GST 101 — Recursive Assembly and Organisational Levels

Formal Description

Recursive assembly occurs when an assembly becomes a component of a larger assembly. Its parts can remain organised while it takes on a new role. The same entity can therefore be studied as a whole at one level and as a component at another.

An organisational level identifies how assemblies are nested. A level of emergent capability identifies what an assembled entity can produce or accept that its components cannot separately. A further stage of assembly establishes another level of nesting. Whether it establishes a new capability is a separate question.

By the end, the learner should be able to map two levels of organisation, i.e., levels of assembly and levels of emergence, trace the transfers connecting them and explain what evidence would establish an emergent capability at either level.

Plain English Explanation

Nested Assemblies

Suppose A and B become organised as an assembly C, while D and E become organised as an assembly F. C and F can then become components of G. If they retain their internal organisation, A and B still participate in C and D and E still participate in F. The additional step is the relationship established between C and F. Nesting in this way gives us new levels of organisation.

Emergence and Levels of Causality

To see how emergence can also give us a new level of causal relationships, consider what happens when one person speaks to another. Suppose the former says to the latter, “The meeting has moved upstairs.” The speaker’s breathing, vocal cords, tongue and lips work together to produce the sounds of speech. The speaker also draws on their knowledge of the language to put those sounds together into a message. No one of those components can produce the spoken message independently.

The listener’s ears respond to the sound, and their nervous system processes it. If the listener knows the language, then they can understand what the speaker is telling them and may go upstairs. The listener’s ear alone can respond to the sound, but it cannot understand the message.

The message is carried by sound. What makes it an emergent transfer is that the organisation of one person enables them to produce a spoken message and the organisation of another enables them to receive and understand it. This establishes a causal relationship between the two people that their components could not establish independently. This new level is ontological: a person can change what another person knows or does by speaking to them. That is something that can happen in the world, not simply a different way of describing the sound.

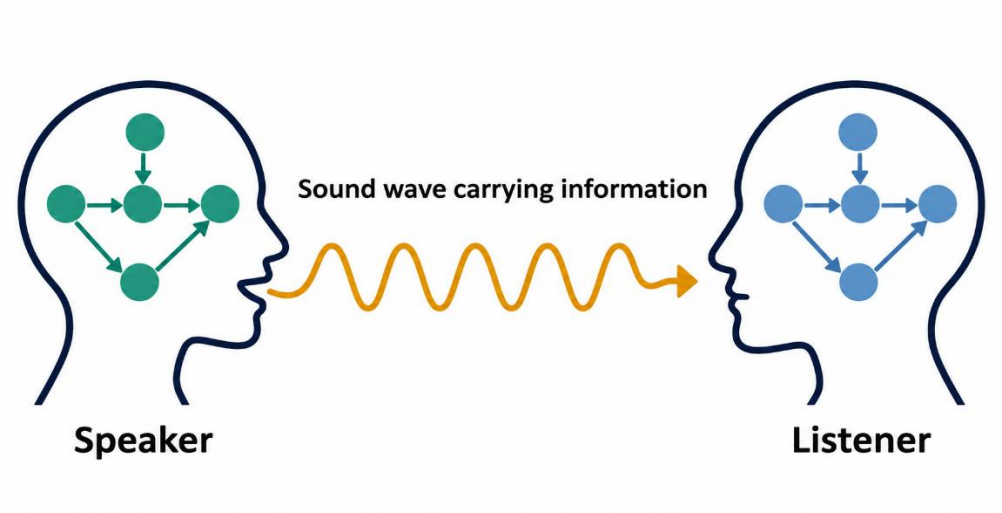
What Carries Over When Assemblies Join

The speaker and listener can already use language to exchange information. Suppose they now work together to check two rooms and report which one is ready for a meeting. Each checks a different room, and one passes their findings to the other. Both retain their ability to speak and understand, but their roles now determine who checks each room and who puts the findings together. Those capabilities remain available even when neither person is speaking.

To assess emergence, we should specify what the team can transfer and under what conditions. Suppose neither person can check both rooms before the report is due. By dividing the checks and sharing what they find, the team can give the organiser a report based on both inspections in time for a decision. The spoken message between the two people is an internal transfer. The combined report

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is an output of the team. To establish that the capability is emergent, we should ask whether either person could deliver the same report independently under comparable conditions, and whether the team could still deliver it if they could no longer share their findings.
Existing assemblies can contribute to further assembly in other ways. A cell, for example, produces and brings together molecules that become parts of cellular structures. Those structures can then participate in other processes. Assembly can add levels of organisation, while disassembly and reorganisation can remove or simplify them. Whether a new level also brings a new capability depends on what the assembled whole can do.



The speaker's organisation enables them to produce a spoken message. Sound carries the message to the listener, whose organisation enables them to understand it. The transfer connects two people at a level of causal organisation that their individual components cannot achieve independently.

Examples
An assembly can retain a capability even when it is not using it. When one assembly delivers an emergent output and another can accept it as an input, that transfer can establish a causal relationship at the level of the assembled wholes.
A generating unit and a pumping unit. A hydroelectric generating unit can use flowing water to supply electricity. A pumping unit can accept that electricity and use it to move water elsewhere. The turbine alone cannot supply electricity, and the pump alone cannot take electricity as its input; it needs the motor and its connection to the pump. The electrical transfer therefore lets the generating unit drive the pumping unit. Both units retain these capabilities while they are idle, provided their components remain connected and ready to operate.
A fruiting plant and a fruit-eating bird. A plant can produce ripe fruit containing seeds. Its leaves supply sugars, its stems transport materials, and its flowers develop into fruit. No one of these parts can produce the fruit independently. A bird can take the fruit as food because its beak, swallowing muscles and digestive organs work together. The plant retains the capacity to produce fruit between fruiting seasons, and the bird retains the capacity to eat it between meals. When the transfer occurs, the plant as a whole supplies food to the bird as a whole.

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An orchestra and a dance company. An orchestra can deliver a live performance in which several musical parts are played together. No individual player can deliver that performance alone. A dance company can take the performance as an input: the dancers use shared musical cues to time their movements in relation to one another. Rehearsal keeps both capabilities available between performances. When the orchestra plays for the company, it can guide the timing of a coordinated dance through the music it delivers.

In each example, the component interactions explain how the transfer is produced or received. The new causal relationship is what becomes possible between the assembled entities.

Provenance and Links

This module applies the account of nested participation and transfers in *Causal Assembly Theory: Assembly and Disassembly as Causal Processes*. It builds on GST 99 and GST 100, and introduces the retained capabilities developed in the next module.

Challoner, J. A. (2026a). Foundational causality. Rational Understanding. https://rational-understanding.com/efgst/

Challoner, J. A. (2026b). Causal assembly theory: Assembly and disassembly as causal processes. Rational Understanding. https://rational-understanding.com/efgst/

Practical Exercise

1. **Map the assemblies.** Draw A and B as components of C, D and E as components of F, and C and F as components of G. Choose a concrete example that fits this pattern and label each assembly and component.
2. **Trace the transfers.** Identify one transfer between components within F and one from C to F. For the second transfer, explain how it can be an output of C and an input to F, while remaining internal to G.
3. **Test for emergence.** Propose one capability for C or F and another for G. For each, specify what the assembly can produce or accept, under what conditions, and what evidence would show that its components cannot do the same independently. For G, consider what would happen if C and F were disconnected while each remained intact. Which capabilities would remain, and which, if any, would be lost?

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