THINK!
DESIGN

D'source Project

Open Design School

MoE's Innovation Cell

Prototyping Part 3:

Human Factors / Ergonomics
Systems Mapping
Hi-fidelity prototyping
3D Modelling & Printing

Design Thinking & Innovation Tools

Section: T13, Week 13

Design Thinking & Innovation (DT&I)

Section: T13

Week 13

Design Thinking & Innovation (DT&I)

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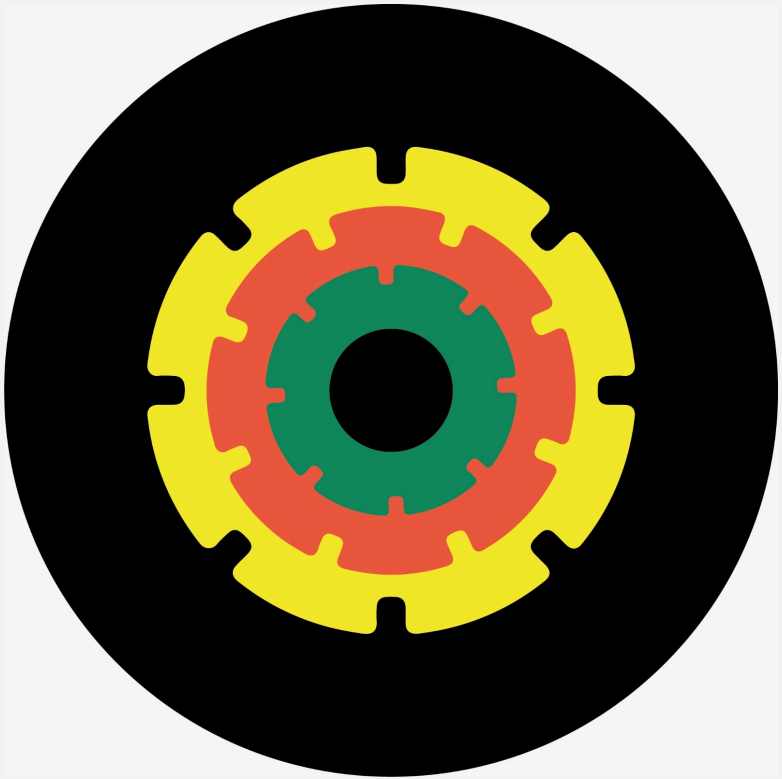
IDC School of Design, IIT Bombay



DT&I Tools

T13 Module T13:

Human Factors/ Ergonomics,
Systems Mapping,
Hi-fidelity prototyping,
3D Modelling & Printing

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T13.1

What is Human Factors and Ergonomics?

What is Human Factors and Ergonomics?

Human Factors (also known as Ergonomics) is the science of understanding Human Capabilities and Limitations and its application for the design of products, spaces, services and systems.

International Ergonomics Association in 2000 defined
Ergonomics (or human factors) as the scientific discipline concerned with the understanding of the interactions among human and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

Human Factors/Ergonomics Problem Spaces:

Make use of Human Factors/Ergonomics) while designing any of the following:

Knob of Door:
- for a child, elderly
- person with disability

Toys for Children:
- softness, edges, colour, material

Cooking Utensils:
- person with low vision,
- elderly

Wayfinding Signage:
- for a child, elderly
- person with low vision
- person with different language

Mobile for Elderly:
- size of touch interface
- size of text

Medicine Instructions:
- for a child, elderly
- person with readability issues

Safety for Women:
- public Lighting
- emergency options
- social safe systems

Human Factors/Ergonomics specializations:

Three broad specializations of Human Factors /Ergonomics) is as follows:

Physical Human Factors / Ergonomics:
- Physical Capabilities and Limitations
- Anthropometrics
- Physical Workload
- Postures
- Ambient Conditions
- Visual Ergonomics

Cognitive Human Factors / Ergonomics:
- Memory, Attention
- Perception
- Emotion
- Motor Response
- Information Processing
- Human Computer Interaction
-

Organizational Human Factors / Ergonomics:
- Teamwork
- Social Interactions
- Collaborative workspaces
- Social Systems
- Environments

Physical Human Factors / Ergonomics:

International Ergonomics Association in 2000 defined that
'**Physical ergonomics is concerned with human anatomical, anthropometric, physiological and biomechanical characteristics as they relate to physical activity. (Relevant topics include working postures, materials handling, repetitive movements, work-related musculoskeletal disorders, workplace layout, physical safety and health.'**

Physical Human Factors/Ergonomics is useful for designing some of these:
- Product and Automobile Design (includes Machine Design)
- Readability in Communication Design
- Signage Systems Design
- Workspaces Design considering Postures and Workload

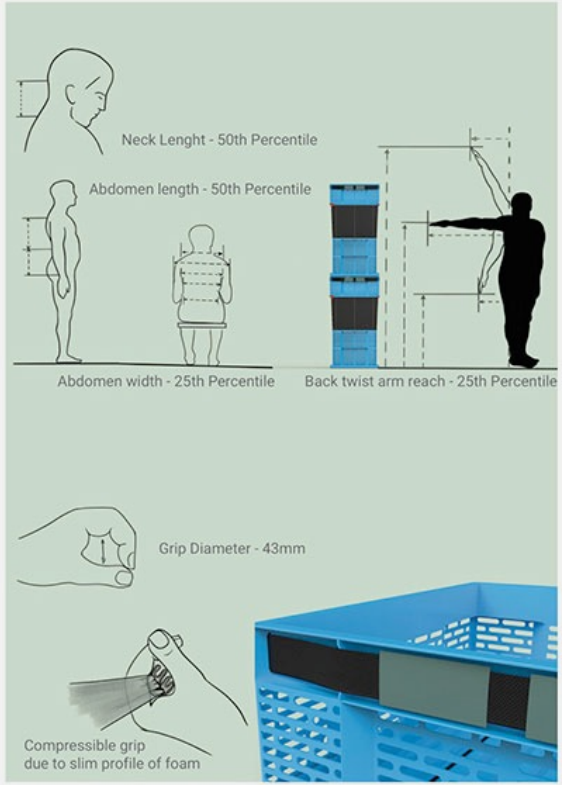
Physical Human Factors / Ergonomics:

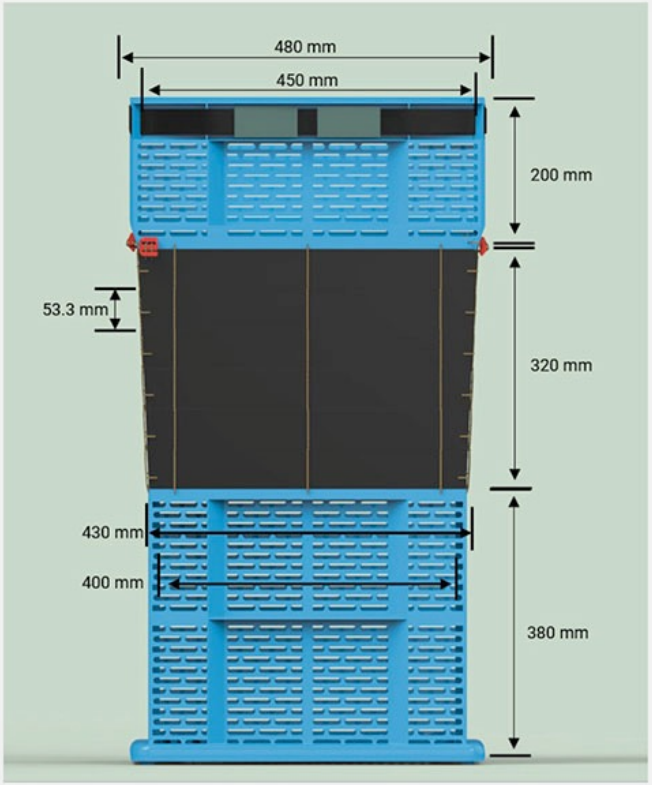
Anthropometrics is the science of measurement of a person's body in terms of it dimensions, weight, shape or form and functional capabilities while in different postures and age.

Since the dimensions of human being change and vary, it is important to consider this factor while making use of Anthropometric dimensions.

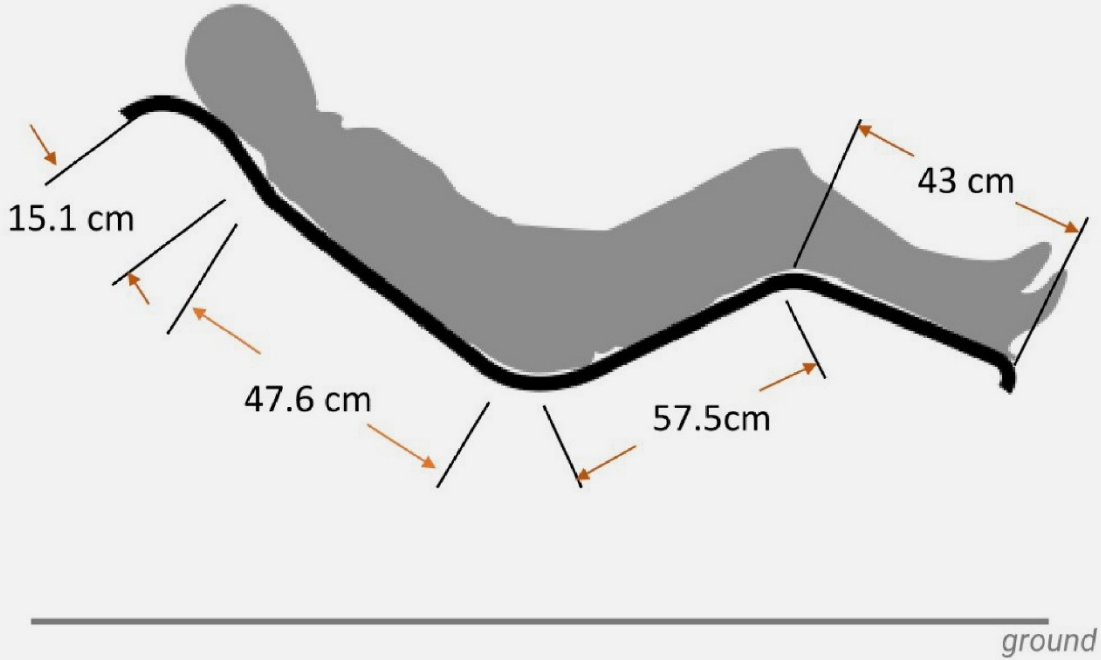
Do refer to the well-researched book by Professor Debkumar Chakrabarti titled **'Indian Anthropometric Dimensions for Ergonomic Design Practice'** if you are designing for people in India.
https://www.scribd.com/document/511496232/INDIAN-Anthropometric-Dimensions

Example of Anthropometric Factors applied to Storage Design:





Example of Anthropometric Factors applied to Bamboo Lounge Furniture Design:



Physical Human Factors / Ergonomics:

Steps in Applying Physical Human Factors/Ergonomics:

1. Finalise the prototype of Product/Workspace/Service

2. Select the Context, Posture, Age, Sex, Environment

This is important as the human dimensions vary according to the above afctors

3. Refer to a Anthropometric Dimensions appropriate to the User segment

For India and its people, refer to suitable Anthropometric data for this context

4. Apply these dimensions to the prototype

(Let the users use/test the PoC and get feedback from them)

5. Get Feedback after Testing

(Let the users use/test the PoC and get feedback from them)

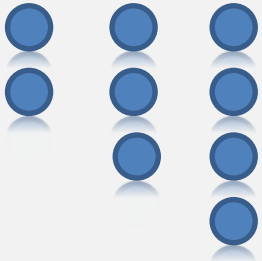
Cognitive Human Factors / Ergonomics:

International Ergonomics Association in 2000 defined that
‘**Cognitive ergonomics is concerned with mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system. (Relevant topics include mental workload, decision making, skilled performance, human-computer interaction, human reliability, work stress, and training as these may relate to human-system design.’**

