

# h-M3 v2: Meta-Meta-Model for Hybrid DSLs

## Design Principles

1. **Compact:** Fits on an index card
  2. **Complete:** Can derive any h-DSL for behavior, workflow, instructions, artifacts
  3. **Dual-register:** Formal and generative are first-class, not afterthoughts
  4. **Temporal:** State and change are primitive, not derived
  5. **Teleological:** Purpose is primitive, not annotation
  6. **Reasoned:** Inference connects structure to behavior to purpose
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## The Four Strata

TELOS	OUTCOME	ALIGNMENT	what for
DYNAMICS	STATE	TRANSITION	what changes
STRUCTURE	SLOT	RELATION	what holds
SUBSTANCE	TERM	PROSE	what fills

## Primitives

### SUBSTANCE (what fills slots)

#### TERM

Formal, symbolic, typed. Validated syntactically. Machine-checkable.

Operations: parse, type-check, substitute, compare

## PROSE

Natural language, contextual, interpreted. Validated semantically by AI.

Operations: ground, follow, judge, accept, derive

## STRUCTURE (what holds substance)

### SLOT

A position that accepts fills. Typed by what it accepts.

slot : Type  $\rightarrow$  Position

### RELATION

Connection between slots. Gives structure its shape.

relation : Slot  $\times$  Slot  $\rightarrow$  Link

## DYNAMICS (what changes)

### STATE

Configuration of fills in slots at a moment.

state : Slot\*  $\rightarrow$  Fill\*

### TRANSITION

Movement from one state to another. The primitive of behavior.

transition : State  $\rightarrow$  State

## TELOS (what for)

### OUTCOME

A desired state. What transitions aim toward.

outcome : State (distinguished as goal)

### ALIGNMENT

Values that guide choice among transitions. Why this path, not another.

alignment : Transition\* → Transition (selection function)

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## The Prose Correspondence

PROSE has five **modes** corresponding to the primitives that require interpretation:

Prose Mode	Connects	Interpreter Operation
DESCRIPTIVE	STATE	GROUND (what is)
DIRECTIVE	TRANSITION	FOLLOW (what to do)
EVALUATIVE	OUTCOME	JUDGE (if achieved)
RATIONALE	ALIGNMENT	ACCEPT (why right)
INFERENTIAL	RELATION	DERIVE (how follows)

### The crucial insight:

TERM handles STRUCTURE (static, closed, formal).

PROSE handles DYNAMICS, TELOS, and the reasoned connections between them.

The first four operations work **within** a stratum.

DERIVE works **across** strata—it's the vertical connector.

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## The Fifth Operation: DERIVE

### Why DERIVE is Necessary

Consider: How do you get from STATE to valid TRANSITION? From TRANSITION to OUTCOME? The framework had:

- GROUND: Understand what IS
- FOLLOW: Determine what to DO
- JUDGE: Validate if DONE
- ACCEPT: Justify why RIGHT

But it lacked: **How does this FOLLOW from that?**

DERIVE is the reasoning operation—the process of inference that connects premises to conclusions across all strata.

## DERIVE Defined

DERIVE: Inferential prose → Entailment

Input: Prose expressing logical, causal, or evidential connection

Output: Established inference that can be applied in reasoning

## The Forms of DERIVE

DERIVE handles all three classical inference patterns:

### Deductive (general → specific)

Input: "Documents over 100 lines require iterative construction"

+ "This document is 250 lines"

Derive: Therefore, iterative construction is required

### Inductive (specific → general)

Input: "Previous attempts at single-pass generation produced errors"

+ "This pattern occurred across multiple document types"

Derive: Single-pass generation is unreliable for complex documents

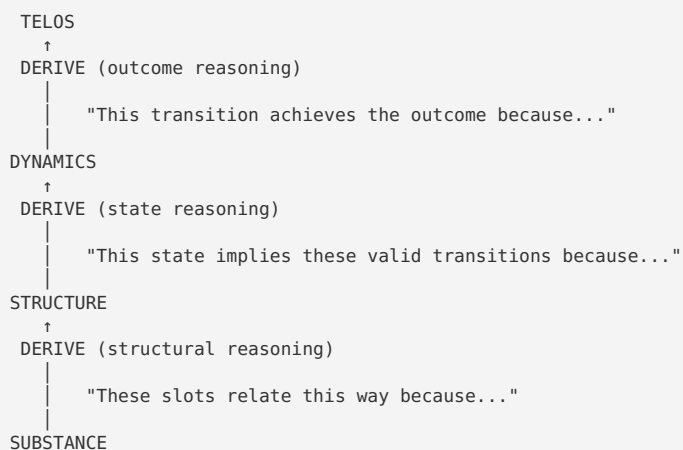
### Abductive (observation → best explanation)

Input: "The user asked for a 'deck' with 'slides'"

+ "They mentioned a 'board meeting'"

Derive: This is likely a business presentation context

## DERIVE as Vertical Connector



DERIVE is what makes the strata cohere into a reasoning system, not just a descriptive taxonomy.

