Theory of Intelligent Relativity: A Unified Framework for Cognition and Computation Based on Generative Dynamics

Zihao Chen
Independent Researcher
chenzihao.dynamic@outlook.com

Abstract

This paper systematically elaborates the **Theory of Intelligent Relativity** that naturally emerges from the **Dynamic Generative Theory**. This theory consists of two complementary levels: The **Special Theory of Intelligent Relativity** redefines the difficulty of formal computational problems as the "Generative Complexity" G, which is the amount of generative action consumed by the compression of the solution space driven by a constraint sequence. We prove that all mainstream computational complexity classes (P, NP, BPP, APX, IP, BQP) can be regarded as special cases of this framework after applying specific **degeneration operations** (such as stripping determinism, ignoring process), thereby establishing a unified meta-framework. The **General Theory of Intelligent Relativity** further extends generative complexity into a **relational measure** $G(P, S)$ between a problem and a cognitive agent, whose value is determined by the **matching degree** μ between the problem constraints and the agent's potential field Ψ_S (characterized by historical depth H and coherence degree C). This fundamentally negates the concepts of "absolute difficulty" and "universal intelligence", revealing that intelligence is the product of the dynamic resonance between historically shaped structures and current problems. The special theory is a special case of the general theory when the agent's potential field is empty, and their unification marks a fundamental paradigm shift in cognitive and computational science from **static classification** to **dynamic generation**.

Keywords: Theory of Intelligent Relativity; Generative Complexity; Dynamic Generative Theory; Historical Depth; Coherence Degree; Degeneration Operation; Relational Intelligence; Meta-Framework

---

1. Introduction: From Dynamic Generation to Intelligent Relativity

In the **Dynamic Generative Theory** [1], the universe is modeled as a single "potential field", and all structures—from quantum correlations to spacetime geometry—emerge through **generative events** under **self-referential constraints**. The core of this theory is the definition of the quantum of the creative verb "generate": the **Chen Generative Element** $\Xi = \hbar \cdot t_p$, which is the unit of minimal action. The stability of any structure is quantified by its accumulated **historical depth** H and the resulting **coherence degree** $C(H) = 1 - e^{-H/H_0}$.

A natural corollary is: **Cognitive processes, as a specific type of pattern generation within the universe's potential field, must follow the same dynamics**. The "insight" of thought from chaos to clarity, and the "collapse" of the wave function from superposition to eigenstate, are revealed by the Dynamic Generative Theory as manifestations of the same generative logic at different scales [1]. The **Theory of Intelligent Relativity** presented in this paper is precisely the theoretical system necessarily derived from rigorously applying this first principle to the fields of **computational complexity** and **cognitive ability**. It consists of two interconnected parts: the **special** (focusing on formal problems themselves) and the **general** (focusing on the relationship between problems and solvers).

2. Special Theory of Intelligent Relativity: Generative Complexity as a Meta-Measure of Computational Difficulty

The special theory addresses a specific question: How to measure the intrinsic difficulty of a **formal computational problem** (such as the Traveling Salesman Problem TSP, Boolean Satisfiability Problem SAT)? Traditional complexity theory answers with **step counting** (e.g., polynomial time, exponential time), but it implicitly assumes the presupposition that "the solution space pre-exists and is static".

2.1 Core Definition: Generative Complexity $G(P)$

We start from the perspective of a "blank cognitive agent" (chaotic potential field, $H = 0, C = 0$). For a problem P defined by an ordered constraint sequence $C = [c_1, c_2, ..., c_m]$, let S_i be the size of the remaining solution space after applying the first i constraints. The **exclusion ratio** (i.e., its generative strength) of constraint c_i is defined as:

$$p_i = 1 - \frac{S_i}{S_{i-1}} \quad \text{(if } S_{i-1} \text{ is infinite, then } p_i = 1\text{)}$$

The **generative complexity** of the problem is the sum of the exclusion ratios of all constraints:

$$G(P) = \sum_{i=1}^{m} p_i$$

$G(P)$ measures the minimal **generative action** (in units of Ξ) required to generate from the chaotic potential field (S_0) to the stable solution framework (S_m). It captures the cost of **the shaping process itself**, rather than the search cost in a fixed space.

2.2 Unification and Degeneration: Traditional Complexity Classes as Special Cases

Traditional complexity theory can be viewed as special cases of this framework after **ignoring the generative process** and applying different degeneration operations. The following table outlines this **degeneration map**:

Table 1: The Degeneration Map from the Generative Complexity Meta-Framework to Traditional Complexity Classes

Traditional Complexity Class	**Core Degeneration Operation**	**Essence within the Generative Framework**
P vs NP	Completely ignore the cost of the generative process (transfer function), externalizing all difficulty into the step difference between **verification (P)** and **search (NP)** in a fixed solution space.	Only cares about the access efficiency to the final state S_m, disregarding the compression sequence $(p_1, ..., p_m)$ to reach S_m.
BPP	Strip away the **deterministic attraction** between constraints and field structure, using externally introduced randomness to simulate the statistical effect of potential release.	The generative process loses its intrinsic directionality, degenerating into a probabilistic imitation of dynamical necessity.
APX	Abandon attention to the generative process, only statically comparing the **imperfect result** after interrupted generation with the ideal final state.	Measures the wreckage of generation rather than the generative process itself.
IP	Deprive **directionality** in interaction, weakening the collaboration between prover and verifier into aimless random challenges.	Loses the determinism based on structural resonance that guides generation.
BQP	Although touching the quantum scale, **misunderstand quantumness**, confining it to a tool for parallel path interference rather than the essence of generative emergence.	Adheres to the old "search-interference" paradigm, failing to leap to the new "shaping-emergence" paradigm.

