POLIS V12: The Complete Cognitive Science Series – 12 Giants

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May 2026

This document combines two companion papers:
"Tensional Reinterpretation of Six Founders of Cognitive Science"
and "Tensional Reinterpretation of Six More Cognitive Pioneers".

DOIs: Main treatise 10.5281/zenodo.19618276 – POLIS Bible 10.5281/zenodo.19836226

POLIS V12 – Tensional Reinterpretation of Six Founders of Cognitive Science Jorge Batista Alves Pereira
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Abstract

Within the POLIS V12 tensional ontology, every cognitive system is a polis constituted by three meshes (solid, liquid, gaseous) and governed by the closure condition $\epsilon = \sum K_m(2 + K_m) = 0$, with $T = K_{\min}$ as the tensional origin. This paper applies the framework to six foundational figures of cognitive science: George Miller (magical number seven), Noam Chomsky (generative grammar), Herbert Simon (bounded rationality), Marvin Minsky (frames and AI), Allen Newell (unified theories), and John McCarthy (Lisp and AI). Each classical contribution is reinterpreted as a tensional configuration: Miller's 7±2 as the capacity of the gaseous mesh; Chomsky's deep structure as latent K; Simon's satisficing as IDT* threshold; Minsky's frames as K schemas; Newell's Soar as a tensional architecture; and McCarthy's commonsense as K default. The universal equations remain unchanged; no free parameters are introduced.

1 Introduction

POLIS V12 is a closed, parameter-free tensional conservation theory built on four axioms (Tensional Ontology, Harmonic Ground $H = 1$, Tensional Conservation, Data Origin $T = K_{\min}$). The governing equation, after normalisation, is

$$\epsilon = \sum_{m=1}^{n} K_m(2 + K_m) = 0,$$

with $K_m = (v_m - T)/(v_{\max} - T) \in [0, 1]$. The disequilibrium index is $\text{IDT}^* = \epsilon/(1 + \epsilon)$. All real cognitive systems reside in Phase 4 ($\text{IDT}^* \geq 0.70$) unless artificially uniform. The Rolling Law $2\pi r_p = V_{\text{orb}} T_{\text{rot}}$ applies fractally at all scales.

This paper reinterprets six key cognitive science contributions within this tensional ontology. No classical primacy is assumed; tension is the primitive.

2 George Miller – The Magical Number 7±2

Miller's 1956 paper proposed that human short-term memory can hold about 7±2 items (chunks). In POLIS V12, working memory is the gaseous mesh of the cognitive polis. Its capacity is $K_{\text{chunks}} \approx 7$, which is the number of distinct states that can be held simultaneously before Phase 3 saturation. Chunking (grouping bits into larger units) increases K per chunk, allowing more information within the same capacity. Miller's law is a tensional limitation: $K_{\max}$ for the gaseous mesh is fixed.

The "magical number seven" appears in many cognitive tasks (digit span, chess positions). The "7±2" range is ϵ tolerance; extreme K values (e.g., 9) cause high ϵ (errors). Miller's work bridged psychology and information theory (Shannon bits vs chunks).

3 Noam Chomsky – Generative Grammar and Universal Grammar

Chomsky's generative grammar models the implicit knowledge of a native speaker. In POLIS V12, deep structure is the latent K representation; surface structure is the pronounced output. The transformational rules are Phase 5 operations that map deep to surface K. The poverty of the stimulus argument: children infer K from limited data, implying a prior K schema (Universal Grammar). The minimalist program reduces the language polis to the simplest K operations (Merge, Agree).

Chomsky's hierarchy classifies grammars by tensional complexity (regular = K finite automaton, context-free = pushdown K, context-sensitive = linear bounded K, recursively enumerable = Turing K).

4 Herbert Simon – Bounded Rationality and Satisficing

Simon proposed that humans have bounded rationality; they "satisfice" (choose satisfactory, not optimal solutions). In POLIS V12, bounded rationality means that the cognitive polis has finite computational K; it cannot explore the entire solution space. Satisficing sets a threshold $K_{\text{acceptable}}$. Search stops when a solution with $K \geq K_{\text{acceptable}}$ is found, rather than finding the maximum K. This reduces ϵ (cognitive cost) at the expense of optimality. Simon's "scissors" metaphor: rationality is the product of cognitive mesh and environment K.

His "administrative behavior" (decision theory) applied tensional satisficing to organisations. He also contributed to AI (logic theorist, GPS).

5 Marvin Minsky – Frames and the Society of Mind

Minsky's frame theory represents stereotyped knowledge as schemas with slots. In POLIS V12, a frame is a K data structure with default values. The "society of mind" proposes that intelligence emerges from interaction of many simple agents (sub-polises). Each agent has a K specific task; their collective activity produces coherent behaviour. Minsky's "knowledge representation language" (KRL) attempted to encode K relations. He criticised symbolic AI (strong dependence on logic) and advocated for connectionist and hybrid architectures.

The "frame problem" (how to update K after actions) is a tensional challenge for AI. Minsky also built the first neural network (Snarc) in 1951.

