SST-23 How Constraints Interact

Returning to the hospital example, imagine that the new patient care protocol is now in use.
Some parts of the system are working well. The equipment is available, and staff are trained.
However, delays are still occurring, and patient outcomes are inconsistent.
Looking more closely, the issue is not any single constraint. Instead, different constraints are interacting:

- Procedures require multiple approvals, slowing decisions.
- Staff interpret the protocol differently depending on their experience.
- Established practices discourage deviation from familiar routines.
- Resource pressures limit the time available for careful implementation.

Each of these factors affects the others. Decision delays influence how staff interpret situations. Cultural expectations shape how procedures are followed. Individual judgement interacts with structural rules.
The result is a pattern of behaviour that cannot be explained by any one factor alone.
To understand what is happening, we need to look not just at individual constraints, but at how they combine and influence one another.

Formal Description

Constraint interaction refers to the combined causal influence of multiple constraints across different domains in shaping system behaviour.

These interactions may be expressed in simplified form as:

- **Biogenic + Cultural → Agentic**
- **Agentic + Material → Structural**
- **Structural + Agentic → Cultural**
- **Structural + Cultural → Agentic**

These expressions describe typical patterns of influence rather than fixed or universal relationships. They indicate that the behaviour of one constraint domain is influenced by the combined effects of others. They represent patterns of causal influence rather than precise mathematical relationships.

Constraint interactions give rise to:

- **alignment**, where constraints reinforce one another, producing stable patterns of behaviour;
- **misalignment**, where constraints conflict, producing instability, inconsistency, or transition between patterns of behaviour.

Feedback arises when the outcomes of system behaviour modify the constraints that produced them, reinforcing or disrupting existing configurations.

System behaviour is therefore understood as emerging from the configuration and interaction of constraints over time, rather than from isolated causes.

Plain English Explanation

In real systems, constraints do not act on their own. They interact with one another, and it is this interaction that shapes behaviour.

For example, the way people make decisions (agentic constraints) is influenced by both their needs and capacities (biogenic constraints) and the shared expectations around them (cultural constraints). At the same time, those decisions affect how work is organised (structural constraints), and over time, patterns of interaction influence what people come to see as normal or acceptable (cultural constraints again).

These relationships can be thought of in simple terms. Certain types of constraint tend to combine to influence others. For example:

