



TEMPORAL ENTANGLEMENT: TWO PARTICLES OR TWO OBSERVATION POINTS?



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ABSTRACT

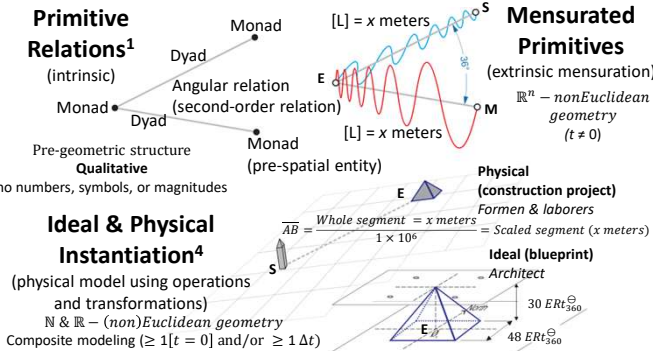
In a novel relational time model, a single temporal point maps multiple spatial points at indeterminate locations.

One observer's measurement selects a deterministic spatial outcome, forming a bound relational state; a second observer independently does the same at the same temporal entanglement. Correlations arise not from particle interactions but from referencing the same relational instant of now. This temporal entanglement replaces particle linkage with observer relations, proposing non-local quantum correlations as features of time itself.

Exploration of this concept offers opportunity for further theoretical development.

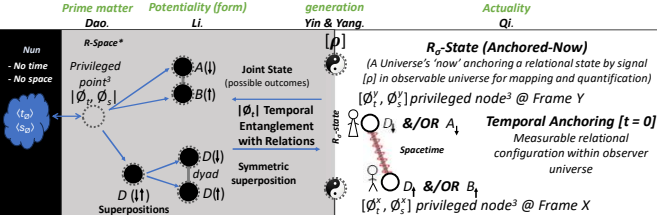
1 Advancing Relationalistic Framework: From Quantum to Cosmic¹⁻⁴

'Rishta' relationalism's (RtR) uses relations with three refined steps for building concrete object-oriented composite (geometric) models: (1) **Absolute primitive relations** (monads/dyads/angles), (2) **quantified primitives** (extrinsic measurement within system), and (3) **instantiation** of mensurated primitive elements modeling with dimensional and relational accuracy (1D Rt units on 2D surfaces (flat or non-flat), building 3D objects).



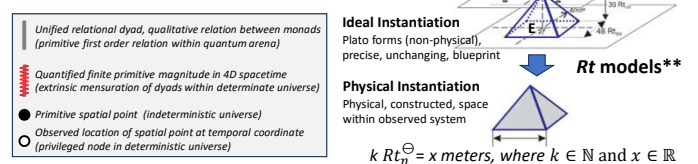
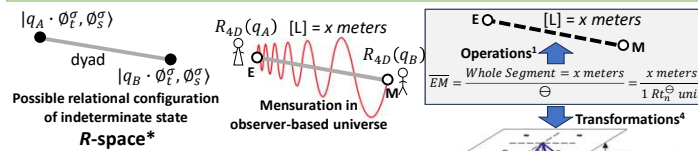
2 Entanglement (spacetimeless): Two 'Particles' OR Two Observation Points (or a Composite)?

Notes: (1) Includes exploratory similarities between philosophical descriptions (e.g., *Capra*, *Aristotle*, *Daoism*). (2) Symbols, definitions, and images are subject to change through advancing work.

