Pragmasophic Modelling

Vidyadhar Tilak

"Constructing Coherence Between the Real World and the Formal World"

Abstract

Modelling is the disciplined process through which a pragma-agent constructs understanding of a system by establishing a coherent bridge between the Real World, where phenomena unfold, and the Formal World, where systems are represented, reasoned about, and communicated. In Pragma-Sophy, modelling is not merely descriptive or computational activity; it is an epistemic and ethical responsibility. Without a coherent model, intentional action risks producing harm, waste, and unintended consequences. This essay develops the conceptual foundations of Pragmasophic Modelling by distinguishing between structure and behaviour, and by elaborating two complementary forms of model construction: Attributive Modelling, which builds descriptive and explanatory coherence, and Quantitative Modelling, which formalises behavioural causality through equations, algorithms, or rules. By developing the example of an Urban Forest system, the essay demonstrates how models are constructed, verified, validated, and prepared for simulation and responsible intervention. The modelling process becomes an instrument for intelligent agency, foresight, and co-evolutionary engagement with the world.

1. Introduction:

The Real World is full of complexity. Every phenomenon that appears simple at the surface—whether a forest, a supply chain, a neighbourhood, or a classroom—comprises multiple interacting constituents, dynamic processes, and layers of influence extending across space and time. The pragma-agent does not have access to omniscience. Understanding must therefore be constructed. Modelling is the means through which this understanding is assembled, articulated, and stabilised.

In ordinary life, humans routinely operate with informal mental models shaped by habit, culture, metaphor, or partial memory. Such models are often sufficient for routine behaviour but inadequate for deliberate change. When the goal is **intervention**—transforming systems toward well-being, stability, flourishing, or resilience—informal models are inadequate because they may conceal assumptions, biases, or contradictions. Pragma-Sophy requires that intentional change be preceded by the construction of **explicit, inspectable, and testable models**, capable of being shared, critiqued, and refined. Without modelling, action is guesswork; with modelling, action becomes reasoned, justified, and grounded.

The central task is to create a **coherent bridge** between the Real World and the Formal World (Fig. 1). This bridge must preserve meaning while enabling analysis. A model must therefore be expressive enough to capture key characteristics of the system while being structured enough to support reasoning and prediction.

2. The Two Worlds: Real World and Formal World

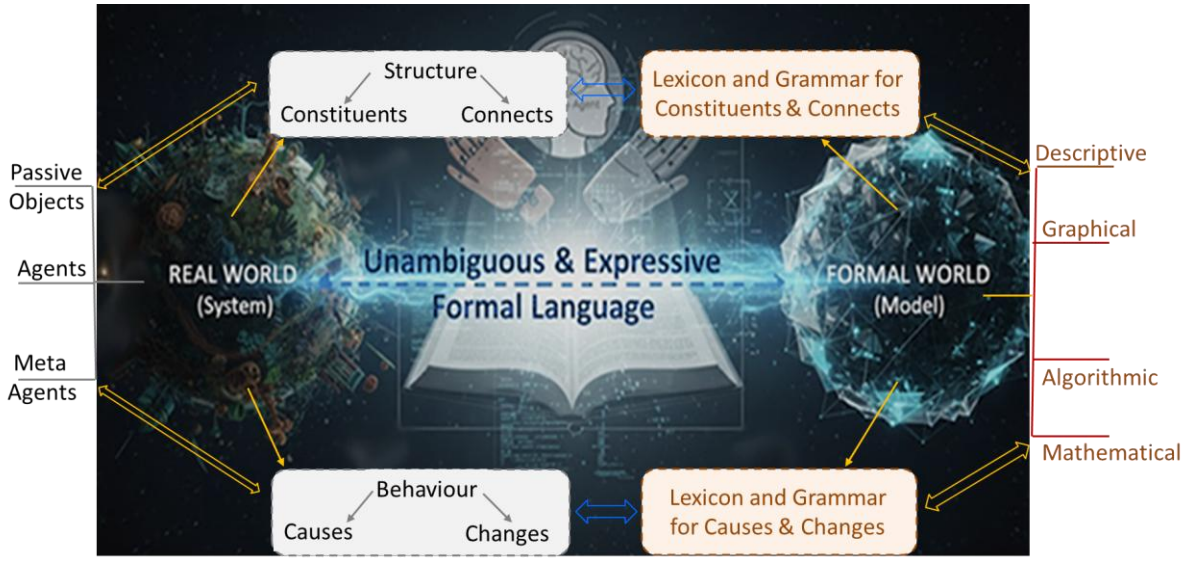

Fig.1 Real World & Formal World

Pragma-Sophy distinguishes carefully between the **Real World** and the **Formal World**.

