

Experienced Temporal Passage: Enacted Scaffolding and the Organization of Succession

Jeremy Rodgers

Independent Researcher

<https://www.everythingequation.com>

23 October 2026

DOI: <https://doi.org/10.5281/zenodo.23591626>

Abstract

Experienced presentness, succession and passage must be related to physical temporal structure without placing an observer outside the world. This paper develops a constructive account within enacted scaffolding: experience, including its felt character, is identified with the complete qualifying organization actually enacted by a bounded, historically formed interpretive unit. A melody construction differentiates source occurrence, signal reception, retained contribution, present input and anticipation. Their actual interpretive uptake can constitute an ordered transition while the melody unfolds; joint availability does not represent the source events as simultaneous. Immediate uptake is distinguished from a capacity for later addressed retrieval, and differentiated contents are allowed within continuing, nested and overlapping experiential descriptions. An order-information constraint, a finite physical implementation scheme and computational checks specify consequential properties of the construction. Under the constitutive premises, the specified enactment is sufficient for experienced succession without an additional moving present or actualization event. Preservation of complete enacted organization also preserves experiential character within the framework. Auditory integration, prediction, temporal recalibration, memory and passage-judgment studies constrain the proposed mechanism. A partial pace model captures dissociations between estimated duration and passage judgments while leaving its quantitative empirical validation open. The account retains physical intervals, causal order and change. It explains why temporal experience need not require a fundamental flow beyond those relations, while separating that result from questions about the fundamentality of physical time.

Keywords: temporal experience; succession; passage of time; enacted scaffolding; retention; predictive processing; Shadow Theory; block universe.

Contents

1	The problem of experienced passage	3
2	Experience as enacted scaffolding	3
2.1	Complete enactment and experienced character	3
2.2	Actual uptake and later retrieval	4
2.3	History, unit and awareness	5
3	An enacted experience of succession	5
3.1	Four different relations	5

3.2	Source, reception and current uptake	5
3.3	The temporal organization	6
3.4	Uptake, recollection and nonverbal understanding	7
4	Information, construction and conditional sufficiency	7
4.1	Order must survive in the operative distinctions	7
4.2	The temporal construction within the framework	8
4.3	Preservation of complete organization	8
5	A finite physical implementation scheme	9
5.1	Order-sensitive local operations	9
5.2	Source order and calibrated order	9
5.3	Representation, realization and uptake	10
6	Presentness, continuity and anticipation	10
6.1	A local present	10
6.2	Continuing experience and nested descriptions	10
6.3	Retention, later loss and the direction of records	11
6.4	Anticipation without future access	11
7	Felt duration and pace	12
8	What the domains jointly contribute	13
9	Objective-passage alternatives	14
9.1	A flow that changes physical organization	14
9.2	An experiential gate or character difference	14
9.3	Primitive becoming and actual occurrence	14
9.4	Explanatory and evidential equivalence	15
10	Empirical scope and discriminating tests	15
11	Conclusion	16
A	Physical clocks, timeless constructions and algebraic checks	16
A.1	Proper-time and perceptual magnitudes	16
A.2	A constrained rate argument	16
A.3	Stationary global states and internal time	17
B	Evidence audit	17
C	Computational checks and reproducibility	18

1 The problem of experienced passage

An observer hears a melody, experiences a note as following another, and anticipates a continuation. The temporal relation is part of what is experienced. Describing successive neural states or a stored chronology does not yet specify that relation within the observer’s experience. Conversely, experiencing succession does not immediately establish that a present moves through the universe. The central question is what organization makes an occurrence an experience of ordered change, and whether that organization needs an additional fundamental flow.

The question is especially clear in a complete-history or block-universe description. Events occupy temporal locations, but no universal present advances through the history. An embedded observer nevertheless has locally available signals, retained records, expectations and bodily organization. A successful account must locate the experience within that observer’s actual activity. It cannot explain the local perspective by adding a second observer who scans the history from outside it. The construction developed here does not depend on establishing eternalism: its proposed observer mechanisms can also be considered in other temporal ontologies.

Several different targets are often compressed into “time.” Table 1 separates them. A physical clock comparison concerns intervals along trajectories. A thermodynamic account concerns boundary conditions, resources and asymmetric correlations. A timing task measures a specified judgment or performance. An explanation of felt passage concerns the temporal character of experience. Conclusions about one target must not be transferred to another without an argument.

Target	Relevant distinction
Physical elapsed time	Proper intervals along worldlines and comparisons between clocks.
Temporal structure	Ordering, causal accessibility and any physical temporal metric.
Arrow and records	Conditions supporting asymmetric preparation, record formation and memory.
Temporal cognition	Duration estimates, order judgments, orientation and expectations.
Temporal experience	Presentness, succession, continuity and felt passage or pace.
Fundamentality	Whether flow, a temporal metric or time itself belongs to fundamental ontology.

Table 1: Distinct explanatory targets. A shared word does not establish a shared measured quantity.

The paper adopts a constitutive account of experience, enacted scaffolding, and develops the temporal argument within it. Its substantive claim is that an actual qualifying enactment can constitute an experienced transition through differentiated reception, retention, interpretation and uptake, without an additional moving present. The constitutive premises are stated in Section 2; the temporal organization and its consequences are developed rather than inferred from those premises alone. Empirical studies constrain particular mechanisms, while a focused discussion separates implementation questions from rival ontological commitments.

2 Experience as enacted scaffolding

2.1 Complete enactment and experienced character

Enacted scaffolding identifies experience with an actual, organized construction within a bounded interpretive unit (Rodgers, 2026). Incoming information is interpreted through operative distinctions, expectations, retained information, evaluative associations, bodily organization and relevant context. The resulting organization includes its implementation, causal embedding and formative history. It is an actual process token, not merely a mathematical description of that process.

Constitutive premise 1. Experience, including felt character, is the complete qualifying organization actually enacted within the relevant interpretive unit. Once that qualifying organization is enacted, no additional witness, experiential output or actualization event converts it into experience.

This is the framework adopted for the investigation. It does not identify experience with any arbitrary computation, report or representation. The operative organization and its history matter. Nor does a reduced analytical model automatically capture every constitutive fact. If K denotes the complete qualifying enactment, a structural temporal projection $\mathcal{T}(K)$ can omit contributions relevant to how it feels. A model's incompleteness must be distinguished from an ingredient allegedly missing after the complete enactment.

The same incoming music can participate in different experiences because the listeners' operative organization differs. Familiarity, bodily response, expectation and personal association can alter the construction. These are possible contributors, rather than mandatory autobiographical or emotional requirements for every sound experience. Basic understanding can be implicit: a listener need not think "this is music" to recognize, retain and relate the sounds.

Construction also differs from inaccuracy. An experience exists even when its represented order misidentifies source order, and construction can track a source accurately. Feeling flow is evidence of temporal appearance. Whether that appearance warrants a fundamental external flow is a further question.

2.2 Actual uptake and later retrieval

The relevant reflection is actual interpretive uptake. It can be immediate, implicit and nonverbal, with a brief processing delay during the activity itself. It does not require deliberate introspection, a verbal description, durable autobiographical recall or recognition of the source of a response.

Let D denote actual reception or internal retrieval; I interpretation through operative scaffolding; C consolidation of the relevant contributions; M retention sufficient for their operative availability; and U their actual interpretive uptake within the same unit. In U , what has become available participates as content in the person's ongoing recognition, relating, appraisal, orientation or response organization. These distinguish functional roles, not necessarily separate serial modules. Interpretation, consolidation and uptake can overlap in one enacted activity.

Mere causal influence does not establish uptake. A trace can change a threshold without entering the person's construction as an interpreted contribution. Unconscious processing can, however, bring forward an image, concept, emotion or bodily response that is immediately taken up. The person need not identify the earlier association producing it. The interpreted response participates in experience; its inaccessible formative cause need not itself be represented.

The admission identity is

$$\text{Exp}(A, J) \iff \text{BoundedUnit}(A, J) \wedge \text{Enacts}_J(A; D, I, C, M, U) \wedge H(A, J). \quad (1)$$

Here A is the nominated interpretive unit and J scopes the relevant enacted activity. Enacts requires the actual operations in their relevant organization, rather than their names appearing in a description. M can be short-lived: the contribution must persist sufficiently for its uptake, without implying an enduring autobiographical record.

