



SST-15 Regulation of Structural Constraints: Nervous Systems and Learning



A deer stands at the edge of a forest, lowering its head to feed. The scene is calm, but suddenly it pauses. A faint and unfamiliar sound carries across the landscape. In an instant, its body responds. Muscles tense, attention sharpens, and it lifts its head to scan the surroundings. It prepares to move. If the sound signals danger, it will run; if not, it will return to feeding. Its behaviour is not random but coordinated, shaped by the rapid integration of information and response. Now imagine a much simpler organism, one without this capability. It cannot detect distant threats, nor can it coordinate a rapid or flexible response. Its reactions, if they occur at all, are slow and limited. The difference between these two systems is not simply one of greater complexity, but of a fundamentally different kind of capability. The deer can coordinate its behaviour in response to its environment, while the simpler organism cannot. This marks a crucial step in evolution, where systems begin to regulate not only their internal conditions, but also their actions in relation to the world around them.

Formal Description

Structural constraints arise from the organisation of a system and determine what actions or processes can or cannot occur.

The emergence of nervous systems introduced mechanisms for coordinating internal processes and interactions with the environment, thereby altering structural constraint configurations.

Learning further extended this capability by enabling systems to modify their behavioural organisation in response to experience.

Agency is the capacity of a system to regulate structural constraints affecting its own behaviour in ways that affect its viability.



Agency emerges when systems acquire the ability to modify their behaviour in response to conditions affecting access to satisfiers and exposure to contra-satisfiers.

Plain English Explanation

In earlier stages, systems could regulate material constraints — they could maintain themselves physically and chemically.

But they could not act in flexible ways.

The emergence of nervous systems changed this. Systems could now:

- detect changes in their environment
- transmit information internally
- coordinate responses

This allowed behaviour to become a key part of survival.

Instead of passively experiencing conditions, systems could actively respond to them.

Learning extended this further. Systems could adjust their behaviour based on past experience, improving their ability to respond to similar situations in the future.

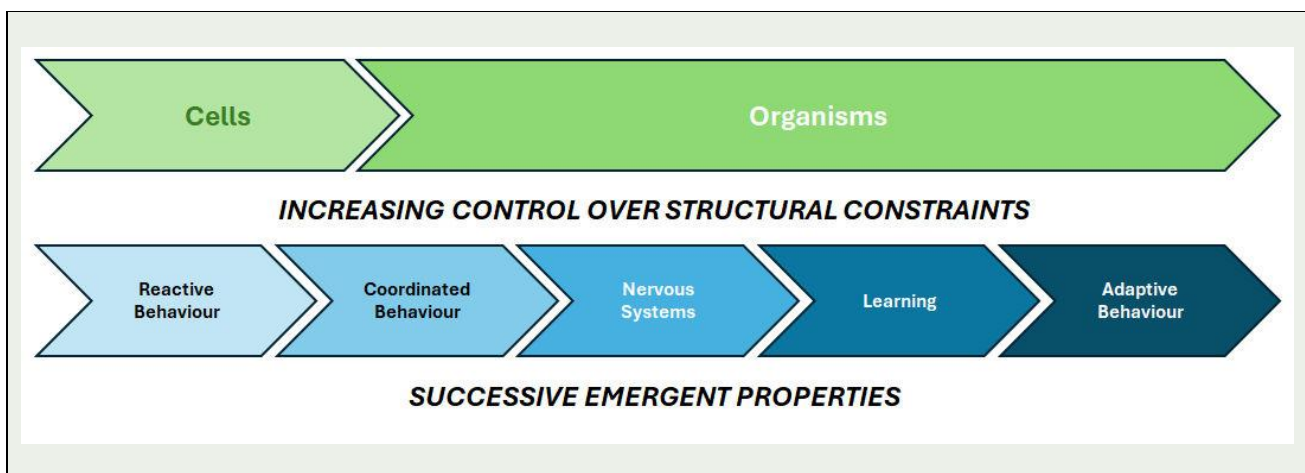
This is where agency begins.

Agency does not mean complete freedom. Systems are still constrained. But they now have the capacity to modify how they act within those constraints.

A system with agency can:

- seek out satisfiers more effectively
- avoid contra-satisfiers more reliably

This represents a major advance in constraint regulation.



Example 1 (Basic organism)

A simple organism responds chemically to stimuli but cannot coordinate complex actions. Its behaviour is limited by its structure.

Example 2 (Animal)

An animal detects danger, processes information, and runs. Its nervous system allows rapid coordination of behaviour.



Example 3 (Learning)

An animal learns where food is located and returns to that location, improving its ability to access satisfiers.

Provenance and Links

This module draws on:

- Neuroscience and learning theory, including Donald Hebb, who proposed that neural connections are strengthened through experience.
- Theoretical neuroscience and predictive processing, including Karl Friston, which explains how organisms regulate their internal states through interaction with the environment.
- Evolutionary theory, particularly the development of increasingly complex organisms capable of coordinated behaviour.
- Systems and sociological theory, including Margaret Archer, whose work on agency provides a foundation for understanding its role in social systems.

This module interprets these developments as the emergence of agency through the regulation of structural constraints.

Practical Exercise

Choose an organism (e.g. animal or human).

Explain:

1. What structural constraints affect its behaviour?
2. How does it sense and respond to its environment?
3. How does learning improve its ability to survive?

👉 Write a short paragraph (6–8 sentences).