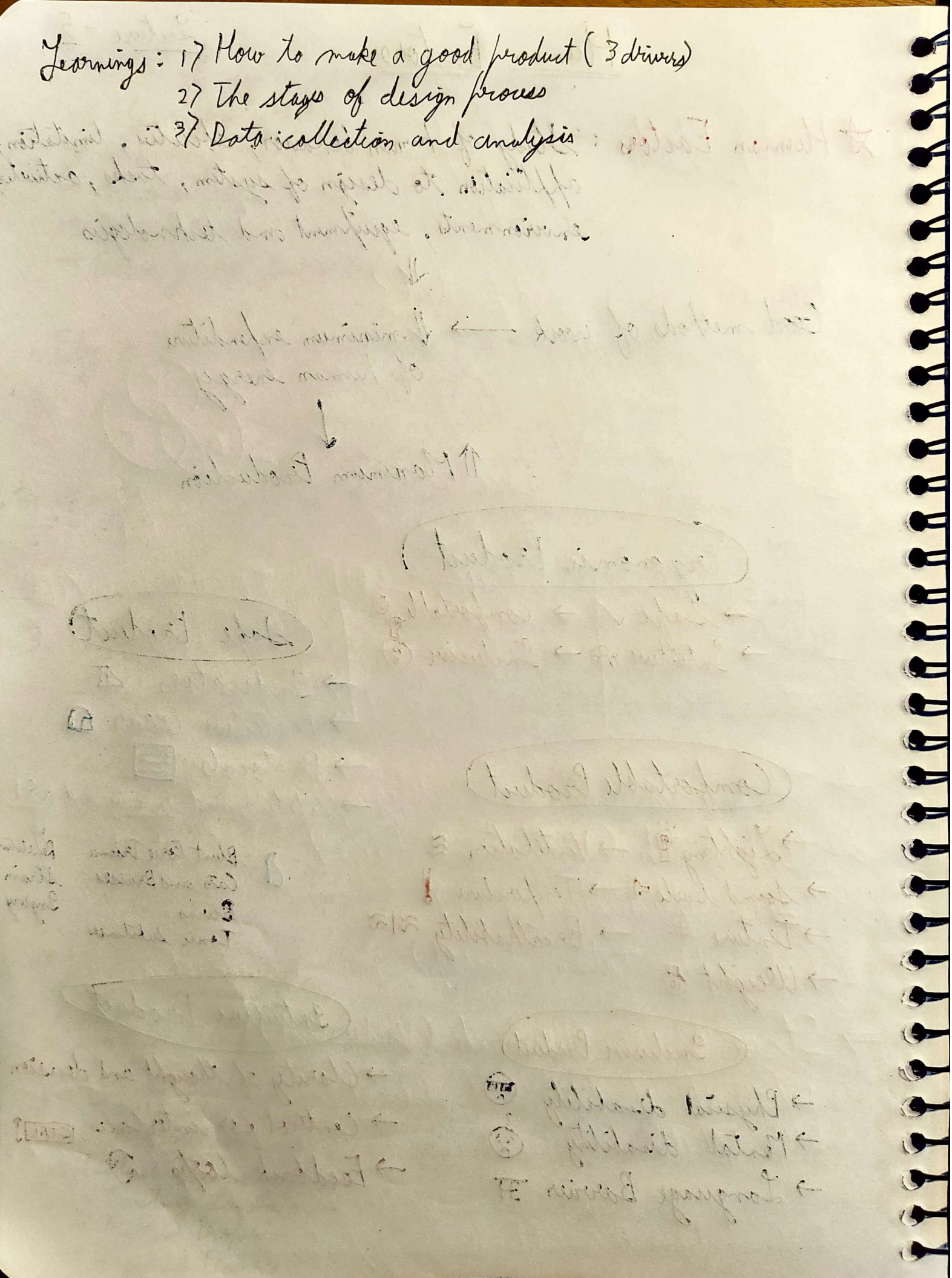
4. Desk Research → Latest and upcoming technologies / trends
   → Articles + Research Papers
   → Existing Solutions

→ Data Analysis

⇒ Analyse Interaction
- → What is the function? (Function, working principle)
- → Who is going to use the product? (User profile)
- → Where will it be used? (Environment / Context)
- → When will it be used? (Specific Time / Season)
- → How will it be used? (Action sequence / interaction)

⇒ Analyse Technology
- → Existing Products
- → Material Properties
- → Required Features

Learnings: 1) How to make a good product (3 drivers)
2) The stages of design process
3) Data: collection and analysis



Human Factors.

