

Appendix

This appendix provides technical details, mathematical derivations, and extended examples supporting the main text. The material is organized to support readers who want deeper understanding of the mathematical foundations, implementation details, and computational aspects of the quadrant structure.

Mathematical Foundations

Expected Free Energy Derivation

The Expected Free Energy (EFE) combines epistemic and pragmatic components (see also Equation (??)):

$$\mathcal{F}(\pi) = \mathbb{E}_{q(s_\tau)}[\log q(s_\tau) - \log p(s_\tau | \pi)] + \mathbb{E}_{q(o_\tau)}[\log p(o_\tau | s_\tau) + \log p(s_\tau) -$$

Epistemic Component

The epistemic affordance measures information gain:

$$H[Q(\pi)] = \mathbb{E}_{q(s_\tau)}[\log q(s_\tau) - \log p(s_\tau | \pi)]$$