

# Renko Time

— Third Edition: Time as an Accumulation of Events / Proper Time, Coarse-Graining and Relational Time as an  
Open Framework — [Paper 82]

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August 2026

— *From thinking to syncing.* —

## ABSTRACT

What is the time we “feel”? This paper takes one intuition and, laying it carefully upon established physical neighbours, **proposes it as an open framework (a research programme)**: that time is not an evenly-spaced ruler but an **event-based quantity that advances one step only when enough change has accumulated**. In the metaphor of financial charts, time is less like the evenly-spaced **time candlestick** and more like a **Renko chart** — a brick chart (from technical trading) that prints a new brick only when price moves past a fixed threshold. This intuition has two royal-road neighbours. (1) **Proper time  $\tau$** : in relativity, the invariant accumulated along a worldline,  $c^2 d\tau^2 = c^2 dt^2 - dx^2$ , is “the time actually elapsed for that object”; along a light worldline  $d\tau = 0$  (light prints no bricks at all). The faster one moves, the slower proper time runs — this is standard relativity itself, and the **honest core of “moving clocks run slow.”** (2) **Relational / thermal time** (Rovelli; Connes--Rovelli): time is not fundamental but **emergent from change and correlation**. The Renko intuition is a folk version of relational time. **Scope (most important)**: this paper does **NOT re-derive or replace special-relativistic time dilation** (which follows from Lorentz invariance). “Rendering lag,” “Universe OS,” “3D game,” “the waking of consciousness” are **Layer-3 non-scientific lenses (metaphors), not mechanisms and not testable claims**. Coordinate time, proper time, and thermodynamic (event) time are **three distinct times and are not fused** (distinct roots; Papers 58/48). There is no new prediction, and the origin of the arrow of time (the past hypothesis) is not solved. The contribution is only to give the intuition its **correct home and correct label**.

**Positioning of this paper (discipline)**: This paper is a **structural interpretation** of established physics (relativistic proper time, Rovelli’s relational/thermal time, the coarse-graining of Paper 77) and an **open framework** with its speculative parts explicitly quarantined. **It does not rewrite or re-derive special relativity in any way**. “Universe OS,” “rendering,” “rendering lag,” “consciousness,” and “3D game” are **Layer-3 (vision) metaphors carrying the “non-science” label**, not claims of physical mechanism. It contains no new physical law and no new prediction.

# 1. Introduction: What Is the Time We Feel?

A clock ticks in equal intervals. Yet the time we **experience** runs long in a dull meeting and vanishes in an absorbing hour. This difference is usually dismissed as illusion, but this paper asks a little more seriously: **is there, within physics, a time that is not “an evenly-spaced ruler” but “an accumulation of events”?**

The author has long called this, from years of intuition in the markets (FX), **“time as a Renko chart.”** A Renko chart prints a new brick not with the passage of time but **only when price moves by a fixed threshold**. Time jumps irregularly, and intervals with no change print no brick at all. This paper organizes where that intuition has its “home” in physics, upon the royal-road neighbours (proper time, relational time, coarse-graining). It is a proposal of a framework, not a resolution.

## 2. Two Times: The Candlestick (Clock) and the Renko (Events)

| Chart metaphor   | Physical counterpart          | Nature                                                |
|------------------|-------------------------------|-------------------------------------------------------|
| Time candlestick | coordinate time; atomic clock | evenly-spaced ruler; regular; a coordinate choice     |
| Renko brick      | proper time / event time      | one brick per threshold of change; irregular; one-way |

An atomic clock is “precise because it is regular,” not because it measures “how much has happened.” It is an evenly-spaced ruler (a candlestick). The time we feel as an arrow, by contrast, lives on the side of **accumulated change — the Renko**. We now illuminate the identity of this “Renko time” with two royal roads.

## 3. Royal-Road Neighbour I: Proper Time — Light Prints No Bricks

Established Fact 3.1 (Proper Time)

In relativity, the invariant accumulated along a worldline,

$$c^2 d\tau^2 = c^2 dt^2 - d\mathbf{x}^2, \quad d\tau = dt\sqrt{1 - \frac{v^2}{c^2}},$$

is the **proper time**  $\tau$  = “the time actually elapsed for the object itself.” At rest,  $d\tau = dt$ ; the faster one moves, the smaller  $d\tau$ ; and **along a light worldline** ( $v = c$ ),  $d\tau = 0$ : for light, no time passes at all (light prints not a single brick).

