Knowledge System Research Document 12-1-24

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# Knowledge System Facts

1. All characters have a ‘**memory**’ that stores ‘**knowledge**’ in their ‘**brain**’. This memory and knowledge in it, at the most basic level, is a collection of individual words and words organized into units of various sizes including phrases, clauses, sentences, and paragraphs. Some words will be the compound type with hyphenation to allow for representation of more complex ideas with getting into phrase-like structures. The progression of the complexity in ideas is as follows: word → compound word → phrase → clause → sentence → paragraph → section. The collective of all the words and words units any given character has at any give time is known as their **‘knowledge base**’.
2. The character memory is first organized into three core ‘**memory systems**’ including ‘**sensory memory**’, ‘**short-term memory**’, and ‘**long-term memory**’.
3. The character has three ‘**information processing** **systems**’ that allow the player to interact with their memory this includes ‘**perception**’, ‘**attention**’, ‘**cognitive processing**’, and ‘**storage & retrieval**’.
4. The character acquires words of various types using a text parsing system allowing them to build their knowledge base. Concepts build on each other leading to more and more sophisticated conceptual structures like ‘schemas’ and ‘frameworks’
5. Your conceptual framework as a puzzle matrix transforms the game into a dynamic, interactive knowledge-building experience. By incorporating keywords, operators, and semantic blueprints into interconnected puzzles, each concept becomes a rewarding challenge, tightly linked to the game’s progression and functionality. This approach enhances immersion, scalability, and player satisfaction while grounding the system in cognitive and gameplay principles.
6. The purpose of the knowledge in the memory is to allow the player to access game functionality including ALL game actions, dialogue possibilities, and their overall ability to interact with the environment as in real life. Some unique game actions include being able to utilize thinking along with using knowledge for reasoning, problem solving, and decision making
7. Summary: The character adds to their memory by perceiving their environment which add text to their sensory memory, attention is then used to focus on specific words or units of words that move those items to short-term memory, short-term memory contains the working memory that uses cognitive processing to store text in the long-term memory which can be retrieved and used later.

# Memory Systems

* 1. Sensory Memory
     1. Stream of Consciousness-Thoughts that pop into the mind of the player. These thoughts appear as text in the short-term memory along with other typical sensory observations. Intuitions are also part of this but they are a little more clear.
     2. Introspection-Purposeful thinking to generate text.
     3. Observations-lead to ‘impressions’ Perhaps is better described as experiences. Sensory inputs need paired with emotional reactions.
     4. System 1-There needs to be a place for gut reaction thoughts the player can be prompted by. They still need to flow from the knowledge the character knows.
     5. Hearing and Reading — Initial exposure to concepts might come from conversations with NPCs, books, signs, or overheard dialogue. These sources would provide Tier 1 and Tier 2 words.
     6. Experimenting — The player might try panning with a basic tool, but if they’re missing essential Technique or Tool Words, their attempts could be clumsy or inefficient, encouraging them to seek more information.
     7. Completing Tasks or Quests — Completing related tasks could reward the player with Methodology Words or higher-level Tool Words, which improve their skill and understanding.
     8. Trial and Error Feedback — If players attempt a task without all the necessary words, they could receive partial, humorous, or mixed feedback. For example, trying to pan without knowing the word "swirl" might result in spilling the dirt, hinting that the player needs more information.
     9. Insights and Epiphanies
     10. Receiving teaching
     11. Purposeful education
     12. Thinking about things
  2. Short-Term Memory (includes Working Memory)-Text accumulates here in short bunces 5-9 concepts in reality. Using working memory, text can be selected and stored. Sometimes ‘implicit learning’ allows for the acquisition of knowledge directly to long-term memory.
     1. Working Memory-Identify subject first then categorize into conceptual hierarchy. Break down the subject into components.
        1. Cognitive Load Management-The brain has a limited capacity for working memory, which is used to process and manipulate new information.
           1. Capacity Limits: Implement a finite number of text entries (e.g., 10 slots) in short-term memory.
           2. Prioritization: Players must choose which texts to retain or discard, adding a strategic layer.
           3. Memory Expansion: Abilities or items that increase memory capacity as the game progresses.
           4. Decay Over Time: Introduce a mechanic where unused texts fade, emphasizing timely analysis.
           5. Visual Representation: Use mind maps or diagrams to display connections between knowledge types.
           6. Player Agency: Allow players to manually organize their knowledge base, fostering a sense of ownership.
           7. Chunking: Allow players to group facts or words into "chunks," reducing the perceived load.
        2. Text Parsing: Players use formatting tools to highlight and classify important information. The words can be picked out in different ways using formatting tools like bolding, underlining, strikethrough and all the other means. These formatting tools are used for classifying different things.
        3. Combination “Alchemy”: The process of combining words could become like alchemy, with its own layer of discovery. Players could keep a "Word Equation Book" that records successful word combinations and inspires players to experiment with even more.
        4. Hidden Combination Bonuses: Some words might yield unexpected or hidden combinations when paired, encouraging players to experiment with everything they’ve collected. Special or secret combinations could be more powerful and act as "Easter eggs" in the game, creating excitement around the idea of finding every possible pairing.
        5. Exclusive Combinations by Category Completion: Completing a category of words could unlock a new set of “ultimate combinations” within that category, motivating players to seek out every word in each set.
     2. Insight Journal: Alongside the words in STM, players keep a journal that logs each insight gained about a word. This can include initial observations, fragments, and later understandings, providing a progression of how they came to know the word. This helps to overcome the limitations of short term memory.
  3. Long-Term Memory
     1. Explicit (Declarative)
        1. Episodic Memory-These come from experiences. Call these memory traces.
           1. Events

