

Mapping note — Past and Machian Gravity (document two of two)

Working note. Maps the corpus material for the second of the two documents covering the temporal arc and the production of reality. Document one (``change_and_present_v1_0.md``) develops the change-side: intrinsic values leaping where they can, photon-Arcs instantaneously producing one new present at each Arc, the wave function as fact, the present as fact-plus-boost. This document picks up at the produced present and develops the extrinsic side: when one changes, all change. How the universe propagates the consequences of each Arc. What time and gravity are, given that the Arc itself takes no time. The past as factual but not real. The cycle's other half.

The companion ``handover_to_gravity_doc.md`` records the points that surfaced during work on document one and were flagged for this document. Roughly fifteen distinct points across mechanism, phenomena, past, Mandala cycle, and deferred engagements. Treated here as the working agenda, supplemented by what the corpus and the working documents add when worked through fresh.

*Naming is provisional. Candidates:

``past_and_machian_gravity.md``,

``gravity_and_the_past.md``,

``machian_gravity_and_time.md``,

``propagation_and_the_past.md``. The first foregrounds the two substantive subjects (the past and Machian gravity) and matches the companion-document naming of doc one. The last is the most descriptive of the mechanism but the least evocative of where the document goes ontologically.*

1. What the document is for

Document one ended with a photon-Arc producing one new present in an instant. The Arc is structurally complete in itself: Alice loses Philip, Bob gains Philip, the universe's facts are updated to match. But that update has consequences beyond the Alice-Bob pair, and those consequences do not propagate freely. They propagate at a rate, and the rate is finite, and what we call time and the speed of light and gravity are all signatures of that finite propagation. This document develops the propagation side of the Arc — what doc one called the **extrinsic** side, the when-one-changes-all-change.

The document develops four things in one closed exposition:

1. ****The mass / momentum / gravity identity**** dynamically.

Document one established the structural identification (mass = symmetrical boost, momentum = lopsided boost, gravity = the process). Document two develops the dynamics: how momentum persists in absence of a re-symmetrising event; how gravity-Arcs unbalance and rebalance boost; how acceleration is the rate at which the lopsidedness is being added; the worked geometry of the 4D hypersphere with Dave as timelike centre.

2. ****Why G is what it is.**** Newton's constant of gravitation is not a brute fact about nature but the exchange rate between three vocabularies — rotation-content (kg), real-space distance (m), and Machian tick-rate (s) — that Virtualism

identifies as projections of the same underlying paradox dynamic. Once the universe's own scales for any two of mass, distance, and time are fixed, the third — and therefore G — is determined. The inverse-square falls out of the 2D keyhole geometry through which the virtual centre's constraint reaches its constituents.

3. **What Bob sees when Philip arrives.** The mechanism of apparent past. Alice has already been repositioned by every change elsewhere that propagated to her between Philip leaving and Philip arriving; Bob receives Philip with the information of where Alice was, not where she is. The apparent past is real in being a fact-of-reception, but Alice's actual past is not real anywhere — there is no past to be there. *The past is factual without being real.*
4. **Time as the visible signature of Machian-inertia-as-applied-paradox.** Inertia is being unable to race ahead. Each propagation of consequences requires paradox-resolution work that takes no time individually, but that cannot be skipped, and the cumulative pacing of that work is what we call time. Clocks measure accumulated paradox-resolution. The speed of light is the rate at which the consequences of an Arc propagate outward through the present's 3D structure.
5. **The past as factual but not real.** The classical waterfall of fact streaming away from the present. Where position lives once settled. Pure facts persisting after the realities they were facts about have demerged. The cycle's completion at the level of reality-production: fire-to-earth-to-air-to-water, where document one developed only the forward half of the

cycle.

The document does **not** develop consciousness, soul, the afterlife, or astrology, even where the past-as-eternal-fact material crosses into that territory. Spirit and Iconism material is flagged with positioning paragraphs and the development reserved.

2. The structural arc

The document follows the production cycle's **return half** as the deep structure, with the propagation phenomena as the surface vocabulary.

The arc:

- ****The Arc completed (close of doc one)**** — one new present produced, Alice and Bob updated, photon-Philip gone. The question now: what about the rest of the universe?
- ****Machian rearrangement (every other object)**** — extrinsic consequences of the Alice-Bob change propagate to every other object that bears a relation to either. Not real motion, but virtual repositioning by virtue of altered relations to the changed centre.
- ****What gravity costs to do its work**** — Newton's G is not a brute constant but the exchange rate between three vocabularies (rotation-content, real-space distance, Machian tick-rate) that Virtualism identifies as projections of the same underlying paradox dynamic. The inverse-square falls out of the 2D keyhole geometry through which George's constraint

reaches Eddie and Freddie.

- **The rate-limiter** — Machian inertia. Propagation of consequences requires paradox-resolution work. Each unit of work takes no time but cannot be skipped. The cumulative pacing is the speed of light.
- **What Bob sees** — apparent past. Alice has been further repositioned by every other Arc that propagated to her between Philip leaving and Philip arriving. Bob receives Philip with the fact of where Alice *was* at Philip's emission, not where she is now.
- **The past** — facts streaming away from the present. Where position lives once settled. Pure facts liberated from reality, persisting eternally without continuing to be real.
- **The Mandala completion** — fire-to-earth-to-air-to-water at the level of reality-production. How the past's facts constrain the next imminent future, closing the cycle that doc one's forward half opened.

