ITEM #200 - Knowing–Doing Co-Progress Intelligence (KD-CPI): Decision and Action Under Fuzzy Metrics and Competitive Constraints

Conversation： ACLM Vertical Bridging Simplification

20260101

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(English Version)

Abstract

Beyond Statistical Intelligence and Structural Intelligence, this item proposes a third, fundamental paradigm: **Knowing–Doing Co-Progress Intelligence (KD-CPI)**.

KD-CPI characterizes intelligent behavior under unavoidable biological and engineering constraints: decisions must be made **before** metrics, models, and structures are complete. Action is not postponed until certainty is achieved; instead, action and knowledge acquisition proceed simultaneously.

This paradigm is intrinsic to biological survival competition and is directly manifested in DBM engineering problems such as ACLM Gap Bridging, where incomplete metrics and structures coexist with the necessity to advance execution.

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1. The Unavoidable Constraint: Competitive “Anytime” Decision

In biological evolution, survival is constrained by:

- Incomplete information
- Incomplete internal models
- Irreversible time pressure

An organism that waits for certainty is outcompeted by one that acts with bounded risk.

This same constraint appears in modern engineering systems:

- Real-time control
- Online planning and routing
- Fault recovery and emergency handling
- Incremental program synthesis and execution

KD-CPI formalizes this constraint as **anytime decision under competition**.

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2. The Knowing–Doing Co-Progress Hypothesis

KD-CPI addresses the classical paradox:

Knowledge is needed for correct action,
but action is needed to obtain knowledge.

Instead of resolving this paradox theoretically, KD-CPI resolves it operationally:

- Decisions are made under partial knowledge.
- Actions generate new evidence.
- Evidence refines metrics and structures.
- Refined structures guide subsequent actions.

Knowledge and action therefore **co-evolve**.

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3. DBM Interpretation: Fuzzy Metric and Anytime Action

In DBM terms, KD-CPI operates under the following conditions:

1. **Fuzzy Metric Distance**
   Distance is not a single scalar but an estimate with uncertainty, bounds, or confidence.
2. **Anytime Decision Loop**
   The system must produce a viable decision at any time, improving it incrementally.

3. **Action-as-Measurement**
   Actions are treated as probes that reduce uncertainty and enrich structure.

KD-CPI thus complements Structural Intelligence rather than replacing it.

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4. Instinctive, Pre-Linguistic, and Non-Declarative Nature

KD-CPI is often:

- Instinctive rather than symbolic
- Prior to formal reasoning
- Difficult to express declaratively before execution

However, KD-CPI is not irrational.
Its logic emerges **after action**, through evidence accumulation and structural stabilization.

Language and rules act as post-hoc explanatory layers, not pre-conditions.

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5. Reward Structure: Competitive Advantage Through Initiative

In KD-CPI, reward is multi-dimensional:

- Outcome reward (success or survival)
- Information gain (reduced uncertainty)
- Structural gain (new anchors, paths, rules)
- Positional advantage (early occupation of solution space)

Initiative itself becomes a selective advantage, explaining the long-term persistence of adaptive systems.

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6. ACLM Gap Bridging as a Canonical KD-CPI Case

ACLM Gap Bridging exemplifies KD-CPI:

- Metrics are incomplete or fuzzy.
- Calling Graphs are partial.
- Operation mappings are uncertain.

- Yet execution must proceed.

The Anchor-First Vertical Bridging strategy demonstrates KD-CPI in practice:

1. Act using known anchors and reachable structures.
2. Incrementally refine via zoom-in and reranking.
3. Resort to high-risk mappings only as a last fallback.

This embodies “act first, stabilize later” under strict budget control.

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7. Relationship to Other Intelligence Paradigms

Paradigm	Core Assumption	Primary Strength
Statistical Intelligence	Data sufficiency	Pattern generalization
Structural Intelligence	Structural sufficiency	Explainable reasoning
KD-CPI	**Sufficiency is unattainable in time**	**Survival-grade action**

KD-CPI provides the missing link between perception, structure, and execution.

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8. Summary

Knowing–Doing Co-Progress Intelligence captures a fundamental mode of intelligence operating under uncertainty, competition, and time pressure.

DBM does not merely observe this mode; it provides a framework for **engineering it**, enabling intelligent systems to act, learn, and structure themselves simultaneously.

ITEM #200 - 知行同进智能（KD-CPI）：

模糊度量与生存竞争约束下的决策与行动范式

（中文版）

摘要

在统计智能与结构智能之外，本文提出第三种基础性智能范式：**知行同进智能**
（Knowing–Doing Co-Progress Intelligence, KD-CPI）。

KD-CPI 描述了一类在信息、度量与结构均不完备的条件下，仍必须做出决策并采取行动的智能行为模式。
在该范式中，行动不是知识完备之后的结果，而是知识生成过程的一部分。

这一范式根植于生物生存竞争，也在 DBM 工程问题（如 ACLM Gap Bridging）中得到直接体现。

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1. 不可回避的约束：抢答式决策

生物演化中存在一个不可回避的事实：

- 等待确定性意味着失败
- 延迟行动具有不可逆代价

同样的约束广泛存在于工程系统中：

- 实时系统
- 在线规划
- 故障处理
- 程序生成与执行

KD-CPI 正是对这种**必须在不完备条件下抢答**的智能形式的抽象。

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2. 知行同进假说

KD-CPI 面对一个经典困境：

行动需要知识，
知识却往往只能通过行动获得。

KD-CPI 的解法不是理论上的“先后排序”，而是实践中的并行推进：

- 在不完备知识下行动
- 行动产生新证据
- 证据修正度量与结构
- 结构反过来指导下一步行动

知识与行动因此形成同进循环。

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3. DBM 语言下的表达

在 DBM 体系中，KD-CPI 具有三个核心特征：

1. **模糊度量（Fuzzy Metric）**
   距离并非单一数值，而是带不确定性的估计。
2. **Anytime 决策机制**
   系统必须随时给出“当前可行”的决策，并允许持续改进。
3. **行动即测量**
   行动本身是信息获取与结构构造的手段。

KD-CPI 并非替代结构智能，而是其在生存约束下的补充。

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4. 本能性与非先验可言说性

知行同进智能往往表现为：

- 本能性的
- 先于形式推理的
- 行动前难以完整言说的

但它并非非理性。
其理性结构是在行动之后，通过证据链与结构固化逐步显现的。

语言与规则更多是**事后解释层**，而非行动前的充分条件。

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5. 抢答奖励与进取优势

KD-CPI 的奖励并不仅是“结果是否成功”，还包括：

- 信息增益
- 结构资产的积累
- 竞争位势的提前占据

正是这种进取优势，使生命系统与工程系统得以持续演化。

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6. ACLM Gap Bridging：典型案例

ACLM Gap Bridging 是 KD-CPI 的典型工程实例：

- 度量不完备
- 结构不完备
- 映射不确定
- 但系统必须推进

Anchor-First 的 Bridging 策略体现了 KD-CPI 的工程范式：

1. 先利用已有锚点行动
2. 再通过 zoom-in 逐步收敛
3. 最后才使用高风险映射兜底

这是标准的“先可行，后稳定”路径。

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7. 与其他智能范式的关系

智能范式	基本假设	核心优势
统计智能	数据充分	泛化能力
结构智能	结构充分	可解释推理
知行同进智能	**充分性不可及时获得**	**生存级决策能力**

KD-CPI 连接了认知、结构与行动。

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8. 总结

知行同进智能揭示了一种在不确定、竞争与时间压力下运行的基本智能形态。

DBM 不只是描述这一形态，而是为其提供了**工程化与系统化的实现框架**。