Episodic Memory Integration-Condense episodic memories into more compact recall chunks to save space while losing some detail.

* + - * 1. Examples-Experiences give the players examples to learn from.
        2. Timeline Sequencing
        3. As a Resource-These are used to help build concepts as well
      1. Semantic Memory
         1. Data (or Elements)

Data Labels: Tags applied to data points for classification tasks. The smallest units for information that you gather from memory.

Cross-Domain Relevance: Basic categories (e.g., "red") are often the first learned and are cognitively efficient across domains. These are words generic enough to use all over.

Precepts-The raw sensory inputs or experiences that form the foundation of conceptual thought.

Semantic Primitives-Primitives are irreducible, fundamental units of meaning from which more complex meanings are constructed. These primitives serve as the building blocks for all complex meanings in human language.

Possible Word Tiers

Tier 1: Awareness Words — Basic, introductory words that introduce the player to a concept or activity. These words don’t give the player any real ability yet, but they spark curiosity and indicate potential. Example: Hearing the word "panning" might unlock a thought bubble that hints, "There might be gold in streams."

Tier 2: Familiarity Words — These words begin adding more depth, describing the purpose and setting of the concept. Players start to gather more context but still lack practical know-how. Example: Words like "gold," "minerals," and "streams" give the player a clearer picture of panning's purpose but don’t yet tell them how to pan for gold.

Tier 3: Technique Words — These are action-oriented words that describe the methods, steps, and processes involved. Acquiring these words unlocks specific actions the player can perform. Example: Words like "swirl," "sieve," "wash," and "filter" teach the player specific steps of panning for gold.

Tier 4: Tool Words — Words that represent physical tools, materials, or items necessary to carry out the action. Knowing these words allows the player to gather or craft the needed items. Example: Words like "pan," "sluice," and "trowel" let the player acquire or recognize these items in the environment or purchase them.

Tier 5: Methodology Words — These are high-level words that describe overarching strategies, combinations of tools, or advanced techniques. This level unlocks expert actions or strategies and may even allow players to refine their skills. Example: Words like "concentration," "sedimentation," and "efficiency" let the player refine their panning technique for faster or more effective gold extraction.

Classify words in your system based on their linguistic roles.

* + - * 1. Facts- Players don’t need to actively manage phrases outside of short-term memory; they serve as temporary scaffolds for understanding and combining words. Once relational understanding is established, phrases are no longer necessary and fade naturally from gameplay.

Semantic Networks-Connects related pieces of facts in spatial relationships.

Pattern Recognition Puzzles-symbols etc

Trial and Error-learn by doing

Syntax- Syntax governs the arrangement of words into valid sentences.

Descriptive Facts: Provide attributes or characteristics of a concept (e.g., "Potions are made from herbs").

Functional Facts: Explain how something works or its purpose (e.g., "Mixing herbs creates healing potions").

Relational Facts: Describe how a fact connects to other concepts (e.g., "Alchemy is related to herbalism").

Procedural Facts: Outline steps or processes (e.g., "Step 1: Grind the herbs").

Historical/Cultural Facts: Offer context or origins (e.g., "Alchemy began as a spiritual practice in ancient times").