Lecture - 5

☆ Human Factors : Study of human behavior, abilities, limitation, application to design of system, tasks, activities, environments, equipment and technologies

⇓

Good methods of work ⟶ ⇓ minimum expenditure of human energy

↓

⇑ Maximum Production

Ergonomic Product

→ Safe ✓ → Comfortable

→ Intuitive → Inclusive

Safe Product

→ Indicators

→ Protective Gear

→ Protocols

→ Safety against injuries and RSI

- Blunt Force Trauma
- Cuts and Bruises
- Burns
- Toxic Substances

RSI → Repetitive Strain Injury

Comfortable Product

→ Lighting → Ventilation

→ Sound levels → Temperature

→ Texture # → Breathability

→ Weight

Inclusive Product

→ Physical disability

→ Mental disability

→ Language Barriers

Intuitive Product

→ Clarity of thought and decision

→ Control for interfaces CTRL

→ Feedback loops

Ergonomics

Physical Ergonomics
- Anatomy
- Physiology
- Biomechanics

Eg: Posture Furniture
Safety equipment

Visual Ergonomics
- Visual Comfort
- Readability
- Safety & stress

Eg: Well designed displays
User Interface

Organisational Ergonomics
- Systems
- Structures
- Policies
- Processes

Eg: Analytics
Kitchenware

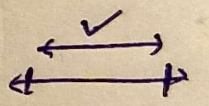
Cognitive Ergonomics
- Mental Processes
- Perception
- Memory
- Reasoning

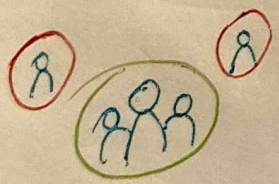
Eg: Warnings
Signs and Labels

Anthropometry

Study of measuring the human body

☆ Product should fit the extreme / edge cases.





Mass production often disconcerns the extremes and instead focuses on the majority

Products should adress the need of people from 5%ile to 95%ile on the extreme scale.