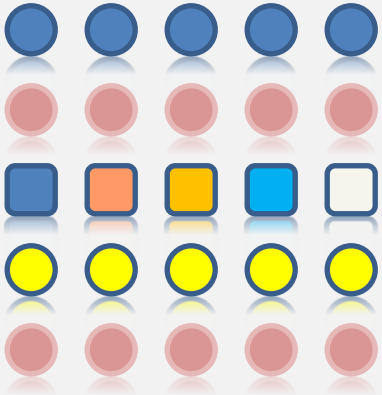
Cognitive Human Factors/Ergonomics is useful for designing some of these:
- User Machine Interface
- Controls for a System (Automobile, Aeroplane, Power Stations, Traffic Control, etc.)
- Signage Design
- Packaging Design

Gestalt laws of Proximity and Similarity:

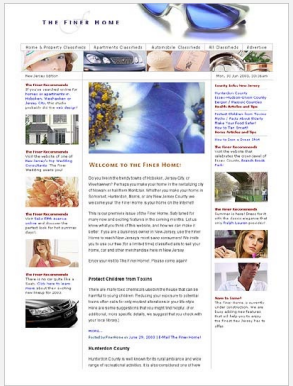
Gestalt Laws of Proximity *:
The closer the objects are to each other, more likely they are perceived as a group (Vertical)



Gestalt Laws of Similarity:
Objects or elements that are similar are likely to be grouped together (Horizontal)



Gestalt Laws of Proximity and Similarity:
Application of these laws leads to:
- less ambiguity
- easy identification
- visual organisation



* Gestalt Laws founded by: Max Wertheimer, Kurt Koffka, and Wolfgang Köhler

Application of Gestalt laws of Proximity and Similarity:

Gestalt Laws of Proximity and Similarity:

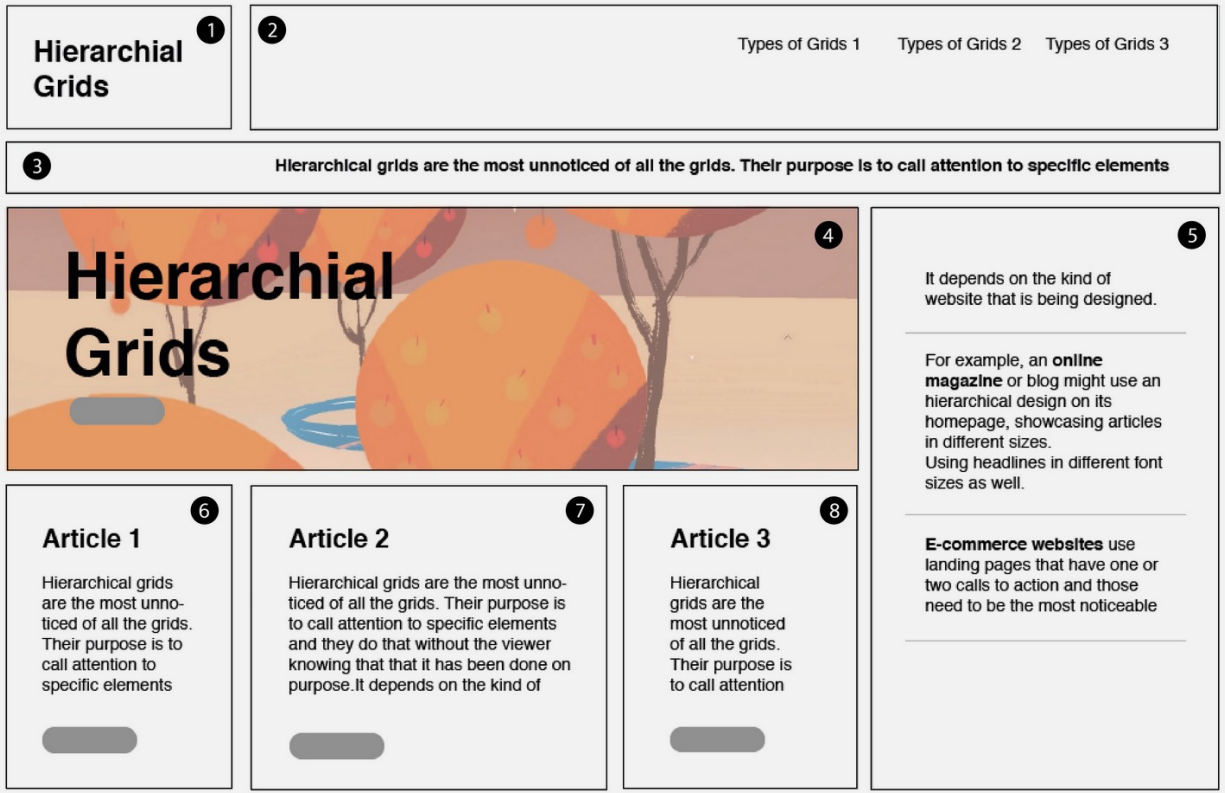
Shown here is a Signage Design for different Firms in 3 floors of an office building.
Proximity and Similarity to differentiate different floors

1st Floor	102	Composite technologies Pvt. Ltd.
	105	Glow and Digitial printers
	105	Shahiways Art and Publicity Service
	108	Sona Prints
	112	Millenea
	115	Print World
2nd Floor	201	Karan Signs
	206	Sagar Arts
	222	Zodiac Advertisers
	234	Special Effects
	234	Spark Signs
3rd Floor	303	Blue Mount Communications Pvt. Ltd.
	333	Tech Byte
	311	Pragati Arts
	331	Venture Visual Graphics.

Application of Gestalt laws of Proximity and Similarity:

Gestalt Laws of Proximity and Similarity:

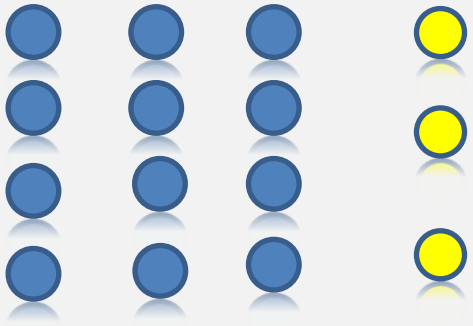
Shown here is a webspace on Grids. The use of Proximity and Similarity Laws lets the viewer move his eyes as planned from one to another.