Limitations/Negative Facts: Define boundaries or counterexamples (e.g., "Alchemy cannot transmute lead into gold").

Actionable Facts: Facts the player can immediately apply in gameplay (e.g., "These herbs restore health").

Supporting Facts: Provide context but require additional facts to be useful (e.g., "This tool is used in alchemy").

Challenge Facts: Facts that must be tested, analyzed, or validated (e.g., "The alchemist claims this, but I need proof").

* + - * 1. Concepts- Concepts have elements, organized into a conceptual framework, that can be acquired by meeting requirements at each level of development along a continuum.

Conceptual Framework

Glossary

Awareness Words

Material Words

Labels-Descriptive tags or terms used to identify and group entities within a domain.

Building Block words

Modifier Terms

Core Terms

Pathway Terms

Root Terms

Branch Terms

Unlock Terms

Anchor Terms

Contexts-Note where and how you first encountered the word. Was it in a novel, conversation, scientific paper, or a news article? This setting will influence the word's connotations, tone, and formality level.

Semantic Fields: Related concepts grouped by meaning within a domain.

Rarity Levels: Words can have rarity levels (common, uncommon, rare, legendary) to make the collection feel layered. Common words are easily found, but rare words might require unique encounters, deep exploration, or mastery challenges. Legendary words are rare and carry world-changing influence, symbolizing the peak of the player’s learning journey.

Completion Rewards: Completing a category (e.g., all Emotional or Cognitive words) could unlock special abilities or perks that encourage players to pursue a full set of words in each category. Players might also gain titles or badges for completing word sets, giving them a visible marker of their progress.

Word Journal and Progress Bar: A detailed Word Journal where players can see which words they've collected and which are missing. Each word entry could have a tiered progress bar, showing how close the player is to fully mastering it.

Word Evolution Animations: When words reach higher tiers, they could have visual effects or animations, signaling their transformation into something more profound. This creates excitement as players watch their words evolve from simple traits to powerful abilities or insights.

Feature List-Features act as labels or tags for identifying and distinguishing advanced concepts.

Loop-Based Proficiency Puzzles: Each attempt highlights a missing element or introduces new context, building on the last attempt until the skill is mastered.

Uses Cases

Physical, Functional, Abstract etc

Layers of Abstraction-At each level of complexity, features of one level become the building blocks for the next.

Low-Level Features: Derived directly from primitives and raw percepts. Example: Visual primitives like "line," "angle," or "curvature" combine to form low-level features like "shape" or "edge."

Mid-Level Features: Start representing coherent entities or properties. Example: "Furry," "four-legged," "barking" are mid-level features describing "dog."

High-Level Features: Serve as attributes for abstract, advanced concepts. Example: "Loyalty" and "domesticated" are high-level features for the concept "dog" in a societal or cultural context.

Feature Bundling: Multiple features combine to form a concept with new features emerging as combinations of others as well.

Topics (Could also call this properties or components)

Hierarchical Representation-Concepts are layered in a hierarchy, where features of higher-order concepts are derived from combinations of lower-order features.

Example (Concept Hierarchy for "Dog"): Primitives: "Animal," "Move," "Bark."

Features: "Furry," "Four-legged," "Domesticated."

Advanced Concept: "Dog."

Specialized Concept: "Golden Retriever" (inherits the general "dog" features and adds specific features like "golden fur").

Procedures-Organizations of words in a sequence that demonstrate ‘how’ to do things in relation to the concept.

Word Association Chains-Place words in a sequence of one following another.

Cause & Effect Puzzles-flowcharts etc.

Lab Systems/Crafting Tables-combining elements to discover new elements ala Minecraft etc. Use terms like ‘core words’, ‘complementary terms’ , methods, practices, ideas etc.

Mimicry-Copy others to learn procedures.

Mnemonic Puzzles: Players arrange words or symbols into mnemonic patterns. Correct sequences allow recall, while flawed sequences highlight gaps in understanding.

Arrange Actions into Processes — For highly complex tasks, players might need to arrange several Technique and Tool Words into a sequence, effectively creating a mini “recipe” or “process” for the task. For example:

Match Words — Players match Tier 3 and Tier 4 words (techniques + tools) to create functional actions in the game. For example, pairing "swirl" with "pan" might enable the "Swirl the Pan" action.

Chain Words for Advanced Actions — Advanced actions require Methodology Words that allow multiple Technique Words to be used in sequence, creating a complete skill. For example, “swirl + sedimentation + concentration” might allow an expert panning technique that filters gold more quickly.

