GST 110 — Recognising Genuine Emergence

Formal Description

A capability is emergent when the maintained causal organisation of participating components establishes a capability to produce or accept physical transfers unavailable to those components acting independently.

When components become organised into an assembly, we may observe changes in what they do. However, these changes do not necessarily mean that a new causal capability has emerged. For example, several components may combine their existing effects, an existing capability may become more efficient, or a previously inactive capability may become active. The organisation may also change how existing component capabilities are exercised, without establishing a new one. Alternatively, we may simply recognise a capability that was already present but previously unknown to us. To establish genuine emergence, we must identify a capability that depends upon the organisation of the components and that those components cannot produce or accept independently.

The relevant comparison concerns the capabilities of the participating components and the causal process by which the assembly produces or accepts the transfer. Equivalent emergent capabilities may arise through different organisations.

Plain English Explanation

When several things are put together, the result may do more than any one of them could do alone. But that does not automatically mean a new capability has emerged.

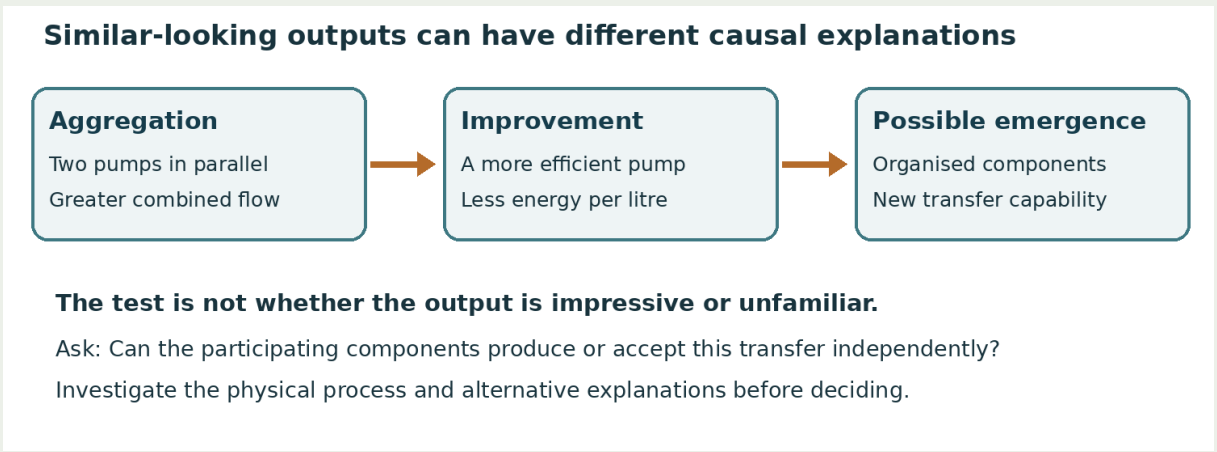
Imagine two pumps connected in parallel. Together they can deliver more water than either pump alone. The increase in flow may simply be the combined effect of capabilities both pumps already possessed. Similarly, a redesigned pump may use less energy to move the same water: that is an improvement, not necessarily a new capability.

Now consider a generator. Its shaft, rotor and windings interact through an organised physical process to accept mechanical work and deliver electrical energy. The important question is whether that organised conversion capability is unavailable to the participating components independently; not whether electricity itself is new.

There are other traps. A capability may have existed all along but only just been noticed. Or a component may already possess a capability that is activated, inhibited or redirected when it joins an assembly. We must trace the actual transfers and test these possibilities before calling the result emergent.

Emergence is therefore a claim about physical causal organisation, not merely a striking outcome or a new way of describing something.

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Schematic comparison. These are candidate explanations, not a decision rule: each case requires investigation of its causal organisation and component capabilities.

Examples

Combined water pumps. Two pumps supplying the same pipe may increase total flow through aggregation. Greater output alone does not demonstrate emergence.

Improved solar cell. A modified cell may convert more of the incident light into electrical energy while exercising the same general conversion capability more effectively. Increased efficiency alone is not evidence of a newly emergent capability.

Electric generator. A maintained arrangement of rotor, stator and other components enables an organised mechanical-to-electrical conversion process. This is a candidate emergent capability because it depends on the components interacting in the appropriate organisation.

Newly discovered enzyme activity. Discovering that an existing enzyme catalyses another reaction is new knowledge, but does not establish that the capability has newly emerged. Its causal history and supporting organisation must be investigated.

Provenance and Links

This account follows the distinction between assembly, causal capability and emergence developed in *Causal Assembly Theory and A Causal Account of Emergence*, (Challoner, 2026).

Related concepts: emergent capability; causal integration; latent causal potential; ontological versus epistemic novelty; physical transfers. The next modules examine the maintenance of capabilities and causal integration in greater detail.

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Practical Exercise

Consider the following three cases:

(a) A bicycle with gears. A cyclist changes to a lower gear and finds that climbing a steep hill becomes easier. The bicycle's components and their arrangement remain unchanged, but the way they interact has been altered.

(b) A flock of birds. A group of birds flies together, changing direction in a coordinated manner. Each bird can fly and respond to its surroundings independently, but the flock exhibits patterns of movement not normally observed in individual birds.

(c) A workplace team. Several employees who previously worked independently are brought together to deal with customer enquiries. They begin sharing information and coordinating their activities, enabling the team to handle enquiries that individual employees previously found difficult.

For each case:

1. Identify the capability that appears to have been established or changed.
2. Identify the physical transfers involved, including any transfers of physically embodied information.
3. Consider what the participating components could do independently.
4. Decide whether the observed change might represent genuine emergence, an improvement or modification of an existing capability, or another consequence of causal organisation.
5. Explain what further evidence would be needed to distinguish between these possibilities.

Finally, explain why observing a new pattern of behaviour or improved performance does not, by itself, establish that a genuinely new causal capability has emerged.

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