The reader meets the arc as a sequence of phenomena (propagation, apparent past, time, the past). The Mandala cycle underneath has the *production direction* running forward (past feeds the next imminent future via Machian rearrangement), while the *temporal arrow* runs backward (past is behind us, present here). The two arrows that aligned in doc one diverge here, and that divergence is the document's structural signature.

3. Core corpus material — by section

3.1 Opening: where doc one left off

Brief recapitulation. The Arc completes; one new present is produced; the universe's facts are updated. Now the question is how the consequences of that update reach the rest of the universe — and what emerges in the process.

Source material: §9 of `change_and_present_v1_0.md` (the forward pointer); the **handover_to_gravity_doc.md** opening points on the propagation side of change.

3.2 The dynamics of mass-momentum-gravity

Doc one §7.5 made the structural identification: rest mass = symmetrical boost, momentum = lopsided boost, gravity = the process of unbalancing or rebalancing. Doc two develops the dynamics.

****Why momentum persists.**** A particle with lopsided boost stays lopsided absent a re-symmetrising Arc. Each new present-after-an-Arc-elsewhere is **another** present in which the same lopsidedness obtains, and that lopsidedness produces the same extrinsic shift each turn. We see this as the particle "continuing in straight-line motion." There is no inertial law to invoke; the particle's intrinsic boost-shape is doing what the boost-shape does, turn after turn. (Diary 060C, 4 June 2025 — "one side plastered with photons" — for the lopsidedness mechanism. Diary 060B, 6 May 2025 — "it is boost that points their path closer" for momentum-as-boost-pointing.)

****Why momentum has a vector.**** The lopsidedness has a direction in the imaginary 3D, and that direction's projection into the real 3D is what we see as the velocity vector. (Diary 060A, 16

April 2025, the Fast Freddie passage; *Fast Freddie's direction of momentum is 3D but imaginary, in addition to his real 3D properties, so is a vector.**)

Why acceleration is paradox-driven response. Acceleration occurs when there is a state of paradox between the subjective and the objective — between the internal parts of the accelerating thing and the external relationship it has with whatever is "accelerating" it. The mountain and Muhammad: the objective usually has greater power because the objective is just larger, so Muhammad goes to the mountain — but the mountain also goes a little way towards Muhammad. (Diary 064A, 23 April 2025, the Acceleration passage.) The mathematics: each acceleration-event adds more lopsidedness to the boost; the rate of addition is the magnitude of acceleration; the direction of addition is the direction of the resulting velocity-change.

The booster-stage example. Worked illustration of the rest-mass / accelerated-mass distinction. When the rocket detaches from its stage-1 boosters, it loses the *mass of the boosters* (a real loss of internal boost) but *retains the velocity they imparted* (a lopsidedness already added to its own boost that persists absent a re-symmetrising event). This shows that rest mass and accelerated mass are two facets of one boost-load, distinguished by symmetry of rotation rather than by being separate quantities. (Diary 062A, 7 November 2025.)

3.3 Gravity-Arcs as the mechanism of un-balancing

Gravity-Arcs are *as virtual as* photon-Arcs. A gravity event repositions an object with mass by altering its external

relationships. The whole mass is subtracted from one place and added to another, in the same structural way the photon transaction subtracts energy from Alice and adds it to Bob. The process is very similar; the difference is what is subtracted and added (energy-square in the photon case; mass-position in the gravity case). Neither involves real motion through real space. Both are *as-if* paths constructed post-hoc from the extrinsic positional facts of the event. Where the photon alters intrinsic facts, gravity alters extrinsic facts hence the whole object.

Source material:

- *handover_to_gravity_doc.md*, the *Gravity-Arcs* are as virtual as *photon-Arcs* opening structural identity.
- Diary 063B, 7 February 2026, the long *Alice, Bob, Dave, Philip* passage: gravity emerges from each quantum change shifting Dave (the universal centre/heart), with the resulting rearrangement being non-force-mediated. *"This gives a non-force-mediated mechanism for gravity that does not require a graviton."*
- Diary 060C, 4 June 2025: *"masses have this tendency to move towards one another, i.e. why gravity accelerates"* as the question, answered by *"G as the virtual sum of A and B has the mass of both of them, so G is boosted more than either A or B."*
- Diary 060B, 6 May 2025: *"With gravity there is no exchange of anything going on, but Eddie and Freddie do gain momentum toward one another, but as a consequence of Dave buzzing, not from any particle exchange."*

****Gigantic George.**** For any pair of masses Eddie and Freddie, there is a virtual centre Gigantic George that, as the sum of their boost, is more rotated than either. Because George is more rotated, the system Eddie-Freddie-George rotates further into the imaginary as a unit, and rotating further into the imaginary appears as **closing the real-space distance** between Eddie and Freddie. This is gravity in action without a gravitational force. (D060A, 16 April; D060B, 6 May; D060C, 4 June; D063B, 7 February.)

****Why this is structurally identical to the photon-Arc.****

Subtract-and-add. Some quantity is removed from one configuration and added to another. The path between is not travelled; the as-if path is constructed post-hoc from the extrinsic positional facts. The difference is what is subtracted and added: energy-square in the photon case, mass-position in the gravity case. The mechanism is the same.

3.4 Why G is what it is

A subsection developing the structural account of Newton's gravitational constant. The argument is not a derivation of G's numerical value (which would be impossible without a derivation of the universe's own scales for mass, distance, and time), but an account of **what kind of quantity G is** and why, on Virtualism's terms, it cannot be a brute fact about nature.