This is the **most honest physical core of “time as a Renko chart.”** Proper time is precisely the **accumulation of change along a worldline**, a quantity distinct from the evenly-spaced coordinate time  $t$ . A fast-moving clock appears to run slow

because its Renko (proper time) prints only slowly — relative to a stationary observer's coordinate time (the candlestick).

**But the discipline is stated explicitly:** this is **special relativity itself**, not something newly derived here. Time dilation follows rigorously from Lorentz invariance (the universality of  $c$ ). Moreover, a massive clock can never reach  $c$  (light has no rest frame). All this paper may say is a **rereading**: “proper time already provides a home for the intuition of event-based time.”

## 4. Royal-Road Neighbour II: Relational / Thermal Time (Rovelli)

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The other neighbour is Carlo Rovelli's **relational time** and the Connes--Rovelli **thermal time hypothesis**. The claim: time is not a fundamental background of the universe but **emerges from change and correlation (the relations among events)**. In particular, the thermal time hypothesis states that **a thermal equilibrium state itself defines “its own flow of time.”**

### Observation 4.1 (Renko = the Folk Version of Relational Time)

The intuition “events accumulate into time (Renko)” may be regarded as an **intuitive restatement of relational time**: time is not first a “ruler,” but **stands up one brick at a time each time a change (event) occurs**. Where there is no change there is no time; where change is dense, time is thick. This is the trader's-language expression of Rovelli's “time is not fundamental but emergent.”

## 5. What Is One Renko Brick? — The Coarse-Graining Threshold (Paper 77)

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What, in physics, does one Renko “brick” correspond to? In the coarse-graining language of Papers 77, 78, and 81 — **one brick = a macroscopically distinguishable, irreversible change (crossing one coarse-graining cell)**. Microscopic fluctuations below threshold are not recorded and do not advance the Renko (= Paper 77: the microscopic is reversible, carries no arrow). Experienced time — event time — advances only by the amount of macroscopically irreversible change that has accumulated.

### Observation 5.1 (The Arrow of Felt Time = Accumulated Coarse-Grained Events)

The arrow of the time we feel is a direct restatement of Paper 77's “the arrow resides in coarse-graining”: **one Renko brick = one coarse-grained irreversible event**. And Paper 81's Poincaré recurrence (reversal) corresponds, in Renko terms, to a “reversal threshold” — a threshold of order  $e^{10^{23}}$  that is unreachable, which is precisely why time keeps stacking in one direction.

### The Author's Vision (Layer 3, non-science label / not a mechanism, not a prediction)

From here is a metaphor the author has nurtured for years. We state explicitly that it is **a picture for carrying intuition, not a physical claim**.

In the morning, consciousness “flashes” awake. In that instant, a causal light sphere  $r = ct$  (Paper 61) rises around the observer, and from there the frames of a “3D game” go on updating — is time not this **Renko, accumulating along the expansion of the light sphere**? And when “an atomic clock carried at the speed of light runs slow,” is it not because the Universe OS **cannot keep up with rendering a fast-moving object, and so prints Renko bricks less often (rendering lag)**? —

**This picture carries the non-science label.** As seen in §3, time dilation is rigorously explained by special relativity (proper time; Lorentz invariance), and **“rendering lag” is not a replacement for that mechanism**. Consciousness, the 3D game, and the OS claim no physical substance. This is a lens to make “why we feel it this way” sit comfortably in the mind, not a testable proposition. And yet — proper time saying “light prints no bricks ( $d\tau = 0$ )” and this picture saying “at light speed the Renko stops” are **the rigorous face and the poetic face of one and the same fact**. Keeping the labels separate — poetry as poetry, physics as physics — we cherish both.

