Lezione 3 - Embodiment Design

↳ Next step in the design process from what we looked at last time

- Mains steps
- Architecture and layout definition
- Checklist
- Power transmission

From conceptual to embodiment design

Embodiment Design → we turn concepts into physical designs that can deliver the function through some working principle.

Morphological Table is a tool supporting the comparison and combination of different conceptual design variants.

↳ It allows us to look at different possible modes of completing different tasks and giving us an idea on how to connect them.

↳ Can be by text or by sketches.

For the backpack carrier we looked at last time

(Material is a requirement only if the manufacturer only uses set materials)

Functional Requirements:

Position

docking Mechanism

Protection

etc.

Only one possible interpretation

other examples in slides.

After conceptual development, the embodiment design goes on to:

- Define the architecture → definition of hierarchy, shapes and connections
- Preliminary Design: identification of ports and preliminary design of special ports (make or buy)
- Define global shape and dimensions of main ports and related (functional and physical) connections.

Connections → structural (geometrical)
→ for power transfer (energy)
→ transfer of information (bytes, bits and large quantities)

→ We need to realize this since this will define the layout of our systems, these connections constrain our systems.

In the architecture we include the ports which we want to include.

↳ This helps us see all the elements and maybe outline the constraints

↳ Understanding the constraint we begin to understand how to locate the different ports.

Architecture & Functional Requirements (Modular vs. Interconnected)

The part on the left has one part for each requirement, unlike on the right everything is interconnected

↳ We call the type of design on the left modular design, whereas what is on the right we call integral design.

The modular is more modifiable for it's not very optimizable, whereas the integral is optimizable, but if we change one part we change everything (it is more rigid.)

In the modular we can create more versions without changing the design much, it allows us to define a platform to create more versions, It's more adept to the recycling of parts, since integral requires the whole product needs to be thrown out when one part comes to it's end of life.

Coupled Design
↳ Each control affects the functional requirements

Decoupled Design
↳ Different parts affect the functional requirements differently.

It is better to be able to separate what is addressing what.

Architecture and functional Cells
↳ The next step is to outline the schematic connections for our design.
↳ In most case engineers recieve size constraints for designers, this means that we have to play on where to put different elements.

Architecture and layout
↳ the re are many factors that can affect our layout, mass distribution is one of the main ones.

Architecture and physical
↳ Having physical limits puts constraints on our layout and affect how we place different things.

Questions we should ask ourselves:
- what is the minimum size?
- what layout constraints should be considered?
- are there any constraints on material?

- what are the most critical issues?
  ↳ it's better to start with most challenging parts so we can then place parts with more freedom.

Before proceeding to detailed design

Checks before finalizing our layout?

↳ Any safety issue? → Even if we don't want people to do the same
↳ Are there any issues related to product ergonomics?
↳ What is the expected number of products to be manufactured over time (product volume)

→ This is the reason sparkling water bottles have slits to let out gas so the pressure is not too high.

Other questions for different aspects of embodiment design.