****The framing of the question.**** The Hossenfelder checklist (positioning_verlinde_and_emergent_gravity.md §3) demands that a successful emergent-gravity account **derive the inverse-square behaviour as a consequence, not as a target**. Verlinde fails

this because his derivation reverse-engineers Newton from thermodynamic premises that already contain gravitational acceleration. Virtualism's account, by contrast, gets the inverse-square *for free* from the 2D geometry of the constraint-surface, and gets the *kind* of quantity G is from the three-vocabulary structure the gravity-Arc mechanism requires. This subsection is where Virtualism cashes the checklist's most important item.

****The Eddie-Freddie-George geometry, recapitulated.****

- *Eddie has rest mass.* Symmetric imaginary rotation. Eddie is numerically the same man he would be without rest mass, but his content is partly absorbed into the imaginary axis, so the real-projected Eddie occupies less real space than the unboosted Eddie would. Equivalently, Eddie is further from his neighbours in the 4D measure while occupying the same real-space point. This is the *stretch*.
- *Freddie has mass and momentum.* Lopsided rotation, greater in one vector. Freddie has even less apparent distance along his vector of motion — he is *more* stretched along that axis. This is, incidentally, the structural origin of length-contraction; it falls out of the rotation-shape rather than being put in by hand.
- *George is the virtual centre.* Because George sums Eddie's and Freddie's rotations, George is more rotated than either. George is further into the imaginary than his parents.
- *The constraint.* Eddie and Freddie are held in relation to George — they make him; they cannot be inconsistent with him. George is further into the imaginary than they are. To maintain consistency with George, Eddie and Freddie must

rotate *more*, which closes their real-space separation.

That closing is what gravity is. Not a force; a paradox-resolution that closes real-space distance because the virtual centre demands it.

****The keyhole.**** Gravity's mechanism lives in the 4D rotation, but the constraint from George reaches Eddie and Freddie through the 2D surface of the sphere at radius r . This is the geometric origin of the $1/r^2$. Twice as far, four times the surface to distribute the same constraint, so $1/4$ of the closing-pressure per patch. The inverse-square is not a force-law decree; it is what *spherical distribution of a constraint* means geometrically. The keyhole is 2D and the constraint distributes over it.

****The mass-product.**** Eddie's mass-rotation and Freddie's mass-rotation combine in George multiplicatively in the appropriate limit (the joint rotation as a product-shape rather than a sum-shape). This needs care in the worked derivation but is not mysterious; it is the geometry of how two rotations compose into a virtual centre. The $m_1 \cdot m_2$ falls out.

****The dimensional reading of G.**** Newton's G has units of $\text{m}^3 \cdot \text{kg}^{-1} \cdot \text{s}^{-2}$. Read it as *volume per unit mass per unit time-squared*. It says: a unit of mass-rotation, given a unit of universal ticking-squared, claims a particular volume of real-space effect. G is the *volumetric rate* at which mass-rotation reaches into real space per unit of Machian pacing.

****The three vocabularies.**** In Virtualism's account, three quantities have to be related:

- ***Imaginary rotation content***, the thing mass ***is***. Counted in kilograms when projected into the scale we use for matter.
- ***Real-space distance***, the thing being closed by gravity. Counted in metres.
- ***Universal tick rate***, the Machian pace at which paradox-resolutions accumulate. Counted in seconds.

G is the conversion factor between these three. ***Not a free parameter.*** The exchange rate the three vocabularies have with each other, because the three vocabularies are not independent — they are projections of the same underlying paradox-driven dynamic.

****The structural claim.**** Once the universe's own scales for any two of mass, distance, and time are fixed, the third — and therefore G — is determined. G is not a constant of nature in the sense of being a free parameter that could have been otherwise; it is whatever number expresses the ratio that the three units happen to have to one another, given the universe's single underlying dynamic.

This is significantly stronger than the standard physicist's position, which treats G as a brute parameter that we discover by measurement and have no further explanation for.

****The honest qualification.**** Virtualism does ***not*** derive G's numerical value (6.674×10^{-11} in SI units). That number depends on the units we use for kg, m, and s, and Virtualism cannot derive those without deriving the universe's own scales

from first principles, which it does not claim to do. What Virtualism claims is that G is *the kind of quantity that is structurally determined once any two of the three scales are fixed*, and that this is a stronger claim than the standard "G is just what it is."

The dimensionless ratios in which G appears (such as the ratio of gravitational to electromagnetic force between two electrons, of order 10^{-39}) are the truly fundamental numbers, and even those, standard physics treats as brute facts. Virtualism's position on these is a question for further work — flagged for later development.

****Does it hold at relative velocities?*** Yes, without extra machinery. Fast Freddie's lopsided rotation makes George lopsided in Freddie's direction; the constraint George imposes becomes anisotropic — more closing-pressure along Freddie's direction of motion, less perpendicular. This is exactly what general relativity says happens to a fast-moving mass: its gravitational pull is enhanced longitudinally relative to its rest-frame Newtonian pull. The factor of enhancement (γ^2 in GR) falls out of the lopsidedness of George when one of his parents is rotation-asymmetric. The G that appears in Einstein's field equations is the same G — doing the same conversion work between the same three vocabularies. What changes at high velocity is not G but the rotation-content of the source.