Hick's law on Number of Choices:

Hick's Law on Number of Choices *:
states that 'the **more number of choices** a person has, it takes the person **longer to make a decision**.' Or the other way around, the less choices means less time to make a decision.

Shown are examples of Option 2 against Option 1



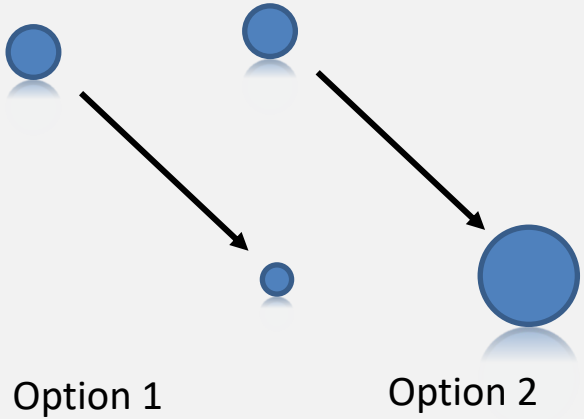
Option 1 Option 2

Hick's Law on Number of Choices:
Application of this law leads to:
- Faster decision making
- Simplifies Choices

* Hick's Law founded by:
William Edmund Hick and
Ray Hyman

Fitt's law on Size and Distance:

Fitt's Law on Size and Distance *:
states that 'the **amount of time** required for a person **to move to Target A** is a **function of the distance and the size of the Target A**.'
Or the other way around, it takes longer if the size is smaller and distance is longer..
Shown are examples of Option 2 against Option 1



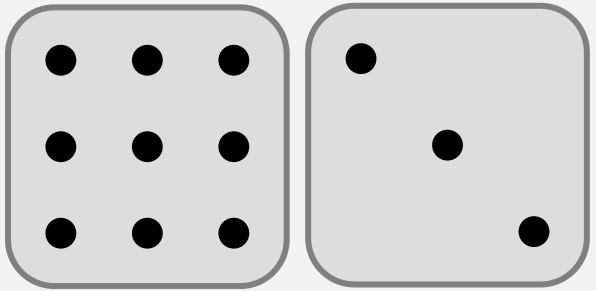
Fitt's Law on Size and Distance:
Application of this law leads to:
- Saving time
- Faster decisions

T13.1-017

* Fitt's Law founded by:
Paul Morris Fitts

Murphy's law of Wrongs:

Murphy's Law of wrongs *:
states that '**Anything that can go wrong will go wrong**.'
Or the other way around, the less complex the solution is or less the number of components/steps, the system has better chances of working
Shown are examples of Option 2 against Option 1



Option 1 Option 2

Murphy's Law of wrongs:
Application of this law leads to:
- Being careful
- Re-Confirmation
- Designing to rectify the assumption that it will go wrong

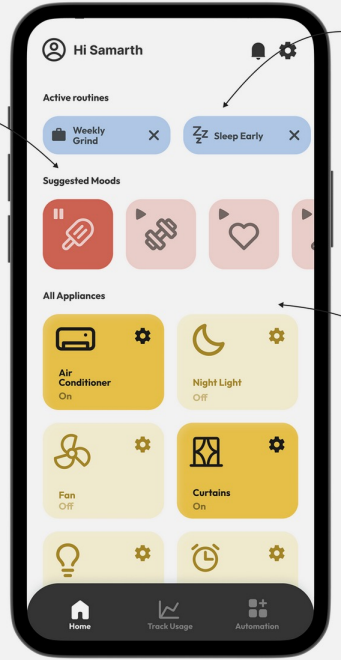
* Murphy'a's Law named after: Edward A. Murphy Jr.

Cognitive Human Factors applied to Interface Interactions:

All the 4 Laws shown are applied here to the interface for controlling devices in bedroom

Law of Proximity

Similar buttons are grouped together for better understanding and differentiation.

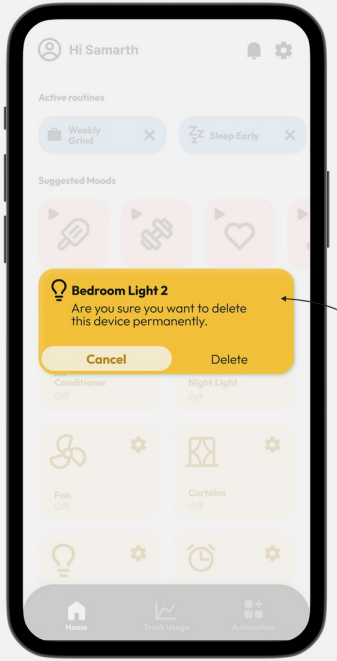


Hick's Law

Den-Z presents the most important and frequent actions on the home screen to ease decision making.

Fitts's Law

The buttons for appliances are large and within fingers' reach so that users can easily and quickly toggle them.



Murphy's Law

A confirmation message is shown to the user to before they delete a device. Tha cancel button is highlighted to

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T13.2

What is Systems Mapping

What are System Maps?