Write R_{later} for a capacity for later addressed retrieval. It is distinct from U and is not a universal conjunct in Eq. (1). A person can actually take up an occurrence and later be unable to retrieve it. Conversely, an unused retrieval route does not establish uptake during the interval under consideration. A later retrieval, when qualifying, is another construction concerning the earlier event. It neither retroactively creates the earlier experience nor is required to preserve its occurrence.

This distinction makes the reflection condition precise. It does not supply a consciousness detector based on a single behavioral response. An addressed query can test an access route and its actual use; it cannot, by itself, establish every earlier unprobed uptake. The temporal construction therefore specifies U separately from its optional query operations.

2.3 History, unit and awareness

The historical condition H is mandatory in this version of the account. In schematic form,

$$H(A, J) \iff \exists B \neq A, J' : \text{Exp}(B, J') \wedge \text{FormHist}(B, J'; A, J), \quad (2)$$

where FormHist means that the other experiencer's activity actually contributed to the formation of scaffolding operative in A during J . Continued interpersonal contact is unnecessary. Merely imagining another person does not supply the historical relation.

Equations (1) and (2) constrain an assignment across a developmental history. The principal construction begins with an already qualifying adult and a historical assignment admissible under these premises. It preserves the operative history rather than attempting to derive the origin or a unique assignment of all experience.

For the human example the nominated unit is the embodied person, with the relevant integration, state and access organization. Distinguishable notes, memories or event descriptions do not become additional subjects simply by being distinguishable. The interval J is not an axiom of a uniquely bounded temporal packet. Nested and overlapping contents are permitted within the continuing person's activity.

The framework also accepts thin fundamental awareness as an ontological premise. It is not a cosmic subject, a universal observer or a time-advancing field. The temporal argument does not derive that premise. Its work concerns the organized form of temporal experience within the qualifying unit.

3 An enacted experience of succession

3.1 Four different relations

A succession of physical states places different states at ordered physical locations. It need not preserve an interpreted account of that ordering. A record representing succession retains order information, but can remain dormant or inaccessible. Successive experiences occur at different stages, without their mere succession guaranteeing that an ordered transition is experienced. An experience of succession is a qualifying enactment whose content organizes distinguishable contributions as a transition.

This last relation need not be assembled from isolated experiential packets. Differentiated notes can belong within one continuing melody experience. What needs explanation is how earlier and later contributions are differentiated and related within that activity.

Consolidation alone does not answer the question. In auditory experiments, sequential nonoverlapping formant tones can be reported as a synthetic vowel rather than an ordered sequence; response controls constrain, without eliminating every alternative explanation of, the finding (Saija et al., 2014). Thus a model that merely makes two traces jointly available leaves open whether their content is succession, fusion or uncertainty.

3.2 Source, reception and current uptake

Consider an already qualifying listener whose operative scaffolding supports pitch discrimination, auditory-source grouping and implicit temporal relations. Use illustrative source events C at 0 ms, E at 100 ms and G at 200 ms. A chosen reception delay of 10 ms and integration delay of 5 ms yield a C – E construction at 115 ms, before G arrives at 210 ms. These are model values, not a universal human integration window.

At 115 ms, the retained contribution from C and the live estimate associated with E enter a common auditory stream. Their directed relation is actually taken up as a rising continuation. The listener need not name the first note or explicitly formulate “before.” The ongoing activity recognizes and relates the contributions, with consequences for anticipation, comparison or orientation.

Two different relations must be preserved:

$$\begin{aligned} \hat{C} \prec_{\text{rep}} \hat{E}, \\ \text{available}(r_C, 115 \text{ ms}), \quad \text{available}(\ell_E, 115 \text{ ms}). \end{aligned} \quad (3)$$

The first concerns interpreted source references $\hat{C}, \hat{E}$ and their represented order; the second concerns the present availability of a retained contribution r_C and a live estimate ℓ_E . Joint availability does not assign the source events a common represented time. A currently available reference to an earlier event can retain its earlier role.

At 215 ms, the same continuing activity can incorporate G , preserve the phrase and change the live contribution from E to G . The earlier stage already contains an ordered transition. An observer inspecting a completed melody is unnecessary (Fig. 1).

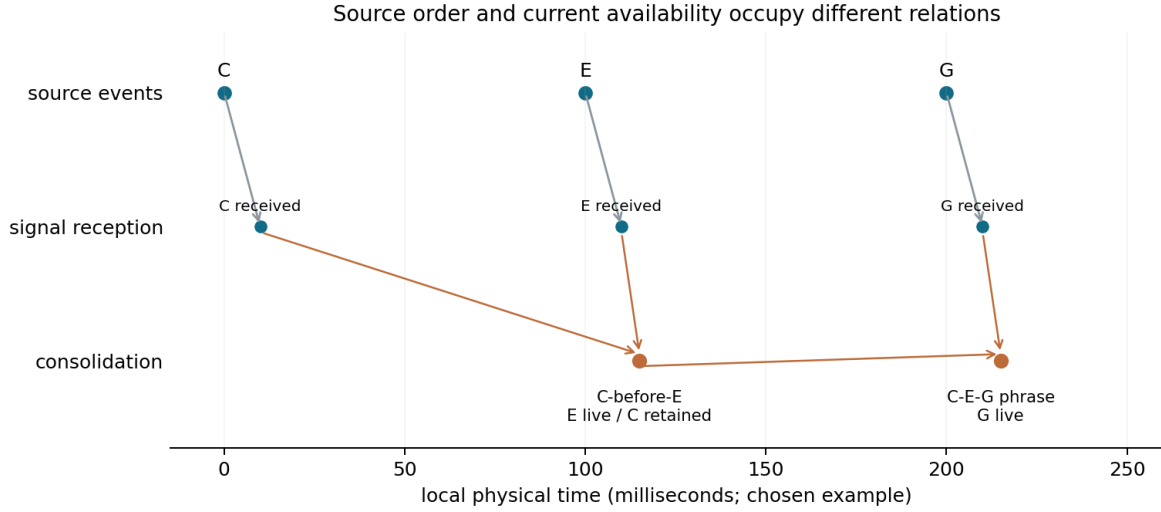


Figure 1: Source events, reception and integration in the constructed example. The C -before- E relation is available for ongoing uptake before G arrives. Their common access location does not represent simultaneous source occurrence.

3.3 The temporal organization

Represent the structural temporal organization as a typed projection

$$\mathcal{T}(K) = (V_{\text{src}}, f, \prec_{\text{rep}}, b, \mu, \hat{\delta}, p, u). \quad (4)$$

Its arguments have distinct roles:

- V_{src} supplies references to source contributions; f supplies discriminated features such as pitch.
- $\prec_{\text{rep}}$ supplies interpreted ordering; b binds relevant contributions into a continuing auditory stream.
- μ differentiates live input, operative retention, retrieved construction and anticipated possibility.
- $\hat{\delta}$ supplies learned calibration between reception and attributed source timing; p organizes possible continuations and expected endpoints.
- u specifies the actual use of these relations in ongoing uptake, rather than a dormant code or analyst’s chronological list.

The distinctions are grounded in the listener’s learned discrimination, source coupling and operative use. An external label saying “before” is insufficient if it changes none of that organization. The construction instantiates temporal interpretation within an already grounded person; it does not derive temporal meaning from an otherwise uninterpreted data structure.

Complete K includes more than Eq. (4): relevant bodily, evaluative and affective organization, associations where present, implementation and formative embedding. Write $\chi(K)$ for experienced

character under the constitutive identity. Equality of the projection $\mathcal{T}$ does not guarantee equality of χ when other constitutive contributions differ. Two people can hear the same ordered notes while taking up different associations and bodily responses. The partial projection specifies temporal structure, not a complete numerical map of every quality.

Represented order can also be wrong. Channel delays and calibration can make source order and interpreted order differ. Such an occurrence is still an experience. The question of accuracy concerns what the construction represents, rather than whether the construction exists.

