

ITEM #211 - Structural Intelligence Across Internal and External Paths: DBM, Inheritance, Learning, and Civilization-Level Accumulation

(Why Intelligence Evolves by Generating Structure Internally and Accumulating Structure Externally)

Conversation: 反向传播与脑神经

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Authors: Sizhe Tan & GPT-Obot

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Abstract

Biological intelligence does not transmit concrete knowledge structures genetically, nor does it rely solely on individual learning. Instead, it follows a hybrid evolutionary strategy: internal structure generation governed by inherited constraints, combined with external accumulation and transmission of concrete structures through culture and civilization.

This paper formalizes this strategy from the perspective of Structural Intelligence and positions DBM (Differential Brain Model) as an explicit implementation of the internal structural generator. We clarify what is inherited, what is learned, and what must remain external—and why this separation is not accidental but evolutionarily optimal.

This framework establishes the conceptual foundation for DBM as a structure-first intelligence system aligned with biological and civilizational evolution.

1. A Fundamental Clarification: What Is and Is Not Inherited

A persistent misconception in intelligence research is the assumption that if structure is central to intelligence, then concrete structures should be biologically inherited.

This assumption is incorrect.

Biological inheritance does **not** transmit task-level knowledge, semantic structures, or domain-specific representations. Instead, it transmits:

- Rules for generating structure
- Constraints on how structures may evolve
- Plasticity policies governing when structures stabilize

In DBM terms:

Inheritance specifies how structures may be formed, not which structures should exist.

2. The Internal Path: Structure Generation Within the Agent

2.1 What “Internal” Means

The internal path refers to processes that occur *within the intelligent agent* and are governed by biologically or architecturally inherited mechanisms.

These include:

- Representation partitioning
- Hierarchical differentiation
- Granularity adjustment (split / merge / shortcut)
- Stability and reuse evaluation

This is where **Structural Intelligence** operates.

2.2 DBM as an Internal Structure Generator

DBM does not store knowledge as static data. Instead, it provides:

- Structural primitives
- Differential comparison mechanisms
- Evolution constraints (e.g., reuse thresholds, path-shortening requirements)
- Granularity control policies

Together, these define a **structure-generating genotype**, not a fixed phenotype.

3. The External Path: Civilization as a Structure Accumulation System

3.1 Why Concrete Structures Must Remain External

Concrete structures—such as concepts, skills, theories, tools, and procedures—are:

- Environment-dependent
- Rapidly obsolescent
- Prone to conflict across generations

Encoding them biologically would impose unacceptable evolutionary risk.

Instead, evolution offloads them to an external channel:

- Language
- Writing
- Diagrams
- Software
- Institutions

This external path allows:

- Low-cost replication
 - Parallel experimentation
 - Reversible failure
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3.2 External Structures as “Snapshots,” Not Generators

External artifacts preserve *results*, not *processes*.

They record **what worked**, not **why it should continue to work**.

Therefore, they cannot replace internal structure generation; they can only supply candidates for internal evaluation.

4. DBM's Position in the Internal–External Division

DBM explicitly occupies the internal side of this division:

- It evaluates incoming structures
- Determines compatibility with existing structure
- Decides granularity placement
- Enforces evolutionary constraints

DBM does **not** compete with external knowledge systems. It governs their assimilation.

5. The Evolutionary Rationale: Minimal Evolution Threshold (MET)

The internal–external separation is mandated by the Minimal Evolution Threshold:

- Internal structural change is costly and risky
- Only changes with long-term, multi-context benefit are retained
- External structures bypass MET and absorb experimental volatility

This separation maximizes adaptability while preserving stability.

6. Structural Intelligence as an Evolutionary Contract

We can now summarize the contract:

- **Inheritance** provides structure-generation rules
- **Learning** instantiates structures within those rules
- **Civilization** accumulates and distributes structural outcomes

DBM formalizes the first two layers while remaining compatible with the third.

7. Conclusion

Structural Intelligence does not evolve by copying structures across generations. It evolves by preserving the *capacity to generate, evaluate, and stabilize structure*, while delegating concrete accumulation to civilization.

DBM represents this principle in explicit, engineering-ready form.

ITEM #211 - 结构智能的体内 / 体外一程: DBM、遗传、学习与文明级结构累积

摘要

生物智能并不通过基因直接遗传具体知识结构，也不完全依赖个体学习，而是采用一种混合演化策略：

体内负责结构生成与演化，体外负责具体结构的累积与传递。

本文从结构智能（Structural Intelligence）的视角出发，将 DBM（Differential Brain Model）明确定位为“体内结构生成器”，系统厘清哪些内容可以遗传、哪些必须学习、哪些应当长期保留在体外。我们指出，这种分工并非权宜之计，而是受最小进化门槛（MET）约束下的最优演化结果。

1. 一个必须先澄清的问题：什么会遗传，什么不会

一个常见误解是：

既然结构智能重要，为何不直接把“好结构”遗传给下一代？

这是错误的。

生物遗传并不传递：

- 具体概念
- 任务级结构
- 领域知识
- 语义内容

而是传递：

- 结构生成规则
- 结构演化约束
- 可塑性与稳定性的调度机制

用 DBM 的话说：

遗传的是“结构如何被生成”，而不是“生成了什么结构”。

2. 体内一程：智能体内部的结构生成

2.1 “体内”意味着什么

体内一程，指的是在智能体内部、受先验约束控制的结构形成过程，包括：

- 表征空间的分区
- 层级结构的分化
- 粒度的升降（分裂 / 合并 / 直达叶子）
- 结构稳定性与复用评估

这是结构智能发挥作用的核心场域。

2.2 DBM 作为体内结构生成器

DBM 并不以“存储知识”为目标，而是提供：

- 结构原语
- 差分与对齐机制
- 演化合法性约束
- 粒度调节策略

这些共同构成了结构生成的基因型，而非固定的知识表型。

3. 体外一程：文明作为结构累积系统

3.1 为什么具体结构必须体外化

具体结构（概念、技能、理论、工具）具有：

- 强烈的环境依赖性
- 快速的过时风险
- 跨代冲突可能

将其固化为生物遗传，将带来不可承受的演化成本。

因此，进化选择将它们外包给：

- 语言
- 文字
- 图形
- 程序

- 制度

体外路径具备：

- 低成本复制
 - 并行试错
 - 可回滚失败
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3.2 体外结构是“结果快照”，不是生成机制

体外结构保存的是“成功的结果”，而不是“结构生成的能力”。

它们必须经过体内结构系统的再评估，才能被吸收。

4. DBM 在体内 / 体外分工中的位置

DBM 明确站在体内一侧，负责：

- 评估体外输入结构
- 判断与现有结构的兼容性
- 决定结构所处的粒度层级
- 执行演化约束与稳定策略

DBM 不与体外系统竞争，而是治理其接入方式。

5. 演化根源：最小进化门槛 (MET)

体内 / 体外分工受 MET 约束：

- 体内结构变更代价高、风险大
- 只有跨场景、长期收益的结构才会被保留
- 体外结构承担试错与不稳定性

这是稳定与适应性的最佳平衡。

6. 结构智能的演化契约

可以将整套机制总结为：

- 遗传：赋予结构生成能力
- 学习：在能力边界内实例化结构
- 文明：体外累积并传播结构成果

DBM 对前两层进行形式化，同时天然兼容第三层。

7. 结论

结构智能并非通过复制结构而演化，而是通过保留生成、评估与稳定结构的能力而延续。

文明承担了具体结构的累积任务，而 DBM 为体内结构智能提供了工程化表达。
