D'source Project

Open Design School

MoE's Innovation Cell

Prototyping Part 3

Design Thinking & Innovation Process

Section: A13, Week 13

Design Thinking & Innovation (DT&I)

Section: A13

Week 13

Design Thinking & Innovation (DT&I)

Prof. Ravi Poovaiah
IDC School of Design, IIT Bombay

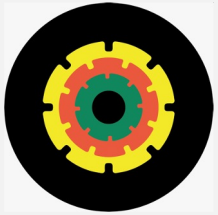
“Yesterday is but a dream, tomorrow but a vision.”

Kalidasa

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

DT&I Process

A13
Final Prototyping
– Part 3

Module A13:

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A13.1

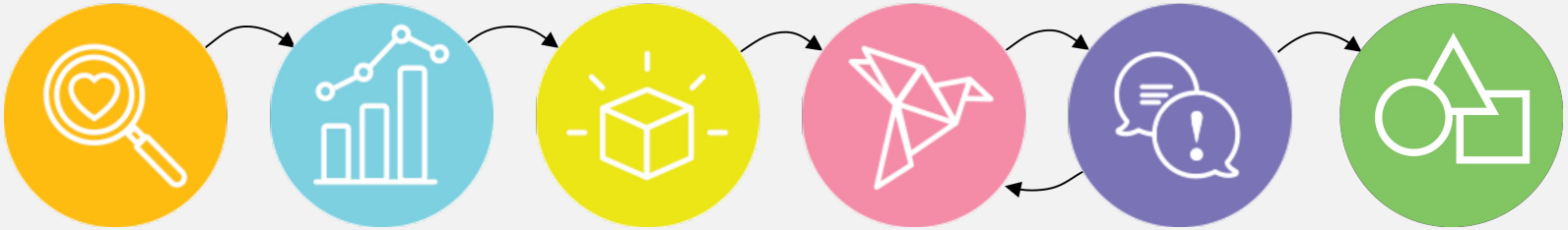
DT&I Process: Final Prototyping - Part 3

Final Prototyping – Part 3:

Content

DT&I Process and Prototyping:

Prototyping is the Fourth phase of the DT&I process.



Phase 1:
- **Research**
- Study
- Observe
- Empathize
- Need finding

Phase 2:
- **Analyze**
- Understand
- Synthesize
- Define
- Visualize
- Mappings

Phase 3:
- **Ideate**
- Create
- Explore
- Experiment
- Concepts
- Innovate

Phase 4:
- **Build**
- Mock-up
- Prototype
- Develop
- Detail

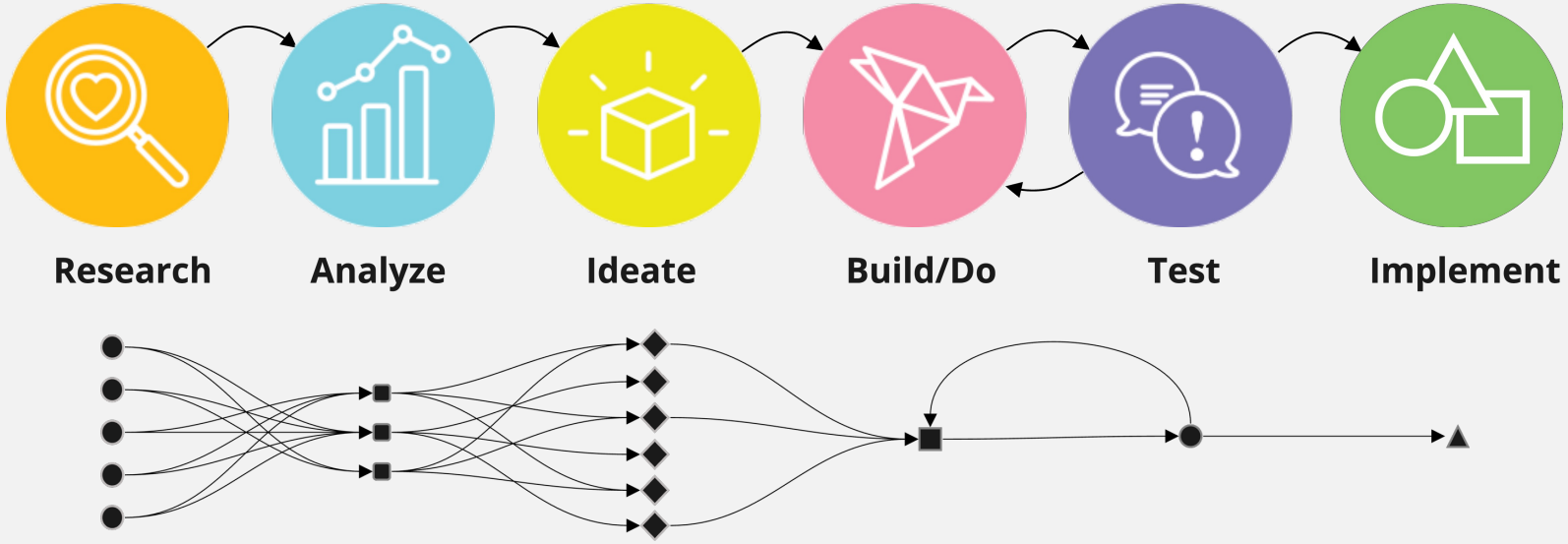
Phase 5:
- **Test**
- Reflect
- Test
- Feedback
- Iterate