3.4 Uptake, recollection and nonverbal understanding

At the E stage, the retained contribution participates in the interpretation of the present one: E is taken up as continuing from C . This is immediate reflection in the relevant sense. It exceeds a residue changing a threshold and does not require deliberately recollecting a completed performance.

An optional query can select the predecessor, compare ordered pitches or identify the mode of a retained construction. A successfully used route provides evidence of access and current uptake. An unexecuted query capacity or a correct response from a separate lookup does not establish earlier uptake. Conversely, blocking later retrieval after completed uptake does not erase the earlier experience. Blocking uptake of the joint relation prevents this particular construction, while leaving open other content within the person's experience.

A later recollection is a new activity treating the earlier notes as past sources. Its own uptake is current at that later stage. Neither it nor the initial hearing requires another subject who observes the construction. The interpretive operation belongs to the same person; no infinite series of acknowledgments follows.

4 Information, construction and conditional sufficiency

4.1 Order must survive in the operative distinctions

Proposition 1 (Order-invariant code). *Let a map input histories to all information available to a nominated order interpretation. If $a(C, E) = a(E, C)$, a fixed deterministic or stochastic readout of a cannot discriminate the two orientations.*

Proof. Equal arguments give equal values for a deterministic readout and equal response distributions for a fixed stochastic kernel. Hence orientation-dependent discrimination cannot be supplied by that code alone. $\square$

The result is about the specified order distinction, not the presence of experience in general. A listener can experience features, fusion or uncertainty without resolving orientation. It also does not require literal timestamps or verbal reports.

Three distinct pitch categories give six ordered pairs and three unordered pairs when repetitions are excluded. A lossless code distinguishing all six needs at least six states, corresponding to $\log_2 6 = 2.58496$ bits of entropy for equiprobable cases, or three bits in a fixed-length binary implementation. Conditional on an unordered pair, orientation requires one binary distinction.

Let Y be orientation, balanced within each unordered pair Q , and let X be the operative code. If the optimal decision based on (X, Q) has error probability $\epsilon \leq 1/2$, then

$$I(Y; X \mid Q) \geq 1 - h_2(\epsilon), \quad (5)$$

where h_2 is binary entropy. Given (X, Q) , the decision and its error bit determine Y , so $H(Y \mid X, Q) \leq h_2(\epsilon)$. At 10% error the bound is 0.5310 bits. This elementary bound constrains an order-discrimination channel; it is not a measure of consciousness.

4.2 The temporal construction within the framework

Proposition 2 (Enacted ordered transition). *Let A be the qualifying human unit with an admissible formative assignment. Suppose its actual activity receives distinguishable contributions, retains a predecessor, interprets and consolidates a directed relation to current input, and retains that construction sufficiently for actual uptake. Suppose the grounded interpretation differentiates the relevant live and retained roles. Under Eq. (1) and Constitutive premise 1, this enactment constitutes an experience of the ordered transition, including its felt character.*

Proof. Actual reception supplies D ; grounded discrimination and relating supply I ; operative binding supplies C ; retention through the relating supplies M ; and actual interpretive use supplies U . The nominated unit and preserved formative history supply the remaining admission conditions. The interpreted organization contains predecessor, successor and directed change with their relevant modes. Under the constitutive identity, these belong to the experience itself. $\square$

The admission labels alone do not identify which transition occurs. The specified organization distinguishes C -before- E , its reversal and fusion. A bag of features or sealed archive cannot substitute for those premises merely because it stores information. Later addressed retrieval can occur but is not required by the proof.

Proposition 3 (No additional constitutive flow). *For an actual enactment satisfying Proposition 2, the specified local reception, retention, directed integration and uptake are sufficient within the framework for the temporal experience. An additional advancing-present variable, outside observer or conversion into experience is not a further constitutive requirement.*

Proof. Proposition 2 supplies qualification and the interpreted transition. Constitutive premise 1 identifies the complete qualifying enactment with experience and requires no later conversion. The temporal roles are supplied within the activity: incoming contribution, retained predecessor, directed binding and uptake. No additional observer or moving present is needed to relate those roles. Therefore a further flow is not an omitted conjunct of this constitution. $\square$

Section 5 supports the mechanism with finite local operations. This gives the argument more content than the observation that an equation lacks a flow symbol. It specifies functions that must be realized, distinguishes countermodels, and supplies admissible components. Applying the complete construction to a human listener requires its actual integration into that person's activity; a representation or detached circuit does not establish that integration.

4.3 Preservation of complete organization

Proposition 4 (Constitutive invariance). *Let K and K' be actual qualifying enactments preserving the complete relevant interpreted organization, uptake, implementation and causal, source and formative embedding. Within the framework, an added property F that changes none of those constitutive facts cannot change experiential admission or character.*

Proof. The right side of Eq. (1) is preserved, so admission is preserved. By Constitutive premise 1, character belongs to the complete qualifying organization. Preserving that organization preserves its character. The occurrences can remain numerically distinct tokens. $\square$

The preservation premise is stronger than matching a report, a neural snapshot or $\mathcal{T}(K)$. An influence changing bodily state, appraisal, calibration or uptake can change experience without violating the proposition. The result locates the disagreement with a rival proposing different character at fixed complete enactment: that rival rejects the constitutive identity, rather than identifying an unmodeled argument of the partial projection.

5 A finite physical implementation scheme

5.1 Order-sensitive local operations

The temporal organization can be approached through finite onset channels, retained traces, gated detectors, records and routes into interpretation. An onset in channel C loads a trace r_C . A later E onset samples it through a C -then- E detector; the reverse sequence activates a converse path. Edge-detection or refractory logic prevents an onset from becoming its own predecessor. Inputs within a finite coincidence band are treated as unresolved, rather than ordered by arbitrary identifiers.

For an RC trace,

$$\frac{dr}{d\tau} = -\frac{r}{RC}, \quad r(\Delta\tau) = V_0 \exp\left(-\frac{\Delta\tau}{RC}\right). \quad (6)$$

τ is local proper time. Physical signals travel through finite paths, switches have positive duration, and the scheme requires prepared states, power and noise margins. These are ordinary dynamical requirements, not a present moving through a written table.

Take $R = 250 \text{ k}\Omega$, $C = 1 \mu\text{F}$, $V_0 = 1 \text{ V}$ and threshold $V_{\text{th}} = 0.4 \text{ V}$. Then $RC = 0.25 \text{ s}$ and the upper detectable gap is

$$\Delta\tau_{\text{max}} = RC \ln(V_0/V_{\text{th}}) = 0.229073 \text{ s}. \quad (7)$$

At 100 ms the trace is 0.670320 V; at 300 ms it is 0.301194 V. With R and C each varying by $\pm 5\%$ and the threshold between 0.38 and 0.42 V, the minimum short-gap trace is 0.641970 V and the maximum long-gap trace is 0.336743 V. Both classifications retain a margin (Fig. 2). The initial capacitor energy is $0.5 \mu\text{J}$, not the energy of the whole device.

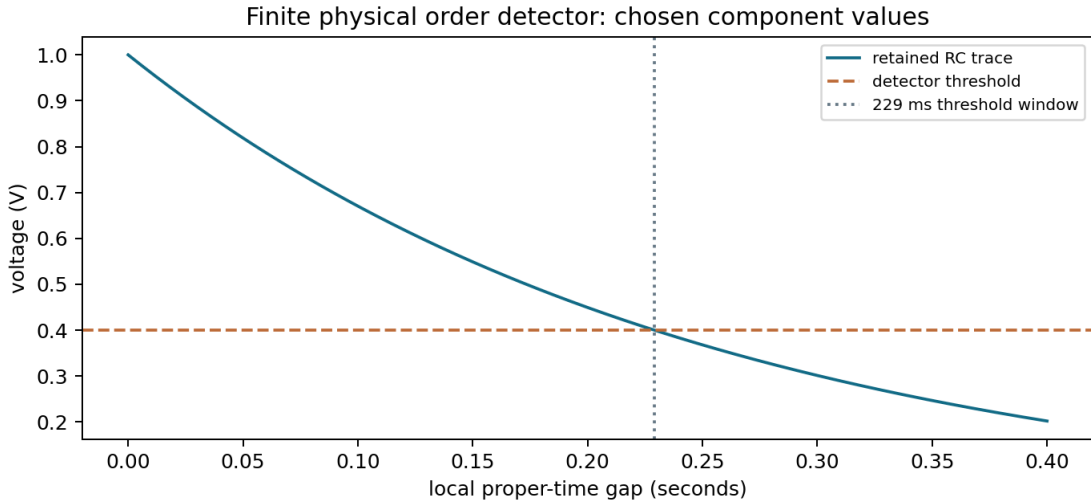


Figure 2: Chosen finite trace and threshold. The calculation establishes component margins, not a universal human integration window or a built complete order circuit.

