

Appendix A — Glossary and Fundamental Notations

Name	Symbol	Description
Actualized reality	R	The actualized reality, in which entities manifest spatiotemporal properties and obey observable physical laws.
Original reality	R'	The original reality or relational domain, where the original entities e' reside. It is not describable in spatiotemporal terms but only in relational terms. From it, R emerges.
Actualized entity	e	An entity actualized in R , endowed with spatiotemporal coordinates and measurable physical properties.
Original entity	e'	An entity in R' , defined solely by its coexistences with other entities. Each e in R corresponds bijectively to its e' counterpart.
Actualization function	Π	The function that transforms entities and coexistences from R' into corresponding entities and relations in R .
Relational coexistence	Ω_{ij}	The function of relational coexistence between the original entities e'_i and e'_j . It takes values $0 \leq \Omega_{ij} \leq 1$.
Relational time	τ	A mathematical construct that models variations of coexistence Ω in R' . It is not a physical time but a parameter used to describe relational evolution in R' .
Decoherence time	τ_{dec}	The characteristic time of quantum decoherence in R , inversely proportional to the growth rate of relational entropy. It defines the effective flow of time in actualized systems and must be distinguished from τ , which is only a mathematical parameter in R' .
Relational temperature	T_{rel}	Proportional to the sum of oscillations (in frequency and amplitude) of the coexistences Ω_{ij} . At $T_{\text{rel}} = 0$, absolute entanglement occurs.
Relational entropy	S_{rel}	Defined as: $S_{\text{rel}}(\tau) = -\sum_{i < j} \Delta \Omega_{ij}(\tau)$. It increases when coexistences lose specificity. It is the cause of the breaking of the original symmetry, cosmic expansion, the arrow of time, and quantum decoherence.
Total relational coherence	$C_{\text{rel}}^{(e)}$	The sum of the coexistences $\Omega_{e'_i}(\tau)$ of an entity e in R with all other entities to which it is connected in R' . Measures the degree of relational integration of e within its environment.
Relational reduction factor	γ_{rel}	Represents the combined reduction due both to lower entropic variation and to reduced creation of relational time. Takes values $\gamma_{\text{rel}} < 1$.
Spatiotemporal distance	d_R	Distance between two actualized entities in R , measured according to the spatiotemporal metrics of the actualized reality.
Arrow of time	—	Emergent direction defined by the variation of relational entropy S_{rel} : if $\frac{dS_{\text{rel}}}{d\tau} > 0$, new units of spacetime are created and time advances; if $\frac{dS_{\text{rel}}}{d\tau} = 0$, creation halts but already actualized units persist; if $\frac{dS_{\text{rel}}}{d\tau} < 0$, space and time are progressively subtracted until they dissolve in the limit $\Omega \rightarrow 1$.
Quantum decoherence	—	Loss of relational specificity ($\Delta \Omega_{ij} < 0$), equivalent to entropy increase in the standard description.
Cosmic expansion	—	Manifestation in R of the progressive relational degradation in R' . A structural and irreversible phenomenon.
Gravity	—	Emergent effect of Ω_{ij} gradients. Interpreted in the TCR as an anti-entropic force that can locally restore maximum coexistence (e.g., black holes).
Principle of Relational Indifferentiation	—	Postulate according to which, on average, coexistences in R' tend to lose specificity $\frac{d\Omega_{ij}}{d\tau} < 0$, causing S_{rel} to increase.
Entanglement	—	Limiting case of perfect coexistence ($\Omega_{ij} = 1$), which manifests in R as an ideal quantum correlation.
Black holes	—	Systems in which gravity locally prevails over entropy. Inside, the creation of new units of space and time initially halts ($dS_{\text{rel}}/d\tau = 0$). If relational entropy becomes negative ($dS_{\text{rel}}/d\tau < 0$), space and time are progressively subtracted, until disappearing in the limit $\Omega \rightarrow 1$, which restores the original relational coherence.