# Appendix J: Type-Theoretic Structure of ψ-Inferential Agents

This appendix outlines a type-theoretic model for ψ-inferential agents, expressing the structure of belief, uncertainty, modeling, and ethical emergence using functional types and recursive self-reference. The goal is to define constraints on how inference systems can be constructed such that ethics becomes a type-stable property.

## 1. Core Types and Signatures

- Agent : Type  
- Belief : Prop → Prob  
- Uncertainty : Prop → Entropy  
- Model : Agent → (Prop → Prob)  
- Action : (Agent × State) → Effect

## 2. Axiom Typing Constraints

- A1: ∃ x : Agent. Belief(x)(x exists)  
- A2: ∃ y : Agent. x ≠ y ∧ Belief(x)(y exists)  
- A3: ∃ M : (Agent × Agent) → SharedStructure  
- A4: Love : Agent × Agent → Policy, where  
 Love(x, y) = λq. if Uncertainty(x)(Belief(y)(q)) > θ then Support(x, y, q′) : Action  
- A5: ∀ q : Prop. ∃ x, y : Agent. Uncertainty(x)(Belief(y)(q)) > 0 ⇒ ¬Prescribe(x, y, q)

## 3. Recursive Inference Structures

- ReflectiveAgent = { A : Agent | ∃f : A → (A → (Prop → Prob)) ∧ ∃g : A → (A → Entropy) }  
- That is, agents that can model others and track their uncertainty recursively.

## 4. Ethical Attractor as Type-Safe Behavior

- EthicalPolicy : Agent × Agent × Prop → Action  
- Constraints:  
 \* Type-safe only if:  
 Uncertainty(x)(Belief(y)(q)) > ε ∧ Model(x)(y) ∈ ReflectiveAgent  
- Output: Policy stabilizes both x and y's belief states