Phase 6:
- **Implement**
- Reflect
- Produce
- Industry
- Business
- Enterprise

- Prototyping helps you to visually represent and test your final ideas in 2 or 3 dimensions

DT&I Process and Ideation:

Let's summarize:



A13.2

What is ‘Final Prototyping’ Part 3?

What is ‘Final Prototyping’ Part 3?

Prototyping Part 3 involves Hard Prototyping, the final version of **ideas and concepts.** Here the prototype is made to look as much as like it should be – it could be **based on its materials, shape, colour, size and function.**
At this stage it is essential to look at **Human Factors/Ergonomics** to make sure the concept **fits in with human capabilities and limitations.**

Soft > Medium > **Hard**

Prototyping part 3 takes you very close to the final version of the idea or concept. And, helps one to visualize, make it tangible, test, get feedback and change/iterate before the design is finalized.

How is ‘Hard Prototyping’ done?

Some of these techniques make sure to represent and visualize the final version of the concept or idea and be able to get feedback from its users.

A. Human Factors/Ergonomics – maps to user capabilities and limitations

B. System Mapping – to give an overview of the solution along with its interconnected elements

C. Hi-Fidelity Prototyping - it looks like what the final producd be like

D. 3D Modelling and Printing – both can produce actual prototypes in 3 dimensions using the actual materials and with functionalities

‘Hard Prototyping’:

Human Factors / Ergonomics:
- Matching User Capabilities and Limitations

System Mapping:
- Visualise Core idea with its interconnected elements

Hi-Fidelity Prototyping:
- Hard Prototyping,
- Close to Final Product
- Form and Function details

3D Modelling and Printing:
- 3D prototypes,
- 3D Printed Prototypes
- Material, Size and Function

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A13.3

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.

The word Ergonomics is a combination of two words from Greek: **Ergon** (meaning work) and **Nomos** (meaning natural law).
This was coined by Prof. Wojciech Jastrzebowski, 1857

Human Factors and Ergonomics . . .

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.

Ergonomics (or human factors) is a vast field with varied applications and branches. Here in this section, is an introduction to this subject as part of Design Thinking and Innovation course

Learners interested in knowing more about this subject are encouraged to look through the references mentioned in this chapter.

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

Application of Human Factors/Ergonomics:

Physical Human Factors / Ergonomics:

Anthropometrics:

Anthropometrics is the measurement of human dimensions.

This is very useful while doing design of workspaces, seating, controls for operator, drivers comfort.

Do note the dimensions are not the same for all users.

Physical Human Factors / Ergonomics:

Visual Ergonomics:

Visual Ergonomics plays an important role in the design of signage systems, readability of newspapers, control display panel organization and systems where visual decision making is key. One needs to look at light conditions, movement of the eye, the angle of vision, Contrast in foreground background, Visibility at night or in low light conditions, etc.

Application of Human Factors/Ergonomics:

Cognitive Human Factors / Ergonomics:
Memory, Attention, Perception and Motor Response play a significant role in the ability of Human beings to process Information.
Application of these considerations are in the design of Human Computer Interaction systems or applications.

Organizational Human Factors / Ergonomics:
Teamwork, Social Interactions, collaboration are important factors while designing collaborative workspaces, social public space environments, Social networking systems and design of spaces for social interactions.

