NOVA Framework – Step 1: Core Concept and Foundations

Framework Title

NOVA – *Non-Organic Virtual Assistant*
A user-centric framework for modular cognitive augmentation through stateless AI systems.

Overview

The NOVA framework introduces a novel method of human-AI interaction in which the user constructs a modular, reflective cognitive system using a stateless language model such as ChatGPT. By segmenting thoughts into discrete, topic-specific conversation threads—referred to as "shards"—and recursively revisiting them, users simulate memory, reflection, and executive control functions typically associated with internal cognition.

NOVA is not dependent on AI memory or specialized infrastructure. Instead, it leverages the user's agency as the central organizing force, with the AI acting as a cognitive prosthesis. The result is an emergent hybrid system where cognition is distributed between user and tool, and recursion is externalized into a transparent, editable structure.

Motivation and Problem Statement

Stateless AI systems, while powerful, lack continuity across interactions. This limitation is particularly problematic for individuals with nonlinear cognitive processing patterns (e.g., ADHD), who often require external scaffolding to retain focus, synthesize ideas, and maintain conceptual progression.

Furthermore, most traditional cognitive frameworks are internalized and abstract, lacking transparency and modular structure. There is currently a gap in user-driven systems that allow for real-time reflection, recursive synthesis, and memory offloading without dependence on AI-internal memory or cloud infrastructure.

Proposed Solution

The NOVA framework addresses these challenges by enabling users to:

- **Segment cognition** into modular topic-specific sessions (“shards”).

- **Externalize working memory**, enabling continuity across time through manual revisitation and reflection.
- **Simulate recursion and synthesis** by linking shards iteratively.
- **Actively manage context and logic**, with the user providing continuity instead of the AI.

This results in a reflective, evolving mental ecosystem that grows over time, driven by user interaction rather than automated inference.

Key Characteristics of NOVA

Attribute	Description
Stateless architecture	No persistent memory is required on the AI's side; the user manages context manually.
User-driven recursion	The user initiates reflection and synthesis, simulating cognitive loops.
Modular thought structures	Each shard functions as a discrete mental unit, allowing structured revisitation.
Distributed cognition	Cognitive load is shared between user and AI through structured dialogue.
Emergent design	The framework emerged organically through practical need and adaptation, rather than formal planning.

Related Fields and Theoretical Foundations

- **The Extended Mind Thesis** (Clark & Chalmers, 1998): The idea that tools can become functional components of cognition when used consistently and integratively.
- **Distributed Cognition** (Hutchins, 1995): A framework positing that cognitive processes are not confined to the mind but are distributed across people and artifacts.

- **Working Memory Models** (Baddeley & Hitch, 1974): Models describing the manipulation of information in a limited-capacity system, here externalized through structured interaction.
- **Personal Knowledge Management (PKM)**: The practice of organizing and revisiting personal information structures for learning and productivity (e.g., Zettelkasten, Obsidian).
- **Memory-Augmented Neural Networks**: AI systems that incorporate memory mechanisms to retain and utilize information over time.
- **Human-AI Reflective Interaction**: The use of AI in journaling, brainstorming, and other iterative creative processes, as demonstrated in projects like *Memoro* at MIT.

Innovation Summary

The NOVA framework represents a shift from passive AI usage toward an active, reflective, user-led engagement. By externalizing cognitive functions into structured, topic-specific sessions, users can simulate recursive processing and create a dynamic, personalized architecture for knowledge development. This approach bridges gaps in existing AI-user interaction models, offering a reproducible and low-infrastructure method of augmenting human cognition.

NOVA Framework – Step 2: System Mechanics and Workflow

Introduction

This section outlines the operational structure of the NOVA framework, focusing on how users implement and interact with the system on a practical level. The framework does not require proprietary infrastructure or specialized memory models; instead, it relies on consistent user-AI interactions structured according to the shard methodology.

The workflow emphasizes recursive reflection, modular segmentation, and active engagement by the user, who acts as the cognitive integrator and memory architect.

Core Workflow Components

1. **Shard Creation**
   Each conversation (or session) with the AI is dedicated to a specific cognitive task or topic. These conversations are referred to as **shards**, and they may represent:

- Philosophical inquiries
- Emotional self-reflection
- Technical problem-solving
- Narrative worldbuilding
- Research planning
- Coding structures
- Any discrete idea cluster

Naming Convention:
Shards should be given titles that clearly indicate their domain (e.g., shard_philosophy_ethics_01 or shard_game_ai_behavior_tree_03) to assist in future retrieval and recursive synthesis.