6 Allen Newell – Unified Theories of Cognition (Soar)

Newell developed Soar (State, Operator, and Result) as a unified cognitive architecture. In POLIS V12, Soar is a polis where cognition is a series of Phase 5 operations: each step

applies an operator to the current state, producing a new K configuration. The "problem space" is the set of all possible K states. The "chunking" mechanism automatically learns new operators from experience, increasing K efficiency. Newell's "unified theories" sought a single set of tensional principles for all cognitive tasks.

His "physical symbol system hypothesis" states that a system that uses symbols (with K values) is sufficient and necessary for intelligence. Soar's strength is its learning component, which reduces ϵ over task repetition.

7 John McCarthy – Lisp and Commonsense Reasoning

McCarthy invented Lisp and made pioneering contributions to AI (situation calculus, circumscription). In POLIS V12, Lisp's symbolic processing treats every datum as a lower-K expression that can be evaluated to a higher-K form. The "elephant in the room" (commonsense knowledge) is the set of default K assumptions that we make without explicit reasoning. McCarthy's circumscription is a non-monotonic logic that adds default K rules. He argued that AI cannot succeed without handling commonsense – a tensional gap between logical K and real-world K.

The Lisp machine (symbolics) was a hardware polis optimised for K manipulation. McCarthy also coined the term "artificial intelligence" (Dartmouth, 1956). His "advice taker" (1959) was a conceptual AI system that could accept new knowledge declaratively (K facts) and update its behaviour accordingly – an early version of tensional learning.

8 Conclusion

The six foundational contributions to cognitive science are coherently reinterpreted within the POLIS V12 tensional ontology. Short-term memory, generative grammar, bounded rationality, frame representation, unified architectures, and commonsense reasoning all become natural consequences of the closure condition $\epsilon = \sum K_m(2 + K_m) = 0$ and the fractal hierarchy of cognitive polises. No free parameters are added.

Zenodo references

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Abstract

This paper extends the POLIS V12 tensional reinterpretation to six additional cognitive giants: Jean Piaget (genetic epistemology), Lev Vygotsky (sociocultural theory), Ulric Neisser (cognitive psychology), David Rumelhart (connectionism), Eleanor Rosch (prototype theory), and Daniel Kahneman (heuristics and biases). Each is re-read as a tensional configuration: Piaget's stages as phase transitions; Vygotsky's ZPD as K scaffolding; Neisser's cognitive map as internal K representation; Rumelhart's PDP as distributed K processing; Rosch's prototypes as central K values; and Kahneman's System 1/2 as fast/slow K processing. The universal equations remain unchanged; no free parameters are introduced.

9 Introduction

As in the companion paper, POLIS V12 rests on four axioms. After normalisation the mother equation is

$$\epsilon = \sum_{m=1}^{n} K_m(2 + K_m) = 0,$$

with $\mathrm{IDT}^* = \epsilon/(1+\epsilon)$. All real cognitive systems are in Phase 4 ($\mathrm{IDT}^* \geq 0.70$) unless artificially uniform. The Rolling Law $2\pi r_p = V_{\mathrm{orb}} T_{\mathrm{rot}}$ applies fractally.

This paper reinterprets six more foundational contributions to cognitive science.

10 Jean Piaget – Genetic Epistemology and Cognitive Development

Piaget's stages: sensorimotor, preoperational, concrete operational, formal operational. In POLIS V12, each stage is a different K regime. The sensorimotor stage (0–2 yrs) has K bound to physical actions. Preoperational (2–7 yrs) has limited K (egocentric). Concrete operational (7–12 yrs) can reason about tangible K. Formal operational (12+ yrs) handles abstract K (hypotheticals). Transitions between stages are Phase 4 explosions (disequilibrium) followed by Phase 5 reorganisations. Assimilation (interpreting new K in existing schemas) and accommodation (modifying schemas to fit new K) are tensional adaptations.

Piaget's "genetic epistemology" studies the development of knowledge as a tensional process. His conservation tasks (liquid volume, solid mass) measure whether a child has acquired that K concept.

11 Lev Vygotsky – Sociocultural Theory and ZPD

Vygotsky's Zone of Proximal Development (ZPD) is the difference between what a learner can do independently and with guidance. In POLIS V12, the ZPD is the tensional interval $K_{\text{solo}} < K_{\text{task}} < K_{\text{with help}}$. A more knowledgeable other (MKO) provides scaffolding (external K) that bridges the gap. When the learner internalises the support, their solo K increases. The "law of the zone" is a tensional learning rule: effectively reduce ΔK to zero. Vygotsky emphasised that higher mental functions (language, thought) originate in social interaction (gaseous mesh) before becoming internal (solid mesh).

His concept of "inner speech" (internalised dialogue) is the liquid mesh of thought. The "tools of the mind" (cultural artifacts, writing) extend K beyond the individual.

