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When Complexity is ***transformed*** into coherence, it leads to emergence.

The ''transformation'' variable can be self-organized, or directed from a node or group of nodes, and both options don't exclude each other because they depend on the point of view of the observer.

For example, a human directly designing an AI model can be seen as an exogenous organization from the perspective of analyzing the individual and their specific frame of analysis. However, if we change the scale and analyze it over a higher temporal lapse, it can be recognized as a species adapting by self-organizing within its new environment.

The key insight is that these two modes are not mutually exclusive. What appears as directed design at one scale may function as a component of self-organization at a higher scale. They can be nested within each other, demonstrating how structure emerges across different levels of organization.

For algorithmic reasons, I'll name this transformation as a variable called ''Structuring Process'', so now we can analyze the context with concept-driven structures and also the machine learning algorithms that make them empirically provable.

Let a system be a set of components $S=c1,c2,\ldots,cn$.

The initial state of the system is characterized by its Complexity, $C(S)$, a measure of its entropy or dimensionality.

A **Structuring Process**, denoted by P, transforms the system based on a given **Scale** parameter, σ. The process maps the initial complex state to a new, ordered state, S'.

$$P\sigma:S\longrightarrow S'$$

This transformation results in **Coherence**, $H(S')$, which is a measure of the emergent order or reduced complexity in the new state, where $H(S')<C(S)$. This coherence gives rise to a global **Emergence**, E, a property of S' not observable in the individual components $ci\in S$.

The process P can be defined in two ways:

1. Exogenous (Directed) Organization:

The structuring principles are imposed by an external agent via an objective function or blueprint, Φ. The resulting system S' is the one that optimizes this external goal.

$$Pexo(S,\Phi)\longrightarrow S' \textbf{ such that } S'=args{*}min\Phi(s{*})$$

2. Endogenous (Self) Organization:

The structuring principles are defined by a set of local rules, R, that govern the interactions between components c_i. The system evolves iteratively, $S_{t+1}=R(S_t)$, until it reaches a stable state, S'.

$$P_{endo}(S,R) \rightarrow S' \textbf{ where } R(S') \approx S'$$

Nesting of Processes:

As mentioned, the two modes are not mutually exclusive. A directed process can operate on the emergent structures of a self-organized one. This can be represented as a composition of functions:

$$P_{total}=P_{exo} \circ P_{endo}$$

$$P_{total}(S)=P_{exo}(P_{endo}(S,R),\Phi)$$

So, we could describe it also by saying that when complexity is transformed into coherent complexity, it leads to emergence.

This is because complexity without coherence also exists, and we can observe those dynamics, but they tend to eventually collapse if the incoherence gets too high. Complexity + Critical Incoherence Threshold. = Self-Implosion, which will be approached in a separate and specific document.

We can then empirically notice that:

Coherent complexity is or leads to emergence, or that emergence is stacked coherent-complex loops that converge into an intent or objective.

Like described with the presented concepts and algorithms, those definitions don't exclude each other because they depend on the point of view of the observer; they can be nested.