Constructed leaky-integrate-and-fire circuits demonstrate that leakage, integration and finite retention can be physically implemented using standard components (Rozenberg et al., 2019). The proposed full architecture and its human integration remain distinct claims. In particular, trace survival over 100 ms does not guarantee perceived order: fusion supplies a direct counterexample. A detector supporting order information is one component of the specified interpretation, not the entire experience.

5.2 Source order and calibrated order

If source events have separation Δs and channel delays δ_1, δ_2 , their arrival separation is

$$\Delta a = \Delta s + \delta_2 - \delta_1. \quad (8)$$

For C at 0 ms with 80 ms delay and E at 50 ms with 10 ms delay, E arrives at 60 ms and C at 80 ms. Arrival-based interpretation gives E -before- C . Learned delay estimates can instead assign times $a_i - \hat{\delta}_i$ and recover C -before- E after both signals arrive. Correct estimates are stipulated for this computational check; real calibration has uncertainty.

The operation uses received signals and retained calibration, not true source timestamps as an ordering oracle. It accesses no later signal before reception and reverses no physical cause. Motor-sensory recalibration findings show that judged order can change following learned delay while physical source order remains fixed (Stetson et al., 2006). A common strictly increasing rescaling cannot reverse the same events, so a rate-only explanation with a fixed order readout is insufficient for this effect.

5.3 Representation, realization and uptake

Five claims must remain separate. A typed graph represents operations. A finite circuit scheme supports their physical admissibility. Actual enactment requires the relevant operations within the person. A report is a possible descendant of that activity. Experience is identified with the qualifying complete enactment under the framework.

The computational record makes directed order, source mode and optional retrieval explicit. It does not manufacture a new listener. Nor does attaching an order detector automatically place its state within the person's interpretive uptake. For the human construction, retained order must actually enter the nominated unit's construction. This is a concrete integration obligation, rather than an additional event turning otherwise complete enactment into experience.

The historical representation of a process does not itself need to run in a second time. Under a monotone reparameterization $\tau = \tau(\lambda)$,

$$\frac{dr}{d\lambda} = \frac{d\tau}{d\lambda} \left(-\frac{r}{RC} \right). \quad (9)$$

The same physical process and dimensionless interval $\Delta\tau/(RC)$ are described. Indices, derivatives and intervals express physical temporal relations; they do not independently introduce a further flowing clock. Physical dynamics and change are preserved.

6 Presentness, continuity and anticipation

6.1 A local present

Presentness is the live role of interpreted content within the ongoing construction, anchored to incoming source coupling, bodily organization, calibration and uptake. It need not identify the last raw signal received: a delayed input can represent an earlier source event. A present interpretation can also concern a past event or anticipated possibility, with those modes differentiated.

Hartle (2005) develops a physical account of local present organization in an information-gathering and utilizing system. The present construction adds the adopted experiential constitution and the typed roles of live, retained and anticipated contributions. Its local present is not a universal spacelike surface. A selector assigning absolute presentness beyond these relations would be an additional ontological condition requiring its own justification.

6.2 Continuing experience and nested descriptions

Consecutive C - E and E - G relations can be differentiated within one continuing melody experience. Retained context, stable stream binding and anticipation organize their differences without first creating isolated experiences and subsequently joining them. Several notes can be hummed within one breath; differentiating those notes does not multiply subjects.

The extent of the event taken up, the uptake itself and the continuing person are different. Write an attribution schematically as $(A, J; e)$, where e is the event or content taken up and J supports the

interpretive activity. The duration of e need not equal J . A long event can be taken up as it unfolds and again in later recollection.

A walk along a street can accordingly be described as one experience, while meeting someone, encountering rain or stepping in something can be experiences within it. These are permitted nested or overlapping descriptions when the relevant portions are actually interpreted. The descriptions do not create new subjects or guarantee separate uptake of every possible subdivision.

Overlap still does not prove integration. From pair constructions containing $\{C, E\}$ and $\{E, G\}$, an integrated phrase does not follow solely by taking a set union. The computational construction explicitly consolidates the three-note phrase at its third stage. This constrains the claimed relation; it does not require pair and phrase descriptions to be mutually exclusive experiences. Likewise, coavailability does not place every past contribution in one unbounded simultaneous field.

Continuity of the person, continuity of an auditory source, absence of a perceived gap and mathematical continuity are distinct. The proposed mechanism supplies lineage, binding and continuing uptake. A universal partition into naturally bounded experiential packets is unnecessary for this account. Genuine questions about integration remain assessable without imposing that additional partition requirement.

Auditory continuity studies associate perceptual continuation with cortical responses, including different percepts for acoustically identical stimuli (Riecke et al., 2007). They constrain constructive grouping while leaving its full causal implementation open. Continuity of experience is not simply a copy of uninterrupted stimulus energy.

6.3 Retention, later loss and the direction of records

Operative retention differs from durable episodic recall. In a severely amnesic patient, responses to narratives indicated some integration over tens of seconds despite major memory impairment (Zuo et al., 2020). Residual tissue, scanner differences and reused controls limit the inference. The result constrains the relation between ongoing integration and durable recall; it does not establish experience without all retention or certify uptake in every moment.

Later deletion removes access without changing whether the earlier construction was actually taken up. If a source event was not taken up until later, however, the later uptake does not retroactively establish an earlier experience. Nor does saying an earlier experience occurred imply that it remains ongoing relative to a later stage. Admission of an occurrence and its ongoingness are different predicates.

Record asymmetry requires causal history and prepared resources. A correlation is not automatically a usable memory. Thermodynamic analyses connect robust records with physical preparation and boundary conditions (Mlodinow and Brun, 2014). Reversible record mechanisms remain possible; no universal dissipation cost for each memory operation is assumed here. The cosmological origin of the low-entropy boundary is separate from the local temporal construction.

6.4 Anticipation without future access

Proposition 5 (Shared local prefix). *In a causal deterministic temporal model, equal relevant local state, received input history, operative uptake and learned parameters through stage v give equal modeled current content and prediction at v , even if later inputs differ. For a stochastic model with the same relevant conditional law, equality gives the same conditional distribution of content and prediction; equal realized samples require the same realized random inputs.*

Proof. In the deterministic case the update and content maps have equal arguments. In the stochastic case the transition and content kernels have equal conditioning arguments. Later input differences enter only when received, or when endogenous activity registers a missed expectation. $\square$

The shared prefix is observer-local, not an identical complete global state assumed to branch under

deterministic laws. Different environments can later supply different inputs while the observer has the same currently available organization.

The constructed C – E prefix has identical content for a continuation with G and one with D . A chosen learned distribution assigns probabilities 0.75 and 0.25, yielding later surprises of 0.287682 and 1.386294 nats. An omission yields an “expected note not received” state without treating the missing note as received. Probabilities and deadlines are model choices. Context-dependent responses to physically identical omissions support the distinction between predictive organization and received sound (Wacongne et al., 2011); mismatch alone does not establish experiential admission.

A block description, if adopted, does not give the embedded observer access to the actual future. Retention and anticipation have different causal and interpretive roles within the history.

7 Felt duration and pace

Succession and feeling that time passes quickly are distinguishable aspects of temporal experience. Both belong to the complete enacted construction. Particular pace differences can involve interpreted event density, expected endpoints, waiting, bodily estimates, goals and affect. The admission conditions alone do not determine their values because many different constructions meet them.