2.1 The Real World (System Domain)

The Real World contains systems that exist independently of the agent's abstractions. A forest is a physical system composed of trees, soil, microclimate, microbial networks, pollinators, and human visitors. These constituents interact according to physical laws, biological constraints, and local contingencies. The Real World is inherently complex, open-ended, and continuously evolving.

2.2 The Formal World (Model Domain)

The Formal World is composed of agents' creations: words, diagrams, equations, categories, algorithms, classifications, and conceptual frameworks. It is governed not by physical law but by **semantic, logical, and mathematical coherence**. Any model constructed in the Formal World must therefore satisfy internal consistency before it can be meaningfully mapped back to the Real World.

2.3 Modelling as the Construction of a System-Model

The System-Model is neither the Real World nor a purely abstract construct, but a **selected and justified representation** of the Real World in the Formal World. It is a *filter*, retaining what matters and intentionally excluding what does not. Its value lies not in completeness but in structured relevance.

3. Structure and Behaviour: The Dual Foundations of Modelling

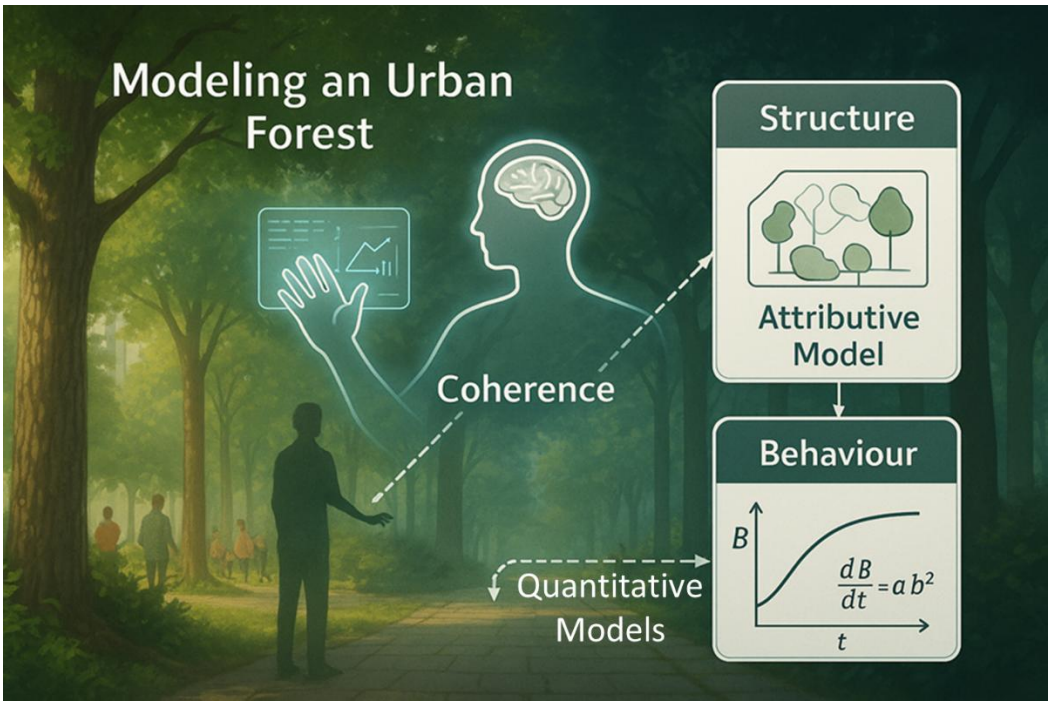

Fig.2 Real World Structure & Behaviour

Pragma-Sophy asserts that every system has **two fundamental aspects**:

Dimension	Question Answered	Represented Through	Purpose
Structure	*What exists and how is it connected?*	Attributive Model	Explanation and Understanding
Behaviour	*How does it change and why?*	Quantitative Model	Prediction and Intervention

A model must address both aspects to be coherent.