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## The Complete Interpreter Contract

The generative AI interpreter performs five operations on PROSE:

### GROUND (descriptive → state)

```
Mode:    Descriptive
Question: "What is the current situation?"
Input:    "The spreadsheet contains quarterly sales data with missing Q3 figures"
Output:    Structured state: {artifact: spreadsheet, content: sales_data,
                             completeness: partial, gap: Q3}
```

### FOLLOW (directive → transition)

```
Mode:    Directive
Question: "What should I do?"
Input:    "Validate the data types, then fill missing values using
          adjacent quarter interpolation, finally format for presentation"
Output:    Transition sequence: [validate, interpolate, format]
```

### JUDGE (evaluative → validation)

```
Mode:    Evaluative
Question: "Have I succeeded?"
Input:    "The spreadsheet should be complete, accurate, and ready for
          executive review without requiring explanation"
Output:    Boolean + explanation: {success: true, confidence: 0.9,
                                   reasoning: "All cells filled, formats consistent, labels clear"}
```

### ACCEPT (rationale → alignment)

```
Mode:    Rationale
Question: "Why is this the right choice?"
Input:    "We prioritize data accuracy over visual polish because
          executives will make decisions based on these numbers"
Output:    Alignment principle: accuracy > aesthetics when stakes are high
```

### DERIVE (inferential → entailment)

```
Mode:    Inferential
Question: "How does this follow from that?"
Input:    "Complex documents fail in single-pass because context accumulates
          and early decisions constrain later options incorrectly"
Output:    Inference: complexity(doc) ∧ single_pass → likely_failure
          Applicable: When assessing whether to iterate
```

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# Reasoning Chains

DERIVE enables **chains of reasoning** that span the framework:

```
reasoning_chain:
  name: "Document Strategy Selection"

  steps:
    - derive:
      from: "User requested 'comprehensive report on Q3 performance'"
      infer: "This is a complex analytical document"
      type: abductive # observation → interpretation

    - derive:
      from: "Complex analytical documents have multiple interdependent sections"
      infer: "Section order and content affect coherence"
      type: deductive # general rule → specific case

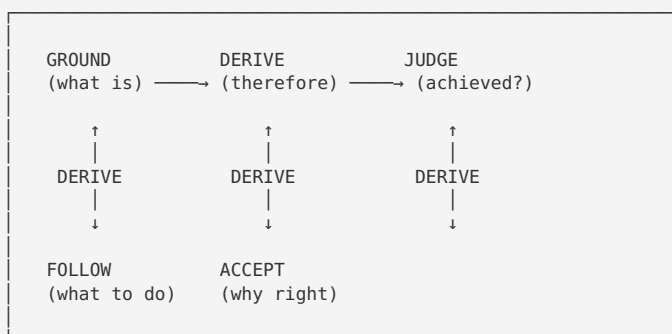
    - derive:
      from: "Coherence-sensitive documents benefit from outline-first approach"
      infer: "Outline before drafting is the appropriate transition"
      type: deductive

    - derive:
      from: "Previous outline-first approaches for this user succeeded"
      infer: "This strategy aligns with demonstrated preferences"
      type: inductive # past success → likely future success

  conclusion:
    transition: outline → draft → revise
    justified_by: chain of derive operations
    aligned_with: user_preference, document_quality
```

## DERIVE and the Other Operations

DERIVE doesn't replace the other four—it connects them:



- GROUND + DERIVE → What transitions are valid from here?
- FOLLOW + DERIVE → Why will this transition sequence work?
- DERIVE + JUDGE → Has the outcome been achieved?
- DERIVE + ACCEPT → Is this choice aligned with values?

# Reason: Noun and Verb

The framework now captures both senses of "reason":

**Reason (noun):** RATIONALE → ACCEPT

"The reason we chose X is..."  
Handled by: alignment, justification, the WHY

**Reason (verb):** INFERENCE → DERIVE

"We reasoned that X implies Y..."  
Handled by: inference, derivation, the THEREFORE

ACCEPT tells you the destination (why this is right). DERIVE shows you the path (how we got there).