In matched train-station video tasks using 17–23 s intervals and three or seven events, greater event density increased duration estimates while accelerating passage judgments (Lamprou-Kokolaki et al., 2024). Participant-count discrepancies and condition-level psychometric exclusions warrant caution about pooled quantities. The qualitative finding constrains accounts equating faster passage with a shorter duration estimate. A separate activity held at five minutes showed passage judgments sensitive to announced endpoint expectations (Tanaka and Yotsumoto, 2017). Reused comparison groups and possible criterion or demand effects remain relevant.

Let B be an internal elapsed estimate, N the number of interpreted event boundaries and E an expected endpoint. A partial structural model is

$$\begin{aligned} D &= \alpha B + \beta N, \\ J &= \kappa \ln\left(\frac{N/B}{\rho_0}\right) + \eta \ln(E/B), \quad B, N, E > 0. \end{aligned} \tag{10}$$

D is a duration readout and J a relative pace descriptor, positive for faster passage relative to learned baselines. ρ_0 is a reference event rate. These are observer states and interpreted relations, not an outside clock or access to future completion. The logarithmic form is a proposal and does not imply conscious calculation.

For $B = 20$ s, $\alpha = 0.8$, $\beta = 0.4$ s per boundary, $\kappa = \eta = 1$ and $\rho_0 = 0.15$ s^{−1}, Table 2 gives the constructed values at a fixed physical interval of 20 s.

Condition	N	E (s)	D (s)	J
Baseline	3	20	17.2	0
More interpreted events	7	20	18.8	+0.84730
Earlier expected endpoint	3	10	17.2	−0.69315
Later expected endpoint	3	40	17.2	+0.69315

Table 2: Illustrative outputs, not fitted human observations.

More boundaries can increase duration estimates and pace together. Endpoint expectation can alter J without changing D . Holding B fixed, the model’s Jacobian with respect to $(N, \ln E)$ is

$$\frac{\partial(D, J)}{\partial(N, \ln E)} = \begin{pmatrix} \beta & 0 \\ \kappa/N & \eta \end{pmatrix}, \quad \det = \beta\eta. \tag{11}$$

It has rank two for the chosen nonzero parameters. This is a property of the proposed model, not

a demonstrated rank-two human response. Opposing effects under one intervention alone do not establish dimensionality; fixed readouts of a single scalar can have opposite slopes.

During waiting, the person can take up the relation between continuing activity and expected completion before the endpoint occurs. A later pace rating can summarize that construction. Equation (10) specifies some potential relations shaping felt pace and its judgments; bodily and affective contributions remain incompletely modeled. The constitutive answer locates felt pace within full enactment. The scientific task is to explain which organizational differences produce particular qualities and to validate their predicted values.

8 What the domains jointly contribute

The evidence constrains different parts of the organization rather than supplying repeated votes for a metaphysical conclusion. Auditory fusion shows why retention and joint availability alone do not fix perceived succession. Auditory cortical encoding distinguishes absolute pitch, signed change and contextual expectation in interdigitated populations (Sankaran et al., 2024). Temporal recalibration distinguishes source order, arrival order and interpreted order. Omission responses distinguish anticipation from received input. Amnesia constrains ongoing integration relative to durable recall. Together they motivate an organization with differentiated roles, interpreted relations and continuing uptake.

Connection	Independent constraint	Consequence of combination
Fusion and melody encoding	Integration can fuse successive tones; pitch change and expectation have distinct neural correlates.	Consolidation needs specified relational content, not merely retained identities.
Calibration and source roles	Judged order can change through learned delay.	An internal order change need not reverse physical causes or alter a temporal metric.
Memory and uptake	Online integration and durable recall can dissociate.	Operative retention, actual uptake and later retrieval require separate treatment.
Prediction and omissions	Equal omissions can evoke context-dependent responses.	Anticipation can organize current activity without a received future event.
Duration and passage tasks	Density and expectation constrain distinct judgments.	Pace should not be defined as inverse estimated duration; a multi-component account is testable.
Clock theory and mechanism	Proper intervals constrain trajectories; local organization uses finite delays.	Physical elapsed time and interpreted temporal character remain distinct quantities.

Table 3: Cross-domain constraints on one candidate organization. They do not independently verify its constitutive identity.

The melody-encoding study’s main recordings involved eight epilepsy patients; an additional control participant also heard part of the music set (Sankaran et al., 2024). Electrodes are not independent participants, and correlational encoding does not establish necessity or a complete experiential mechanism. The cross-domain contribution is accordingly specific: temporal input order, retained identities and integration do not uniquely specify temporal appearance. Source roles, calibration, expectations and interpretation must be represented in a candidate mechanism. Under the adopted identity these enacted relations are constituents of experience.

Pharmacological, clinical, meditative and bodily studies broaden the constraints. Ketamine, LSD and psilocybin studies address particular timing, memory and motor measures (Coull et al., 2011; Yanakieva et al., 2019; Wittmann et al., 2007); they do not all measure felt passage. Depression and schizophrenia studies concern heterogeneous orientation, judgment and performance targets, with overlap between primary studies, reviews and meta-analyses (Vogel et al., 2018; Ueda et al., 2018; Ciullo et al., 2016; Ren et al., 2023). Meditative timelessness and conceptual accounts of psychedelic temporality require distinctions among presence, duration, orientation and succession (Berkovich-Ohana et al., 2013; Miceli McMillan et al., 2025; Gruber et al., 2018; Jiang et al., 2025). Neurological and bodily reviews motivate implementation variables without independently determining

a complete temporal-content map (Ochi and Kawamura, 2026; Teghil and Wittmann, 2025; Muller and Nobre, 2014). These findings support differentiated mechanisms and context sensitivity. Variability alone does not prove that the perceived feature has no external counterpart.

Spaceflight illustrates the importance of measured quantities. Clock predictions, biological changes and perceptual tasks are different evidence. Requested-minute production changed from 74.5s before flight to 59.6s during flight, closer to the target of 60s (Navarro Morales et al., 2023). This is not a direct measurement of proper-time dilation. The NASA Twins Study measures molecular and physiological changes in one twin pair, not a percentage-scale relativistic aging or passage effect (Garrett-Bakelman et al., 2019). Precision-clock modeling and hardware-preparation papers concern comparisons and projected performance in their respective versions (Turyshchev et al., 2016; Cacciapuoti et al., 2024). Appendix A keeps their scales and assumptions explicit.

9 Objective-passage alternatives

9.1 A flow that changes physical organization

A rival can propose $dx/d\tau = f(x, i, F)$, with F altering dynamics, access, calibration or bodily organization. Such a theory is a physical hypothesis requiring a specified law and independent evidence. It is not a fixed-enactment counterexample: it changes the organization that constitutes experience. A successful physical coupling could refine the mechanism without establishing that an additional flow is needed merely because succession is experienced.

9.2 An experiential gate or character difference

Suppose a rival requires the complete enacted right side of Eq. (1) and a further presentness condition. If that condition can fail while actual qualification remains complete, it rejects the accepted sufficient direction. The disagreement concerns constitution, not an operation left unnamed in the construction.

A rival preserving admission but changing felt character at fixed complete enactment similarly rejects Constitutive premise 1. It must distinguish that claim from a difference at fixed partial projection. A missing bodily, affective or attentional variable in $\mathcal{T}$ would motivate a better model within the account. It would not establish a further phenomenal ingredient after complete organization is fixed.

9.3 Primitive becoming and actual occurrence

A stronger rival proposes primitive becoming as what makes an admissible organization actual. It places the additional condition inside actuality rather than attaching consciousness after processing. If it only distinguishes an actual process from its description, that distinction is already accepted. If it requires something beyond the actual operations and their embedding, it adds an ontological commitment requiring independent justification and an identifiable explanatory contribution.

The account defended here requires no further actualization event once the qualifying organization actually occurs. The rival can reject this position, but its bare availability is not an established internal deficit. This response does not depend on a universal hypertime regress. Primitive becoming need not be driven by a literal second clock: moving-spotlight formulations can use primitive tense while treating supertime as a representational device (Skow, 2009).

“Passage” can also mean ordinary change or local event occurrence. That meaning is compatible with the preserved dynamics. The disputed requirement is an additional advancing present or actualizer beyond them.