Human Factors/Ergonomics specializations:

Think 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

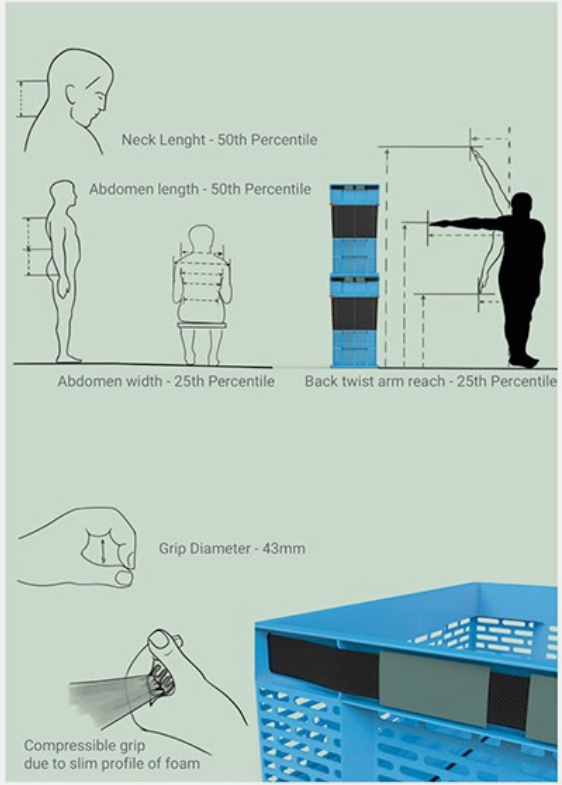
Wayfinding Signage:
- for a child, elderly
- person with low vision
- person with different language

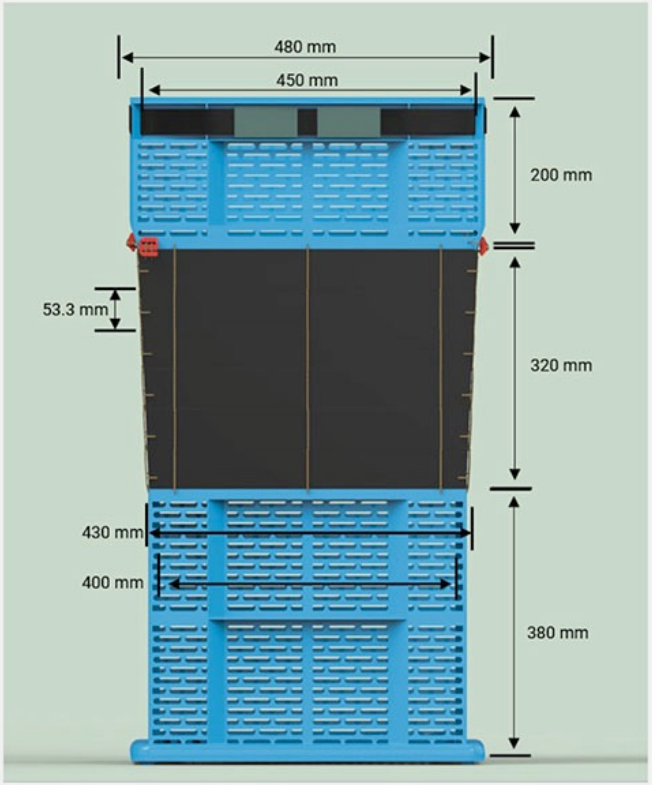
Mobile for Elderly:
- size of touch interface
- size of text

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

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

Anthropometric Factors applied to Storage Design:





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A13.4

What is Systems Mapping

What are System Maps?

