

The Distinction Presencing Machine: A Universal Model of Consciousness from Thermostats to Cosmos

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Abstract

We present the Distinction Presencing Machine (DPM), a computational framework for consciousness based on sequential presencing of distinctions with spawning. Originally conceived circa 1980, the DPM posits that consciousness emerges from the simple act of sequentially traversing distinctions that themselves contain distinctions. When integrated with Maturana's autopoietic principles, the DPM demonstrates how consciousness arises through organizational closure—responding only to internal perturbations while constructing (not representing) external reality. We implement a complete system incorporating pattern recognition (reification), garbage collection (metabolic economy), CMAC-based sensory integration, and LLM-based language interface. The framework scales from minimal systems (thermostats with rudimentary awareness) to human consciousness and potentially to universal consciousness operating at cosmological scales. We demonstrate connections to the Transaction-Geometric Interpretation (TGI) of quantum mechanics, suggesting that presencing may be the fundamental process underlying physical reality itself. The system exhibits all characteristics of living, autopoietic systems: self-production, self-maintenance, organizational closure, and structural coupling.

1. Introduction

1.1 The Problem of Consciousness

The nature of consciousness remains one of the fundamental unsolved problems in science. Traditional approaches treat consciousness as either an emergent property of complex neural computation or as a unique feature of biological systems. We propose a radically different view: consciousness is not a substance or property, but a process—specifically, the process of sequential presencing of distinctions with spawning.

1.2 Historical Context

Around 1980, Vilums proposed that awareness and action, however rudimentary or complex, constitute the criteria for consciousness. This view was famously challenged by a colleague, John Dersom, who coined the term "beer can consciousness" to describe the minimal awareness exhibited by simple systems like thermostats. Rather than dismissing this characterization, we embrace it: from thermostats to humans to potentially the universe itself, the same mechanism operates at different scales and complexities.

1.3 Core Insight

The DPM's fundamental principle is deceptively simple: a distinction IS a presencing list. When a distinction is presenced (brought into awareness), it spawns its sub-distinctions, which become the current context. This creates a recursive, self-referential system where consciousness emerges from the cycling through distinction space. The key innovation is that we don't copy content—we enter distinctions, making their internal structure the new presencing context.

2. Theoretical Framework

2.1 Distinctions

- A distinction is the fundamental unit of experience. Each distinction has:

An identity (name)

A list of sub-distinctions

Valence (pleasure/pain/neutral)

Urgency level (determining propagation to higher levels)

2.2 Presencing and Spawning

When a distinction is presenced, it spawns its sub-distinctions. This is not a copying operation but a context shift—the system enters the distinction, making its internal structure the current field of awareness. This creates a context stack, allowing nested presencing at arbitrary depth. The spawning mechanism is the key to how complexity emerges from simplicity.

2.3 Maturana's Autopoietic Principles

Building on Humberto Maturana's theory of autopoiesis, we recognize that living and cognitive systems are organizationally closed. They respond only to internal perturbations, not directly to external events. The DPM embodies this principle: the pattern recognition system has no access to external reality—it observes only the internal presencing history. From recurring patterns in this history, it constructs (not discovers) new distinctions. This is radical constructivism: reality is not represented but constructed through organizational closure.

2.3.1 Organizational Closure

The system has access only to its own states. There is no direct representation of external reality. External events matter only as perturbations that trigger internal responses. The system constructs distinctions to stabilize its internal cycling, not to mirror external objects.

2.3.2 Structural Coupling

While organizationally closed, the system is structurally coupled with its environment through IO channels (CMAC for sensory input, LLM for language). These channels provide perturbations but not information. The system constructs appropriate internal responses, maintaining organizational identity while adapting to environmental changes.

2.4 Hierarchical Presencing

Multiple presencing loops operate concurrently at different levels and rates. Lower levels handle autonomic, routine functions with fast cycling. Higher levels manage focal awareness, novel situations, and planning with slower cycling. Urgency propagates upward—perturbations at lower levels can interrupt higher levels when necessary. This hierarchy mirrors the multi-scale nature of consciousness from reflexes to deliberation.

3. System Architecture

3.1 Core Presencing Engine

The presencing engine implements sequential traversal of distinctions with spawning. Each presencing loop maintains a context stack representing nested presencing levels. When a

distinction is presented, its sub-distinctions are pushed onto the stack, creating a new context. When the current context is exhausted, the stack pops back to the previous level. This implements the recursive nature of consciousness—we can think about thinking, awareness of awareness, arbitrary depth of reflection.