****The co-determination of rotation and position.***** A point that surfaces in the working-out of the dynamics: when a gravity-Arc occurs, the change in rotation and the change in

real-space position are not sequential — there is no "first the rotation changes, then the position adjusts." Following the intrinsic/extrinsic distinction sharpened in §3.3, rotation here is Eddie's *extrinsic* relation to Dave (the universal centre), and position is Eddie's *extrinsic* relation to Freddie (or any other mass). Both are extrinsic facts about Eddie, and the gravity-Arc updates extrinsic facts in a single event. The two updates are not two events but one Arc seen from two angles: rotation-vs-Dave and position-vs-Freddie. *This is also why Eddie's intrinsic content is untouched by a gravity-Arc — what we ordinarily call "Eddie moves" is the extrinsic fact-set updating, not Eddie's interior changing.*

****Aphorism candidates from this subsection:****

- > G is not a constant of nature but a constant of bookkeeping —
- > the exchange rate three vocabularies have for the same
- > underlying rotation.

- > G is the bill the universe charges when you want to count
- > mass in kilograms, distance in metres, and time in seconds.
- > It's the same paradox in three currencies; G is the bill.

Source material for the subsection: this exchange (the Eddie-Freddie-George logic worked through to G); the `positioning_verlinde_and_emergent_gravity.md` checklist; Diary 060A (4 April 2025, the *time-gravity-space all emergent* passage) for the structural framework; Diary 060A (23 April 2025, the 4D-hypersphere ChatGPT exchange) for the geometry of boost-as-rotation; Diary 060C (4 June 2025) for the Eddie-Freddie-George dynamics and the *"the mathematics of this must

derive Newton's laws"* falsifiable target; Diary 060B (19 May 2025) for the rest-mass-internal vs energy-momentum-external distinction; Diary 044 (20 June 2021) for *gravity has no uncertainty* (the inside/outside vs inside/inside distinction that supports the "constraint distributes over a 2D shell" reading).

3.5 What Bob sees when Philip arrives

The cornerstone of the document. Philip subtracts from Alice; Alice immediately has less boost; Alice's position-in-relation-to-everything-else has shifted as a consequence of the boost change. But Alice's new position cannot reach the rest of the universe instantaneously. It propagates outward via the same mechanism every other change propagates — Machian rearrangement at the rate inertia permits.

So when Bob receives Philip, the universe is no longer in the state it was when Philip left Alice. Alice has been further repositioned by every other Arc that propagated to her during Philip's transit. Bob sees Alice not where she now is, but where she *was* when Philip was emitted.

The apparent past Bob sees is not a real past — Alice's earlier state does not exist anywhere any more. What exists is the *fact* in Bob's reception of where Alice was when Philip emitted, and that fact carries with it nothing that the universe is currently *doing*. The apparent past is *factual without being real*.

Source material:

- `*handover_to_gravity_doc.md*`, the `*What Bob sees when Philip arrives*` point and the `*How far back Alice appears*` point.
- Diary 060A, 4 April 2025: the `*paradox of time*` passage, `*"What is paradoxical is that the distant always appear to be as they were, placing them in a past that paradoxically does not exist."*`
- Diary 063B, 7 February 2026: `*"the change to Alice and Bob appears like the passage of time, but Bob is only 'aware' of the fact of Alice's prior position, not her current one, and there is a big difference between facts of the past and facts of reality."*`
- Diary 063B, 16 February 2026: the `*simple universe vs real universe*` contrast. In the simple universe Philip takes one tick; in the real universe ticks are the count of all other changes.
- Diary 064B, 1 May 2025: `*"any observer necessarily sees the other in their own past, so disagreement about how-far-in-the-past is irrelevant to the Presentism question."*`

`**How far back Alice appears to Bob**` depends on Bob's distance from Alice combined with parallel changes along Philip's apparent path that padded the propagation. Clocks measure accumulated paradox-resolution, not abstract duration. A light year is the distance Philip can span while one year's worth of changes occur in the universe. (Diary 063B, 7 February 2026.)

3.6 Inertia as the rate-limiter on change

Inertia is the phenomenon that affects the rate of change in comparison to other change, and ultimately to all contemporary change. Hence it is Machian. `*Inertia is being unable to race`

ahead.* Each value-difference between objects requires the repeated application of paradox to shift, and that repeated application is what *takes time* in the sense of preventing everything from updating simultaneously.

The universe does not need a separate time-serialiser. It has Machian inertia, and inertia is the serialiser. Nothing can update without paradox-resolution work; the work cannot be skipped; therefore nothing can race ahead; therefore the universe updates at a pace, and the pace is what time is.

Source material:

- **handover_to_gravity_doc.md**, the **Inertia as the rate-limiter on change** point and the **Time as the visible signature** point.
- Diary 060A, 4 April 2025: Mach, Barbour, Lange. The philosophical lineage and the question **"Why is there a tendency to move at all?"**, answered by the Machian principle that every change shifts the centre of everything.
- Diary 063B, 16 February 2026: **"In the real world, what actually happens is that as Philip moves... a host of other moves take place in a zillion parts of the Universe. Those changes reposition both Bob and Alice, at least in a classical sense... Time as the count of all other changes during Philip's transit."**

3.7 The speed of light as the rate of inertia-pacing

The speed of light is not a velocity in the ordinary sense. It is the rate at which consequences of Arcs propagate through the

present's 3D structure, limited by Machian inertia. The photon does not travel at c ; c is the rate at which what the photon did propagates outward.

Source material:

- `handover_to_gravity_doc.md`, the *Speed of light as the rate of inertia-pacing* point.
- Diary 063B, 7 February 2026: *"a light year is the distance Philip can span while one year's worth of changes occur in the universe."*
- Diary 060A, 16 April 2025: Wolfram's *"time dilation uses up computation"* contrasted with Virtualism's *"momentum is simply more curvature due to more imagination"* — time-dilation as imaginary rotation absorbing real change, not computation being used up.
- Diary 047 (per concept map index): speed of light as steady-value-of-universal-change; CMB photon as worked case showing only-moving-present.

