



SST 35 – Diagnostic Expansion



During a routine shift at a water treatment plant, an alarm suddenly appeared in the control room. The warning indicated that water quality had fallen outside its normal operating range.

The plant operators immediately knew that something required attention, but the alarm did not reveal the cause of the problem. The treatment plant contained hundreds of components, including pumps, filters, sensors, chemical dosing systems, storage tanks, and control equipment. Any one of these systems, or a combination of them, might be responsible.

Rather than inspecting every component in the plant, the operators began by narrowing the search. First they checked which part of the process was affected. They then examined the equipment associated with that part of the system. Gradually, the investigation became more focused until they identified a faulty sensor that was providing incorrect readings.

The operators did not begin with a detailed analysis of the entire plant. Instead, they moved from a general concern to progressively more specific areas of investigation.

This process of progressively narrowing the search for a problem is common in engineering, medicine, management, and everyday life. It is also central to the diagnosis of social systems.



Formal Description

Diagnostic Expansion is the process of progressively disaggregating a general concern regarding system viability into increasingly specific dimensions, indicators, and areas requiring investigation. This process narrows the search space, allowing attention to be focused on those aspects of a system most likely to require further investigation.

Plain English Explanation

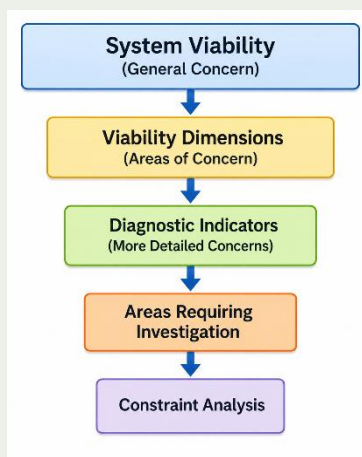
When people encounter problems in complex systems, they rarely begin by analysing every possible cause. Such an approach would usually be impractical because complex systems contain too many interacting parts.

Instead, we typically begin with a general concern. We may feel that something is wrong without knowing exactly what it is. An organisation may appear to be underperforming. A public service may seem to be struggling. A nation may appear to be becoming less effective. At this stage, the concern is real, but it remains vague.

The purpose of diagnosis is to transform that vague concern into a more focused understanding of where attention should be directed. This happens through a process of progressive refinement. We start with a broad question such as "Is this system healthy?" We then break that question into smaller questions concerning different dimensions of system viability. As we gather more information, attention becomes focused on particular functions, processes, or subsystems that appear to be contributing to the problem.

Diagnostic Expansion therefore helps us manage complexity. Rather than attempting to understand everything at once, it allows us to progressively reduce the search space until detailed investigation becomes practical.

The process does not explain the causes of a problem. Instead, it helps identify where explanation should begin. It acts as a bridge between a general concern and a focused investigation.





Example 1 – Medicine

A patient feels generally unwell. The doctor first considers broad aspects of health such as circulation, infection, nutrition, and mental wellbeing. Further investigation gradually narrows attention towards a specific condition requiring treatment.

Example 2 – Engineering

An aircraft develops an unusual vibration during flight. Engineers first determine whether the problem originates from the engine, airframe, landing gear, or control surfaces. Investigation then becomes increasingly focused until the fault is identified.

Example 3 – Education

A school notices declining student performance. Initial concern leads to examination of attendance, teaching quality, curriculum, resources, and student wellbeing. Further investigation identifies the factors most likely to be responsible.

Provenance and Links

The idea of progressive diagnosis appears throughout medicine, engineering, management, and systems science. Herbert Simon's work on bounded rationality highlighted the practical limitations of analysing complex systems in their entirety. Peter Checkland's Soft Systems Methodology similarly recognised the need to progressively structure and investigate complex situations.

This module extends these traditions by formalising the process as Diagnostic Expansion. Within the diagnostics framework, diagnostic expansion provides a structured method for moving from a general concern regarding viability towards specific areas requiring further investigation.

Practical Exercise

Consider an organisation, community, or public service that you know well.

1. Identify one general concern that someone might have about the system.
2. Break this concern down into three more specific questions.
3. For each question, identify one indicator that could provide useful information.
4. Explain how this process helps reduce the complexity of the investigation.