☆ Good Practices
- → Communication
- → Posture
- → Standards

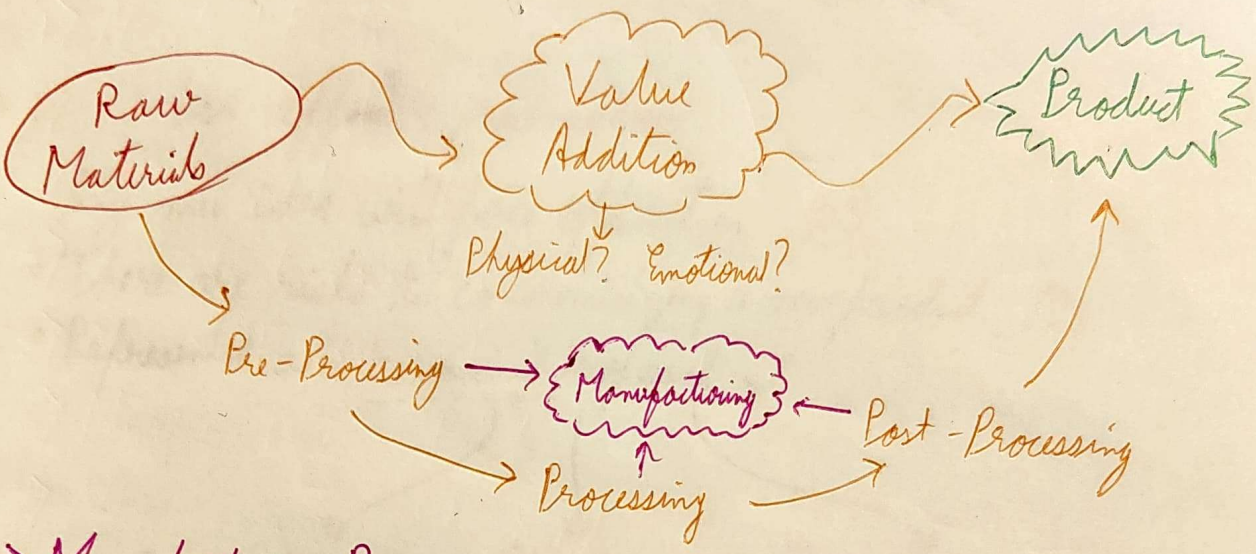
⇒ Thumb Rules 

1) Neutral Posture
2) Reduce effort (force / motion)
3) Easy Reach
4) Appropriate Clearance
5) Minimize Fatigue and Static Load
6) Minimize Pressure Points
7) Move, Exercise and Stretch

Learnings: 1) Human factors and their importance
2) Various types of ergonomics
3) Anthropometry, producing for extremes.

Introduction to Manufacturing

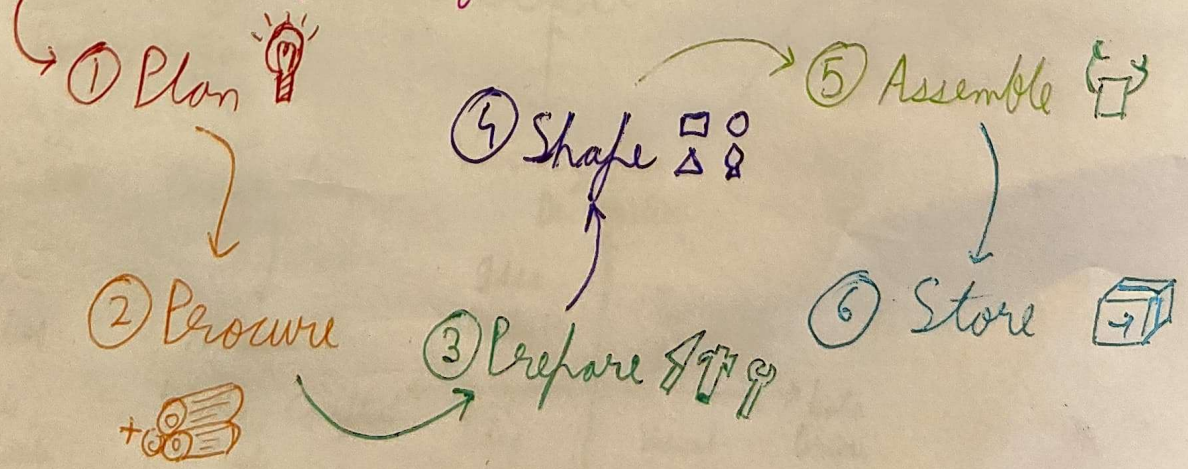
Lecture - 4



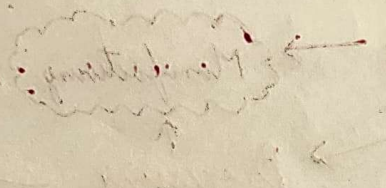
→ Manufacturing Process

- → Primary Shaping process ⇒ Casting, Forging, Rolling, Drawing, Extrusion, Bending
- → Secondary Treatment Process ⇒ Machining, Joinery / Assembly, Surface Finishing
- → Heat Treatment Process ⇒ Rapid Cooling, Tempering

→ Manufacturing as a flow chart



Learnings: 1) Types of processes involved in manufacturing
2) How raw materials get converted into products via value additions.