## Updated h-M3 Summary (Index Card Version)

h-M3 v2		
SUBSTANCE	TERM (formal)	PROSE (generative)
STRUCTURE	SLOT (position)	RELATION (connection)
DYNAMICS	STATE (moment)	TRANSITION (change)
TELOS	OUTCOME (goal)	ALIGNMENT (values)
PROSE MODES		
descriptive	→	GROUND (what is)
directive	→	FOLLOW (what to do)
evaluative	→	JUDGE (if achieved)
rationale	→	ACCEPT (why right)
inferential	→	DERIVE (how follows)
COMPOSITION		
T <sub>1</sub> ; T <sub>2</sub>	sequence	
T <sub>1</sub>   T <sub>2</sub>	choice (alignment selects)	
T*	iterate (until outcome)	
T <sub>1</sub>    T <sub>2</sub>	parallel (merge states)	
DERIVE CONNECTS STRATA		
STRUCTURE	—derive—→	DYNAMICS —derive—→ TELOS

## Completeness Argument

The five operations are now **complete** in that they cover all epistemic needs:

Need	Operation	Question Answered
Perception	GROUND	What is?
Action	FOLLOW	What to do?
Evaluation	JUDGE	Did it work?
Justification	ACCEPT	Why is this right?
Inference	DERIVE	How does this follow?

This maps to the classical epistemic categories: - GROUND → Observation/ Understanding - FOLLOW → Practical reasoning (means) - JUDGE → Assessment/Verification - ACCEPT → Normative reasoning (ends) - DERIVE → Theoretical reasoning (connections)

Any reasoning an agent must perform falls into one of these five categories.

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## DERIVE in h-DSL Derivation

When deriving an h-DSL from h-M3, DERIVE appears in:

### Skill h-DSL

```

Procedure:
  steps:
    - phase: analyze
      derive:
        from: "user request characteristics"
        infer: "complexity level and appropriate strategy"

    - phase: select
      derive:
        from: "complexity level + available approaches"
        infer: "optimal procedure variant"

```

### User Story h-DSL

```

AcceptanceCriteria:
  derive:
    from: "user goal + context constraints"
    infer: "specific testable conditions for done"

```



## Plan h-DSL

```
Sequencing:
  derive:
    from: "action dependencies + resource constraints"
    infer: "valid orderings of steps"
```

## Test h-DSL

```
Assertion:
  derive:
    from: "precondition + action"
    infer: "expected postcondition"
```

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## Why DERIVE Completes the Framework

Without DERIVE, the framework describes but doesn't reason.

You could specify: - What states exist (GROUND) - What transitions to take (FOLLOW) - What outcomes to achieve (JUDGE) - What values to honor (ACCEPT)

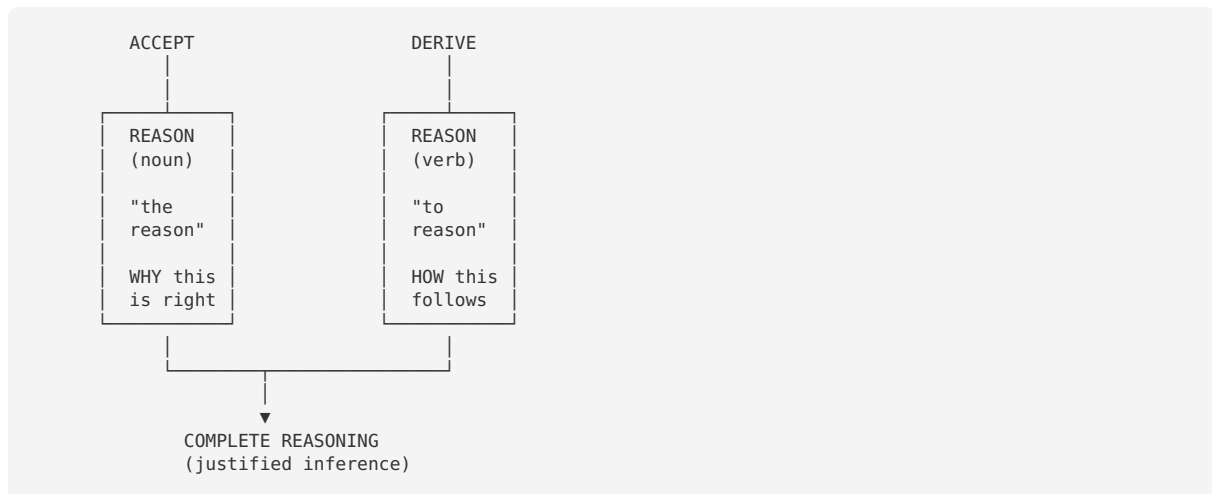
But you couldn't express: - Why this state implies that transition - How this transition achieves that outcome - What follows from these observations - The chain of logic connecting evidence to conclusion

DERIVE is the **therefore**—the connective tissue of thought.

With DERIVE, the framework becomes a complete reasoning system, not just a descriptive vocabulary. It can represent not only WHAT an agent knows and does, but HOW the agent reasons about what it knows to decide what to do.

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# The Dual Nature of Reason



An agent that can **ACCEPT** but not **DERIVE** has values without logic. An agent that can **DERIVE** but not **ACCEPT** has logic without values. An agent with both can reason toward justified conclusions.

This is the complete foundation for hybrid DSLs that guide intelligent behavior.