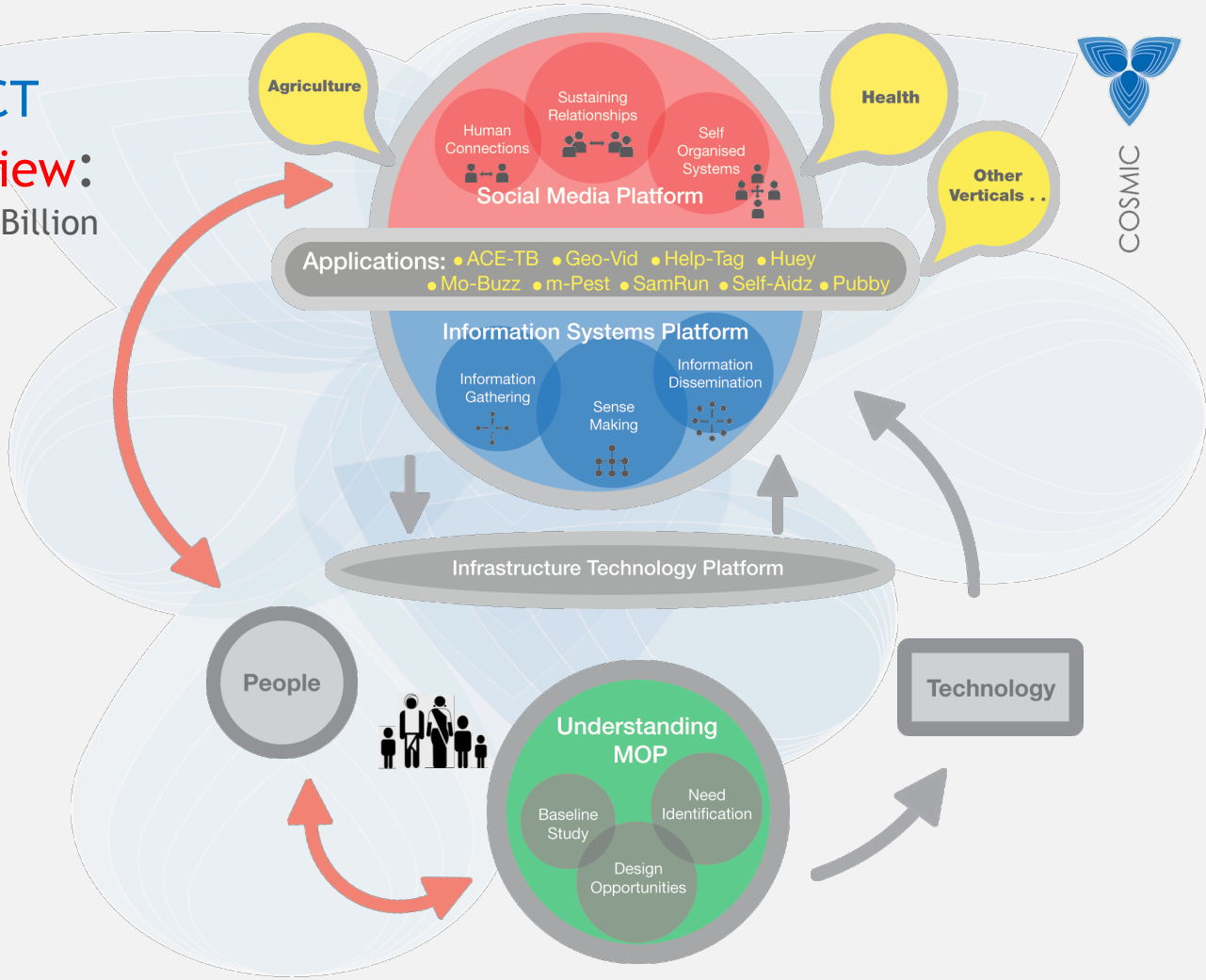
System maps are kind of similar to Concept Maps (shown in week 10 Tools) **and depict how the final design solution is interconnected and linked to other components or parts of the solution.**

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

COSMIC PROJECT

-Systems Overview:

Empowering the next Billion



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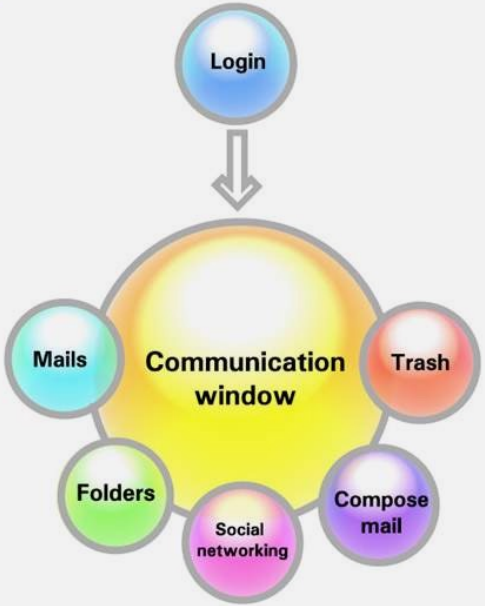
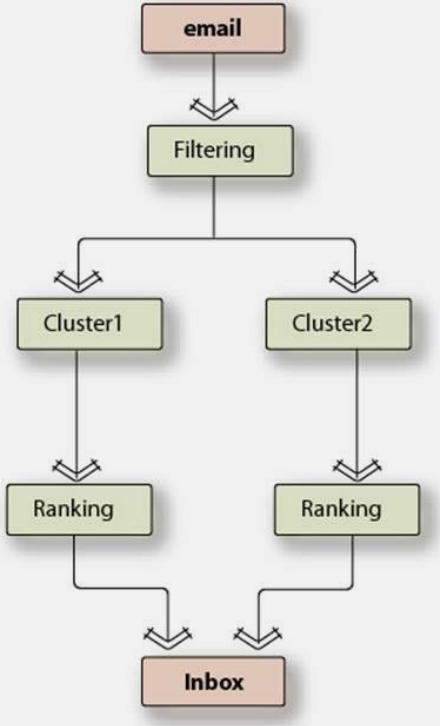
Systems Map for a new email interface:





A13.5

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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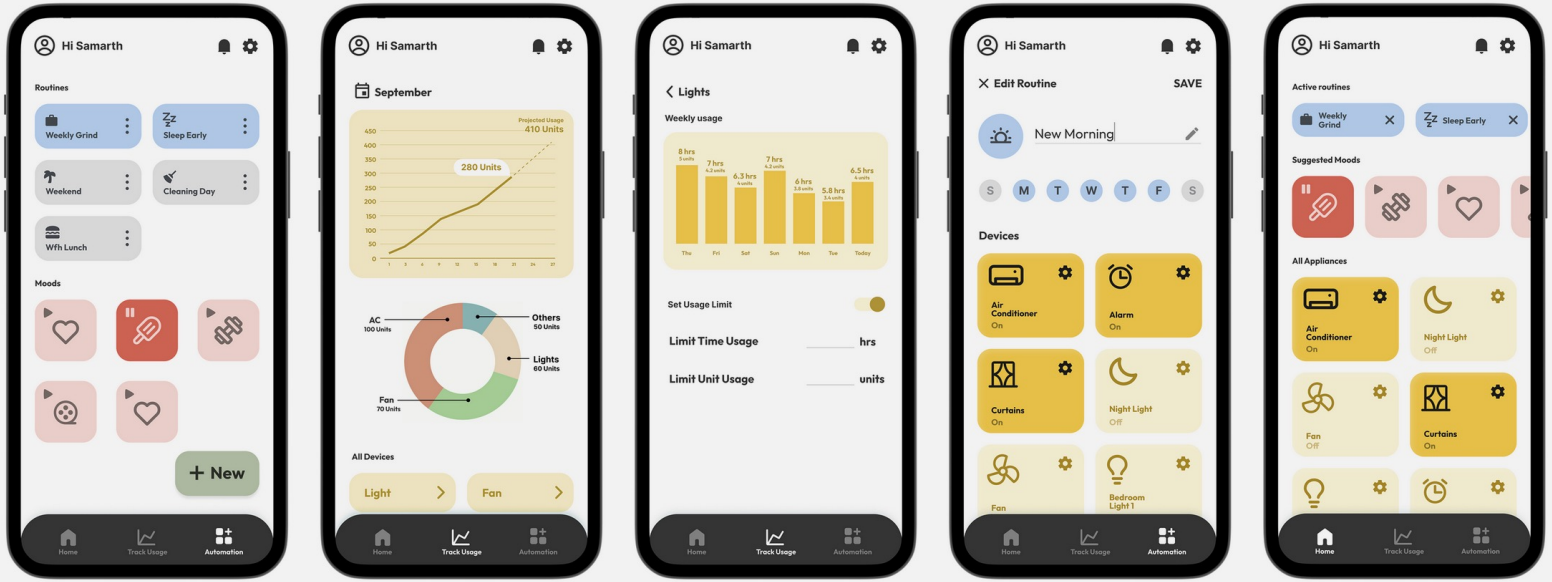
Examples of Hi-Fidelity prototype:

- 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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A13.6

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: 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.

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A13.7

Why is Prototyping part 3 Important?

Why is ‘Prototyping part 3’ important?

Hard Prototyping part 3 takes you to the final version of the idea or concept. And, helps one to visualize, make it tangible, test, get feedback and change/iterate.

