

Engineering

Unit C3 – UNIT C3: Physical and Visual Prototyping Tools

Lecture LC3.1 – Physical and visual
prototyping methods



Co-funded by the
Erasmus+ Programme
of the European Union

DISHOLEA | Improving the digital
skills of workforce in Shoe and
Leather goods Industry in Jordan and
Palestine | GA 101129194



T2.2 – Development of modular
courses and training
material.

C3. – Modular Course in
Design Engineering

Content

- **Physical Prototyping Methods**

- 3D Printing (Additive Manufacturing)
- CNC Machining
- Vacuum Casting
- Laser Cutting and Engraving
- Handmade Prototypes
- Modular Prototyping

- **Visual Prototyping Methods**

- Wireframes
- Mockups
- Interactive Prototypes
- Rapid Prototyping
- Digital Prototyping Tools

LC3.1 – Physical and visual prototyping methods

1- Physical Prototyping Methods: the creation of a tangible sample of the product.

The process typically involves the following steps:

1) **Mold Preparation:** A mold (last) suitable for the shoe design is selected or specially produced.

2) **Material Cutting:** The leather and other components are cut. Laser cutting or hand-cutting techniques can be used at this stage.

3) **Sewing and Assembly:** The upper surface (upper) is sewn and joined with the base. It can be done by hand or with machines.

4) **Sample Production:** The first physical sample of the design is prepared. This example is evaluated both aesthetically and ergonomically.

5) **Functional Tests:** The product's properties such as durability, flexibility, and waterproofing are tested.

LC3.1 – Physical and visual prototyping methods

2- Visual Prototyping Methods

Visual prototyping is the visual presentation of the product, either digitally or physically. These methods speed up the design process and provide the opportunity to gather customer feedback at an early stage.

2D/3D Design Software: Shoe design is done digitally with CAD/CAM systems. In this way, visual evaluation can be made from different angles.

<https://youtu.be/QJKkdOiOmne?si=y1YJuvQCtwJMSYbR>

3D Printing: Used for rapid prototyping. The exterior of the shoe and some functional features can be tested.

Virtual Reality (VR) and Augmented Reality (AR): Presenting the product to customers in a digital environment, trying out color and style alternatives.

Renders and Animations: Visual presentations of the product are prepared for marketing materials.

LC3.1 – Physical and visual prototyping methods

Physical Prototyping Methods

3D Printing (Additive Manufacturing)

1. **FDM (Fused Deposition Modeling)**: Thermoplastic material is melted and shaped layer by layer.
2. **SLA (Stereolithography)**: The resin-based material is laser-hardened to produce high-precision prototypes.
3. **SLS (Selective Laser Sintering)**: Powder material is sintered with a laser to obtain durable parts.
4. **PolyJet**: Detailed prototypes can be produced with multiple materials and colors.
5. **Metal Laser Sintering**: Metal powders are used to create functional and durable prototypes.

LC3.1 – Physical and visual prototyping methods

CNC Machining

- Computer-controlled milling machines produce precision parts from materials such as metal, plastic, or wood.
- It is generally preferred in prototypes that require high durability and