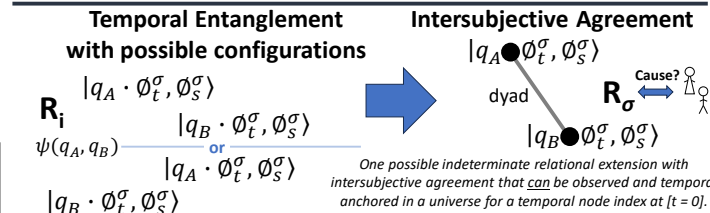


3 Mathematical Categories: RtR with Modern Physics

Indeterminate mathematics	Operational mathematics	Intermediate mathematics
What can exist (possible relational states)	What is measured (extrinsic quantification)	What is constructed (relational reconstruction framework)
Primitive Elements (monads/dyads/angles)	Operational Primitives (Location/1-D quantities)	Ideal & Physical Instantiations (Built from mensurated primitives)
Non-time (t_0): formless empty-set Present-now: before perception [t = 0]: anchoring at perception	$t \neq 0, t \rightarrow 0$ within spacetime with gravity, mass, velocity, acceleration, etc. (anchored-now by perception)	$\geq 1 [t = 0] \ \& \ / \text{or} \ \geq 1 \Delta t$ (composite with memory)
Qualitative relational configuration ($R_t\text{-Space}^*$)	Classical & Quantum physics (incl. Q-space, P-space; vectors)	Measured relational elements (rishtars)
Unified whole; qualitative, indivisible (intrinsic pre-geometric structure)	Quantification (Non-Euclidean geometry, calculus, Cartesian coordinates, Hilbert space, algebra, approx. rules, \mathbb{R} (e.g., \sqrt{x}, π))	Magnitude; quantitative, divisible (Euclidean (point, line, angles, ratios, proportions, 2D/3D), \mathbb{N} , terms, combinatorics)
Universal Frame (quantum simultaneity)	Observer-related frames of reference	Static composite frame for ideal and physical outputs
Temporal Entanglement (non-spacetime qualities)	Temporal Anchoring (Frame-dependent temporal coordinate)	Temporal Actualization (Intersubjective Agreements)



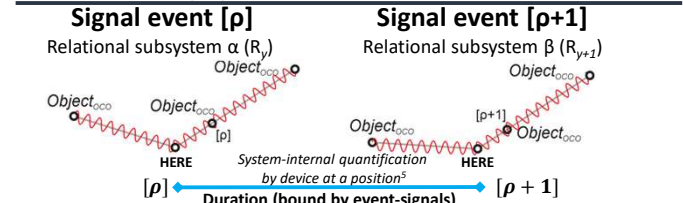
4 From Entangled Relational Possibilities (R_i) to Intersubjective Agreement (R_o) bound by Observation



(Left: R_i -space) Temporal entanglement: superpositions with qualitative relational possibilities. (Right: R_o -state) A possible static relational configuration extending Adlam and Rovelli's (physical) intersubjective agreement as an intrinsic qualitative dyadic relation between entangled outcomes at the present-now that can be anchored by a system-internal signal.

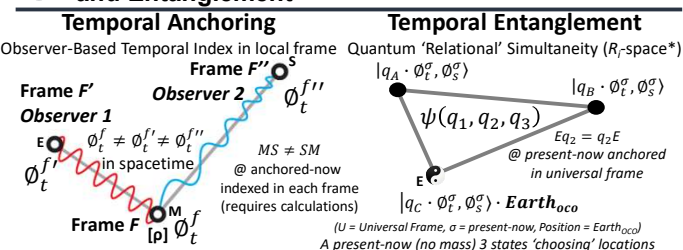
The framework distinguishes three categories of mathematical structure: (i) **indeterminate mathematics**, where R_i -space is a pre-geometric domain of qualitative configurations; (ii) **operational mathematics**, where R_o -states are measured within an observed system; and (iii) **intermediate mathematics**, where Rt modeling constructs complex composite relations that can include system-internal time using Euclidean geometry via operations and transformations.