Relationships-

Cognitive Maps- A mental representation of spatial or conceptual relationships.

Analogies or Examples

Generalization: Applying learned knowledge to existing concepts.

Integration: Combining new information with existing knowledge to form a cohesive understanding.

Association: Forming links between concepts to enhance memory and understanding.

Elimination: Picking the word that does not relate to other words.

Synonyms-Place words that are closet in meaning together.

Hierarchies-Place words into a hierarchical structure.

Semantic Networks: Concepts are nodes, and relationships between them are edges (e.g., "dog" is connected to "animal" and "pet").

Explore Synonyms and Antonyms-Compare the word to others that mean something similar. Often, this reveals subtleties in meaning. For example, "happy" is close to "content" or "joyful," but each has a different emotional intensity or situational fit.

Tests

Crossword Puzzles-Answer questions correctly and use the crossword clues to find the right answers among a pool.

True/False

Quizzes

Thought Experiments

Hypothesis Testing

Definitions

Prototype- The most typical or ideal example of a concept (e.g., a robin as a prototype for "bird").

Semantic Matching/Blueprints-Place words into the their correct spots within a larger pre-determined sentence structure.

Sentence Webs-Consider the semantic blueprints could have pre-loaded answers were you can select different paths to use the same template to do different things (over a true fill in the blank). This would be espeically useful for the conversation mode. “Context sensitive keywords etc”

Word Operators-These are tools that establish relationships between words similar to mathematical relationships. The player uses the words and operators to form definitions from scratch. Operators would include other words as well that are keywords elsewhere but serve as modifiers. I can also use physics type formulas where letters equal a word or concept. This should be used extensively.

Combination: Merging primitives (e.g., "agent" + "action" = "a person running").

Semantic Tags- Add tags or labels to each term to define their roles in a relationship. Examples::X (cause) → Y (effect)" → "Heat (cause) leads to transmutation (effect). X (subject) uses Y (tool)" → "Alchemy (subject) uses catalysts (tool)."

Abstraction: Extending primitives to broader or more abstract contexts (e.g., the primitive "container" becomes the abstract concept of "inclusion").

Specialization: Adding details or constraints (e.g., "animal" → "mammal" → "dog").

Transformation (~): Words in the same class can be transformed, turning "curiosity" ~ "knowledge" into "wisdom."

Multiplication (×): Amplifies the effect of two similar traits, like "patience × resilience" yielding "endurance."

**1.1. Relational Operators**

**Purpose**: Define relationships between concepts or words.

**Examples**:

Words: "is," "relates to," "depends on," "causes."

Usage: "Alchemy is a type of science." / "Alchemy depends on catalysts."

**Gameplay Role**: Build connections between ideas, forming the backbone of concept relationships.

**1.2. Transformative Operators**

**Purpose**: Modify or combine words to create new meanings or contexts.

**Examples**:

Words: "combine," "separate," "reverse," "enhance."

Usage: "Fire + Alchemy = Pyroalchemy." / "Separate heat from substance."

**Gameplay Role**: Encourage creative experimentation and discovery.

**1.3. Logical Operators**

**Purpose**: Enable reasoning, hypotheses, and decision-making.

**Examples**:

Words: "if," "then," "and," "or," "not."

Usage: "If heat is applied, then transformation occurs."

**Gameplay Role**: Build logical frameworks for understanding and testing knowledge.

**1.4. Procedural Operators**

**Purpose**: Describe sequences, processes, or methods.

**Examples**:

Words: "first," "then," "requires," "follows."

Usage: "First grind herbs, then mix with water."

**Gameplay Role**: Allow players to piece together step-by-step methodologies or workflows.

**1.5. Comparative Operators**

**Purpose**: Compare concepts or attributes.

**Examples**:

Words: "more than," "less than," "similar to," "different from."

Usage: "Alchemy is more complex than herbalism." / "Alchemy is similar to chemistry."

**Gameplay Role**: Encourage analytical thinking and classification.

**1.6. Evaluative Operators**

**Purpose**: Judge or assess concepts or relationships.

**Examples**:

Words: "valid," "invalid," "important," "useful."

Usage: "This hypothesis is valid." / "Catalysts are important in alchemy."

**Gameplay Role**: Allow players to test or refine statements and knowledge.

**1.7. Temporal Operators**

**Purpose**: Relate concepts in terms of time or sequence.

**Examples**:

Words: "before," "after," "during," "while."