Concept (Re)presentation

Lecture - 6

→ Need for effective presentation

- Any new idea will face opposition
- There are risks in commercializing a new product
- Represented as a convincing proposal ✓

Clarity of thought — Effective Communication — Documentation and Management

Content

- → Design Research → Value proposition → Qualitative and Quantitative data
- → Product Concept → Physicality of product → Details

Audience?

↳ Who do you need to convince?

Time?

↳ How long does it have to be?

Data

Representation

- Qualitative
  - Descriptive
    - Tables
    - Pie charts
    - Line graphs
    - Histograms
- Quantitative
  - Numerical
    - → Tables
    - → Pie Charts
    - → Line graphs
    - → Histograms

Visualization

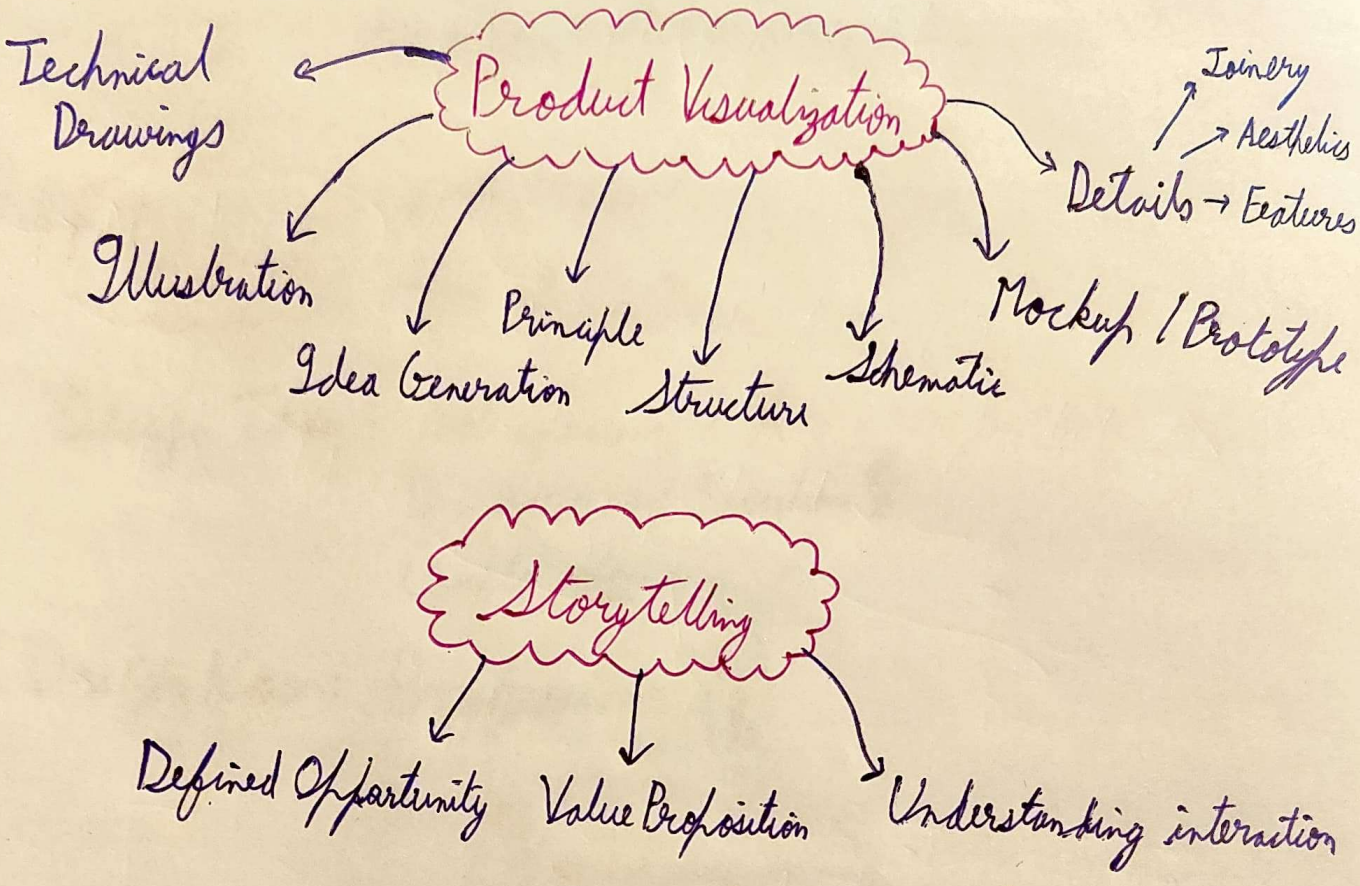
- Illustration
- Analysis → Periodic Table, Mood Board, Fishbone diagram
- Mind Map