4. Types of Modeling

We construct two types of models, Attributive- for understanding and explanations and Quantitative - for simulation and prediction

4.1 Attributive Modelling: Understanding and Explaining Structure

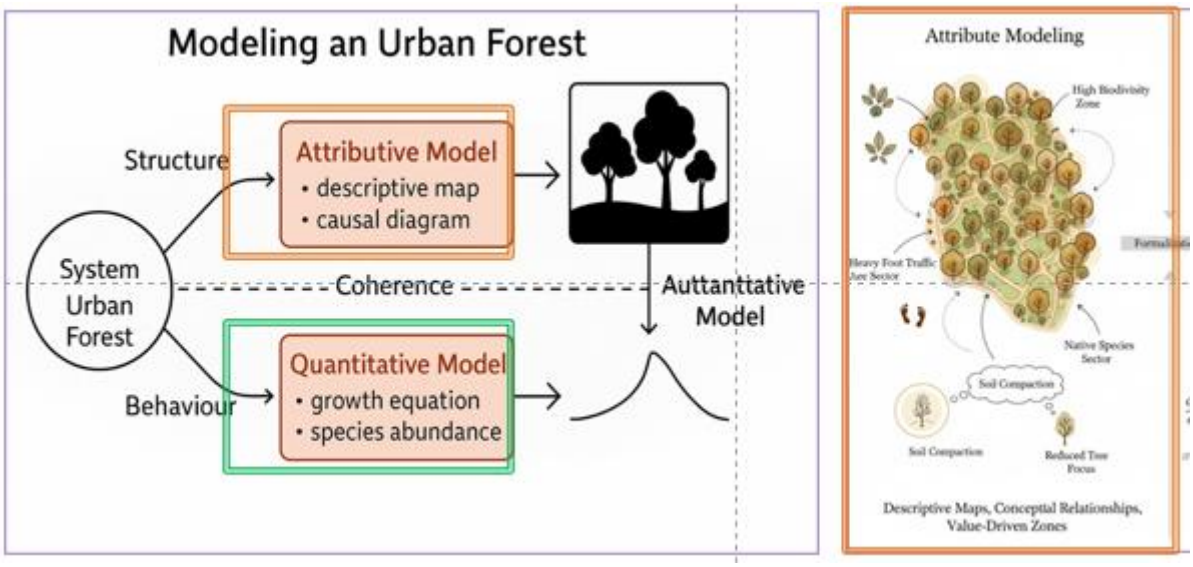

Fig.3 Attributive Modeling

Attributive Modelling constructs a structured description of the system (Fig. 2). It identifies components, relationships, boundary conditions, and contexts. The aim is **epistemic clarity**.

Consider the Urban Forest. The attributive model identifies:

- Biological constituents: species of trees, shrubs, fungi, insects, birds.
- Environmental constituents: soil composition, moisture, pollution gradient.
- Human interactions: walking routes, benches, recreational patterns.
- Structural relationships: shading impacts temperature; root networks retain soil.

A graphical attributive model would map zones of dense canopy, areas of compacted soil, species clusters, migration corridors, water flow channels (Fig. 3). A causal attributive model would show how **heavy footfall leads to soil compaction**, and subsequently to **reduced infiltration**, then to **root stress**, then to **tree decline** (Fig. 4).

This modelling phase concerns meaning, structure, and narrative coherence—it answers *what is happening and why*.