Usage: "Alchemy existed before chemistry." / "Heat during the process enhances results."

**Gameplay Role**: Add complexity by tying knowledge to timelines or sequences.

**1.8. Spatial Operators**

**Purpose**: Place concepts in physical or abstract space.

**Examples**:

Words: "within," "outside," "near," "far."

Usage: "Alchemy exists within the realm of science." / "Catalysts work near the reaction site."

**Gameplay Role**: Enhance contextual understanding and spatial reasoning.

**1.9. Quantitative Operators**

**Purpose**: Relate to quantities, amounts, or degrees.

**Examples**:

Words: "many," "few," "more," "less."

Usage: "Alchemy uses many ingredients." / "Less heat leads to slower reactions."

**Gameplay Role**: Introduce measurable aspects to concepts.

**1.10. Causal Operators**

**Purpose**: Describe cause-and-effect relationships.

**Examples**:

Words: "because," "leads to," "results in."

Usage: "Alchemy works because of catalysts." / "Heat leads to transformation."

**Gameplay Role**: Build explanatory models and test hypotheses.

Synapse Builder: A puzzle mini-game where players connect words with logic links, testing out different pathways to create new word combinations or boost the power of existing traits.

Modify: Change a word’s intensity or scope (e.g., "enhanced" + "alchemy").

Rearrangement Puzzles- Players are given a jumbled or disordered set of words, phrases, or sentences and must rearrange them into a meaningful order.

Fill in the Blank

Logic Statements that build on one another

Simple Words serving as operators; operator-type words can be classified into distinct categories or classes significantly deepens the gameplay and knowledge-processing system.

Clue Boards-How do other games do this?

Answer the 7Ws and H

Exemplar Theory: Features of specific examples are stored and used to compare new inputs.

Applications-How the concept can be used for action.

Conceptual Framework Principles

Mastery Levels

Gaining Mastery

Repeated Exposure-Increases mastery through either use by the player or exposure to in the environment. Levels include foundational knowledge, application, and integration, and automatic.

Practice Using the Word in Writing and Speaking

Expose Yourself to the Word in Different Contexts

Reflect on the Word’s Impact and Usage Over Time

Teach the Concept to Someone Else

Seek Feedback and Ask Questions

Validation Challenges

Mechanic: Once a player thinks they’ve built a concept, they test it through:

NPC Quizzes: NPCs ask questions to verify the player’s understanding.

Scenario Simulations: Apply the concept to solve a problem (e.g., use alchemy to neutralize a poison).

Experimental Trials: Test a hypothesis based on the concept (e.g., "If transmutation works, this lead should turn to gold").

Word Rating-Every word has a numerical score that reflects its strength and effectiveness. For instance, "strength: 50" and "agility: 30" might produce "athleticism: 40" (based on an averaging or other formula).

Skill Growth Over Time: Words develop into stronger abilities as the player uses them. For example, using "empathy" frequently in conversations could evolve it into "compassion" or "understanding."

Practice and Mastery Quests: Higher-level words may require "Mastery Quests," where the player has to demonstrate their understanding of the concept in a significant way. For instance, to fully develop "wisdom," the player might need to solve a moral dilemma or pass a trial of knowledge.

Unfamiliar Words Section: Words the player has heard but doesn’t fully understand are stored in an "Unfamiliar Words" section. This encourages the player to seek out situations or NPCs that can help them unlock the meaning.

Reflection Mechanic: At times, players might be prompted to "reflect," gaining further understanding of the words they've unlocked. This could be a quiet downtime activity, like meditating by a river or watching the sunset, allowing words to "bloom" into new concepts or unlock deeper meanings.

Incentivizing Mastery and Exploration-Encourage players to pursue knowledge actively:

Rewarding Completion — Once the player fully masters a task (e.g., completing the entire word set for panning), they unlock perks, faster processes, or bonuses that make the task more efficient.

Encouraging Exploration — Use words as both keys and rewards. Some locations might be inaccessible or tasks impossible without key words, incentivizing players to explore more NPCs, books, and locations to gain knowledge.

Evolving Tasks — Introduce new challenges that require the player to apply familiar words in novel ways or combine words in different sequences, simulating real-world expertise growth and keeping the learning experience fresh.

Verified Information-Replacing outdated or incorrect information with accurate knowledge.

General vs. Domain Specific Knowledge-Some knowledge is used across various contexts in a meta sort of way where general knowledge is used to build domain knowledge.