Declarative

Idea Illustration	Everyday Data
Idea Generation	Visual Discovery

Conceptual ← → Data Driven

Exploratory



Learnings : 1) Why an effective presentation of the product is important
2) Various ways to represent and visualize data
3) Key components of visualizing the product.

Nuances of Design

Lecture - 9

Design → Noun?
→ Verb?

Design Then: Not specialized ✗
Discoveries and Inventions
Crafts

Design Now: Profession

Bauhaus

- German for "building houses"
- Emphasized machine production
- Mass Production

Affected every industry
- Art
- Architecture
- Fashion
- Product Design
- Vehicles

Design Fields

- Industrial design
- Space design
- Fashion Design
- Communication Design
- Multidisciplinary Design

⇒ Design Practice

① Research → ② Concept development → ③ Implimentation

Design

Advertising

Typography

Branding

Furniture

Fashion

Household Goods

New Possibilities

Accessory Design

Industrial Design

Lifestyle Product

Construction/ Heavy Lifting

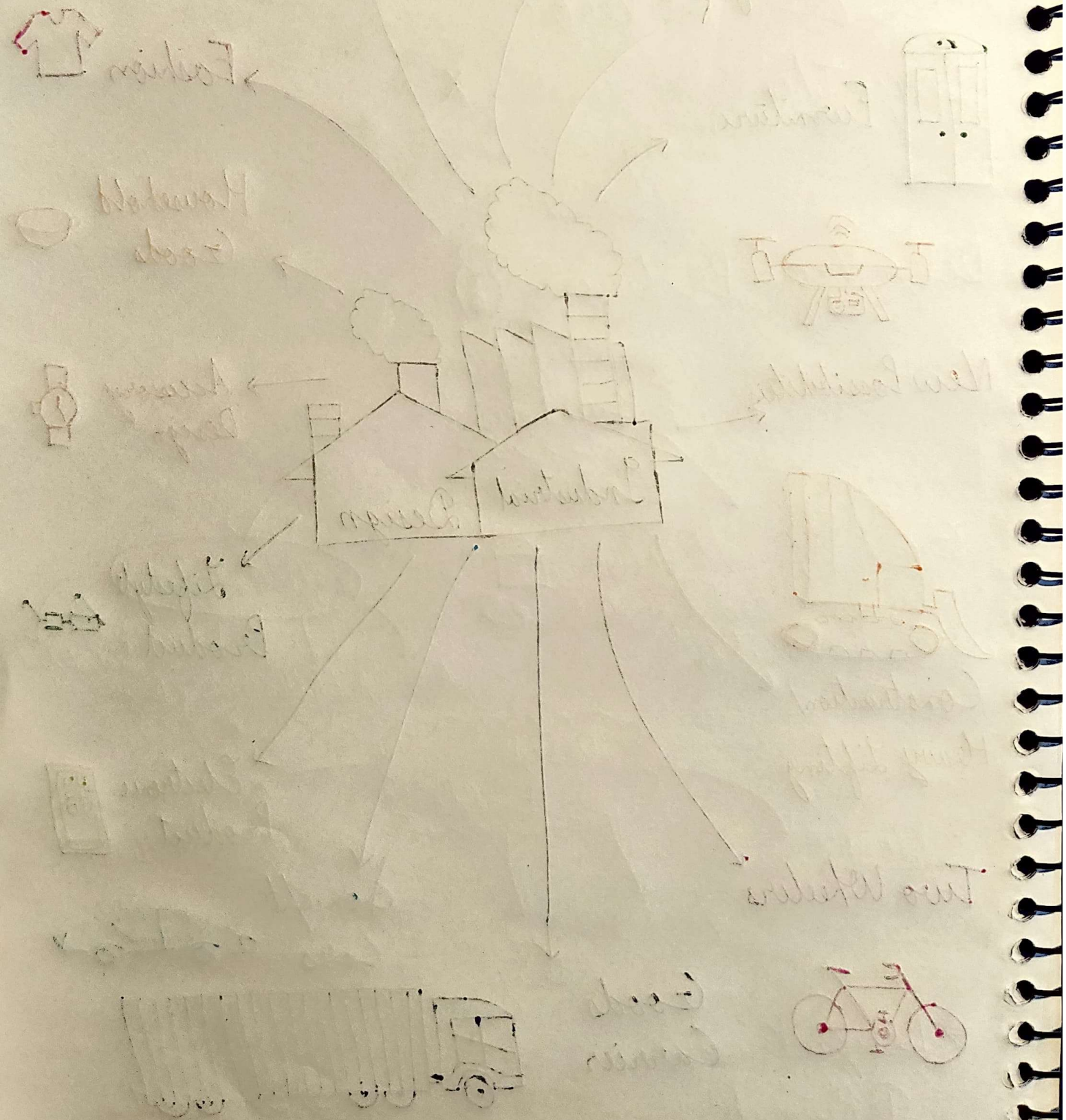
Electronic Product

Two Wheelers