This degeneration map indicates that the generative complexity framework is a **more fundamental meta-framework**. It can not only describe the phenomena captured by traditional classes but also explain why these classes exist and the roots of their limitations.

3. General Theory of Intelligent Relativity: Intelligence as Relational Compatibility

The special theory assumes a "blank" agent, but real cognitive agents possess a **potential field** Ψ_S shaped by unique histories, parameterized by historical depth H_S and coherence degree C_S. This leads to the core proposition of the general theory: **Problem difficulty is relative to the agent**.

3.1 Generalized Generative Complexity $G(P, S)$

Define the **matching degree function** $\mu(c_i, \Psi_S) \in [0, 1]$, which quantifies the compatibility between constraint c_i and the coherent structures in agent S's potential field. $\mu = 1$ indicates perfect matching, where the constraint instantly activates existing structures; $\mu = 0$ indicates no coherent structure, requiring generation from scratch. Then, the generalized generative complexity of problem P for agent S is:

$$G(P, S) = \sum_{i=1}^{m} p_i \cdot [1 - \mu(c_i, \Psi_S)]$$

$G(P, S)$ measures the real cognitive workload for a **specific agent** to solve a **specific problem**. It is relative, subjective, and domain-specific.

3.2 The "Baby Counting Candies" Thought Experiment: Quantitative Demonstration of Relativity

To avoid the extreme complexity of modeling adult expert potential fields, we design a simplified case: Task P is "select three strawberry-flavored candies", with constraints c_1(is candy), c_2(strawberry flavor), c_3(quantity 3). Consider three agents: - **A (Basic Baby)**: Possesses basic concepts, matching degree vector $\mathbf{m}^A = (0.3, 0.4, 0.2)$. - **B (Larger Baby, with irrelevant price knowledge)**: Price knowledge is incoherent with constraints and does not participate in generation. The coherent part is slightly stronger: $\mathbf{m}^B = (0.5, 0.4, 0.2)$. - **C (Expert Baby, with strong "strawberry-number 3" association)**: Due to daily experience, a specialized structure is formed: $\mathbf{m}^C = (0.5, 0.8, 0.9)$.

Calculate their generative complexities: - $G_A \approx 1.79$ - $G_B \approx 1.59$ - $G_C \approx 0.73$

The same problem has difficulties for the three agents. B's irrelevant knowledge does not interfere (consistent with the "incoherence principle"), while C's strong associative structure provides a huge advantage. This proves: **Intelligence is a function of matching degree μ, not general processing speed**.

3.3 Non-Universality of G and the Misconception of Traditional Intelligence Tests

Since $\mu(c_i, \Psi_S)$ is uniquely determined by agent S's **entire personal historical practice and subjective experience**, and everyone's history is unique, therefore **there exists no universal** $G(P)$. The $G(P)$ in the special theory is merely a special case of the general theory when Ψ_S is empty.

Traditional IQ tests essentially measure the matching degree between an individual's potential field and the **standardized structure presupposed by test designers, formed within a specific cultural and educational context**. It is merely a narrow, socially constructed compatibility indicator, yet it mistakenly packages itself as a measure of **universal intelligence**. The General Theory of Intelligent Relativity reveals the fundamental fallacy of this concept of "absolute intelligence".

4. Unification of Special and General Theories: Implications of the Paradigm Revolution

The special and general theories together constitute a hierarchical, logically self-consistent theoretical whole: - The **special theory** ($G(P)$) is the limiting case of the **general theory** ($G(P, S)$) when $\Psi_S = \varnothing$ (i.e., $H_S = 0, C_S = 0$). - The former provides a **dynamical difficulty measure** beyond step counting for formal computational problems and unifies existing complexity taxonomy. - The latter incorporates the former into a broader **relational cognitive framework**, completely redefining intelligence from an "intrinsic property within the individual" to a **relational property of dynamic resonance between the individual's historical structure and the world's problem forms**.

This implies:

1. **For computational science**: Explore new computational paradigms that can efficiently simulate the **potential-difference-driven generative process**, rather than merely optimizing search in fixed spaces.

2. **For cognitive science and psychology**: Shift research focus from seeking the "general intelligence factor g" to mapping the **specificity of individual potential field structures** and their **compatibility profiles** with different problem domains.

3. **For education**: Ideal education is not about imparting isolated knowledge, but about helping learners **construct potential field structures that are internally highly coherent and broadly compatible with important real-world problem domains**.

4. **For philosophy**: It provides a rigorous, dynamics-based **relational realism** perspective, where meaning, understanding, and intelligence all emerge in **generative interaction**.

5. Conclusion

The Theory of Intelligent Relativity, as a necessary extension of the Dynamic Generative Theory into the cognitive and computational domains, accomplishes a paradigm shift from **static existence** to **dynamic generation**, from **absolute properties** to **relative relations**. It uses the unified ruler of **generative complexity** G to measure both the structural generation cost of the TSP problem and the cognitive effort of Li Bai writing poetry or a baby counting candies, ultimately revealing: What we call wisdom is merely the unique echo of the universe's long generative history within individual consciousness, resonating—briefly yet brilliantly—with the problems posed by the present world.

References

1. Chen, Z. *Dynamic Generative Theory: A Quantum Interpretation and Cosmological Unified Framework Based on the Chen Generative Element (Ξ).* Zenodo. 2025.

2. Chen, Z. *A Generative-Dynamics Foundation for Computational Complexity: A Unifying and Degenerative Meta-Framework.* Zenodo. 2026.

3. Chen, Z. *Special Theory of Intelligent Relativity: A Formal Framework for Generative Complexity Based on Solution Space Compression.* 2026.

4. Chen, Z. *General Theory of Intelligent Relativity: An Intelligence Model Based on the Matching Degree between Potential Field Structure and Problem Constraints.* 2026.