GST 65 – Representing Systems for Investigation

Formal Description

The representation of a system depends upon the purpose of the investigation. An entity may be represented as the system of interest, as a subsystem or as a component according to the explanatory relevance of its own emergent properties, behaviours or outputs. Changing the representation does not change the underlying reality. It changes only the level of causal organisation explicitly represented within the investigation.

Plain English Explanation

The real world does not come neatly divided into systems, subsystems and components. These are ways of representing reality so that we can understand it more effectively.

When we investigate something, we first decide what we wish to explain. This becomes our system of interest. We then decide how much detail is needed to explain its behaviour.

Suppose we are investigating how a person grasps an object. In this investigation, the hand is naturally represented as a subsystem of the arm, while the bones, muscles, tendons and ligaments are represented as components of the hand. Their detailed biological behaviour is not the focus of the investigation because we are interested primarily in how they work together to produce grasping.

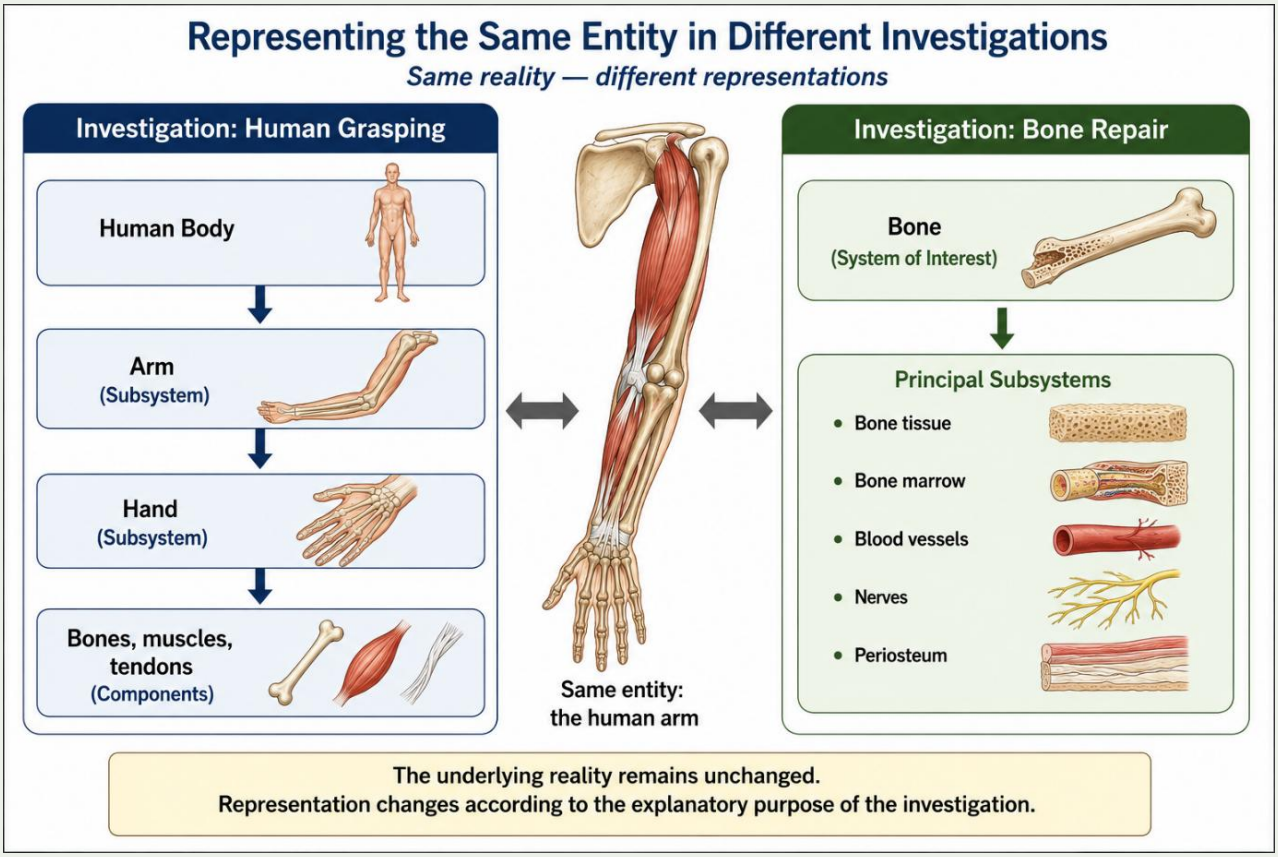
Now suppose we investigate how bones repair themselves after a fracture. The underlying reality has not changed, but our representation has. The bone now becomes the system of interest. Its cells, blood supply and internal structure become the components that explain its behaviour.

This illustrates an important principle of General Systems Theory. The same entity may be represented differently in different investigations. Whether an entity is represented as a system, subsystem or component depends not upon the entity itself but upon the purpose of the investigation and the explanatory relevance of its own emergent properties, behaviours or outputs.

Choosing an appropriate representation is an important part of systems investigation. Representing too much detail may obscure the essential behaviour of the system, while representing too little may overlook important causal mechanisms. Effective systems investigation therefore seeks an appropriate balance between explanatory power and unnecessary complexity.

The underlying reality remains unchanged. Only the representation changes.

The following modules explain these representational concepts in increasing detail, beginning with components.



Examples

A river may be represented as a component of a catchment when investigating regional water resources. The same river may become the system of interest when investigating flooding, ecology or water quality.

A university department may be represented as a component of a university when investigating institutional governance. The same department may become the system of interest when investigating teaching quality or research performance.

A human heart may be represented as a subsystem of the circulatory system when studying the body as a whole. It may become the system of interest when investigating heart disease.

Provenance and Links

General Systems Theory has long recognised that the representation of systems depends upon the purpose of the investigation and the choice of system boundary. Within a Critical Realist perspective, the underlying causal organisation exists independently of the observer, while the representation selected reflects the explanatory needs of the investigation. Different representations may therefore describe the same underlying reality without contradiction, provided each is appropriate to its investigative purpose.

Practical Exercise

Choose a familiar object such as a bicycle, a tree, a computer or a human hand.
Describe two different investigations involving the same object.
For each investigation:

- Identify the system of interest.
- Decide which entities should be represented as subsystems.
- Decide which entities should be represented as components.
- Explain why these representational choices are appropriate for the investigation.

Finally, explain why the underlying physical reality remains unchanged even though the representation has changed.