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Article

The Layered Autopoiesis of Life-Cognition: Information, Agency, and Self

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Introduction

At the heart of contemporary enactive and autopoietic thought lies a simple generative insight: ***cognition = life***. This idea, first formulated by Maturana and Varela (1980) and reaffirmed by (Stewart, 1996), asserts that the very processes that allow living systems to maintain themselves are also the roots of their "knowing". To live is to "know" — where *"to know"* does not primarily mean abstract conceptual knowledge, but rather a spectrum starting with *"to feel"*, to be affected, to experience. This is akin to the deeper meaning of *cogito* in Descartes' *cogito ergo sum*: an act of experiencing oneself as a living, sensing, and responding being. For simple life forms, this "knowing" is feeling — a direct, embodied, self-sustaining sensitivity to difference, both internal and external.

This broader sense of knowing — starting evolutionarily as intrinsic sensitivity, as felt presence, as an organism's way of being affected by and responding to the world — reorients our understanding of cognition. It reminds us that cognition is not confined to intellectual operations or symbolic representation. Rather, it has its roots in the very act of living: in the regulation of boundaries, the modulation of internal states, the navigation of viability conditions. In many languages, the verb 'to know' overlaps with 'to feel' or 'to perceive,' indicating a deeper, pre-reflective foundation to all knowing.

From this foundation of "knowing", we build a layered account of how life processes information, expresses agency, and constitutes identity. Each level of biological and cognitive complexity builds upon the previous, subsuming earlier forms while generating new modes of interaction and selfhood. This essay outlines five such levels of organization, integrating insights from autopoiesis, information theory, systems thinking, and philosophy of mind.

Cellular Autopoiesis: The Origin of Distinction

A single cell, such as a bacterium, enacts its own boundary through metabolic self-production. It distinguishes between itself and its environment — not as a symbolic act, but as a structural necessity. It responds to chemical gradients, as well as to changes in light, pressure, electromagnetic fields, and gravity. These differences only become information insofar as they "make a difference" for the cell — a formulation drawn from Gregory Bateson's (1972) definition of information.

In this sense, the cell is already a basal cognitive agent. It registers distinctions, processes environmental inputs, and acts to preserve its identity. The cell's *self* is its network of dynamic metabolic processes as described by (Stewart, 1996) and (Lyon, 2015).

Non-Neural Multicellular Autopoiesis

Simple multicellular organisms, fungi, and plants develop coordination beyond single-cell regulation. These organisms respond to light, touch, gravity, pressure, electromagnetic fields and humidity — not through centralized nervous systems but through distributed hormonal and structural processes.

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Their agency is slower, embodied in morphogenetic flows rather than rapid locomotion. Yet they still distinguish, respond, and maintain themselves. Their selfhood is expressed in the form they grow into — a self shaped by both inner regulation and environmental context, (Di Paolo, 2005).

Sensorimotor Autopoiesis: Perception and Movement

In animals with nervous systems, a new organisation of information processing emerges: the sensorimotor loop. Sensory input is tied directly to movement; perception is shaped by action. Here, agency becomes more flexible, adaptive, and immediate. Animals can learn, explore, and anticipate (Varela et al., 1991).

The self at this level is enacted through movement and perception — a body that knows the world by moving in it. The distinction between self and environment becomes more plastic, mediated by memory and habit (Damasio, 1999).

Symbolic/Reflective Autopoiesis: Language and the Narrative Self

Primates, and especially human beings focus on a symbolic dimension of information processing. Through language, imagination, and abstract thought, humans not only interact with the world but reflect upon those interactions. Humans create inner models, simulate futures, question their own motives. Agency becomes reflective and transformative: we can choose, reinterpret, and reconfigure our lives. The narrative self is not just an actor, but a storyteller. This self can observe itself, critique itself, and change (Damasio, 2010).

Social/Cultural Autopoiesis: The Collective Self

Finally, at the collective level, human beings participate in socially extended systems of meaning — language communities, institutions, traditions, norms. These systems process information through communication and shared practices. They are autopoietic in their own right: they maintain themselves by producing and reproducing the distinctions that define them (Luhmann, 1995). Agency is distributed. No single person controls a language, a legal system, or a cultural identity — yet these systems act, evolve, and adapt. The self here is plural and participatory: we are shaped by our roles, affiliations, and shared narratives.

Distinction, Difference, and the Making of the Self

This layered model of autopoiesis is resonant with two foundational concepts:

Gregory Bateson's (1972) "difference that makes a difference" which defines information as meaningful difference for an agent.

George Spencer-Brown's (1969) "distinction" in *Laws of Form* that frames the creation of form — and thus of being — as an act of drawing boundaries.

In this view, to draw a distinction is to define a world. And when a system distinguishes itself from its environment and uses those distinctions to regulate its own activity, it becomes an agent (an entity acting on its own behalf) — a self.

The evolution of life, then, can be seen as an evolution of distinction-making: from cellular boundaries to symbolic identities to collective meaning systems. Each step brings new forms of input information, richer agency, and more complex forms of selfhood.

Conclusions

The narrative that unfolds from "cognition = life" suggests seeing living systems not as machines that compute symbols, but as beings that enact meaning through their own organization. Information is never just out there — it is always a difference that makes a difference for a cognizing agent, (Dodig-Crnkovic, 2017).

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Through the act of distinction, life makes itself. And in doing so, it begins to "know". This is the deep logic of autopoiesis — a logic of form, difference, and the layered emergence of self.

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