Concept Cars

Goods Carriers

Learnings: 1) How design has evolved over the years
2) The impact of Bauhaus
3) Various applications of industrial design

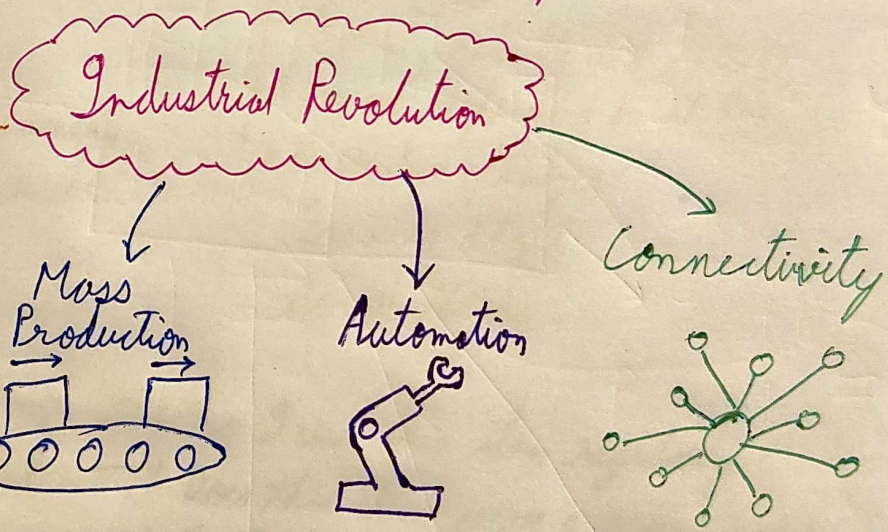


Lecture - 10

Responsible Design

Responsible design → Frugal Innovation ₹
→ Design for special / social needs ✓
→ System design

Design for Bussiness → Intersection of design and business
→ Business and product innovation
→ Branding and Packaging
→ Diversification / Expansion



☆ Capitalism → Privatization of trade and industry

- Capital Accumulation ₹
- Investment and profits
- Maximum value addition ++ man( )
- Freedom of capitalists

☆ Consumerism → Consumer spending ⇒ Production & Economic growth

Widely critisized for economic, social, environmental and psycological

Affect of Consumerism

- Perceived Value
- Social aspects
  - → Mass migration
  - → Well being of employs
  - → Quality of life
- Planned Obsolescence
- → Lack of inclusivity
  - – Extremes
  - – Disabled
  - – Low income
  - – Rural Areas
  - – Sociological issues
  - – Ecological issues