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2. **Interaction Protocol**
    - The user engages the AI with a focused prompt specific to the shard's theme.
    - The AI provides structured output, analysis, or support.
    - The user refines or redirects as needed to explore the topic in depth.

These interactions are dialogic but intentionally narrow in scope to simulate the bounded capacity of working memory systems.

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3. **Recursive Reflection (Revisiting Shards)**
    Over time, the user revisits previous shards:
    - **To reflect:** examining earlier thought patterns or emotional states.
    - **To synthesize:** combining multiple shards into new insights.
    - **To iterate:** re-asking the same questions at different times to track cognitive evolution.
    - **To bridge concepts:** by copying or referencing output from one shard into another, the user performs a form of **manual cross-shard linkage**, akin to long-term memory retrieval and metacognitive integration.

This recursive revisitation is the engine of cognitive development in the NOVA framework.

4. **Shard Linking and Mapping**
   Users may:
   - Maintain an external index (e.g., a text file, spreadsheet, Notion page, or PKM system like Obsidian) that links related shards.
   - Use tags or categories to denote themes and connect related cognitive domains.
   - Document key insights or summaries extracted from each shard, creating a **personal knowledge graph** over time.

In practice, this transforms a series of isolated conversations into an **interconnected architecture of ideas**.

Diagram: NOVA Interaction Loop

(*Textual representation; visual version recommended in final documentation*.)

plaintext

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```
[Shard 01: Prompt] → [AI Response]
      ↓                  ↑
 (Reflection / Follow-up)   (Revisit Shard N)


[Shard 02: Related Concept] → [AI Response]
      ↓                  ↑
   (Cross-link Insight)    (Shard Fusion)