## 6. The Distinct-Roots Discipline: Time Is Not One Thing

Here is the most important discipline. What is lumped together as “time” is at least **three distinct quantities**, and however the Renko metaphor rhymes across them, **they must not be fused into one** (Papers 58/48).

| Time                             | Identity                                 | Domain (3rd ed.)                            | Layer      |
|----------------------------------|------------------------------------------|---------------------------------------------|------------|
| Coordinate time $dt$             | a coordinate choice; evenly-spaced ruler | <b>none</b> (a chart component)             | convention |
| Proper time $d\tau$              | an invariant along a worldline           | <b>curves</b> (worldlines)                  | Layer 1    |
| Entropy $dS$                     | coarse-grained irreversible accumulation | <b>measures</b> (phase space)               | Layer 2    |
| Flow parameter $t_{\text{flow}}$ | the rate at which shape itself changes   | <b>a path in <math>\text{Met}(M)</math></b> | Layer 2    |

### Observation 6.1 (Third edition, addition I: the three differ in type, not in value)

The first edition listed the three as “different quantities” but **did not say what differed**. Paper 118 wrote it out as a difference of **logical type**:  $dt$  is a coordinate and has no domain (it becomes a clock only once pasted onto a congruence of worldlines);  $d\tau$  is a functional of a curve;  $dS$  is a functional of a measure. Hence  $d\tau$  and  $dS$  are not even two numbers of differing value; they are different functionals living on different spaces. There was never an arena in which to compare them.

**Note that the separation of  $dt$  from  $d\tau$  is not a discovery of this series** — it is Minkowski's, from 1908, and within this series it is treated by Paper 108 (see Paper 118, second edition).

### Observation 6.2 (Third edition, addition II: there is a fourth)

Paper 119 reported that **this series was already using a fourth type** — the “time” appearing in the Ricci flow and renormalisation-group flow of Papers 103 and 110. **It is neither  $dt$ , nor  $d\tau$ , nor  $dS$** . From the explicit sphere solution  $r^2 = r_0^2 - 2(n-1)t$  one reads  $[t] = L^2$ : **a squared length, not a second, and two quantities of different dimension cannot be the same quantity** (the measuring stick of Paper 116). Nor does it live inside the manifold: it advances along **a path in the space of metrics  $\text{Met}(M)$**  — and since **the very instrument of measurement is being deformed**, it cannot be a length measured by that instrument.

**And the fourth turned out to be not one but a pair**: the parameter is **a relabelable label**, while what carries a direction is **a monotone** (Perelman's  $\mathcal{W}$ , Zamolodchikov's  $c$ ). **The  $(dt, dS)$  split is replayed, unchanged, on another stage. But the root of the arrow differs** — there it is coarse-graining, here parabolicity.

### Observation 6.3 (Third edition, addition III: declare the clock before counting a brick)

The central notion of this paper was a way of counting: **one step advances only once enough change has accumulated. The third edition gives that step a type.**

**A brick can be counted in four ways, and the four counts do not agree.**

- **Counted in  $d\tau$ :** light lays down **no brick at all** ( $d\tau = 0$  on a null worldline). Yet the same light, as radiation, is increasing  $dS$ .
- **Counted in  $dS$ :** a reversible harmonic oscillator lays down **no brick at all** (by Liouville's theorem  $dS = 0$  without coarse-graining). Yet its proper time keeps accumulating.
- **Counted in  $dt$ :** a brick is dutifully drawn even when nothing happens. **This is a ruler, not an event** — the very thing this paper first doubted.
- **Counted in the flow parameter:** the unit of a brick is **not even a second** ( $L^2$ ).

**Therefore, before stating how many steps of time have passed, one must declare which ledger was used.**

**This is not a correction to the present paper.** The first edition offered **an open framework** — that time is an accumulation of events — and that framework stands unchanged in the third edition. **What has been added is only a type declaration:** write which type of quantity you are counting before you put it into the framework (Paper 118).

### Observation 6.4 (The Renko Is a “Rhyme,” Not an “Identity”)

The Renko metaphor rhymes with proper time (accumulation of change along a worldline) and with event time (accumulation of irreversible change). But proper time is a **reversible geometric quantity** (relativity), while event time is an **irreversible coarse-grained quantity** (thermodynamics) — distinct origins (distinct roots). To fuse them as “both are accumulations of change, hence the same” would be an error. This paper's task is to **sort out which of the three times the intuition belongs to**, not to make the three into one.