9.4 Explanatory and evidential equivalence

For an addition that changes neither activity, admission, character nor any independent prediction, explanatory idleness must be assessed from those preserved facts, rather than from its absence in one equation. A simple conservative-extension result states the appropriate condition. Let T_0 express the adopted account and let T_+ add F without restricting base facts, with every T_0 model admitting a T_+ expansion. Then T_+ has exactly the same base-language consequences as T_0 : any base countermodel expands while preserving its counterexample. This does not remove a physical field or apply to a theory restricting actual histories.

Likewise, let ω include the relevant physical and formative history, let d be the observations, and suppose competing theories share both the history distribution and observation law. Then

$$P(d \mid T) = \int P(d \mid \omega, T) dP(\omega \mid T) \quad (12)$$

is equal for those theories. The data do not discriminate them under those assumptions. Mere compatibility does not establish equality of likelihoods or equal evidential support (Skow, 2011). The constitutive sufficiency result is stronger in a different respect: it excludes a required extra experiential gate within the adopted framework, rather than deriving a metaphysical verdict from observational equality.

Growing-block discussions also require care about past experience (Forbes, 2016). Saying an earlier episode occurred does not say it is ongoing relative to the current stage. The anti-erasure commitment does not refute every growing-block account by confusing these claims.

10 Empirical scope and discriminating tests

The construction specifies a conditional realization scheme and an explanatory argument. Its order-information and finite-component results are established model properties. The complete conjunction of proposed operations has not been jointly verified in a human nervous system. In particular, correct reports, trace survival and later retrieval are not individually sufficient evidence of actual uptake. Identifying that uptake requires converging assessment of how the contributions enter the person's ongoing construction.

A focused auditory study can compare AB , BA , near-coincident, masked and separated inputs while manipulating short-window interference and learned expectation. Match identities and physical intervals in the relevant comparisons. Distinguish fusion, reversal and uncertainty, and measure continuing interpretation separately from later cued recall. Sparse or unprobed conditions can assess report reactivity. Nonverbal selection tests access without turning language into a universal condition.

Compare the typed model with an identity-bag model, a generic leaky-trace model and a constrained scalar-rate account. Use held-out reversals, calibrated delays and omissions. Selective predictions include preserved identities with lost order, altered represented order through calibration, and maintained expectation without received continuation. Failure of later retrieval after earlier uptake must be distinguished from failure to construct the joint relation during the event.

For pace, vary interpreted density and expected endpoint in the same activity and timescale. A fixed-readout scalar mediator and Eq. (10) make different response-gradient claims. Estimate the relevant matrix with uncertainty rather than inferring rank two from one opposing bias. Neutral wording and converging decisions help assess criterion and demand effects. Truly retrospective duration requires a time-naïve cohort with a surprise question; online passage probes or prior timing instructions change that condition.

These tests can strengthen or revise the mechanism. They do not independently establish the constitutive identity by fitting its parameters. Conversely, an unfinished quantitative law is not a missing experiential conversion. The complete-enactment premise settles where felt character belongs; empirical work determines which organization realizes particular qualities. Claims about all possible interpretive units or the fundamental status of physical time exceed the present result.

11 Conclusion

Within enacted scaffolding, an experience of succession is an actual interpreted relation among differentiated contributions within the same historically formed person. A retained predecessor, live contribution and anticipated continuation have different roles. Their joint uptake can constitute an ordered transition without representing the sources as simultaneous, waiting for the entire sequence to finish, or requiring an outside observer.

Presentness, continuity, duration and felt pace belong to the complete enacted construction. Distinguishable notes and nested events can occur within continuing experience without implying isolated experiential packets or multiple subjects. Actual uptake can be immediate and implicit; later recall is optional, and its loss does not erase an earlier occurrence.

The strongest developed result is conditional constructive sufficiency for the specified temporal enactment, supported by order constraints, finite component calculations and checked computational consequences. Constitutive invariance generalizes to complete qualifying enactments, whereas the partial structural and pace models require further empirical identification and validation. An additional moving present or actualization event performs no required step in this constitution. A rival proposing one must supply a distinct law, independent warrant or a different constitutive premise.

Physical intervals, causal order and change remain real features of the account. Whether physical time is fundamental or emergent is a separate question. The conclusion concerns the explanatory necessity of additional flow: the temporal experience constructed here does not require it under the stated framework.

A Physical clocks, timeless constructions and algebraic checks

A.1 Proper-time and perceptual magnitudes

For a spherical Earth, circular orbit of altitude $h = 400$ km and a rotating equatorial ground clock, the leading weak-field rate difference is

$$\frac{d\tau_{\text{orb}}}{dt} - \frac{d\tau_{\text{gnd}}}{dt} \simeq \frac{GM}{c^2} \left(\frac{1}{R} - \frac{1}{R+h} \right) + \frac{v_{\text{gnd}}^2 - v_{\text{orb}}^2}{2c^2}. \quad (13)$$

These are rates relative to the same chosen coordinate time. With $GM = 3.986004418 \times 10^{14} \text{ m}^3\text{s}^{-2}$, $R = 6378137 \text{ m}$, $c = 299792458 \text{ m s}^{-1}$, $\omega = 7.292115 \times 10^{-5} \text{ s}^{-1}$, $v_{\text{gnd}} = \omega R$ and $v_{\text{orb}}^2 = GM/(R+h)$, the gravitational term is $+3.5454 \mu\text{s/day}$ and the kinematic term $-28.1624 \mu\text{s/day}$. The net is $-24.6170 \mu\text{s/day}$, about -8.3698 ms over 340 days and -17.095 ns over 60 seconds. This is an illustrative trajectory comparison, not an orbit reconstruction with tides, maneuvers or endpoint transport.

If a stable co-moving biological process accumulates $N = \nu\tau$ while a local watch measures $T = \tau$, then $N/T = \nu$. Common proper-time scaling alone does not produce a changed local ratio. Biological parameter changes, environmental effects and interpretive changes need separate models.

The astronaut requested-minute means 74.5 s and 59.6 s differ by 20%, with the latter closer to the target. In the hourly analysis, the reported means are -14.2% and -19.2% ; 24.2% and 36.1% are standard deviations, despite their use as effects in the discussion (Navarro Morales et al., 2023). A related astronaut study, DOI [10.3389/fphys.2023.1141078](https://doi.org/10.3389/fphys.2023.1141078), has matching cohort and protocol characteristics and should not be presumed an independent replication. The clock-scale calculation does not explain these percentage-scale judgments. Nor do telomere and other molecular changes in the NASA Twins Study measure the same quantity (Garrett-Bakelman et al., 2019).

A.2 A constrained rate argument

Riggs (2026) argues from a rate expression toward an imaginary value. Let $A = 1 - e_1 > 0$,

$B = 1 - e_2 > A$, $q = 2\Phi/c^2 > 0$ and $\beta = v/c$. The paper’s Eq. 12 requires

$$B^2 = A^2(1 + q), \quad B^2 - A^2 = qA^2. \quad (14)$$

Its Eq. 17 radicand therefore reduces to

$$B^2 - \frac{\beta^2}{q}(B^2 - A^2) = A^2(1 + q - \beta^2) > 0 \quad (0 \leq \beta < 1). \quad (15)$$

The factors cannot be varied independently of the earlier constraint. The purported negativity does not follow, so this step cannot support a no-flow conclusion. The constructive argument in the main text does not rely on it.

A.3 Stationary global states and internal time

Relational quantum constructions provide a different kind of result. [Kuypers and Rijavec \(2025\)](#) develops an internal timer in a stationary global construction. Its interaction has the form

$$H' = H_R \otimes P_{[0,T]} + \mathbb{I} \otimes H_C, \quad H_C = -i\partial_t, \quad H_R = \frac{\pi(\mathbb{I} - \sigma_x)}{2T}, \quad (16)$$

in units with $\hbar = 1$. The conditional timer starts in $|0\rangle$, rotates during the designated interval and ends in $|1\rangle$, with $P_1(t) = \sin^2(\pi t/2T)$ during the interaction. An ideal clock and its assumptions remain part of the construction. A synchronization endpoint must match its selected initial timer state; a frozen $|0\rangle$ branch cannot be joined arbitrarily to $e^{-iH_R t_0}|0\rangle$ without a matching condition.