Taxonomy: A hierarchical structure organizing entities into categories and subcategories.

Superordinate (Broad): General categories (e.g., "Living Organisms").

Intermediate (Basic Level): Recognizable categories (e.g., "Animals").

Subordinate (Specific): Granular labels (e.g., "Felines" → "Lions").

* + - * 1. Subjects-Organized into onotology. Think of a skill tree like structure where things are unlocked underneath along various different paths. Think Path of Exile.

Specialization: Breaking a general idea into more specific subcategories.

* + - * 1. Schema-Frameworks that organize information about a particular concept (e.g., your schema for "restaurant" might include menus, waitstaff, and ordering food). Organize concepts into a broader framework. Schema are organized into an ontology. A higher-level structure that combines concepts, categories, and relationships for contextual reasoning.

Part-Whole Relationships: Ideas that can be broken into components or contribute to a larger system.

Ontologies: Formal frameworks that define categories, properties, and relationships between ideas in a domain.

Controlled Vocabularies: Standardized sets of terms to maintain consistency in categorization.

Example: The Library of Congress Subject Headings (LCSH)

* + - * 1. Principles (Propositional Knowledge)

Cause and Effect

Patterns

Abstraction-The process of distilling specific experiences into general concepts or rules.

Semantic Blueprints-Sentence templates that contain operators in order etc

Theories

Rules

Methods-Method terms act as verbs in the learning process, providing actions like “distill,” “meditate,” or “analyze.” Each method has unique effects on how terms interact or evolve.

Analogies: Drawing parallels between two seemingly unrelated ideas.

Function or Purpose

Causality: Understanding how one idea leads to another.

Philosophical Axioms-Foundational, self-evident truths that serve as the basis for logical reasoning.

* + - * 1. Categories- A grouping of concepts based on shared properties (e.g., animals, tools, emotions).

People

Places

Things

Cultural and Social

Self-Knowledge

Beliefs/Values

* + - * 1. Levels of Concepts

Domain

Branch

Category

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Schema

Concept

Fact

* + - * 1. Skill Acquisition Levels (Dreyfus Model)

Novice: Learning basic rules and facts.

Advanced Beginner: Starting to use rules in real situations.

Competent: Gaining experience and making conscious decisions.

Proficient: Intuition begins to guide actions.

Expert: Effortless, intuitive handling of complex situations.

* + 1. Implicit (Non-Declarative)
       1. Procedural Memory
       2. Tacit Knowledge
       3. Priming
       4. Conditioning
       5. Biologically Inherited
       6. Habit Formation
       7. Associative Knowledge-Patterns or associations the brain recognizes without explicit reasoning.

# Information Processing Systems

* 1. Perception
     1. Enhanced Automaticity with Practice: Perception skills could become “automatic” after repeated practice, needing less input to execute flawlessly.
  2. Attention
  3. Cognitive Processing (Working Memory Name)
     1. STM
        1. Chunking: Grouping individual pieces of information into meaningful units for easier processing.
        2. Pattern Recognition
        3. Association
        4. Categorize
     2. Scientific Method-You can make observations to create data. Then you can recognize patterns and relationships and then test hypothesis etc.
     3. Thinking
        1. Reasoning
           1. Deductive-Using general principles to explain or predict specific instances.

Gear systems where you take pieces and try to create a machine etc.

* + - * 1. Inductive-Building ideas from specific observations to general theories.

Fitting shapes of different sizes to form complete larger shapes. Each shape could have words on it etc.

* + - * 1. Abductive
        2. Synthesis: Combining multiple ideas to create new, integrated concepts.
        3. Critical Reflection: Analyzing and testing ideas to refine or discard them.
      1. Problem Solving
         1. Spatial Organization Puzzles-The words represent physical objects that have spatial relationships. This can be used as a Jigsaw or just a plain adjacent space puzzle.
      2. Decision Making (Executive Function here for should it be broader?)
         1. Inference-Mental models enable inference by simulating scenarios and predicting outcomes. For example, an NPC with a mental model of "river currents" might infer that crossing the river at a calm spot is safer.
         2. Mental Model: A representation of how systems or processes work, allowing reasoning and prediction. This is knowledge applied to a situation.

Frames: More dynamic, situationally-bound schemas that adapt to context (e.g., a "party" frame includes decorations, music, and attendees).

Mad Libs-Situations present statements with blanks that the player can apply different types of words too to generate different types of solutions.