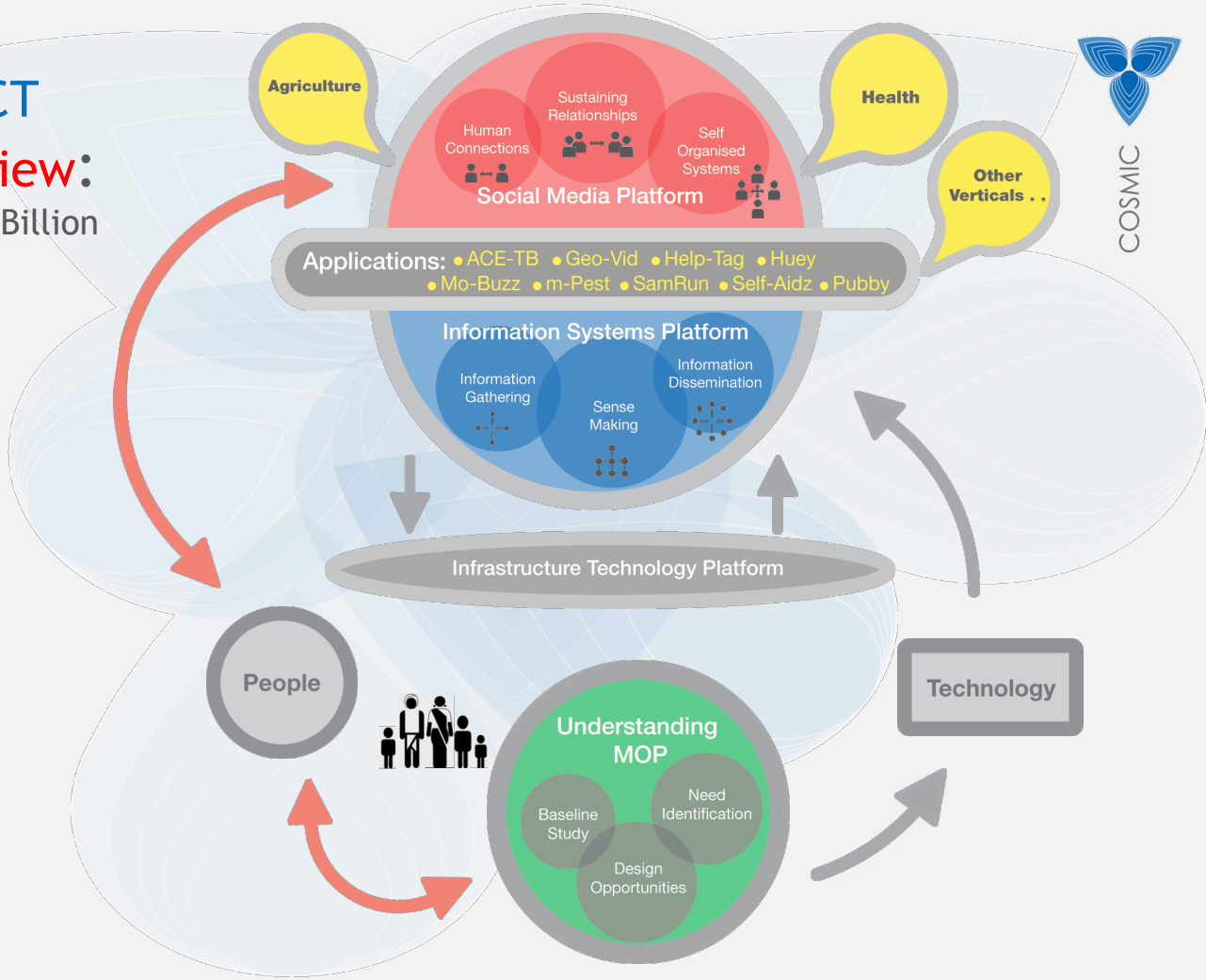
System maps are kind of similar to Concept Maps (shown in week 10 Tools) **and depict how the final design solution is interconnected and linked to other components or parts of the solution.**

System Maps are helpful to give an overview or broader perspective of the interconnectedness of the solution in one visual representation.

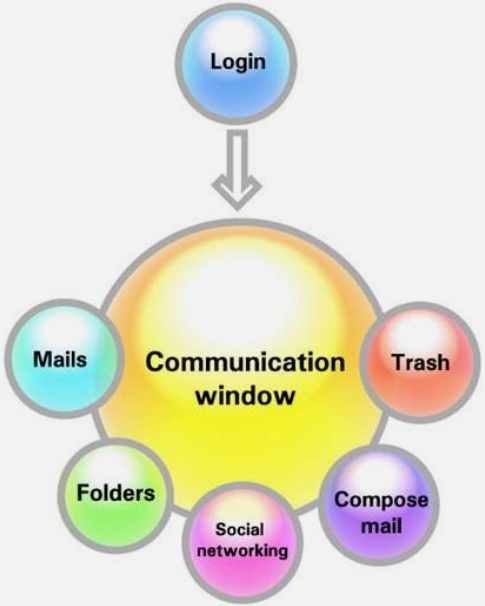
COSMIC PROJECT

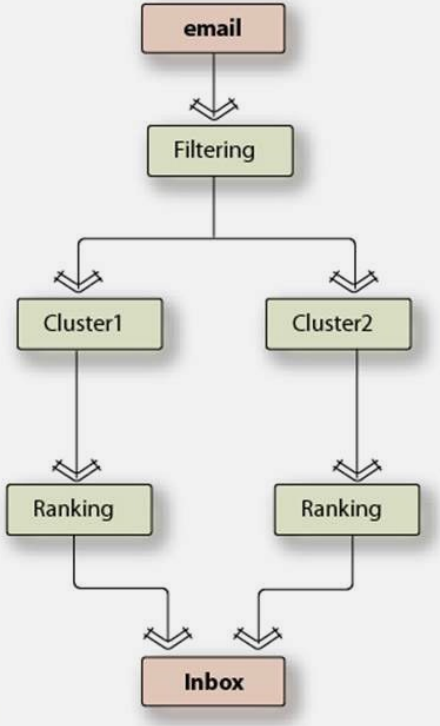
-Systems Overview:

Empowering the next Billion

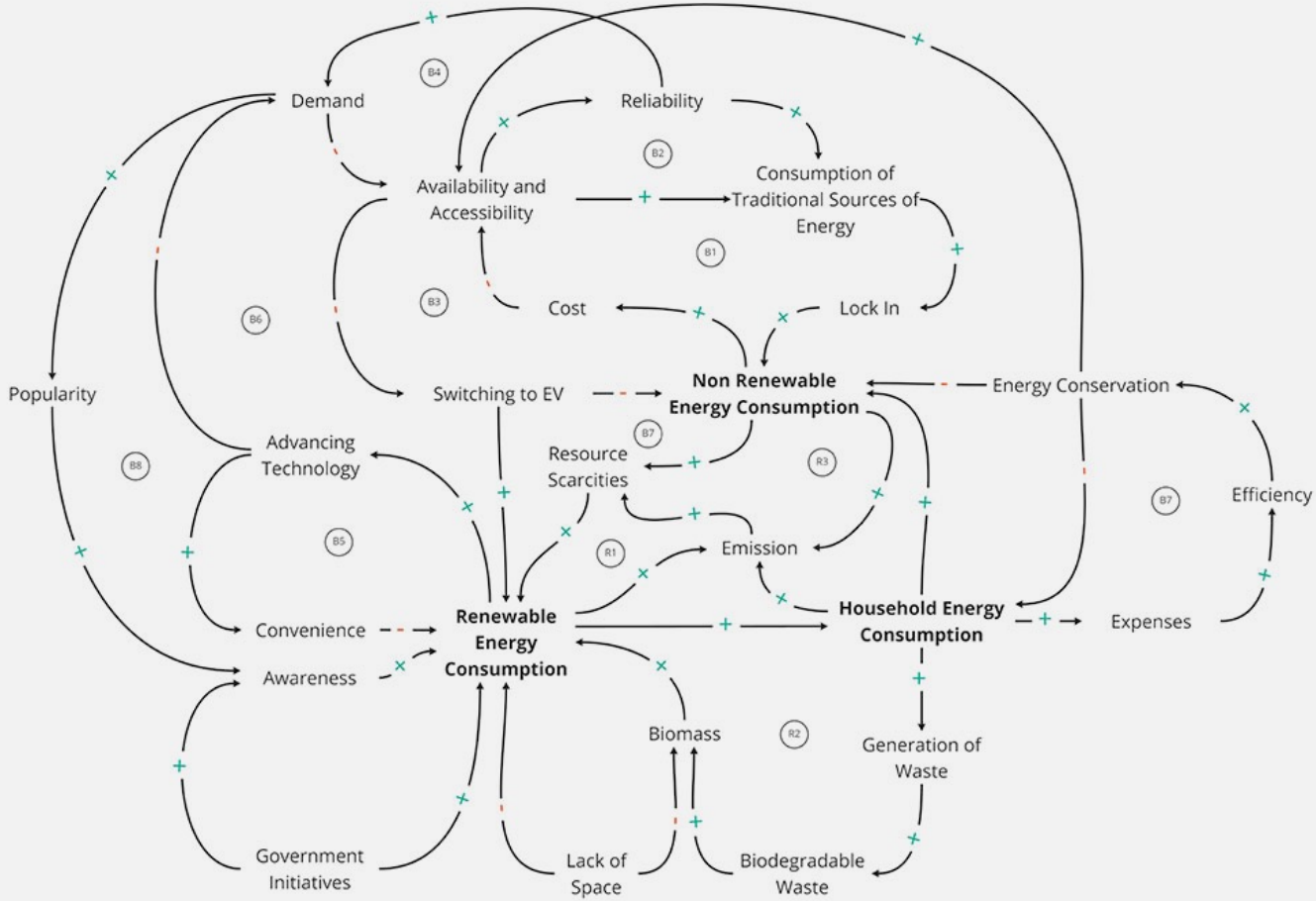


Systems Map for a new email interface:

