GST 111 — The Maintenance and Latency of Emergent Capabilities

Formal Description

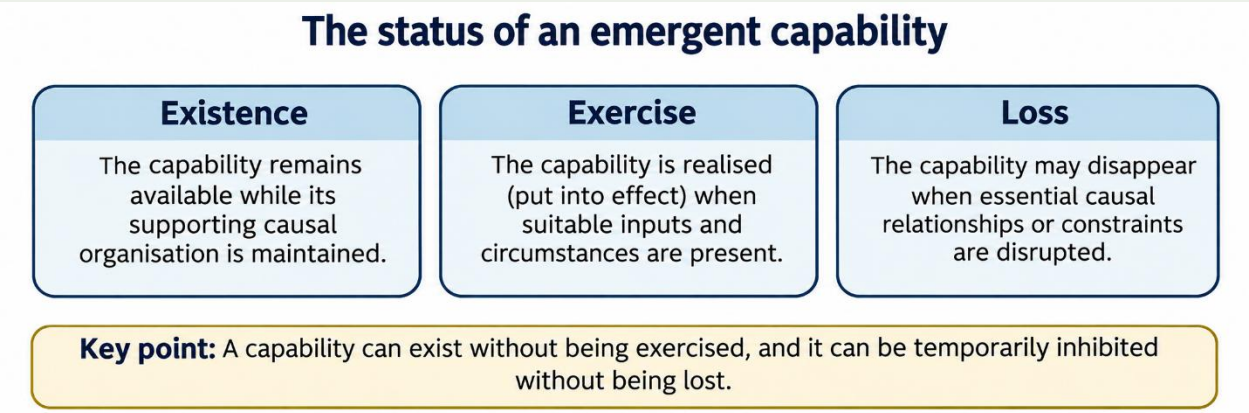
An emergent capability exists while the causal organisation that establishes it is sufficiently maintained. Its existence must be distinguished from its exercise: a maintained capability may remain unrealised when appropriate inputs or enabling circumstances are absent. Its duration may be brief or extended; these are differences in duration, not separate kinds of emergence. Changes in components need not eliminate the capability if the relevant organisation is maintained. Conversely, disruption of essential causal relationships or constraints may remove the capability without complete disassembly. Temporary inhibition of exercise must not be confused with loss of the capability.

Plain English Explanation

A generator can be ready to produce electricity even when its shaft is not turning. The ability is still there because its parts remain organised in the way needed to generate electricity. Turning the shaft under suitable conditions allows the capability to be exercised. If the windings are damaged or the rotor is removed, however, the generator may no longer possess that capability.

The same distinction applies to an enzyme awaiting a suitable molecule, or to a short-lived chemical arrangement that can carry out a reaction only while it remains intact. An emergent capability does not have to operate continuously, nor does it have to last a long time. What matters is whether the organisation supporting it continues to exist.

Components may sometimes be replaced without losing the capability, provided the necessary causal relationships are preserved. We should therefore ask three separate questions: Does the capability exist? Is it currently being exercised? What would cause it to be lost?



The diagram distinguishes a maintained capability, its exercise under suitable conditions, and possible loss following disruption of its supporting organisation.

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Examples

Electrical generator. A correctly assembled generator may retain the capability to produce electrical output while stationary. Mechanical energy entering through the shaft enables electrical energy to leave through the terminals when the circuit and operating conditions are suitable. A broken winding may remove the capability; lack of rotation merely prevents its exercise.

Enzyme. An enzyme can retain the capability to catalyse a reaction while no suitable substrate is present. When the substrate binds under appropriate conditions, physical interactions permit the reaction to proceed and products to be released. Changes that disrupt the enzyme's active organisation can remove the capability.

Short-lived reaction complex. Molecules may temporarily form an organised complex capable of a particular reaction. The capability exists only while the relevant organisation is maintained. Its short duration does not make it a different kind of emergence.

Provenance and Links

Developed in *A Causal Account of Emergence* (Challoner, 2026), building upon the account of maintained causal organisation, causal capabilities and latent causal potential in Causal Assembly Theory.

Related concepts: emergence; maintenance of organisation; latent causal potential; causal coupling; assembly and disassembly.

The examples use established physical and biochemical processes; identifying a particular capability as emergent still requires investigation of the participating components.

Practical Exercise

Consider three cases not discussed in the examples above.

(a) A battery-powered torch is switched off but remains intact.
(b) A group of musicians has rehearsed a piece together but is not currently performing.
(c) A temporary soap bubble forms and then bursts.

For each case, identify a candidate capability, the components and organisation that might support it, and the physical transfers involved when the capability is exercised. Explain what conditions would allow exercise and what changes might remove the capability. Distinguish a capability that is merely inactive from one that has been lost. In the musical example, consider whether the group has acquired a genuinely collective capability or is only combining existing individual capabilities. What evidence would help decide?

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