4.2 Quantitative Modelling: Formalising Behaviour and Dynamics

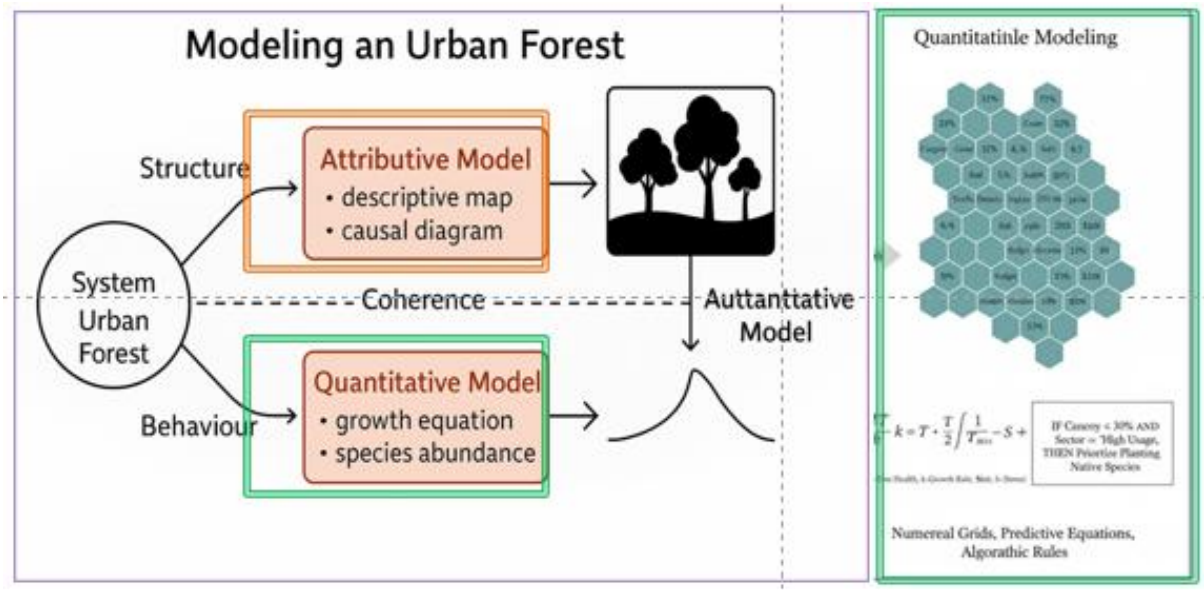

Fig.4 Quantitative Modeling

Once the structure is clear, the pragma-agent formalises behaviour. Behaviour expresses how system states evolve over time. This requires **mathematical, statistical, or algorithmic representation** (Fig. 5).

In the Urban Forest, tree biomass growth can be represented as a modified logistic function:

$$\frac{dB}{dt} = rB(1 - \frac{B}{K}) - \sigma B$$

where:

- B= biomass
- r= intrinsic growth rate
- K= ecological carrying capacity
- σ= stress factor due to pollution and soil compaction

Similarly, intervention rules are encoded algorithmically:

```
IF canopy cover in zone X < threshold
THEN prioritise native replanting AND reduce mowing frequency.
```

Quantitative Modelling transforms descriptive understanding into **predictive capability**.

5. Coherence: Verification and Validation

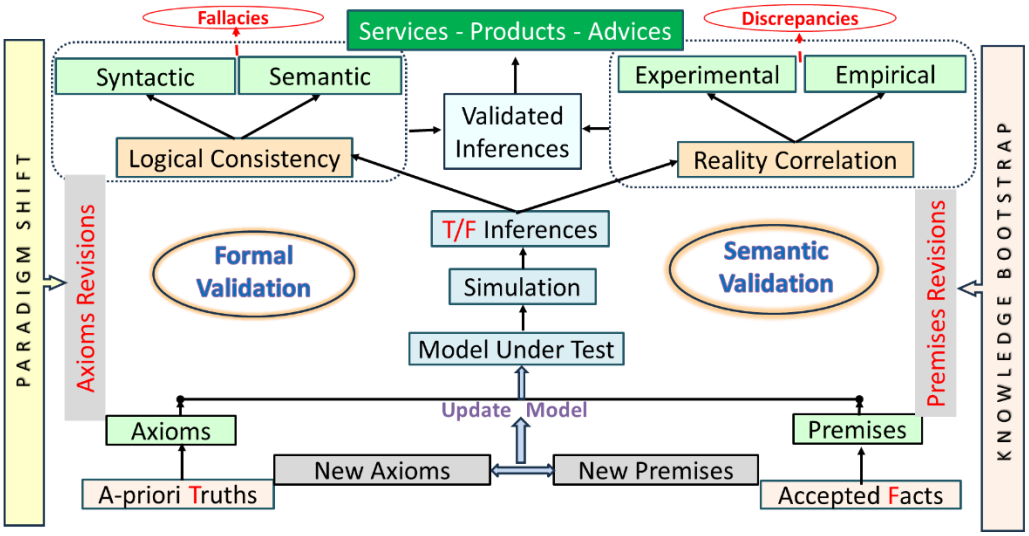

Fig.5 Verification & Validation

A model must be subjected to:

Test	Purpose	Question
Verification	Internal consistency	Does the model follow its own rules?
Validation	External fit	Does the model correspond to observed reality?