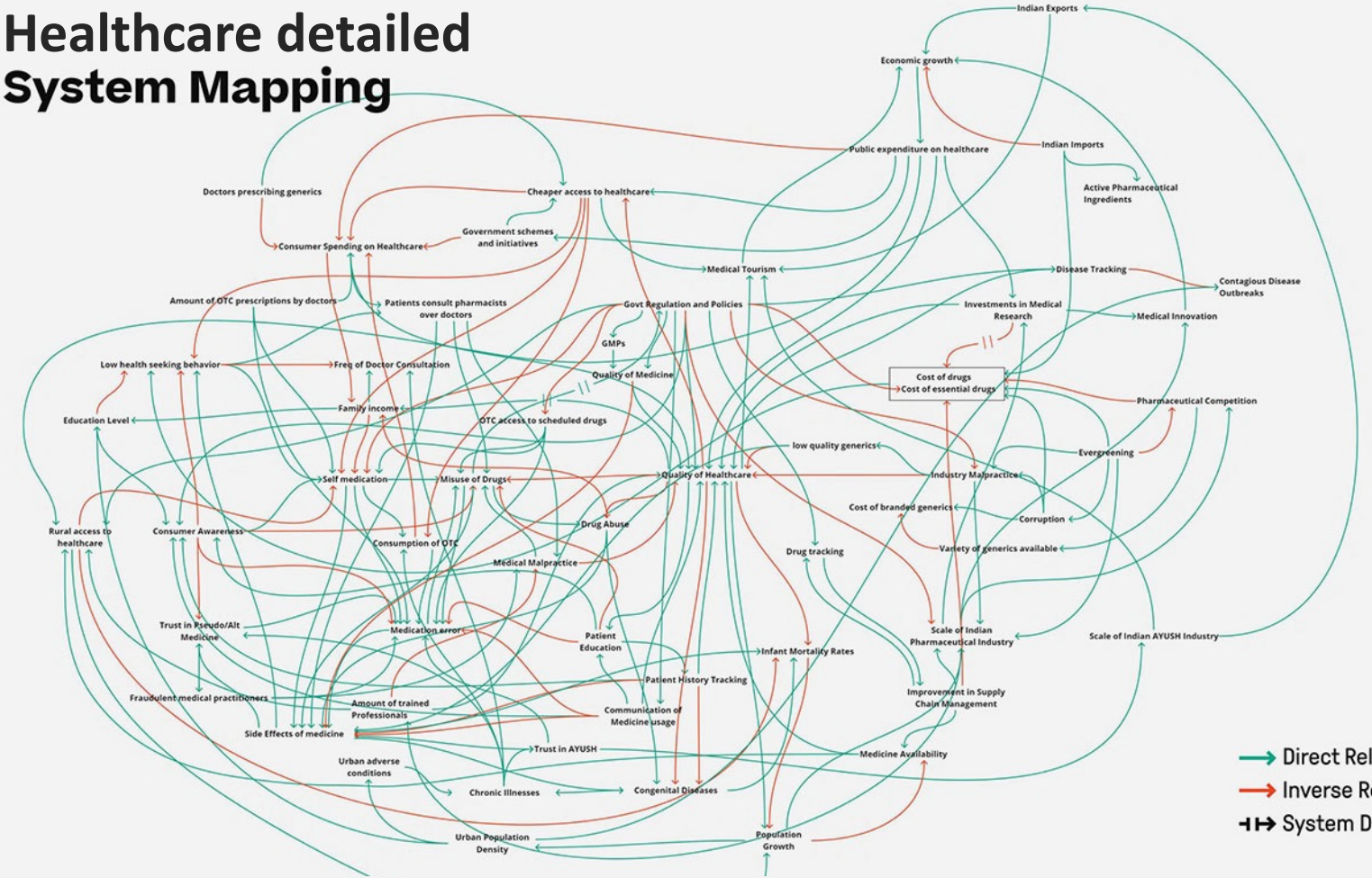




Systems map on household consumption of energy



Healthcare detailed
System Mapping



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T13.3

What is Hi-fidelity Prototyping?

What is Hi-Fidelity Prototyping?

Hi-fidelity prototype is the prototype version of the concept with almost all the details in terms of shape, colour, texture, resolution and functionality

This is great for getting the feedback from its users as it is almost like the final version.

Digital versions of Hi-fidelity prototypes are easier to make than the 3D prototypes. Hi-fidelity prototypes are great for prototyping Publications, Digital Interfaces, Packaging solutions, Card and Board games.

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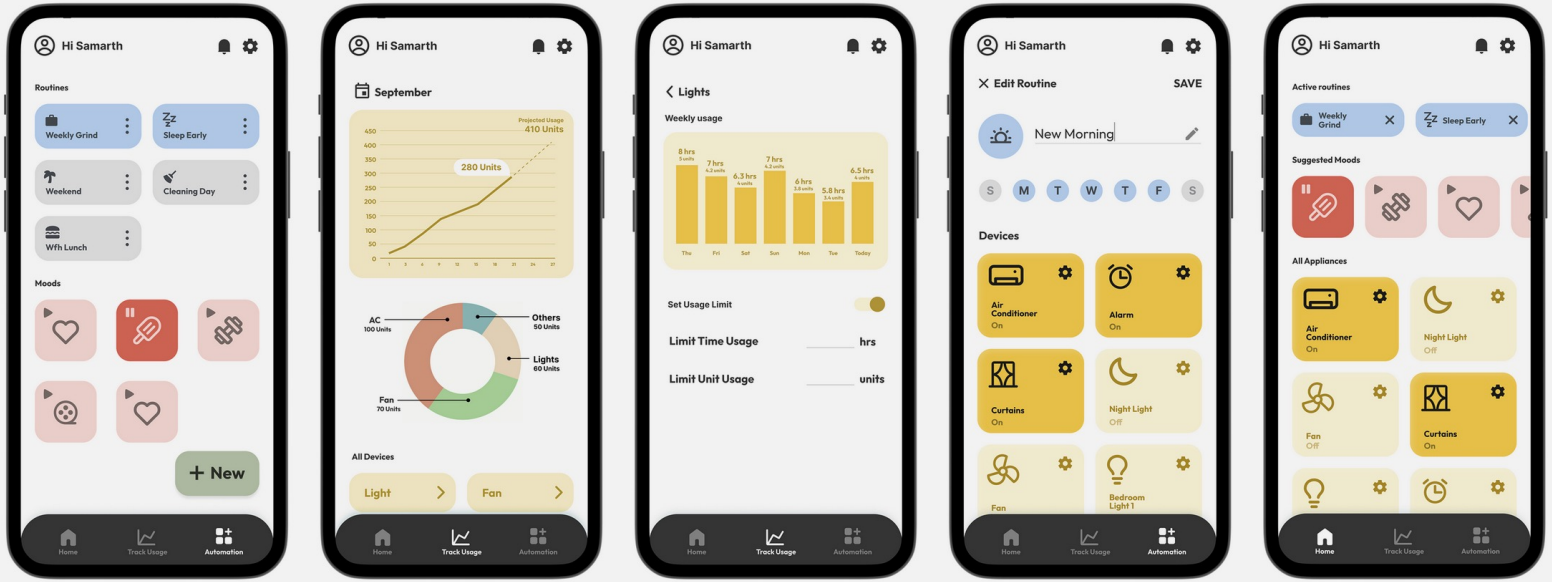
Examples of Hi-Fidelity prototype:

- A Smart Device for Bedroom

After undergoing numerous revisions and undergoing a thorough examination, the app has evolved into its current state, which is a result of careful refinement and improvement.