5 0D/1D Space + Finite System-Internal Point-Time: Duration (Δt) Measured at Position of Here^{1-3,5}



- System-internal temporal duration** (intrinsic to observed universe; unmeasured) bound by non-simultaneous signal-events. Anchored by system-internal event-signals $[\rho]$. Time is a relational quantity that emerges from non-simultaneous events within the system.
- Extrinsic time measurement** is system-internal including oscillator at here⁵, relativity (light-based), selective-attention/divided-attention (cognitive-based), etc.
- Each **temporally indexed subsystem** (R_t and R_{t+1} states of α & β) is spatially unique.
 - Closed 2D geometric duration model⁵: Partitioning a causal duration into 12 equal relational units (12-gon).
 - Duration quantified within system by device at place of HERE⁵

6 Relational Configurations for Temporal Anchoring and Entanglement^{3,5}



- Temporal anchoring in an observer-based universe**. A temporal node is an assigned coordinate within an observer's frame via a non-simultaneous signal-event used for local frame anchoring when received. System-internal information arrives through signal propagation across 3D/4D spacetime (near or far), becoming locally indexed with unique spatial & temporal history. Information delays create intersubjective disagreement at the privileged nodes, producing non-commutative metrics ($MS \neq SM$), motivating relativistic corrections. System internal information propagation is limited to light speed.
- Temporal entanglement in an omnipresent state**. A shared 0-D temporal point underlies an omnipresent state. Quantum & relational subsystems have possible outcomes; an intersubjective agreement of primitives within physical actualization through system-internal anchoring by observation/mensuration. Conceptually, information exchange in 'joint wave function' is outside spacetime constraints.

7 Conclusions

- 'Particle' is a pairing of spatial & temporal points outside continuous spacetime.
- Temporal anchoring & Temporal entanglement**: Mapping 0D time points & relations in either local spacetime coordinates or prior to anchoring in observed universe (R_t -state)
- Proposing an **additional relational mapping rule** within quantum state space that connects quantum descriptions to classical observation through an intermediate relational structure.
- R_i -space: a qualitative layer where basis states include relational configurations.
- R_{4D} : a quantitative spacetime coordinate for a privileged node spatially and temporally anchored in a local frame world history used to calculate relational metrics.

[1] Moore, S.D., Separating Space and Time for Dimensional Analysis and Euclidean Relational Modeling, Journal of Applied Mathematics and Physics, 2023, 11(9): p. 2704-2738. [2] Moore, S.D., Relational and Euclidean Temporal Space, Journal of Applied Mathematics and Physics, 2024, 12(2): p. 683-719. [3] Moore, S.D., Intrinsic and Extrinsic Relational Geometry in a Universe of Stationary Subsystems, Universal Journal of Mathematics and Mathematical Sciences, 2024, 21(2): p. 84-94. [4] Moore, S.D., Object-Oriented Geometric Figures with Operations and Transformations for Relational Modeling, Symmetry, 2024, 16(5): p. 725-763. [5] Moore, S.D., US Provisional Patent Application No. 94/094827 (B) Adams, L., et al., Information in Physical Cause-Perception Links in Relational Quantum Mechanics, Philosophy of Physics, 2022, 11(1): p. 1-19. [6] Earth-Moon-Sun conjunction, OCC = Object Centroidal Origin, α = present-now that can be indexed within a system upon quantum subsystem state observations in a frame of reference history, t_{00} = non-space, t_{01} = non-time, t_{02} = non-time, t_{03} = non-time, t_{04} = non-time, t_{05} = non-time, t_{06} = non-time, t_{07} = non-time, t_{08} = non-time, t_{09} = non-time, t_{10} = non-time, t_{11} = non-time, t_{12} = non-time, t_{13} = non-time, t_{14} = non-time, t_{15} = non-time, t_{16} = non-time, t_{17} = non-time, t_{18} = non-time, t_{19} = non-time, t_{20} = non-time, t_{21} = non-time, t_{22} = non-time, t_{23} = non-time, t_{24} = non-time, t_{25} = non-time, t_{26} = non-time, t_{27} = non-time, t_{28} = non-time, t_{29} = non-time, t_{30} = non-time, t_{31} = non-time, t_{32} = non-time, t_{33} = non-time, t_{34} = non-time, t_{35} = non-time, t_{36} = non-time, t_{37} = non-time, t_{38} = non-time, t_{39} = non-time, t_{40} = non-time, t_{41} = non-time, t_{42} = 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