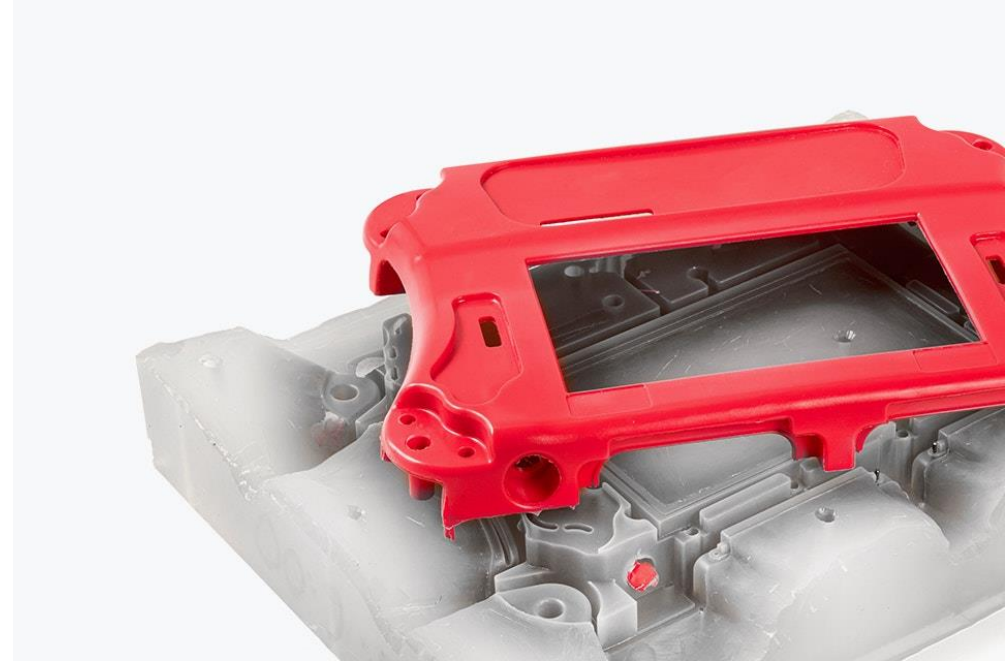


LC3.1 – Physical and visual prototyping methods

Vacuum Casting

Low-volume production is done using silicone molds.

It is often used for copying the master model produced by 3D printing.



LC3.1 – Physical and visual prototyping methods

Laser Cutting and Engraving

It is suitable for fast and precise cutting of flat surface parts.

It is commonly used on plastic, wood, and metal sheets.



LC3.1 – Physical and visual prototyping methods

Handmade Prototypes

- They are low-cost and fast prototypes made with materials such as foam, cardboard and clay.
- It is used to visualize ideas in the early stages of design.



LC3.1 – Physical and visual prototyping methods

Modular Prototyping

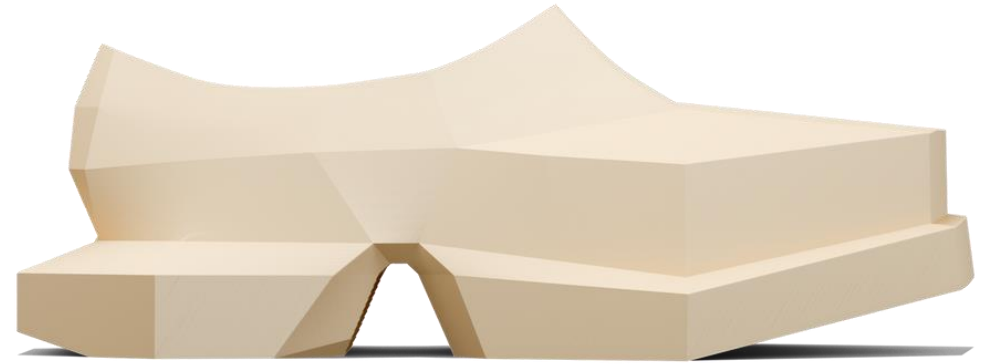
- These are prototypes created by combining ready-made parts.
- Common in electronic and mechanical systems.
- These methods are used in critical stages of the product development process, such as design verification, functional testing, and production optimization. Which method to choose; It varies depending on the complexity of the product, the intended use, and the budget.
- If you want, I can also detail the advantages of these methods and in which sectors they are

Visual Prototyping Methods

Visual prototyping

Common Visual
Prototyping Methods

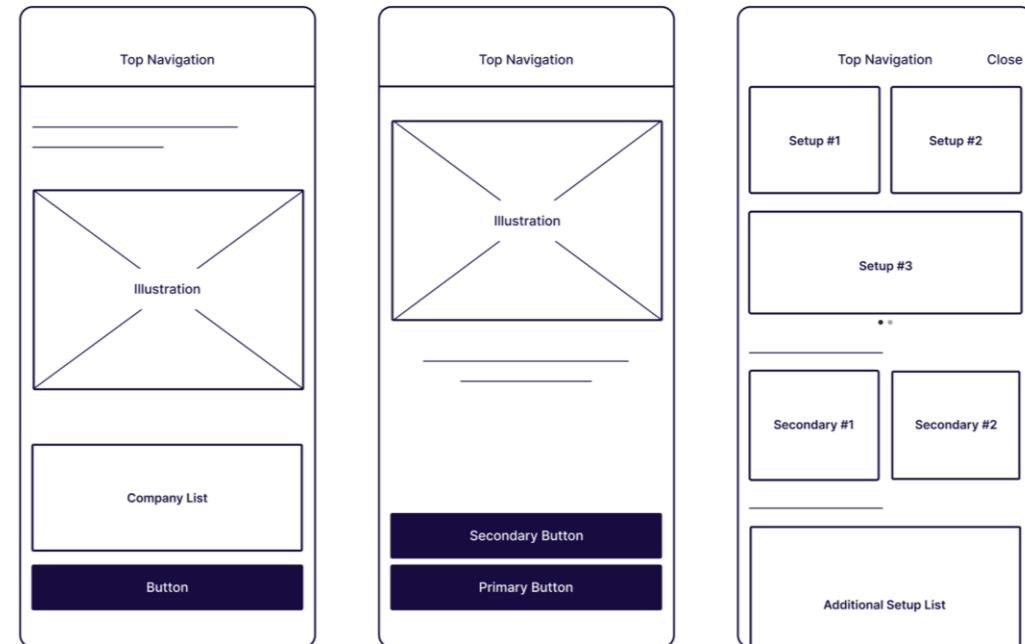
1. Paper Prototyping
2. Sketches or drawings on paper to represent interface layouts and user flows.
3. Great for early-stage brainstorming and low-cost iteration.



