Section 7. Collapse = Re-Routing (Mechanism in Detail)

This section provides the detailed mechanism of collapse in QIA. Collapse is not treated as the destruction of a wavefunction, but as an information re-routing transition in a lossless entropic network. The goal is to define collapse as a physical process that can be decomposed into identifiable sub-steps, with explicit trigger conditions and stability criteria.

7.1 Trigger types

In QIA, a collapse event is triggered when the existing routing configuration becomes incompatible with new constraints or with the stability requirements of the entropic network. Three primary trigger classes are distinguished.

(a) High measurement coupling: the interaction strength between system and apparatus becomes sufficiently large that the existing routing of the wave-pattern cannot remain stable under the measurement boundary.

(b) Entropic instability threshold: internal network evolution can push the wave-pattern into a regime where routing cost exceeds a stability threshold, forcing a transition to a lower-cost attractor even without an explicit measurement device.

(c) Boundary condition shock: abrupt boundary updates, such as rapid environmental perturbations or sudden channel restrictions, reshape the compatibility landscape and trigger re-routing.

7.2 The routing selection problem

Once collapse is defined as re-routing, a central question emerges: when multiple routing attractors are available, which one is selected? QIA treats this as a selection problem in an entropic compatibility landscape. Each candidate attractor corresponds to a distinct routing channel that satisfies the injected constraints. Selection therefore depends on the relative stability weights of these attractors, determined by routing cost, compatibility **K**, and the entropic distance structure d_E.

$$\mathit{Select\ attractor\ i\ \ with\ weight}\ \ w\_i\ =\ w\_i(\kappa, d\_E, S\_E)$$

The next section formalizes how this selection rule produces probabilistic outcomes and links naturally to the Born-rule limit.

7.3 Collapse dynamics

Collapse dynamics can be decomposed into three sequential sub-processes. While the full network evolution is continuous, the classical interface perceives a rapid transition because the re-routing occurs on timescales much shorter than coarse-grained observation.

(i) Constraint injection: the measurement apparatus or the environment injects constraints into the network. These constraints can select an effective basis, define a pointer-stability condition, and restrict accessible channels.

(ii) Rapid re-routing: once constraints are injected, the prior routing configuration becomes unstable. Information flow reorganizes rapidly toward channels with lower entropic cost and higher compatibility.

(iii) Stabilization: the system reaches a new stable routing attractor. At this point, a new effective boundary is established, defining what appears as a definite outcome.

$$\Psi\ \ \rightarrow\ \ \boldsymbol{\mathcal{R}}(\Psi \mid \boldsymbol{\mathcal{C}}\_meas)\ \ \rightarrow\ \ \mathit{stabilized\ attractor\ state}$$

7.4 Why collapse appears random

In QIA, randomness is not fundamental indeterminism in the destruction of the wavefunction. Instead, apparent randomness emerges from partial accessibility. The observer does not see the full network state, including environmental degrees of freedom and hidden routing variables. The collapse outcome is therefore determined by a high-dimensional selection process that is effectively unpredictable at the local interface. In this sense, randomness is an epistemic appearance generated by hidden routing degrees of freedom in a lossless but inaccessible entropic network.

7.5 Why outcomes are discrete eigenvalues

A further key measurement feature is discreteness: outcomes appear as eigenvalues of an operator rather than continuous values. QIA interprets this as eigen-channel locking. Measurement constraints impose a spectrum of stable channels (eigen-channels) defined by the apparatus boundary conditions. Routing dynamics then locks the wave-pattern information into one of these discrete stable channels because intermediate routing configurations are unstable or incompatible. Thus, discreteness is not a metaphysical quantization postulate but a stability consequence of constraint spectra.

$$
\begin{aligned}
Eigen - channel\ locking&: routing \\
&\rightarrow\ stable\ channels\ defined\ by\ constraint\ spectrum
\end{aligned}
$$