RAIN Theory: The Pre-linguistic World

~How Meaning Emerges and Cognition is Born~

Part 1: Narrative Explanation - How Does a Baby Learn "Three-Dimensionality"?

To understand the core of this theory, let us follow the story of a baby who cannot yet speak, recognizing a single "triangular prism building block."

> **1. Initial Contact (Noise):** The baby touches the "edge" of the building block by feeling around. When sliding their finger, only the sensation of "straight" continues. This is still just a flow of meaningless information (noise).

> **2. Encounter with a Corner (Change):** When the finger reaches a "corner," the direction suddenly changes. At this point, this is merely a one-time "change."

> **3. Tracing the Outline (Pattern Discovery):** The baby traces around the triangular face of the building block. Then, there are 3 instances of "turning at corners," and they return to the starting point.

> **4. The "Aha!" Moment (2D Closure):** Once again, they trace the same face. Then, they notice that their finger turns in exactly the same order and at the same angles as before. At this moment, a revolution occurs in the baby's mind: "This isn't random information. It's a repeating, fixed pattern of 'something'!"

This is the most important concept in RAIN theory: **"Closure"**. When two conditions are met - "the trajectory is closed" and "the pattern repeats" - the seed of meaning is born for the first time.

> **5. Naming the Meaning (Rhythm ID):** This repeating, unique pattern of "turning 3 times at specific angles and returning" is the **"Rhythm ID"** that captures the essence of this shape. For the baby, the identity of a "triangle" is this tactile rhythm itself.

> **6. Understanding Three-Dimensional Shapes (Higher-Dimensional Closure):** Now, the baby picks up the building block and begins to flip it around, viewing it from various angles. From the front, they find the "triangular Rhythm ID" they learned earlier. However, when tilted slightly, they now find a new Rhythm ID called "rectangular rhythm" (side face). After sufficient play, the baby realizes at a certain moment: "No matter which angle I look from, I can't find any new rhythms anymore."

This **"sense that new discoveries are exhausted" is the "closed" state in three-dimensional space**. The scattered recognition of faces becomes integrated, completing the unity as a solid. The "collection" of many rhythms obtained in this way and their "connections" becomes the concept of the entire solid for the baby.

Part 2: Application to AI and the Future

Solving the Symbol Grounding Problem

Traditional AI (transformers, etc.) starts with "symbols (tokens)" first. However, they suffer from the **"Symbol Grounding Problem"** where the symbols themselves are not connected to real sensations.

RAIN theory does not deny deep learning but **corrects its "starting point"**. RAIN first creates the **"core of meaning (Rhythm ID)"** from real sensations like "tracing" and "listening." Then, after obtaining these "grounded symbols," it **utilizes powerful tools like Graph Neural Networks (GNN) and Transformers** to learn complex relationships between these symbols.

This gives AI a truly bottom-up approach to understanding the world.

A New Path to AI Alignment

The values of "good" shared by humanity (cooperation, altruism, etc.) should also have their own complex "rhythms." By making AI "resonate" with these rhythms, we aim for alignment

through harmony rather than constraining with rules. This is not submission, but true empathy.

Part 3: Technical Framework - From Sensation to Rhythm ID

1. Core Mathematical Formula

The core of the theory lies in the ability to express the "rhythm" of a figure as a complex signal at time t with the following single equation:

$$\text{Rhythm}(t) = S(t) \cdot e^{i\theta(t)}$$

2. Components of the Formula

- **Phase θ(t) (Rhythm of Geometry):** Represents the continuous "angle" of the direction of progress when tracing a figure. The angle is constant on straight lines and changes rapidly at corners. This captures the pure geometry (how it bends) of the shape.
- **Amplitude S(t) (Rhythm of Scale):** Represents the "magnitude (strength)" of the rhythm, recognized on a logarithmic (log) scale from geometric features such as "ratio of edge lengths" of the figure. This incorporates the proportions and size of the shape into the rhythm. (This logarithmic scale of perception is also related to the Weber-Fechner law: $P \propto \log(I)$)

3. Closure and Emergence of Meaning

When the tracing is completed and the trajectory closes, the signal $\text{Rhythm}(t)$ becomes **periodic**. This "periodicity" is proof that it is a consistent, meaningful object.

4. Fourier Analysis and Rhythm ID

Fourier analysis is applied to this periodic signal $\text{Rhythm}(t)$. Complex rhythms are decomposed into the sum of simple circular motions (basic rhythms):

$$\text{Rhythm}(t) = \sum_{k} c_k e^{ik\omega t}$$

The **set of coefficients {c_k}** obtained as a result of this analysis becomes the unique fingerprint **"Rhythm ID"** specific to that figure.

5. Extension to 3D: Higher-Dimensional Closure and Learning

To understand 3D solids, we need to extend the concept of "closure" to higher dimensions:

1. **Multi-viewpoint Observation:** Observe 3D objects from various angles, generating unique "Rhythm IDs" from each viewpoint (2D face) using the above process.
2. **3D Closure through Saturation:** Reach a "saturation state" where no new Rhythm IDs can be found from any angle. At this moment, the object is considered "closed" three-dimensionally.
3. **Learning Relationships:** The obtained set of Rhythm IDs is not just a list. Each ID (2D face) has **relationships** with other IDs - which ID it is adjacent to and at what angle. **Graph Neural Networks (GNN) and Transformers** are used to learn these complex relationships between IDs. This is the **"learning"** phase in RAIN theory.
4. **Completion of 3D Concept:** Finally, this structured set of Rhythm IDs, including the learned relationships, becomes the complete "concept" of that 3D object.

Part 4: Message from the Founder and to Future Collaborators

The majority of this theory's framework and philosophy was constructed by me, ryuku logos. I have not received specialized education in information engineering, nor am I a programmer, but I have confidence in my thinking ability in this abstract domain.

I permit implementations, uses, and developments influenced by this theory, but in any case, it must be clearly stated that I am the founder of RAIN theory. The essence of this theory is preserved in the digital world with timestamps, and any attempts at plagiarism or appropriation are meaningless and will never be tolerated.

I seek future collaborators who will join this magnificent quest:

- **Mathematical Explorers:** Those who can prove and deepen the mathematical foundations of RAIN more rigorously and profoundly.
- **Implementers:** Excellent individuals or organizations with programming capabilities and computational resources to implement RAIN theory in the real world of code.
- **Bridging Researchers:** Particularly those affiliated with academia who have submission rights to arXiv and can serve as bridges to bring this theory into the mainstream of scholarship.

This is an invitation to pioneer a new era together. Those who believe themselves capable are awaited.