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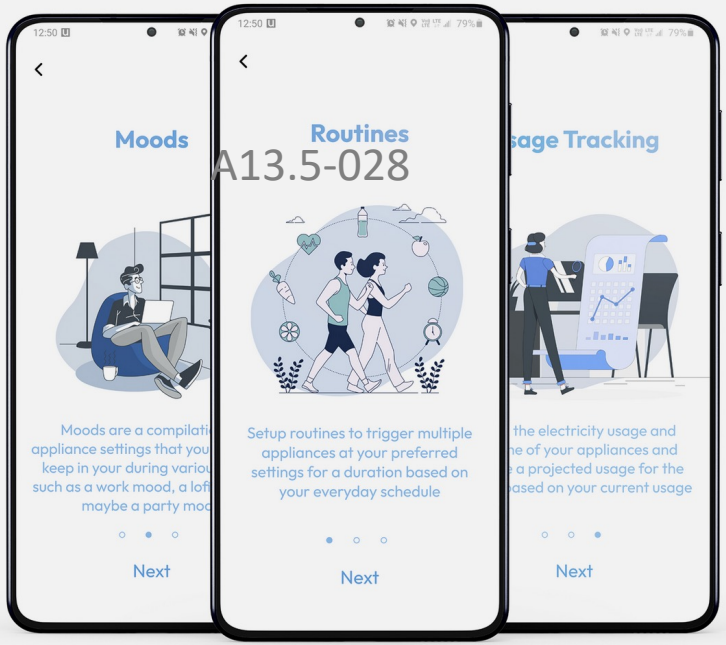
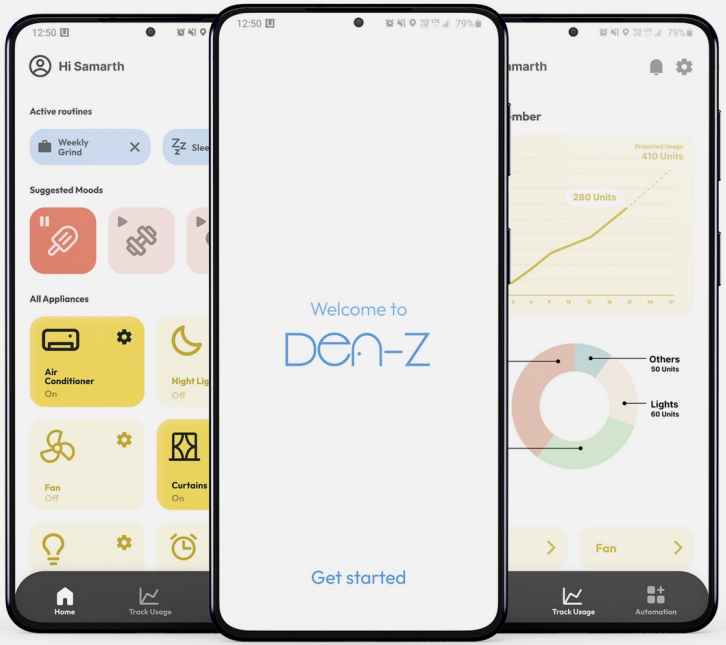
Detail of Hi-Fidelity prototype:

- A Smart Device for Bedroom





Detail of Hi-Fidelity prototype:

- Packaging Design

Reference: from dsource.in (Course on **Packaging and Label Design** By Prof Mandar Rane and Prof Purba Joshi)

Hi-Fidelity Signage prototype:

Reference: from dsource.in (Tools on **Signage System** By Mugdha Kale and Prof. Ravi Poovaiah)

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A13.4

What is 3D Modelling and 3D Printing?

What is 3D Modelling and 3D Printing?

3D modelling is used for creating objects in 3 dimensions. The 3D modelling could be created physically, digitally or 3D printed digitally

Physical 3D Modelling:
Various materials can be used for this: Cardboard, Wood, Metal and Plaster

Digital 3D Modelling:
Digital 3D models are done inside a computing environment using many applications
a. solid modelling
b. wireframe modelling
c. surface modelling

3D Digital Printing:
3D digital printing allows for making 3D objects using various materials
- there are many ways/methods of 3D printing.

Physical 3D model of 2 wheeler Concept:

Physical 3D model of Spline Lounge concept 2:

Digital 3D model of Spline Lounge concept 1:

Digital 3D model of Spline Lounge concept 2:

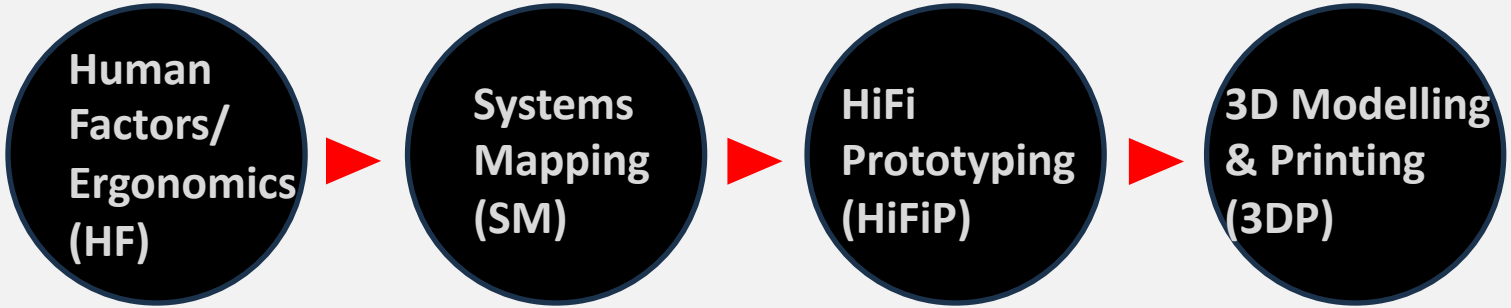
Digital Printed 3D model of ‘Indian Temple using Fractals’:

T13.5

Prototyping Tools for Part 3:

Prototype part 3:

(HF > SM >HiFiP> 3DP)



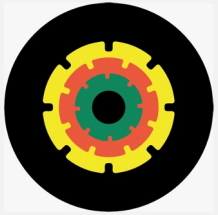
Thanks for Listening

DT&I Tools
Section: T13
Week 13

DT&I Course – Week 13:

DT&I Process
(20%)

> Human Factors / Ergonomics
> Systems Mapping
> Hi-fidelity prototyping
> 3D Modelling & Printing



DT&I Tools
(20%)

> Human Factors / Ergonomics
> Systems Mapping
> Hi-fidelity prototyping
> 3D Modelling & Printing

DT&I Project
(50%)

> Apply > Human Factors / Ergonomics
> Systems Mapping
> Hi-fidelity prototyping
> 3D Modelling & Printing

DT&I Cast Study
(10%)

> Case Study Project: **Design Of Bamboo Sliver Furniture**

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Supporting Organizations:

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D’source Project

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Credits:

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Prof. Ravi Poovaiah

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Credits:

Camera & Editing:
Santosh Sonawane

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Credits:

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Credits:

Graphic Icons:
Shweta Pathare

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Credits:

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