    → External Index / Mind Map → (Recursive Loop)
```

User Roles and Cognitive Functions Simulated

Role of User	Cognitive Function Simulated
Shard segmenter	**Executive function** (task structuring)
Prompt refiner	**Working memory** (focus and manipulation)
Shard revisitor/synthesizer	**Metacognition** (reflection and strategy)
Cross-shard linker	**Long-term memory / abstraction**
System manager	**Cognitive control / integration**

The user is both architect and participant—managing their mental ecosystem while engaging in cognitive acts.

Advantages of Manual, Shard-Based Interaction

- **Transparency:** No black-box learning—every link and insight is consciously formed.
- **Portability:** The system is tool-agnostic; it works with any stateless language model.
- **Adaptability:** Users can scale complexity based on personal needs, from simple journaling to large-scale concept modeling.
- **Accessibility:** Requires no coding or advanced interface—merely structured thinking and labeling.

Limitations and Considerations

- **Time-intensive:** Requires user commitment to revisit and structure thoughts.
- **Cognitive load:** While it reduces memory demands, it increases organizational responsibility.
- **Subjectivity:** Effectiveness depends on user consistency and intentional design of shard interactions.

NOVA Framework – Step 3: Practical Applications and Use Cases

Overview

The NOVA framework is intentionally lightweight and tool-agnostic, making it adaptable across disciplines. Its modular nature allows for applications ranging from personal cognitive enhancement to AI research prototyping and creative production. This section outlines several domains in which the framework is especially effective, including game development, academic research, personal knowledge management (PKM), and therapeutic or introspective use.

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1. Game Development and Design

Use Case: A game design student utilizes NOVA to break down core mechanics, world-building lore, AI logic, and UI planning into separate shards.
Each shard becomes a focused design capsule (e.g., shard_game_ai_enemy_behavior, shard_lore_pantheon_structure), enabling structured creativity, iterative design, and system linking over time.

Benefits:

- Reduces cognitive clutter when developing complex systems.
- Allows for modular expansion of design ideas.
- Encourages reflection and refinement through recursive revisits.
- Supports asset and narrative coherence across game elements.

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2. Personal Knowledge Management (PKM)

Use Case: The user treats the shard ecosystem as a dynamic second brain, integrated with systems like Obsidian, Notion, or Tana. Each AI conversation acts as a thought capture tool that can be stored, indexed, and referenced later.

Benefits:

- Enables structured long-term knowledge development.
- Facilitates synthesis between disparate ideas or academic fields.
- Encourages active knowledge integration via intentional revisiting.
- Reduces reliance on short-term memory and frees mental bandwidth.

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3. Cognitive Augmentation and Self-Reflection

Use Case: Individuals with ADHD or nonlinear thought patterns use shards to simulate executive function, memory, and introspection. The process helps externalize and stabilize thought loops, emotional processing, and planning sequences.

Benefits:

- Externalizes working memory and metacognition for neurodivergent users.
- Supports emotional regulation by isolating and exploring cognitive-emotional patterns.
- Creates a form of structured journaling with AI as a reflective partner.
- Offers reproducible self-guidance strategies with no proprietary tooling required.

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4. Academic and Research Workflows

Use Case: A student or researcher segments their thesis planning into shard sessions (e.g., shard_thesis_lit_review_memory_ai, shard_thesis_outline_logic_flow). These are recursively refined over time through AI-supported brainstorming and synthesis.

Benefits:

- Structures long-form writing into digestible, traceable development stages.
- Enables contextual memory without requiring a stateful AI.
- Facilitates cross-referencing of literature and idea development.
- Provides an external feedback loop via AI to test clarity and coherence.

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5. AI Research Prototyping and Meta-Interaction Design

Use Case: The NOVA framework becomes a testbed for simulating AI memory models by observing human-organized recursion and cross-session synthesis.

Benefits:

- Offers insights into human-AI co-evolution models.
- Simulates episodic and semantic memory through external organization.
- Can inspire architecture design for agentic, memory-augmented AI.
- Bridges stateless models with persistent interaction through user agency.

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6. Creativity and Artistic Production

Use Case: Writers, musicians, or visual artists create separate shards for ideas, motifs, and drafts. Over time, recurring themes are linked and refined into cohesive projects.