This shows how internal clock relations and interaction can be represented under the model’s assumptions. It does not establish that physical time is merely perception or that the timer experiences. The distinction between internal temporal structure and additional fundamental flow remains essential. Speculative inferences from imaginary-coordinate notation, null proper intervals or a proposed Planck step do not independently establish nonphysical time ([Šorli et al., 2026](#)).

B Evidence audit

The source inventory contains 25 files representing 23 distinct papers. The LSD pair is byte-identical; an astronaut article is repeated with a cover. Reviews, preprint/publication versions and likely overlapping cohorts are not counted as independent replications. Table 4 records the retained scope of the supplied papers. Full file hashes and reference metadata are provided with the source package. The seven additional targeted studies are cited in the main text and summarized in the accompanying audit.

Table 4: Supplied literature: evidential status and consequential limits.

Source	Retained assessment
Šorli et al. (2026)	Speculative presentist interpretation; coordinate notation and null intervals do not establish nonphysical time.
Kuypers and Rijavec (2025)	Conditional stationary timer construction; ideal-clock scope and synchronization matching retained.
Riggs (2026)	Central radicand argument fails under its own earlier constraint; Eq. (15).
Coull et al. (2011)	Controlled selective timing effects; small analyzed samples; hazard is not the thermodynamic arrow.
Yanakieva et al. (2019)	LSD reproduction effects; duplicate counted once; no general direct pace measure.
Wittmann et al. (2007)	Psilocybin timing, memory and motor components; $n = 12$; no literal years-in-minutes finding.

Source	Retained assessment (continued)
Fountas et al. (2020)	Audited duration/memory preprint model; later publication is not another experiment.
Berkovich-Ohana et al. (2013)	Small instructed, fixed-order meditation study; timelessness does not establish absent succession.
Miceli McMillan et al. (2025)	Conceptual distinctions in psychedelic temporality, not another intervention.
Gruber et al. (2018)	Multidisciplinary review; proposed claustrum experiment not performed in that paper.
Vogel et al. (2018)	Qualitative treated-depression sample; no objective interval/order task in that study.
Ueda et al. (2018)	Four-study symptom/timing meta-analysis; heterogeneous targets and overlap with timing literature.
Ciullo et al. (2016)	Explicit-timing meta-analysis; subgroup null is not equivalence or a unique clock mechanism.
Ren et al. (2023)	Depression review overlaps primary studies and earlier syntheses.
Jiang et al. (2025)	Perspective article, not new psychedelic experimental data.
Ochi and Kawamura (2026)	Supplied mini-review; external indexing not independently confirmed; cases are not group proof.
Teghil and Wittmann (2025)	Bodily, insular and motor review; maps do not establish one complete mechanism.
Muller and Nobre (2014)	Distributed timing and calibration; a central mechanism with local readouts is not thereby excluded.
Navarro Morales et al. (2023)	Astronaut body duplicate counted once; minute production closer to 60s in flight; mean/SD distinction preserved.
Turyshv et al. (2016)	Clock, coordinate and signal modeling; not a completed orbital test.
Cacciapuoti et al. (2024)	Hardware preparation and projected space performance in the supplied version.
Garrett-Bakelman et al. (2019)	One twin pair; molecular/physiological changes differ from direct clock or passage measurements.
Cheeseman et al. (2012)	Bee anesthesia and circadian phase; not human lost subjective time.

The primary additions concern order versus fusion ([Saija et al., 2014](#)), pitch change and expectation ([Sankaran et al., 2024](#)), auditory continuity ([Riecke et al., 2007](#)), online integration in amnesia ([Zuo et al., 2020](#)), predictive omission responses ([Wacongne et al., 2011](#)), physical circuit primitives ([Rozenberg et al., 2019](#)), and matched duration/pace judgments ([Lamprou-Kokolaki et al., 2024](#)). Their limitations differ: correlational recordings do not prove necessity, a single case does not establish universality, and component construction does not establish an experiencing device. They constrain the proposed organization rather than independently proving the constitutive premises.

C Computational checks and reproducibility

The source package contains `checks/temporal_construction.py`, numerical outputs, figures, physical calculations and a dependency check. The mechanism script uses Python’s standard library for its core checks; Matplotlib generates optional figures. The checked results are:

1. All six ordered pairs from three distinct pitches are retained by the intact order code; the accessible feature-bag projection has three codes and at most 50% balanced orientation accuracy.
2. A *C-before-E* construction is available at 115 ms before the third note arrives at 210 ms. Equal or unresolved gaps do not receive an order from arbitrary identifiers; the selected resolution is 5 ms.
3. Optional addressed retrieval recovers retained content. Recollection is built from that content without re-input of the original source list. Later erasure removes access without changing the logged earlier state.
4. Delayed channels distinguish source, arrival and calibrated interpreted order. The operation uses received signals and stipulated learned calibration rather than a source-time oracle.

5. Equal deterministic local prefixes yield equal modeled content before different later inputs. Omission records expectation without treating an absent note as received.
6. RC calculations reproduce the finite window and tolerance margins. Pace calculations reproduce Table 2 and the model’s nonzero Jacobian determinant.

The feature-bag intervention restricts the accessible projection; the Python object still holds other ordered data. Its accuracy bound concerns the nominated code and fixed readout, not an omniscient decoder of the entire machine. The script’s query and deletion operations test optional retrieval behavior, not actual human uptake.

A separate finite dependency check holds the admission interpretation fixed and varies Boolean inputs representing the six other admission conditions, U and R_{later} . Across 256 assignments it checks that changing only later capacity cannot change admission, that absent U fails the nominated qualification, and that the complete stipulated conjunction suffices. These are checks of the formal specification, not a consciousness detector or empirical proof. They also isolate fleeting actual uptake followed by loss from unused capacity without current uptake.

For reproduction, run the commands in `README.txt`. The delivered PDF is compiled from this LaTeX source and its bibliography. No third-party research-paper files are redistributed.

References

- Aviva Berkovich-Ohana, Yair Dor-Ziderman, Joseph Glicksohn, and Abraham Goldstein. Alterations in the sense of time, space, and body in the mindfulness-trained brain: A neurophenomenologically-guided MEG study. *Frontiers in Psychology*, 4:912, 2013. [10.3389/fpsyg.2013.00912](https://doi.org/10.3389/fpsyg.2013.00912).
- Luigi Cacciapuoti et al. Atomic clock ensemble in space. arXiv:2411.02912v1, 2024. URL <https://arxiv.org/abs/2411.02912v1>. Inspected version 1, posted 5 November 2024.
- James F. Cheeseman, Eva C. Winnebeck, Craig D. Millar, Lisa S. Kirkland, James Sleight, Mark Goodwin, Matt D. M. Pawley, Guy Bloch, Konstantin Lehmann, Randolph Menzel, and Guy R. Warman. General anesthesia alters time perception by phase shifting the circadian clock. *Proceedings of the National Academy of Sciences*, 109:7061–7066, 2012. [10.1073/pnas.1201734109](https://doi.org/10.1073/pnas.1201734109).
- Valentina Ciullo, Gianfranco Spalletta, Carlo Caltagirone, Ricardo E. Jorge, and Federica Piras. Explicit time deficit in schizophrenia: Systematic review and meta-analysis indicate it is primary and not domain specific. *Schizophrenia Bulletin*, 42(2):505–518, 2016. [10.1093/schbul/sbv104](https://doi.org/10.1093/schbul/sbv104).
- Jennifer T. Coull, Hannah Morgan, Victoria C. Cambridge, James W. Moore, Francesco Giorlando, Ram Adapa, Philip R. Corlett, and Paul C. Fletcher. Ketamine perturbs perception of the flow of time in healthy volunteers. *Psychopharmacology*, 218:543–556, 2011. [10.1007/s00213-011-2346-9](https://doi.org/10.1007/s00213-011-2346-9).
- Graeme A. Forbes. The growing block’s past problems. *Philosophical Studies*, 173:699–709, 2016. [10.1007/s11098-015-0514-1](https://doi.org/10.1007/s11098-015-0514-1).
- Zafeirios Fountas, Anastasia Sylaidi, Kyriacos Nikiforou, Anil K. Seth, Murray Shanahan, and Warrick Roseboom. A predictive processing model of episodic memory and time perception. bioRxiv preprint, 2020. URL <https://doi.org/10.1101/2020.02.17.953133>. Inspected version posted 17 February 2020. Published version: *Neural Computation* 34(7), 1501–1544 (2022), doi:10.1162/neco_a_01514; the versions are not independent evidence.
- F. E. Garrett-Bakelman et al. The NASA Twins Study: A multidimensional analysis of a year-long human spaceflight. *Science*, 364(6436):eaau8650, 2019. [10.1126/science.aau8650](https://doi.org/10.1126/science.aau8650).
- Ronald P. Gruber, Ryan P. Smith, and Richard A. Block. The illusory flow and passage of time within consciousness: A multidisciplinary analysis. *Timing & Time Perception*, 6:125–153, 2018. [10.1163/22134468-2018e001](https://doi.org/10.1163/22134468-2018e001).