Visual Prototyping Methods

Wireframes

- Basic visual guides that represent the skeletal structure of a digital product.
- Focus on layout and navigation rather than aesthetics.



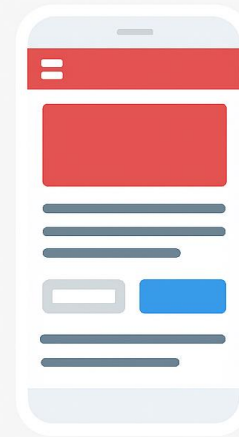
Visual Prototyping Methods

Mockups

- Static, high-fidelity representations of the final design.
- Useful for visualizing color schemes, typography, and branding elements.

MOCKUPS

Static, high-fidelity representations of the final design

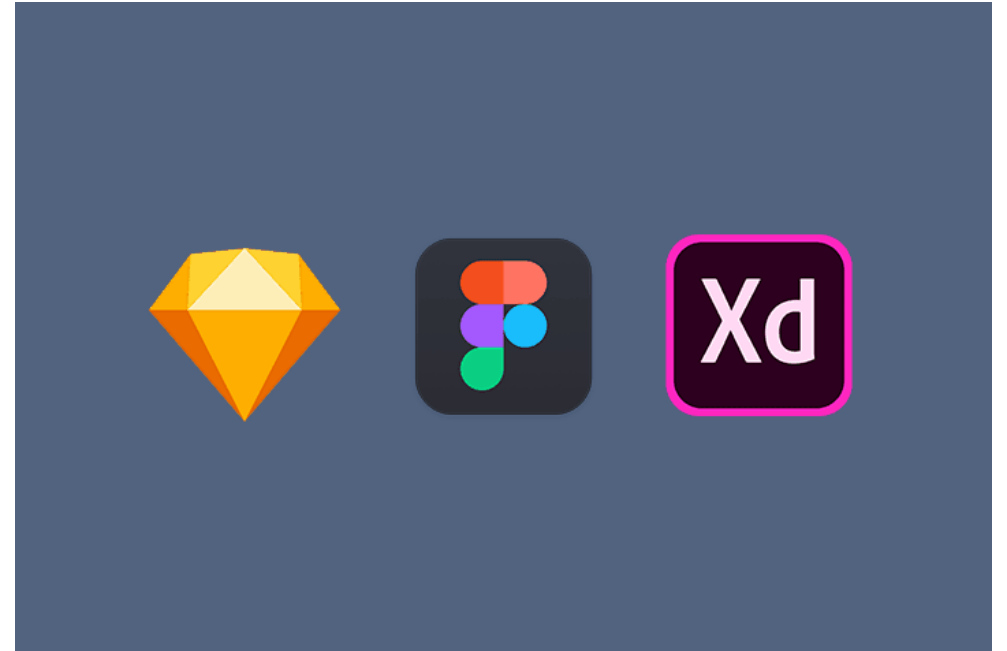


- Visualizing color schemes
- Typography
- Branding elements

Visual Prototyping Methods

Interactive Prototypes

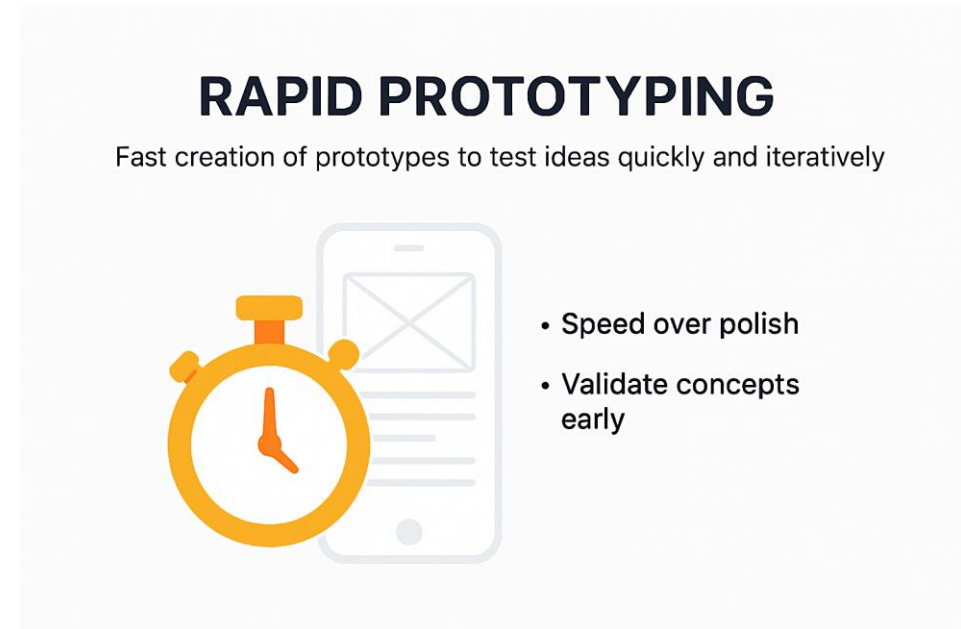
- Clickable models that simulate user interactions.