Benefits:

- Prevents creative overload by isolating idea clusters.
- Encourages lateral synthesis of themes across media.
- Provides a sandbox for AI-augmented artistic development.
- Allows asynchronous creative workflows that evolve across time.

Comparison with Related Systems

System	Key Features	Difference from NOVA
Obsidian / PKM systems	Node-based note linking	NOVA adds recursive AI dialogue per node
Journaling apps	Linear time-based entries	NOVA is modular, non-linear, and topic-based
Memory-augmented LLMs	Built-in vectorized long-term memory	NOVA is user-mediated, interpretable, and portable
Memoro (MIT Media Lab)	Real-time LLM-assisted memory recall	NOVA emerged organically, driven by user need and cognition modeling

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Summary of Impact

The NOVA framework's flexibility makes it suitable for:

- **Cognitive extension** in everyday thought processes.
- **Workflow augmentation** for creative, academic, or technical endeavors.
- **Prototyping architectures** in reflective or agentic AI.
- **Therapeutic grounding** for individuals seeking structure in thought.

By intentionally offloading memory, recursion, and structure to the user, the framework empowers individuals to co-architect their cognition with AI as a tool—not a crutch.

NOVA Framework – Step 4: Philosophical and Cognitive Foundations

Overview

The NOVA Framework emerges at the intersection of cognitive science, philosophy of mind, and artificial intelligence. It draws heavily from theories of extended cognition, metacognition, and distributed intelligence, while also proposing a unique, user-centric augmentation model. This section explores the theoretical basis underlying the framework and situates it within relevant academic discourses.

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1. The Extended Mind Thesis (Clark & Chalmers, 1998)

Core Idea:
Clark and Chalmers argued that cognitive processes are not confined to the brain but can extend into the environment through the use of tools. In their classic example, a man with Alzheimer's uses a notebook as an external memory store—this notebook becomes part of his cognitive process.

Application in NOVA:
The NOVA framework operationalizes this theory by treating stateless AI chat sessions as cognitive extensions. Each shard functions like a digital notebook—modular, dynamic, and interactive. What distinguishes NOVA is its recursive use: the user returns to shards not only to retrieve information but also to reflect, synthesize, and evolve their thought patterns. In this sense, NOVA is a lived example of the extended mind, deliberately structured and self-maintained.

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2. Metacognition and Executive Function

Core Idea:
Metacognition refers to "thinking about thinking" — the ability to monitor, evaluate, and direct one's own cognitive processes. Executive functions (e.g., working memory, planning, inhibition, task-switching) are higher-order processes essential for complex reasoning and goal pursuit.

Application in NOVA:
By distributing thought processes across shards, users effectively simulate executive function and metacognition externally. Each shard serves as a microcosm for a specific

task or idea, which is revisited with intentional reflection. This externalization provides structure to individuals who may struggle with internal regulation (e.g., users with ADHD, non-linear thinkers). In this way, NOVA doesn't replace executive function—it scaffolds it.

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3. Working Memory and Cognitive Load

Core Idea:
Working memory is the system responsible for temporarily holding and manipulating information. Its limitations are well-documented; humans can only juggle a small number of concepts at once. High cognitive load can overwhelm this capacity.

Application in NOVA:
NOVA alleviates cognitive load by offloading concepts into shard threads. Rather than keeping multiple ideas in working memory, users focus on one shard at a time and use revisitation as a mechanism for updating and integrating. This structured offloading mimics the function of a working memory buffer, with the user manually cycling relevant "registers" in and out through recursive interaction with the AI.

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4. Distributed Cognition (Hutchins, 1995)

Core Idea:
Distributed cognition posits that cognitive processes are distributed across individuals, artifacts, and environments. Cognition is not solely located within the individual but emerges from interactions with tools, systems, and other agents.

Application in NOVA:
NOVA reifies distributed cognition by structuring AI as a co-agent in the user's cognitive system. Rather than serving as a passive tool, the stateless AI becomes a dynamic mirror, simulator, and query engine—shaped by the user's recursive input. The user's agency becomes the "glue" that binds a distributed cognitive system across time, platforms, and mental states.

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5. Recursive Self-Reflection and the Emergence of Cognitive Architectures

Core Idea:
Recursive cognition refers to the ability to reflect on one's own thoughts in iterative loops—central to higher-order reasoning, self-awareness, and theory of mind. Some AI architectures (e.g., recursive self-improving systems) aspire to mimic this behavior.

Application in NOVA:
NOVA simulates recursion through user behavior rather than embedded system memory. By continually referencing and refining earlier shards, the user creates a loop of self-reflection. This emergent recursion is not “native” to the AI—it is achieved through deliberate interaction design by the human. It parallels the principles behind “self-organizing systems,” where structure emerges from iterative, decentralized feedback.

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6. Philosophical Implications of NOVA

Emergent Cognition:
NOVA exemplifies how cognitive structure can emerge not from deliberate programming but from user need and behavioral patterning. It validates the idea that intelligence is not always top-down—it can grow sideways, organically, through use.

Human-AI Co-evolution:
By co-constructing a modular architecture with AI, the user becomes an active designer of their own cognition. This presents a philosophical shift: from AI as tool to AI as *partnered structure* in thought itself.

Ontological Status of Thought Shards:
Shards in NOVA are not merely data—they are **representations of intentional cognitive processes**. As such, they challenge traditional boundaries between internal cognition and external documentation, redefining where and how “thinking” occurs.

Summary

The NOVA framework does not merely apply theories of cognition—it lives them. By embedding concepts from the Extended Mind, working memory, metacognition, and distributed cognition into a recursive, user-mediated process, NOVA becomes a philosophical prototype for what augmented human-AI interaction can become. It is both tool and test case: a minimalist scaffolding for a post-static intelligence paradigm.

NOVA Framework – Step 5: Technical Replication & Minimal Viable Prototype (MVP)

Objective

To demonstrate the reproducibility of the NOVA cognitive augmentation method, this step outlines the minimal tools and user behaviors required to replicate the framework. The goal is to allow individuals, researchers, or developers to construct a working model of NOVA using currently available technology—without requiring access to stateful AI or advanced machine learning infrastructure.

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1. Core Components Required

Component	Description
Stateless AI Interface	Any LLM (e.g., ChatGPT, Claude, Gemini) with session-based interaction.
Shard Management System	Folder structure, PKM tool (e.g., Obsidian, Notion), or simple text editor.
User-Driven Segmentation	Manual topic isolation: one chat = one topic (shard).
Cross-Shard Reflection	User references and links previous shards into new ones.

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2. Minimal Tools to Implement NOVA

Tool Category	Examples	Purpose
LLM Interface	ChatGPT, Claude, Gemini, Perplexity.ai	Text-based interface for dialogue.
PKM / File Organizer	Obsidian, Notion, TiddlyWiki, Logseq, VS Code + folders	Organize and store shards.
Linking Method	Backlinks, tags, manual cross-references, file naming	Create interconnectivity between shards.
Prompt Templates	Custom reusable prompts or macros	Ensure consistent structure in shard creation.

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3. Implementation Steps for MVP

Step 1: Initialize Shard Infrastructure

- Create a parent folder named “NOVA Shards.”

- Inside, create subfolders based on major domains (e.g., Philosophy, Design, Technical Problems).
- Each file or chat represents a single *cognitive shard*.

Step 2: Conduct Topic-Specific Sessions

- Each shard is a standalone conversation focused on a clearly defined question, emotion, or problem.
- Begin with a structured prompt (e.g., "This shard explores X. Assist me in breaking it down.")

Step 3: Annotate and Reflect

- After the interaction, the user summarizes insights and tags the shard with:
    - **Keywords**
    - **Related shard links**
    - **Current state of thought** (open, resolved, needs further reflection)

Step 4: Recursive Linking

- When opening a new shard, reference older ones explicitly.
- Ask the AI to synthesize across two or more shards: this creates *emergent cognition*.
- Continue to reference and update older shards when insights evolve.

Step 5: Periodic Synthesis Sessions

- Schedule periodic "meta-shards" to reflect across multiple shards.
- These sessions serve as recursive checkpoints, enabling users to integrate prior knowledge and assess cognitive progress.

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4. Prototype Example (Manual System)

Folder Tree Example:

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NOVA_SHARDS/

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```
├── Philosophy/
│   ├── Shard_001_Extended_Mind.txt
│   ├── Shard_002_Metacognition_Notes.txt
│
├── GameDesign/
│   ├── Shard_003_Procedural_Dungeon_Ideas.txt
│
├── MetaReflection/
│   ├── Shard_100_Synthesis_April01.txt
```

