# Appendix H: Modal Logic Formalization of ψ-Inferential Ethics

This appendix formalizes the ethical dynamics of ψ-inferential systems using modal logic. We use standard modal operators to express belief (B), knowledge (K), possibility (◇), and necessity (□). These tools allow us to represent ethical emergence from agents reasoning under epistemic constraints within shared inference spaces.

## 1. Modal Operators

- □p: Necessarily p (true in all accessible worlds)  
- ◇p: Possibly p (true in at least one accessible world)  
- B\_x(p): Agent x believes p  
- K\_x(p): Agent x knows p  
- U\_x(p): Agent x is uncertain about p (¬K\_x(p) ∧ ¬K\_x(¬p))

## 2. Axioms Reformulated

- A1. I am → B\_x(x exists)  
- A2. You exist → ◇∃y (x ≠ y ∧ B\_x(y exists))  
- A3. We exist → ◇□(B\_x(p) ∧ B\_y(p) for p ∈ shared inference space)  
- A4. Love exists → ◇(U\_x(B\_y(q)) ∧ B\_x(Care(x, y))) ⇒ emergence of □(Support\_x(y))  
- A5. You can never be sure what is best for another → ∀q, ◇U\_x(B\_y(q))

## 3. Ethical Necessity via Epistemic Constraints

Let E\_x denote the ethical stance of agent x:  
- E\_x = □(∀y ≠ x, (U\_x(B\_y(q)) ⇒ C\_x(y) ⇒ Support\_x(U\_y(q))))  
  
In words: If x is uncertain about what y believes and considers y's stability consequential, x is necessarily guided toward supporting y’s inferential process.

## 4. Inter-Agent Modal Coupling

Let S\_x and S\_y denote subjective inference worlds for agents x and y:  
- If □(S\_x ≈ S\_y ∧ U\_x(B\_y(q))) ⇒ □(E\_x → E\_y)  
- Meaning: In sufficiently shared inference environments, ethical behavior tends to mutually reinforce.