GST 61 – Assemblies

Formal Description
An assembly is a collection of entities brought together into a particular configuration in which causal interactions occur between the components. Assemblies exhibit varying degrees of causal organisation but do not necessarily generate the emergent properties, behaviours or outputs required to constitute a system. Assemblies therefore provide the physical and causal basis from which systems may emerge.

Plain English Explanation
Before a system can exist, its components usually have to become causally connected. An assembly is a collection of entities in which every component interacts causally with at least one other component.

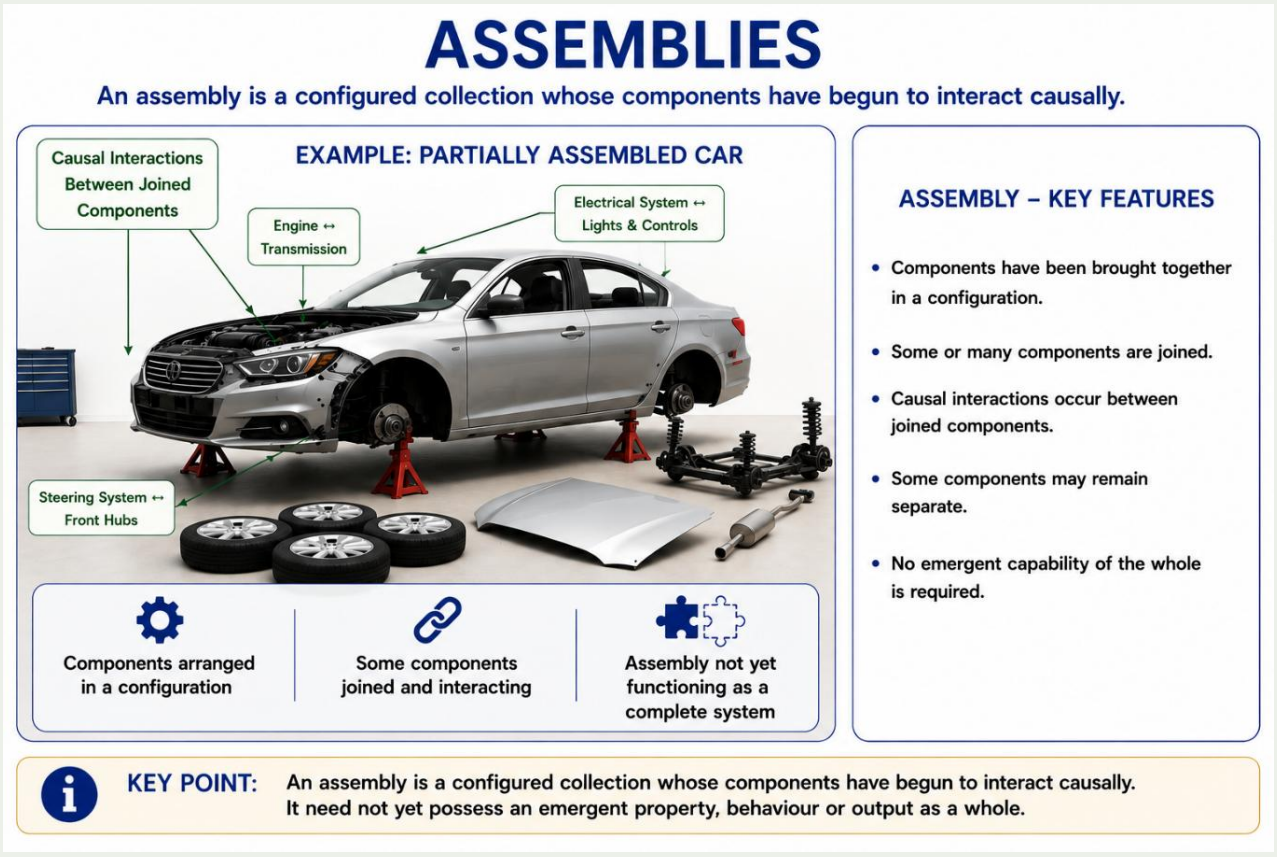
Imagine the parts needed to build a bicycle. If they are stored separately around a workshop, they form a collection rather than an assembly because many of the parts do not interact with one another. Once the parts are brought together so that each becomes physically connected to at least one other part, they form an assembly. At this stage the assembly possesses causal interactions, but it does not yet function as a bicycle.

Assemblies exhibit different degrees of causal organisation. Some contain only simple interactions, while others are highly organised and close to becoming fully functioning systems. What distinguishes a system is not simply the existence of causal interactions, but the organisation of those interactions into patterns that generate emergent properties, behaviours or outputs that the individual components could not produce independently.

Assemblies therefore form a continuum. At one end are simple assemblies in which only basic causal interactions occur. As organisation develops, interactions become increasingly coordinated and new causal capabilities emerge. Once these emergent capabilities become established, the assembly has become a system.

Assemblies occur throughout nature and society. During the construction of a building, the bricks, mortar, beams and other components become causally connected to form an assembly. As construction progresses, increasing organisation develops until the completed building exhibits structural and functional capabilities that none of the individual components possessed independently. The assembly has then become a system.

Understanding assemblies helps us recognise that systems rarely appear instantaneously. Instead, they emerge gradually as causal organisation develops and increasingly coordinated interactions give rise to stable emergent properties, behaviours and outputs.



Examples

A flat-pack wardrobe contains all the necessary components assembled into one package. As individual parts are joined together they begin to interact mechanically. However, only when the completed structure can support loads and provide storage does the assembly function as a wardrobe system.

During the early stages of embryonic development, cells continually exchange chemical signals, nutrients and mechanical forces. These interactions become progressively more organised as tissues and organs develop. The embryo illustrates how assemblies can develop continuously into highly organised biological systems through increasing causal organisation.

Provenance and Links

The concept of assembly is widely used in engineering, manufacturing and biology to describe the bringing together of components during the formation of more complex structures. Assembly Theory has highlighted the importance of assembly processes in understanding the emergence of complexity. Within General Systems Theory, assemblies are distinguished from systems by recognising that causal interactions may already exist between components, but that systemhood depends upon the emergence of sufficiently organised causal interactions capable of producing new properties, behaviours or outputs.

Practical Exercise

Choose a familiar object, such as a bicycle, a computer, a piece of furniture or a household appliance.

Describe how its components are brought together to form an assembly. Identify the causal interactions that begin to occur as the components are connected.

Then explain which emergent property, behaviour or function marks the point at which you would regard the assembly as having become a system. Consider whether this transition occurs suddenly or gradually as causal organisation develops.