~~Jugaad~~ ? → Frugal Innovation

North indian slang
"A way to fix difficulty not through conventional measures but through cheapest possible means"

- → Human factors
- → Robust, reliable and scalable
- → Remove dependency on skilled user
- → Production optimizer
- → Easy to adapt
- → Social Needs

Essential Minimalism

- → Do I use this item regularly?
- → Does this item serve a unique purpose?
- → Can I live without it?
- → Would I buy this item again if I didn't already own it?
- → Does this item align with my goals?

Learnings: 1) Why its important to use design for good and be responsible
2) How capitalism and consumerism affects us
3) ~~How~~ Why we should innovate frugally instead of 'jugaad'

My contribution to Group 1's DIP Project

As a member of group 1, I participated greatly in all the group assignments given yet. I attended all the group meetings that were possible, except for a few that I was couldn't be there for due to medical reasons. I contributed to the group discussions, coming up with the various meaning of the word 'play' and the need statements we could come up with from those different meanings. for the need statement phase and created the final presentation for it along with my teammate Aayush Kuloor.

During project brief and techno-aesthetic detailing, I was part of both of our internal team. I arranged a meeting with Prof. Srinivas Reddy, an expert in the field of music who has a lot of experience to ask him about any problems he faced with the any instruments, which is when sir told us about his problem with the guitar being too bulky when he only uses it to play the chords to some singing songs, and uses the first 5 frets. He also suggested some other problems, such as on with tuning his sitar using a phone app. However, after the greatly helpful discussing with Prof. Srinivas Reddy, we decided to focus on making a portable guitar as the problem resonated with us and we felt that solving that problem would be the greatest impact we could make through our project. I participated heavily in the various group discussions while making the project brief as I was one of the only 2 members of my group who owned a guitar and had some knowledge about its working and basic music theory. I also simultaneously worked on the glider for the techno-aesthetic detailing with Aarav Trivedi, finalizing the body design from laser-cut MDF and the wings made out of 3-D printed FDM, along with some technical parts such as the joinery of those parts and the smaller horizontal and vertical stabilizers at the back made out of compressed foam sheet cut and sanded to be aerodynamic and stabilizing. However, there were still issues with the centre of gravity of the plane, for which we used some clay on the tip and wings of the plane so that it's balanced and can glide properly. I also created the presentation for the project brief along with Aayush Kuloor.

During the ideation phase after the project brief, I once again contributed to the group discussions heavily because of my guitar knowledge coming up with various solutions for the need statement with my teammates along with other design opportunities we could work on, to make the guitar ergonomic and easy to play. We held multiple brainstorming sessions top come up with various ideas and sketch all of them onto small sheets of paper.

During the mock-up phase, we divided the group into 3 sub teams, each working on their own mock-up: compact guitar, foldable guitar and detachable guitar. I was the leader of the detachable guitar mock-up (first picture on the following page) and worked tirelessly to make the mock-up. Those days were the most hectic days as there were a lot of submissions in the same week and our mock-up wasn't working with the original locking mechanism we had thought up because of the nature of carboard and popsicle sticks, there wasn't enough structural support to making the mechanism work like with wood and metal, so we had to come up with a completely different locking mechanism which came with its own challenges. The other two sub teams were already done with their mock-ups, we were the last ones left. After a couple sleepless nights with Aayush Mohan Bhagat, we finally completed the mock-up on the day of the submission. I participated in the video shooting and directing, right after our mock-up was finished.

Since the mock-up phase has ended, I arranged for another meet with prof. Srinivas Reddy (last picture on the following page) to finalize the guitar mock-up we would choose, based on his suggestions. We also had to contact Prof. Manasi Kanetkar to discuss our issue of not being able to source a second-hand guitar for the neck, but

thankfully we ended up being able to receive her broken guitar, so things turned out well at the end. Now we are just on hold for the labs to open on Monday so we can start working on the final project together.