## 7. Scope (What Is Shown, and What Is Not)

**Restraint added in the third edition: the four are not reduced to one “real time”** (electing any one as genuine is itself the error of type; Paper 118); **felt time is not explained** — what the opening intuition points at is **a fourth quantity that is none of  $dt$ ,  $d\tau$ ,  $dS$  or the flow parameter** (psychology and neuroscience), and it is **left untouched** (Paper 118, second

edition); **Perelman's  $\mathcal{W}$  is not identified with thermodynamic entropy** (Papers 88, 103, 119); **the flow parameter is not called physical time** (its dimension is  $L^2$ ; Paper 119).

#### What is shown (descriptive):

- The intuition of “time as an accumulation of events (Renko)” has two royal-road homes: proper time (change along a worldline;  $d\tau = 0$  for light) and relational/thermal time (emergent from change).
- One Renko brick corresponds to Paper 77's coarse-grained irreversible event, and the reversal (recurrence) threshold is unreachable by Paper 81 — hence time stacks one way.

#### What is not shown (restraint):

- **Special relativity is neither re-derived nor replaced.** Time dilation is a standard consequence of Lorentz invariance; this paper only rereads it. “Rendering lag” is not its mechanism.
- **Consciousness, OS, 3D game, and rendering are Layer-3 non-science lenses.** They carry no physical substance and no testable claim (§5 dashed box).
- **The three times are not fused.** Coordinate, proper, and event time are distinct roots (Papers 58/48).
- **The origin of the arrow is not solved.** Why the past was low-entropy (the past hypothesis) remains open (the same edge as Papers 75, 77, 81).
- **No new prediction is made.** It yields the same observational results as standard relativity and statistical mechanics. Hence it remains at Layer 2 (with Layer 3 explicitly quarantined).

**Promotion gate:** if “event time” ever gives a prediction differing from proper time or standard thermodynamics at a single point, it could be promoted to Layer 1. At present it does not. The map is not the railway.

## 8. Conclusion

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“Might time be something like a Renko chart?” — this question, born of long intuition in the markets, turns out to have a firm home in physics. **Proper time** is “the accumulation of change along a worldline,” and for light not a single brick is printed ( $d\tau = 0$ ). **Relational / thermal time** says “time emerges from change.” And one Renko brick corresponds to Paper 77's **coarse-grained irreversible event**. The evenly-spaced atomic clock (candlestick) is a precise ruler, but felt time (the Renko) is a different quantity.

Yet we keep the discipline: this is not a rewriting of relativity (time dilation stays standard), and the pictures “consciousness flashes awake, the light sphere expands, the 3D game goes on,” “at light speed rendering lag slows time” are a **Layer-3 vision carrying the non-science label** — cherished as poetry, not mixed with physics. Time is not one but three distinct roots (coordinate, proper, event), and the origin of the arrow (a low-entropy past) remains open. What this paper could offer is only to give a beautiful intuition its **correct home and its correct label**. Even so, that a trader's eye should have named

“events becoming time” — and that it truly rhymes with relativity's proper time and with modern relational time — is one page worth recording honestly.

## Revision Record

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**Third edition (August 2026): an addition of types only; nothing has been retracted.** The **open framework** offered by the first edition — that time is an accumulation of events — stands unchanged. **Three things are added:** (1) that the three times differ **in logical type, not in value** (coordinate / functional of a curve / functional of a measure; Paper 118); (2) that **a fourth type exists** (the flow parameter,  $[t] = L^2$ , a path in  $\text{Met}(M)$ ) and that **this series was already using it** in Papers 103 and 110 (Paper 119); and (3) **a type declaration:** state which clock is being used before counting a brick. The first edition listed three “different quantities” without saying **what differed**; the third edition writes their domains in. **Note also that the separation of  $dt$  from  $d\tau$  belongs not to this series but to Minkowski (1908), and within this series to Paper 108.**

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