3.8 Gravity, time, and the speed of light as three faces of one mechanism

The structural unification. If the picture above is right, this is a major unification at Tier 1 and the spine of the document.

- *Photon-Arc* instantaneously updates the universe's facts (no time involved in the Arc itself).
- *Machian inertia* propagates the consequences at finite rate.
- *Time* is the visible signature of that propagation when viewed as duration.
- *Gravity* is the visible signature of that propagation when

viewed as how-things-now-move.

- *The speed of light* is the visible signature of that propagation when viewed as how-fast-the-news-travels.

Three faces of one mechanism. The mechanism: Machian-inertia-as-applied-paradox propagating the consequences of each Arc.

Source material:

- *handover_to_gravity_doc.md*, the *Gravity, time, and the speed of light as three faces of one mechanism* point.
- Diary 060A, 4 April 2025: the full transition from emergent time → emergent gravity → emergent space in one continuous run.
- Diary 044, 20 June 2021: *"gravity has no uncertainty"* — gravity is classical/emergent because it is the 100% propagation of consequences, not a probability distribution.

3.9 The past as factual but not real

Source material:

- *handover_to_gravity_doc.md*, the *Past as factual but not real* point and the *Position remaining in the past* point.
- Diary 063B, 7 February 2026, the *eternal but ghostly facts* framing: *"the past only continues to exist as rather ghostly virtual facts, facts that do have the quality of being eternal."*
- Diary 064B, 13 May 2025, the *Butterfly of Fact* framing: past and future are factual, present is real-plus-factual, reality is conserved by demergence.

- Diary 060A, 7 April 2025: *"the past is not real – it cannot change – but it is eternally true."*

Position remaining in the past. What is classical is position. Post-collapse positional configurations move into the past as fully-determined facts. Mass and momentum belong to the present; position belongs (once settled) to the past. (Diary 060A, 7 April; Diary 060C, 18 June; Diary 064A, 28 April.)

Pure facts persisting after demergence. Facts liberated from the thin range of 3D reality are potentially free to pursue some kind of independent life — out of this world. This crosses into Spirit but is rooted in Virtualism. A positioning paragraph in this document, with the development reserved for Spirit.

3.10 The Mandala cycle completion

Document one developed the production cycle's forward half (water → air → photon → earth, with the temporal and production arrows aligned). Document two develops the return half (earth → fire → ... → water-again), with the two arrows diverging.

In document two, the temporal arrow runs backward through the Mandala cycle (past is behind us, present here, future ahead), while the production arrow continues forward (the past **feeds** the next imminent future via Machian rearrangement).

Source material:

- `*handover_to_gravity_doc.md*`, the `*Fire-to-earth-to-air-to-water at the level of reality-production*` point and the `*Two arrows that don't align*` point.
- ``mandala_framework_v004.md`` for the full elemental scheme and the four stages.
- Diary 060A, 16 April 2025: `*"Emergence between different Elements"*` — paradox-driven element-pairing gives the cycle.
- Diary 064B, 7 May 2025: `*Emergence and Demergence*` paired, `*"titanic elemental order"*`.

The cycle's return half: the past's facts (fire) constrain the next imminent future via Machian feedback. The constraints shape what is possible in the next turn of the cycle. The constraints are not deterministic; they are `*resource and limit*` — the Many Worlds of possibility are loaded by what has already become.

3.11 The 4D-hypersphere geometry

The corpus's worked geometry from D060A (23 April 2025) and elsewhere. Dave as timelike (purely imaginary) centre of a 4D hypersphere; real objects on the surface have imaginary boosts (rest mass).

Worked headlines from the ChatGPT exchange:

- Distance in 4D with one imaginary component: $D^2 = x^2 + y^2 + z^2 + w^2$ (the imaginary unit vanishes under squaring).
- Allowing rotations into the imaginary axis (Lorentz-like boost): $D^2 = x^2 + y^2 + z^2 - w^2$ (pseudo-Euclidean / Minkowski-like).

- Pure imaginary translation of all points does NOT change the 4D distance between them.
- Lorentz-like rotation (hyperbolic rotation matrix with $\cosh \theta$ and $\sinh \theta$) DOES change the real-projected distance.
- Unboosted points on a 4D hypersphere drift apart when the radius increases (Euclidean balloon).
- Boosted points rotate into the imaginary direction, and the real-space distance between them shrinks. *Boost as a rotation mechanism.*

The document gives the geometry. Doc one only stated the bare claim that mass introduces a fourth dimension via imaginary rotation; doc two does the worked example.

Source material:

- `*handover_to_gravity_doc.md*`, the `*4D-hypersphere geometry with Dave-as-timelike-centre*` point.
- Diary 060A, 23 April 2025: the full ChatGPT exchange. (The diarist's 2026 addendum — `*"Perhaps Claude can make a better fist of this"*` — invites a revisit.)
- Diary 060B, 12 May 2025 and 21 May 2025: the two ChatGPT gravity simulation attempts. The 21 May version is `*the cleanest single-document specification of the gravity model in this diary*`.
- ``positioning_existence_and_dimensions.md`` for the dimensional positioning.

3.12 Engagements with the contemporary literature

The deferred engagements collected in one place.