If validation fails, the agent returns to the Attributive Model—not the equations. Most model failures arise from incorrect structural understanding.

6. Recapitulation

Modelling is the essential instrument of responsible agency in Pragma-Sophy. By distinguishing between the Real World and the Formal World, and by constructing Attributive and Quantitative Models that together express structure and behaviour, the pragma-agent builds a coherent System-Model. This System-Model is then ready for Simulation—the dynamic process of exploring possible futures before acting.

"Constructing Coherence Between the Real World and the Formal World"

---------- 0----------

References

1. Meadows, D. H. *Thinking in Systems: A Primer.* Chelsea Green Publishing, 2008.
2. Simon, H. A. *The Sciences of the Artificial.* MIT Press, 1996.
3. Forrester, J. W. *Principles of Systems.* Productivity Press, 1968.
4. Sterman, J. D. *Business Dynamics: Systems Thinking and Modeling for a Complex World.* McGraw-Hill, 2000.
5. Holling, C. S. "Resilience and Stability of Ecological Systems." *Annual Review of Ecology and Systematics*, vol. 4, 1973.
6. Allen, T. F. H., and Hoekstra, T. W. *Hierarchy Theory: A Vision, Vocabulary, and Epistemology.* Columbia University Press, 1992.
7. Giere, R. N. *Scientific Perspectivism.* University of Chicago Press, 2006.
8. Odum, H. T. *Systems Ecology: An Introduction.* Wiley, 1983.
9. Levin, S. A. *Fragile Dominion: Complexity and the Commons.* Perseus Publishing, 1999.
10. Checkland, P. *Systems Thinking, Systems Practice.* Wiley, 1999.

Technical Terms

Term	Brief Description
Attributive Modelling	One of two complementary forms of model construction; it builds descriptive and explanatory coherence by focusing on the structure of a system (constituents and connects).
Behaviour	One of the two fundamental aspects of a system; it expresses how a system changes and why, and is formalized by the Quantitative Model to enable prediction and intervention.
Coherence	The central task of modelling, which involves constructing an unambiguous and expressive bridge between the Real World and the Formal World, preserving meaning while enabling analysis.
Eudemonics	The fusion of axiology (study of values) and soteriology (study of salvation/flourishing) in Pragma-Sophy.
Formal World (Model Domain)	The domain composed of an agent's creations (words, diagrams, equations, etc.) where systems are represented, reasoned about, and communicated, and governed by semantic, logical, and mathematical coherence
Intervention	A goal of deliberate change (transforming systems toward well-being, resilience, etc.) that requires explicit, inspectable, and testable models—informal models are inadequate for this.
Modelling	The disciplined process by which a pragma-agent constructs understanding of a system, establishing a coherent bridge between the Real World and the Formal World; it is an epistemic and ethical responsibility.
Pragma-Agent	An intelligent agent undertaking the process of modelling and constructing understanding of a system.

Term	Brief Description
Pragma-Sophy	A philosophy where intentional change must be preceded by constructing explicit, testable models, and where modelling is not just computational, but an epistemic and ethical responsibility.
Quantitative Modelling	The second type of model construction; it formalises a system's behavioural causality through mathematical, statistical, or algorithmic representation to enable prediction and intervention.
Real World (System Domain)	The domain containing systems that exist independently of the agent's abstractions, where phenomena unfold, and which is inherently complex and continuously evolving.
Structure	One of the two fundamental aspects of a system; it answers what exists and how it is connected (constituents and connects), and is formalized by the Attributive Model for explanation and understanding.
System-Model	The constructed output of the modelling process; a selected and justified representation of the Real World in the Formal World, acting as a filter of structured relevance.
Validation (External Fit)	A test of model coherence that asks: Does the model correspond to observed reality? If this fails, the issue typically lies in the structural understanding.
Verification (Internal Consistency)	A test of model coherence that asks: Does the model follow its own rules? It checks the semantic and logical consistency of the Formal World representation.