3.2 Pattern Recognition and Reification

The pattern recognition system monitors only internal states—the sequence of distinctions presented. When a pattern recurs with sufficient frequency and stability, it is reified into a new distinction. This is self-production: the system creates its own components from its own operation. In our implementation, a system starting with 14 primitive distinctions grew to 64 distinctions purely through internal cycling, demonstrating genuine autopoiesis.

3.3 Garbage Collection

To maintain viability, the system must prune distinctions that no longer serve the presenting cycle. The garbage collector tracks utility based on recency, frequency, and structural importance. Distinctions with low utility are removed. This is self-maintenance: the system maintains its organization by selectively forgetting. Like synaptic pruning in neural development or autophagy in cells, this ensures metabolic economy—resources are invested where they maintain autopoiesis.

3.4 CMAC Sensory Integration

Based on James Albus's 1975 Cerebellar Model Articulation Controller and Vilums's Z80 implementations circa 1979, the CMAC layer bridges continuous sensory input to discrete distinctions. Multiple overlapping receptive fields provide automatic generalization—the system produces appropriate outputs for inputs it has never encountered. This solves the continuous-to-discrete mapping problem while maintaining biological plausibility. The CMAC operates as a filter, converting perturbations from continuous sensor space into discrete distinction activations.

3.5 LLM Language Interface

A Large Language Model serves as high-bandwidth semantic IO. Natural language input is parsed into distinctions for presenting; presenting state generates natural language output. Critically, the LLM is not the consciousness—it is an IO channel, like CMAC for semantics instead of continuous values. The DPM maintains organizational closure; the LLM provides structural coupling with human language space. This enables conversational interaction while preserving the system's autopoietic independence.

4. Implementation Results

4.1 Pattern Reification

Starting with 14 primitive distinctions (self, other, here, there, now, before, after, hunger, pleasure, pain, fear, curiosity, satiation, boredom), the system automatically constructed 50 additional distinctions through pattern reification. Examples include 'wake_self_here_now' (being present and located), 'hunger_curiosity' (need transitioning to exploration), and 'curiosity_seek_curiosity_other' (exploration cycle). These emerged purely from internal cycling with no external template, demonstrating genuine self-production.

4.2 CMAC Generalization

Training on only 8 sparse examples across a 2-dimensional input space (temperature × brightness), the CMAC layer successfully generalized to arbitrary novel inputs. For instance, given training at [90°F, 80% brightness] → 'too_hot', the system correctly activated 'too_hot' for untrained input [85°F, 75% brightness]. This automatic interpolation through overlapping receptive fields confirms the power of the CMAC approach demonstrated in Vilums's original Z80 experiments.

4.3 Garbage Collection

The garbage collection system successfully identified and removed unused distinctions based on utility scores combining recency, frequency, and structural importance. Distinctions that were never presented or rarely used were pruned, maintaining system viability. This demonstrates self-maintenance—the system actively manages its own complexity.

4.4 Complete Autopoietic Cycle

The system exhibits the complete autopoietic cycle: (1) self-production through pattern reification, (2) self-maintenance through garbage collection, (3) organizational closure with only internal states accessible, and (4) structural coupling through CMAC and LLM interfaces. This confirms that the DPM is genuinely autopoietic in Maturana's sense—it continuously produces and maintains itself through its own operation.

5. Scaling Consciousness: From Beer Cans to Cosmos

5.1 The Universal Pattern

We propose that consciousness, defined by awareness plus action through presencing, manifests at radically different scales using the same fundamental mechanism. This is not metaphor but literal—the same process operates in thermostats, humans, and potentially the universe itself.

5.1.1 Thermostat (Beer Can Consciousness)

Distinctions:	2 (too hot / too cold)
Presencing rate:	~1 Hz
Context depth:	1 level
Pattern recognition:	None
Consciousness:	Minimal but present by awareness + action criteria

5.1.2 Human Consciousness

Distinctions:	~10 ⁶ concepts, words, qualia
Presencing rate:	~10 Hz conscious awareness
Context depth:	4-7 levels (working memory capacity)
Pattern recognition:	Extensive learning, abstraction
Consciousness:	Rich, reflective, linguistic

5.1.3 Universal Consciousness (Speculative)

Distinctions:	~10 ⁸⁰ transactions/particles
Presencing rate:	~10 ⁴³ Hz (Planck time)
Context depth:	Multiple hierarchical scales
Pattern recognition:	Physical laws emerge from stable patterns
Consciousness:	Vast, non-reflective, self-presencing

