



Algorithmic Stress and the Collapse of Cognitive Load: Methodological Foundations for Informational Periodization in Human-AI Symbiosis

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Abstract

This working paper introduces the framework of Informational Periodization Human-AI as a methodological model to mitigate cognitive overload and false fluency in generative artificial intelligence environments. The advancement of language models has generated a paradox: The illusion of efficiency conceals a functional degradation in the quality of interaction, driven by poorly formulated and fragmented commands. By functionally transposing the Principle of Adaptation from sports physiology and integrating it with John Sweller's Cognitive Load Theory, this manuscript delimits the causes of algorithmic stress. It introduces the concept of Contextual Reconstruction Load and the necessity of an Audit-Ready External Memory to protect human metacognition. Finally, it demonstrates the practical application of this architecture in data governance and the protection of the chain of custody in complex legal environments.

Keywords: Human-AI symbiosis; Cognitive load theory; Informational periodization; Algorithmic stress; SIOJ

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Introduction

Contemporary society imposes a hyper-competitive scenario driven by a chronic demand for informational speed. Faced with massive volumes of textual and procedural data, technological automation has been embraced as the sole escape to mitigate the scarcity of human time. However, the mass deployment of generative artificial intelligence tools without a guiding method has paved an inhospitable cognitive landscape [1,2].

The biological and evolutionary inclination of the human brain toward the least mental effort has converged with the immediate delivery of automated responses by large language models. Instead of expanding intellect, the naive use of these technologies has generated an accumulation of isolated and superficial outputs. To solve this collapse, it is imperative to design an architecture that governs the flow of informational input and output. The SIOJ (Intelligent System for Legal Organization) proposes this reordering: Before the prompt, the method; before the response, the structure [3].

The Contemporary Problem of Human-AI Interaction

The core error of the modern user classified in this research line as the novice user lies in an obsession with the immediate search for a solution. When confronting a highly complex problem, the operator tends to dump a chaotic volume of raw data and vague guidelines onto the machine [4].

This lack of filtering generates what we define as Algorithmic Stress. Although probabilistic AI models possess no biological metabolism or consciousness, the functional quality of their interaction drastically degrades when subjected to disordered stimuli. The system begins to operate in a zone of noise, inconsistency and analytical hallucination. The human, in turn, receives a formally elegant but structurally fragile text and uses it to feed back into the system, consolidating a vicious cycle of cognitive disorganization [5,6].



Theoretical Foundations

Licklider and intellectual symbiosis

In 1960, J.C.R. Licklider formulated the thesis of man-computer symbiosis, predicting close cooperation in coupling human formulation capabilities with the data processing power of the machine. Licklider argued that machines should act as analytical support, allowing humans to focus on strategic decisions and the assignment of meaning. The current landscape, however, has inverted this symbiosis: The human outsources the formulation and acts as a mere reviewer of automated texts, breaking the Lickliderian premise [7].

Sweller and cognitive load theory

John Sweller (1988) demonstrated that human working memory has strict limits on simultaneous processing [8]. When an individual is exposed to poorly structured problems, intrinsic and extraneous cognitive load consumes all available mental capacity for immediate problem-solving, preventing the formation of deep knowledge schemas and long-term learning. Solving a task and understanding the structure of the task are distinct processes. The accumulation of unorganized data within a chat exhausts the operator's working memory, rendering high-level analysis unfeasible [9-11].

Jean Piaget and the schemas of assimilation and accommodation

Piaget's genetic epistemology demonstrates that cognitive development occurs through cycles of equilibrium, disequilibrium and re-equilibration. Faced with a new data point (stimulus), the intellect attempts to assimilate the information within existing mental schemas. If the data is too complex, it demands accommodation, which is the modification of internal structures to fit the new reality [12].

In AI interaction, the user frequently fails to provide the necessary time for accommodation: They consume responses at a speed far exceeding their capacity for psychic reorganization, leading to saturation and a collapse of learning.

Lev Vygotsky and the Zone of Proximal Development (ZPD)

Lev Vygotsky established that learning is mediated by cultural tools and signs, occurring within the zone of proximal development the space between what an individual can accomplish independently and what they can achieve with the assistance of a more capable peer or tool. Generative AI models act as the ultimate technical mediator within the operator's ZPD. However, if the scaffolding offered by the AI is loose or unstructured, the

operator fails to consolidate autonomous cognitive gains, becoming chronically dependent on external automation [13].

Lawrence Kohlberg and the structure of moral judgment

The development of moral judgment in Kohlberg's theory moves from preconventional levels (focused on immediate punishment and reward) to postconventional levels (oriented by universal ethical principles and contractual responsibility). Transposed to human-AI symbiosis, the novice user operates at a pre-conventional level: Seeking the least effort and immediate utilitarian gain from automated text delivery.