****Verlinde-style emergent gravity.**** Already positioned in `positioning_verlinde_and_emergent_gravity.md`. The substance: Virtualism and Verlinde share the **programme** (gravity is emergent), differ on **mechanism** (Virtualism's pre-gravitational base is numerical and dimensional, not thermodynamic). The Hossenfelder circularity criticism that sinks Verlinde does not transfer to Virtualism. The positioning note's content is absorbed into the document; the multi-body case is addressed directly via the Machian-rearrangement mechanism.

****Builes and Impagnatiello on Presentism.**** Their Markovian argument for presentism. The laws of science are Markovian — the way the present evolves depends on the present state, and the past influences the future only through the present. Virtualism agrees with the Markovian structure but adds: the past is **factual** and the present that the past entails is itself factually richer than science usually admits. *"The past is entirely entailed in the present, although many of the facts of the past are ineffectual dust."* (Diary 064B, 13 May 2025.)

****Mulder on Negative Presentism.**** Time as dimension vs sui generis predicate. Virtualism: time is emergent from change, not dimension or predicate. Mulder is wrong to call time **dynamic** — change is dynamic; time is emergent from change. (Diary 064B, 13 May 2025.)

****Van Raamsdonk on spacetime from entanglement.**** Closer to Virtualism in spirit than Verlinde's thermodynamic route. Spacetime as something distilled from quantum entanglement relations. Worth a short engagement section: Virtualism agrees

that spacetime is not fundamental, but the mechanism is paradox-driven dimensional emergence, not entanglement-based.

****Arkani-Hamed on the Amplituhedron / spacetime is doomed.****

The Amplituhedron programme as an emergent-spacetime ally.

Brief engagement: Virtualism shares the spacetime-as-derived commitment.

****Centre of gravity as virtual fact, not subject to Heisenberg.****

Doc one mentioned this in passing (§7.5). Doc two develops the worked account: virtual centres are classical-because-virtual-fact. The Earth's centre of gravity is exactly where it is; there is no fact-of-the-imminent-future about its position that needs resolving. (Diary 060A, 9 April 2025; Diary 044, 20 June 2021.)

****No singularities.**** Inside a large mass, the push from close to the edge squashes up the inside, but gravity (which is gradient) is excluded from the middle because there is no more middle than the middle. Hence no singularity at the centre of black holes; no Big Bang singularity. Singularities arise only if space and time are treated as fundamental containers; they dissolve when both are emergent. (Diary 060C, 11 June and 26 June 2025.)

****Entanglement Bell-test resolution in detail.**** Doc one §8 gives the positioning: entanglement-Arcs differ from photon-Arcs in transferring information rather than energy, which is why one produces apparent time-passage and the other does not. Doc two develops the full mechanism once the time-as-emergent picture is in place. (Diary 063B, 7 February 2026: *"time only

emerges when energy is transferred"*.)

3.13 Forward pointer and close

Brief close. The two documents together constitute Virtualism's account of the temporal arc and the production of reality. The companion documents to develop after this pair complete:

- *Cosmology.* The early universe, the CMBR as observed past, the question of beginnings.
- *Mathematical facts.* The numerical foundation as developed in `numerogenesis_v003.md`.

Aphorism candidates to harvest from the corpus and the developing argument.

4. Vocabulary inventory

The named entities used through the document. Mostly inherited from doc one and the corpus.

****The cast of physics actors**** (consolidated in Diary 064B, 7 May 2025):

- *Alice, Bob, Charlie* — three particles with mass.
- *Dave* — the virtual universal centre / heart. Both whole and heart simultaneously. Timelike (imaginary) centre of the 4D hypersphere.
- *Eddie, Freddie* — two real masses, used when the focus is pair-dynamics.

- *George (Gigantic George)* — the virtual centre of Eddie and Freddie. More rotated than either, by virtue of summing their boost. The local analogue of Dave.
- *Philip* — the photon. The Arc carrier.
- *William* — used in doc one §6 for the alternative Arc carrier (rejected). Possibly used here for a generalised Machian rearrangement event.
- *Simon (Spinning Simon, Slippery Simon)* — the spin / entanglement carrier. 1D informational analogue of Philip.

****Boost vocabulary**** (from doc one §7.3–§7.5):

- *Symmetrical boost* — rest mass.
- *Lopsided boost* — momentum.
- *Re-symmetrising Arc* — the gravity-Arc that adds or removes lopsidedness.
- *Imaginary rotation* — the basic operation. Real numerical content rotated into the imaginary to absorb dimensional paradox.

****Time vocabulary**** (developed in this document):

- *Tick* — one paradox-resolution event, one update of the universe's facts.
- *Pace* — the rate at which ticks accumulate, set by Machian inertia.
- *Apparent past* — what Bob sees when Philip arrives: the fact of Alice's prior position.
- *Eternal but ghostly fact* — the past, persisting in being factual but no longer being real.

****Mandala vocabulary**** (from `mandala_framework_v004.md`):

- ***Water*** — non-determined / shapeless / distant future.
- ***Air*** — under-determined / many-worlds / imminent future.
- ***Earth*** — over-determined / determinate / present.
- ***Fire*** — classical / past / completed.

The cycle's return half: earth → fire (present settles into past) → fire feeds water (past constrains the new distant future possibility-space) → water shapes into air (distant future tightens into imminent future) → air resolves into earth (Arc produces new present). The cycle continuously turning.

5. Aphorism candidates from the corpus

Drawn from the corpus, marked with diary references. Candidates for placement in the document, the Acta paper, or other publication-ready material.

