Rule of Recursion

All elements that define viability, on one level of recursion, of a system must occur on all levels of recursion of the system.

For a complex agent to be viable or for a simple agent to be effective in a complex environment, (of agents) the Agent must be “acted upon” (and/or be acting) at a minimum of three Levels of Recursion (“above,” at the level of the Agent and a level “below” the Agent).

Actions that on a single Level of Recursion that are additive, on multiple Levels of Recursion will usually be multipliers. leverage is accomplished by employing more than one Level of Recursion (thus, dealing with the Requisite Variety Rule: Variety must equal Variety). Generally, greater complexity can be dealt with or accomplished by employing Recursion than by action on one level of a system (given the same number of actions and level of resources).

Emergence happens “between” (out of) Levels of Recursion.

Rule of Iteration

All things being equal, a single iteration of work, in isolation, is additive between steps while multiple iterations of work (in a continuous process) multiplies results.

Work iterations must happen in rapid succession and within time compression for maximum effect.

Rule of Feedback

Feedback is the message from a sensor of the system to the controller of the system of the difference between performance and expectation. Positive feedback amplifies; negative feedback attenuates.

Feedback on feedback and/or feedback between Levels of Recursion is feedback of a complex kind and is required for the governance (self correction) of complex and emergent systems.

Rule of Iterative, Feedback Driven Systems acting on Multiple Levels of Recursion

These systems exhibit increasing returns and learning. They co-evolve (with their environment) emergent behavior. They are open-ended and cannot be predicted or controlled.

These systems can be operated in a way so that the desired kinds of results are consistently accomplished. This is possible when the Rules of Iteration, Feedback and Recursion are employed in a System of specific architecture (as described) that employs sufficient critical mass. Emergence is the result of complexity. Complexity is a factor of iteration, feedback, recursion, critical mass and the number of Agent (nodes) interactions in a specific time period and place.

Principles of Iteration and Feedback

and

The Rule of Recursion