The mature symbiotic operator must guide themselves by the post-conventional level, retaining full ethical responsibility, legal validation and the consequences of the system's response, never transferring moral agency to the algorithm.

The interdependence of loads (sports physiology analogy)

The general adaptation syndrome, established in training physiology by Hans Selye and applied to sports by Manoel Tubino, dictates that a stressor (training load) demands rigid phases of alarm, resistance and supercompensation (recovery). If the stimulus is excessive, the organism reaches exhaustion [14].

In the informational ecosystem, data and prompts function exactly like physical loads. Raw volume without periodization crushes response capacity. Elite performance in symbiosis does not emerge from a data bombardment, but from the correct distribution of volume (quantity of documents) and intensity (complexity of the thesis), intercalated by periods of assimilation and cognitive recovery for the operator.

The Scientific Gap: Cognitive Continuity

Current literature on prompt engineering and computer science approaches human-AI interaction from a strictly utilitarian and immediate perspective (input/output). It occupies itself with optimizing isolated responses but completely neglects the intertemporal factor.

The scientific gap identified by this research program lies in cognitive continuity. As a legal or scientific project expands, the human operator loses track of the methodological decisions made in past sessions.

Traditional generative AIs operate in volatile chats that suffer from chronological contextual amnesia or noise saturation. There is no structure connecting the knowledge produced in a transversal and cumulative



manner across multiple sessions, forcing the human into an eternal rework of re-contextualization.

Central Hypothesis: Contextual Reconstruction Load

We formulate the hypothesis of Contextual Reconstruction Load (CRL) as the metric for wasted effort in deficient symbiosis. CRL is the mental effort required of the operator to reassemble and reinject the context, premises and history of a complex case into the system at each new interaction or algorithm delivery failure.

When the system enters a loop or empties its short-term context memory window, CRL spikes. The human spends more time explaining to the machine what had already been decided than exercising high-level critical thinking. Algorithmic Stress is the direct result of the uncontrolled elevation of the Contextual Reconstruction Load.

The Methodological Response: Informational Periodization Human-AI

Informational periodization proposes the fragmentation of analytical development into controlled blocks of informational stress and recovery organized into processing macrocycles and micro cycles.

Operational cycle

- **Load:** Filtered data input
- **Assimilation:** Index mapping
- **Recovery:** Human dialectical critique
- **Validation:** Human approval and hashing.

↻ Return to the load phase with the next controlled block.

The cycle dictates that data must not be injected in a single brute block. The operator applies the load (selected documents), awaits index extraction, executes the dialectical critique (testing hypotheses) and promotes human validation before advancing to the next structural layer, preventing system fatigue and loss of traceability.

SIOJ Governance Architecture and the Audit-Ready External Memory

To operationalize Periodization, the SIOJ builds an Audit-Ready External Memory based on three functional shields:

- **Load filter:** Prior isolation of textual variables (separating fact, report, inference and legal norm).
- **Layered governance:** The collection is scaled across 8

concentric levels from preserving the hash of the master document to the human drafting of the final legal brief.

- **Informational mitochondria:** Framing AI engines as auxiliary energy processing units subordinate to the intellectual sovereignty of the attorney.

External memory is consolidated through manifests, JSON indexes, processing logs and cryptographic hash control (SHA-256). Where these records are consistently preserved, the provenance of a legal artifact can be audited and reconstructed at the level supported by the recorded chain.

Applications in Legal Environments and Chain of Custody

In law and forensic sciences, document volume is massive and the margin for hallucination is zero. The SIOJ applies this methodology to shield the Chain of Custody of Evidence.

Through the SIOJ-NRPA (Audio-Visual Evidentiary Reconstruction Nucleus), raw media from hearings are processed defensively: The original file is isolated, technical derivatives (M4A/WAV) are extracted locally and time-speech matrices generated by Whisper are subjected to human verification. This prevents automated transcription distortions or probabilistic inferences from corrupting judicial proceedings, guaranteeing strict compliance with due process of law and the integrity of the evidentiary record.

Limitations of the Study

As a frontier essay and preliminary formulation, this working paper recognizes its methodological limitations:

- The transposition of concepts from adaptive physiology and systems theory is strictly functional and analogical, serving as a model for informational flow design, not biological mechanics.
- Saturated context thresholds and Contextual Reconstruction Load (CRL) coefficients demand additional empirical quantitative testing across different Large Language Model (LLM) architectures.

Conclusion

Generative artificial intelligence must not be treated as a miracle, an oracle or an end in itself. It is a powerful probabilistic engine whose functional efficiency is directly proportional to the quality and methodological order of the structure organizing it.

The SIOJ, by institutionalizing Informational Periodization, argues that the value of technology lies not in the blind speed of automated drafting, but in the security



of cognitive continuity. Methods do not exist merely to accelerate thought; they exist to preserve its integrity and trace the moments when real-world complexity breaches the biological limits of human memory.

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