



GST 71 – System Environments

Formal Description

A system environment comprises all entities, processes and causal networks lying outside the boundary of a system that are capable of influencing, or being influenced by, that system through transfers of matter, energy or information. A system may participate simultaneously in several environments because it interacts with several external causal networks. Many environmental causal networks are themselves recursively organised, giving rise to nested environmental hierarchies.

Plain English Explanation

No system exists in complete isolation. Every system operates within one or more environments consisting of everything outside its boundary that is capable of interacting causally with it. The environment therefore includes all external causal networks that may influence the system or be influenced by it. These causal networks may be assemblies, pre-systemic assemblies or complete systems. They may provide resources, impose constraints, exchange matter, energy or information, or otherwise influence the behaviour of the system. Thus, a system's environment may comprise multiple other systems or parts of multiple other systems.

Many of these external causal networks are themselves components of larger systems. For example, a surgeon interacts directly with an operating theatre, but the operating theatre forms part of a surgical department, which forms part of a hospital, which in turn forms part of a national healthcare system. The surgeon's healthcare environment can therefore be represented as a nested hierarchy of systems.

A system may also interact with several different environmental hierarchies simultaneously. The same surgeon interacts not only with the healthcare system but also with family, transport, professional organisations, government regulation and wider society. Each of these forms part of the surgeon's overall environment because each is capable of causal interaction with the surgeon. Each may also belong to a different systems hierarchy.

Closely coupled systems obtain most of the resources necessary for their functioning from one dominant parent system and are therefore conveniently represented by a single environmental hierarchy. More loosely coupled systems obtain important resources from several external systems simultaneously and therefore participate in several overlapping environmental hierarchies. Which of these hierarchies is represented depends upon the purpose of the investigation.

Recognising environmental hierarchies helps us organise complex investigations by focusing upon those causal networks most relevant to the question being studied. The hierarchy is therefore a useful representation of the environment rather than the environment itself.

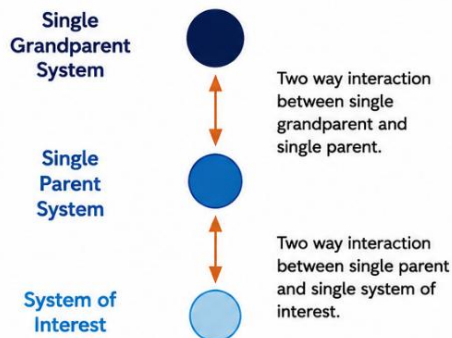
In the next module we shall examine how matter, energy and information cross the system boundary as inputs and outputs, linking the system to its environments.



System Environments: Tight vs. Loose Coupling

TIGHTLY COUPLED SYSTEMS

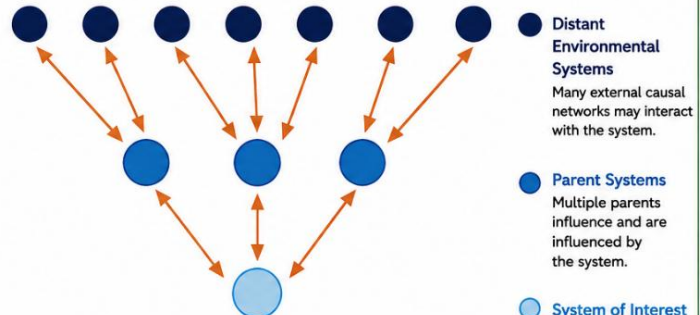
Single dominant parent hierarchy



Most necessary transfers pass through the single parent at each level. The hierarchy is a good representation of the important causal relationships.

LOOSELY COUPLED SYSTEMS

*Multiple parents and grandparents
(branching network)*



Necessary transfers come from several sources. The system participates in several environmental causal networks (hierarchies).

INVESTIGATIVE PRACTICE

The investigator selects the **System of Interest** and then chooses one or more **Hierarchies of Interest** (relevant causal pathways) for representation according to the purpose of the investigation. Other environmental interactions remain part of reality but are not represented.

Single arrow with double head =
Two way interaction

Examples

A manufacturing department operates within the organisational environment of its company while simultaneously interacting with suppliers, customers, regulatory bodies, transport systems, financial institutions and the wider economy. Different investigations may focus upon different environmental hierarchies depending upon the question being asked.

A tree exists within the environment of a woodland, but it also interacts directly with soil organisms, pollinating insects, atmospheric conditions, surrounding vegetation and human activity. These form several overlapping environmental causal networks, some of which may themselves be organised hierarchically.

Provenance and Links

General Systems Theory has long recognised that systems interact continuously with their environments through exchanges of matter, energy and information. Within the present framework, environments are understood as collections of external causal networks capable of interacting with the system of interest. Many of these networks are recursively organised and may therefore be represented as nested environmental hierarchies. The environmental hierarchies selected for representation depend upon the explanatory purpose of the investigation rather than being unique features of reality.



Practical Exercise

Choose a familiar system such as a school, a hospital, a business or a biological organism.

1. Identify the system boundary and the system of interest.
2. Identify at least four different environments capable of interacting with the system.
3. For each environment, identify one or more systems or processes that influence the system of interest.
4. Choose one environmental hierarchy that is particularly relevant to your investigation and represent it from the immediate environment to the widest environment considered.
5. Explain why this environmental hierarchy was chosen and identify at least one important environmental interaction that lies outside it.

Finally, explain why representing one environmental hierarchy does not imply that other environmental interactions cease to exist.