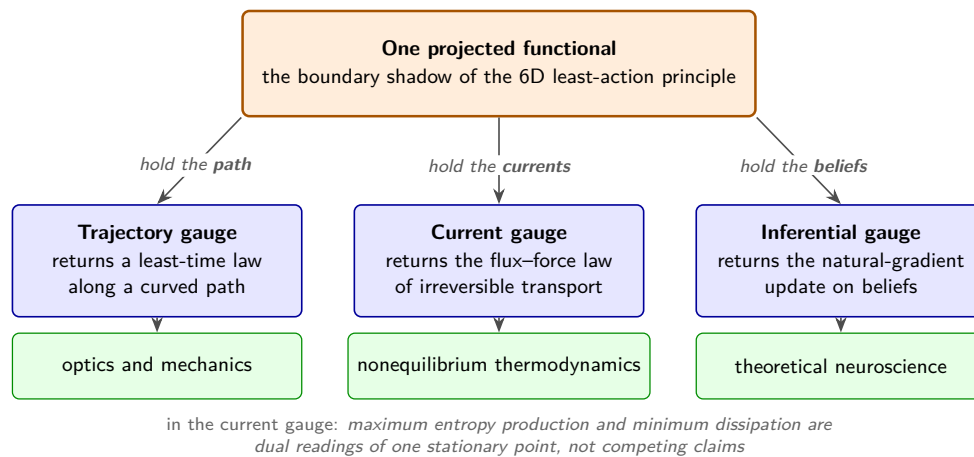


The Three Rules Are One Thing Seen Three Ways



The whole supplement in one picture. Three sciences ask the same question — which way does an open system go? — and answer it with three different rules. Each rule works where it works: Prigogine’s minimum principle is a theorem in a bounded regime, maximum entropy production is a heuristic with striking successes and no derivation, and the free energy principle is a modeling language whose own defenders have withdrawn the claim that it is a law. The suspicion that these are three faces of one law is old and weakly shared, and it had never been written down. The single functional at the top is not a new postulate — it is the boundary image of a six-dimensional least-action principle the companion papers build for reasons that have nothing to do with any of these three literatures. Each arrow is the same stationarity condition asked with a different quantity held primary. Hold the *path* and it returns the least-time law of optics and mechanics; hold the *currents* and it returns the flux-force law of irreversible transport, with maximum entropy production and minimum dissipation falling out as two readings of one stationary point rather than as rivals; hold the *beliefs* and it returns the natural-gradient update of the brain sciences. The bottom row names the community that has been using each form without knowing the other two were the same object. What is derived and what is not is marked throughout: the three gauge theorems are derived, the cascade closure they rest on carries one open residue, and maximum entropy production does not become universally true — it does not, and the derivation says why. In full: Figure 7, p. 71.