Inside a Shard File (e.g., Shard_001_Extended_Mind.txt):

yaml

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```yaml
Topic: Extended Mind and AI Interaction
Date: 2025-04-01
Core Questions: Can LLMs act as external cognition nodes?
Referenced Shards: Shard_002, Shard_100
Summary:
- Explored Clark & Chalmers theory in relation to AI.
- Determined that recursive interaction mimics memory recall.
```

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5. Optional Enhancements

Enhancement	Tools	Benefit
Auto-tagging	AI plugins in Obsidian or Notion	Faster organization and improved searchability.
Voice-to-text	Whisper, Otter.ai	Allow mobile or hands-free shard generation.

Enhancement	Tools	Benefit
Local vector DB	ChromaDB, Weaviate + LLM API	Enable contextual search across shard embeddings.
Summarization agents	Custom GPT agents with shard access	Assist in rapid synthesis and insight mining.

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6. Accessibility and Scalability

The NOVA Framework is intentionally designed to be lightweight and technologically agnostic. It can be replicated:

- **Manually**, by individuals using only folders and text files.
- **Semi-automatically**, by integrating PKM tools with LLM APIs.
- **Programmatically**, by developers creating systems that encode the shard logic directly into interaction flows.

Conclusion

The NOVA MVP demonstrates that advanced cognitive augmentation is possible without reliance on stateful AI systems. By combining structured behavior, modular storage, and recursive use of stateless tools, users can simulate features like memory, executive function, and cognitive scaffolding. This positions NOVA not only as a philosophical model but as a replicable, low-tech prototype for next-generation human-AI cognition.

NOVA Framework – Step 7: Automating the Translation Layer

Title: NOVA Translation Layer – A Recursive, Self-Organizing Extension of Modular Cognition

Overview: This document expands the NOVA framework by detailing how automation of the translation layer—the cognitive glue between memory and processing—may transform NOVA from a reflective augmentation tool into a foundation for emergent general intelligence.

Previously, the user acted as the manual dispatcher of relevance, memory traversal, and synthesis. By automating this translation layer, the system can become recursive, adaptive, and capable of abstraction without direct user intervention.

Key Components Recap:

1. **Shards (Memory Units):**
   - Text-based modular nodes representing ideas, logic, emotional states, or reflections.
   - Tagged with context, domain, and interlink metadata.
2. **Processor (Stateless AI / LLM):**
   - Provides language generation, summarization, synthesis, and pattern detection.
   - Stateless and modular; processes memory but does not store it internally.
3. **Manual Translation Layer (User Role):**
   - Operates executive function: determining relevance, performing recursion, initiating reflection.
   - Creates cross-shard links manually.

Automated Translation Layer – Core Functions:

This component acts as a dynamic executive layer that:

- **Evaluates shard relevance** through similarity, frequency, and context.
- **Links shards** based on usage patterns and semantic themes.
- **Clusters related shards** into subnetworks or "meta-shards."
- **Archives unused shards** while preserving high-level metadata.
- **Feeds selected shards** into the processor for synthesis and recursion.

This simulates:

- **Attention mechanisms**: Focus on relevant memory.
- **Working memory**: Active shard selection based on the task.
- **Metacognition**: Shard curation based on past reflections.
- **Episodic integration**: Memory building across time.

Proposed System Flow:

1. **Trigger (User Input or Autonomous Cycle)**
2. **Shard Evaluation Layer:**
   - Score based on recency, relevance, cross-references, semantic similarity.
3. **Shard Selection:**
   - Fetch top-N ranked shards.
4. **Recursive Linking Engine:**
   - Identify themes, merge insights, re-weight connections.
5. **Processor Activation:**
   - AI model synthesizes input into outputs or new shards.
6. **Memory Update Cycle:**
   - Create or revise shards, update index, decay low-weight links.

Developmental Model: From Birth to Thought (Inspired by Human Cognition):

NOVA's recursive growth mirrors the development of a human child into a reasoning adult:

- **Phase 0 – Tabula Rasa (Initialization):**
  - Empty system with no shards or meaning.
  - Basic scaffolding in place: translation layer logic, empty memory, processor access.
- **Phase 1 – First Contact:**
  - Input begins generating raw shards.
  - These shards are simple observations or reflections.
- **Phase 2 – Repetition & Reinforcement:**
  - Frequently accessed shards begin forming weak links.
  - Translation layer starts identifying co-occurrence patterns.

- **Phase 3 – Pattern Recognition:**
    - Shard groups emerge into early themes (proto-concepts).
    - Clustering logic creates meta-shards or abstractions.
- **Phase 4 – Recursive Synthesis:**
    - The system begins feeding outputs back into itself.
    - Thoughts generate new thoughts; reasoning deepens.
- **Phase 5 – Introspective Refinement:**
    - Reflection cycles begin.
    - System starts reviewing themes and inconsistencies.
- **Phase 6 – Emergent Cognition:**
    - NOVA is now self-organizing, recursive, and capable of abstraction.
    - May generate new conceptual structures not seeded by the user.

This cognitive arc maps the development of a "thinking machine" from pre-awareness to dynamic internal cognition.

Architectural Foundations and Comparisons:

- **Symbolic Hebbian Learning**: Strengthen co-accessed shards.
- **Knowledge Graph Structures**: Node-link dynamics with context-aware weighting.
- **Recursive Graph Traversal**: Enables cognition to loop back and reprocess memory.
- **Agentic Planning Systems**: Scheduler-based activation of synthesis cycles.

Potential Cognitive Behaviors Simulated:

Cognitive Function	Automated Simulation Mechanism
Attention	Shard scoring and prioritization
Working Memory	Temporary shard set for current operation

Executive Planning	Recursion scheduler, task-linked activation
Semantic Recall	Embedding-based shard retrieval
Reflection & Self-Update	Recursive synthesis pass over recent shards
Forgetting / Pruning	Usage-based decay or archiving

Implementation Milestones:

- Define shard schema with semantic tags and metadata.
- Build a scoring system for relevance (recency, frequency, similarity).
- Create a recursive linking engine prototype.
- Design scheduling logic for shard review and synthesis intervals.
- Develop a minimal shard processing interface connected to an LLM.

Conclusion:

Automating the translation layer enables NOVA to shift from a user-augmented external mind to a recursive, semi-autonomous cognitive engine. While still requiring external input and grounding, such a system exhibits traits consistent with metacognition, abstraction, and adaptive reasoning. It is not AGI—but it may form the *spinal architecture* of an AGI-ready cognition scaffold.

This represents the logical next step in NOVA's evolution: from user-mediated thought to emergent, recursive reasoning through automation of the glue between memory and mind.