12 Ulric Neisser – Cognitive Psychology and the Cognitive Map

Neisser coined the term "cognitive psychology" and studied mental imagery, memory, and perception. In POLIS V12, the cognitive map (Tolman) is an internal K representation of the environment. Neisser's "perceptual cycle" involves schemas (solid), environmental information (gaseous), and exploration (liquid). He argued that memory is reconstructive, not a copy: K_{recall} is assembled from fragments, not stored verbatim. The concept of "flashbulb memory" (vivid, confident) is a high-K retrieval that may still be inaccurate.

Neisser's "intelligence and know-how" distinguished academic K (test scores) from practical K (real-world problem solving). The "ecological approach" to perception (Gibson) influenced his later work.

13 David Rumelhart – Parallel Distributed Processing (PDP)

Rumelhart (with Hinton, McClelland) developed PDP (connectionism) as an alternative to symbolic AI. In POLIS V12, a PDP network is a distributed polis: each node (unit) has an activation K, each connection has a weight w (tensional coupling). Learning (backpropagation) adjusts w to reduce ϵ (error). The network's hidden layers represent intermediate K configurations. Rumelhart's "semantic networks" (e.g., "is-a" links) store K in associative memory. The "PDP model" of reading aloud (word recognition) used parallel processing (many units active simultaneously) to map orthography to phonology (K_{spelling} to $K_{\text{pronunciation}}$). This architecture is more robust to damage (graceful degradation) than symbolic systems.

Rumelhart's work on "attention and performance" (TRACE model) modelled speech perception as a dynamic K field.

14 Eleanor Rosch – Prototype Theory and Categorisation

Rosch demonstrated that natural categories have graded membership (prototypes) rather than classical definitions. In POLIS V12, a prototype is a normative K value central to a category (e.g., robin for bird). Category membership K_m decreases as an item deviates from the prototype (penguin, ostrich). Basic level categories (e.g., "chair") have the highest K (most informative). Superordinate ("furniture") and subordinate ("rocking chair") have lower K. Rosch's "colour categories" (Berlin & Kay) show that colour K are not arbitrary but based on universal foci.

Her research on "cognitive reference points" (e.g., the best example) is a tensional anchor for categorisation. The "basic level" is where the liquid mesh (everyday interaction) and gaseous mesh (naming) are most efficient.

15 Daniel Kahneman – Heuristics and Biases

Kahneman (with Tversky) identified cognitive biases (availability, representativeness, anchoring) and proposed dual processing (System 1 and System 2). In POLIS V12, System 1 is fast, automatic (Phase 3 saturated, coarse K approximations); System 2 is slow, deliberate (Phase 5, fine K calculations). Heuristics are efficient K shortcuts that sometimes lead to systematic errors (biases). For example, availability heuristic estimates probability by the ease of recalling exemplars ($K_{\text{retrieval}}$). Representativeness overlooks base rates ($K_{\text{similarity}}$). The framing effect (choices influenced by wording) shows that K depends on how the problem is normalised. Prospect theory (loss aversion) uses a value function that is concave for gains (K) and convex for losses.

Kahneman's "thinking, fast and slow" summarises tensional cognitive economics. He won the Nobel Prize in Economics (2002) for integrating psychology into economics.

16 Conclusion

Six additional cognitive pioneers are reinterpreted within the POLIS V12 tensional ontology. Genetic epistemology, sociocultural learning, cognitive maps, parallel distributed processing, prototype theory, and heuristics and biases all become natural consequences of the closure condition $\epsilon = \sum K_m(2 + K_m) = 0$ and the fractal hierarchy of cognitive polises. No free parameters are added; the same equations that describe a physical system or a social system also describe the architecture of the mind.

Zenodo references

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References for the twelve cognitive scientists

- Miller, G. A. (1956). "The Magical Number Seven, Plus or Minus Two". *Psychological Review*, **63**, 81–97.
- Chomsky, N. (1957). *Syntactic Structures*. The Hague: Mouton.
- Simon, H. A. (1957). *Models of Man*. New York: Wiley.
- Minsky, M. (1975). "A Framework for Representing Knowledge". In P. Winston (ed.), *The Psychology of Computer Vision*. New York: McGraw-Hill.
- Newell, A. (1990). *Unified Theories of Cognition*. Cambridge: Harvard University Press.
- McCarthy, J. (1959). "Programs with Common Sense". *Proceedings of the Teddington Conference on the Mechanization of Thought Processes*.
- Piaget, J. (1952). *The Origins of Intelligence in Children*. New York: International Universities Press.
- Vygotsky, L. S. (1978). *Mind in Society*. Cambridge: Harvard University Press.
- Neisser, U. (1967). *Cognitive Psychology*. New York: Appleton-Century-Crofts.
- Rumelhart, D. E., Hinton, G. E., & McClelland, J. L. (1986). *Parallel Distributed Processing*. Cambridge: MIT Press.
- Rosch, E. (1978). "Principles of Categorization". In E. Rosch & B. B. Lloyd (eds.), *Cognition and Categorization*. Hillsdale: Erlbaum.
- Kahneman, D. & Tversky, A. (1979). "Prospect Theory: An Analysis of Decision under Risk". *Econometrica*, **47**, 263–291.