Massachusetts Institute of Technology

Architecture of Complex Systems
WEEK 1: SYSTEM THINKING

Key Takeaways

This week's central focus was systems thinking and the variety of outcomes that can be achieved with systems thinking. An entry-level goal of systems thinking is understanding what a system is, examining it, and trying to make sense of it. A more advanced goal of systems thinking is predicting what might happen if something changes. This requires an ability to predict emergence – which is the art and goal of systems thinking.

The four tasks of systems thinking are:

- **Task 1:** Identify the system, its form, and its function.
- **Task 2:** Identify the entities of the system, its form and function, and the system boundary and context.
- **Task 3:** Identify the relationships among the entities.
- **Task 4:** Based on the functions of the entities and their functional interactions, identify the emergent properties of the system.

These tasks lead to a structured thought process that helps in analyzing and understanding the architecture of the system. At the highest level, the goal of systems thinking is to allow us to reason about systems. The world is full of systems that employ increasingly complex architecture. Systems thinking helps unlock complex architectures and reveal their underlying systems.

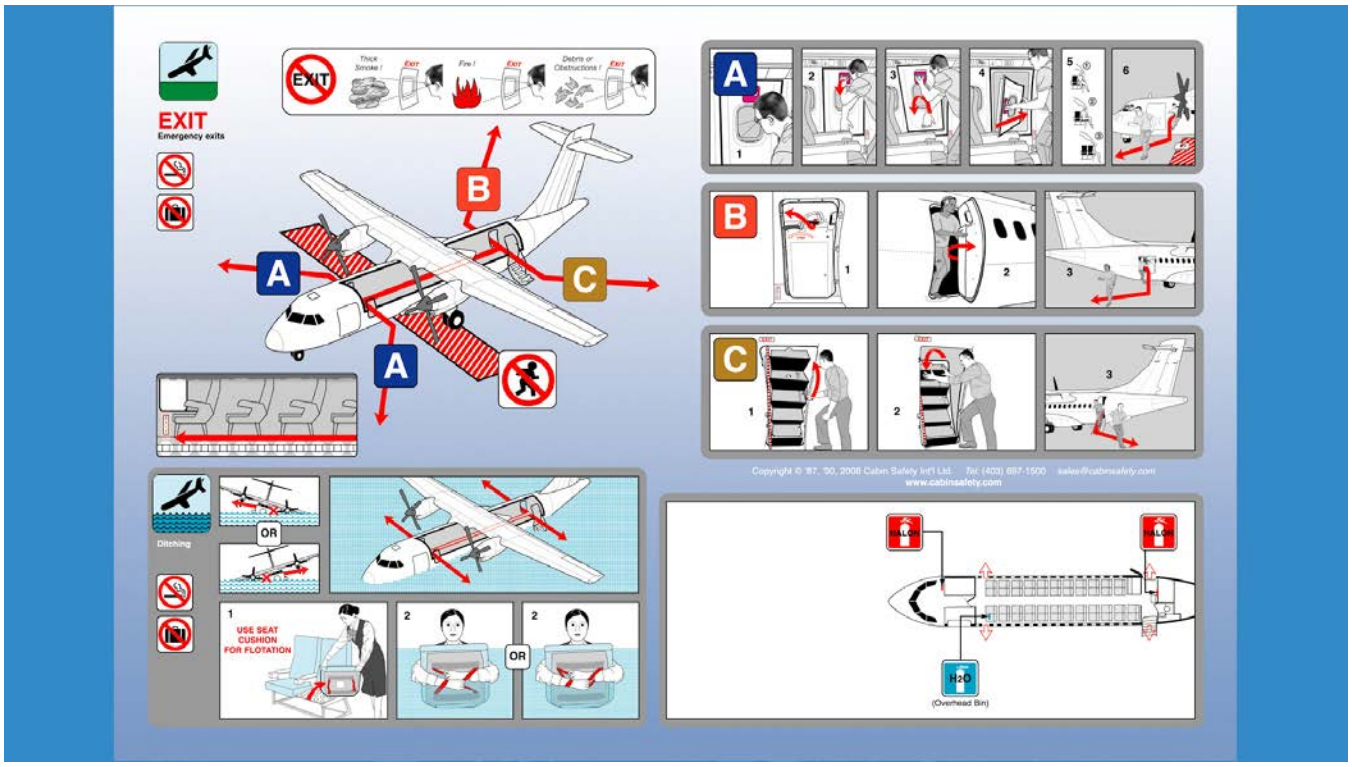
Form was another central theme this week. Form, an instrument of function, is a system attribute that is the physical/informational embodiment of a system which exists or has the potential to exist. Form can be decomposed into objects of form, and those objects have formal relationships or structure.

- Form is what the system is: Objects + structure

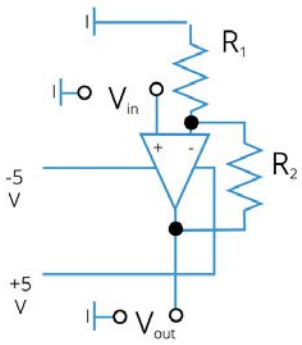
The form of the system combines with other accompanying systems (with which it interfaces at its boundary) to create the whole product system that generates value. You looked at the example of a paper cup (in the "Architecture and Form" discussion) and tried to separate form and function for a better understanding of form. Learning about the form architecture of the system, including the relationship between various form objects, is the first step towards a deeper understanding of system architecture.