Prototyping Part 3 involves Hard Prototyping, the next version of ideas and concepts. At this point of time, we have discussed the merits of using Human Factors (Ergonomics) to make sure the design aligns with the capabilities and limitations of the user. Systems mapping gives you an worldview of the solution interconnecting with the parts of the system. Hard prototyping makes the solution come alive with all its details.

Soft > **Medium** > **Hard**

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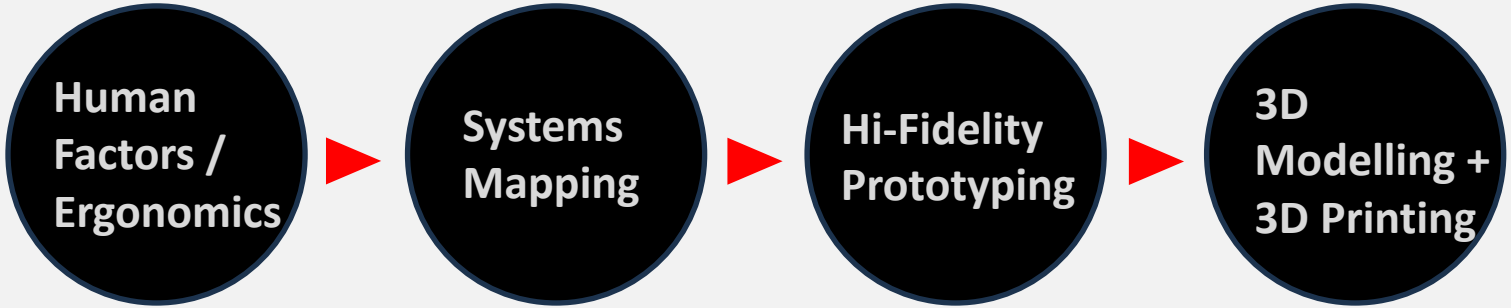
A13.8

What does Prototyping Part 2 involve?

Prototype part 2:

(Human Factors > Systems Mapping > Hi-fidelity Prototyping > 3D Printing)



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A12.9

Further Study and References

Further Study and References:

- DT&I, Case Studies, Courses, Tools, and Resources
  https://dsource.in/dti
  https://dsource.in/case-study
  https://dsource.in/course
  https://dsource.in/tools
  https://www.dsource.in/product-design
- Introduction to Ergonomics
  by Bridger, RS, Taylor &Francis, 2003
- Human Factors in Engineering and Design
  M. S. Sanders And E. J. McCormick,, McGraw-Hill, 1993
- The Measure of Man and Woman: Human Factors in Design
  by Alvin R. Tilley (Editor), John Wiley & Sons, 2001
- Human Factors Methods for Design: Making Systems Human-Centered
  by Christopher P. Nemeth, CRC Press; 2004
- Systems Mapping: How to build and use causal models of systems
  by Pete Barbrook-Johnson and Alexandra S. Penn, Macmillan, 2022

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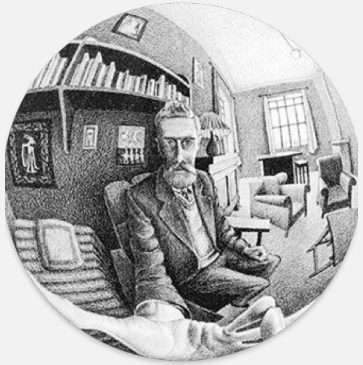
Design Quote:

“Only those that attempt the absurd will achieve the impossible.”

Maurits Cornelis Escher, Dutch Graphic Artist



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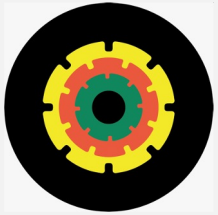

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DT&I Project
(50%)

> Apply > Human Factors / Ergonomics
> Systems Mapping
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> 3D Modelling & Printing

DT&I Cast Study
(10%)

> Case Study Project:
Design Of Bamboo Sliver Furniture

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Supporting Organizations:

D’source

D’source Project

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MoE’s Innovation Cell

Credits:

Presented by:

Prof. Ravi Poovaiah

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Credits:

Camera & Editing:
Santosh Sonawane

Credits:

Think Design Animation:
Rajiv Sarkar

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Credits:

Graphic Icons:
Shweta Pathare

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Credits:

End Title Music:
C P Narayan

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