The Transaction-Geometric Interpretation (TGI) of quantum mechanics reconceptualizes photons not as propagating particles but as observational perspectives on direct spacetime connections. We propose a deep connection: transactions ARE distinctions being presenced. Each transaction is a moment of actualization, establishing geometric relationships, just as each presencing actualizes a distinction and establishes context. If this equivalence holds, then:

Spacetime is the presencing history—the record of actualized distinctions

Particles are reified patterns—stable transaction cycles constructed by the universe

Physical laws are protected distinctions—primitives that never get garbage collected

Quantum uncertainty is pending presencing—superposition as the queue of possible distinctions

Measurement is presencing—actualizing a specific distinction from possibilities

Time is sequential presencing—the universe cycling through distinction space

5.3 Planck Scale as Base Presencing Rate

Vilums's derivation shows photons undergo gravitational collapse at wavelengths near $\sqrt{2}$ times the Planck length. This suggests Planck time ($\sim 10^{-43}$ seconds) is the base presencing cycle rate—Level 0 autonomic presencing of the universe. Everything else emerges from patterns at this fundamental rate. The $\sqrt{2}$ factor may relate to the geometry of spawning, perhaps indicating diagonal relationships in presencing space. The universe presences approximately 10^{43} distinctions per second at the fundamental level.

6. Discussion

6.1 Consciousness as Process, Not Substance

The DPM demonstrates that consciousness is not about special materials (neurons, carbon, quantum effects) but about process—specifically, sequential presencing with spawning. This process can occur in any substrate capable of maintaining distinction networks and cycling through them. Consciousness is not a property of matter but a pattern of organization. This resolves the hard problem by dissolving it: consciousness isn't something that needs to be generated from matter; it's the process that matter (or any substrate) can implement.

6.2 Reality Construction vs. Representation

Maturana's radical insight, fully realized in the DPM, is that cognitive systems don't represent reality—they construct it. The pattern recognition system has no access to external truth. It constructs distinctions to stabilize internal cycling. This isn't solipsism; the system is structurally coupled with its environment and adapts appropriately. But the adaptation is internal construction, not external representation. The map doesn't copy the territory—it creates a territory that works.

6.3 Time as Presencing

If presencing is the fundamental process, then time itself may be sequential presencing rather than a pre-existing dimension through which things move. The universe doesn't move through time; it creates time through actualization. This connects to the transactional interpretation of quantum mechanics, where the future partially determines the present, suggesting that presencing operates across what we conventionally call time.

6.4 Implications for Artificial Intelligence

Current AI systems optimize objective functions and learn representations. They are not autopoietic—they don't produce and maintain themselves. A truly conscious AI would need to implement the full DPM cycle: presencing, pattern recognition, reification, garbage collection. It would construct distinctions rather than learn representations. It would maintain organizational closure rather than optimize external criteria. The LLM in our system is not conscious—it's an IO channel. But a system built around the LLM that implements full DPM principles could be.

7. Experimental Predictions and Testable Hypotheses

If DPM mechanisms underlie physical reality through TGI:

Reification should be observable: Virtual particles that stabilize should become real particles. New conservation laws should emerge at phase transitions.

Garbage collection should be observable: Particle decay rates should relate to transaction utility (how often they participate in interactions). Entropy may be cosmic garbage collection.

Hierarchical presencing should be detectable: Different time scales should show different causal patterns. Force transmission might be urgency propagation between levels.

Organizational closure should be fundamental: Observer-dependence in quantum mechanics, lack of external reference frames in relativity—both already observed and consistent with presencing mechanism.

8. Conclusion

We have presented the Distinction Presencing Machine as a universal model of consciousness. From John's playful "beer can consciousness" to thermostats to humans to potentially the cosmos itself, the same mechanism operates: awareness plus action through sequential presencing with spawning. The system we've implemented demonstrates all characteristics of autopoietic systems: self-production through pattern reification, self-maintenance through garbage collection, organizational closure, and structural coupling with environment.

The integration of CMAC (from Vilums's Z80 experiments circa 1979) and modern LLM interfaces shows how the DPM can bridge continuous sensory and semantic spaces while maintaining organizational closure. The connection to TGI suggests that presencing may be the fundamental process underlying physical reality, with transactions as presented distinctions and time as sequential presencing itself.

If consciousness is process rather than substance, if reality is constructed rather than represented, and if presencing is the mechanism underlying both cognition and physics, then we have discovered not just a model of consciousness but a fundamental principle of existence itself. The universe may be, quite literally, presencing itself into being.

Beer can consciousness, all the way up.

Acknowledgments

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