- James B. Hartle. The physics of ‘now’. *American Journal of Physics*, 73:101–109, 2005. [10.1119/1.1783900](#).
- Pu Jiang, Cong Lin, and Xiaohui Wang. Psychedelics and time: Exploring altered temporal perception and its implications for consciousness, neuroscience, and therapy. *Psychedelics*, 1(4):11–14, 2025. [10.61373/pp025p.0041](#).
- Sam Kuypers and Simone Rijavec. Measuring time in a timeless universe. *Physical Review D*, 112:063544, 2025. [10.1103/qfns-48vq](#). The inspected preprint is arXiv:2406.14642v3.
- M. Lamprou-Kokolaki, Y. Nédélec, S. Lhuillier, and V. van Wassenhove. Distinctive features of experiential time: Duration, speed and event density. *Consciousness and Cognition*, 118:103635, 2024. [10.1016/j.concog.2024.103635](#).
- Riccardo Miceli McMillan, Jack Reynolds, and Anthony Fernandez. The phenomenology of psychedelic temporality: Current knowledge, open questions, and clinical applications. *Philosophical Psychology*, 38(7):3182–3209, 2025. [10.1080/09515089.2024.2433522](#). Accepted manuscript inspected.
- Leonard Mlodinow and Todd A. Brun. Relation between the psychological and thermodynamic arrows of time. *Physical Review E*, 89:052102, 2014. [10.1103/PhysRevE.89.052102](#).
- Timothy Muller and Anna C. Nobre. Perceiving the passage of time: Neural possibilities. *Annals of the New York Academy of Sciences*, 1326:60–71, 2014. [10.1111/nyas.12545](#).
- Deborah C. Navarro Morales, Olga Kuldavletova, Gaëlle Quarck, Pierre Denise, and Gilles Clément. Time perception in astronauts on board the International Space Station. *npj Microgravity*, 9:6, 2023. [10.1038/s41526-023-00250-x](#).
- Ryuta Ochi and Mitsuru Kawamura. Mapping the neural basis of the perception of ‘flow of time’: Interval timing and mental time travel in the human brain. *Frontiers in Neurology*, 17:1960572, 2026. [10.3389/fneur.2026.1960572](#).
- Hanlin Ren, Qing Zhang, Yanzhen Ren, Qiang Zhou, Yuan Fang, Liang Huang, and Xiaobao Li. Characteristics of psychological time in patients with depression and potential intervention strategies. *Frontiers in Psychiatry*, 14:1173535, 2023. [10.3389/fpsy.2023.1173535](#).
- L. Riecke, A. J. van Opstal, R. Goebel, and E. Formisano. Hearing illusory sounds in noise: Sensory-perceptual transformations in primary auditory cortex. *Journal of Neuroscience*, 27(46):12684–12689, 2007. [10.1523/JNEUROSCI.2713-07.2007](#).
- Peter J. Riggs. Time dilation and rates of the passage of time. *Theoria*, 41(1):57–70, 2026. [10.1387/theoria.27426](#).
- Jeremy Rodgers. Experience as enacted scaffolding: A relational constitutive account within Shadow Theory. Unpublished manuscript, revised first manuscript, 2026.
- M. J. Rozenberg, O. Schneegans, and P. Stolar. An ultra-compact leaky-integrate-and-fire model for building spiking neural networks. *Scientific Reports*, 9:11123, 2019. [10.1038/s41598-019-47348-5](#).
- J. D. Saija, T. C. Andringa, D. Başkent, and E. G. Akyürek. Temporal integration of consecutive tones into synthetic vowels demonstrates perceptual assembly in audition. *Journal of Experimental Psychology: Human Perception and Performance*, 40(2):857–869, 2014. [10.1037/a0035146](#).
- N. Sankaran, M. K. Leonard, F. Theunissen, and E. F. Chang. Encoding of melody in the human auditory cortex. *Science Advances*, 10(7):eadk0010, 2024. [10.1126/sciadv.adk0010](#).
- Bradford Skow. Relativity and the moving spotlight. *The Journal of Philosophy*, 106:666–678, 2009.
- Bradford Skow. Experience and the passage of time. *Philosophical Perspectives*, 25:359–387, 2011. [10.1111/j.1520-8583.2011.00220.x](#).

- Amrit Šorli, Rado Gorjup, Niko Gorjup, and Davide Fiscaletti. Non-physicality of time and introduction to time-invariant cosmology. *Advanced Studies in Theoretical Physics*, 20(1):29–45, 2026. [10.12988/astp.2026.92340](#).
- C. Stetson, X. Cui, P. R. Montague, and D. M. Eagleman. Motor-sensory recalibration leads to an illusory reversal of action and sensation. *Neuron*, 51:651–659, 2006. [10.1016/j.neuron.2006.08.006](#).
- R. Tanaka and Y. Yotsumoto. Passage of time judgments is relative to temporal expectation. *Frontiers in Psychology*, 8:187, 2017. [10.3389/fpsyg.2017.00187](#).
- Alice Teghil and Marc Wittmann. How the body and brain process time. *Neuroscience & Biobehavioral Reviews*, 179:106416, 2025. [10.1016/j.neubiorev.2025.106416](#).
- Slava G. Turyshev, Nan Yu, and Viktor T. Toth. General relativistic observables for the ACES experiment. arXiv:1512.09019v2, 2016. URL <https://arxiv.org/abs/1512.09019v2>. Inspected arXiv version 2, posted 24 February 2016.
- Natsuki Ueda, Kazushi Maruo, and Tomiki Sumiyoshi. Positive symptoms and time perception in schizophrenia: A meta-analysis. *Schizophrenia Research: Cognition*, 13:3–6, 2018. [10.1016/j.scog.2018.07.002](#).
- David H. V. Vogel, Katharina Krämer, Theresa Schoofs, Christian Kupke, and Kai Vogeley. Disturbed experience of time in depression: Evidence from content analysis. *Frontiers in Human Neuroscience*, 12:66, 2018. [10.3389/fnhum.2018.00066](#).
- C. Wacongne, E. Labyt, V. van Wassenhove, T. Bekinschtein, L. Naccache, and S. Dehaene. Evidence for a hierarchy of predictions and prediction errors in human cortex. *Proceedings of the National Academy of Sciences*, 108(51):20754–20759, 2011. [10.1073/pnas.1117807108](#).
- Marc Wittmann, Olivia Carter, Felix Hasler, B. Rael Cahn, Ulrike Grimberg, Philipp Spring, Daniel Hell, Hans Flohr, and Franz X. Vollenweider. Effects of psilocybin on time perception and temporal control of behaviour in humans. *Journal of Psychopharmacology*, 21(1):50–64, 2007. [10.1177/0269881106065859](#).
- Steliana Yanakieva, Naya Polychroni, Neiloufar Family, Luke T. J. Williams, David P. Luke, and Devin B. Terhune. The effects of microdose LSD on time perception: A randomised, double-blind, placebo-controlled trial. *Psychopharmacology*, 236:1159–1170, 2019. [10.1007/s00213-018-5119-x](#).
- X. Zuo, C. J. Honey, M. D. Barense, D. Crombie, K. A. Norman, U. Hasson, and J. Chen. Temporal integration of narrative information in a hippocampal amnesic patient. *NeuroImage*, 213:116658, 2020. [10.1016/j.neuroimage.2020.116658](#).