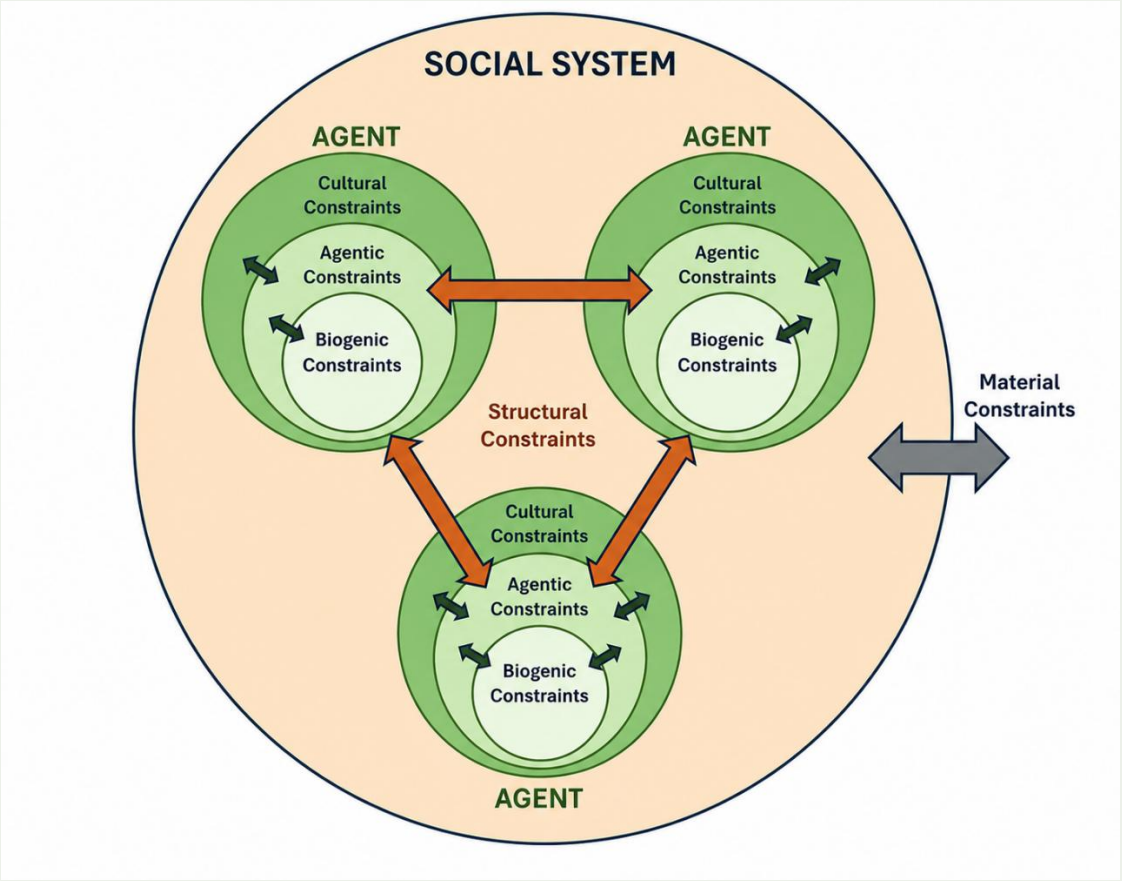
- biological needs and cultural expectations influence how people decide and act;
- decisions made under particular conditions shape how systems are organised;
- patterns of interaction reinforce shared beliefs and expectations;
- existing structures and cultural norms influence future decisions.

When these influences are consistent with one another, the system tends to settle into stable patterns of behaviour. Things work smoothly because the different constraints are aligned.

When they conflict, problems arise. People may be pulled in different directions, decisions may be inconsistent, and the system may become unstable or begin to change.

Another important feature is feedback. The outcomes of behaviour can feed back into the system by reinforcing or changing the constraints. For example, if a particular way of working proves effective, it may become standard practice. If it causes problems, rules or expectations may be revised.

So, to understand how a system behaves, it is not enough to list constraints. We need to understand how they interact, whether they are aligned or in conflict, and how they change over time.



Example 1 – Healthcare System
In a hospital:

- **Biogenic + Cultural → Agentic**
  Fatigue (biogenic) and professional norms (cultural) influence clinical decisions
- **Agentic + Material → Structural**
  Decisions made under resource pressure shape how care processes are organised
- **Structural + Agentic → Cultural**
  Repeated patterns of practice reinforce shared expectations

Result:
→ Stable routines emerge when aligned; inconsistency and risk arise when constraints conflict

Example 2 – Transport System
In a rail network:

- Infrastructure limits (material) and operator decisions (agentic) shape scheduling structures
- Scheduling patterns (structural) influence expectations about service reliability (cultural)
- Passenger behaviour and expectations feed back into system operation

Result:
→ Delays and recovery patterns emerge from interacting constraints, not a single cause

Provenance and Links

This module builds on:

- The constraint framework developed in *Constraint Analysis: A Causal Framework for Understanding and Influencing Complex Systems (Challoner, 2026)*
- The Enhanced Morphogenetic Cycle *(Challoner, 2026)* (interaction of structure, culture, and agency)
- Systems theory and feedback concepts

Related concepts:

- Constraint alignment and misalignment
- Feedback
- System stability and instability

Practical Exercise

Think of a system you are familiar with. What is its primary function?

1. Identify:
    - Two different types of constraint acting in the system
    - How they influence each other
2. Describe:
    - One example of **alignment** (constraints reinforcing each other)
    - One example of **misalignment** (constraints in conflict)
3. Reflect:
    - How do these interactions affect the stability or performance of the system?