- Created using tools like Figma, Adobe XD, or Sketch to test usability and flow.



Visual Prototyping Methods

Rapid Prototyping

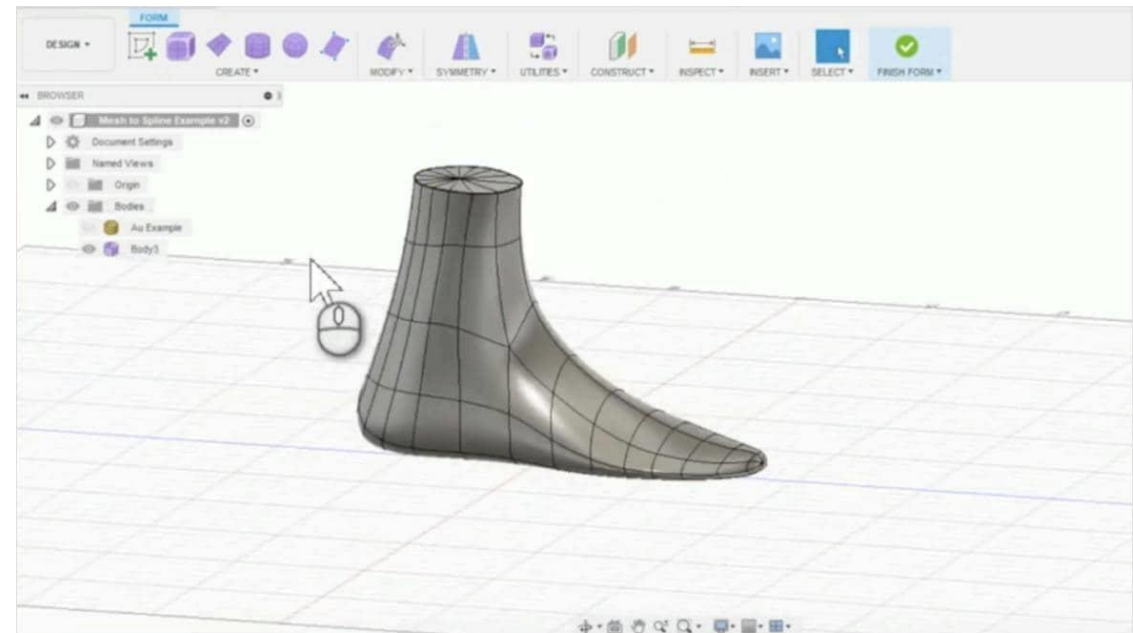
- Fast creation of prototypes to test ideas quickly and iteratively.
- Emphasizes speed over polish to validate concepts early.



Visual Prototyping Methods

Digital Prototyping Tools

- Platforms like **Webflow**, **InVision**, and **Mockplus** allow designers to build and test prototypes with drag-and-drop interfaces, animations, and collaboration features.



Visual Prototyping Methods

Low-Fidelity vs. High-Fidelity Prototypes

- Low-fidelity: simple, often grayscale, focusing on structure and flow.
- High-fidelity: detailed, polished, and closer to the final product.