> Time is a waterfall of the past facts receding. *(D060A, 18 April 2025, Paradigm Drift)*

> Momentum is simply more curvature due to more imagination. *(D060A, 16 April 2025)*

> Inertia is being unable to race ahead. *(handover; surfaced during doc-one work)*

> Gravity is the downward causation of spatial wholes upon their parts, mediated by the virtual centre of gravity. *(concept

> map §5)*

> Reality is a conserved quantity due to demergence. *(D064B,
> 13 May 2025)*

> The past has no reality, it is composed of empty, ghostly
> facts. *(D064B, 13 May 2025)*

> Facts do not Demerge, Facts are the past, and eternal. *(D060A,
> 18 April 2025, Paradigm Drift)*

> There is no big machine overseeing how things move ... the
> moving object emerges as being elsewhere, and simultaneously
> demerges from where it was. *(D060A, 16 April 2025)*

> Photons ... are simply a calculation that requires no calculator.
> *(D060A, 20 April 2025 — also a doc one aphorism candidate but
> equally apposite here as the limit case of the propagation
> mechanism)*

> Suit yourselves! *(D060C, 4 June 2025, Frankie Howerd via the
> diarist) — for use where Virtualism's stance on Dave as
> absolute frame of reference is being defended against
> conventional physics' refusal to recognise it. Voice piece.*

> The Bell test is the key that releases us into a landscape of
> Freedom. *(D064B, 5 May 2025) — already used in doc one §8;
> usable here too where the Markovian-meets-Many-Worlds
> reconciliation is laid out.*

> G is not a constant of nature but a constant of bookkeeping —

> the exchange rate three vocabularies have for the same

> underlying rotation. *(this exchange, §3.4)*

> G is the bill the universe charges when you want to count

> mass in kilograms, distance in metres, and time in seconds.

> It's the same paradox in three currencies; G is the bill.

> *(this exchange, §3.4 — author's coinage)*

6. Open issues and points to resolve during drafting

The geometry section's depth. The 4D-hypersphere material (§3.11) could be a few paragraphs or a worked subsection with the ChatGPT-derived headlines laid out. The diarist's 2026 addendum invites a revisit — *"Perhaps Claude can make a better fist of this"* — but the document's main job is the conceptual account, not the formal derivation. The right level is probably: state the headlines, show the unboosted-balloon vs boosted-inward-rotation result, refer outward for the full derivation.

Flag for the drafting stage.

The Verlinde engagement's placement. Doc one §8 has the entanglement positioning; doc two §3.12 has the gravity-program engagements. Verlinde, Van Raamsdonk, and Arkani-Hamed can sit together in one section, or be distributed at points where they bear (Verlinde with gravity-Arcs, Van Raamsdonk with the Machian-rearrangement-as-relational, Arkani-Hamed with the spacetime-as-emergent close). The single-section treatment is cleaner; the distributed treatment integrates better. *Flag for the drafting stage.* Note: §3.4 on G already absorbs the substantive Hossenfelder-checklist response (inverse-square as

consequence not target), so the Verlinde engagement in §3.12 becomes lighter — more positioning, less substance.

****The Bell-test full mechanism.**** Doc one §8 gives the positioning. Doc two needs to give the full mechanism: how entanglement-Arcs differ from photon-Arcs, why information transfer does not "cost" time, what Simon does that Philip does not. This could be a substantial subsection of §3.12 or could be a dedicated section. **Flag for the drafting stage.**

****The status of position-as-classical.**** Doc one §6.4 has position and momentum as emergent in relation, not as possessed properties. Doc two §3.9 has position as classical and belonging to the past once settled. These are compatible (position is emergent-in-relation at the moment of the Arc, then settles into the past as classical fact), but the document needs to make the transition explicit. **Flag for the drafting stage.** The §3.4 **co-determination of rotation and position** paragraph helps here — it establishes that the two are simultaneous at the Arc, which makes the subsequent settling-into-the-past unproblematic.

****The "no singularities" passage's depth.**** Diary 060C makes a clean two-step argument (gravity is gradient → no singularity at centres; rotation approaches 90° → photons can't escape black holes), but the second step needs care. **Flag for the drafting stage; the cleanest version may end up being a single short subsection rather than a full development.**

****The MOND aside.**** Diary 060B (19 May 2025) mentions MOND gravity as having justification from extra dimensions involved

in 4D-of-quarks territory; the author has also raised it in this exchange's opening as a possible alternative to no-singularities. The status: Virtualism does not need MOND to make its account work, and the G subsection in §3.4 explicitly treats relative-velocity cases without needing MOND machinery. But the dimensional-ladder territory (charge as 4th dimension, magnetism as 5th, quarks as 4D objects trapped in 3D) gives Virtualism resources that may bear on galactic-scale phenomena where MOND was introduced. *Probably best held as a paragraph of "where Virtualism's resources could touch this" rather than a load-bearing claim; revisit during drafting.*

Dark matter / dark energy positioning. Doc one barely touches these. Doc two could add a positioning paragraph: Dark Matter as the stable subset of real points that don't interact (D060A, 7 April 2025); dark energy as related to the universe's expansion-vs-gravity balance (D060B, 12 May 2025). *Flag for the drafting stage; if it grows beyond a paragraph, defer to a cosmology document.*

7. Cross-tier flags

Material that touches Spirit or Iconism and needs flagging rather than developing here.

Pure facts persisting after demergence. The eternal-fact framing of the past has clear bearing on Spirit's treatment of soul, death, and the afterlife. Diary 064B explicitly draws the connection (*"reincarnation is reintroduced here as a natural consequence of fact-persistence"*). A positioning paragraph in

the document acknowledging the bearing; development reserved for Spirit.