* + - * 1. Using Examples
      1. Reflective Thinking- Analyzing and evaluating past experiences to improve understanding. Call things gotten through this process ‘discoveries’.
      2. Bloom’s Taxonomy
         1. Remembering

Hebbian Learning: "Cells That Fire Together Wire Together"

* + - * 1. Understanding
        2. Analyzing
        3. Evaluating
        4. Creating
  1. Practicing
  2. Storage & Retrieval
     1. Personal Dictionary
  3. Applications
     1. Education: Scaffolding knowledge, where simpler ideas support the learning of more complex ones.
     2. Creativity: Using divergent and convergent thinking to generate and refine new ideas.
     3. AI and Knowledge Representation: Building ontologies and knowledge graphs that mimic human conceptual systems.
     4. Skill Fusion and Enhancement: Combining two high-proficiency skills creates an “Enhanced Skill,” an upgraded ability that’s more effective or versatile.
        1. Example: Combining “alchemy” and “botany” might unlock “Herbal Alchemy,” increasing the potency of herbal-based potions.
     5. Word-Gated Equipment Access: Certain high-level tools or materials are only accessible if the player has the required word proficiency, reinforcing that mastery isn’t only about resources but also about knowledge.
     6. Skill Checks: Challenges that test the player's current understanding, rewarding successful application of knowledge.
  4. 3. Equipment and Material Component (Resource System)-Skills rely on a material foundation—equipment, tools, and ingredients—bringing a tangible, hands-on element to gameplay. Acquiring and using these resources is integral to achieving mastery.
     1. Basic Equipment: Learning certain words unlocks access to beginner-level tools, like a simple cauldron for “alchemy” or a basic toolkit for “mechanics.” This equipment allows players to attempt skills but with limited effectiveness.
     2. Advanced Equipment: As proficiency grows, players gain access to more refined tools. Intermediate proficiency in “alchemy” might require specialized beakers, rare herbs, or precise measurement tools. Master-level skills could require legendary or rare materials.
     3. Material Gathering: Players gather materials through exploration, quests, or crafting, and these items have quality levels. For instance:
     4. Low-quality herbs yield weaker potions at low proficiency, but high-quality herbs, combined with high proficiency, lead to powerful, rare potions.
     5. Higher-level skills might require items like enchanted metals, rare gems, or ancient texts, which drive exploration and questing, creating a natural cycle of collection, refinement, and skill advancement.
     6. Skill and Equipment Synergy: Some equipment provides bonuses based on the player’s proficiency level, rewarding those who invest in developing a particular skill. For example, an Advanced Alchemy Kit boosts potion potency only if the player has at least Intermediate proficiency in alchemy.
* **6. Representing Knowledge in Gameplay**

To make this system usable and engaging, implement **intuitive tools** for navigating and interacting with the knowledge base:

* **6.1. Knowledge Grid or Tree**
* A **grid or hierarchical tree** where players can see how words, facts, concepts, and schemas are interconnected.
* Nodes on the tree represent knowledge categories:
  + **Words**: Single nodes.
  + **Facts**: Grouped into clusters by relevance.
  + **Concepts**: Central hubs connecting facts and words.
  + **Schemas**: Larger clusters that combine multiple concepts.
* **6.2. Mind Map**
* A **visual, branching diagram**:
  + Core ideas (like "Alchemy") appear as central nodes.
  + Branches show subcategories, relationships, and dependencies.
* Players can interact with the map to:
  + Expand or collapse nodes.
  + Add or rearrange connections.
* **6.3. Codex or Journal**
* A more traditional **text-based format** where knowledge is categorized by type and domain.
* Allows players to browse and review their collected knowledge at any time.
* **Step 1: Encountering a New Stimulus or Term**
* **Process**: The learner is exposed to a novel term, concept, or phenomenon through sensory input (e.g., seeing, hearing, touching).
* **Science**: Sensory memory temporarily holds the information.
* **Example**: Seeing the word "photosynthesis" for the first time.
* **Step 2: Initial Recognition and Attention**
* **Process**: The brain identifies the stimulus as distinct and directs focus toward it.
* **Science**: Attention mechanisms in the prefrontal cortex are activated; sensory information is passed to short-term memory.
* **Example**: Noticing "photosynthesis" as an unfamiliar term in a textbook.
* **Step 3: Labeling and Categorization**
* **Process**: The learner assigns a label to the term or associates it with an existing category.
* **Science**: Activation of semantic memory networks in the temporal lobe.
* **Example**: Categorizing "photosynthesis" as a scientific term related to plants.
* **Step 4: Associating Basic Facts**
* **Process**: The learner links the term to initial, surface-level facts.
* **Science**: Facts are encoded in declarative memory, often through rote learning or association.
* **Example**: Learning that photosynthesis involves plants and sunlight.
* **Step 5: Clarification Through Definitions**
* **Process**: Definitions are sought or provided, refining understanding of the term's meaning.
* **Science**: Semantic elaboration strengthens neural connections.
* **Example**: Learning that photosynthesis is "the process by which plants convert sunlight into energy."
* **Step 6: Connecting with Existing Knowledge**
* **Process**: The learner integrates the new information into prior knowledge frameworks (schemas).
* **Science**: Activation of schemas in the hippocampus and neocortex; constructive learning occurs.
* **Example**: Relating photosynthesis to prior knowledge about sunlight, leaves, and energy.
* **Step 7: Exploring Related Concepts**
* **Process**: The learner investigates terms or ideas closely associated with the new concept.
* **Science**: Spreading activation in semantic networks.
* **Example**: Discovering related terms like "chlorophyll," "carbon dioxide," and "oxygen."
* **Step 8: Formulating a Conceptual Model**
* **Process**: The learner organizes related facts and concepts into a coherent framework.
* **Science**: Schema construction and cognitive integration.
* **Example**: Creating a mental image of how sunlight, water, and carbon dioxide interact in a leaf.
* **Step 9: Applying to Concrete Examples**
* **Process**: The learner tests the concept by identifying or analyzing specific instances.
* **Science**: Procedural memory systems may activate for problem-solving; reinforcement in the prefrontal cortex.
* **Example**: Explaining photosynthesis as the reason leaves are green and plants grow in sunlight.
* **Step 10: Understanding Causal Relationships**
* **Process**: The learner identifies cause-and-effect relationships within the concept.
* **Science**: Activation of principle-related schema and inductive reasoning in the prefrontal cortex.
* **Example**: Realizing that without sunlight, photosynthesis cannot occur, and plants may wilt.
* **Step 11: Deepening Understanding with Analogies**
* **Process**: The learner uses analogies to deepen comprehension or communicate understanding.
* **Science**: Activation of creative and abstract reasoning pathways.
* **Example**: Comparing photosynthesis to a solar panel converting sunlight into electricity.
* **Step 12: Active Engagement (Discussion and Exploration)**
* **Process**: The learner discusses, debates, or teaches the concept, refining and reinforcing knowledge.
* **Science**: Enhanced learning through retrieval practice and feedback.
* **Example**: Explaining photosynthesis in a group discussion or writing about it in an essay.
* **Step 13: Experimentation and Validation**
* **Process**: The learner tests the knowledge through experiments or real-world applications.
* **Science**: Procedural and declarative knowledge integration; activation of the motor cortex and sensory pathways.
* **Example**: Conducting a science experiment to observe plant growth under different light conditions.
* **Step 14: Reflecting and Revising**
* **Process**: The learner reflects on the concept, revising or updating knowledge as needed.
* **Science**: Metacognitive processes and neural plasticity strengthen accurate connections.
* **Example**: Realizing that previous assumptions about plant growth were oversimplified.
* **Step 15: Generalizing to Broader Contexts**
* **Process**: The learner applies the concept to a wide range of situations, demonstrating mastery.
* **Science**: Abstract reasoning and transfer of knowledge.
* **Example**: Using the concept of photosynthesis to understand environmental issues like deforestation and climate change.
* **Step 16: Automating Recall**
* **Process**: The learner achieves fluency in recalling and using the knowledge with minimal effort.
* **Science**: Strengthened neural pathways and long-term potentiation.
* **Example**: Instantly explaining photosynthesis without needing to pause and think.
* **Step 17: Synthesizing with Other Knowledge**
* **Process**: The learner integrates the concept into a larger body of interdisciplinary knowledge.
* **Science**: Cross-domain schema integration.
* **Example**: Connecting photosynthesis to global energy cycles, ecosystems, and human impact.
* **Step 18: Innovating or Creating**
* **Process**: The learner uses the knowledge to innovate, solve problems, or create new ideas.
* **Science**: Activation of higher-order thinking and creative networks.
* **Example**: Designing a sustainable system based on the principles of photosynthesis.

This sequence provides a structured approach to understanding how knowledge develops from initial exposure to mastery and beyond, aligning with scientific principles while offering flexibility for practical exploration.