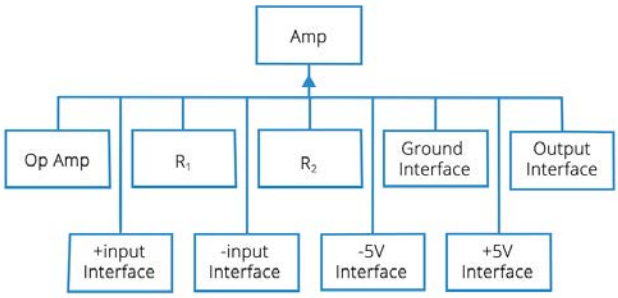
In future weeks, you will look at function in more detail and consider how layers of processes and operands begin shaping the architecture of the system. You will also review the core idea of architecture: the allocation of physical/informational function to elements of form.

Architecture and Form>What Is Form?>

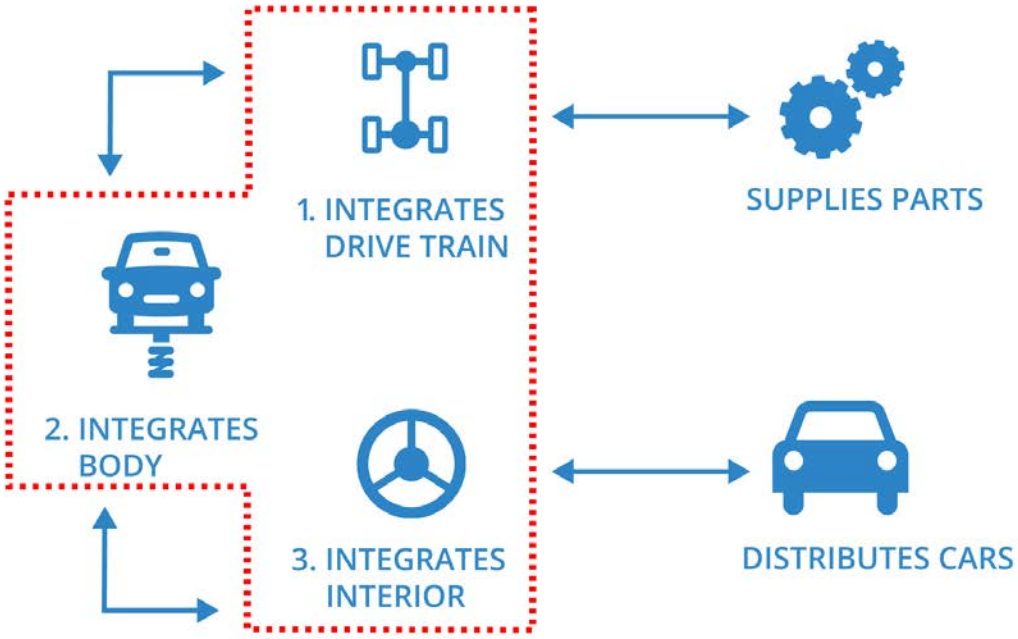


Architecture and Form>Decomposing Form into Entities>

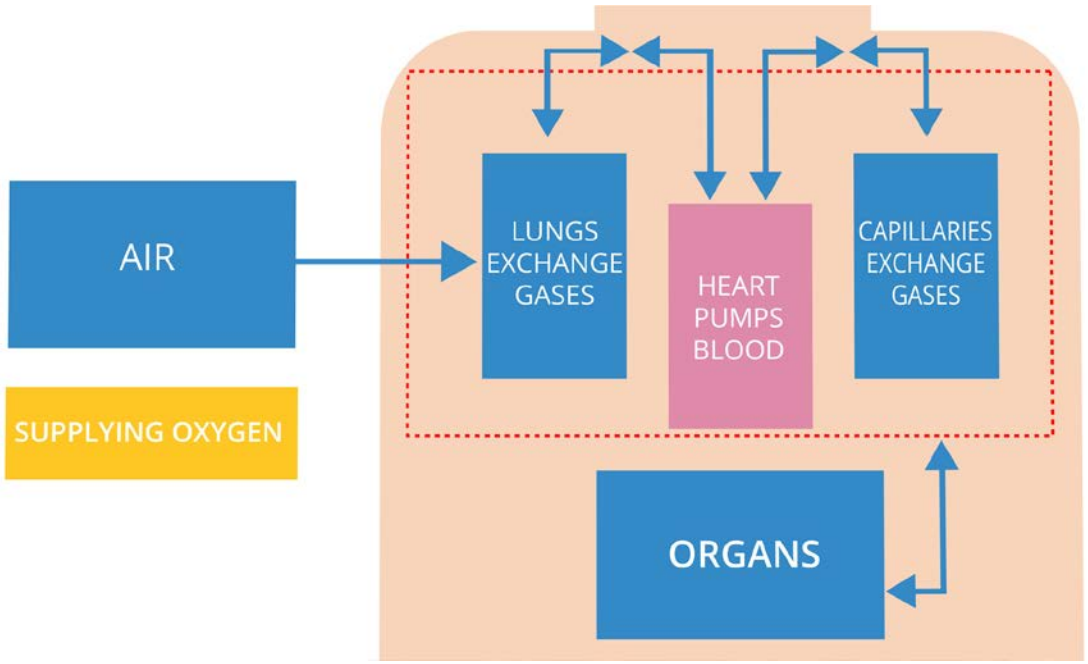




Four Tasks of Systems Thinking>Tasks 1 & 2>



Four Tasks of Systems Thinking>Tasks 3 & 4>



Architecture and Form>Structure and Form>