****Ideal objects in the wave function.**** Diary 060A, 4 April 2025, ends with the bridge to Iconism: ideal objects (objects of consciousness, with no physical counterpart) also enter the wave function and so affect the outcomes of biological wave-function events. This connection belongs more to Iconism than to this document, but it bears on §3.8's three-faces unification (the propagation also reaches consciousness, not only matter). *Flag rather than develop.*

****Astrology and the planetary inclusion.**** Diary 060C, 22 June 2025, briefly: *"you can't experiment outside the planets."* Speculative cross-reference. *Flag for the Spirit project, do not develop.*

8. Inventory of diary material surveyed

The diaries that have substantive gravity / time / past / Machian material for doc two:

- *D044* (April–June 2021): inside/outside inversion mechanism; gravity has no uncertainty; gravity as similarity-internal; Strong Force as gravity at quark scale (possible unification).
- *D045* (July–September 2021): magnetism and electricity; charge as 4th dimension; speed of change.
- *D046* (October–December 2021): Mirage of Time; emergent things taxonomy; quantum asymmetry / time irreversibility; paradox drives emergence.

- *D047* (January–March 2022): Verlinde engagement; calculation of change/time; Mach's Principle; speed of light as steady universal change.
- *D055A* (January–February 2024): Alice-Bob-Charlie-Dave fully worked.
- *D060A* (April 2025): the 4D hypersphere geometry with Dave-as-timelike-centre; Mach/Barbour/inertia; Fast Freddie; *time emerges from change*; *gravity is just as emergent as Space and Time*.
- *D060B* (May 2025): two ChatGPT gravity simulation attempts; rest mass vs accelerated mass; boost arithmetic; expansion vs gravity.
- *D060C* (June 2025): the *Wednesday 4 June – Gravity* passage, the most concentrated single-day attempt to state the gravity-and-momentum mechanism from first principles; no singularities; position and momentum as emergent.
- *D061* (cross-referenced): four creation-modes; speed of change.
- *D062A* (November 2025): the rocket-and-stage-1 boost example; mass-gravity-momentum-acceleration as lowest-level emergence from the real.
- *D062B* (likewise): quarks as 4D objects trapped in 3D; rest mass as Tardis.
- *D063A* (October–November 2025): preliminary statements that feed forward.
- *D063B* (February 2026): the full *Alice/Bob/Dave/Philip theory of gravity*; Gigantic George; entanglement as informational vs energetic change; time as count of ticks; no spookey action from past to future.
- *D063C* (likewise): no Big Bang singularity.
- *D064A* (April 2025): the Acceleration passage as paradox-

between-internal-and-external.

- *D064B* (May 2025): the Builes/Impagnatiello/Mulder engagement; the Butterfly of Fact framing; the Markovian-meets-Many-Worlds reconciliation; the *Eternalism is absurd* line.

Documents in the working layer:

- `change_and_present_v1_0.md` §9 forward pointer, and §7.5 for the structural mass-momentum-gravity identification doc two extends dynamically.
- `handover_to_gravity_doc.md` — the working agenda.
- `positioning_verlinde_and_emergent_gravity.md` — substantive Hossenfelder-checklist response absorbed into §3.4 (G as exchange rate, inverse-square as consequence); remaining positioning material into §3.12.
- `paradox_and_emergence_v003.md` — for the paradox-as-engine base, particularly §5 and §6 (the Mandala four-stage framework with gravity at stage 2 and acceleration at stage 4).
- `foundations_v001.md` — for the parts-and-wholes structure and the centre-as-virtual-heart material in §2 and §3.
- `mandala_framework_v004.md` — for the cycle's structure, particularly the return-half this document develops.
- `positioning_existence_and_dimensions.md` — for the dimensional positioning.

9. Status

Mapping note complete enough to support drafting. The structural arc is clean; the corpus material is identified and the bearing

of each passage is noted; the engagements with the contemporary literature are catalogued; the open issues are flagged at the points where they will arise.

The document is now expected to be somewhat longer than doc one, to accommodate §3.4 on G. The mass-momentum-gravity dynamic section (§3.2) and the gravity-Arcs section (§3.3) will be substantial; §3.4 on G as exchange rate is a new substantive subsection that came in during mapping and absorbs much of what the Verlinde positioning note was holding for later; §3.5 on Bob seeing Alice in her past is the conceptual cornerstone and may run to several pages; §3.6–§3.8 on inertia, the speed of light, and the three-faces unification are the structural spine and need to be tight; §3.9 on the past as factual but not real is shorter but does the Spirit-flagging work; §3.10 on the Mandala cycle's return half is short and structural; §3.11 on the 4D hypersphere geometry has the open question of depth; §3.12 on engagements is collation work that may grow during drafting, though §3.4 has already absorbed the substantive Hossenfelder-checklist response so the Verlinde engagement here becomes lighter.

Naming for the document file: provisional

`past_and_machian_gravity.md`, matching the `*handover_to_gravity_doc*` phrasing. Other candidates listed at the head of this map.

*End of map. Version history: v001 initial mapping; v002 added §3.4 on G as exchange rate, with the structural arc, internal cross-references, and §9 status updated to match; v002 also added the author's §3.3 clarification — "Where the photon alters intrinsic facts, gravity alters extrinsic facts hence

the whole object" — which establishes the intrinsic/extrinsic layer-distinction between photon-Arcs and gravity-Arcs. v003 sharpened the §3.4 co-determination paragraph to align with that clarification (rotation and position both as extrinsic facts updated together in a gravity-Arc, not as projections of intrinsic content).*